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**THESIS**

**MOTHERHOOD AND HEALTH: MEASURING  
DISPARITIES OF MATERNAL HEALTH OUTCOMES  
OF SERVICE MEMBERS**

by

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**MOTHERHOOD AND HEALTH: MEASURING DISPARITIES OF MATERNAL  
HEALTH OUTCOMES OF SERVICE MEMBERS**

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## **ABSTRACT**

Motherhood goes unrivaled among many life experiences; yet it also can disrupt almost everything in a woman's life—including her physical health. Black women, in particular, have worse maternal health outcomes than White, non-Hispanic women in the civilian population. This project compares birth outcomes among civilian and military populations to determine whether maternal health disparities disappear in a universally insured sample of women under TRICARE. The military tracks detailed health data over time and provides purportedly equal access to care to its active duty members, regardless of race/ethnicity or level of education. If a federally funded healthcare system reduces—or eliminates—maternal health inequality, it provides a path forward for reducing inequality in the civilian health sector. Results indicate that gaps are smaller in some, but not all, outcomes in the universally insured population. Further studies on pre-military experiences and health exposures may explain the persistent gaps in maternal health disparities among military service women.

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## LIST OF ACRONYMS AND ABBREVIATIONS

ACA	Affordable Care Act
ACOG	American College of Obstetricians and Gynecologists
API	Asian Pacific Islander
ASCO	American Society of Clinical Oncology
BIHR	Birth and Infant Health Registry
CHC	community health centers
DEERS	Defense Enrollment Eligibility Reporting System
DOD	Department of Defense
HMO	health maintenance organization
ICD-9-CM	International Classification of Disease Ninth Revision Clinical Modification
IUGR	intrauterine growth restriction
LBW	low birth weight
PCM	primary care manager
PPO	preferred provider organization
PTB	preterm birth
SGA	small for gestational age
VLBW	very low birth weight
WHO	World Health Organization

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# I. INTRODUCTION

## A. PROBLEM DESCRIPTION

For years, disparities in maternal outcomes have been attributed to healthcare access among various races and ethnic groups. Literature indicates that Black, Hispanic and Asian/Pacific Islander women suffer worse maternal health and birth outcomes than White women (Shen et al., 2005). When compared to White women, Blacks are more likely to have preterm labor, preeclampsia, transient hypertension, pregnancy-induced hypertension, gestational diabetes, placenta previa, placental abruption, premature rupture of membranes, infection of the amniotic cavity, and cesarean section; Hispanics are more likely to have gestational diabetes, placenta previa, infection of the amniotic cavity, and cesarean sections; Asian/Pacific Islanders are more likely to have diabetes, placenta previa, premature rupture of membranes, infection of the amniotic cavity and postpartum hemorrhage (Shen et al., 2005). Arguments for why disparities exist range from socioeconomic constraints to institutionalized racism being determinants that shape the risks women of color are exposed to while pregnant. The topic of birth outcomes by race and ethnicity has been refined to multiple areas of research to describe the ongoing disparities.

This thesis explores whether maternal health disparities disappear in a universally insured sample of women with equal access to care: the U.S. military. Since each military service woman has access to TRICARE, this thesis examines whether universal access to care will close various gaps that exist in maternal and birth outcomes for women. Birth outcomes of service women are contrasted with birth outcomes of civilian women who have varying access to care. Pregnant women or women who desire to become pregnant receive care from various forms of private or public healthcare options in the civilian sector. My research suggests that universal access to care during pregnancy decreases gaps, and the policies that currently assure military readiness can be used to support government initiatives surrounding universal care for pregnant civilian women or women who desire to become pregnant.

## **B. RESEARCH QUESTION**

My primary research question examines whether immediate maternal health outcomes differ by race or ethnicity (Black/non-Hispanic, Hispanic White, and non-Hispanic White) in a setting with universal healthcare access? The study includes a comparative analysis of summary statistics of pregnant service women and pregnant women insured by public or private civilian healthcare providers to determine if military maternal and birth outcomes gaps are smaller than those that exist in the civilian population. The military tracks detailed health data over time and presumably provides equal access to care to its active duty members to ensure military readiness, regardless of race/ethnicity or level of education. To promote effective and efficient care, the Defense Health Agency was established in 2013. The goals are to “empower and care for military service members ensuring equitable treatment, optimize operations across the military health system, co-create optimal outcomes for health, well-being and readiness, and deliver solutions to combatant commands” (Defense Health Agency, 2017).

## **C. SCOPE**

This study uses quantitative summary statistic tables to analyze outcomes that are prevalent in both military and civilian healthcare. The maternal and birth outcomes described and compared are not exhaustive, but can be used correlatively to suggest the positive, neutral or negative impacts that universal access may have on reducing inequalities.

## **D. ORGANIZATION OF THESIS**

This thesis is organized into seven chapters. The first chapter has introduced the notion that disparities exist in maternal health and that Black women often experience worse outcomes than any other racial subgroup. The research question, scope and organization are listed in Chapter I as well. Chapter II orients the reader to the institutional structure of obstetric care in both the military and civilian populations. Additionally, this chapter summarizes the major differences and their potential implications on birth outcomes. Chapter III is the literature review. This chapter is divided into four sections that define specific outcomes, analyze studies of specific

outcomes in civilian setting, analyze studies of specific outcomes in the military setting, and contrast the differences.

Chapter IV describes the economic and conceptual framework, evaluating logic and what ought to be in a population of universally insured women during pregnancy. Chapter IV also navigates economic theory to orient readers to potential reasons why there would be disparities in maternal and birth outcomes by race and ethnicity. Chapter V describes the data and methodology used. In a detailed analysis, Chapter VI depicts the tables of summary statistics for the specific outcomes. Finally, Chapter VII presents the conclusion and recommendations for follow on research.

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## **II. INSTITUTIONAL STRUCTURE OF OBSTETRIC CARE**

This chapter focuses on the differences in healthcare access that pregnant women have in the military and civilian population. Though the debate of healthcare has been on the public agenda in the United States for hundreds of years, healthcare policies have expanded to cover millions of Americans (Cummings, 2015). From the passage of Medicare and Medicaid in 1965 to the Patient Protection and Affordable Care Act or Affordable Care Act (PPACA) in 2010, politicians and governing officials have advanced the agenda of who and how patients should receive care in the United States. Therefore, understanding the current healthcare system in the United States is essential to realizing the disparities that exist in the birth outcomes for women in the military and those in the civilian population.

### **A. MILITARY TREATMENT**

The military provides servicemembers, retirees and their families with healthcare coverage around the world through TRICARE. TRICARE provides comprehensive coverage to all beneficiaries ranging from health plans, special programs, prescriptions and dental. The robust healthcare services require all participants to be enrolled in Defense Enrollment Eligibility Reporting System (DEERS) which retains information on military service members, their families, Department of Defense employees and those sponsored by the U.S. government. TRICARE healthcare services can only be provided if participants are registered in DEERS of which active duty service members are automatically enrolled. Once enrolled, service members can obtain services through a variety of providers: persons, businesses, or institutions.

To ensure the widest coverage, service members can be treated by network providers who have formal agreements with their regional contractor who accept the negotiated rate as payment in full. They can be treated by non-network providers who have no formal contract with the regional contract and therefore service members may incur upfront payments. Lastly, most service members are treated at military hospitals and clinics run by the Department of Defense (DOD) and do not charge fees for most

services. As long as the aforementioned parameters are met, servicemembers are eligible to contact their primary care manager for care, and for any service left untreated, the service member must have a referral to network provider. Active duty service women who receive maternity care have access to medical services including care before, during and after delivery and treatment of complications. In general, TRICARE covers care for pregnant active duty service women; however, limitations exist.

## **1. Prenatal Care**

Prenatal care is received from the moment an active duty service woman finds out that she is pregnant until she delivers her child. TRICARE does offer a range of antepartum services such as amniocentesis, chorocentesis, chorionic villis sampling, fetal stress test and electronic fetal monitoring (TRICARE, 2019). TRICARE also offers women ultrasounds at varying stages during pregnancy and covers

- ultrasounds used to estimate gestational age
- evaluate fetal growth
- conduct a biophysical evaluation for fetal well-being
- evaluate a suspected ectopic pregnancy
- define the cause of vaginal bleeding,
- diagnose or evaluate multiple gestations
- confirm cardiac activity
- evaluate maternal pelvic masses or uterine abnormalities
- evaluate suspected hydatidiform mole
- evaluate the fetus's condition in late registrants for prenatal care. (TRICARE, 2019, sec. Ultrasounds)

TRICARE does not cover routine ultrasounds or ultrasounds for gender determination. Additional prenatal screenings under TRICARE include

- anemia screening
- asymptomatic bacteriuria screening
- UTI or other infection screening
- gestational diabetes mellitus screening
- high risk gestational diabetes screening
- hepatitis B screening
- HIV screening
- RH incompatibility screening
- syphilis screening

- other screenings as recommended by the U.S. Department of Health and Human Services.  
(TRICARE, 2019, sec. Prenatal Screenings)

## **2. Labor and Delivery**

Pregnant service women also have coverage for anesthesia, monitoring and other required services such as a cesarean section if needed. However, if a service woman elects to have a cesarean section, TRICARE may not cover all related expenses. Under TRICARE the type of birthing facility used by the beneficiary is dependent on the type of TRICARE plan the beneficiary is enrolled. Active duty service women are automatically enrolled in TRICARE prime; therefore, primary care managers will use military treatment facilities before referring service members to an outside network provider. TRICARE allows service members to use obstetricians, family practice doctors, and certified midwives for delivery. After vaginal delivery, members are covered for two days and four day after a cesarean section.

## **3. Post-partum Care and Complications**

Post-partum care is the treatment received after giving birth and under TRICARE, the duration is roughly six weeks. Procedures not medically required are excluded from pregnancy and childcare coverage. However, TRICARE will cover a minimum of two post-partum visits after delivery to ensure the member is recovering properly. Additional services and treatment can be covered as determined by the service member's doctor.

## **B. CIVILIAN TREATMENT: HMOS, PPOS, AND MEDICAID**

Many countries have healthcare systems that reflect a universal right to treatment, however in the U.S. civilian women can select a variety care depending on income. Intricacies exists regarding care during pregnancy because the healthcare system in the U.S. have parts that are run by individual organizations to include government, nonprofit, and for-profit enterprises (Cummings, 2015). The U.S. currently has 5,198 community hospitals which “are defined as all nonfederal, short-term general, and other special hospitals” (American Hospital Association, n.d.). Of these, “56.5% are nongovernment

not-for-profit community hospitals, 24.9% are investor-owned (for-profit) community hospitals, and 18.5% are state and local government community hospitals” (American Hospital Association, n.d.).

The U.S. healthcare system does not function like basic economic markets due to embedded government regulation which creates a co-dependency on third-party insurance providers (U.S. Department of Health and Human Services, 2018). Instead of paying directly for healthcare services, intricacies of the system are exacerbated because of the exchanges that happens between private or public health insurers, consumers, physicians and policymakers. Large out of pocket healthcare expenses acquired through unexpected injuries and illnesses causes a reliance on third-party insurance providers which is generally comprehensible (U.S. Department of Health and Human Services, 2018). Since insurers agree to pay providers for the total episode of childbirth-related care, which for vaginal deliveries prices ranges from \$5,017 to \$10,413, it is understandable why women scour the third-party payment system to ensure optimal coverage during pregnancy (Fair Health Access, n.d.).

Public health insurance is income dependent and services are typically rendered under Medicaid, Medicare, Children’s Health Insurance Program which are federal and state-run insurance programs. The regulations for eligibility for Medicaid are established by the Federal government; therefore, states are required to include provisions in their Medicaid plan for the categorically and medically needy, and special groups (Required Services for the Categorically Needy, 2010). Coverage for categorically needy group necessitates an income that is equal or below 133% of what is considered the federal poverty level, while the medically needy are those women whose income is too high to qualify them for the categorically needy group (Pregnant Women, 2013). Services required for both the pregnant woman and fetus are obtainable through Medicaid to include

- prenatal care
- delivery
- postpartum care
- family planning
- Services covered for conditions that might complicate the pregnancy

- pregnancy related diagnoses
- pregnancy related illnesses
- medical conditions that may threaten a woman's ability to carry the fetus to full term or deliver the fetus safely.  
(Required Services for the Categorically Needy, 2010)

Formal pregnancy documentation, residency documentation for both U.S. and non-U.S. residents and statements of income must be verified and validated to receive care through Medicaid which can be a lengthy process; however, pregnant women typically receive precedence in eligibility determination which decreases the eligibility process to 2–4 weeks (American Pregnancy Association, 2019).

Plans not accessible through an individual's state or the federal government are considered private health insurance plans and are typically offered by major companies or brokers. If women want control over the care received during pregnancy, then they would be subjected to the approval and costs of a private insurer. The most popular medical health insurance plans are Health Maintenance Organizations (HMOs) or Preferred Provider Organizations (PPOs). HMOs are insurance providers that operate with contracted physicians who are dedicated to providing healthcare services to patients who pay fees for any services obtained within that specific network (Hayes, 2019). PPOs operate under a managed-care construct where healthcare facilities, specialists and physicians' contract with insurers to provide services to clients at a discounted price. Though coverage is generally broader in PPOs, subscribers of PPOs typically pay more for services in comparison to HMOs (Grant, 2019). According to Hayes, HMOs offer lower annual premiums; however, a drawback is the required subscriber and primary care manager (PCM) referral process which requires subscribers to be referred by PCM to receive treatment within and outside of the network (Hayes, 2019). Grant explains how PPO subscribers can see any provider within the insurance company's network, including specialists and in most cases, referrals are not necessary (Grant, 2019). Before the Affordable Care Act (ACA), maternity coverage was not a guaranteed benefit. Some health insurance plans offered coverage; however, many insurers considered pregnancy to be a pre-existing condition which limited coverage for pregnant women or forced them to incur additional cost for coverage (eHealth, n.d.). Maternity and newborn care were

added provisions in the essential health benefits requirements section of the ACA. Therefore, insurers are required to provide plans that covers a range of outpatient care (e.g., screening, pre and post pregnancy visits, lab work, medications) to support the pregnant mother (eHealth, n.d.).

As mentioned, military service women utilize TRICARE which covers members under an HMO.

### **C. SUMMARY OF DIFFERENCES**

Many Americans have private health insurance which has an array of advantages, but there also disadvantages. As mentioned, if women want control over the care received during pregnancy they can do so because with private healthcare because they often have more flexibility in choosing a doctor and medical facilities (MedicareHelp, n.d.). Generally private insurance is associated with having shorter wait times for care, highly specialized physicians, improved facilities and technology. Public health insurance is said to lack flexibility in choice of medical service providers, longer wait times for treatment, and sub-optimal providers. However, a comparative study conducted by Basu et al., 2012 revealed physicians in the private sector had considerable medical practice violations in conjunction with worse client outcomes; lower efficiency was also attributed to healthcare provided by the private sector due to the incentivized use of testing and treatment which resulted in an increase payouts by insurers (Basu et al., 2012). The study highlights the differences in which public healthcare often experience a deficit in the number of skilled providers, medications and supplies for patients.

Ultimately, if a person has the means to pay, then a priority is placed on the care they receive. The differences in public and private insurance often lead to debates regarding disparities in care. Due to the stigma associated with Medicaid, those who utilize public care may have a lesser valuation placed on the quality of care they should receive. According to a study conducted by Currie et al. (1994) preconceived notions surrounding poor reimbursement rates of Medicaid causes healthcare providers to become hesitant to treat patients receiving Medicaid. Therefore, despite some private insurers acceptance of patients who are insured through government sponsored programs,

societal attitudes towards a patient's ability to pay may reflect in the quality of care a patient receives.

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### **III. LITERATURE REVIEW: CIVILIAN BIRTH OUTCOMES**

In this chapter, I will describe studies that have been conducted in civilian literature on maternal health outcomes by race and ethnicity. Specifically, this chapter describes major maternal birth and health outcomes. Low birth weight (LBW), preterm birth (PTB), small for gestational age (SGA) are birth outcomes that infants experience, while preterm labor, hypertensive disorders, and gestational diabetes are maternal outcomes that mothers experience as a result of complications during pregnancy. The list of maternal health outcomes that women experience during and post pregnancy is extensive; however, to compare disparities that exist among military service women (who represent a smaller subsection of the civilian population), this chapter covers those outcomes that are frequently documented in civilian studies. In this chapter, I also discuss the effect of health centers on decreasing racial and ethnic disparities on maternal health outcomes as a prelude to the impact that access to the Department of Defense's military health system has on service women.

#### **A. LOW BIRTH WEIGHT**

Cutland et al. (2017) define low birth weight as “the weight of an infant is the first weight recorded after birth, ideally measured within the first hours after birth, before significant postnatal weight loss has occurred” (p. 6492). Universally LBW is characterized as an infant who weighs less than 2500 g (Cutland et al., 2017). Other categories and characterizations for an infant's birth weight are very low birth weight (VLBW, <1500g) and extremely low birth weight (ELBW, <1000 g) (Cutland et al., 2017). Their study indicates LBW infants are generally a product of women who have PTB, meaning the gestation period was less than 37 weeks. They also attribute LBW infants to intrauterine growth restriction (IUGR)<sup>1</sup> or a combination of both complications.

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<sup>1</sup> IUGR is a health condition that means a fetus is not growing at the rate which is deemed healthy for a healthy delivery (WebMd, n.d.).

A study that analyzes disparities in maternal outcomes between racial groups in community health centers (CHCs), showed in 2001, that Blacks had the highest LBW rates (8.4%) and VLBW (2.4%) compared to other racial groups in the study (Shi et al., 2004). The study recorded the following rates for LBW: Whites (6.1%), Asian Pacific Islanders (APIs, 5.6%), and Hispanics (4.5%); the study also recorded the following VLBW: Whites (1.2%), APIs (1.0%), and Hispanics (1.1%).

According to the study conducted by Shi et al. (2004), rates for timely newborn and postpartum care for Black mothers were roughly the same as White mothers. In some cases Black mothers were less likely than mothers in other racial groups to receive timely care post-delivery care. The rates in the study are counterperceptive particiularly because with the highest rates for LBW infants, Black mothers received the same, if not less postpartum and newborn care. The study recorded the following rates for timely postpartum and newborn care: Whites (70.7%), Blacks (70.8%), Hispanics (75.0%), American Indians/Alaska Natives (56.1%) and APIs (81.7%). The study recorded the following rates for timely newborn care: Whites (66.7%), Blacks (69.9%) Hispanics (76.3%), American Indians/Alaska Natives (78.7%) and APIs (80.3%).

Shi et al. (2004) offer that the counterintitive rates of newborn and post delivery care between racial groups are symptomatic of the time Black mothers and their newborns spend in the neonatal intensive care unit due to complications of LBW. The study examined whether CHCs reduced LBW disparities and found “for every 5% increase in first-trimester prenatal care the LBW rate decreased by 1.02%” (Shi et al., 2004, p. 1890). Although Black mothers were primarily disadvantaged in this study, Black mothers that were users of CHCs experienced LBW complications (including VLBW) at 3.3 percentage points. In the study, mothers at the national level with a low socioeconomic status experienced LBW complications at 5.8 percentage points and mothers across the entire U.S population experienced LBW complications at 6.2 percentage points. The lower rates for Black mothers that were users of CHCs compared to the nations low socioeconomic status and total U.S. population may be directly attributable to Black mother’s ability to access to primary healthcare during pregnancy through CHCs (Shi et al., 2004).

Another study regarding LBW disparities, by Almeida et al. (2018) aimed to show the psychosocial implications of stress on LBW infants. Among the myriad of variables that could contribute to LBW births, different studies debate the significance of the relationship between stress and LBW (Almeida et al., 2018; Dominguez, 2011). The findings in existing literature, according to Almeida et al., is partly due to the lack of standardization in measuring and defining what stress is and being unable to identify when stress occurs in the individual giving birth (e.g., before pregnancy, during pregnancy, childhood). To address gaps in previous literature Almeida et al., increased the number of observations in their sample, included population data with many racial subgroups and systematically assessed psychosocial stressors. In doing so, they found that non-Hispanic Black women had the highest rate of LBW infants. The study showed when compared to non-Hispanic White women, non-Hispanic Black women had a .87 higher risk of having a LBW infant. After accounting for stress effects, the increased in risk for non-Hispanic Black women were not fully explainable (Almeida et al., 2018).

## **B. PRETERM BIRTH**

Preterm birth is a birth outcome with large disparities among Black and White women in the civilian population. According to the World Health Organization (WHO), preterm birth is characterized as an infant born prior to 37 weeks of gestation (WHO, 2018). The WHO further characterizes preterm birth into additional categories ranging from extremely preterm (before 28 weeks gestations) to late preterm (32 to 37 weeks gestation). This outcome is particularly significant because an estimated 15 million infants are born preterm annually and of the 15 million born preterm, 1 million die due to preterm birth complications (Liu et al., 2016). While globally premature births are the top cause in death in children under 5, those who do survive often face a lifetime of complications from learning, visual or hearing disabilities (WHO, 2018).

First world countries often see higher survival rates for infants born preterm; whereas less developed countries do not (Chawanpaiboon et al., 2019). The United States ranks number six of the countries across the world with the greatest number of preterm

births; therefore, a refined understanding of what causes preterm births can improve and expand solutions to further prevent preterm births (WHO, 2018).

In a study conducted by Braveman et al. (2014), PTB rates differed greatly among a 10,400 sample population of Black and White women from California; the rates were 12.8% and 7.4% respectively. The study was conducted from 2003 to 2010 and analyzed how various socioeconomic factors (e.g., income, education, occupation) contributed to disparities in PTB among Black and White women. Their research showed the proportion of women with incomes at or below the federal poverty level was nearly tripled for Black women compared to White women (49.3% and 15.3% respectively). Among socioeconomically disadvantaged subgroups, the study found no significant Black-White disparities. However, disparities emerged among Black-White groups that were socioeconomically better off. In the study, PTB rates improved for Whites with a higher socioeconomic status, but not for Blacks with a higher socioeconomic status (Braveman et al., 2014). The notion that PTB rates improved for Whites with a higher socioeconomic status, but not for Blacks allows inferences to be made regarding social characteristics apart from income and access to care that may impact PTB disparities (Braveman et al., 2014). My hypothesis is that through offering universal access to care to pregnant service women, disparities caused by social biases (e.g., implicit biases, racism, discrimination, prejudices) as seen in the civilian population will be minimal. The ethos of the military service and the military health system demands equitable care to all beneficiaries regardless of race and socioeconomic background.

### **C. SMALL FOR GESTATIONAL AGE**

SGA is another birth outcome that has large disparities among Black and White women in the civilian population. Infants with “a weight below the 10th percentile for the gestational age” are considered SGA (Schlaudecker et al., 2017). In many cases SGA babies may appear physically and neurologically normal; however, they have lower weight and body mass compared to infants of similar gestational age (Children’s Hospital of Philadelphia [CHOP], n.d.).

Additionally, SGA infants can be born premature, full term or post term as with low birth weight babies. Infants considered SGA often have IUGR; risk factors for mothers of infants born SGA range from body stature and weight to the mother's overall health history and drug use, if any (McCowan & Horgan, 2009; CHOP, n.d.). SGA infants born full term may not experience the complications related to organ system immaturity as compared to SGA babies born premature; however, they are at risk for conditions such as meconium aspiration, perinatal asphyxia, polycythemia, hypoglycemia and hypothermia (Stavis, 2019).<sup>2</sup>

A study conducted by Bediako et al. (2015), found that women who identified only as Black had the largest probability of having LBW, PTB and SGA outcomes. The study showed mothers who identified as Black and Hispanic experienced outcomes at a lower probability than women who identified as only Black, but higher than mothers who identified as only Hispanic. In the study, the SGA outcome had the smallest probability gap between mothers who identified as only Black, Black and Hispanic and only Hispanic; the probability of having an SGA infant was highest for women who identified as only Black. The adjusted results for mothers who identified as only Black was 8.83%, Black and Hispanic 6.58%, only Hispanic 5.60% and non-Hispanic White 4.98% (Bediako et al., 2015). The study that acknowledges disproportionate reproductive outcomes exists particularly for non-Hispanic Black women, even when compared to women who identified as Black and Hispanic or only Hispanic.

#### **D. PRETERM LABOR, HYPERTENSIVE DISORDERS, GESTATIONAL DIABETES**

The final maternal disparities mentioned in this thesis surrounds the mother's maternal health vices the infant health. Each of these health outcomes have been analyzed

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<sup>2</sup> Perinatal asphyxia is "a lack of blood flow or gas exchange to or from the fetus in the period immediately before, during, or after the birth process" (Gillam-Krakauer & Gowen Jr, 2019). Meconium aspiration occurs when stress causes the fetus to take forceful gasps, so that the amniotic fluid containing meconium (dark green, sterile fecal material), is breathed (aspirated) in and deposited into the lungs (Balest, 2018). Hypoglycemia is when the infant's level of sugar in the blood is too low, polycythemia is when there is an abnormally high concentration of red blood cells and hypothermia is a core temperature less than 97.7 degrees Fahrenheit (Dysart, 2018; Liesveld & Reagan, 2019; Stavis, 2019).

in various research regarding women's maternal health and seek to find correlative evidence surrounding disparities among Black and White mothers. According to the American College of Obstetricians and Gynecologists, preterm labor is when a mother begins experiencing contractions prior to 37 weeks of gestation resulting in her cervix thinning and fetus entering the birth canal (The American College of Obstetricians and Gynecologists [ACOG], 2019a). Preterm labor can lead to an early delivery; however, it is not always the case as doctors can prescribe certain medications to delay labor. If preterm labor persists, infants are at higher risk (compared to those infants born at full-term), to develop brain and neurological damage due to the inadequacy of growth near the end of the pregnancy. According to Barfield (2018), the final period of gestation is critical due to the development of vital organs such as the lungs, brain, and liver.

Regarding hypertensive disorders during pregnancy, pregnant women can be subjected to negative outcomes before, during, and after their pregnancy depending on the type of hypertension experienced. These outcomes include preterm delivery and fetal growth restriction due to the elevated blood pressure reducing oxygen flow for the fetus to obtain nutrients and grow (Centers for Disease Control [CDC], 2020). Severe hypertensive disorders often require mothers to undergo caesarean sections and expose mothers to development of chronic hypertension in the future. Preeclampsia is characterized by the WHO, as any new episode of chronic hypertension where a mother's diastolic blood pressure is  $\geq 90$  mm Hg and there is an increase of protein in the mother's urine (World Health Organization [WHO], 2013). According to the ACOG, preeclampsia is detrimental to a mother's organs and is generally diagnosed in the third trimester (ACOG, 2019b). After 20 weeks of pregnancy, gestational hypertension is characterized as having increased blood pressure (systolic  $\geq 140$  or diastolic  $\geq 90$  mm Hg) with no previous abnormal blood pressure, protein in urine or symptoms of preeclampsia (Mammaro et al., 2009). This form of hypertension is also a transient form of hypertension, where a mother is diagnosed retroactively once childbirth has occurred and blood pressure normalizes by the 12-week postpartum appointment (Mammaro et al., 2009).

Gestational diabetes, according to the ACOG, is characterized as having increased levels of sugar in the bloodstream that is not being used for energy (ACOG, 2017). This form of diabetes, if not controlled, can result in the baby being overfed and growing larger and increases difficulties during labor. Mothers who suffer from uncontrolled forms of gestational diabetes are more likely to give birth through a cesarean section or experience an episiotomy during a vaginal delivery (ACOG, 2017). According to the ACOG (2017), infants of mothers with gestational diabetes are predisposed to having jaundice, breathing complications and low blood sugar levels at birth. Infants that grow larger due to complications of gestational diabetes have an increased likelihood of experiencing trauma during birth which can ultimately require infants to be admitted to the neonatal intensive care unit.

In a study that analyzed disparities in maternal outcomes among four ethnic populations, odds ratios generated using multivariate analysis showed Black women to generally have twice the risk of experiencing negative pregnancy outcomes when compare to White women. Odds ratios for hypertensive disorders including preeclampsia (OR 1.59), gestational hypertension (OR 1.38) and transient hypertension of pregnancy (OR 1.13) showed Black women had higher risks when compared to White women (Shen et al., 2005). In the same study, odds ratios were calculated for preterm labor (OR 1.71) and diabetes (OR 1.26), of which Black women still demonstrated greater risk that Whites. Overall the study examined 11 measures that contribute to poor maternal outcomes and Black women had significantly higher risks in 10 of the 11 outcomes.

#### **E. AMERICA'S MATERNAL HEALTH CENTER**

CHCs, since their inception in the 1960s, provided primary care for inner city and rural localities that were largely underserved and had low socioeconomic status (Regan et al., 2008). The health centers offer primary care that is efficient and would not otherwise be accessible due to various barriers such as income, transportation or lack of insurance to vulnerable populations. Research conducted on the significance of primary care and the potential for CHCs to decrease disparities has not led to causality; however, studies indicates lower rates in specific disparities are attributable to CHCs and the access to care

provided to vulnerable groups (Regan et al., 2008; Shi et al., 2004). Causality is extremely difficult to determine in studies regarding medical outcomes, largely because of user's selection bias. Users of CHCs are more likely to seek care compared to non-users due to the belief that care is needed. Therefore, self-selection bias is a limitation when considering the effects of CHCs. To establish a less biased treatment effect of CHCs on vulnerable populations, a study on non-users of CHCs would be beneficial or encouraging non-users to obtain needed services from CHCs could reduce the impact of self-selection bias (Shi et al., 2004).

The parallel between CHCs and the DOD's ability to offer access to primary care services enables exploration of two healthcare models and their impacts on maternal outcomes. This research analyzes effects of access, where military service women have universal access to care and civilian women do not. The DOD military health system by design, eliminates potential biases that exist when analyzing maternal disparities from an accessibility perspective. Assessing maternal outcomes in a military setting where biases are reduced allows analysts to move closer to determining a causal relationship between the effects of having universal access to care. Though service women are a subset of the general population, upon entering the service, they have access to a wide range of coverage and barriers such as income and transportation that would generally create biases are negligible in a military setting.

## **F. SUMMARY**

Of the literature mentioned and combined studies that examine disparities in maternal outcomes, Black women are regarded as the subgroup with the worst outcomes. This chapter highlights outcomes that exist prevalently in the civilian population. Highlighting prevalent differences that exists in the civilian population allows a comparative analysis to be conducted on civilians and military service women who may experience the same outcomes but operate under a completely different health system. In a military setting where service women have universal access to care, disparity gaps could be eliminated; potentially leading to policy initiatives that support wider access to treatment for women in the civilian population. In addition to highlighting the stark

differences in maternal birth and health outcomes, this chapter also offers insight to the results and benefits that CHCs have had in closing racial disparity gaps that exists in maternal birth and health outcomes (Shi et al., 2004). Although progress in closing disparity gaps is slow for Black women, the study conducted by Shi et al. 2004 is the first of its kind to show strong evidence of how access to perinatal care can decrease negative birth outcomes for Black women.

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## IV. CONCEPTUAL FRAMEWORK

This chapter will provide economic theory to orient readers to potential reasons why there would be Black-White disparities in maternal health and birth outcomes. I present information that explores whether having care, in general, has any influence on an individual's health. In addition to establishing whether or not access to care improves health, I will discuss a term widely used in economics called "ceteris paribus." In short ceteris paribus allows economists to isolate the effect variables and measure the impact those variables have on an outcome. It is an important concept to understand because if women have access to care, and all things are held constant, ideally women in the civilian and military population would share similar maternal outcomes. The concept will be explained more concretely as it pertains to maternal health and birth outcomes. This chapter will also discuss the utility function which describes how consumers pursue goods and services that maximizes utility. For those who have access, I will evaluate how utility can influence maternal outcomes.

### A. DOES ACCESS TO CARE IMPROVE HEALTH?

The definition of access varies in medical and insurance settings. Andersen et al. (1983) define access "as those dimensions which describe the potential and actual entry of a given population to the healthcare delivery system, where the availability component of the delivery system refers to the volume and distribution of medical resources in an area" (p. 51). Weissman and Epstein (1993) define access as "the attainment of timely, sufficient, and appropriate healthcare of adequate quality such that health outcomes are maximized" (p. 244). They acknowledge that there is not an exhaustive description of access and no single index or set of specified services exists to summarize access entirely for a specific group. However, Weissman and Epstein present an adequate description of access and is the description I use to analyze whether access improves the overall health of an individual.

An assumption I make regarding access to care is if a person needs access to care, then when care is received that individual would benefit because their health improves.

For example, a longitudinal study conducted by (Lurie et al., 1984) followed patients at a clinic for a year after some of the hypertensive patients lost Medicaid coverage. The study found that at six months and a year, those who lost access to care had worsening blood pressure, compared to those who maintained Medi-Cal<sup>3</sup> coverage. The study reported, after a full year, diastolic blood pressure for patients who lost coverage increased (6 mm Hg) and those patients who kept coverage decreased (3 mm Hg). The study recorded results at six months and one year for patients who lost coverage and also had diastolic blood pressure higher than 100 mm Hg. Results showed blood pressure increased from 3% to 31% at 6 months, then dropped to 19% at one year. For the control group, no significant changes for patients with diastolic blood pressure higher than 100 mm Hg were reported (Lurie et al., 1984).

In 2019, the American Society of Clinical Oncology (ASCO) analyzed Medicaid expansion under the ACA and time to treatment in Black and White cancer patients. In the study, Black patients benefited greatly from Medicaid expansion. The expansion ultimately reduced disparities that existed in timely treatment for cancer. Overall, the study showed a 6.1 and 2.1 percentage point increase among Black and White patients for timely treatment; however, the increase for Whites was not statistically significant (“2019 ASCO,” 2019).

Lastly, a study conducted by Chaudhary et al., (2018) analyzed whether TRICARE reduced traumatic injury disparities for Black patients. The study found under TRICARE, Black patients had decreased odds of readmission at 30 and 90 days (OR 0.87 and 0.86 respectively)<sup>4</sup> and decreased odds of complication at 90 days (OR 0.91). The study ultimately supports the notion universal access to care has significant impacts on reducing disparities (e.g., hospital readmission, post injury illness, post discharge care usage) that exists for Black patients (Chaudhary et al., 2018).

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<sup>3</sup> Medi-Cal offers reduced healthcare to low income families it serves as the state’s Medicaid program.

<sup>4</sup> OR is odds ratio. Defined as “a measure of association in a case-control study which quantifies the relationship between an exposure and health outcome from a comparative study” (“Odds Ratio,” n.d.).

As it relates to maternal health, it is important to understand that for those needing care, having access can significantly improve overall outcomes as determined in the studies previously mentioned.

## **B. CETERIS PARIBUS: HOLDING ALL OTHER THINGS CONSTANT**

A Latin phrase used often in economics analysis, *ceteris paribus* allows economists to examine the relationship between specific variables and outcomes while holding all other factors constant. For instance, in a multivariate regression analysis, economists isolate the (marginal) effect of one variable on an outcome, while holding constant all other variables; this effect can be positive or negative. The research design of such a regression model, and the estimated positive or negative relationship that exists between variables and outcomes is important to establish the causal relationship between them. For this thesis, outcomes of interest are the maternal health and birth outcomes detailed in Chapter III, and independent variables of interest are primarily race and healthcare access. The term *ceteris paribus* does not ensure every relationship between variable and outcome is evaluated; therefore, it is important to note that there may be other variables outside of race and access to care that influence maternal health and birth outcomes that are being held constant.

Understanding *ceteris paribus* and recalling from the previous section how beneficial access to care is to those with a demand for it is important. The two notions shape the framework for my comparative analysis of pregnant women in the civilian and military population. However, omitted variables bias creates difficulties for analysts to establish causal relationships between independent variables and outcomes of interests. If variables beyond access to care and race effect maternal outcomes, then we would expect differential outcomes as a result, even in the case of universal access to care. This is the basis of omitted variables bias and this bias has the potential to overstate or understate the marginal effects of the variables in the regression model. For example, active duty service women tend to have increased physical demands (i.e., routine physical fitness tests) than women in the civilian population; therefore, active duty service women who utilize the MHS are likely to be more fit. Active duty service women with increased

physical fitness capabilities presumably have better health conditions, on average. Therefore, omitting physical fitness would create an overstated positive bias of the impacts of a universal healthcare system on maternal health outcomes. Opportunities to incur omitted variables bias in regression analysis are limitless and can skew results of any model; therefore, it is imperative to include all variables that are theoretically relevant in the regression model to avoid omitted variables bias.

### **C. A NOTE ON UTILITY: IMPLICATION OF ACCESS ON MATERNAL CARE**

Weissman and Epstein (1993) suggest lacking proper healthcare can impact how patients utilize healthcare services; therefore, the framework for this thesis analyzes and compares any implications that TRICARE has on pregnant service women compared to women in the civilian population.

#### **1. Defining Utility**

The purpose of this commentary is to introduce readers to a concept that drives consumer behavior. Utility by definition is a term used by economists to describe the usefulness or satisfaction that a consumer obtains from any good or service (Mankiw, 2012). Theory suggests, all else equal, a rational person will always choose the option that has the highest utility and maximizes the sum of utility achieved (Ehrenberg & Smith, 2015; Mankiw, 2012). Therefore, economists designed utility functions which are mathematical expressions that measure a person's preferences over a set of goods and services. Utility functions are used among economists because they offer a quantitative framework to model an individual's likelihood of making a decision (Beck, 2019). Any object or circumstance (pecuniary or non-pecuniary) can be considered for utility measuring. Although utility measurements do not provide absolute insight to consumer behavior, it does however, provide a framework to better understand decision making from a consumer's perspective.

## **2. Utility and Healthcare Consumption**

For this thesis, a utility function can help describe how pregnant women in both the military and civilian population consume obstetric healthcare. Specifically, for civilian women with varying access to care, utility largely depends on the type of insurance obtained. We know that whenever individuals have a demand for services and treatment, health insurance decreases the cost enabling individuals to consume more for less (Weissman & Epstein, 1993). However, the goods and services offered by various insurers are premium based. Those who can afford higher premiums have greater access to goods and services which often equates to higher utility. As mentioned in Chapter II, how often and how well a physician is paid may encourage physicians to deliver efficient services to patients, which can also increase the rate at which patients consume services that are insured (Weissman & Epstein, 1993). This tendency is known as moral hazard<sup>5</sup> and can be a driver of the disparities that exists in civilian obstetric care.

## **3. Implications of Utility and Access on Healthcare Disparities**

Under conventional theory, moral hazard is often considered unfavorable and inefficient by insurers and health economists (Nyman, 2004). According to Nyman's study regarding moral hazard, insurers consider moral hazard to have negative implications because insurers often pay higher cost toward patient benefits than originally anticipated. From the economist perspective, he notes that insurance pays for care and effectively reduces the cost of care to zero. To the consumer, the reduction makes care appear more favorably and encourages an increased consumption of services at a reduced rate. Consuming more at a reduced price indicates to economists the value of care is below market price. Since care is still costly to produce (high market price) and the value is apparently low to consumers (increased consumption at reduced prices) market inefficiency is created (Nyman, 2004). He further explains that under conventional insurance theory, to reduce inefficiency, insurers often impose penalties (e.g., co-payments, deductibles) to discourage healthcare service overconsumption.

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<sup>5</sup> "Moral hazard" refers to consumer behavior when healthcare is discounted once an individual becomes insured. The idea is that consumer increase health consumption when prices are lower cost to the consumer.

Nyman (2004) describes the ambiguity that exists between pros and cons of moral hazard. He explains that moral hazard and the normal convention would be applicable to services that insured consumers elect to have (e.g., Lasik, breast enhancements, facelifts). In such cases consumers have increase utility at a reduced marginal cost. However, for life-threatening treatments the normal conventions of moral hazard would not be applicable. Namely there is a social gain and increased marginal utility from the former than the latter healthcare provision.

Contrary to some insurers and health economists, moral hazard can be efficient and welfare increasing. In Nyman's *Is 'Moral Hazard' Inefficient? The Policy Implications Of A New Theory*, he proposes a way to model the welfare increasing nature of moral hazard and reinterprets moral hazard as an income transfer effect:

If insurers actually transferred income to an ill person in one lump-sum payment, the welfare implications of moral hazard would be unambiguous. For example, consider Elizabeth, who has just been diagnosed with breast cancer. Without insurance, she would purchase only the \$20,000 mastectomy required to rid her body of the cancer. If she had purchased an insurance policy for \$4,000 that paid off with a \$40,000 cashier's check upon diagnosis of breast cancer, she might purchase the \$20,000 mastectomy and also a \$20,000 breast reconstruction procedure. For economists, this behavior implies that the additional \$40,000 in income from the insurance pool had increased her willingness to pay for the breast reconstruction so much that it is now greater than the \$20,000 market price, causing her to purchase the second procedure. This moral hazard is efficient because she could have spent the additional \$40,000 on anything she chose but opted to purchase the breast reconstruction. The purchase of this additional procedure represents a moral-hazard welfare gain to the extent that with the additional \$40,000 in income, she would have now been willing to pay more than the \$20,000 that it cost to produce the procedure. (Nyman, 2004)

Nyman's key takeaway is to ultimately perceive moral hazard positively and replace the previously unexamined axiom of welfare loss with the axiom of welfare maximization (Kelman & Woodward, 2013). Nyman's theory does not deny moral hazard; he differs in his formulation and characterization of it and suggests that policy should be directed at insuring the uninsured to reduce mortality (Kelman & Woodward,

2013; Nyman, 2001). His analysis suggests that the benefit from moral hazard's effect would likely exceed the entire cost of the moral hazard.

As it pertains to maternal health, service women receive care in a setting where insurance contracts equalize marginal utility across different demographics. Thus, this equalization affords the insured service woman to demand more healthcare at every price than she had previously, which unambiguously increases utility or welfare (Kelman & Woodward, 2013). Einav and Finkelstein (2018), believes this to be the best insurance contract, because individuals with low and high marginal utility of income can utilize services when necessary. This kind welfare maximization can lead to a reduction in mortality as stated by Nyman and also can be the catalyst to reduce disparities in birth outcomes.

#### **D. SUMMARY**

This chapter aims to provide a framework that establishes why there may be Black-White disparities in maternal outcomes. The conceptual framework highlights various economic terms and theories that attempt to explain consumer behavior as it pertains to insurance. The reader should perceive healthcare to have a direct impact on consumer welfare and that if unattainable can exacerbate disparities. The chapter also references utility (satisfaction derived from consumptions of goods and services) based on the level of access they have to healthcare. Assuming insurance creates a moral hazard (consuming more of a service at a reduced cost) and using Nyman's *Theory of Demand of Health Insurance*, I presume a universal care system would reduce disparities in maternal outcomes. This reduction is due to women seeking care at every price along the demand curve. The increased consumption (moral hazard) would result in a welfare gain and demonstrate positive implications on overall welfare.

The civilian health system does not insure all; therefore, social initiatives have been undertaken to alleviate the cost and discriminatory nature of insurance (e.g., public hospitals, free clinics, pro-bono charity care) (Weissman & Epstein, 1993). Given the magnitude of disparities that exist in maternal health, it is a safe assumption that those efforts are not sufficient to equalize outcomes. Ultimately, the utility derived from care

among pregnant women in the civilian population is important because it establishes trends at which Black and White women consume care based on their levels of access to care.

## V. DATA AND METHODOLOGY

My research and analysis for maternal health and birth disparities in the civilian sector is based on several empirical studies. The research studies used coincide with the longstanding reality of Black-White disparities in maternal health in the civilian population. Data for military birth outcomes comes from the Department of Defense Birth and Infant Health Research (BIHR) program. BIHR program employs research analysts who have access to all databases that detail birth outcomes for military service women (Naval Health Research Center, n.d.). Sources for service member data include Military Health System Data Repository, Defense Manpower Data Center and DEERS (Naval Health Research Center, n.d.).

I use a data from the BIHR that examined Black-White maternal health disparities among active duty service women from January 2003 through August 2015 (Clinton et al., 2019). International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) codes are used in the study to define birth outcomes (Clinton et al., 2019).<sup>6</sup> To test statistical significance of each outcome among Black-White subgroups, I conducted an un-pooled Z-test (chi-squared test) where the formula for the test statistic is:

$$z_t = \frac{\hat{p}_1 - \hat{p}_2}{\hat{\sigma}_D} \quad \hat{\sigma}_D = \sqrt{\frac{\hat{p}_1(1 - \hat{p}_1)}{n_1} + \frac{\hat{p}_2(1 - \hat{p}_2)}{n_2}}$$

To compare with civilian population studies, my analysis primarily focuses on the differences between Black and White women in military service. Since civilian literature supports disparities existing among Black and White women in the civilian population, I use the data to determine whether the same disparities exist in a universally insured population.

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<sup>6</sup> ICD-9-CM codes used were grouped by diagnostic or procedure. ICD-9-CM codes were used to define the following military outcomes: hypertension disorders (401.xx-405.xx), gestational diabetes (648.8x), SGA (656.5x). Methods used to define LBW, PTB, preterm labor were previously described in Chapter III.

Without having control variables to conduct regression analysis, this thesis was limited to a comparative examination of previous bodies of work conducted on maternal health disparities. Data for military service members is from the BIHR; therefore, due to the self-reported administrative data used in the study, measurement error may exist. Data entry errors could skew classifications and results of maternal outcomes.

## VI. RESULTS

The BIHR data identified 182,000 live births; 167,463 infants remained for the analysis after excluding infants with birth defects, women <18 years at infant birth and women who identified their race as “unknown” (Clinton et al., 2019). Results showed non-Hispanic Black women were less likely to have gestational diabetes, but more likely to have a hypertension or preeclampsia diagnosis compared to non-Hispanic White women. Non-Hispanic Black women were also more likely to have preterm labor/delivery than non-Hispanic White women. Of the 3014 births that were defined as SGA, non-Hispanic Black women accounted for 2.4% and non-Hispanic Whites accounted for 1.6% (Table 1). To determine whether the two subgroups differed, I tested for statistical significance among the two groups using a two-sample z-test.

Table 1 displays the estimated differences in the Black-White gap between military mothers from my data. In Table 1, each infant and maternal outcome was statistically significant. The null hypothesis was that Black and White active duty mothers were the same in the data from Clinton et al. (2019). Compared to non-Hispanic Whites in the military, non-Hispanic Black women were 3.4 percentage points more likely to have low birth weight babies, 3.4 percentage points more likely to have preterm births, 0.8 percentage points more likely to have infant small for gestational age, 3.6 percentage points more likely to have preterm labor, 0.6 percentage points more likely to have hypertension in pregnancy, 0.6 percentage points less likely to have gestational diabetes and 1.3 percentage points more likely to have preeclampsia.

Table 1. Black-White infant and maternal outcomes among active duty U.S. military service women in the DOD Birth and Infant Health Research Program, 2003–2015, and two-sample Z-test used to assess whether non-Hispanic Black and non-Hispanic White rates differ. Adapted from Clinton et al. (2019).

Outcomes	Non-Hispanic Black (n = 47506)	Non-Hispanic White (n = 83570)			% Difference
	(%)	(%)	z-test	p-value	
<i>Infant outcomes</i>					
Low birthweight (<2500g)	6.6	3.2	26.36	0.000	3.4
Preterm birth (<37 weeks gestation)	9.9	6.5	21.25	0.000	3.4
Small for gestational age	2.4	1.6	9.76	0.000	0.8
<i>Maternal outcomes</i>					
Preterm labor/delivery	9.7	6.1	22.64	0.000	3.6
Hypertension in pregnancy	8.7	8.1	3.75	0.000	0.6
Gestational diabetes	5.1	5.7	-4.69	0.000	-0.6
Preeclampsia	6.6	5.3	9.49	0.000	1.3

Table 2 displays the estimated differences in the Black-White gap between civilian mothers; data comes from the CDC (2008, 2019). In Table 2, each infant and maternal outcome was statistically significant. The null hypothesis was that Black and White civilians were the same. Compared to non-Hispanic Whites in the civilian population, non-Hispanic Black women were 7.2 percentage points more likely to have low birth weight babies, 5 percentage points more likely to have preterm births, 7 percentage points more likely to have infant small for gestational age, 5.1 percentage points less likely to have preterm labor, 1.01 percentage points more likely to have hypertension in pregnancy, 0.7 percentage points less likely to have gestational diabetes and .08 percentage points more likely to have preeclampsia.

Table 2. Black-White military and civilian population percentage point differences in maternal health outcomes. Adapted from CDC (2019); CDC (2008).

Outcomes	Non-Hispanic Black	Non-Hispanic White			% Difference	Diff of Diff
	(%)	(%)	z-test	p-value		
<i>Infant outcomes</i>						
Low birthweight (<2500g)	14.1	6.9	143.36	0.000	7.2	-3.8
Preterm birth (<37 weeks gestation)	14.13	9.09	98.45	0.000	5.0	-1.6
Small for gestational age*	17	10	9.76	0.000	7.0	-6.2
<i>Maternal outcomes</i>						
Preterm labor/delivery	25.17	30.29	-76.40	0.000	-5.12	8.7
Hypertension in pregnancy	8.65	7.64	24.31	0.000	1.01	-0.41
Gestational diabetes	5.24	6.01	-22.34	0.000	-0.77	0.17
Preeclampsia	0.33	0.25	9.14	0.000	0.08	1.22

\*Small for gestational age summary statistics have been adapted from 2005, which is the most recent year for available information.

Table 2 also displays the estimated differences in the Black-White gap between military mothers from my data and the civilian mothers from CDC (2008, 2019). This is the difference of the difference across groups. The magnitude differences between military and civilian mothers suggest that women often experience LBW, PTB, SGA and preterm labor. These outcomes had the largest gaps; however, military service women experienced LBW, PTB and SGA outcomes at a lower rate than women in the civilian population. Figure 1 depicts the percentage point differences and the differences of the differences among the military and civilian population. By determining the differences of the differences, the primary research question of whether gaps are closed in a universally insured population can be answered. Results indicate that the military closes maternal health disparities in four of the seven outcomes analyzed in this thesis (i.e., LBW [-3.8],

PTB [-1.6], SGA [-6.2], hypertension [-0.41]). The military did not close gaps for mothers who experienced preterm labor, gestational diabetes and preeclampsia, as the gaps were actually wider in the military sample for these outcomes.

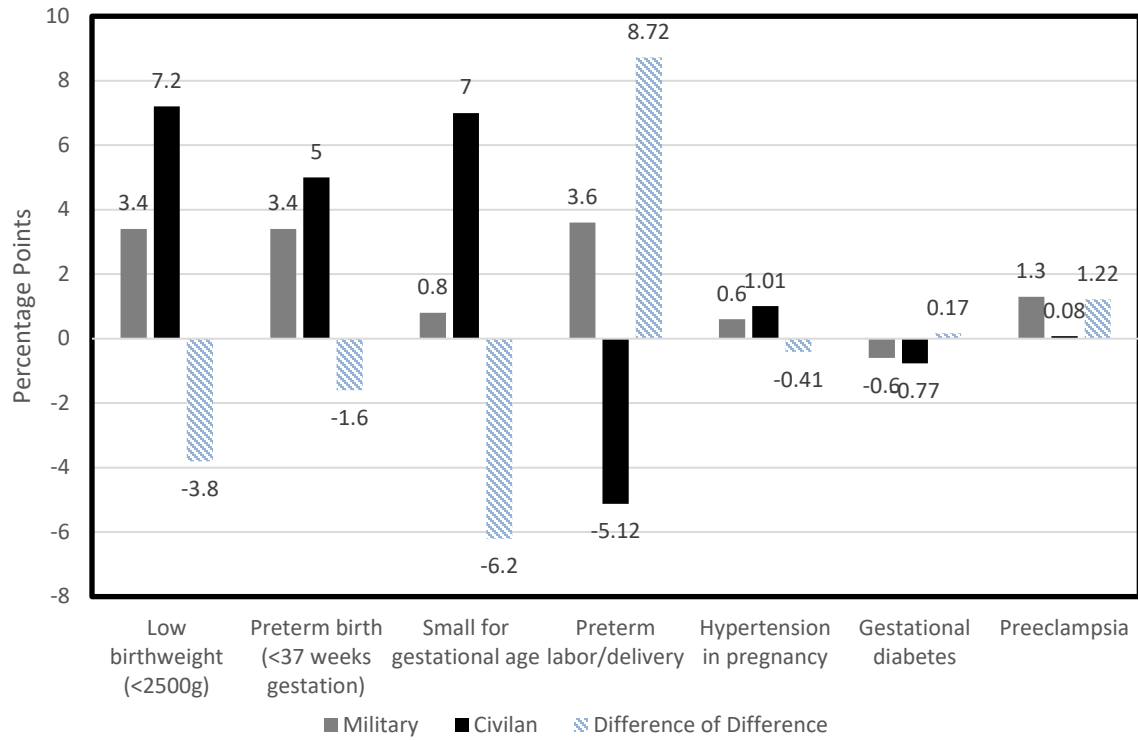


Figure 1. Military and civilian population difference of the difference.

## VII. DISCUSSION

### A. SUMMARY

This thesis examined whether maternal health disparities were reduced among a universally insured population of military service women, compared to civilian women. The research conducted compared civilian studies on maternal health to DOD data from the Naval Health Research Center. Historically, civilian studies have indicated that Black mothers have higher risks and probabilities of experiencing poor maternal health and birth outcomes than White mothers. Studies have researched and implied various causes that may perpetuate maternal health disparities (e.g., systemic racism, genetics, access to care); however, fewer studies have compared civilian and military populations to better understand the implications that TRICARE may have on maternal health disparities. That is, does having TRICARE close gaps that exist in maternal health? With TRICARE representing a universal form of healthcare for service women, this thesis explores the institutional differences of public and private obstetrics care to express the severe impact that access to health insurance has on pregnant women. Third-party insurance systems often dictate the level of access to care, which has exposed Black women to greater risks during and post pregnancy.

Chapter III highlights frequently documented maternal birth and health outcomes that Black and White women experience in the civilian population (i.e., low birth weight, preterm birth, small for gestational age, preterm labor, hypertensive disorders, gestational diabetes). In the studies, Black women had the worse outcomes. Even after socioeconomic factors were accounted for, Black women nevertheless experienced unfavorable outcomes when compared to their White counterparts. Overall, compiling research conducted on maternal health in the civilian population facilitated a comparative analysis of maternal health disparities among Black and White women in the military.

Chapter IV details an economic framework establishing the notion that access to care does improve an individual's health; especially those with a demand for it. Therefore, explaining the term "ceteris paribus" helped determine that if anything beyond

access to care (e.g., race, income, quality of care) impacts maternal outcomes, then there would be differential outcomes even in the case of universal access to care. Chapter IV also explains the positive implications of insurance utility and how moral hazard, as deemed negative and welfare decreasing by economist, can actually be efficient and welfare increasing. The added utility that individual receives from consuming more healthcare at a discounted cost when needed can result in equalized maternal outcomes for Black and White women in the civilian and military population.

## **B. CONCLUSION AND RECOMMENDATIONS**

My research, economic framework and data indicate that TRICARE does reduce gaps in majority of the frequently documented disparities in maternal health among Black and White women (LBW, PTB, SGA, hypertension). Gaps in the civilian population were marginally higher in the outcomes stated above and is likely due to the continuity of care and screening of military service members upon entry into the service. This study suggests the increased benefit of a universal care system; however, since not all gaps were reduced in the military population, further research can study pre-military exposures and experiences that impact service women. Since Black and White service women are also subsets of the civilian population pre-military exposures and experiences in healthcare may impact the way women seek prenatal and obstetrics care after joining the military service. Research on the healthcare exposure prior to military entry can help bridge the gap and provide insight to the gaps that still exists inside on the universal healthcare system. In this way, the DOD will be better equipped to make policy decisions on health and wellness programs that benefit pregnant service women who may have had limited healthcare exposure prior to gaining access to care through TRICARE.

I believe the life-course 12-point plan according to Lu et al. (2010) would equalize maternal health outcomes in both military and civilian populations. They suggest the following

1. Provide interconception care to women with prior adverse pregnancy outcomes
2. Increase access to preconception care to African American women
3. Improve the quality of prenatal care

4. Expand healthcare access over the life course
  5. Strengthen father involvement in African American families
  6. Enhance coordination and integration of family support services
  7. Create reproductive social capital in African American communities
  8. Invest in community building and urban renewal
  9. Close the education gap
  10. Reduce poverty among African American families
  11. Support working mothers and families
  12. Undo racism
- (pp. 62–63)

Establishing universal care to be superior to the public and private sector insurance options afforded to women in the civilian populations is critical. In doing so, the actions indicated above would form the foundation for civilian public policy initiatives. Closing the gaps in maternal health is not only an issue of morality in the U.S. healthcare system, but also an avenue that affords equal opportunities for health and wellness for Black and White mothers and their infants.

### **C. FUTURE RESEARCH**

This thesis relies on previous studies to conduct a comparative analysis of maternal health and birth outcomes in the military and civilian population. To extend this study to quantitative research, I recommend multiple linear regression analysis be used to explore the following questions:

1. Do immediate maternal health outcomes differ by race/ethnicity (Black/non-Hispanic, Hispanic White, and non-Hispanic White) in a setting with universal healthcare access after statistically adjusting for other variables?
2. Does medium-term maternal health recovery differ by race/ethnicity?
3. Do patterns differ by other characteristics (e.g., education, age, motherhood experience)?

Longitudinal data from the Army's Person-Event Data Environment (PDE), includes monthly data on duty assignment location, dependent family member details, other demographic details, and dependent date(s) of birth. Service members take various

fitness tests throughout the year, and the military tracks various physical/mental health measures, weight, and body fat composition. This longitudinal data could be used to examine changes following birth, rates of recovery and how these patterns differ by race/ethnicity. Since health and well-being are consistently tracked in the military, methods to achieve quantitative analysis includes running multiple linear regression models. For research question one:

$$(1) Y_i = \beta_0 + \beta_1 Black_i + \beta_2 Hispanic_i + \beta_3 Other_i + X_i\gamma + \varepsilon_i$$

$Black_i$ ,  $Hispanic_i$ , and  $Other_i$  would represent a series of indicators equal to one for those who identify as non-Hispanic Black, Hispanic and other non-White groups, with non-Hispanic White as the excluded category. Estimating the model with only the variables listed above will get the raw differences between groups before adding a control vector  $X_i$  that includes demographic, birth and job characteristics (e.g., age of the mother, month of the birth, education level, enlisted/officer, branch of service, job category and prior test scores). After accounting for observable characteristics, the difference between non-Hispanic Whites and Blacks can be estimated and interpreted. A final version of this model should include baseline health characteristics, to measure whether post-birth outcomes change more for the non-White groups than for White mothers. Outcomes of interest would include physical fitness measures, mental health outcomes, weight, body fat composition and any health-related job limitations.

For research question two, modifications to model one would examine whether health recovery is faster for White mothers than for other groups, as follows:

$$(2) Y_{it} = \beta_0 + \beta_1 Black_i + \beta_2 Hispanic_i + \beta_3 Other_i + \delta_0 TimeSinceBirth_{it} + \delta_1 TimeSinceBirth_{it} * Black_i + \delta_2 TimeSinceBirth_{it} * Hispanic_i + \delta_3 TimeSinceBirth_{it} * Other_i + X_i\gamma + \varepsilon_{it}$$

where  $TimeSinceBirth_{it}$  is measured as the number of months since giving birth to the timing of the outcome measurement and the other variables are as noted above. Including non-mothers in the analysis as a control group would help depict a “typical” level of a given outcome. The variable will allow estimation to recovery for White mothers

following birth, as how quickly they start to recover compared to “typical” levels, based on observable characteristics. The primary variable of interest would be the *TimeSinceBirth\*Black* variable, which provides an estimate of how recovery of Black mothers differs from the recovery of White mothers.

For research question three, estimates can be achieved by analyzing the models separately by education level (high school degree or GED vs. some college or more), age (by quantile of the mother sample), and by motherhood experience (first-time mothers vs. mothers who already had a child). Ultimately, this form of analysis could strengthen the notion of universal insurance and the implications it has on maternal health disparities.

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