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Individual Risk Factors Associated with Cesarean Section Surgical Site Infections Among African American Women in California

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
2024

Abstract

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MPH, South University, 2021

BS, Savannah State University, 2018

Doctoral Study Submitted in Partial Fulfillment

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Abstract

Healthcare-associated infections (HAIs) are a significant public health issue. More than 600,000 patients in the United States develop HAIs every year. Surgical site infections (SSIs) are a very common HAI and can develop when a woman has a Cesarean section (C-section). The complications from the development of an SSI can be severe. SSIs and C-section rates are high among African American women. The purpose of this quantitative study, utilizing secondary data provided by the California Health and Human Services Open Data Portal, was to determine if age at the time of delivery, smoking status of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, human immunodeficiency virus status, and sickle cell disease status were associated with C-section SSIs among African American women. The theoretical framework for this study was the web of causation theory. The sample included 7,206 African American women who had a C-section in California at any time during 2022. Binary logistic regression, chi-square, and Fisher's exact test were used to analyze the data. The findings of this study revealed that age at the time of delivery significantly predicted the development of a C-section SSI, smoking and alcohol consumption during pregnancy were statistically significantly associated with the development of a C-section SSI, and sickle cell disease status significantly predicted the development of a C-section SSI. The results of this study can lead to positive social change by providing valuable information that may guide practitioners, hospital leaders, and critical public health stakeholders in reducing C-section SSIs among African American women and improving maternal health outcomes.

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Dedication

I dedicate this doctoral study to my Lord and Savior, Jesus Christ, for giving me strength, endurance, knowledge, and patience to complete this journey. Luke 1:37 states, "For with God, nothing is impossible." I also dedicate this study to my loving parents, Paul and Margaret. Their support and encouragement have guided me throughout this journey. Your belief in my dreams and your sacrifices to fulfill them has been the cornerstone of my achievements. This achievement is as much yours as it is mine. To my sisters, Shaqueena and Kelley, who are also my best friends, your patience and understanding during this journey have not gone unnoticed. From sending memes and TikTok videos whenever I needed a break and a good laugh, your belief in me made all the difference. I am forever grateful for our many moments of laughter amidst the stress. To my children, Christian and Dwayne, who are my greatest joy and motivation, watching you grow has instilled in me a more profound sense of purpose and determination. Both of you are why I aspire to be the best in all I do and show you that you can do anything you want. To my brother-in-law, Jacob, thank you for picking up my slack when I had to study, read, and write. You were always ready to step in whenever needed. I am genuinely appreciative.

Most importantly, to my husband, Dwayne, thank you for encouraging me and telling me every day that I could do this. I am deeply grateful for you standing by me every step of the way. Your unselfishness in putting my needs first and dedication to our family has made this achievement possible. I did this to show you all that with God, nothing is impossible. Cheers to the next chapter and the upcoming adventures that await.

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My deepest gratitude to my committee chairperson, Dr. Jennifer Gadarowski, for your invaluable guidance, insightful critiques, and unwavering support throughout my doctoral research journey. Your advice, expertise, and timely responses have been greatly appreciated. To Dr. Jamuir Robinson, your meticulous attention to detail has significantly shaped and refined my work, and your encouragement during challenging times was a constant source of motivation. Thank you both for providing constructive feedback and expert advice. Your diverse perspectives and profound knowledge in the areas of healthcare-associated infections and health equality among minorities have immensely contributed to the depth and rigor of this study. Your willingness to share your time has greatly benefited my work.

Special thanks are also due to my colleagues for their endless support and insightful discussions during my doctoral journey. Your shared knowledge and thoughtful advice enriched my work and made the journey more enjoyable and fulfilling. I cherish the camaraderie and learning I have experienced with each of you.

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Table of Contents

List of Tables

List of Figures

Section 1: Foundation of the Study and Literature Review

Introduction

Healthcare-associated infections (HAIs), also known as nosocomial infections, are a type of infection that occur in a patient because of receiving healthcare services in a healthcare facility, such as a hospital, clinic, or long-term care facility (Haque et al., 2018; Moore et al., 2023). The four main types of HAIs are surgical site infections (SSIs), catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs), and ventilator-associated pneumonia (VAP; Moore et al., 2023). SSIs are a type of infection that occurs at the site of a surgical incision (Agency for Healthcare Research and Quality [AHRQ], 2019). Bacteria, viruses, or fungi can cause these infections and occur after any type of surgery, including minor and major procedures (Haque et al., 2018). Symptoms of an SSI can include redness, swelling, warmth, pain, or drainage from the surgical site (AHRQ, 2019; Haque et al., 2018). Other SSI presentations include wound dehiscence, non-purulent drainage, and induration (Haque et al., 2018).

More severe infections can cause fever, chills, sepsis, and even death (Gyawali et al., 2019). SSIs are a concern for several reasons. First, SSIs can increase the length of hospitalization, increase the need for additional medical interventions, and reduce patient satisfaction (Fenny et al., 2020). SSIs can be highly costly; they increase the use of resources (i.e., antibiotics, diagnostic tests, and additional surgeries), leading to a surge in healthcare costs (Fenny et al., 2020; Ohr et al., 2021). SSIs can lead to antibiotic resistance (Velin et al., 2021). Antibiotics to treat SSIs can promote the growth of

antibiotic-resistant bacteria, making future infections more difficult to treat (Velin et al., 2021). Lastly, SSIs can have legal and regulatory implications (The Joint Commission, 2017). Healthcare facilities and providers are responsible for preventing SSIs and are subject to regulations and accreditation requirements for infection prevention and control (AHRQ, 2019). Failure to avoid SSIs can lead to legal action, regulatory sanctions, and damage to the reputation of the healthcare facility or provider (AHRQ, 2019).

A more severe problem that has increased over the past several years is the development of an SSI because of a cesarean section (C-section). SSIs are reported to occur in nearly 3–20% of all individuals who have C-sections (Gomaa et al., 2021). Studies have shown that African American women are more likely to have C-sections and develop SSIs from C-sections than non-Black women (Kawakita, 2019). Factors for this increase include maternal health disparities, implicit bias, and stereotyping (Kawakita, 2019; Taylor, 2020). Maternal health outcomes for African American women are noticeably worse compared to those of women from other racial and ethnic backgrounds. (Chen et al., 2021; Taylor, 2020). They experience higher rates of pregnancy-related complications, including hypertension, preeclampsia, gestational diabetes, and placental abnormalities (Chen et al., 2021; Chinn et al., 2021). Howell (2018) determined that African American women are three to four times more likely to die a pregnancy-related death as compared with White women.

I aimed to determine if there was a relationship between age at the time of delivery, smoking tobacco and non-tobacco products during pregnancy, alcohol use during pregnancy, human immunodeficiency virus (HIV) and sickle cell disease (SCD)

status, and the development of an SSI among African American women who underwent a C-section in California. This research is essential as it will enhance the understanding of the disparities in maternal health faced by African American women. By exploring the individual risk factors associated with the development of SSIs, the study can contribute to better health outcomes. This knowledge will be beneficial among healthcare providers and public health professionals to make them more aware of individual risk factors associated with the development of C-section SSIs among African American women take a proactive approach to infection prevention and control, which can lead to better patient outcomes, reduced healthcare costs, and improved patient satisfaction.

Section 1 of this study includes a discussion on the research topic of individual risk factors associated with the development of SSIs among African American women who underwent a C-section. The focus was placed on describing and addressing the existing research gap. This section also includes background information, the problem statement, the purpose of the study, research questions, and hypotheses explaining why the study was severely needed. The definitions of key terms related to the study, assumptions, scope, limitations, delimitations, significance, summary, and conclusions are also described.

Background

HAIs involving the bloodstream, respiratory tract, surgical wounds, and urinary tract have steadily increased across the United States over the past decade (Magill et al., 2018). According to the Centers for Disease Control and Prevention (CDC, 2022c), there were nearly 690,000 documented HAIs among hospital patients, and more than 70,000

died because of their infection in the United States in 2015. HAIs can occur in any healthcare setting, and patients with certain individual risk factors may be at a higher risk of developing infections (Haque et al., 2018). While all patients are at some risk for developing an HAI, some may be at higher risk due to individual factors such as age, chronic conditions, or recent surgery (Haque et al., 2018; Moore et al., 2023). Healthcare providers can take additional measures to prevent infections and improve patient outcomes by identifying these factors.

Patients with diabetes may be at a higher risk of developing an SSI due to impaired wound healing and increased susceptibility to bacterial infection (Dasari et al., 2021; Guo & DiPietro, 2010). Healthcare providers can monitor and manage blood sugar levels during and after surgery, provide appropriate wound care, and administer prophylactic antibiotics when indicated (Seidelman et al., 2023). Patients who are immunocompromised, such as those with (HIV)/ acquired immunodeficiency syndrome (AIDS) or cancer, may be at higher risk of developing HAIs due to weakened immune systems (Haque et al., 2018). Healthcare providers and other public health professionals can take additional precautions to prevent the spread of infections, such as implementing isolation precautions and providing additional immunizations to avoid common infections (Seidelman et al., 2023). By recognizing individual risk factors for HAIs, healthcare providers can take a proactive approach to infection prevention and control, leading to better patient outcomes, reduced healthcare costs, and improved patient satisfaction. It is paramount to ensure that infection prevention measures are appropriate for each patient, determined by considering their unique needs and circumstances.

Recognizing and addressing risk factors for HAIs is crucial for improving patient safety and reducing healthcare costs.

Ever since the 1990s, when the rate of C-section births started to rise, studies in the United States have highlighted that African American women are more prone to undergoing C-section deliveries compared to their White counterparts (Rubashkin, 2022). Implicit bias and stereotyping by healthcare providers have been identified as potential factors contributing to racial disparities in C-section rates (Huesch & Doctor, 2015; Taylor, 2020). Bias can affect decision-making and communication between healthcare providers and patients, ultimately impacting birth outcomes (Huesch & Doctor, 2015). Historical foundations of racism and socioeconomic factors play a role in increased C-section rates among African American women (Taylor, 2020). Historical experiences, such as a legacy of mistreatment and discrimination in healthcare, can influence patient-provider relationships and healthcare decision-making (Taylor, 2020). The historical context of racism and distrust may affect African American women's attitudes toward childbirth, leading to a higher likelihood of choosing C-sections (Taylor, 2020).

Socioeconomic status (SES) is crucial in healthcare access and outcomes (See et al., 2017). African American women, on average, have lower SES compared to their White counterparts (Chinn et al., 2021; See et al., 2017). Limited access to quality prenatal care and healthcare facilities, along with higher levels of poverty and inadequate insurance coverage, can contribute to higher C-section rates (Daw et al., 2020; Miller & Baker, 2021). All these complications and factors can increase the likelihood of C-sections among African American women. Despite knowing that African American

women are more likely to experience mistreatment and discrimination in healthcare and increased rates of C-sections and SSIs, there is a gap in the literature to determine the individual risk factors of C-section SSIs.

The results of this study will provide support for future research endeavors. They could contribute to a more comprehensive comprehension of the factors contributing to the occurrence of SSIs among African American women who underwent a C-section. Gaining insight into the specific, individual risk factors that contribute to the occurrence of C-section SSIs among African American women is essential for the effective implementation of infection prevention and control initiatives targeting HAIs. My findings on the individual risk factors associated with the development of SSIs among African American women may significantly impact the efforts for educating healthcare providers and public health professionals and raising awareness of this public health issue.

Problem Statement

HAIs remain a significant public health issue. More than 600,000 individuals in the United States develop HAIs while being treated at a healthcare facility for other health problems every year (Magill et al., 2018). SSIs are a very common HAI and can develop when a woman has a C-section. The complications from the development of an SSI can be severe (Haque et al., 2018). Once an individual develops an SSI, it may enter the bloodstream, causing sepsis (Gyawali et al., 2019). Sepsis is characterized as a critical medical emergency arising when the body's immune response to a severe infection leads

to widespread organ dysfunction, potentially culminating in organ failure and fatality (Gyawali et al., 2019).

Valdes (2020) determined that African American women in the United States have significantly higher C-section rates than every other race. According to data from the National Center for Health Statistics, the C-section rate for African American women in the United States was 36% from 2019–2021, compared to a national average of 30% for all other races (CDC, 2023b). Several factors contribute to the high C-section rates among African American women. One major factor is systemic racism and bias in the healthcare system (Chinn et al., 2021; Valdes, 2020). Studies have shown that African American women are more likely to experience mistreatment and discrimination during pregnancy and childbirth, which can lead to unnecessary interventions such as C-sections (Chinn et al., 2021; Miller & Baker, 2021). African American women are also more likely to have chronic health conditions such as obesity, hypertension, and diabetes, which can all increase the likelihood of needing a C-section (Chinn et al., 2021; Oribhabor et al., 2020). There are socioeconomic factors such as poverty and lack of access to healthcare that can contribute to the high C-section rates among Black women (Chinn et al., 2021; Daw et al., 2020). Studies have shown that Black women are more likely to live in areas with limited access to obstetric care, which can increase the likelihood of a C-section if complications arise during childbirth (Miller & Baker, 2021; Oribhabor et al., 2020).

According to Kawakita (2019), African American women have a higher incidence of C-section SSIs compared to women who are not African American. SSIs significantly

increase medical costs and prolonged hospitalizations (Fenny et al., 2020). Approximately 3% of individuals who develop an SSI will die because of the infection (Saeed et al., 2017). Even with the extensive knowledge and awareness currently available, there remains a notable deficiency in research specifically addressing the individual risk factors linked to the development of SSIs among African American women in California who have undergone C-sections. Although prior studies have documented a higher incidence of C-section SSIs among African American women compared to their non-African American counterparts, the literature is markedly sparse when it comes to exploring the distinct risk factors contributing to SSIs within this demographic (Kawakita, 2019).

According to Mehari et al. (2020), advanced maternal age is defined as a woman being 35 years or older at delivery time. In the United States, numerous studies have shown that the average age of women having their first child has consistently risen over the last four decades (Mehari et al., 2020). From 1990 to 2012, the birth rate for women aged 40–44 more than doubled (Mehari et al., 2020). Previous studies revealed that African American women are more likely to experience advanced maternal age during pregnancy because of increased delays in accessing health care and numerous health inequities (Holzman et al., 2009; Njoku et al., 2023). Evidence-based research has revealed that women who have an advanced maternal age have an increased risk of delivering via C-section (Bergholt et al., 2020). After extensively reviewing the literature, there are no studies to determine if African American women with an increased maternal age have an increased risk of developing a C-section SSI.

Hirth et al. (2022) conducted a study that determined pregnant Black women are more likely to engage in both smoking and alcohol consumption if they had a high school degree or less. Women who smoke tobacco and consume alcohol during pregnancy are more likely to need a C-section due to increased risks of complications (De Wit et al., 2013; Wolfsberger et al., 2021). Vaping and the use of e-cigarettes are growing in popularity. Increasing evidence suggests that the use of e-cigarettes and vaping products by pregnant women could negatively affect placental performance and potentially lead to structural abnormalities in the fetus (Mescolo et al., 2021). A thorough review of the literature has determined that there are no recent studies regarding African American women who smoke tobacco and non-tobacco products or consume alcohol during pregnancy having an increased risk of developing a C-section SSI.

HIV continues to disproportionately affect Black or African American women, who account for nearly 60% of new HIV infections among women in the United States, despite making up less than 15% of the total population (Ojikutu & Mayer, 2021). When a pregnant woman who is HIV-positive reaches the 38th week of pregnancy, a scheduled C-section is recommended to reduce mother-to-child HIV transmission with an unknown viral load or high viral load (Cambrea & Pinzaru, 2018). Past studies revealed that compared with HIV-negative women, C-sections among HIV-positive women had an increased likelihood of infectious complications, surgical trauma, and prolonged hospitalizations (Kourtis et al., 2014; Semprini et al., 1995). Despite the evidence indicating a high prevalence of HIV among Black women, there is a concerning lack of

research on whether Black women living with HIV and undergoing a C-section have a heightened risk of developing an SSI.

According to the CDC (2022b), 1 out of every 365 births among Blacks or African Americans will result in a child being born with SCD. SCD is an inherited disorder involving erythrocytes or red blood cells. The most prominent symptom of SCD is periodic episodes of extreme pain, sometimes referred to as pain crises (CDC, 2022b). Infections, acute chest syndromes, and strokes can result from the inflicted pain (CDC, 2022b). Fisch et al. (2021) studied pregnancy outcomes in women with SCD in California, and their findings revealed that African American women with SCD were more likely to have a C-section, as well as being more likely to experience post-partum complications associated with SCD. Studies have not determined if having SCD is an individual risk factor for developing an SSI.

Purpose of the Study

The purpose of this quantitative doctoral research study was to determine if age at the time of delivery, smoking tobacco and non-tobacco products during pregnancy, alcohol use during pregnancy, HIV status, and SCD status are associated with C-section SSI among African American women in California. Although researchers have investigated some of these issues, there is very little or no literature on individual risk factors associated with C-section SSIs among African American women, assessing age at the time of delivery, smoking tobacco and non-tobacco products during pregnancy, alcohol use during pregnancy, HIV status, and SCD status. Previous research has established that African American women have a higher incidence of SSIs following C-

sections compared to women who are not Black (Kawakita, 2019). Despite this, there is a significant gap in the literature concerning the specific risk factors that contribute to the occurrence of SSIs in this particular group (Kawakita, 2019).

Research Questions and Hypotheses

I used the following research questions in this quantitative study to investigate the individual risk factors associated with the development of SSIs among African American women who underwent a C-section in California:

Research Question 1 (RQ1): What is the association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section?

$H_0$1: There is no association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section.

H_A1: There is a statistically significant association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section.

Research Question 2 (RQ2): What is the association between smoking tobacco and non-tobacco products and alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section?

$H_0 2_a$: There is no association between smoking tobacco and non-tobacco products during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_A2_a: There is a statistically significant association between smoking tobacco and non-tobacco products during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_02_b: There is no association between alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_A2_b: There is a statistically significant association between alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section.

Research Question 3 (RQ3): What is the association between HIV and SCD (SCD) status and the development of an SSI among African American women who underwent a C-section?

H_03_a: There is no association between HIV status and the development of an SSI among African American women who underwent a C-section.

H_A3_a: There is a statistically significant association between HIV status and the development of an SSI among African American women who underwent a C-section.

H_03_b: There is no association between SCD status and the development of an SSI among African American women who underwent a C-section.

H_A3_b: There is a statistically significant association between SCD status and the development of an SSI among African American women who underwent a C-section.

Theoretical Foundation for the Study

The theoretical framework that supports this study is the web of causation theory. Developed by Ipsen et al. (1960), this theory proposes that the emergence of a disease

can be understood as a result of a complex interplay of numerous interconnected elements. These factors encompass individual and environmental aspects as well as social and behavioral determinants, all contributing to the intricate web that influences disease development. The web of causation theory is frequently used in public health and epidemiology to understand the complex interplay of multiple factors contributing to a health outcome or disease (Krieger, 1994). It emphasizes that diseases or health conditions result from interactions between various levels of factors. These factors can be broadly categorized into three levels or factors, which include (a) distal, (b) intermediate, and (c) proximal (Krieger, 2008). Distal factors include the societal, cultural, and environmental factors that set the context for individual health (Krieger, 2008; Ventriglio et al., 2016). They have social determinants of health (SDOH) such as socioeconomic status, education, employment, access to healthcare, and cultural norms.

Distal factors influence the intermediate and proximal factors in the web of causation (Krieger, 2008). Intermediate factors represent more specific and immediate influences on health outcomes. They include lifestyle factors (i.e., diet and physical activity), behavioral choices (i.e., smoking and alcohol consumption), and psychosocial factors (i.e., stress and social support). Intermediate factors mediate the relationship between distal and proximal factors (Krieger, 2008). Proximal factors are the immediate and direct factors that directly affect health outcomes (Krieger, 2008). They include biological and genetic factors, exposure to specific pathogens or toxins, and individual clinical characteristics. Proximal factors are influenced by both intermediate and distal factors (Krieger, 2008). The web of causation theory illustrates how these levels of

factors interact and influence each other in a complex manner (Ventriglio et al., 2016). It emphasizes that health outcomes result from various factors acting together. It also recognizes that modifying one factor in isolation may not be sufficient to bring about significant changes in health outcomes, as the interconnectedness of factors requires a comprehensive and multi-level approach to interventions and prevention (Krieger, 1994).

The web of causation theory helps researchers and public health practitioners understand the complexity of health outcomes and design interventions that address multiple levels of factors (Krieger, 1994; Ventriglio et al., 2016). Considering the interactions and relationships between various factors promotes a holistic and comprehensive approach to improving population health.

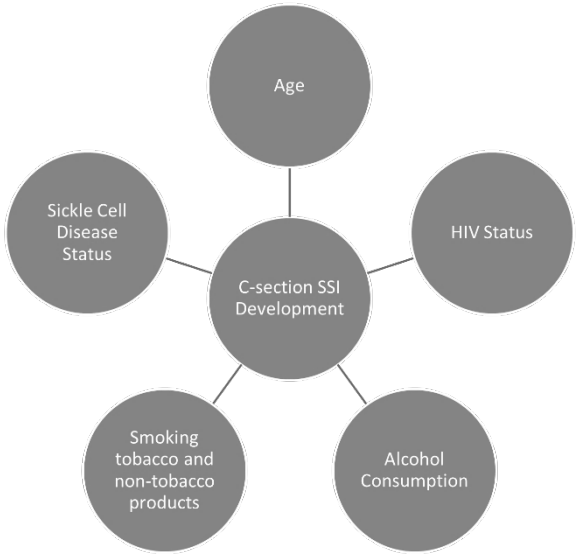
The web of causation theory further demonstrates that diseases do not occur randomly within a specific population but instead focus on identifying the risk factors associated with the development of diseases, emphasizing the need for research to pinpoint these factors (Krieger, 1994). This theory introduces a significant paradigm shift in understanding disease causation by acknowledging the presence of multiple causes or risk factors for a disease (Ventriglio et al., 2016). Additionally, the web of causation theory posits that disease prevention is possible by severing certain strands of the web, i.e., eliminating specific risk factors. Generally, the factors most directly linked to the disease are addressed first (Aschengrau & Seage, 2018). The relevance of this theory to my study lies in how it illustrates the development of a disease through a complex network of interrelated elements, including sociodemographic factors and personal behaviors (Krieger, 1994). By determining the risk factors associated with C-section SSIs

(visually seen by web strands of the model conducted from the study), SSIs can be prevented by being able to "cut" web strands from the model.

The logical connections between the framework presented and the nature of my study are evident in that the web of causation theory reveals the multitude of paths through which a disease, whether communicable or non-communicable, can be contracted, and these pathways or causes may vary among individuals (refer to Krieger, 1994). In my research, I have applied the web of causation theory to demonstrate the various risk factors involved in the development of SSIs among African American women who have undergone C-sections. This study aimed to prevent the development of SSIs in this demographic by identifying and addressing specific risk factors, akin to cutting certain strands from the web of causation, as depicted in Figure 1. This approach is intended to enhance maternal health outcomes for African American women.

Figure 1

Web of Causation for C-section SSI Development



Nature of the Study

The nature of the study was a quantitative, retrospective cross-sectional study to explore the association between individual risk factors and the development of an SSI among African American women who underwent a C-section in California in 2022. The secondary data were obtained via the California Health and Human Services (CHHS) Open Data Portal and the California Department of Public Health (CDPH). The independent variables were age at the time of delivery, smoking tobacco and non-tobacco products during the pregnancy, alcohol use during the pregnancy, HIV status, and SCD status. The dependent variable was the development of a C-section SSI. A retrospective cross-sectional study design was appropriate for this study because it gathers data from a population or sample at a specific point in time to describe the prevalence or distribution of a characteristic or outcome of interest (see Wang & Cheng, 2020). It provides valuable insights into the population's characteristics and associations between variables (Wang & Cheng, 2020). I used binary logistic regression and chi-square test for independence to test the relationship or association between the independent variables (age, smoking status of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status) and the outcome variable (C-section SSI development).

Literature Search Strategy

The literature search included the following databases: Google Scholar, ScienceDirect, the Walden University Library, PubMed, and MEDLINE with Full text. The key search terms and combination of search terms included *surgical site infections*,

healthcare-associated infections, *African American women*, *Black women*, *non-Black women*, *sepsis*, *maternal mortality*, *risk factors*, *pregnancy*, *hospital setting*, *racial disparities*, *bias*, *racism*, *socioeconomic factors, health disparities*, *cesarean section*, *HIV*, *age*, *smoking*, *tobacco*, *vaping*, *e-cigarettes*, *alcohol*, *sickle cell disease*, and *public health*. Many articles utilized in this study were published from 2018 to 2022, with a few exceptions that specifically pertained to this doctoral research. The literature sources were carefully selected to align with and address the research questions and hypotheses. To ensure currency, peer-reviewed journal articles older than 5 years were included in the search, except for a few relevant articles from reputable sources pertinent to this research investigation.

Literature Review Related to Key Variables and/or Concepts

In this section, I examined the literature on key variables and concepts related to this study, which involved HAIs, SSIs, and C-sections. The individual risk factors associated with the development of SSIs among African American women were also explored, which included age at the time of delivery, smoking tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status.

HAIs

HAIs are infections that patients contract while receiving healthcare services (Haque et al., 2018). HAI refers expressly to infections associated with hospital admissions (previously known as nosocomial infections; Moore et al., 2023). The definition has expanded to include infections acquired in healthcare settings, such as

long-term care facilities, family medicine clinics, home care, and ambulatory care (Moore et al., 2023). HAIs are infections that develop 48 hours or later following hospitalization or within 30 days after receiving healthcare services (Haque et al., 2018). HAIs can be caused by various microorganisms, including bacteria, viruses, and fungi. They can occur in various body parts such as the bloodstream, urinary tract, surgical wounds, or respiratory tract (Haque et al., 2018).

HAIs can develop because of numerous factors, including improper hand hygiene by healthcare providers, contaminated medical equipment or devices, antibiotics that promote antibiotic-resistant bacteria, and transmission of infectious agents between patients or between patients and healthcare providers (Wiemken et al., 2020). HAIs can result in significant morbidity and mortality rates, prolonged hospital stays, increased healthcare costs, and lead to other adverse outcomes (Forrester et al., 2022; Haque et al., 2018). Preventing HAIs is an important goal for public health professionals, healthcare facilities, and providers. These infections are independent of the initial illness that led patients to seek hospital care and are not present or in the incubation phase at admission (Jeon et al., 2014). There are four main types of HAIs, which are: (a) SSIs, (b) catheter-associated urinary tract infections, (c) CLABSIs, and (d) ventilator-associated pneumonia (Haque et al., 2018). Agencies such as the National Healthcare Safety Network (NHSN) of the CDC closely monitor these infections. Over the past few decades, hospital administrators have recognized the significance of HAIs and have implemented rigorous infection tracking and surveillance systems (Haque et al., 2018). Many hospital administrators have implemented comprehensive prevention strategies to decrease the

occurrence of HAIs (Moore et al., 2023). The consequences of HAIs extend beyond individual patients and impact the community, mainly due to their association with multidrug-resistant infections (Haque et al., 2018; Moore et al., 2023). Identifying patients with risk factors for both HAIs and multidrug-resistant infections plays a crucial role in preventing and reducing these infections.

HAIs are increasingly recognized as a significant public health issue for various reasons. They pose a substantial risk to patient safety, resulting in heightened morbidity, mortality, and extended hospitalizations (Puro et al., 2022). Patients who acquire infections during healthcare encounters face elevated risks of complications and poorer health outcomes (Haque et al., 2018). This places a burden on both the individuals affected and the overall healthcare system. HAIs have significant financial implications. In U.S. hospitals alone, HAIs incur a minimum of $28.4 billion annually in direct medical costs (Forrester et al., 2022). To contribute an additional $12.4 billion in expenses related to premature deaths and reduced societal productivity (Forrester et al., 2022). SSIs comprise nearly 80% of the total costs associated with HAIs in the United States (Seidelman et al., 2023). The treatment of HAIs necessitates supplementary healthcare resources, including prolonged hospitalizations, heightened medication usage, and additional diagnostic tests (Haque et al., 2018; Puro et al., 2022). These supplementary expenses contribute to the escalating healthcare costs and can strain healthcare budgets (Forrester et al., 2022).

Healthcare settings foster an environment conducive to rapidly transmitting infectious diseases due to close interactions among patients, healthcare workers, and

contaminated surfaces or equipment (Dalton et al., 2020). The risk of transmission is heightened in settings characterized by high patient turnover, invasive procedures, and compromised immune systems (Shang et al., 2019). Hospitals and other healthcare facilities become potential epicenters for disseminating infections (Dalton et al., 2020). The increasing concern surrounding HAIs can be attributed to the emergence of novel pathogens and multidrug-resistant organisms. These newly identified or evolving pathogens may possess distinctive characteristics, heightened virulence, or limited treatment options, presenting significant challenges in their control and management within healthcare settings (Dalton et al., 2020). Numerous HAIs are attributed to bacteria that have acquired resistance to multiple antibiotics, a condition called antibiotic resistance (Avershina et al., 2021). This development significantly complicates infection treatment and diminishes the effectiveness of available therapies (Avershina et al., 2021; Dalton et al., 2020). The emergence of antibiotic-resistant infections intensifies the complexity and urgency surrounding the challenge of HAIs.

Chen et al. (2021) found that Black individuals have a higher likelihood of contracting an HAI compared to their White counterparts. Several factors may contribute to this discrepancy, such as implicit biases of healthcare providers toward minority groups, socioeconomic inequalities in health determinants, systemic underfunding of hospitals primarily serving vulnerable populations, and a lack of in-depth research addressing racial and ethnic disparities in HAIs (Chen et al., 2021; Hoffman et al., 2016). On a personal level, implicit bias refers to unintentional attitudes or stereotypes that subtly shape our interpretations of situations, influencing our actions, interactions, and

decisions (Shah & Bohlen, 2023). In the context of healthcare, these unintentional biases from medical professionals toward patients of different racial or ethnic backgrounds can create differences in the standard of care, with minority patients often receiving less optimal treatment compared to White patients (Chen et al., 2021; Howell, 2018).

Hoffman et al. (2016) scrutinized medical students and residents, uncovering widespread misconceptions, such as the idea that Black patients have biological differences, like altered pain tolerance, compared to White patients. These underlying biased perspectives and behaviors in healthcare professionals heighten feelings of mistrust and perceptions of racial bias among minority patients (Hoffman et al., 2016). Such attitudes perpetuate longstanding disparities in care, where patients from marginalized backgrounds may experience reduced nurse interactions, limited diagnostic evaluations for similar symptoms, and insufficient pain relief (Hoffman et al., 2016).

Variations in income and education across racial and ethnic groups can lead to differences in the occurrence of HAIs (Howell, 2018). Factors such as poverty levels, income disparities, and the proportion of Black individuals in the population have demonstrated strong associations with HAIs (Fishman et al., 2021; Howell, 2018). The Society for Healthcare Epidemiology of America recently highlighted an inadequacy in the current studies, emphasizing the need to understand better the impact of SDOH on antibiotic prescribing trends across different racial and ethnic demographics (Charani et al., 2021; Harvey et al., 2023). The scarce research on how HAI prevention strategies affect racial and ethnic disparities indicate a missed opportunity to recognize the root causes of these inequities and to devise targeted interventions to bridge these divides

(Chen et al., 2021). This is in the face of abundant data that confirm the presence of racial and ethnic discrepancies in HAIs.

SSI

SSIs are among the most common HAIs and are expensive, costing more than $3 billion annually (Seidelman et al., 2023; Villers, 2020). More than 300,000 individuals are diagnosed with an SSI yearly in the United States (De Simone et al., 2020). Approximately 3% of individuals who develop an SSI will die because of the infection (Saeed et al., 2017). Patients who undergo surgery and develop an SSI face a mortality risk that is two to 11 times greater compared to those who do not contract an SSI (Silva de Andrade et al., 2019). The SSI can be directly attributed to the death in more than 75% of patients with the SSI (Silva de Andrade et al., 2019). With such staggering numbers, SSIs remain a public health issue.

SSIs can range in severity from minor to severe or life-threatening. Despite the severity, all SSIs contribute to significant patient suffering and affect health outcomes. The repercussions of SSIs can be severe, affecting patients' mental and physical well-being both during their hospital stay and after they are discharged (Totty et al., 2021). There is a known association between physical impairment and depressive symptoms, and it has been observed that nearly half of the patients who experience depression while hospitalized continue to exhibit signs of depression 6 months after being discharged (Totty et al., 2021). Pain is the most frequently reported symptom associated with SSIs (Avsar et al., 2021). Individuals suffering from SSIs often recount experiencing sudden, almost intolerable pain (Avsar et al., 2021).

Tanner et al. (2012) highlighted that patients suffering from SSIs characterized their pain as persistent, lasting for several weeks or even months, and leading them to feelings of "complete hopelessness" and a "desire for death." Patients noted that the odor of the wound was unpleasant, and the excessive fluid discharge was profoundly humiliating, evoking feelings of shame (Avsar et al., 2021). Patients also expressed uncertainty in recognizing new symptoms. They felt a sense of unease when examining their wounds due to a lack of understanding of what a healthy wound should appear like (Avsar et al., 2021; Tanner et al., 2012). Further, they noted that physical symptoms, including swelling, redness, and occasionally elevated body temperature, could manifest suddenly or several days after the initial surgical procedure (Avsar et al., 2021). The influence of SSIs on mental and physical health may lead to additional, unquantified financial burdens for both the patient and healthcare providers due to the extra treatments needed to address the direct and indirect effects of the infection (Totty et al., 2021). Every SSI that develops will result in an increased hospital length of stay, typically 7 to 11 days, increasing the cost of hospitalization or admission by more than $20,000 (Fenny et al., 2020). Patients with SSIs have more than 3 million excess hospital days every year (Fenny et al., 2020). SSIs are common due to the number of surgical procedures performed. In the United States, nearly 50 million surgeries are performed in hospitals and over 51 million in ambulatory or outpatient surgical centers, totaling more than 300 million annually (Dobson, 2020).

Based on NHSN guidelines, an SSI is determined if, following an NHSN surgical procedure, an event indicative of an SSI appears within 30 days and is limited to the skin

and the underlying subcutaneous tissue at the incision site (CDC, 2023a). Evidence of infection should be present, such as pus from the superficial incision, identification of infectious agents from a specimen taken cleanly from the incision or the underlying tissue using either culture or non-culture methods aimed at diagnosis or treatment, or a conscious decision by a medical professional to open up the superficial incision where no culture or non-culture test is done (CDC, 2023a). The patient should also exhibit at least one of these symptoms: (a) localized pain, (b) swelling, (c) redness or warmth, or (d) an SSI diagnosis by a qualified medical practitioner (CDC, 2023a). SSIs fall under three categories: (a) superficial incisional, affecting the skin or layers beneath it at the incision; (b) deep incisional, impacting the muscle or connecting tissues at the incision site; and (c) organ/space, related to areas and structures more profound than the incision (CDC, 2023a). For monitoring purposes per NHSN, superficial incisional infections are observed for 30 days. In contrast, deep incisional and organ/space infections are tracked for 30 or 90 days based on the specific surgical operation (CDC, 2023a).

Research findings indicate that African Americans may face an elevated risk of SSIs in comparison to other racial and ethnic groups (Azin et al., 2020). Multiple factors contribute to this disparity, including disparities in healthcare quality, comorbidities, socioeconomic factors, and biological considerations (Azin et al., 2020). Azin et al. (2020) noted that compared to non-Hispanic Whites, African Americans displayed a 20–50% increase in the raw mortality rate after undergoing surgery. African Americans show elevated postoperative complications, including a higher likelihood of disease returning (Azin et al., 2020). It is essential to understand that these comparisons have mainly been

based on data from specific institutions or national groups or have been confined to some surgical regions such as neurosurgery, cardiac surgery, orthopedic surgery, and general surgery. Lower income levels and limited healthcare access among African Americans can contribute to an increased risk of SSIs (Rickard et al., 2020). The lack of access to quality healthcare and potential delays in receiving surgical interventions can heighten the likelihood of developing SSIs (Rickard et al., 2020).

African Americans may have a higher prevalence of comorbid conditions, such as diabetes, obesity, and hypertension, which are established risk factors for SSIs (Khosla et al., 2021; Lofton et al., 2023; Ogunniyi et al., 2021). These conditions can increase susceptibility to infections and impede the healing process after surgery (De Simone et al., 2020). While certain genetic and physiological factors may play a role in the higher SSI risk among African Americans, further research is required to comprehend the biological mechanisms behind this disparity fully. To tackle the racial gap in SSIs, a comprehensive approach is necessary. This approach should prioritize enhancing healthcare access, reducing healthcare disparities, implementing evidence-based infection prevention practices, and addressing the SDOH. By actively addressing these factors, healthcare systems can make strides in reducing SSIs and enhancing outcomes for all patient populations, including African Americans.

C-Sections

A C-section is a surgical procedure in which a fetus or fetuses are delivered through an abdominal incision (laparotomy) and an incision in the uterus (hysterotomy; Sung & Mahdy, 2022). The first recorded C-section took place in 1020 A.D., and since

then, the procedure has undergone significant advancements (Sung & Mahdy, 2022). It is the most frequently performed surgery in the United States, with over one million women undergoing cesarean deliveries each year (Sung & Mahdy, 2022). Over time, the rate of cesarean deliveries has risen from 5% in 1970 to more than 30% in 2016 (Cao et al., 2023). C-sections are typically conducted when vaginal delivery poses risks to the health and well-being of the mother or baby or under specific predetermined circumstances (Gomaa et al., 2021; Zakerihamidi et al., 2015). Planned C-sections may be scheduled in advance for various reasons, such as a history of previous C-sections, breech presentation, multiple pregnancies, or certain medical conditions (Cao et al., 2023). In certain instances, emergency C-sections may be necessary when complications arise during labor or delivery (Sung & Mahdy, 2022).

Studies have shown that African American women are more likely to be perceived as high-risk and have a significantly higher probability of undergoing a C-section compared to other women (Huesch & Doctor, 2015). Data from the CDC revealed that in 2019, the C-section rate for Black women in the United States was 33.8%, while the national average stood at 31.7% (CDC, 2023a). This trend has been observed in various studies conducted at single hospitals, large cities, regional systems, and nationwide data sets. The racial disparities in C-section rates have persisted from the early 1990s to more recent periods without any signs of reduction (Huesch & Doctor, 2015).

There are several potential reasons that contribute to these racial disparities in care. Firstly, differences in observed or unobserved indications for C-sections may exist,

leading to variations in the care provided to African American women based on the available evidence-based research and studies (Okwandu et al., 2022). Factors related to the mother, fetus, and placenta have been associated with C-section rates and unobserved or unrecorded indications (i.e., body mass index) may also vary among different racial and ethnic groups (Okwandu et al., 2022). The extent to which preexisting indications are adequately adjusted for is not well understood, particularly due to the limitations of administrative data that often lack important variables such as parity, obesity, and gestational age, which are clinically significant factors in decision-making. Another factor contributing to the disparities in C-section rates among African American women is the potential variation in patient-provider or hospital interactions (Howell, 2018; Okwandu et al., 2022). This implies that there may be obstacles for African American women in effectively communicating their maternity care preferences to healthcare providers, or providers may be less likely to act upon the preferences expressed by these women (Chambers et al., 2022; Oribhabor et al., 2020). Patient preferences themselves might contribute to the observed differences in the care received among racial and ethnic groups (Moore et al., 2022).

A study conducted by Hanson et al. (2022) investigated racial disparities in cesarean deliveries among nulliparous women who delivered at term in Nebraska between 2005 and 2014. It was revealed that Black women had a higher risk or association with C-sections compared to other races (Hanson et al., 2022). Suggested risk factors included obesity and low education status. Black women experience higher rates of obesity compared to other racial/ethnic groups, regardless of socioeconomic status, as

indicated by Lofton et al. (2023). Various systemic obstacles contribute to this disparity in weight management, including limited access to healthy food options, disproportionate marketing of unhealthy foods, and fewer safe exercise environments (Hanson et al., 2022; Lofton et al., 2023). Additionally, women who are overweight or obese tend to gain more weight during pregnancy and struggle more with postpartum weight loss. This pattern of high pre-pregnancy BMI and substantial gestational weight gain increases the risk for cesarean sections and the likelihood of repeated C-sections in future pregnancies if the additional weight is not shed.

Disparities in C-section rates between African American women and non-African American women remain consistent across various studies and datasets (Huesch & Doctor, 2015; Snowden et al., 2020). The factors contributing to these disparities are intricate and encompass variations in observed and unobserved indications for C-sections, as well as limitations in appropriately adjusting for relevant factors within the available data (Hanson et al., 2022; Snowden et al., 2020). To mitigate the discrepancies in C-section rates among Black women, it is crucial to address both the underlying factors and individual risk factors. This involves tackling systemic racism and bias within the healthcare system, improving access to high-quality obstetric care, and promoting patient-centered approaches that actively involve patients in the decision-making process. Additionally, exploring individual risk factors can also be beneficial in improving health outcomes and increasing patient satisfaction.

Age

Maternal age can greatly influence the outcome of a pregnancy. Women 17 years old and younger and those 35 and older are more likely to experience complications during their pregnancy (Chakole et al., 2022). Pregnancy during adolescence is closely linked to suboptimal outcomes for both the mother and the infant (Diabelková et al., 2023). Pregnant teenagers often suffer from inadequate prenatal care, mainly because the girls might not recognize their pregnancy early on or might lack sufficient knowledge about prenatal care to seek it before entering their third trimester (Chakole et al., 2022). This lack of prenatal attention frequently leads to higher instances of preterm births and babies born with low weights worldwide among teen mothers (Chakole et al., 2022; Diabelková et al., 2023). Particularly for girls younger than 14, there are heightened health risks due to their immature pelvic development, which can complicate childbirth (Ami et al., 2023; Chakole et al., 2022). Pregnant teenagers are prone to labor complications, including obstetric fistulas, a condition where a tear in the birth canal leads to uncontrollable leakage of urine or feces (Chakole et al., 2022). This issue can arise when labor is obstructed and a C-section is not available. Particularly in less developed countries, complications from pregnancy and childbirth stand as the primary reasons for fatalities among girls aged 15 to 19 (Chakole et al., 2022; Diabelková et al., 2023).

In the United States, teenage pregnancy and birth rates tend to be higher among African American adolescents compared to their White counterparts (Cox, 2020; Dumas et al., 2020). The prevailing notion attributes this discrepancy to ethnic minority status

and socioeconomic challenges. Economic disadvantages can limit access to quality education and healthcare, including reproductive health services and contraception (Maheshwari et al., 2022). Factors such as the level of parental engagement, the influence of peers, inadequate sex education, and the use of substances like alcohol all play a part in the high rate of teenage pregnancies among African Americans (Cox, 2020). Among these, parental engagement and peer influences are consistently noted as significant risk factors for teen pregnancy in numerous studies (Cox, 2020; Dumas et al., 2020).

Pregnant teenagers are more likely to need a C-section, therefore increasing the risk of complications, including SSIs (Eriksen et al., 2016; Maheshwari et al., 2022). There are numerous circumstances necessitating a C-section among this population, including cases of immediate fetal distress or a disproportion between the size of the fetus and the woman's pelvis, also known as cephalopelvic disproportion (Ami et al., 2023; Maheshwari et al., 2022; Yussif et al., 2017). *Fetal distress* is a condition characterized by inadequate oxygen (hypoxia) in the fetus, leading to respiratory and circulatory issues during labor, often evidenced by alterations in fetal heart rate patterns (Deng et al., 2023). This distress can potentially result in hypoxic-ischemic encephalopathy, which may further progress to cerebral palsy or even perinatal death (Deng et al., 2023). In such cases, an emergency C-section may be necessary to expedite delivery and prevent harm to the baby. Timely recognition and management of fetal distress can mitigate harm to the fetus' vital organs before birth (Deng et al., 2023). It is crucial to improve monitoring of the fetus' condition within the womb during pregnancy to safeguard both the unborn child and the expecting mother. Cephalopelvic disproportion occurs when there is an

inconsistency between the size or shape of the baby's head and the mother's pelvis (Ami et al., 2023). This discrepancy can lead to a "failure to progress" in labor due to physical impediments (Ami et al., 2023). If not addressed, it can result in obstructed labor, which, without the intervention of a cesarean section, may elevate the risks of mortality or serious health issues for the mother or the baby during the perinatal period (Ami et al., 2023).

Mehari et al. (2020) defined *advanced maternal age* as 35 or older at delivery time. Beyond that, maternal age above 40 is considered a very advanced maternal age, and above 45 is an extremely advanced maternal age. In the United States, multiple studies have consistently shown a rising trend in the average age of women having their first child over the past four decades (Mehari et al., 2020). Between 1990 and 2012, the birth rate for women aged 40–44 more than doubled (Mehari et al., 2020). The increasing trend of advanced maternal age can be attributed to women prioritizing careers and financial stability, resulting in a delay in childbearing (Bergholt et al., 2020; Glick et al., 2021). Advancements in reproductive technology have expanded the window of reproductive possibilities, contributing to a higher incidence of pregnancies among women of advanced maternal age (Glick et al., 2021). It is important to note that advanced maternal age is considered a risk factor for adverse outcomes for both the mother and the fetus (Glick et al., 2021; Mehari et al., 2020). Negative birth outcomes linked to older maternal age encompass higher instances of genetic irregularities, pregnancy loss, premature labor, admissions to the neonatal intensive care unit, and stillbirth (Glick et al., 2021).

Several research studies have indicated that Black or African American women are more likely to be of advanced maternal age when pregnant (Crandall, 2021; Holzman et al., 2009). Contributing factors encompass delayed access to healthcare, health challenges stemming from work environments, fewer opportunities to engage in a healthful lifestyle with regular exercise and a balanced diet, exposure to environmental pollutants, resorting to risky behaviors such as smoking, alcohol, and drug consumption, and facing heightened stress due to experiences of discrimination, violence, economic hardships, unstable housing, and a lack of supportive social networks (Holzman et al., 2009). It is worth noting that many of these causes are prevalent and, to some extent, "infectious" within communities characterized by high levels of deprivation. Evidence-based research has shown that women of advanced maternal age have an elevated risk of delivering via cesarean section (Bergholt et al., 2020). One factor involves the increased likelihood of pregnancy complications.

Advanced maternal age is associated with a higher incidence of certain pregnancy complications, such as gestational diabetes, gestational hypertension, and pre-eclampsia (Glick et al., 2021; Sun et al., 2023). These conditions can increase the likelihood of needing a C-section to ensure the safety of both the mother and the baby (Sun et al., 2023). Another factor involves a higher incidence of fetal distress. As women age, the placenta's function may decline, leading to an increased risk of fetal distress during labor (Lean et al., 2017). Women of advanced maternal age are more likely to conceive twins or higher-order multiples due to the higher likelihood of assisted reproductive technologies (Glick et al., 2021; Mehari et al., 2020). Multiple pregnancies carry a higher

risk of complications, such as preterm labor or abnormal fetal presentation, which may require a C-section for a safer delivery (De La Calle et al., 2021). Older women may experience slower labor progression due to decreased uterine muscle tone or other age-related physiological changes (Glick et al., 2021; Pascual & Langaker, 2022). Prolonged labor can increase the risk of complications, such as fetal distress or maternal exhaustion, necessitating a C-section.

Despite this knowledge, there is a gap in the literature to determine if African American women with advanced maternal age or those who are adolescents have an increased risk of developing SSI after undergoing a C-section. Since African American women are more likely to experience a pregnancy with advanced maternal age or during the adolescent years, the risk increases the likelihood of needing a C-section. Among women with advanced maternal ages, the effects of aging on the skin have a significant impact on wound healing, as skin changes are noticeable signs of aging (Khalid et al., 2022). It is commonly observed that wounds in older adults may take up to four times longer to heal compared to younger individuals (Fillit et al., 2017). This delay in healing is partly attributed to the effects of aging on the body's cells (Fillit et al., 2017; Guo & DiPietro, 2010). In individuals with advanced and very advanced maternal age, cell division occurs at a slower pace or, in some cases, may not occur at all, a condition known as senescence (Fillit et al., 2017; Shin et al., 2023). The skin's ability to heal is compromised, leading to slower and inadequate wound regeneration (Guo & DiPietro, 2010; Yang et al., 2019). This delayed healing process leaves the body more vulnerable to bacterial infections as the regrowth of skin takes longer and lacks the protective barrier

against microorganisms (Guo & DiPietro, 2010; Maheswary et al., 2021). Research suggests that non-dividing cells may contribute to increased inflammation and damage to surrounding tissues, further hindering the healing process (Guo & DiPietro, 2010). There are no studies to determine if there is an association between age and the development of an SSI among African American women who underwent a C-section.

Smoking Tobacco and Nontobacco Products During Pregnancy

Tobacco smoking during pregnancy poses a significant global health concern, with prevalence rates of approximately 7% in the United States in 2016 (CDC, 2018). Researchers have demonstrated that women who were regular smokers before pregnancy often continue smoking during pregnancy (Liu et al., 2020; Smedberg et al., 2014). Maternal tobacco smoking during pregnancy is strongly associated with adverse outcomes for both the fetus and the newborn (Assari & Boyce, 2021). Impaired placental and umbilical circulation resulting from smoking increases the risk of pregnancy-related complications such as placental abruption and pre-eclampsia, which, in turn, contribute to a higher likelihood of neonatal morbidity and mortality (Kaminsky et al., 2007; Lurie et al., 2014). Moreover, exposure to tobacco during pregnancy is associated with various negative outcomes such as premature birth, reduced birth weight, decreased head size, restricted fetal growth, neurological issues, significant congenital abnormalities, and sudden infant death syndrome (Wolfsberger et al., 2021).

Smoking cigarettes during pregnancy is associated with an increased risk of needing a C-section (Hamadneh & Hamadneh, 2021; Tarasi et al., 2022). Several factors contribute to this association, including placental complications. Smoking tobacco during

pregnancy can lead to placental problems, such as reduced blood flow to the placenta or placental abruption (Hamadneh & Hamadneh, 2021; Tarasi et al., 2022). These complications can increase the likelihood of fetal distress and necessitate an emergency C-section for the safety of both the mother and the baby (Wolfsberger et al., 2021). Another factor is fetal growth restriction. Smoking during pregnancy is linked to intrauterine growth restriction, which means the baby may not develop to their full potential in the womb (Delcroix-Gomez et al., 2022). When the baby's growth is significantly compromised, a C-section may be recommended to prevent further risks associated with vaginal delivery (Delcroix-Gomez et al., 2022; Tarasi et al., 2022). Smoking increases the risk of preterm birth, which refers to the baby being born before 37 weeks of gestation (Stock & Bauld, 2020). Preterm birth can necessitate a C-section, mainly if the baby's lungs are not fully developed or there are other complications requiring immediate medical intervention (Lurie et al., 2014; Tarasi et al., 2022). Smoking is associated with an increased risk of labor complications, such as prolonged labor or failure to progress (Hamadneh & Hamadneh, 2021). If these complications arise, a C-section may be performed to avoid potential risks to the mother and the baby. Smoking during pregnancy can contribute to various maternal health issues, including hypertension and pre-eclampsia (Tarasi et al., 2022). These conditions may require a C-section for the well-being of both the mother and the baby.

Hirth et al. (2022) determined that Black pregnant women who have only attained a high school diploma or less are more inclined to both smoke and consume alcohol and are also more susceptible to having unplanned pregnancies. Such unplanned pregnancies

are crucial when considering the health of both the mother and the child, with higher incidences among women who consume substances like tobacco (Assari & Boyce, 2021; Hirth et al., 2022). Tobacco use during pregnancy is a prevalent factor leading to adverse health outcomes for both the mother and the infant, potentially causing lifelong health issues (Tarasi et al., 2022). The repercussions of smoking during pregnancy include higher rates of stillbirth, premature deliveries, and babies with low birth weight relative to their gestational age (Hamadneh & Hamadneh, 2021; Stock & Bauld, 2020). It is widely acknowledged that maternal smoking can increase complications, such as neonatal respiratory distress syndrome (Hamadneh & Hamadneh, 2021).

Neonatal respiratory distress syndrome, often referred to as infant respiratory distress syndrome, predominantly impacts preterm babies (Dyer, 2019; Yadav et al., 2023). This condition arises when an infant's lungs are underdeveloped and lack sufficient surfactant, a crucial substance necessary for maintaining the openness of the lung's air sacs (Yadav et al., 2023). Neonatal respiratory distress syndrome can make it difficult for the baby to breathe on their own and can lead to significant respiratory complications (Dyer, 2019; Yadav et al., 2023). The primary cause of neonatal respiratory distress syndrome is underdeveloped lungs, particularly a surfactant deficiency (Yadav et al., 2023). Surfactant is a substance that coats the inside of the air sacs in the lungs, reducing surface tension and preventing the collapse of the air sacs during exhalation (Wang et al., 2021). Without enough surfactant, the air sacs cannot collapse after each breath, making it challenging for the baby to exchange oxygen and carbon dioxide adequately (Wang et al., 2021; Yadav et al., 2023). Premature infants are

at a higher risk of developing neonatal respiratory distress syndrome because their lungs have not had enough time to produce sufficient surfactant (Yadav et al., 2023). The severity of neonatal respiratory distress syndrome depends on the degree of prematurity, with very premature babies being at greater risk (Dyer, 2019; Yadav et al., 2023). Other factors that can increase the risk of neonatal respiratory distress syndrome include maternal diabetes, cesarean delivery without labor, and multiple pregnancies (Dyer, 2019). The signs and symptoms of neonatal respiratory distress syndrome typically appear shortly after birth or within a few hours (Dyer, 2019). They may include rapid and labored breathing, flaring nostrils, retractions (visible pulling in of the chest wall), grunting sounds during breathing, and a bluish tint to the skin (cyanosis) due to inadequate oxygen supply (Dyer, 2019; Reuter et al., 2014). To diagnose neonatal respiratory distress syndrome, healthcare providers may perform various tests, including assessing the baby's symptoms, monitoring blood oxygen levels, and conducting a chest x-ray to evaluate lung appearance and the severity of the condition (Reuter et al., 2014).

Vaping and the use of electronic cigarettes (e-cigarettes) are significantly gaining popularity among adolescents and older adults. In simple terms, e-cigarettes are electronic mechanisms that transform chemical compounds into vapor (Oriakhi, 2020). These devices consist of various parts, such as a mouthpiece, a reservoir for liquid, a heating component, and a power source (Oriakhi, 2020). They come in various shapes, sizes, and designs and are identified differently by different users. The most prevalent terms include e-cigs, vapes, e-hookahs, vape pens, mods, tanks, or electronic nicotine

delivery systems (Oriakhi, 2020). Utilizing these devices is commonly known as vaping or juuling, with the latter term derived from a specific device brand (Oriakhi, 2020).

The risks of smoking e-cigarettes during pregnancy are still largely unknown (Mescolo et al., 2021). Evidence suggests that even nicotine-free e-cigarette aerosols may cause harm to the fetus due to harmful chemicals (Mescolo et al., 2021). E-cigarettes produce aerosols that contain toxic chemicals such as formaldehyde and acrolein (Lorkiewicz et al., 2022). Exposure to formaldehyde has been linked to adverse outcomes during pregnancy, including decreased fertility, unplanned miscarriages, hindered fetal development, birth defects, and low birth weight (Franklin et al., 2019). Exposure to acrolein during pregnancy notably decreases the weight of the fetus and testes and significantly impacts the testes' ability to produce testosterone (Yang et al., 2017). Research has shown that the health dangers from secondhand exposure to e-cigarettes are, in specific ways, like those from indirect exposure to tobacco (Mescolo et al., 2021).

There are no recent studies nor literature to determine if African American women who smoke tobacco and non-tobacco products during pregnancy have an increased risk of developing an SSI from undergoing a C-section. Research indicates that African American women with only a high school education or less education are more likely to smoke during pregnancy, therefore increasing the risk of needing a C-section (Assari & Boyce, 2021; Lurie et al., 2014; Tarasi et al., 2022). There are no studies to determine if there is an association between smoking tobacco and non-tobacco products during pregnancy and developing an SSI among African American women who underwent a C-section. Research has validated that smoking can delay wound healing

and increase the risk of infection (Chiang et al., 2022). Smoking reduces blood flow by prolonging wound healing time (Kokkinidis et al., 2020). There are very few studies that address whether there is a correlation between smoking tobacco and non-tobacco products during pregnancy and developing an SSI among African American women who underwent a C-section.

Alcohol Consumption During Pregnancy

Consuming alcohol while pregnant carries significant dangers to the unborn child and is linked to adverse birth outcomes, potentially at higher rates than previously believed (DeJong et al., 2019; Hirth et al., 2022). Given that nearly half of all pregnancies in the United States are not planned, an unborn child might be exposed to alcohol during vital embryonic phases, even before the mother realizes she is pregnant (DeJong et al., 2019). Alcohol consumption during pregnancy is a major and avoidable cause of birth defects and developmental issues in the United States, with one of the most serious outcomes being fetal alcohol syndrome (DeJong et al., 2019). This syndrome includes various problems related to the central nervous system, distinctive facial characteristics, and growth deficits (Vorgias et al., 2023). Children affected by fetal alcohol syndrome can face challenges in learning, memory, attention, communication, and sensory functions like sight and hearing, or a mix of these issues (CDC, 2022d; Vorgias et al., 2023). Furthermore, such children often face academic struggles and encounter difficulties in interpersonal relationships (CDC, 2022d).

Consuming alcohol while pregnant is linked to several negative health outcomes, including miscarriage, premature labor, restricted fetal growth inside the uterus, and

stillbirth, as indicated by studies by Addila et al., 2021 and DeJong et al., 2019. These complications can contribute to additional health burdens and potentially exacerbate any underlying disabilities (Addila et al., 2021). Addressing the issue of alcohol consumption among women in their childbearing years, especially during pregnancy, is a vital public health priority both in the United States and worldwide. It is important to emphasize that there is no established safe quantity of alcohol intake either during pregnancy or when trying to get pregnant (CDC, 2022d; DeJong et al., 2019). While the measure of a standard alcoholic beverage might differ globally, in the United States, it is typically deemed to have 0.6 fluid ounces (oz) of pure ethanol (DeJong et al., 2019). This volume is the same as the ethanol in a 12 oz beer or wine cooler, 5 oz of table wine, 8 to 9 oz of malt liquor, or 1.5 oz of a 40% alcoholic spirit (DeJong et al., 2019). Based on the latest findings from the 2019 National Survey on Drug Use and Health, around 10% of expectant mothers in the United States reported drinking alcohol while pregnant (Popova et al., 2021). It is essential to be aware that even occasional drinking during pregnancy can jeopardize the unborn child's health, so the safest approach is total abstinence from alcohol (Armstrong, 2017; CDC, 2022c).

Avoiding all forms of alcohol, including red or white wine, beer, and liquor, during pregnancy is essential (CDC, 2022d; DeJong et al., 2019). Alcohol consumption can pose risks to the developing baby throughout pregnancy, even before a woman realizes she is pregnant (Armstrong, 2017; DeJong et al., 2019). Fetal alcohol syndrome is entirely preventable if a woman refrains from drinking alcohol during pregnancy (CDC, 2022d).

Studies have indicated that there may be racial disparities when it comes to alcohol consumption during pregnancy, with some suggesting that African American women may have a higher likelihood of consuming alcohol compared to women from other racial and ethnic backgrounds (Hirth et al., 2022; Park et al., 2023). Possible contributing factors to higher rates of alcohol consumption during pregnancy among Black women might include socioeconomic disparities, such as lower income levels, limited access to healthcare services, and fewer resources, which may impact health behaviors and contribute to higher rates of alcohol consumption during pregnancy (Hirth et al., 2022; Park et al., 2023). Cultural factors may also play a role. Cultural norms and beliefs around alcohol use vary across different communities (Nwagu et al., 2017; Sudhinaraset et al., 2016). Factors such as social influences, cultural acceptance of alcohol use, and social events where alcohol is present may influence drinking behaviors during pregnancy (Nwagu et al., 2017; Popova et al., 2021; Sudhinaraset et al., 2016). High levels of stress and limited access to effective coping mechanisms may lead some individuals, including Black women, to turn to alcohol as a way to manage stress or emotional difficulties (Hirth et al., 2022; Popova et al., 2021). Black women tend to experience more significant psychological stress compared to White women and disproportionately bear the weight of chronic ailments linked to this stress, such as obesity (Tipre & Carson, 2022). Research indicates that beyond everyday stressors, Black women often grapple with stress tied to their race and gender (Tipre & Carson, 2022). Multiple studies have noted that Black women might be particularly impacted by the physical effects of enduring stress stemming from health inequalities tied to various

chronic stress factors. These factors encompass perceived discrimination, stress related to neighborhoods, daily life, family, acculturation, environment, and maternity (Amaro et al., 2021; Tipre & Carson, 2022). As a result, they might face compounded social stress arising from the intersection of racial and gender bias, further exacerbated by health and socioeconomic imbalances (Tipre & Carson, 2022). This cumulative stress could potentially lead to a heightened risk of disease onset. Historical and systemic factors, including experiences of racism, discrimination, and trauma, can influence health behaviors and contribute to health disparities, including patterns of alcohol consumption during pregnancy (Hirth et al., 2022; Njoku et al., 2023; Taylor, 2020).

Research shows that women who consume alcohol during pregnancy are more likely to need a C-section due to increased risks of complications (De Wit et al., 2013; Wolfsberger et al., 2021). African American women are more likely to consume alcohol during pregnancy, therefore increasing the need for a C-section (De Wit et al., 2013; Wolfsberger et al., 2021). Research indicates that the consumption of alcohol can hinder the process of wound healing and lead to a higher rate of infections (Guo & DiPietro, 2010). There lies a gap in the literature to determine if there is indeed an association between alcohol consumption and the development of an SSI among African American women who underwent a C-section.

HIV

HIV is a viral infection that weakens the immune system, making individuals more susceptible to other infections and illnesses (Cambrea & Pinzaru, 2018; Lin et al., 2021). HIV can be categorized into two groups: HIV-1 and HIV-2 (Lin et al., 2021).

HIV-1 is more prevalent and aggressive worldwide, having its origins in Central Africa (Giovanetti et al., 2020). HIV-2 is less virulent and originates from West Africa (Esbjörnsson et al., 2019). Both virus types share antigenic characteristics with immunodeficiency viruses primarily found in primate species (Esbjörnsson et al., 2019; Giovanetti et al., 2020). HIV continues to be a significant global public health concern, affecting millions of individuals worldwide. In 2019, it was estimated that approximately 38 million individuals were living with HIV globally, with Sub-Saharan Africa bearing the highest burden, including most new HIV infections and AIDS-related deaths (Mweemba et al., 2022). In the United States, HIV remains a significant issue as well. As of the end of 2019, over 1.1 million individuals aged 13 and older were living with HIV in the country (Griffin et al., 2020). It is important to note that approximately 13% of individuals with HIV were unaware of their infection, representing an estimated 158,500 individuals who had not been diagnosed (Griffin et al., 2020).

Like the overall trends in C-section delivery rates in the United States, there has been an increase in the proportion of HIV-infected women undergoing C-sections (Kourtis et al., 2014). This rise can be attributed, at least in part, to the recognized role of C-sections in reducing the risk of mother-to-child transmission of HIV-1 (Kourtis et al., 2014). Research conducted in the 1990s demonstrated that performing a C-section before the onset of labor and before the amniotic membranes rupture can significantly decrease the risk of transmitting HIV from mother to child (Kourtis et al.., 2014; Semprini et al., 1995). When an HIV-positive pregnant woman reaches the 38th week of pregnancy, a scheduled C-section is recommended to minimize mother-to-child HIV transmission in

cases where the viral load is either unknown or high (Cambrea & Pinzaru, 2018; Chilaka & Konje, 2021).

Researchers indicated that HIV-infected women face a higher risk of perioperative morbidity following cesarean delivery compared to HIV-uninfected individuals (Chilaka & Konje, 2021; Kourtis et al., 2014; Semprini et al., 1995). The risk of morbidity is greater with cesarean delivery when compared to vaginal delivery (Kourtis et al., 2014; Semprini et al., 1995). Most of this increased risk is associated with infection-related complications such as urinary tract infection, pneumonia, wound infection, and septicemia (Kourtis et al., 2014; Semprini et al., 1995). It is important to note that the risks of these infections are elevated for all women undergoing a C-section. The highest risks are observed for C-sections performed after the onset of labor or with ruptured membranes, intermediate risks are seen with scheduled C-sections and the lowest risks are associated with vaginal delivery (Sung & Mahdy, 2022). Researchers have indicated that compared to HIV-negative women, C-sections among HIV-positive women carry an increased likelihood of infectious complications, surgical trauma, and more extended hospital stays (Kourtis et al., 2014; Semprini et al., 1995).

HIV is transmitted through various means, including unprotected sexual intercourse with an infected person, sharing contaminated needles or syringes, and from an HIV-positive mother to her child during pregnancy, childbirth, or breastfeeding (Cambrea & Pinzaru, 2018; Joint United Nations Programme on HIV/AIDS, n.d.). This virus disproportionately affects specific populations, leading to health disparities within these communities (Cambrea & Pinzaru, 2018; Laurencin et al., 2018). Certain

marginalized groups, including men who have sex with men, transgender individuals, sex workers, individuals who inject drugs, and racial and ethnic minorities, often experience higher rates of HIV infection (Griffin et al., 2020; Risher et al., 2015). These disparities result from a combination of social, economic, and structural factors, such as stigma, discrimination, and limited access to healthcare services (Griffin et al., 2020; Risher et al., 2015). Within the United States, HIV continues to have a disproportionate impact on Black or African American women. Although they make up less than 15% of the overall population, this group represents almost 60% of the new HIV infections among women (Ojikutu & Mayer, 2021). Additionally, the incidence of sexually transmitted infections is notably higher in Black women and continues to increase (Ojikutu & Mayer, 2021). Moreover, Black women who have been involved with the criminal justice system, including those participating in community corrections programs such as probation and parole, are at particularly high risk (Ojikutu & Mayer, 2021). Addressing these disparities requires comprehensive efforts, including reducing stigma and discrimination, promoting equitable access to healthcare services, expanding HIV prevention and testing programs, providing targeted interventions for high-risk populations, and addressing SDOH (Ojikutu & Mayer, 2021; U.S. Agency For International Development, 2022). Such initiatives can help mitigate the disproportionate impact of HIV on marginalized communities and work towards achieving health equity for all (Lightfoot et al., 2021; Ojikutu & Mayer, 2021).

Previous research has shown that HIV-positive mothers face a heightened risk of experiencing postoperative complications following a C-section (Kourtis et al., 2014).

This risk is particularly elevated in HIV-infected women with severe immunosuppression (Kourtis et al., 2014). Since the data show that Black women have high HIV rates, there are no studies to determine if Black women who are HIV-positive and have a C-section have an increased risk of developing an SSI.

SCD

SCD is the most common genetic blood disorder in the United States, impacting around 100,000 individuals (Brandow & Liem, 2022; CDC, 2022b). This disease predominantly affects African Americans. Roughly 1 in 12 African Americans and 1 in 100 Hispanic Americans have the sickle cell trait, indicating they are disease carriers (CDC, 2022b). A child diagnosed with SCD receives the disease gene from both parents (National Heart, Lung, and Blood Institute [NHLBI], 2022). When both parents possess this genetic mutation, there is a 25% probability that any offspring will have SCD (CDC, 2022b; NHLBI, 2022). If a child gets only one mutated gene (from either of the parents), there is a 50% likelihood that they will have the sickle cell trait (NHLBI, 2022). Those with the trait usually do not exhibit disease symptoms but have the potential to transmit the faulty gene to their offspring.

SCD arises due to a genetic anomaly in the hemoglobin-Beta gene located on chromosome 11 (Nkya et al., 2020). Hemoglobin is pivotal in transporting oxygen from the lungs to various body parts (NHLBI, 2022; Nkya et al., 2020). In those with regular hemoglobin (known as hemoglobin A), the red blood cells are round, flexible, and navigate effortlessly through the bloodstream (NHLBI, 2022). In SCD patients, the abnormal hemoglobin molecules, hemoglobin S, clump together, creating elongated

formations (Eaton, 2019; NHLBI, 2022). This aggregation forces the red blood cells to harden and adopt a crescent or "sickle" shape (CDC, 2022b; NHLBI, 2022). The abnormal shape of these red blood cells leads to blockages and damage to vital organs and tissues (NHLBI, 2022). Sickle cells are rapidly destroyed in individuals with the disease, resulting in anemia. The disease is commonly called sickle cell anemia, or SCD (CDC, 2022b; NHLBI, 2022). The sickle-shaped cells also obstruct blood flow through the vessels, causing damage to lung tissue, resulting in acute chest syndrome, pain episodes, stroke, and priapism (painful, prolonged erection; Darbari et al., 2020; Kavanagh et al., 2022; NHLBI, 2022). They can cause harm to the spleen, kidneys, and liver (Kavanagh et al., 2022). SCD impairs the spleen, making patients, particularly young children, more vulnerable to bacterial infections (Tanabe et al., 2019).

Based on data from the CDC, it is estimated that 1 out of every 365 births among Black or African American individuals will result in a child being born with SCD (CDC, 2022b). A study by Fisch et al. (2021) in California focused on pregnancy outcomes in women with SCD. The findings of this study revealed that African American women with SCD had a higher likelihood of undergoing a C-section and experiencing post-partum complications associated with SCD (Fisch et al., 2021). The decision to perform a C-section in these cases is influenced by several factors, including the increased risk of complications that pregnant women with SCD may face (Romano et al., 2020; Smith-Whitley, 2019). Pregnancy poses additional challenges for individuals with SCD due to the increased demands on the body and the potential complications that may arise (Jain et al., 2019; Romano et al., 2020). These complications, such as sickle cell-related pain

crises, acute chest syndrome, and pre-eclampsia, can heighten the need for a C-section to ensure the safety of both the mother and the baby (Fisch et al., 2021; Jain et al., 2019; Romano et al., 2020).

Women with SCD may have underlying health conditions that require careful management during pregnancy (Afolabi et al., 2022; Smith-Whitley, 2019). The presence of sickle cell-related complications, such as anemia or organ damage, can influence the decision to opt for a C-section to minimize potential risks to the mother's health (Afolabi et al., 2022; Fisch et al., 2021). Studies have demonstrated that SCD can impact blood flow and oxygen delivery to the fetus, increasing the risk of complications like intrauterine growth restriction (Afolabi et al., 2022; Romano et al., 2020). If any of these concerns arise, it may be necessary for the mother to undergo a C-section to prioritize the well-being of both the mother and the baby (Fisch et al., 2021; Jain et al., 2019). Individuals with SCD frequently experience pain crises, which can occur during pregnancy (Jain et al., 2019). These episodes of severe pain can complicate the process of labor and vaginal delivery. Pain management for African Americans is systematically less comprehensive compared to that for White Americans (Hoffman et al., 2016). In some cases, a C-section may be considered a preferred option to minimize pain and reduce the risks associated with prolonged labor (Afolabi et al., 2022; Sung & Mahdy, 2022; Zakerihamidi et al., 2015). Despite this knowledge, studies have not determined if having SCD is an individual risk factor for developing an SSI among African American women who underwent a C-section.

Definitions of Key Terms Related to the Study

Adolescence: The period extending from ages 10 to 19, bridging the gap between childhood and adulthood (World Health Organization, 2019). For this study, an adolescent is 19 years of age and younger.

Adolescent/teen pregnancy: A female who is pregnant at 19 years of age or younger (Maheshwari et al., 2022).

Advanced maternal age: A woman being 35 years of age or older at the time of delivery (Glick et al., 2021).

African American or Black: An individual of African ancestral origins (having origins in any of the Black racial groups of Africa) or who self-identifies or is identified by others as African American (U.S. Census Bureau, 2022). For this study, the terms African American and Black are used interchangeably.

Age at the time of birth: The years of life when the patient's history and C-section were performed and recorded in the dataset. I defined age groups by 0 = less than or equal to 19 years old; 1 = 20–34 years old; 2 = greater than or equal to 35 years old.

Alcohol consumption during pregnancy: A woman who consumes at least 0.6 fl. oz of pure ethanol, one 12 oz beer or wine cooler, 1– 5 oz of table wine, 8 to 9 oz of malt liquor, or 1.5 oz of a 40% alcoholic spirit, during pregnancy (DeJong et al., 2019).

C-section: A surgical procedure in which a fetus or fetuses are delivered through an abdominal incision and an incision in the uterus hysterotomy (Sung & Mahdy, 2022).

HAIs: Infections that individuals contract while receiving healthcare services (Haque et al., 2018).

High-risk pregnancy: Any pregnancy-related circumstance where the mother, fetus, or both are exposed to potential or actual threats to their health and well-being (Rajbanshi et al., 2020).

HIV: A viral infection that weakens the immune system, making individuals more susceptible to other infections and illnesses (Lin et al., 2021).

Pregnancy: The period from fertilization (when a sperm fertilizes an egg) to childbirth, during which the fertilized egg undergoes development within the uterus or elsewhere in the body (Pascual & Langaker, 2022).

SCD: A genetic condition where the red blood cells exhibit an unusual half-moon shape, obstruct tiny blood vessels, and possess a shorter lifespan compared to regular red blood cells (Kavanagh et al., 2022). For this study, a woman is [tests] positive for one of four types of sickle cell-related hemoglobinopathies (Sickle Beta Plus (+) Thalassemia, Sickle Beta Zero (0) Thalassemia, Sickle S/S Disease, and Sickle S/C Disease) will be documented in the dataset as positive for SCD.

Sepsis: A critical medical emergency arising when the body's immune response to a severe infection leads to widespread organ dysfunction, potentially culminating in organ failure and fatality (Gyawali et al., 2019).

Smoking non-tobacco products during pregnancy: A woman who inhales a vapor or smoke created from a non-tobacco product reaching the lungs (Wold et al., 2022). For this study, a woman who inhaled a vapor or smoke created from a non-tobacco product at least once during pregnancy was documented in the dataset as a non-tobacco smoker.

Smoking tobacco during pregnancy: A woman who inhales smoke from burning tobacco into the mouth, usually reaching the lungs, during pregnancy (West, 2017). *Tobacco usage* is defined as the utilization of various products, including cigarettes, little cigars or cigarillos, standard cigars, kreteks (also known as clove cigars), hookah, electronic smoking devices such as e-cigarettes, vape pens, and pod mods, and smokeless tobacco products like chewing tobacco, dip, snuff, and snus. For this study, a woman who inhaled tobacco or used smokeless tobacco at least once during pregnancy is documented in the database as a tobacco smoker.

SSI: An infection related to an operative procedure that occurs at or near the surgical incision within 30 or 90 days of the procedure (AHRQ, 2019).

Assumptions

In examining whether there was a relationship between age at the time of delivery, usage of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status among African American women who had a C-section SSI in California, I relied on secondary data provided by the CHHS Open Data Portal and CDPH. I postulated that the subjective nature of applying the NHSN surveillance definition may result in incorrect identification of C-section SSIs. Even though a guideline is provided for detecting an SSI, the necessity for clinicians and infection preventionists to use their judgment could lead to either underestimation or overestimation of the number of infections. As such, I operated under the assumption that the SSI definition had been correctly applied. The NHSN definition serves as the benchmark for identifying an infection for the surveillance and obligatory public

declaration of certain HAIs. As this research was not aimed at validating data, it was presumed that those who satisfied the NHSN criteria for a C-section SSI had been accurately recognized. It was also assumed that individuals were being honest regarding their alcohol use and use of tobacco and non-tobacco products during their pregnancy.

Scope and Delimitations

The scope of this study involved exploring the relationships between the age at the time of delivery, the use of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status among African American women who underwent a C-section in California. Limitations of this study include the population under investigation. For this research, the population was defined as all African American women who had a C-section in California between January 1, 2022, and December 31, 2022. The study was restricted to the dependent and independent variables chosen for this research. Although additional data and variables were available from the CHHS Open Data Portal and the CDPH, I did not scrutinize or utilize data that were not part of my research questions. Due to the study's focus, other individual risk factors such as marital status, employment status, educational status, and income level were not evaluated in this research.

The generalizability of this study was confined to the state of California. My analysis provided a quantitative basis for individual risk factors linked to the occurrence of C-section SSIs among African American women in California. The conclusions or findings of this study might yield different outcomes when implemented in varying states and countries.

Significance, Summary, and Conclusions

The importance of this study cannot be overstated, as it aimed to explore individual risk factors linked to the development of C-section SSIs, specifically among African American women. HAIs persist as a notable public health challenge. SSIs, being the most expensive type of HAI, cause an economic burden of $3.5 billion to $10 billion in U.S. healthcare costs annually (Seidelman et al., 2023).

It has been established by previous research that African American women have a higher likelihood of contracting SSIs post-C-sections compared to women of non-Black ethnicity (Kawakita, 2019). Approximately 3% of patients who develop an SSI may succumb to the infection (Saeed et al., 2017). The significance of this research lies in its potential to enhance health outcomes for African American women who have developed a C-section SSI.

A thorough investigation of variables such as age at the time of delivery, tobacco and non-tobacco usage during pregnancy, alcohol usage during pregnancy, HIV status, and SCD status is critical for understanding their relationships with the occurrence of C-section SSIs. Given the study's focus on pinpointing individual risk factors associated with C-section SSIs, identifying these risk factors could significantly decrease these infections, fostering positive social change within the target population.

The new insights gleaned from this study can contribute to refining risk reduction strategies and protocols for C-section SSIs. The potential benefits of this endeavor are multifaceted, including diminished SSI costs, improved maternal mortality rates, and reduced hospital stays resulting from SSIs. There needs to be more literature focusing on

the individual risk factors linked to the development of C-section SSIs, specifically among African American women. This study can serve as a significant resource to mitigate C-section SSI rates across numerous healthcare establishments. It will thus fill an essential gap in our knowledge and enable healthcare professionals to devise effective interventions for this demographic, promoting health equity.

Section 2 of this study describes the research study design and methodology for this study. Section 2 includes a brief introduction, research design and rationale, methodology, instrumentation, and operationalization of concepts. The data analysis plan, threats to validity, ethical procedures, and summary were also presented.

Section 2: Research Design and Data Collection

Introduction

The purpose of this study was to determine if there were associations or relationships associated with C-section SSIs among African American women in California, assessing age at the time of delivery, smoking tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status. Identifying potential individual risk factors that are linked to the development of C-section SSIs among African American women can lead to improved health outcomes, reduced healthcare costs, and improved patient satisfaction among this population. For the remainder of this section, I discuss the research design and rationale, the methodology used for this doctoral research study, instrumentation and operationalization of concepts, data analysis plan, threats to validity, ethical procedures, and summary.

Research Design and Rationale

I used a quantitative, cross-sectional research design utilizing secondary data analysis. The research questions were designed to examine the relationships associated with C-section SSIs among African American women, assessing age at the time of delivery, smoking tobacco and non-tobacco products, alcohol use during pregnancy, HIV status, and SCD status. This design was identified to be the most appropriate to explore these relationships. According to Wang and Cheng (2020), cross-sectional studies are very purposeful to help determine or identify associations between variables. This can serve as a beneficial preliminary stage for formulating hypotheses.

Methodology

In the methodology section, I describe the population for this study, the sampling and sampling procedures, the sampling size, and the power calculation.

Study Population

Study participants for this research study included African American women who underwent a C-section in California between January 1, 2022, and December 31, 2022. Ages of the study participants included African American females who were less than or equal to 19 years old, 20–34 years old, and greater than or equal to 35 years old at the time of delivery.

California, the third-largest state in the United States regarding land area, exhibits remarkable distinctions, primarily attributable to its substantial immigrant population (Public Policy Institute of California, 2023). Recent empirical data about immigrants residing within the state underscore their significant presence; approximately half of the children have at least one immigrant parent, and roughly one-fourth of the total residents are immigrants (Public Policy Institute of California, 2023). This unique demographic composition bears considerable ramifications for California's state and local governance, its economic landscape, and the well-being of its populace. It remains intricately entwined with global migration patterns, federal policies, and the broader national political milieu.

According to the U.S. Census Bureau, in 2022, California's estimated population was approximately 39,040,616 individuals (U.S. Census Bureau, n.d.). Of this populace, nearly 50% were female (U.S. Census Bureau, n.d.). Ethnic composition statistics reveal

that over 70% of Californians identify as White, whereas 6.5% are categorized as Black or African American (U.S. Census Bureau, n.d.). In 2022, the median household income in the state was reported to be $91,905, reflecting an important economic aspect of California's diverse and dynamic demographic landscape (U.S. Census Bureau, n.d.).

Sampling and Sampling Procedures

I used publicly available secondary data from the CHHS Open Data Portal and the CDPH. With a focus on individual risk factors associated with developing C-section SSIs, the CHHS Open Data Portal and CDPH collected data to research many risk factors. Because I solely utilized de-identified secondary data, obtaining informed consent was neither expected nor required. Risk factors included age at the time of delivery, smoking status of tobacco and non-tobacco products, consumption of alcohol during pregnancy, HIV status, and SCD status.

To further define the study groups, the outcomes of African American women who developed a C-section SSI were compared to the consequences of African American women who did not create a C-section SSI, assessing age at the time of delivery, usage of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status. Because this was not a data validation study, it was assumed that the C-section SSI surveillance event and definition had been correctly applied to identify patients as having met or not meeting the criteria for a C-section SSI.

Sample Size and Power Calculation

Power analyses are typically conducted before gathering data to help researchers identify the smallest sample size that will provide adequate power to detect an impact

(Andrade, 2020). Studies with unsuitable sample sizes or power fail to yield precise estimates, making it challenging to relay correct information about the treatment's effect and complicating evidence-based assessments or conclusions (Andrade, 2020; Kang, 2021). If the sample size is insufficient, there is a risk that any substantial therapeutic effect observed might be due to random fluctuations (Kang, 2021). An overly large sample size might render too many statistically significant variables beyond what researchers aim to study (Andrade, 2020). This can result in some variables appearing statistically different even when the difference is not practically significant. Discerning which variables are genuinely pertinent becomes a challenge.

Economically speaking, research with overly large sample sizes can result in the unnecessary expenditure of time, money, effort, and resources, especially when resources are scarce (Kang, 2021). In contrast, studies with insufficient sample sizes produce weak power or inaccurate estimates, rendering them ineffective in addressing the research queries. This, too, leads to the squandering of time, money, and resources (Kang, 2021). Given the constraints of budget and resources, determining the right sample size and conducting a power analysis often necessitates balancing between cost efficiency and statistical power.

Ethically speaking, researchers who use huge sample sizes can incur unnecessary expenditures of participants' time and effort and may also subject them to increased risks and discomforts (Andrade, 2020; Kang, 2021). Ethically speaking, researchers with substantial sample sizes expend the time and effort of research participants and might also subject them to increased risks and discomforts (Kang, 2021).

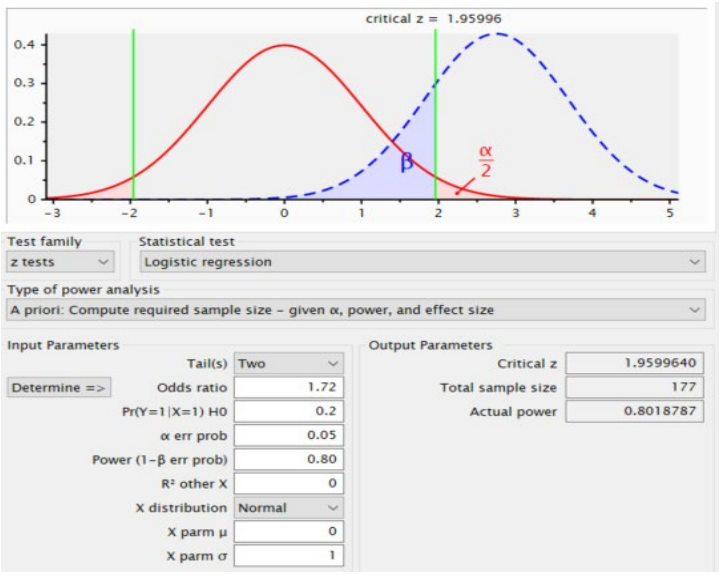
Considering the scientific, financial, and ethical dimensions, determining the right sample size is essential for research to highlight clinically significant disparities effectively (Althubaiti, 2023). Some researchers argue that conducting underpowered studies is unethical, except for smaller trials for treatments of rare diseases or preliminary stages in drug or device development (Kang, 2021). Despite ongoing discussions regarding sample size determination and power analysis, ensuring the correct sample size has emerged as a predominant trend in research.

G*Power is a complementary statistical tool that facilitates determining statistical power across a broad spectrum of tests (Serdar et al., 2021). Users can input the test type, the intended power level, and the alpha level to ascertain the required sample size. The G*Power tool supports various statistical methods in determining sample size and power (Kang, 2021). Typically, the factors guiding sample size computation and power analysis include the following: (a) effect size, power (1-β); (b) the significance level (alpha, α); and (c) the chosen statistical technique (Serdar et al., 2021). Setting the significance level (α) can curtail the possibility of a Type I error, which occurs when the null hypothesis is erroneously rejected; this is commonly set at 0.05 (Tenny & Abdelgawad, 2022). An α value below 0.05 indicates a lower power level (Tenny & Abdelgawad, 2022). Effect size showcases the magnitude of the relationship between variables (Tenny & Abdelgawad, 2022). Power reflects the probability of evading a Type II error (beta, β), which arises when the null hypothesis is not rejected when it should be (Tenny & Abdelgawad, 2022). Power is derived as 1-β. To strike a balance between Type I and Type II errors, a β value of 0.2 is often used, yielding a power of 0.8 (Tenny & Abdelgawad, 2022).

The sample selected for this study included all African American women who had a C-section in California between January 1, 2022, and December 31, 2022. Referring to previous studies for sample size guidance, it was observed that the average sample size for C-section rates in a single hospital was approximately 200 over 1 year (Bizuayew et al., 2021). G*Power 3.1 was employed to determine the appropriate sample size for this research. Given the absence of prior studies addressing similar research questions, the parameters set included a medium effect size (odds ratio = 1.72; see Lipsy & Hurley, 1998), an alpha level of 0.05, and a power level of 0.8. With these input parameters, the sample size needed for a logistic regression coefficient is 177 (see Figure 2). Based on existing literature that states a hospital typically performs 200 C-sections per year, it was anticipated there would be an adequate sample size utilizing all African American women who had a C-section in California between January 1, 2022, and December 31, 2022.

Figure 2

*G*Power Sample Size Calculation*



Instrumentation and Operationalization of Concepts

This research was based on secondary data available from the CHHS Open Data Portal and CDPH, assessing if a C-section SSI developed among African American women, considering the variables age at the time of delivery, smoking tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status, from African American women who had a C-section between January 1, 2022, and December 31, 2022. The CHHS Open Data Portal and CDPH included the data collection instruments.

Study Variables

The objective of this study was to test if there were associations or relationships associated with C-section SSIs among African American women in California, assessing age at the time of delivery, smoking tobacco and non-tobacco products during pregnancy, alcohol use during pregnancy, HIV status, and SCD status using secondary data. The independent variables of this study included the following: (a) age at the time of delivery, (b) smoking tobacco and non-tobacco products during pregnancy, (c) alcohol use during pregnancy, (d) HIV status, and (e) SCD status. For this study, age groups were coded as "0" = less than or equal to 19 years old; "1" = 20–34 years old; and "2" = greater than or equal to 35 years old. Smoking tobacco and non-tobacco products were coded as "1" = Yes or Positive for smoking tobacco or non-tobacco products at least once during pregnancy and "0" = No or Negative for smoking tobacco or non-tobacco products during the entire pregnancy.

Alcohol consumption during pregnancy was coded as “1” = Yes or Positive for consuming at least 0.6 fl. oz of pure ethanol, one 12 oz beer or wine cooler, 1–5 oz of table wine, 8–9 oz of malt liquor, or at least 1.5 oz of a 40% alcoholic spirit at least once during the pregnancy and “0” = No or Negative for consuming less than 0.6 fl. oz of pure ethanol, less than 12 oz beer or wine cooler, less than 5 oz of table wine, less than 8–9 oz of malt liquor, less than 1.5 oz of a 40% alcoholic spirit, or none during the pregnancy. HIV status was coded as “1” = Yes or Positive for HIV and “0” = No or Negative for HIV. An individual was coded as “1” or “Yes” if the individual was recorded in the dataset as either an individual with a newly diagnosed HIV/AIDS case or an individual living with HIV/AIDS, respectively. SCD status was coded as “1” = Yes or Positive for SCD and “0” = No or Negative for SCD. An individual was coded as “1” or “Yes” if the individual was positive for one of four types of sickle cell-related hemoglobinopathies (Sickle Beta Plus (+) Thalassemia, Sickle Beta Zero (0) Thalassemia, Sickle S/S Disease, and Sickle S/C Disease) and “0” or “Negative” if the individual did not have one of the four types of hemoglobinopathies. The CHHS Open Data Portal dataset combines the four types of hemoglobinopathies into one group called “SCD.”

The dependent variable of this study was the development of a C-section SSI. An individual was coded as “1” or “Yes” if the patient did develop an SSI and “0” or “Negative” if the patient did not create an SSI. Table 1 shows the variables used in this study, including the variable names, descriptions, response categories, and variable types.

Table 1

Operational Measures for Key Independent and Dependent Variables

Variable	Description	Response category	Variable type
Age at the time of delivery	The years of life at the time when the patients' C-section was performed	0 = ≤ 19 years old 1 = 20–34 years old 2 = ≥ 35 years old	Ordinal
Smoking status (tobacco and non-tobacco products)	Smoked or inhaled tobacco or non-tobacco products at least once during the pregnancy	0 = No/Negative 1 = Yes/Positive	Nominal
Alcohol consumption	Consumed one standard alcoholic beverage at least once during the pregnancy	0 = No/Negative 1 = Yes/Positive	Nominal
HIV status	Individual identified as either newly diagnosed with HIV/AIDS or living with HIV/AIDS, respectively	0 = No/Negative 1 = Yes/Positive	Nominal
SCD status	Positive for one of four types of sickle cell-related hemoglobinopathies	0 = No/Negative 1 = Yes/Positive	Nominal
SSI development	C-section SSI developed and reported	0 = No/Negative 1 = Yes/Positive	Nominal

Data Analysis Plan

I used IBM Statistical Package for Social Sciences (SPSS) Version 28 for data analysis. Both descriptive and inferential statistics were generated using SPSS Version 28 to provide an overview of the dataset and to analyze or examine whether there was an

association between the outcome or dependent variable of C-section SSI development and the independent variables of age at the time of delivery, smoking status of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status.

The standardized infection ratio (SIR) is a key indicator used to monitor HAIs at different levels – national, state, or local – over some time (CDC, 2022a). It accounts for various factors at the facility or patient level that can influence the risk of HAIs in a particular facility (CDC, 2022a). The calculation of the SIR is comparable to that of the standardized mortality ratio, a commonly used summary statistic in public health for analyzing mortality data (Izadi et al., 2021). When analyzing HAI data, the SIR contrasts the actual reported HAIs with the expected number, considering the standard population (NHSN baseline) and adjusting for several risk factors proven to be significantly linked with variations in infection rates (Izadi et al., 2021). Simply put, a SIR above 1.0 signifies that the observed HAIs exceeded the predicted number, while a SIR below 1.0 implies fewer HAIs were recorded than anticipated. The SIR facilitates comparison with the national benchmark from a baseline period and can be employed to assess progress over time (CDC, 2022a). The SIR enables comparisons between the actual infections recorded by a facility, group, or state and the expected infections based on national (baseline) data. The NHSN calculates SIRs for SSIs. The calculation divides the observed infections by the predicted ones (see Figure 3). Infections are forecasted through multivariable regression models created from national data collected during a baseline time frame. These models utilize facility-specific information about denominators and risk factors to

gauge anticipated infections (CDC, 2022a; Izadi et al., 2021). If the predicted infections fall below 1.0, SIRs are not determined, ensuring adherence to precision standards. This guideline was established to avert the calculation and analysis of statistically unreliable SIRs, which typically exhibit extreme values (CDC, 2022a).

Figure 3

Standardized Infection Ratio (SIR) Calculation

$$SIR = \frac{Observed\ (O)HAIs}{Predicted\ (P)HAIs}$$

In the dataset available from the CHHS Open Data Portal, SIR rates are available for some hospitals or facilities. The SIRs in the dataset were calculated using only complex SSI identified during hospital admission or readmission to the same hospital following inpatient surgeries. The SIR adjusts for patient-level and hospital-level risk factors specific to each procedure type. NHSN calculates an SSI SIR when at least one infection is predicted. The SIR and its comparison are less precise than SIRs based on a more significant number of predicted infections but provide more hospitals with a published interpretation of their data. Since SIR rates vary significantly among hospitals and healthcare systems, the rates were not analyzed.

The Chi-square test for independence was used to test the relationship or association between the independent variables (age, smoking status of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status) and the outcome variable (C-section SSI development). The Chi-square test is a nonparametric test employed to ascertain if there is a significant association

between two or more nominal categorical variables in a dataset (Kent State University, 2023). It analyzes categorical data using a cross-tabulation or a two-way table (Turhan, 2020). Key benefits of the Chi-square test include its tolerance regarding the data distribution, straightforward computation, the comprehensive insights that can be extracted from the test, its applicability in studies where parametric assumptions are unfulfilled, and its versatility in managing data from studies involving either two groups or multiple groups (Turhan, 2020). The Phi and Cramer's V correlation methods evaluated the relationship strength between the dependent and independent variables.

Binary logistic regression was also used for statistical analysis. Binary logistic regression is a statistical tool to explain or predict the occurrence of specific characteristics, behaviors, or outcomes (Harris, 2021). This method operates under certain presumptions, such as the independence of observations, the absence of perfect multicollinearity, and the presence of linearity in data relationships. It is particularly suited for data analysis in cross-sectional studies and is efficacious in predictive modeling and identifying risk factors (Harris, 2021). Binary logistic regression includes at least one independent variable that aids in explaining or predicting the values of a dependent variable. This model's "binary" aspect refers to the nature of the dependent variable, which is limited to two distinct outcomes, generally encoded as 0 or 1. The capacity of binary logistic regression to generate probability-based predictions and its adaptability to various data types render it a highly flexible and applicable tool in research and predictive analytics. All statistical tests in this research were performed with a 5% significance level (0.05), estimating effects at a 95% confidence interval (CI) with an

odds ratio (OR) and a *p*-value of ≤.05. Any factors that showed a significant influence on the outcome were included in the regression models. By identifying the predictive factors (individual risk factors) linked to the occurrence of C-section SSIs in African American women, this study can help clinicians and public health experts identify those at a heightened risk of such infections.

Research Questions and Hypotheses

RQ1: What is the association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section?

$H_0$1: There is no association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section.

H_A1: There is a statistically significant association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section.

RQ2: What is the association between smoking tobacco and non-tobacco products and alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section?

$H_0 2_a$: There is no association between smoking tobacco and non-tobacco products during pregnancy and the development of an SSI among African American women who underwent a C-section.

$H_A 2_a$: There is a statistically significant association between smoking tobacco and non-tobacco products during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_02_b: There is no association between alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_A2_b: There is a statistically significant association between alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section.

RQ3: What is the association between HIV and SCD status and the development of an SSI among African American women who underwent a C-section?

H_03_a: There is no association between HIV status and the development of an SSI among African American women who underwent a C-section.

H_A3_a: There is a statistically significant association between HIV status and the development of an SSI among African American women who underwent a C-section.

H_03_b: There is no association between SCD status and the development of an SSI among African American women who underwent a C-section.

H_A3_b: There is a statistically significant association between SCD status and the development of an SSI among African American women who underwent a C-section.

Statistical Tests for the Study Outcome

For RQ1, the independent variable was the age at the time of delivery, and the dependent variable was the development of a C-section SSI. The Chi-square test for independence was used to test the relationship or association between age at the time of delivery and the dependent variable, or outcome, which was the development of a C-section SSI. Binary logistic regression was used to identify the predictor variable

(individual risk factor of age at the time of delivery) and the development of a C-section SSI. A *p*-value <.05 indicated a rejection of the null hypothesis.

For RQ2, the independent variables were the smoking status of tobacco and non-tobacco products during pregnancy and alcohol consumption during pregnancy. The dependent variable was the development of a C-section SSI. The Chi-square test for independence was used to test the relationship or association between the smoking status of tobacco and non-tobacco products during pregnancy and alcohol consumption during pregnancy and the dependent variable, or outcome, which was the development of a C-section SSI. Binary logistic regression was used to identify the predictor variable (individual risk factors of smoking status of tobacco and non-tobacco products during pregnancy and alcohol consumption during pregnancy) and the development of a C-section SSI. A *p*-value <.05 indicated rejection of the null hypothesis. For RQ3, the independent variables were HIV and SCD status. The dependent variable was the development of a C-section SSI. The Chi-square test for independence was used to test the relationship or association between HIV and SCD status and the dependent variable, or outcome, which was the development of a C-section SSI. Binary logistic regression was used to identify the predictor variable (individual risk factors of HIV and SCD status) and the development of a C-section SSI. A *p*-value <.05 indicated rejection of the null hypothesis.

Threats to Validity

In quantitative research, validity is a crucial concept that pertains to the accuracy, credibility, and soundness of the research findings. It ensures that the research genuinely

captures what it aims to investigate and that its findings are accurate. If validity is compromised, it can undermine the credibility of the researcher's conclusions. Typically, threats to validity fall into five primary categories: (a) internal validity, (b) external validity, (c) construct validity, (d) content validity, and (e) conclusion validity. Internal validity scrutinizes the study's design, execution, and analysis to determine if it provides dependable answers to its research questions (Andrade, 2018). It primarily investigates if observed changes in the dependent variable result from alterations in the independent variable, ensuring causality is attributed correctly. External validity assesses if a study's results can be applied beyond its specific context or participants (Andrade, 2018). It considers the applicability of the findings to different settings, groups, and times. Construct validity ensures that the research tools, such as questionnaires or tests, measure the constructs they are supposed to measure (Leue et al., 2022). Content validity involves the appropriateness and comprehensiveness of the content in a measurement tool or instrument (Almanasreh et al., 2022). Conclusion validity or statistical conclusion validity measures how reasonable a research or experimental conclusion is (Lund, 2020). Threats to conclusion validity include low statistical power, meaning the study is not "powerful" enough to detect an effect that is present (Lund, 2020, p. 524). Reliability of measures is another threat, meaning inaccurate tools or methods reduce confidence in findings (Lund, 2020). Violated statistical test assumptions are another threat, meaning assumptions such as normal distribution or homogeneity of variances are not met (Lund, 2020).

In this study, conclusion validity was improved by screening for data entry errors and violations of assumptions of the planned statistical analysis. Research aims to generate reliable knowledge or offer evidence to inform practical choices. Statistical conclusion validity ensures that a research study's conclusions are grounded in a proper data analysis. This typically implies using suitable statistical techniques that are accurate for small samples and logically aligned to address the research question (Lund, 2020).

Ethical Procedures

Ethics in research are paramount. They guarantee that researchers uphold integrity, prioritizing the safety, rights, dignity, and overall well-being of both the participants and the wider society. In this study, secondary data publicly available from the CHHS Open Data Portal and CDPH were used, thus eliminating any direct interaction with patients and reducing potential ethical issues. The datasets contained de-identified data to ensure patients' safety and confidentiality. To ensure safety, data resided in a protected Microsoft Excel database on a private computer, which was also password-guarded. Any data transferred to SPSS were similarly safeguarded. Backups were kept on an encrypted external drive, and the computer and the drive were stored in a locked compartment when not in active use. Before analyzing the data, I obtained approval through Walden University's Institutional Review Board (IRB approval number 11-21-23-1124959). The insights derived from this study will serve as valuable information for healthcare facility leaders, care providers, and regional and national policymakers.

Summary

I aimed to explore the potential individual risk factors associated with C-section SSIs among African American women in California, assessing age at the time of delivery, usage of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status by analyzing secondary data. I conducted a retrospective, cross-sectional design—utilizing secondary data from the CHHS Open Data Portal and CDPH, focusing on African American women who had a C-section in California between January 1, 2022, and December 31, 2022.

In this section, I elaborated on the research method and design employed for this study, providing comprehensive details on the study methodology, including descriptions of the study population, participants, and the sampling methods utilized for data collection. I justified the sample size and power calculation using G*Power and defined and discussed each variable's operationalization, its levels of measurement, response categories, and descriptions. The research questions and hypotheses were reiterated, and a thorough discussion of the statistical methods employed to address the research questions was provided. The statistical software designated for data analysis was identified. Potential threats to validity and strategies to enhance conclusion validity were outlined. Ethical procedures for accessing secondary data were clarified. The following section will present and discuss the study results and findings about the research questions.

Section 3: Presentation of the Results and Findings

Introduction

The purpose of this quantitative study was to determine if age at the time of delivery, smoking tobacco and non-tobacco products during pregnancy, alcohol use during pregnancy, HIV status, and SCD status were associated with the development of an SSI among African American women who underwent a C-section in California between January 1, 2022, and December 31, 2022. By identifying and improving understanding of the potential individual risk factors and the development of C-section SSIs among African American women, this study may lead to early intervention efforts, improved health outcomes, reduced healthcare costs, and improved patient satisfaction. I used the following research questions to investigate the individual risk factors associated with the development of SSIs among African American women who underwent a C-section in California:

RQ1: What is the association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section?

$H_0$1: There is no association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section.

H_A1: There is a statistically significant association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section.

RQ2: What is the association between smoking tobacco and non-tobacco products and alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section?

H_02_a: There is no association between smoking tobacco and non-tobacco products during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_A2_a: There is a statistically significant association between smoking tobacco and non-tobacco products during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_02_b: There is no association between alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_A2_b: There is a statistically significant association between alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section.

RQ3: What is the association between HIV and SCD status and the development of an SSI among African American women who underwent a C-section?

H_03_a: There is no association between HIV status and the development of an SSI among African American women who underwent a C-section.

H_A3_a: There is a statistically significant association between HIV status and the development of an SSI among African American women who underwent a C-section.

H_03_b: There is no association between SCD status and the development of an SSI among African American women who underwent a C-section.

H_A3_b: There is a statistically significant association between SCD status and the development of an SSI among African American women who underwent a C-section.

This section presents the results of the data analysis to address the three research questions and their hypotheses. The method of obtaining the data set for secondary analysis and data analyses, including descriptive and inferential statistics of the study population, and a summary of the findings are included.

Accessing the Data Set for Secondary Analysis

The data for this retrospective, cross-sectional study were obtained from the CHHS Open Data Portal and CDPH. The California Health and Human Services Agency (CalHHS) introduced the Open Data Portal initiative, a significant endeavor to augment public accessibility to a crucial state resource: non-confidential health and human services data (CHHS, n.d.). “Open data” refers to information that is not only freely available but also conforms to national technical standards for machine readability and format (CHHS, n.d.). This standardization enhances the visibility and reusability of the data. The portal serves as a central hub for standardized data, offering a user-friendly platform where this information can be easily accessed, integrated, downloaded, organized, searched, examined, shared, and reused (CHHS, n.d.). This facilitates various applications, ranging from scholarly research to data analysis.

The scope of the CHHS agency includes offering policy guidance and strategic direction to its affiliated departments and programs. An important part of its role is to reduce overlap and disconnection, enhancing collaboration among different departments (CHHS, n.d.). This contributes to maintaining the integrity of programs and aligns them

with the governor's objectives in health and human services. The agency plays a crucial role in managing a variety of state and federal programs, which cover areas like public health, healthcare services, social services, public assistance, health planning and licensing, and rehabilitation. These programs have a significant impact on the lives of some of California's most underprivileged and vulnerable residents. CalHHS is instrumental in delivering vital health and human services to these populations, while also overseeing and regulating the related financial aspects (CHHS, n.d.).

In California, acute care hospitals are mandated to meticulously track and report occurrences of deep incisional and organ/space SSIs in adult and pediatric cohorts (individuals under 18 years of age; CDPH, 2020; CHHS, 2023). This surveillance extends to 28 distinct types of surgical interventions, notably including cesarean sections. The reporting of SSIs by these hospitals complies with the directives of the CDPH's HAI Program. This reporting is facilitated through the integration with the NHSN, an initiative of the CDC, as stipulated by the Health and Safety Code (HSC) section 1288.55.

Per the mandates of HSC section 1288.55, hospitals must report various HAIs to the CDPH via the NHSN (CDPH, 2020). These include CLABSIs, Clostridium difficile infections, influenza vaccination status of healthcare personnel, Methicillin-resistant Staphylococcus aureus bloodstream infection, SSI, and vancomycin-resistant enterococci bloodstream infection.

The C-section SSI dataset from the CHHS Open Data Portal encompasses a spectrum of hospital types within California, defined by specific criteria. The dataset includes the hospital type where the C-section SSI was identified. The specific types of

California hospitals included in the datasets are central teaching; pediatric; community, greater than 250 beds; community, 125–250 beds; community, less than125 beds; long-term acute care; critical access; free-standing rehabilitation; and rehabilitation unit (CDPH, 2020). Major teaching hospitals are characterized by their medical student education programs and post-graduate medical training offerings. Pediatric hospitals predominantly cater to inpatients aged 18 years or younger. Community hospitals, as designated by the CDPH, are those not classified under the categories of significant teaching, long-term acute care (LTAC), critical access, pediatric, or rehabilitation, with further stratification based on the number of active beds as reported in the NHSN Annual Survey (CDPH, 2020). Long-term acute care hospitals, as defined by the Centers for Medicare & Medicaid Services (CMS), are licensed general acute care hospitals providing extended care (average length of stay exceeding 25 days) for patients with complex medical conditions. Critical access hospitals, designated by CMS, are facilities with at most 25 acute care inpatient beds located significantly distant from other hospitals and with an average length of stay not exceeding 4 days. Rehabilitation hospitals are critical care facilities specializing in the evaluation and restoration of function for patients who have experienced functional loss due to various causes, including acute or chronic pain, musculoskeletal issues, stroke, or catastrophic events leading to partial or complete paralysis. Rehabilitation units are distinct wards within general acute care hospitals that focus on evaluating and restoring function for similar patient demographics. These units usually possess a unique CMS certification number and report their data separately from the main hospital (CDPH, 2020).

After obtaining approval through Walden University's Institutional Review Board (IRB approval number 11-21-23-1124959), I accessed the data and consented to a series of ethical and methodological stipulations set forth by the CDPH. These stipulations explicitly acknowledge CDPH as the primary data source in scholarly publications utilizing this dataset. In addition, it was incumbent upon me to incorporate a disclaimer (see Appendix B) in such publications, attributing any analyses, interpretations, or conclusions derived from the birth or death data exclusively to my scholarly efforts and not to CDPH. I consented that any publication based on this data should present technical descriptions of the birth and death data in congruence with those provided by CDPH. This ensures consistency and accuracy in portraying the data's scope and limitations. I agreed to refrain from employing the birth or death data for any fraudulent purposes or in any attempts to re-identify individuals, whether living or deceased, thus upholding the highest data privacy standards and ethical research practices.

Upon consent to these conditions, I downloaded the dataset, encompassing a comprehensive record of all births occurring within California during the calendar year spanning from January 1, 2022, to December 31, 2022. This dataset is critical for conducting epidemiological and public health analyses, offering invaluable insights into the state's demographic trends, health outcomes, and other vital statistics. Other variables that were accessed and downloaded included race/ethnicity, age at the time of delivery, smoking status of tobacco and non-tobacco products during pregnancy, alcohol use or consumption during pregnancy, HIV status, SCD status, and the development of a C-section SSI. No discrepancies were found with the data set, and no deviations from the

data analysis plan were needed. Data were then compiled into a Microsoft Excel spreadsheet and imported into SPSS for analysis. There was an initial total of 7,208 cases in the dataset. After removing two instances that did not have data for HIV status, the final analysis sample consisted of 7,206 cases.

Descriptive and Demographic Characteristics of the Study Population

Between January 1, 2022, and December 31, 2022, 420,430 women gave birth in California, with current and updated data as of November 2023 (see Table 2). Table 2 shows the frequencies and percentages of the number of births in California according to the delivery method. Out of 130,329 C-sections that were performed in the state of California in 2022, approximately 0.28% (*n* = 360) of women developed an SSI.

Table 2

California 2022 Birth Report by Delivery Method

Type of event	Delivery method	Total births	Percent (%)
Birth	Cesarean	130,329	31.0
Birth	Vaginal	290,101	69.0
Total		420,430	100.0

Note. Data source: CDPH.

Table 3 displays the California C-section SSI rate by race/ethnicity. Black/African American women accounted for 29.45% (*n* = 106) of all C-section SSIs.

Table 3

California 2022 Cesarean Section SSI Rate by Race/Ethnicity

Type of event	Race/ethnicity	Total SSIs	Percent (%)
Birth	Hispanic	162	45.0
Birth	White	54	15.0
Birth	Asian	13	3.61
Birth	Black/African American	106	29.45
Birth	Other	8	2.22
Birth	Multi-race	6	1.67
Birth	Pacific Islander/Native Hawaiian	4	1.11
Birth	Native American/Alaskan Native	7	1.94
Total		360	100.00

Note. Data Source: CHHS Open Data Portal.

Of the 420,430 births that occurred in California between January 1, 2022, and December 31, 2022, the majority, or 32.30% (*n* = 135,830) occurred among women aged 30–34. The lowest number of births, or 0.11% (n = 448), occurred among women 15 years and younger. Women aged 50 and over accounted for 0.12% (*n* = 490) of births (see Table 4).

Table 4

California 2022 Birth Report by Age at the Time of Delivery

Type of Event	Age at the time of birth	Total Births	Percent (%)
Birth	15 years and under	448	0.11
Birth	16-17 years	2,533	0.60
Birth	18-19 years	9,442	2.24
Birth	20-24 years	57,087	13.58
Birth	25-29 years	102,579	24.40
Birth	30-34 years	135,830	32.30
Birth	35-39 years	88,404	21.03
Birth	40-44 years	21,848	5.20
Birth	45-49 years	1,769	0.42
Birth	50 years and older	490	0.12
Total		420,430	100.00

Note. Data Source: CDPH.

Race/ethnicity was also categorized in the dataset. Significant findings showed that Hispanic women accounted for 48.52% (*n* = 203,992) of births, whereas Black/African American women accounted for only 4.7% (*n* = 19,741; see Table 5) of births.

Table 5

California 2022 Birth Report by Race/Ethnicity

Type of event	Race/ethnicity	Total births	Percent (%)
Birth	Hispanic	203,992	48.52
Birth	White	109,254	25.98
Birth	Asian	56,047	13.33
Birth	Black/African American	19,741	4.70
Birth	Other	18,396	4.38
Birth	Multi-race	10,143	2.41
Birth	Pacific Islander/Native Hawaiian	1,587	0.38
Birth	Native American/Alaskan Native	1,270	0.30
Total		420,430	100.00

Note. Data Source: CDPH.

Black/African American women accounted for 4.70% (*n* = 19,741) of all births in California during 2022 (see Table 6).

Table 6

California 2022 Birth Report by Delivery Method Among Black/African American Women

Type of event	Delivery method	Total births	Percent (%)
Birth	Cesarean	7,208	36.51
Birth	Vaginal	12,533	63.49
Total		19,741	100.0

Note. Data Source: CDPH.

The sample population for this study included all African American women who underwent a C-section in California between January 1, 2022, and December 31, 2022. This population included a total sample size of 7,208. However, two cases that did not have data for HIV status were removed, leaving the final analysis sample of 7,206 cases. Frequencies and percentages for the sample characteristics are presented in Table 7. Most of Black/African American women in the dataset were 20–34 years of age at the time of delivery (*n* = 5,000; 69.4%). Approximately 2.1% of the women smoked (*n* = 153) and 6.7% consumed alcohol (*n* = 480). Approximately 4% of the women were HIV positive (*n* = 288), and fewer than 1% were positive for SCD (*n* = 39). One hundred and six women in the sample (1.5%) had developed an SSI.

Table 7

Frequencies and Percentages for Sample Characteristics (N = 7, 206)

Variable	Frequency	Percent
Age at the time of delivery		
19 years or younger	202	2.8
20–34 years	5,000	69.4
35 years or older	2,004	27.8
Smoking status		
No	7,053	97.9
Yes	153	2.1
Consumption of alcohol		
No	6,726	93.3
Yes	480	6.7
HIV status		
Negative	6,918	96.0
Positive	288	4.0
SCD status		
Negative	7,167	99.5
Positive	39	0.5
C-section SSI		
No	7,100	98.5
Yes	106	1.5

Results

Chi-square tests of independence and binary logistic regressions were used to test the association between the independent variables (age, smoking status of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status) and the outcome variable (C-section SSI development). Fisher's exact test was also used for the crosstabulations that did not meet the criteria for the chi-square test of independence, as this statistic is more accurate when cell counts are small. The following sections present the results of the descriptive and inferential analyses performed to answer each research question.

Descriptive Statistics that Characterize the Sample

Table 8 presents the crosstabulation between age at the delivery time and the development of a C-section SSI. Women who were 19 years of age or younger at the time of delivery had the highest proportion of C-section SSI development. Approximately 12.4% of women in the 19 or younger age group developed a C-section SSI.

Table 8

Crosstabulation Between Age and C-section SSI

	C-section SSI			
	No		Yes	
Age	*n*	(%)	*n*	(%)
19 years or younger	177	(87.6)	25	(12.4)
20–34 years	4,941	(98.8)	59	(1.2)
35 years or older	1,982	(98.9)	22	(1.1)

Table 9 presents the crosstabulation between smoking status and the development of a C-section SSI. Approximately 5.9% of women who smoked developed a C-section SSI.

Table 9

Crosstabulation Between Smoking Status and C-section SSI

	C-section SSI			
	No		Yes	
Smoking status	*n*	(%)	*n*	(%)
No	6,956	(98.6)	97	(1.4)
Yes	144	(94.1)	9	(5.9)

Table 10 presents the crosstabulation between the consumption of alcohol and the development of a C-section SSI. Approximately 3.8% of women who consumed alcohol developed a C-section SSI.

Table 10

Crosstabulation Between Alcohol Consumption and C-section SSI

	C-section SSI			
	No		Yes	
Consumption of alcohol	*n*	(%)	*n*	(%)
No	6,638	(98.7)	88	(1.3)
Yes	462	(96.3)	18	(3.8)

Table 11 presents the crosstabulation between HIV status and the development of a C-section SSI. Approximately 2.4% of women who were HIV positive developed a C-section SSI.

Table 11

Crosstabulation Between HIV Status and C-section SSI

	C-section SSI			
	No		Yes	
HIV status	*n*	(%)	*n*	(%)
Negative	6819	(98.6)	99	(1.4)
Positive	281	(97.6)	7	(2.4)

Table 12 presents the crosstabulation between SCD status and the development of a C-section SSI. Approximately 7.7% of women who were positive for SCD developed a C-section SSI.

Table 12

Crosstabulation Between SCD Status and C-section SSI

	C-section SSI			
	No		Yes	
SCD status	*n*	(%)	*n*	(%)
Negative	7,064	(98.6)	103	(1.4)
Positive	36	(92.3)	3	(7.7)

Statistical Assumptions

Before interpreting the results of the analyses, the statistical assumptions of the Chi-square test of independence and binary logistic regression were assessed. The Chi-square test of independence requires that fewer than 20% of the cells in the contingency table have expected counts less than five, and that no cells have expected counts less than one. Table 13 presents the observed and expected counts for each proposed chi-square test of independence. In the crosstabulation of age and C-section SSI, one cell (16.7%) had an expected count of less than five, and no cells had expected counts of less than one; therefore, the analysis requirements were met. In the crosstabulation of smoking status and C-section SSI, one cell (25%) had an expected of less than five, and no cells had expected counts of counts less than one. Therefore, the analysis requirements were unmet.

In the crosstabulation of alcohol consumption and C-section SSI, no cells had expected counts less than five; the requirements of the analysis were met. In the crosstabulation of HIV status and C-section SSI, one cell (25%) had an expected count of less than five, and no cells had expected counts of less than one; therefore, the analysis requirements were unmet. In the crosstabulation of SCD status and C-section SSI, one cell had an expected count of less than one; the analysis requirements still needed to be met. Fisher's exact test was performed instead for the crosstabulations that did not meet the criteria for the chi-square test of independence, as this statistic is more accurate when cell counts are small. To further explain, Fisher's Exact Test represents a statistical tool of significant import, primarily utilized to ascertain the presence or absence of

nonrandom correlations between two distinct categorical variables within a contingency matrix (Kim, 2017). Its utility is especially pronounced when the sample sizes are diminutive, rendering it a more reliable alternative to the Chi-squared test under such conditions (Kim, 2017). The Fisher's Exact Test application is predominantly in the realm of categorical data analysis. A typical use case involves a 2x2 contingency table, wherein the data are bifurcated into two discrete categories in rows and columns. This test is particularly apt for analyses involving smaller sample sizes. Compared to the Chi-squared test, which merely provides an approximate distribution of the test statistic under the null hypothesis, Fisher's Exact Test delivers a precise probability calculation (Bind & Rubin, 2020; Kim, 2017). This test computes the probability (*p*-value) of obtaining an outcome as, or more, extreme than what is observed in the data, premised on the assumption that the null hypothesis holds (Bind & Rubin, 2020). The null hypothesis is rejected if this *p*-value falls beneath a specified threshold, commonly set at .05. A *p*-value lower than the predetermined significance level implies that the association noted within the table is not merely a product of random chance (Bind & Rubin, 2020).

Conversely, a *p*-value exceeding this level suggests potential randomness in the observed association, thereby precluding the rejection of the null hypothesis of independence (Bind & Rubin, 2020). One limitation of Fisher's Exact Test is its diminished efficacy when dealing with larger sample sizes, despite its advantages in smaller samples. For larger matrices (exceeding the dimensions of 2x2), the computational demands for ascertaining the exact *p*-value become considerably more intensive and challenging (Bind & Rubin, 2020; Kim, 2017).

Table 13

Observed and Expected Counts for Variable Crosstabulations

	C-section SSI			
	No		Yes	
Variable	Observed *n*	[Expected *n*]	Observed *n*	[Expected *n*]
Age				
19 years or younger	177	[199.0]	25	[3.0]
20–34 years	4,941	[4,926.5]	59	[73.5]
35 years or older	1982	[1,974.5]	22	[29.5]
Smoking status				
No	6,956	[6,949.3]	97	[103.7]
Yes	144	[150.7]	9	[2.3]
Consumption of alcohol				
No	6,638	[6,627.1]	88	[98.9]
Yes	462	[472.9]	18	[7.1]
HIV status				
Negative	6,819	[6,816.2]	99	[101.8]
Positive	281	[283.8]	7	[4.2]
SCD status				
Negative	7,064	[7,061.6]	103	[105.4]
Positive	36	[38.4]	3	[0.6]

For a binary logistic regression with only categorical independent variables (predictors), no distributional assumptions must be met for the analysis. The only requirements of the binary logistic regression analysis are that the dependent (criterion) variable has only two categories and that there is no severe multicollinearity. In this study, the dependent variable was the development of a C-section SSI, which had only two categories (no or yes). Computing variance inflation factors assessed multicollinearity. Variance inflation factors more significant than 10 indicate severe multicollinearity. The variance inflation factors for the regressions are presented in Table 14. All variance inflation factors were less than 10, indicating no severe multicollinearity, and the requirements for binary logistic regression were met.

Table 14

Variance Inflation Factors for Binary Logistic Regressions

Independent variable	Variance inflation factor
Regression 1	
Age	1.00
Regression 2	
Smoking status	1.02
Consumption of alcohol	1.02
Regression 3	
HIV status	1.00
SCD status	1.00

Statistical Analysis Findings

In this subsection, I included my statistical findings for each research question, which include results from the Chi-square test of independence, Fisher's exact test, and binary logistic regression.

RQ1

For RQ1, the independent variable was the age at the time of delivery, and the dependent variable was the development of a C-section SSI. A Chi-square test of independence was used to test the association between age at the time of delivery and the development of a C-section SSI. The results of the chi-square test of independence were significant, $\chi^2(2) = 170.59$, $p < .001$, Cramer's V = .15, indicating that there was a statistically significant association between age at the time of delivery and the development of a C-section SSI. The null hypothesis ($H_0 1$) was rejected.

A binary logistic regression was used to determine if age at the time of delivery significantly predicted the development of a C-section SSI. In this regression, the independent (predictor) variable was age, and the dependent (criterion) variable was the

development of a C-section SSI. Age was dummy-coded, with 19 years or younger as the reference group. The overall binary logistic regression model was significant, $\chi^2(2) = 70.21$, $p < .001$, Nagelkerke $R^2 = .07$, indicating that age at the time of delivery significantly predicted the development of a C-section SSI. Table 15 presents the coefficients for the binary logistic regression. The coefficients for age showed that women 20–34 years of age were significantly less likely to develop a C-section SSI than women 19 years or younger ($B = -2.47$, $p < .001$). Women 35 years of age or older were significantly less likely to develop a C-section SSI compared to women 19 years of age or younger ($B = -2.54$, $p < .001$).

Similarly, the Exp(B) value for the age variable for 20-34 years was 0.09. Exp(B) is typically easier to interpret (IBM, 2023). Exp(B), or odds ratio, indicates the expected change in the likelihood for each one-unit increase in the predictor. “Exp” represents the exponential of the B coefficient. When the Exp(B) value is below 1.0, it suggests that higher values of the predictor are associated with lower odds of the event occurring. A result of 0.09 indicates that women in the age group 20-34 years are significantly less likely to develop a C-section SSI compared to the reference age group (19 years and below). Specifically, the odds are 91% lower (since 1 - 0.09 = 0.91 or 91%). Exp(B) value for the age variable for 35 years or older was 0.08. This suggests that women aged 35 years or older are even less likely than those aged 20–34 years to develop SSI post-C-section compared to the reference group. The odds are 92% lower (1 - 0.08 = 0.92 or 92%). These results indicate a significant decrease in the likelihood of C-section SSI as

the age of the mother increases, with the lowest likelihood observed in women aged 35 and older.

Table 15

Binary Logistic Regression With Age Predicting C-section SSI

Variable	*B*	S.E.	Sig.	Exp(*B*)	95% CI Lower	95% CI Upper
Age [20–34 years]	-2.47	0.25	< .001	0.09	0.05	0.14
Age [35 years or older]	-2.54	0.30	< .001	0.08	0.04	0.14
Constant	-1.96	0.21	< .001	0.14		

RQ2

For RQ2, the independent variables were the smoking status of tobacco and non-tobacco products during pregnancy and alcohol consumption during pregnancy, and the dependent variable was the development of a C-section SSI. Because the requirements of the Chi-square test of independence were not met, Fisher's exact test was used to test the association between smoking status and the development of a C-section SSI. The results of Fisher's exact test were significant, p <.001, Cramer's V = .05, indicating that there was a statistically significant association between smoking status and the development of a C-section SSI. The null hypothesis (H_02_a) was rejected.

A Chi-square test of independence was used to test the association between alcohol consumption and the development of a C-section SSI. The results of the Chi-square test of independence were significant, $\chi^2(1) = 18.43$, p <.001, Cramer's V = .05, indicating a statistically significant association between alcohol consumption and developing a C-section SSI. The null hypothesis (H_02_b) was rejected.

A binary logistic regression was used to determine if smoking status and alcohol consumption significantly predicted the development of a C-section SSI. In this regression, the independent (predictor) variables were smoking status and alcohol consumption, and the dependent (criterion) variable was the development of a C-section SSI. The overall binary logistic regression model was significant, $\chi^2(2) = 21.98$, $p < .001$, Nagelkerke $R^2 = .02$, indicating that smoking status and alcohol consumption significantly predicted the development of a C-section SSI. Table 16 presents the coefficients for the binary logistic regression. The coefficient for smoking status was significant ($B = 1.25$, $p < .001$) and showed that women who smoked were 3.49 times more likely to develop a C-section SSI compared to women who did not smoke. The coefficient for alcohol consumption was significant ($B = 0.93$, $p < .001$) and showed that women who consumed alcohol were 2.54 times more likely to develop a C-section SSI compared to women who did not consume alcohol.

Table 16

Binary Logistic Regression With Smoking Status and Alcohol Consumption Predicting C-section SSI

					95% CI	
Variable	*B*	S.E.	Sig.	Exp(*B*)	Lower	Upper
Smoking status [Yes]	1.25	0.37	< .001	3.49	1.69	7.23
Consumption of alcohol [Yes]	0.93	0.27	< .001	2.54	1.49	4.33
Constant	-4.36	0.11	< .001	0.01		

RQ3

For RQ3, the independent variables were HIV and SCD status, and the dependent variable was the development of a C-section SSI. Because the requirements of the Chi-

square test of independence were not met, Fisher's exact test was used to test the association between HIV status and the development of a C-section SSI. The results of Fisher's exact test were not significant, $p = .205$, Cramer's V = .02, indicating that there was no association between HIV status and the development of a C-section SSI. The null hypothesis (H_03_a) was not rejected.

Because the requirements of the Chi-square test of independence were not met, Fisher's exact test was used to test the association between SCD status and the development of a C-section SSI. Fisher's exact test results were significant, $p = .019$, Cramer's V = .04, indicating a statistically significant association between SCD status and the development of a C-section SSI. The null hypothesis (H_03_b) was rejected.

A binary logistic regression was used to determine if HIV status and SCD status significantly predicted the development of a C-section SSI. In this regression, the independent (predictor) variables were HIV and SCD status, and the dependent (criterion) variable was the development of a C-section SSI. The overall binary logistic regression model was significant, $\chi^2(2) = 6.95$, $p = .031$, Nagelkerke $R^2 = .01$, indicating that HIV and SCD status significantly predicted the development of a C-section SSI. Table 17 presents the coefficients for the binary logistic regression. The coefficient for HIV status was not significant ($B = 0.55$, $p = .165$), indicating that women who were HIV positive were not more or less likely to develop a C-section SSI compared to women who were HIV negative. The coefficient for SCD status was significant ($B = 1.75$, $p = .004$) and showed that women who were positive for SCD were 5.78 times more likely to develop a C-section SSI compared to women who were negative for SCD.

Table 17

Binary Logistic Regression With HIV Status and SCD Status Predicting C-section SSI

Variable	*B*	S.E.	Sig.	Exp(*B*)	95% CI Lower	95% CI Upper
HIV status [Positive]	0.55	0.40	.165	1.73	0.80	3.77
SCD status [Positive]	1.75	0.61	.004	5.78	1.75	19.08
Constant	-4.26	0.10	<.001	0.01		

A post-hoc analysis, consisting of a binary logistic regression, was used to determine if all the independent variables (age at the time of delivery, smoking status, alcohol consumption, HIV status, and SCD status) significantly predicted the development of a C-section SSI. The overall binary logistic regression model was significant, $\chi^2(6) = 76.19$, $p < .001$, Nagelkerke $R^2 = .07$, indicating that age at the time of delivery, smoking status, alcohol consumption, HIV status, and SCD status significantly predicted the development of a C-section SSI. Table 18 presents the coefficients for the binary logistic regression. The coefficients for age showed that women 20-34 years of age were significantly less likely to develop a C-section SSI compared to women 19 years of age or younger ($B = -2.34$, $p < .001$). Additionally, women 35 years of age or older were significantly less likely to develop a C-section SSI compared to women 19 years of age or younger ($B = -2.41$, $p < .001$). The coefficient for SCD status was significant ($B = 1.56$, $p = .015$) and showed that women who were positive for SCD were 4.78 times more likely to develop a C-section SSI compared to women who were negative for SCD.

Table 18

Binary Logistic Regression Predicting C-Section SSI

Variable	*B*	S.E.	Sig.	Exp(*B*)	95% CI Lower	95% CI Upper
Age [20-34 years]	-2.34	0.31	< .001	0.10	0.05	0.18
Age [35 years or older]	-2.41	0.36	< .001	0.09	0.05	0.18
Smoking status [Yes]	0.51	0.40	.204	1.66	0.76	3.64
Consumption of alcohol [Yes]	-0.03	0.33	.936	0.97	0.52	1.84
HIV status [Positive]	0.26	0.41	.526	1.30	0.58	2.90
SCD status [Positive]	1.56	0.64	.015	4.78	1.36	16.78
Constant	-2.12	0.30	< .001	0.12		

Summary

Secondary data from the CHHS Open Data Portal and CDPH regarding African American women who had a C-section between January 1, 2022, and December 31, 2022, were analyzed to determine the association between the independent variables (age, smoking status of tobacco and non-tobacco products during pregnancy, alcohol consumption during pregnancy, HIV status, and SCD status) and the outcome variable (C-section SSI development). The results for RQ1 showed a statistically significant association between age at the time of delivery and the development of a C-section SSI. The null hypothesis ($H_0 1$) was rejected. Age at the time of delivery significantly predicted the development of a C-section SSI, such that older women were less likely to develop a C-section SSI than women 19 years of age or younger.

The results for RQ2 showed that both smoking status and alcohol consumption were statistically significantly associated with the development of a C-section SSI. The null hypotheses $H_0 2_a$ and $H_0 2_b$ were rejected. Smoking status and alcohol consumption significantly predicted the development of a C-section SSI, such that women who

smoked and consumed alcohol were more likely to develop a C-section SSI than women who did not.

The results for RQ3 showed that HIV status was not statistically significantly associated with the development of a C-section SSI. The null hypothesis $H_0 3_a$ was accepted. SCD status was statistically significantly associated with the development of a C-section SSI; therefore, null hypothesis $H_0 3_b$ was rejected. SCD status significantly predicted the development of a C-section SSI, such that women who were positive for SCD were more likely to develop a C-section SSI than women who were negative for SCD.

The following section will discuss these results, their applications to practice, and their implications for social change.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

The purpose of this retrospective, cross-sectional study was to determine if age at the time of delivery, smoking status of tobacco and non-tobacco products during pregnancy, alcohol use during pregnancy, HIV status, and SCD status were associated with the development of an SSI among African American women who underwent a C-section in California between January 1, 2022, and December 31, 2022. Whereas previous studies have shown that African American women are more likely to develop SSIs after C-sections than non-Black women, there is very little to no literature regarding the individual risk factors associated with the development of an SSI among this population (Kawakita, 2019). The secondary data for this quantitative study were obtained and downloaded from the CHHS Open Data Portal and the CDPH. Key findings of the study revealed that age at the time of delivery significantly predicted the development of a C-section SSI, such that older women were less likely to develop a C-section SSI than women 19 years of age or younger. Results showed that smoking both tobacco and non-tobacco products and alcohol consumption during pregnancy were statistically significantly associated with the development of a C-section SSI. Lastly, HIV status was not statistically significantly related to the development of a C-section SSI, and SCD status significantly predicted the development of a C-section SSI.

Interpretation of the Findings

RQ1

RQ1: What is the association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section?

$H_0$1: There is no association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section.

H_A1: There is a statistically significant association between age at the time of delivery and the development of an SSI among African American women who underwent a C-section.

Studies have shown that maternal age is a pivotal factor influencing pregnancy outcomes (Chakole et al., 2022). Adolescent pregnancies are frequently associated with less favorable outcomes for both the mother and the neonate (Diabelková et al., 2023). One of the primary challenges in teenage pregnancies is often inadequate prenatal care. This shortfall is partly attributable to delayed pregnancy recognition or a lack of comprehensive understanding of the importance of early and consistent prenatal care, resulting in many teenage expectant mothers not seeking care until the latter stages of pregnancy (Chakole et al., 2022). In the United States, the incidence of teenage pregnancies and childbirth is notably higher among African American adolescents in comparison to their White peers, as highlighted in studies by Cox (2020) and Dumas et al. (2020). This disparity is often attributed to intersecting factors of ethnic minority status and socioeconomic challenges. Economic constraints can impede access to comprehensive education and healthcare services, notably reproductive health and

contraception (Maheshwari et al., 2022). Contributing factors to the elevated rates of teenage pregnancies within the African American community include the degree of parental involvement, peer influence, the lack of comprehensive sexual education, and the use of substances like alcohol (Cox, 2020). Among these, parental engagement and peer influence have been consistently identified as significant contributing factors to teen pregnancy in various research studies (Cox, 2020; Dumas et al., 2020).

In their 2021 study, Dessu et al. identified maternal age as a significant determinant in the incidence of post-cesarean section surgical site infections. The research conducted at Bugando Medical Center in Tanzania revealed a notable trend: women aged between 20 and 34 were five times more susceptible to post-cesarean surgical site infections compared to their counterparts aged 19 or younger (Dessu et al., 2021). Furthermore, the probability of post-cesarean section surgical site infections was found to be nine times higher in mothers aged 35 and above, relative to those aged 19 and below. This increased risk, according to the study conducted by Dessu et al. (2021), may be attributed to factors such as diminished capability in basic and instrumental activities of daily living, cognitive impairments, frailty, polypharmacy, and nutritional status variances. However, this finding did not align with the results obtained from similar studies, which revealed women aged 20 and under were more likely to develop a C-section SSI compared to women aged 20–34 years old (Chu et al., 2014; Mamo et al., 2017).

For RQ1, the independent variable was the age at the time of delivery, and the dependent variable was the development of a C-section SSI. The relationship between the

age at delivery and the development of a C-section SSI was analyzed using the Chi-square test of independence. The outcome of this test was statistically significant, demonstrating a meaningful statistical correlation between age at the time of delivery and the development of a C-section SSI. The null hypothesis ($H_0 1$) was rejected. A binary logistic regression was used to determine if age at the delivery time significantly predicted the development of a C-section SSI. In this regression, the independent (predictor) variable was age, and the dependent (criterion) variable was the development of a C-section SSI. The overall binary logistic regression model was significant, indicating that age at the delivery time significantly predicted the development of a C-section SSI. The coefficients for age showed that women 20–34 years of age were significantly less likely to develop a C-section SSI compared to women 19 years of age or younger.

Women 35 years of age or older were significantly less likely to develop a C-section SSI compared to women 19 years of age or younger. This could be due to many factors, such as immature immune systems and lack of antenatal care. Adolescent women may still be in the process of developing their immune system, which may, in turn, increase their vulnerability to infections (Eriksen et al., 2016; Maheshwari et al., 2022). Moreover, in particular socio-economic environments, mothers aged 19 and younger may face limited access to, or involvement in, prenatal care services (Eriksen et al., 2016; Maheshwari et al., 2022). Such a scenario can result in inadequate monitoring and management of various risk factors associated with SSIs, including but not limited to conditions like diabetes and other health issues. Lastly, adolescent mothers may be

disproportionately impacted by socioeconomic determinants, including poverty, educational deficits, and substandard living conditions (Aluga & Okolie, 2021). These factors collectively contribute to an elevated risk of SSIs. This heightened vulnerability is a consequence of the intricate interplay between socioeconomic adversity and health outcomes, underscoring the need for a multifaceted approach to addressing the determinants of SSIs among this demographic.

RQ2

RQ2: What is the association between smoking tobacco and non-tobacco products and alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section?

H_02_a: There is no association between smoking tobacco and non-tobacco products during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_A2_a: There is a statistically significant association between smoking tobacco and non-tobacco products during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_02_b: There is no association between alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section.

H_A2_b: There is a statistically significant association between alcohol use during pregnancy and the development of an SSI among African American women who underwent a C-section.

Studies have shown that women who habitually smoke before becoming pregnant are often likely to continue this practice during their pregnancy (Liu et al., 2020; Smedberg et al., 2014). The act of smoking by expectant mothers has been closely linked to adverse outcomes for both the fetus and the newborn (Assari & Boyce, 2021). The habit of cigarette smoking in pregnant women is correlated with a heightened necessity for a C-section delivery (Hamadneh & Hamadneh, 2021; Tarasi et al., 2022). This correlation is partly due to complications related to the placenta. Tobacco use during pregnancy can result in placental issues, such as diminished blood flow to the placenta or placental abruption (Hamadneh & Hamadneh, 2021; Tarasi et al., 2022). These placental complications elevate the risk of fetal distress, thereby often leading to the requirement of an emergency C-section to ensure the safety of both the mother and the infant (Wolfsberger et al., 2021).

Ketcheson et al. (2017) aimed to determine the incidence of surgical site infections (SSIs) up to 30 days following cesarean delivery, identify associated risk factors, and examine whether these risk factors differed for infections occurring before discharge compared to those occurring after discharge. The study revealed that women in Nova Scotia who smoked during the pregnancy and experienced alcohol abuse were at a higher risk for infection after discharge (Ketcheson et al., 2017). Furthermore, the study concluded that most risk factors for SSIs are known before delivery and that some are potentially modifiable (Ketcheson et al., 2017). It also suggested that targeted clinical and infection prevention and control interventions could further reduce the illness burden associated with these healthcare-related infections (Ketcheson et al., 2017).

For RQ2, the independent variables were the smoking status of tobacco and non-tobacco products during pregnancy and alcohol consumption during pregnancy, and the dependent variable was the development of a C-section SSI. Due to the unmet prerequisites for conducting a Chi-square test of independence, Fisher's exact test was employed to examine the correlation between smoking status and the development of a C-section SSI. The results of Fisher's exact test were significant, indicating a statistically significant association between smoking status and the development of a C-section SSI. The null hypothesis (H_02_a) was rejected. Approximately 5.9% of women who smoked developed a C-section SSI, compared to 1.4% of women who did not smoke.

The consumption of alcohol during pregnancy presents considerable risks to the fetus and is associated with adverse birth outcomes, possibly at a frequency higher than previously estimated (DeJong et al., 2019; Hirth et al., 2022). It is critical to acknowledge that no level of alcohol consumption has been determined to be safe during pregnancy or when attempting conception (CDC, 2022d; DeJong et al., 2019). Although a standard alcoholic drink may vary internationally, in the United States, it is generally defined as containing 0.6 fluid oz of pure ethanol (DeJong et al., 2019).

A study conducted by Onuzo et al. (2022) focused on surgical site infections (SSIs) following cesarean sections among women in Ghana. The study revealed significant risk factors identified for SSIs, which included alcohol consumption during pregnancy (Onuzo et al., 2022). For this study, a Chi-square test of independence was used to test the association between alcohol consumption and the development of a C-section SSI. The results of the Chi-square test of independence were significant,

indicating that there was a statistically significant association between alcohol consumption and the development of a C-section SSI. The null hypothesis (H_02_b) was rejected.

A binary logistic regression was used to determine if smoking status and alcohol consumption significantly predicted the development of a C-section SSI. In this regression, the independent (predictor) variables were smoking status and alcohol consumption, and the dependent (criterion) variable was the development of a C-section SSI. The overall binary logistic regression model was significant, indicating that smoking status and alcohol consumption significantly predicted the development of a C-section SSI. This could be due to several interconnected factors, such as increased inflammation and impaired wound healing. Alcohol can increase systemic inflammation, which might complicate the post-operative healing process and increase the risk of a C-section SSI (Caslin et al., 2021; Onuzo et al., 2022). Furthermore, alcohol consumption has been demonstrated to disrupt the wound healing process, notably by modifying the crucial inflammatory response required for effective wound repair (Guo & DiPietro, 2010). This alteration significantly elevates the susceptibility to SSIs. Similarly, the constituents of tobacco smoke detrimentally impact the body's capacity for tissue regeneration and angiogenesis, consequently prolonging the wound healing process (Chiang et al., 2022; Kokkinidis et al., 2020). Such delays in wound closure extend the duration during which the wound remains vulnerable to infectious agents.

RQ3

RQ3: What is the association between HIV and SCD (SCD) status and the development of an SSI among African American women who underwent a C-section?

H_03_a: There is no association between HIV status and the development of an SSI among African American women who underwent a C-section.

H_A3_a: There is a statistically significant association between HIV status and the development of an SSI among African American women who underwent a C-section.

H_03_b: There is no association between SCD status and the development of an SSI among African American women who underwent a C-section.

H_A3_b: There is a statistically significant association between SCD status and the development of an SSI among African American women who underwent a C-section.

HIV, a viral infection, compromises the immune system, thus rendering individuals more vulnerable to additional infections and diseases (Cambrea & Pinzaru, 2018; Lin et al., 2021). This virus remains a major concern for global public health, impacting millions of individuals worldwide. HIV has a disproportionately high impact on Black/African American women. While they represent less than 15% of the overall population, these women constitute approximately 60% of new HIV infections (Ojikutu & Mayer, 2021).

Studies have shown that women with HIV have an elevated likelihood of experiencing perioperative complications following a C-section delivery in comparison to those without HIV (Chilaka & Konje, 2021; Kourtis et al., 2014; Semprini et al., 1995). The incidence of morbidity is notably higher in C-section deliveries than in vaginal births

(Kourtis et al., 2014; Semprini et al., 1995). A significant portion of this increased risk is attributable to infection-related complications, including urinary tract infections, pneumonia, wound infections, and septicemia (Kourtis et al., 2014; Semprini et al., 1995).

For RQ3, the independent variables were HIV and SCD status, and the dependent variable was the development of a C-section SSI. The results of Fisher's exact test were not significant, indicating that there was no association between HIV status and the development of a C-section SSI. The null hypothesis (H_03_a) was not rejected. This could be due to several reasons, one of which is the advancement of anti-retroviral therapy (ART) and highly active anti-retroviral therapy (HAART). ART constitutes the pharmacological treatment of individuals infected with HIV, employing a regimen of anti-HIV medications. This standard therapeutic approach typically involves a synergistic combination of drugs, frequently referred to as HAART, which functions to significantly suppress HIV replication within the host. A study conducted by Mataramvura et al. (2023) revealed that the commencement of ART has improved health outcomes and immune responses for HIV-positive women. With effective ART, many individuals with HIV can maintain a strong immune system and have similar surgical outcomes to those without HIV (Yan, 2021).

SCD is recognized as the most prevalent genetic hematological disorder in the United States, affecting approximately 100,000 individuals (Brandow & Liem, 2022; CDC, 2022b). This condition is particularly prevalent among African American populations. Statistical evidence suggests that about 1 in 12 African Americans, and 1 in

100 Hispanic Americans carry the sickle cell trait, signifying their status as carriers of the disease (CDC, 2022b). It is estimated that 1 in every 365 births among Black or African American populations results in a newborn diagnosed with SCD (CDC, 2022b).

Fisch et al. (2021) examined pregnancy outcomes in women diagnosed with SCD in California. This study's findings indicate that African American women with SCD are more prone to C-section deliveries and face a heightened risk of post-partum complications directly related to SCD (Fisch et al., 2021). A myriad of factors influences the decision to opt for a C-section in such cases, most notably the escalated risk of pregnancy-related complications in women with SCD (Romano et al., 2020; Smith-Whitley, 2019).

Pregnancy presents additional complexities for individuals with SCD owing to the increased physiological demands and the potential for emergent complications (Jain et al., 2019; Romano et al., 2020). These complications, including sickle cell-related pain crises, acute chest syndrome, and pre-eclampsia, necessitate a heightened consideration for Cesarean delivery to ensure the safety and well-being of both mother and child (Fisch et al., 2021; Jain et al., 2019; Romano et al., 2020).

Fisher's exact test was used to determine if there was an association between SCD and developing a C-section SSI. Fisher's exact test results were significant, indicating a statistically significant association between SCD status and the development of a C-section SSI. The null hypothesis (H_03_b) was rejected.

A binary logistic regression was used to determine if HIV and SCD status significantly predicted the development of a C-section SSI. In this regression, the

independent (predictor) variables were HIV and SCD status, and the dependent (criterion) variable was the development of a C-section SSI. The overall binary logistic regression model was significant, indicating that HIV and SCD status significantly predicted the development of a C-section SSI. The coefficient for HIV status was not significant, indicating that women who were HIV positive were not more or less likely to develop a C-section SSI compared to women who were HIV negative. The coefficient for SCD status was significant and showed that women who were positive for SCD were 5.78 times more likely to develop a C-section SSI compared to women who were negative for SCD.

The results of this finding align with those found in the study conducted by Fisch et al. (2021) and Shegekar and Pajai (2023). The study conducted by Shegekar and Pajai (2023) revealed that mothers with SCD who deliver via C-section have a higher incidence of SSIs.

Interpretation of the Findings in the Context of the Theoretical Framework

The theoretical framework for this research study was based on the web of causation theory. Ipsen et al. (1960) introduced the web of causation theory, which explains the intricate network of factors contributing to the etiology of a disease. This theory encompasses various elements, encompassing individual, environmental, social, and behavioral determinants. Widely employed in public health and epidemiology, the web of causation theory serves as a valuable framework for comprehending the intricate interplay of diverse factors that underlie the emergence of health outcomes or diseases (Krieger, 1994). It underscores that diseases or health conditions result from intricate

interactions between various factors. It emphasizes that diseases do not manifest randomly within specific populations but instead necessitate an exploration of the associated risk factors contributing to their development, warranting extensive research efforts for their identification (Krieger, 1994). This theory marks a pivotal paradigm shift in our understanding of disease causation, as it embraces the concept of multiple causative factors or risk elements for diseases (Ventriglio et al., 2016).

The relationship between the framework and the essence of this study is reflected in the fact that the web of causation theory highlights the numerous paths through which one can contract a disease, encompassing both infectious and non-infectious diseases. According to Krieger (1994), these risk factors or causes can vary from person to person. In the context of this research, the web of causation theory provides a robust analytical tool for elucidating the complex interplay of risk factors involved in the development of C-section SSIs among African American women. The results indicated that age at the time of delivery significantly predicted the development of a C-section SSI, smoking both tobacco and non-tobacco products and alcohol consumption during pregnancy were statistically significantly associated with the development of a C-section SSI, and having SCD significantly predicted the development of a C-section SSI. By identifying these individual risk factors, it becomes feasible to mitigate the risk of SSIs in this demographic, thereby enhancing maternal health outcomes among African American women.

Limitations of the Study

There were a few limitations that were identified in this study. First, the scope of the study was confined to Black/African American women who had a C-section between January 1, 2022, and December 31, 2022. The extrapolation of findings to other racial or ethnic groups was not warranted due to this demographic specificity. The research of this study was limited by its selection of dependent and independent variables, which were tailored to address the specific research questions chosen. Additionally, the CHHS Open Data Portal and the CDPH offered a broader array of data and variables that were not directly relevant to the formulated research questions that needed to be incorporated into the analysis. The study's targeted approach precluded the examination of other individual risk factors, including but not limited to marital status, employment status, educational attainment, and income level, which may have yielded different outcomes.

Another limitation of this study is the assumption regarding the accurate categorization of cases as either C-section SSIs or non-infections, in alignment with the established surveillance definitions of the NHSN. In California, there is a legal requirement for acute care hospitals to diligently document and report instances of deep incisional and organ/space SSIs across both adult and pediatric populations (individuals below 18 years of age). This reporting protocol, adhering to the CDPH's HAI program guidelines, seamlessly integrates with the NHSN framework, a directive of the CDC, as mandated by HSC section 1288.55. Despite standardized criteria for infection classification, the potential for interpretive variability in meeting these criteria cannot be overlooked. It is important to note that this study did not undertake data validation;

hence, it was predicated on the assumption that the reported cases were accurately classified in terms of the presence or absence of infection.

The generalizability of the findings of this study is geographically limited to the state of California. According to the U.S. Census Bureau, in 2022, Blacks/African Americans made up only 6.5% of the race in California, while Whites made up 70% (United States Census Bureau, n.d.). The analytical approach employed in this research offered a quantitative examination of specific risk factors associated with the incidence of C-section SSIs among African American women within California. It is essential to acknowledge that applying these findings in different states or countries may lead to divergent results. Furthermore, to this study's quantitative, cross-sectional methodology, the results should not be interpreted as indicative of causation.

Recommendations for Future Research

The findings from this research study allow for a pathway to continue to explore individual risk factors associated with C-section SSIs among African American women. The findings that age at the time of delivery significantly predicted the development of a C-section SSI, smoking tobacco and non-tobacco products and alcohol consumption during pregnancy were statistically significantly associated with the development of a C-section SSI, and SCD status significantly predicted the development of a C-section SSI provides valuable information that may guide practitioners, hospital leaders, and public health key stakeholders in evaluating the role of C-section SSIs. Future possible factors that should be considered include the impact of socioeconomic variables such as income level, education, access to healthcare, and insurance status. Research can be conducted

regarding the role and impact of patient education and engagement in preventing and managing C-section SSIs, with a focus on culturally competent approaches that resonate with African American communities.

While there was no association between HIV status and the development of a C-section SSI among Black/African American women, more current and updated research can be conducted since much of the literature surrounding HIV and C-sections among this population is outdated. The intersection of HIV and C-section SSIs in Black/African American women is a complex and critical area of study, warranting focused research due to the unique challenges and risks involved. Research indicates that a myriad of complex structural and social factors, as opposed to personal behaviors, predominantly contribute to the elevated risk of HIV infection among African American women. Despite this, a notable gap exists in understanding how this population perceives their risk factors (Rimmler et al., 2022). It would be worthwhile to investigate further how pregnancy-related immune changes in HIV-positive women affect SSI risk. Examining disparities in healthcare access and quality for HIV-positive Black/African American women, particularly regarding prenatal care, C-section procedures, and postoperative care, and how these disparities impact SSI rates and outcomes are much needed. Additionally, encouraging a multidisciplinary research approach involving obstetricians, infectious disease specialists, and public health researchers to address the multifaceted challenges faced by HIV-positive Black/African American women at risk of C-section SSIs could prove highly beneficial. The previously described limitations allow for a broader analysis, such as examining other individual risk factors, including but not

limited to marital status, employment status, educational attainment, income level, and different geographical locations.

Implications for Professional Practice and Social Change

The study of C-section SSIs among African American women is about more than just addressing a single health issue. It is part of a broader imperative to ensure healthcare equity, quality, and inclusivity. It holds the potential to significantly improve maternal health outcomes and inform healthcare policies and practices that are sensitive to the needs of diverse populations. The implications for professional practice arising from the study of C-section SSIs among African American women are extensive and multifaceted. These implications span various healthcare delivery aspects and can enhance clinical outcomes and patient experiences. Key impact areas include community outreach, patient education, and advocacy. Healthcare professionals should engage with African American communities to raise awareness about the risks of C-section SSIs and to promote preventive health behaviors. This can be achieved through community health programs, partnerships with local organizations, and the development of outreach materials that are accessible and culturally relevant. Public health and healthcare professionals should play an active role in educating patients about the risks associated with C-sections, including SSIs. This involves providing information in a culturally sensitive manner, ensuring that patients understand their options, and advocating for patient rights and informed consent.

The insights gained from this area of study should inform the development of healthcare policies that promote equitable care. This includes policies that address systemic barriers to healthcare access for African American women, improve the quality

of care in facilities serving predominantly African American populations, and mandate the reporting and analysis of racial disparities in health outcomes. The findings from research on C-section SSIs in African American women can inform evidence-based practices. Healthcare professionals should stay informed about the latest research developments and integrate these insights into their clinical decision-making and practice guidelines.

Continuing to conduct research and raise awareness on individual risk factors that increase the likelihood of developing C-section SSIs among African American women plays a pivotal role in driving positive social change. This research contributes to social change in several significant ways, including promoting health equity and improved health outcomes. By identifying and addressing the specific risk factors that disproportionately affect African American women, this research can help reduce health disparities. Bringing these issues to light is crucial to ensuring equitable healthcare access and outcomes for all demographic groups, particularly those historically marginalized. Understanding these risk factors enables healthcare providers to develop targeted prevention and treatment strategies. This can lead to better healthcare outcomes for African American women, including reduced infection rates, shorter hospital stays, and better overall maternal health. Positive social change can be achieved by informing local, state, and national policymakers. Effective policies could include increased funding for maternal health research, better hospital infection control practices, and policies to reduce racial disparities in healthcare.

Conclusion

HAIs represent a paramount concern in patient safety, impacting approximately 1 in every 31 hospital patients concurrently (AHRQ, n.d.). Annually, the U.S. healthcare system grapples with over one million HAIs, culminating in the demise of tens of thousands of individuals and contributing billions of dollars in additional healthcare expenditures (Gidey et al., 2023). SSIs emerge as the most frequently recorded and prevalent form of HAI in low- and middle-income nations while ranking as the second most prevalent in European and American healthcare settings (Seidelman et al., 2023; Villers, 2020). The manifestation of SSIs imposes a considerable toll, characterized by exacerbated disability, extended hospitalization durations, and a notable contribution to the escalation of antimicrobial resistance, a consequence of increased antimicrobial utilization (Dhole et al., 2023). SSIs invariably prolong the postoperative recuperation and necessitate augmented healthcare resources (Dhole et al., 2023). This escalation in morbidity and mortality exerts a profound impact on the quality of life of affected patients. Despite substantial strides in the prevention of SSIs and other HAIs over the preceding decade, the field continues to face significant challenges, underscoring the need for ongoing research and intervention.

Cesarean sections, often referred to as C-sections, are the most common surgical procedures for women in the United States, according to Sung & Mahdy (2022). Each year, about one in three of the four million births in the country are carried out through C-section. This method of delivery comes with its own set of surgical risks, increased chances of maternal morbidity and mortality, and possible negative outcomes for

newborns. In the U.S., the rate of first-time mothers giving birth at full term to a single baby in a head-down position (known as nulliparous, term, singleton, vertex, or NTSV cesarean delivery) has risen from 18.4% in 1997 to 26.9% in 2013, as reported by Okwandu et al. (2022). Remarkably, the occurrence of NTSV cesarean deliveries is about 5% higher in non-Hispanic Black women and 1% higher in Hispanic women compared to their non-Hispanic White counterparts, as indicated by Okwandu et al. (2022). This difference in C-section rates among different racial and ethnic groups has been consistent over time, even among those women typically seen as having a lower risk of needing a cesarean delivery. For example, in 2015, non-Hispanic Black women in California had the highest rate of NTSV cesarean deliveries at 29.5%, compared to non-Hispanic White women (24.6%), Hispanic/Latina women (25.1%), and Asian women (25.6%), as noted by Okwandu et al. (2022). The persistence of these disparate rates in NTSV C-section delivery is a public health concern, raising questions about potential overutilization (Okwandu et al., 2022). C-sections are linked with an increased risk of surgical complications, elevated obstetrical costs, a heightened probability of subsequent cesarean deliveries, and dangers of abnormal placentation and hysterectomy (Cao et al., 2023; Okwandu et al., 2022). Various factors may contribute to these observed disparities, including differences in maternal characteristics such as age, prevalence of diabetes and hypertension, obesity, and the necessity for labor induction (Cao et al., 2023; Okwandu et al., 2022). It is imperative to also acknowledge the significant impact of race as a social construct, which bears considerable socioeconomic and health implications rather than a biological determinant. This study shows and validates that African American women are

more likely to experience severe pregnancy-related complications and infections. African American women deserve holistic, high-quality healthcare that is both culturally sensitive and respectful, addressing their complete physical, emotional, and social well-being, while also aiming to enhance maternal health outcomes and reduce infection rates.

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Appendix A: Disclaimer

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