

ABSTRACT

A Failing System: The Review of Maternal Health and the 7P Medical Model as They Relate to Black Women

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For Black women, encountering racial bias within maternal health is commonplace. In fact, the field of Obstetrics and Gynecology was birthed from a physician's experimentations on slaves. This is the legacy of maternal health in America; a legacy that has served as a blueprint for other nations, resulting in preventable deaths that effect Black women the most. This study fills a gap in the literature with an analysis of how Black women are overlooked in Systems Biology and the 7P medical model, which both direct medical care within the United States. This analysis revealed that the frameworks from which all medicine is based does not address the medical concerns of Black mothers. Rectifying this injustice can be achieved by modifying the frameworks of medicine and by viewing the deaths of Black mothers within America as a public health crisis.

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A FAILING SYSTEM: THE REVIEW OF MATERNAL HEALTH AND THE 7P
MEDICAL MODEL AS THEY RELATE TO BLACK WOMEN

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“[T]he American College of Obstetricians and Gynecologists released new guidelines saying *being black* is the greatest risk factor for [maternal] death.”

- The Associated Press of the NBC News

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Lastly, I would like to thank the community that I have come to love at Baylor University. Without the encouragement of faculty, staff, and friends, my undergraduate career would have not been the cinematic experience that I will carry with me post-graduation.

DEDICATION

To the Black women of America and those in existence around the world who risk their lives every day in order to bring forth others. May your legacy and truth live on and be respected within this document.



Kirabo (2016)

CHAPTER ONE

Black Women and Maternal Health

The history of American medicine is one of unparalleled intellect and discovery. From the colonial period to the present, American physicians have been responsible for creating and maturing medical specialties like cardiology, internal medicine, and general surgery, for example. Among these developments include the introduction of a specialty that remains unlike any other within the medical world: obstetrics and gynecology. This medical discipline skillfully blends concepts of family medicine with surgery by delivering babies and treating ailments within women's reproductive organs.

Prior to the 19th Century, there was a lack of both resources and research concerning women's medical care. During this time, it was considered distasteful to treat female patients. Many of women's medical ailments were diagnosed as mental illnesses and overlooked the true origin of these patients' discomfort. Moreover, the care that women received was based on symptoms and treatments that were used to identify and assess illnesses within men. This phenomenon persists today as many ailments concerning chronic pain in women are dismissed within the medical setting and modern treatment plans remain primarily based on how a disease presents in a male patient. Yet, this is not the case in the field of obstetrics and gynecology as every technique, procedure, and protocol is based on findings within women in order to accurately diagnose these patients. Although the creation of obstetrics and gynecology marked a success in the provision of adequate medical treatment for women in America, it did not

exclude the one aspect of medicine that has pervaded each discipline – racial bias.

Medical racism is defined as any discrimination based on a patient's ethnicity, color, origin, and/or race that inhibits the patient from receiving quality care within a health care setting. The presence of racial bias in obstetrics and gynecology is shown to result in preventable deaths among Black women in America and throughout the world. Further investigation into the field reveals that its conception was, in fact, the result of overt racism and cruelty against Black women.

Recognized as the “Father of Gynecology,” James Marion Sims is responsible for creating and revolutionizing surgical tools and procedures that are still used today in the field of gynecology (Holland, 2017) . During the 19th Century, American women were developing vesicovaginal fistulas following childbirth at an alarming rate (Holland, 2017). This type of childbirth complication is characterized by an abnormal fistula tract between the bladder and vaginal wall (Cleveland Clinic, 2017). In an attempt to end the suffering of American women and ease recovery following childbirth, Sims began conducting unregulated research on female slaves. Sims justified the use of these involuntary patients by claiming that “black bodies were incapable of feeling pain,” making them the perfect medical subjects (Holland, 2017).

Sims continued his work by forcibly restraining female slaves and placing them into uncomfortable positions to facilitate the mutilation of their reproductive organs without the administration of anesthesia. Sims had no official training in gynecological work at the time but continued his experiments, allowing his curiosity to permit him complete jurisdiction to the bodies of enslaved Black women (Holland, 2017). As the only physician willing to perform such treatment on slave women, Sims was granted

ownership of these slaves until he believed that their treatment was complete (Holland, 2017). Sims took pride in his ability to experiment with and manipulate the bodies of Black women in his autobiography *The Story of My Life* where he states that “There was never a time that I could not, at any day, have had a subject for operation” (Holland, 2017). Sims went on to label his actions during this period as the most memorable time of his life.

Examining Lucy (Female Slave)

During one of his procedures on an 18-year-old slave named Lucy, Sims recorded Lucy’s pain as extreme, citing that she screamed endlessly during procedures while naked on the floor. He recalled that Lucy contracted blood poisoning as a result of unethical use of a sponge to collect urine from her bladder. Sims left Lucy to die; however, she made a full recovery three months after the interaction. Sims’ first successful fistula repair occurred after 30-consecutive operations that he performed on a 17-year-old slave named Anarcha. After four years of practicing his techniques and curiosities on enslaved women, Sims began practicing on white women with whom he used anesthesia (Holland, 2017).

In relation to his advancements in the realm of obstetrics, Sims experienced zero success in operations on enslaved infants while trying to perfect a surgical procedure to treat neonatal tetanus. This form of medical abuse involved using a shoemaker’s tool to pry apart the infants’ bones and skulls for further examination (Holland, 2017). Sims went on to open the first woman’s hospital in America where he continued his unethical

treatment of Black patients, blaming any deaths on the “ignorance of Black mothers and Black midwives” (Holland, 2017).

Health Concerns in the 20th Century

Fast forward to the 20th Century and the unsettling origin of obstetrics and gynecology has impacted the lives of millions of Black women within America and around the world as they enter into medical institutions as patients with the hope of returning home as mothers. According to the Center for Disease Control and Prevention (CDC), Black women are three more likely to die from pregnancy and childbirth complications than white women with more than half of the resulting deaths being defined as preventable (Tabernese, 2016). Dr. Lisa Hollier, Chief Medical Officer of the Center for Children and Women at Texas Children’s Hospital in Houston, Texas, affirms that this statistic is a result of the racial bias Black mothers experience while seeking maternal care as well as physicians’ inability recognize risk factors like high blood pressure that disproportionately affect this patient demographic (American Heart Association, 2019).

Stacey Ann Walker’s Testimony

One example of this type of physician oversight is the case of Stacey Ann Walker, a 29 year old African American female from Hartford, Connecticut who reported shortness of breath, exhaustion, and edema of the lower extremities during pregnancy. Mrs. Walker’s worries were dismissed by her physician but resulted in an emergency Caesarean delivery that left her and her newborn infant in critical condition (American

Heart Association, 2019). The former active and healthy mother developed postpartum heart valve complications and heart failure, leaving her life and motherhood forever changed. In an effort to investigate the claims of racial bias within obstetrics and gynecology, the CDC examined 3,000 pregnancy related deaths from 2011-2015 and concluded that 60% of these deaths were entirely preventable (The Associated Press, 2019).

Extrapolation of the CDC's findings revealed that pregnancy-related deaths among Black women is not unique to America. International data from 12 million pregnancies monitored by the World Health Organization (WHO) revealed that maternal deaths, specifically those resulting from Caesarean deliveries, occur in the highest frequency within low and middle income countries whose population is mainly composed of women from minority populations (World Health Organization, 2019). The women within these populations receive Caesareans at a rate of 100 times higher than women from higher income levels with up to one-third of their infants dying (World Health Organization, 2019).

Further evidence from the WHO revealed that these mothers experience mistreatment during children while in medical buildings and that women in Ghana and Nigeria are at the highest risk of experiencing physical and verbal abuse during childbirth (World Health Organization, 2019). Dr. Ana Langer, Director of the Women and Health Initiative at the Harvard T.H. Chan School of Public Health, asserts that it is not the type of care Black women receive during pregnancy and childbirth but the quality of the care and the time at which interventions take place that result in preventable maternal deaths among this patient demographic (American Heart Association, 2019). Dr. Langer reports

that "Basically, black women are undervalued. They are not monitored as carefully as white women are. When they do present with symptoms, they are often dismissed" (American Heart Association, 2019). Research conducted both within America and internationally, coupled with the unending testimonies of Black mothers, reveals this statement to be true.

Serena Williams-Ohanian's Testimony

Of these testimonies, perhaps the most publicly jolting was that of Serena Williams-Ohanian. In the case of Mrs. Williams-Ohanian, the famous athlete developed a pulmonary embolism a day after giving birth to her daughter. The athlete brought her concerns to the attention of her medical team but was ignored and denied tests to confirm her hypothesis. If Serena Williams-Ohanian, a world famous athlete with a past medical history of embolisms, had not demanded to be tested, then the blood clots that traveled to her lungs postpartum would have killed her. Her testimony showed the world that addressing the socioeconomic inequalities within health care would not solve this dilemma. For the first time in decades, the medical system was forced to address the racial bias that effects Black women, regardless of social status and economic power.

As these case studies indicate, there is a long history of mistreatment, misdiagnosis and, in some cases, sheer racism in the handling of Black women by medical professionals. To extend the scholarship on this topic, this study fills a gap in the literature with an analysis of how Black women are overlooked in Systems Biology and the 7P medical model, which both direct medical care within the United States.

First, it looks at the historical mistreatment of Black women and their children in medicine. Then, it analyzes the development of Systems Biology and the 7P medical model. The final chapter synthesizes the three areas and offers a solution for a model that also considers Black women. The purpose of this study is to analyze Systems Biology and the 7P medical model through the treatment of Black women within maternal health and to utilize the results of this analysis to address medical racism within this field through a blended solution of public health interventions and physician advocacy on behalf of these patients.

CHAPTER TWO

Black Mothers and Their Children

The United States' classification as the nation with the highest maternal mortality rate among the industrialized countries of the world is, in part, due to the nation's increased rate of pregnancy-related deaths among Black women. Even after accounting for differences in education and socioeconomic status, the fact that these women are Black proves to be the biggest predictor of the quality of care they receive during their pregnancy and childbirth. Based on research conducted at John Hopkins University in 1999, the mortality ratio for Black women is 25.1 per 100,000 deaths while that of non-Hispanic white women is 6.0 per 100,000 deaths (Flanders-Stepans 2000). Within the decades that followed, these rates worsened with the leading causes of maternal death among Black women being hemorrhage, pregnancy-induced hypertension, and embolism (Flanders-Stepans, 2000).

It is worth noting that African Americans have a tendency to bleed more during surgical procedures due to the increased vascularization in their bodies. Resultingly, excessive bleeding during childbirth is often overlooked and viewed as normal. Additionally, American physicians do not recognize Black mothers' increased risk for pregnancy-induced hypertension as this patient demographic experiences elevated stress levels when compared to other racial groups. This increased level of constant stress, known as "weathering," puts Black mothers at a greater risk of going into labor prematurely, placing their infants at a greater risk for death (Chatterjee, 2017). In

addition to the medical vulnerabilities that Black women experience, this patient demographic experiences an increased difficulty in locating safe housing post-delivery as well as healthy food options for both themselves and their infants (Rowley, 1994).

Moreover, the racial bias experienced in the medical setting affects Black infants. Dr. James, an OB/GYN at Wexner Medical Center at Ohio State University, reports that “Black babies in the United States die at just over two times the rate of white babies in the first year of their life,” (Chatterjee, 2017). CDC data supports Dr. James’ claim with statistics stating that there are 11.7 deaths for every 1,000 live births among Black infants compared to 4.8 deaths for every 1,000 live births among white infants (Chatterjee, 2017). Dr. Fuller from the Center for the Study of Race and Ethnicity in Medicine at the University of Kansas School of Medicine revealed that African American infants weigh, on average, 200-300 grams less than European infants at birth (Fuller, 2000). Dr. Fuller’s research showed this trend to be consistent over the past 95 years with recent research conducted by the CDC affirming that this trend remains in effect today. In a study performed by the Division of Epidemiology at the University of California, Berkeley School of Public Health, categorical measures for gestational weight gain based on Institute of Medicine recommendations were used to determine whether or not different racial groups experienced significant differences in infant birth weight. This ten year study used generalized estimating equations, adjusted for marital status, parity, smoking during pregnancy, gestational age, and multiple measures of socioeconomic position. With a 95% confidence interval, the study confirmed that Black mothers birthed infants with significantly lower weights than Hispanic and white mothers (Headen, 2015).

During the nation's battle with slavery, Black women experienced poor nutrition that was coupled with the high energetic costs of physical labor. A concept known as Fetal Programming introduced the idea that the physiology and metabolism of Black infants were passed through generations and that there has not been enough successive generations since the end of slavery to offset the phenomenon of low birth weight within the Black community (Jasienska, 2009). In a segment on Black infant mortality, Amna Nawaz, a PBS broadcast journalist, revealed that the racial disparity Black infants experience today is at a wider gap than in 1850 – fifteen years before the end of slavery. Moreover, Black infants are twice as likely to die during their first year of life than their white counterparts (PBS NewsHour, 2018). Reflecting on the information provided within this document alone, it is apparent that there exists a need for a change within the medical system's interactions with Black women. In order to devise proper modifications to this system, an understanding of its origin as well as the magnitude of its use today via development of the Systems Biology theorem of science and medical care must be formed.

CHAPTER THREE

The Development of Systems Biology

A firm understanding of Systems Biology, its origin, and its intended use is crucial in exploring the medical framework from which the biases that Black women face within maternal health can be addressed. From the time of Ancient Greeks to the Scientific Revolution of the 16th Century, systems biology has informed much of the material that is presently used in understanding both medicine and disease. With the help of Classical Period thinker Galen, life was viewed as a compilation of actions towards an end that manifest themselves into physical organizations. This idea led him to discover the circulation of blood within humans. Using the insight of Jean Fernel, medical personnel were able to view the human body and the illnesses that plagued it through the four humors. These humors (yellow bile, black bile, blood, and phlegm) were believed to correspond to the four primary functions of the body. Moreover, these humors had corresponding temperaments (choleric, melancholic, sanguine, and phlegmatic) that were used to determine patients' ailments.

Progressing from the Classical Period into the Modern Period, thinkers like Descartes and Bernard began contributing to the world's understanding of systems biology and its importance to humans. Asserting that blood was ejected from the heart during diastole, René Descartes introduced the concept of the human body being understood as a compilation of parts and functions into the systems biology framework. William Harvey expanded Descartes ideology with his discovery of a cardiac rhythm that

aligns with the anatomical structure of the human heart. Moreover, Julien La Mettrie expressed that the human body is synonymous with a clock in that it is a machine whose various components elicit distinct functions. This understanding of the body's composition and functioning led Claude Bernard to invent the term *milieu interieur* which is commonly referred to as homeostasis. Bernard believed that an organism's main purpose is to maintain its internal environment in order to uphold the organism's functions.

Each of the previously mentioned philosophers and scientists helped form a strong foundation of systems biology that thinkers like Charles Darwin could build upon with his explanations regarding the diversity of life via concepts like heritable variations, natural selection, and survival of the fittest. Following the advancements of Darwin, botanist Gregor Mendel identified the transmission of unique traits to succeeding generations via genetic laws such as the law of segregation and the law of independent assortment. Due to the discoveries of these thinkers and their predecessors, numerous advancements have been accomplished within the fields of biology and medicine. For example, the work of Mendel has led to genetic sequencing and has even influenced future generations by allowing the field of genetics to be used in family planning sessions and prenatal screenings.

Advancing into the Contemporary Period of systems biology, the focus of the time shifted from innovative thinkers and their trajectory-changing discoveries to the biomolecular lineage and the biosystems lineage. These lineages tend to focus on the two separate lines of biological investigation. Biomolecular lineage emphasizes the methodological or molecular components of systems biology. Contrastingly, the

biosystems lineage emphasizes the theoretical or conceptual nature of systems biology. Moreover, the biosystems lineage focuses on the general systems theory, cybernetics, and organismic biology as they pertain to the 20th Century.

Upon further investigation of the biomolecular lineage, it is revealed that this lineage is based on the convergence of two fields of biology: biochemistry and genetics. Interestingly, the term *biochemistry* was introduced in 1903 by Carl Nueberg, a biochemist who focused on the intermediate metabolism of enzymes. Under the biomolecular lineage, biochemists like Fred Sanger was able to sequence Insulin, a commonly prescribed medication to treat diabetes, by determining the drug's amino acid sequence. In relation to the genetics used in the biomolecular lineage, Wilhelm Johannsen was responsible for popularizing the terms *gene*, *genotype*, and *phenotype*. Using these terms, Thomas Hunt Morgan was able to identify the genes responsible for the inheritance of eye color. This discovery led him to name the Boveri-Sutton chromosome theory of inheritance.

The biomolecular lineage of systems biology are also used to analyze DNA. This molecule of life was first introduced into systems biology as *nuclein* by Friedrich Miescher who originally proposed that the material was used in heredity but lacked the evidence to support his idea. Later, three men known as Avery, MacLeod, and McCarty identified a transforming principle within DNA that resulted in a transfer of phenotypical traits upon insertion into another recipient. Once the true nature of the DNA molecule was understood, the genetic code was determined, resulting in the 64 codons that make up all material. Although the biomolecular lineage provides a methodological explanation

for systems biology and the sciences that compile it, the biosystems lineage must be used to understand the conceptual and theoretical nature of systems biology.

The three foundations of the conceptual component of the biosystems lineage are Reductionism versus Holism, Resultant versus Emergent, and Homeostasis versus Robustness. In relation to the first foundation, reductionism states that any whole entity is a sum of its parts whereas holism states that a whole is actually greater than the sum of its parts via creative evolution. Within the second foundation, the resultant is believed to be a product of an additive interaction such as a determinate. Contrastingly, the emergent is believed to be the product of a non-additive interaction such as a non-determinate. The third foundation, homeostasis versus robustness, states that, according to homeostasis, an entity remains relatively constant despite the varying conditions it experiences. In relation to robustness, it is stated that a system can withstand uneasiness that might affect its functioning. Two additional terms used in this foundation are evolvability and fragility which correspond to the following definitions respectively: the capacity for adaptive change and the quality of exhibiting vulnerability towards change.

The second component of the biosystems lineage involves five foundations that range from systems theory to self-organization, each of which contribute to the overall understanding of systems biology. The systems theory states that each system dies once it reaches equilibrium and that every system is ruled by a set of principles and laws. Cybernetics, another foundation of biosystems lineage, focuses on the management of information and its integration in regulating behavior. The epigenetic landscape, inspired by Conrad Waddington, explains how a dynamic system depends on each of the system's components working together. This dynamic interworking accounts for the

organism's genotype and epigenotype resulting in its phenotype. In relation to the antimechanistic foundation of the theoretical foundation, Walter Elsasser and Ervin Laszlo were critical in developing its framework. Elsasser helped develop the biotonic laws that state that antimechanism is not reducible but rather compatible with physicochemical laws. Moreover, Laszlo affirmed that contemporary science seeks to analyze the different and interacting components of a whole under a variety of influences. This eventually led to the chaos theory which stated that events are not predictable since minor changes in starting conditions result in major system changes. From this, the complexity theory explains that natural phenomena are not isolated events rather they are self-organizing and are distributed throughout a network of systems.

Now that the road to systems biology has been traveled, an attempt at understanding SysBiology and its components can be made. According to New York University, SysBiology exists to create a comprehensive understanding of each organism's genetic material and functioning. This is accomplished via experimental and computational approaches. With this information, it is fair to refer to SysBiology as a new biological discipline since it encompasses the organizational structures, funding, professional societies, and literature required to be considered a discipline. Moreover, institutions like Harvard Medical School and Maastricht University have entire departments and centers dedicated to systems biology. These institutions also offer graduate degrees in systems biology in an attempt to increase the presence of SysBiology in the biological sciences.

In relation to funding this discipline, there are two major public funding agencies within the United States for SysBiology: the NIH's National Center for Systems Biology

and NSF's Understanding the Rules of Life. However, there exists a plethora of other entities that fund this discipline such as the Wellcome Trust and pharmaceutical companies like Anaxomics and Roche. In addition to funding, professional societies such as the International Society of Systems Biology, the Society for Systems Biology and Translational Research, and the IEEE Control Systems Society Technical Committee on Systems Biology also exist to form a community of like-minded thinkers who seek to advance the discipline and integrate it into the larger network of biology.

There is also a growing number of literature concerning SysBiology in the form of journals, textbooks, and monographs. Of these works, three authors, Dennis Noble, Fritjof Capra, Eberhard Voit, have received popularity for their work within the discipline. Noble received popularity for his work developing a musical metaphor that explains the interactions of genes, cells, and environments within systems biology. Similarly, Copra received fame for presenting a new concept regarding the origin of life that encourages life to be viewed from an ecological and holistic worldview. Lastly, Volt's popularity resulted from his work discussing diverse topics within systems biology such as cell signaling and the BRAIN initiative.

Nonetheless, the central dogma of systems biology is to identify principles that direct the flow of information within a biological system. This dogma is composed of three principles that describe systems biology as follows: a network of a repeating pattern that is essential to the performance of a larger system of biological processes, an evolutionary role that optimizes circuit design, and robustness. From this dogma, the two principles of systems biology organization are purposed for governing a system's fixed behavior and coordinating the principles that manage its flexible behavior. Using the

central dogma of systems biology and the aforementioned principles of organization that govern it, Olaf Wolkenhauer developed four categories in which to place each principle: organizing principles, design principles, optimality principles, and isomorphic principles.

Since SysBiology is an emerging discipline that has no singular field of investigation, it requires the implementation of a unique approach. Resultingly, the SysBiology approach encompasses a number of data modeling from bio-omics studies that cover all realms of biology. This approach allows the discipline to apply methodological resources at the systems level. The SysBiology approach relies on four components to accomplish its objectives. The first component focuses on the interactions between the elements within a system's overall structure in determining the different pathways that the system uses in its functioning. The second component focuses on the behavior of a system under a variety of conditions in order to determine the mechanisms used to elicit the system's behavioral responses. The third component focuses on regulating the perturbations a system experiences and the fourth component focuses on identifying the system's properties. Each of the aforementioned components facilitates the overall objective of SysBiology by enhancing the flow of information within a system.

With the emergence of SysBiology and its corresponding approach, many have postulated whether the rise of SysBiology constitutes a scientific revolution. Considering that SysBiology resulted in the formation of a new discipline, approach, and realm of study, the field has, indeed, catalyzed a scientific revolution. Prior to the emergence of SysBiology, the biological sciences were limited to methodology and experimentation, lacking the depth and diversity of SysBiology and its applications to life as a whole.

Additionally, the arrival of SysBiology has all but forced its predecessors into extinction as its widespread application has revolutionized the sciences as well as the scientific community's understanding of systems and their behaviors. SysBiology also allows for further innovation that encourages improvements within the field as well as the production of new biologies. Most importantly, the emergence of SysBiology provides an avenue for the integration of the biological and biomedical sciences and their corresponding research into the scientific world (Marcum, 2019). Accompanying this unity is an endless array of possibilities and discoveries that exist with systems biology and serve as benefits to both the scientific community and all mankind- that is with Black women receiving the remains.

CHAPTER FOUR

The 7P Medical Model

It is worth recognizing that the development of Systems Biology powered the creation of Systems Medicine, the academic foundation on which current medicine continues to build. The resulting 7P medical model is used in America and throughout the world to provide medical care that is both scientifically sound and committed to treating people rather than their symptoms. Nonetheless, this model was created without considering the personhoods of Black bodies resulting in a medical framework that overlooks the symptoms and worries of these patients. SysMedicine is understood as the actual practice of medicine in relation to addressing the needs of a patient. In order to fully comprehend this approach to the provision of medical care, an understanding of the origin of SysMedicine must be formed. Once the background knowledge of SysMedicine is provided, then the importance of the model's oversight in relation to Black mothers can be explained.

Although the practice of medicine is presently believed to belong to the scientific community, this was not always the case. Hippocrates, commonly referred to as "the Father of Medicine," expressed that the medical practice was a form of art based in a physician's skill to treat patients. From this thought, medicine became a rational practice with a foundation in theory and pathology. Prior to the development of SysMedicine, there existed a multitude of predecessors, one of which was Newtonian Medicine. Developed by Archibald Pitcairne, this form of medicine affirmed that disease and the medicine used to eliminate it had a mechanical and mathematical relationship. Pitcairne

expressed that the human body should be viewed as a compilation of mechanisms that obey set laws. This allowed medical treatment to be dictated by rationalism and transformed patient care into a system of computations.

However, medicine is not based on absolute rationalism. Rather, the medical practice involves a degree of empiricism in treating patients. In order to properly address a patient's ailment, empiricism is used to call upon a physician's clinical experience and judgement when diagnosing a patient and creating a treatment plan. Nonetheless, solely relying on empiricism became problematic during the 17th Century as physician's prescribed the same handful of remedies for a myriad of diseases which, in many cases, did not result in improved patient health. The debate over whether medicine should rely on rationalism or empiricism paved the way for a form of medical practice that would balance the two by introducing a scientific therapy that was based in pathology: systems medicine.

The development of SysMedicine was encouraged through the advancements of scientific thinkers like Robert Hooke and Antoni van Leeuwenhoek. Hooke was responsible for identifying the structure of a cell and van Leeuwenhoek was responsible for introducing the concept of microbial life to the scientific community. Though the ideas of these men were unheard of and met with reluctance among their peers, their discoveries and postulations provided a context to better understand the human body and its components. This, in turn, fostered a method of thinking that made the treatment of patients extend deeper than what appeared to be ailing them externally.

From this concept, the solidest theory of pathology was born. Xavier Bichat was a firm believer of this theory which stated that the solids within the body produce fluid

bodies of humors that allow the physical body to be defined in terms of its solid materials. This understanding of the body and its properties led Bichat to process patient samples and visually evaluate them based on categories like color and consistency. This methodology led him to identify twenty-one tissue types within the human body.

Following this theory came one that would change the trajectory of medicine forever: the cell theory. Developed by Matthias Schleiden and Theodore Schwann, the cell theory stated that all living organisms are composed of cells which, therefore, make up the basic unit of all life. From this theory, Robert Virchow was able to determine that all disease and the processes by which they are acquired have cellular origins. This discovery allowed disease to be thought of as of a dysfunction of normal cells within an organism, thereby rejecting the notion that disease was an imbalance of bodily humors.

Once scientists and physicians strengthened their understanding of the cell and its relationship to disease, the issue of disease contraction became a topic of interest. As a result, two theories were formed to attest to the origin of disease. The miasma theory stated that disease was caused by an exposure to dirty or noxious air. Similarly, the contagion theory stated that disease was spread by contact with an agent that was already carrying the disease. These theories led Robert Koch to determine that bacteria was responsible for the spread of infectious diseases.

In relation to patient care, the invention of the stethoscope by René Laennec revolutionized the medical field and the ways in which physicians treated patients. Although first implemented among deceased patients, this device allowed physicians to listen to the innerworkings of patients and assess their pathological state during autopsies. Following this discovery, Pierre Louis began investigating the efficacy of phlebotomy in

patient care plans by comparing patient groups with varying treatment regimens.

Although this seems like an unimpressive feat, Louis' investigation was representative of an epistemological shift that combined both rationalism and empiricism into medical care, paving the way for SysMedicine.

As the medical field expanded and new discoveries continued to result in shifts within patient care, medical societies emerged to help ensure that new information and techniques were disseminated among physicians as expeditiously as possible. This led to the emergence of what is arguably the most popular medical society in North America, the American Medical Association. Founded in 1847, this society has matured into a network that fosters education throughout the entire course of medical training from an aspiring physician's training during the undergraduate career to an actual physician's certification training during medical residency. Moreover, this organization connects physicians with other practitioners and entities that work alongside one another to ensure the production of optimal patient care.

The rise of medical societies was accompanied by an emphasis on medical training that went beyond apprenticeship. Medical schools were founded that required students to complete coursework within the sciences for a minimum of two years before matriculating into further specialized studies. An emphasis was also placed on clinical research and its importance to patient diagnoses and treatments. This emphasis was met with criticism from within the scientific community as William Osler believed that such research should only be conducted at institutions that have personnel who are solely dedicated to it. Osler affirmed that hospitals and their physicians should only concern themselves with the clinical care of patients. Despite the criticisms it faced, the medical

field continued to rely on clinical research to inform patient care which led to the field of biomedicine.

The medical community adopted the term *biomedicine* from the military and redefined it to represent an approach towards understanding both disease and health. As a result of this emergent field, medicine experienced an explosion of specializations as physicians were needed to treat each of the parts that the human body was categorized into within the biomedical archetype. Although the field of biomedicine allowed for a pinpointed treatment of a body system, it brought with it a plethora of problems that continue to plague the medical field. Firstly, the field encouraged reductionism as it tends to exclude the biological factors of disease and focuses on disease as a deviation from a measurable norm. Secondly, the rise of biomedicine has led to overdiagnosis as biomedical technology can identify an abnormality that is not able to be treated due to a patient being asymptomatic. Lastly, biomedicine leads to overmedication as patients are prescribed medications to treat specific ailments affecting specific tissues within the body. In an attempt to remedy these problems, alternative methods of patient care have risen in the form of the biopsychosocial model, the biopsychosocial-spiritual model, and the patient-centered clinical method model.

Following these models, the evidence-based medical approach was introduced. This approach emphasized the systematization of biomedical evidence as it pertains to clinical practice. Moreover, it relies on the following factors: the provision of optimal clinical practice, clinical expertise, and the integration of patient values and preferences into the clinical setting. Nonetheless, this approach has been criticized for relying too heavily on empiricism and for violating both the physician's and patient's independence

in decision making in the event that their decisions are contrary to “best evidence.”

Perhaps most problematic, evidence-based medicine silences the voices and values of patients who are seeking care.

Subsequent to each of the aforementioned discoveries, techniques, and models is systems medicine. This form of medical practice combines the biomedical approach of specialized care with an emphasis on integrating the needs of the patient into treatment. The overarching goal of SysMedicine is to encourage a healthcare system that truly benefits the patient. In order to accomplish this, SysMedicine allows for a personalization of medicine that encourages precision in creating care plans that are unique to each patient’s genes, lifestyle, and environment.

In order to form a working definition of SysMedicine, it is important to understand that it is the integration of biology, theory, medicine, and science into one field. Likewise, the framework for research within this field requires determining a precise problem, forming a testable hypothesis to address the problem, and applying a clinical solution to the verified hypothesis. The network theory seeks to make this form of research-based treatment easier by identifying relationships among the many elements within a system via a network of nodes and edges. Within medicine, prominent networks include the protein-protein interaction networks, metabolic networks, regulatory networks, and RNA networks. Each of which compile together to form the human interactome. From this distinction, the diseasome was introduced as a grouping of genes and proteins involved in disease that are connected together to form a network. The underlying intricacies of the human interactome and diseasome required systems

medicine to develop a model that is equally as intricate in locating disease and individualizing patient care. This model became known as the 7P model of medicine.

Of this model, the first P stands for physico-biomolecular biomes/omics. This entails the individualization of organ systems as well as their integration into the human body's maintenance of homeostasis. The main objectives of this P focus on the genome/omics, epigenome/omics, transcriptome/omics, proteome/omics, metabolome/omics, and microbiome/omics. This leads into the second P, psycho-cognitive biomes/omics which focuses on understanding the nervous system and its interactions with the behavioral and motor responses of patients. This component of SysMedicine allows for the mapping of brain neurocircuitry as well as neuroimaging that can be used to understand patient experience and identify psychiatric disorders. The psycho-cognitive component also focuses on the needs, values, and habits of patients as well as their beliefs and cognition. This allows physicians to provide a level of care that is unique and optimal to each patient.

The third and fourth P correspond to the personal biomes/omics and the populational biomes/omics of SysMedicine, respectively. The personal biomes/omics refers to pathology models that are used to interpret patients' clinical data and assess patients' risk state. This element allows for physicians to determine patients' susceptibility to disease, their phenotypes, and their responses to treatment. Similarly, the populational biomes/omics component of SysMedicine allows physicians to identify patients' risks based on the clinical, socioeconomic, computational, metabolic, and systems-level factors that accompany them into treatment. The population component also relies on the other Ps to create a population perspective of health by which

practitioners can use to educate patients on the importance of health and their participation in it. The remainder of the Ps (predicting, participation, and prevention) focus on integrating the patient into treatment. The predicting component allows the patient to be made aware of personal health risks, thereby encouraging the patient to take an active role within his or her health. Likewise, the participatory component relies on patients to attend programs and adhere to protocols that are designed to produce optimal health and wellness. Lastly, the preventative component allows patients to prevent illness by fostering healthy habits within their lifestyles.

Though the road to SysMedicine was a long one that was filled with discoveries and criticisms, it led to the development of a discipline that has become essential to medicine. Moreover, SysMedicine has revolutionized the role of the patient in medical care and has encouraged physicians to partner with their patients in identifying the best treatment plan available to them. It is with this understanding of SysMedicine and its importance that the medical field and those that practice within it can operate in ways that facilitate optimal health outcomes among patients (Marcum, 2019). Nonetheless, the history surrounding both SysBiology and the 7P Medical Model of SysMedicine was developed by a multitude of white men without giving the slightest consideration into the medical outcomes of Black women.

CHAPTER FIVE

Catalyzing Change

With an understanding of Systems Biology and the 7P medical model that directs medical care within the United States, it is clear how easily Black women can be overlooked within this framework. The history of Systems Biology was created and developed by men with a hunger for intellectual discovery that would benefit both themselves and a society that, at the time, sought to treat white Americans. From this system, the 7P medical model that is still used in American medical practice was born. As a result, a system was created without representing the interests of minority women, specifically Black women. This system continues to be used to treat patients in the 20th Century, including Black women. If it seems backwards that a patient demographic is being treated using tools and procedures that were not created with the patients in mind, then it is because it is and requires immediate modification.

The first step in modifying this system is to acknowledge that the current state of medicine has been politicized and sectorized into a luxury that leaves Black patients marginalized. Once this truth is acknowledged, the work can start to provide this demographic of patients with the quality of care that they deserve. This begins by understanding that the racial disparities that victimize Black women represent a public health crisis (Smedley, 2003). Physicians are beginning to realize that the differences in overall health and rates at which Black women experience chronic illnesses such as diabetes, hypertension, and obesity place them at an increased risk for complications

during pregnancy and postpartum (Howard, 2017). Medical practitioners also speculate that the racial divide among maternal deaths is due to Black women's decreased access to care, medical insurance, and housing. Likewise, these women experience markedly high levels of daily stress when compared to any other racial group, a result of simply being Black in America (Howard, 2017).

In New York City alone, Black women are more likely to give birth in hospitals with higher rates of severe maternal morbidity (Howell, 2016). Only 23% of Black women give birth in "safe" hospitals compared to 63% of white women (Howell, 2016). These hospitals are also known to be of lower quality and the products of historical segregation (Martin, 2017). In an effort to advocate for the lives of Black mothers and their infants during the pregnancy process, the WHO recommends that these patients modify their diets to include daily iron and folic acid supplements as well as increasing their amount of daily exercise (WHO, 2017). In addition to taking these precautions, Dr. Howard recommends that Black women start looking into their familial medical history prior to pregnancy to determine their risk factors and present them to their OB/GYN (Howard, 2017). Although Black women are encouraged to take a more active role in their birthing preparation, physicians are the ones who administer care and are, ultimately, responsible for understanding the medical backgrounds of their patients.

Black women are currently 22% more likely to die from heart disease, 71% more likely to die from cervical cancer, and 243% more likely to die from pregnancy-related complications than white women (Martin, 2017). It was affirmed that educational status was not an indicator of risk as the city of New York shared data revealing that Black women with college degrees still fared worse than white women who had not graduated

high school (NYC Health, 2016). Upon analyzing the data, Dr. Raegan McDonald-Mosley stated that “It tells you that you can't educate your way out of this problem. You can't health care-access your way out of this problem. There's something inherently wrong with the system that's not valuing the lives of black women equally to white women” (Martin, 2017). Dr. Martin believes that the issue surrounding the death of Black women during and after childbirth is a public health crisis that can only be eradicated by increasing Black women’s access to medical insurance, healthy food, safe drinking water, better schools, adequate employment, and reliable transportation. Each of these factors are determinants in the timeline with which Black women seek prenatal care (Martin, 2017). When coupled with the decreased value and level of respect that Black women testify to experiencing at some point along their pregnancy journey, it becomes clear how these women have taken over the number of maternal deaths within America.

In order to change the current narrative surrounding Black women and maternal death, health care providers must commit themselves to intervening earlier and interviewing these mothers more deeply throughout their pregnancy and postpartum to ensure that Black mothers are treated with the same medical dignity as those from other racial groups. For health care providers, this form of advocacy can be as simple as integrating a patient wellness list that is specific to this demographic to ensure that they receive consistent treatment throughout their pregnancy, childbirth, and postpartum periods. Moreover, health care administrators can require providers within maternal health to take an implicit bias test that reveals the ways in which they are susceptible to mistreating certain patients over others. Lastly, community programs can be integrated into patient care plans within maternal health that unite Black mothers with community

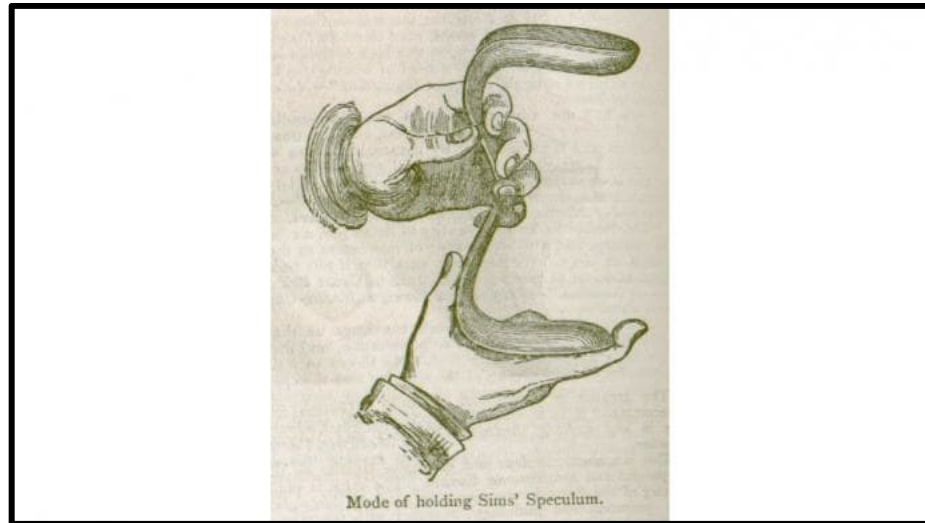
resources like transportation, safe housing, nutritional diets, and alternative billing options to ensure that they have the same accessibility and comfort as other patients.

By understanding this crisis through the blended lenses of public health and medicine, officials within both disciplines can form a taskforce that is designed to rewrite the rules that govern medical practice until they are representative of each patient that the medical profession is entrusted to treat. The implications of the information within this document appear disheartening but are, in fact, inspiring. Once committed to changing the trajectory of Black mothers within maternal health, these women will be afforded the luxury of continuing their lives post-delivery and witnessing the growth and development of their children in a world that supports them and walks alongside them in the eradication of the racial bias that exists within maternal health.

APPENDICES

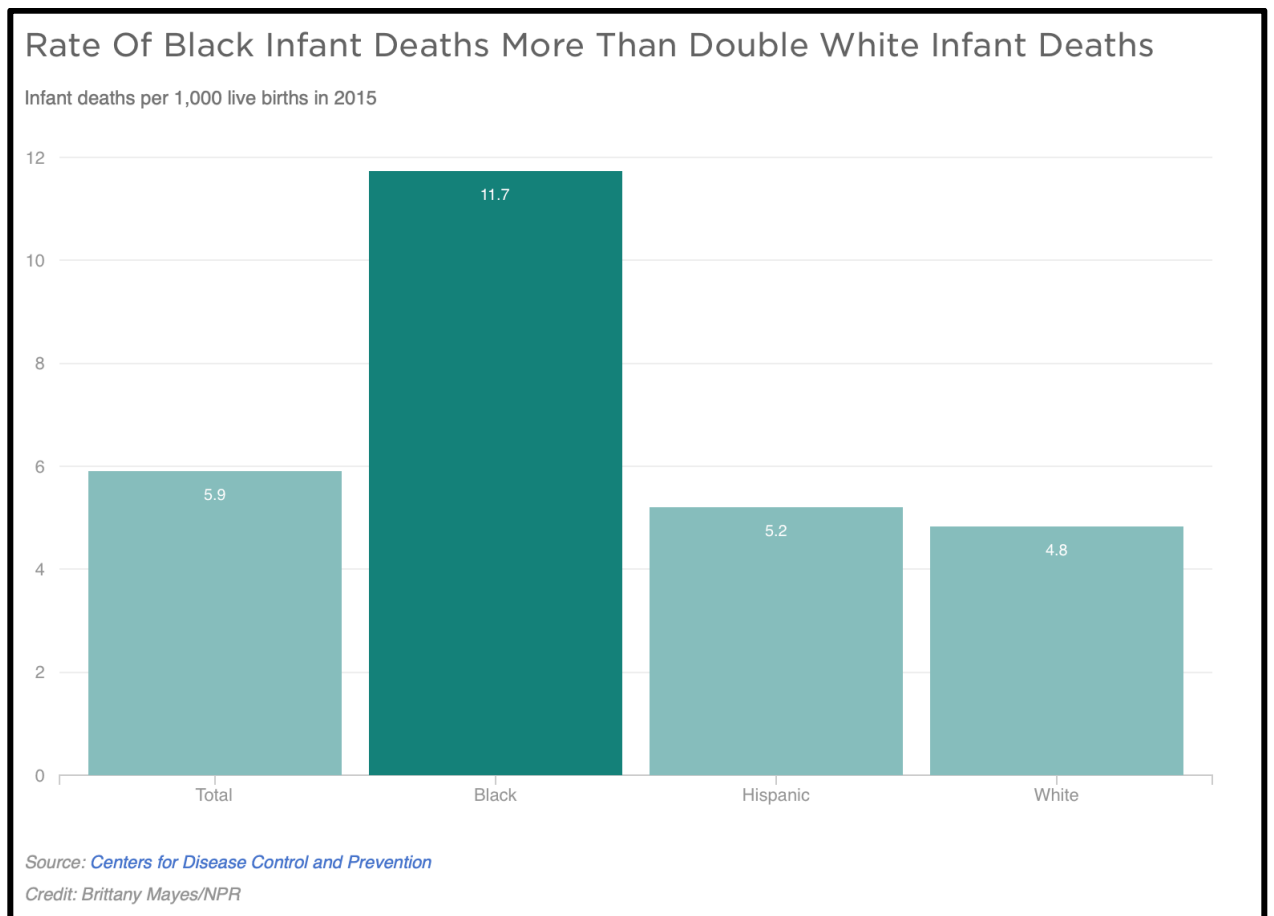
APPENDIX A

Vaginal Speculum that James Marion Sims created and used on enslaved Black women during his experiments.



APPENDIX B

CDC graph comparing the rate of Black infant deaths to other racial groups.



BIBLIOGRAPHY

- American Heart Association. (2019, February 20). Why are black women at such high risk of dying from pregnancy complications? Retrieved April 20, 2020, from <https://www.heart.org/en/news/2019/02/20/why-are-black-women-at-such-high-risk-of-dying-from-pregnancy-complications>
- Chatterjee, Rhitu, and Rebecca Davis. "How Racism May Cause Black Mothers to Suffer the Death of Their Infants." *NPR*, NPR, 20 Dec. 2017, www.npr.org/sections/health-shots/2017/12/20/570777510/how-racism-may-cause-black-mothers-to-suffer-the-death-of-their-infants_.
- "Deaths from Caesarean Sections 100 Times Higher in Developing Countries: Global Study." *World Health Organization*, World Health Organization, 29 Mar. 2019, www9.who.int/reproductivehealth/death-from-caesarean-sections/en/.
- Flanders-Stepans, M.B. "Alarming Racial Differences in Maternal Mortality." *The Journal of Perinatal Education*, U.S. National Library of Medicine, 2000, www.ncbi.nlm.nih.gov/pmc/articles/PMC1595019/.
- Fuller, K E. "Low Birth-Weight Infants: The Continuing Ethnic Disparity and the Interaction of Biology and Environment." *PubMed.gov*, U.S. National Library of Medicine, 2000, www.ncbi.nlm.nih.gov/pubmed/11110360.
- Headen, I, et al. "Racial/Ethnic Disparities in Inadequate Gestational Weight Gain Differ by Pre-Pregnancy Weight." *PubMed.gov*, U.S. National Library of Medicine, Aug. 2015, www.ncbi.nlm.nih.gov/pubmed/25652057.
- Holland, Brynn. "The 'Father of Modern Gynecology' Performed Shocking Experiments on Slaves." *History.com*, A&E Television Networks, 29 Aug. 2017, www.history.com/news/the-father-of-modern-gynecology-performed-shocking-experiments-on-slaves.
- Howard, Jacqueline. "Childbirth Is Killing Black Women, and Here's Why." *CNN*, Cable News Network, 15 Nov. 2017, www.cnn.com/2017/11/15/health/black-women-maternal-mortality/index.html.
- Howell, E. A., Egorova, N. N., Balbierz, A., Zeitlin, J., & Hebert, P. L. (2016). Site of delivery contribution to black-white severe maternal morbidity

- disparity. *American Journal of Obstetrics and Gynecology*, 215(2), 143-152.
doi:10.1016/j.ajog.2016.05.007
- Jasienska, Grazyna. "Low Birth Weight of Contemporary African Americans: An Intergenerational Effect of Slavery?" *American Journal of Human Biology*, vol. 21, no. 1, 2009, pp. 16–24., doi:10.1002/ajhb.20824.
- Kirabo, S. (2016, March 29). 4 Common Lies You Should Stop Believing About Black Single Mothers Right Now. Retrieved April 24, 2020, from <https://everydayfeminism.com/2016/01/black-youth-fatherless-homes/>
- Marcum, J. (2019, April 07). *7P Medical Model*. Lecture presented in Texas, Waco.
- Marcum, J. (2019, March 10). *Systems Biology*. Lecture presented in Texas, Waco.
- Martin, Nina, and Renee Montagne. "Black Mothers Keep Dying After Giving Birth. Shalon Irving's Story Explains Why." *NPR*, NPR, 8 Dec. 2017, www.npr.org/2017/12/07/568948782/black-mothers-keep-dying-after-giving-birth-shalon-irvings-story-explains-why
- "New Guidelines on Antenatal Care for a Positive Pregnancy Experience." *World Health Organization*, World Health Organization, 5 Dec. 2017, www.who.int/reproductivehealth/news/antenatal-care/en/.
- "New WHO Evidence on Mistreatment of Women during Childbirth." *World Health Organization*, World Health Organization, 18 Oct. 2019, www9.who.int/reproductivehealth/mistreatment-of-women-during-childbirth/en/.
- NewsHour, PBS. "Why Are Black Mothers and Infants Far More Likely to Die in U.S. from Pregnancy-Related Causes?" *PBS*, Public Broadcasting Service, 18 Apr. 2018, www.pbs.org/newshour/show/why-are-black-mothers-and-infants-far-more-likely-to-die-in-u-s-from-pregnancy-related-causes.
- NYC Health. "Severe Maternal Morbidity in New York City, 2008–2012." New York, 2016.
- Rowley, D L. "Research Issues in the Study of Very Low Birthweight and Preterm Delivery among African-American Women." *PubMed.gov*, U.S. National Library of Medicine, Oct. 1994, www.ncbi.nlm.nih.gov/pubmed/7807560.
- Smedley, Brian et al. "Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care." *Www.ncbi.nlm.nih.gov*, National Academies Press (US), 2003, www.ncbi.nlm.nih.gov/pubmed/25032386.
- Tabernese, S. "Maternal Mortality Rate in U.S. Rises, Defying Global Trend, Study Finds" *New York Times*, New York Times, September 21, 2016.

The Associated Press. "U.S. Pregnancy Deaths Are up, Especially among Black Women." *NBCNews.com*, NBCUniversal News Group, 9 May 2019, www.nbcnews.com/news/nbcblk/us-pregnancy-deaths-are-especially-among-black-women-n1003806.

"Vesicovaginal Fistula: Causes, Treatments & Tests." *Cleveland Clinic*, Cleveland Clinic, 25 Jan. 2017, my.clevelandclinic.org/health/diseases/16442-vesicovaginal-fistula.