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The Influence of Data Practices on Maternal Mortality Trends in the United States of America, and Targeted Policy Recommendations for Improvement.

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Master of Nursing
Nell Hodgson Woodruff School of Nursing, Emory University
2023

Bachelor of Science in Public Health
College of Charleston
2018

Thesis Committee Chair: Yaw Addo, PhD

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

The Influence of Data Practices on Maternal Mortality Trends in the United States of America, and Targeted Policy Recommendations for Improvement.

By Lindsey Allen, RN, MN

The United States, a high-income nation, is currently experiencing a perceived epidemic of maternal mortality. The rising trends have alarmed the executive branch to declare a 'maternal health crisis'. Historically, global public health measures have prioritized research and commitment to targeted interventions that lessen the burden and tragedy surrounding maternal mortality. Because no one should die a preventable death while having a baby, monitoring the circumstances under which mothers die during pregnancy, during birth and in the postpartum period is the crucial intersection of maternal wellbeing and the health of nations in general. The observations presented in this review primarily focus on maternal mortality trends in the United States. The hypothesis discerns recent changes in data collection have skewed and muddied statistical analysis and significantly changed political outcomes towards policies that will eventually negatively impact research concerning maternal mortality. Further discussion is imperative to protecting the future of maternal health which are driven by public health policy recommendations.

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Acknowledgements

I have never been directly impacted by maternal mortality. For too many, the topics talked about here represent a painful, incomprehensible tragedy. To all of us who are affected by maternal mortality, I wish you peace. The purpose of this presentation is to provide evidence behind current trends to inform future evidence-based interventions, ultimately hopeful of improved, equitable health outcomes.

To my dear immediate family, Mom, Dad, Tyler, Lacey and [of course] JoJo. There are no words to express my gratitude for your unwavering support through all the highs and lows. 'The Grandmas', my women's empowerment warriors. Jenny, thank you for "belovedly" pushing my butt. To friends and families alike, my heartfelt thanks and love to you all.

I would like to extend my deepest gratitude to Brenda Baker, PhD, RNC, FAAN. Her mentorship has been invaluable to me and her commitment to this field fosters genuine and impactful change. To the first professor I spoke with at Emory University, I always felt supported and encouraged by my thesis chair, Yaw Addo, PhD. I am immensely grateful for all I have learned from these two.

Thank you, Rollins School of Public Health, notably Amanda Prophett, MPH, for working with me to complete this program despite any difficulties. The resources and support provided have been energizing sources for continual learning. "The capacity to learn is a gift. To learn is a skill. The willingness to learn is a choice." – Brian Herber

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Abbreviations

CDC – Centers for Disease Control and Prevention
ERASE MM – Enhancing Reviews and Surveillance to Eliminate Maternal Mortality
ICD-10 – International Classification of Disease
MM – Maternal Mortality
MMRC – Maternal Mortality Review Committee
PMSS – Pregnancy Mortality Surveillance System
PRAMS – Pregnancy Risk Assessment Monitoring System
WHO – World Health Organization
NVSS – National Vital Statistics System

Relevant Terms Defined→ Definitions adopted directly from the CDC (Centers for Disease Control and Prevention (CDC), n.d., a)

- DEMOGRAPHIC INFORMATION. The person: characteristics—age, sex, race, and occupation—of descriptive epidemiology used to characterize the populations at risk.
- DISTRIBUTION. In epidemiology, the frequency and pattern of health-related characteristics and events in a population. In statistics, the observed or theoretical frequency of values of a variable.
- EVALUATION. A process that attempts to determine as systematically and objectively as possible the relevance, effectiveness, and impact of activities in the light of their objectives.
- EPIDEMIOLOGY. The study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems.
    - EPIDEMIC PERIOD. A period when the number of cases of disease reported is greater than expected.
- HEALTH INFORMATION SYSTEM**.** A combination of health statistics from various sources, used to derive information about health status, health care, provision and use of services, and impact on health.
- MORBIDITY. Any departure, subjective or objective, from a state of physiological or psychological well-being.
- MORTALITY RATE. A measure of the frequency of occurrence of death in a defined population during a specified interval of time.
- PUBLIC HEALTH SURVEILLANCE. The systematic collection, analysis, interpretation, and dissemination of health data on an ongoing basis, to gain knowledge of the pattern of disease occurrence and potential in a community, to control and prevent disease in the community.
- SECULAR TREND. Changes over a long period of time, generally years or decades.
- VALIDITY. The degree to which a measurement measures or detects what it is supposed to measure.

Key Definitions

- **MATERNAL MORTALITY (MM)** | WHO (World Health Organization (WHO), n.d., a)
    - "The annual number of female deaths from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy."

- **MATERNAL MORTALITY (MM)** | USA – PMSS System (CDC, n.d., h)
    - "The Pregnancy Mortality Surveillance System (PMSS) defines a pregnancy-related death as a death while pregnant or within 1 year [365 days] of the end of pregnancy from any cause related to or aggravated by the pregnancy."
- **Rate**
    - "A rate is a comparison of two quantities with different units of measure. It describes how one quantity changes in relation to another quantity, often over time" (Scheinerman, E.R., 2000)
- **Ratio**
    - Maternal Mortality Ratio Example | "The number of pregnancy-related deaths to the number of births in the same period" (Roser, et. al., 2024)

Chapter 1 | Introduction

Maternity. Motherhood. Parenthood. Words with so much meaning and resonance within every culture that there are holidays celebrated across the globe honoring this calling. The community-wide fervor and warmth associated with the birthing and raising of the next generation raises a challenging dilemma when the word "mortality" follows "maternity." In other words, when this life-changing milestone becomes a life-claiming tragedy, the very fabric of a society is threatened. Because no one should die a preventable death while having a baby, monitoring the circumstances under which mothers die during pregnancy, during birth and in the postpartum period is the crucial intersection of maternal wellbeing and the health of nations in general. The observations presented in this review primarily focus on maternal mortality statistical trends in the United States (US).

Data collection regarding maternal mortality is centrally coordinated by the World Health Organization (WHO) (WHO, n.d., d) Public health surveillance, involving a systematic collection, analysis, interpretation, and dissemination of health data on an ongoing basis, to gain knowledge of the pattern of disease occurrence and potential in a community, to control and prevent disease in the community, (CDC, n.d., h) a daunting and delicate task. WHO's mandate is to protect global health via standardizing data, analyzing research, coordinating global responses to outbreaks, and monitoring health trends. Additionally, per mandate of the United Nations (UN) World Health Assembly, member states (countries) provide their maternal mortality data to the WHO. Maternal mortality is defined by the WHO as, "The annual number of female deaths from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy" (WHO, n.d., a)

When disparate nations, hospitals and other public health institutions seek to measure and report maternal mortality statistics, keeping this number the same across the data ensures comparability and statistical relevance. Therefore, the US national database that tracks mortality statistics, the National Vital Statistics System (NVSS), follows the WHO's metric for quantifying maternal deaths as pregnancy until 42 days postpartum (WHO, n.d., a)

In 1986, however, an additional service, the Pregnancy Mortality Surveillance System (PMSS) was created in the US. The PMSS, "…defines a pregnancy-related death as a death while pregnant or within 1 year [365 days] of the end of pregnancy from any cause related to or aggravated by the pregnancy" (CDC, n.d., h). Ultimately, an additional 323 days to the standard set forth by the WHO were added to the sources of data for maternal mortality. The reasons behind this change are difficult to trace, but conjecture would include the "more data is always better data" fallacy, trends towards women getting pregnant at older ages. There are subtle theories for the reasoning behind initiating PMSS system as a mechanism to capture under reporting from the NVSS system (Hoyert, et. al., 2020). Alternatively, perhaps this is an attempt to capture more post-partum death rates from mental health conditions. Certainly, a woman's body is still physiologically adapting well into the first year after giving birth; however, consistency and attention to detail is important in tracking these trends.

Additionally, in 2003, the US adopted a response system to address the possibility of underreporting maternal deaths, the 'checkbox system'. This system added "maternal mortality" as a possible checkbox choice on formal death certificates. The update was incorporated into standard death certificates with the intent of enhancing data collection within death records; unfortunately, it complicated and further skewed maternal mortality data sets. Skewed in relation to expanded number of cases than the previous NVSS statistic, because there are an additional

323 days that count as maternal deaths, inevitably leading to a higher margin. For visualization, the numerator increased, but the denominator remained the same. First, many states were slow to adopt this addition to the death certificates and, tragically, more than half of the data was found to be false positives (Hoyert, et. al, 2020). One example is data from 2013 that claims 147 of 797 recorded deaths were women over age 85. The volume of this error is expressive in terms of maternal mortality, as physiological barriers must also be considered (Hoyert, et. al, 2020).

The impact of these changes has radically distorted both the reported data and the perceptions of policymakers. Pregnancy is usually thought of in three notable trimesters, often neglecting to mention the fourth essential "trimester". The 'fourth trimester' concerns the 12 weeks (84-days) after a mother endures laboring a child (Choi, et. al., 2022). This critical time frame is an important assessment tool to indicate the health of the mother postpartum. These changes radically increased the perceived number of maternal deaths after 42 days, well outside of the fourth trimester. For example, for data from 2011-2015 (which included only 13 states), the breakdown of timing of maternal deaths in relation to childbirth included:

- 48.2% during pregnancy or day of delivery,
- 33.1% 1 – 42 days postpartum,
- 11.7% 43 – 365 days postpartum, and
- 6.7% - unknown (Petersen, et. al, 2019)

The leading causes of these deaths were cardiovascular conditions, accounting for greater than 33% of the deaths, "non-cardiovascular medical conditions (14.3%), infection (12.5%) and hemorrhage (11.2%)" (Petersen, et. al, 2019). Later, data gathered between 2017-2019, was also aggregated from the PMSS and included 36 states, with a notable 53% of deaths occurring 7 days -1 year postpartum (CDC, 2022, a). This statistic was highlighted as an alarming rate; however, it does not incorporate the guidelines as set by the WHO. It certainly is a more powerful number, however - 53% makes a national crisis while 11.7% is an interesting data

point. The real trouble is represented in Table 4. of a document from the Maternal Mortality Review Committee, relating 22.7% of all deaths to mental health conditions (Trost, et. al, n.d.). Mental health conditions surpass cardiovascular conditions with the inclusion of the maternal deaths occurring after 42 days post-delivery (Lang, et. al., 2008). Therefore, any future funding directed towards mental health conditions instead of cardiovascular conditions will be strongly associated with inaccurate data. The clear change in policy implications directly affects funding, research and focus on health options for women.

Before mental health surpassed cardiovascular conditions as leading causes of death, there have been many reports elating to ethnic and racial gaps, highlighting inequitable birthing outcomes. (Fleszar, et. al., 2023). Whether intentional or unintentional, race-based statistics over the last 3 decades must be further analyzed as a roadmap to future implications. Impacts of the inaccuracies within the checkbox system are also evidenced by an analysis of rural vs. urban deaths between 1999 and 2017 (Rossen, et al., 2022). The results showed a higher influence on rural rates; however, upon closer examination, conclusions were drawn that associated these increases to checkbox errors. By excluding the checkbox data, the study was able to show that rural deaths decreased (Rossen, et al., 2022).

The dramatic increase in perceived statistics regarding maternal mortality due to these changes in measurements have caused a fervor of policy initiatives under the banner “Maternal Mortality Crisis” in June 2022 (Whitehouse, 2022) A national push for examining this important issue is an integral part of driving public policy and all advancements in health sciences improve health outcomes, however, the defined metrics of maternal mortality across different periods have not remained consistent, and this inconsistency and confusion have led to policy initiatives that may perpetuate inequitable interventions. The adage “what gets measured, gets done”

(Barfield, et. al., 2020) is both a strong argument for continuing to closely monitor maternal mortality rates, but also a caution for clearly defining the exact causes and timing of when women die due to pregnancy-related pathologies or complications.

Maternal well-being is a key indicator for any nation's current and future well-being. A systematic analysis has revealed that there is an association between maternal health and child health, highlighting the impact of maternal health on future generations (Mudiyanselage et. al., 2024). While the goal of maternal healthcare does not merely mean the absence of mortality, it is an important indicator as 60% of deaths were deemed preventable according to 2011-2015 data (Petersen, et.al., 2019) and 80% of deaths were preventable between 2017-2019 (CDC, 2022, a) It is a double-edged sword to see an increase in preventable deaths depending on what the underlying statistics represent. Are there more evidence-based, successful interventions preventing mortality? Or are there improved monitoring and evaluation efforts that capture the full effect of the death represented in the count? These are some questions at play that must be asked as a means of prioritizing which interventions should take effect.

The hypothesis discerns that recent changes in data collection have skewed and muddied statistical analysis and significantly changed political outcomes towards policies that will eventually negatively impact research concerning maternal mortality. This report incorporates current and available longitudinal data. Aligning with the cited literature's terminology, the term "maternal" is presumed to reference female sex assigned at birth, as further specification is not provided. It is important for future information to appropriately address gender (Choi, et. al., 2022).

Purpose Statement

Bearing in mind the data confusion and inconsistencies, the purpose of this analysis is to decipher a change in policy objectives within the parameters of the Maternal Mortality Crisis 2022. The Human Development Index, a branch of the United Nations' that assesses overall development, ranked the United States 20th out of 193 countries, in 2022 (United Nations, n.d.). Despite this achievement, there has been an outlying increase in maternal mortality over the past three decades (CDC, n.d., h). Therefore, while the United States logistically ranked "Very High" within the human development category, the alarmingly high maternal mortality rate must be called into question (United Nations, n.d.).

The 'White House Blueprint for Addressing the Maternal Health Crisis', has identified five goals. Each goal corresponds to an "Actions We Will Take", as depicted in the table below (White House, 2022). Each "Actions We Will Take" has many objectives that concern broader topics unrelated directly to the physiological challenges of women post-birth.

Table 1. Summary of White House Blueprint for Addressing 'Maternal Mortality Crisis'

	Goal	Summarized Actions We Will Take	Estimated Costs	Percentage of Cost
1.	"Increase Access to and Coverage of Comprehensive High-Quality Maternal Health Services, Including Behavioral Health Services"	Maternal Health Insurance coverage expanded from 60 days postpartum to one-year postpartum, Veterans Affairs (VA), Mental health	$73 million	23.1%
2.	"Ensure Those Giving Birth are Heard and are Decision makers in Accountable Systems of Care"	Culturally appropriate healthcare training, limit allowable insurance reimbursement, empower pregnant people, breastfeeding initiatives	$153 million	48.4%
3.	"Advance Data Collection, Standardization, Transparency, Research, and Analysis"	Add additional states to the MMRC's (5 million), housing assistance, WIC participation, environmental stressors	$15 million	4.8%

4.	"Expand and Diversify the Perinatal Workforce"	Increase community health workers in underserved areas and birthing centers	$20 million	6.3%
5.	"Strengthen Economic and Social Supports for People Before, During, and After Pregnancy"	Veterans Affairs (VA), streamline awareness to federal programs, environmental risks	$55 million	17.4%
		Total	$316 million	100%

This Blueprint reveals the current political landscape surrounding maternal mortality, including outlined strategies to address the current 'Maternal Health Crisis'. **Goal one** is in relation to expanding health insurance coverage past the current 60-day timeframe to incorporate further coverage for one-year postpartum (White House, 2022). An expansion of this measure is the largest budgeted expenditure which arguably does not directly improve quality of care, but rather the business side of healthcare. **Goal two** talks about aspects revolving around implicit bias training to further awareness on listening to patients. **Goal three** is related to the data and is the lowest budgeted amount, accounting for 4.8% of the total expenditures. It is unclear why this goal has not garnered more attention; however, the fundamentals of the campaign are reliant upon the data that is retrieved from the systems set in place to receive the funding. **Goal four** encourages further funding for a more diversified workforce, alongside creating birthing centers to expand access to more care. **Goal five** addresses widespread prevention of maternal health conditions through expanding access to Veterans Affairs, environmental risks, and streamlining available federal assistance programs.

The largest portions of the set budget indeed are reserved for Goal 2., approximately 50%. Initiatives rooted in qualitative metrics, such as perceptions of care, are difficult to measure for future interventional determination (CDC, n.d., i) Surveying attitudes and experiences by

birthing people throughout the birthing process is an assessment tool difficult to calculate. Meaning, the ~50% allocated budgetary funds based on perceptions surrounding quality of care, require rigorous evaluation of experiences. For example, when people report that they were not responded to appropriately, does this statistic refer to ignorance of the healthcare workers or is there a disconnect behind reasons for prioritizing some tasks over others in the healthcare setting.

Chapter 2 | Literature Review

Descriptive Analysis

Globally, maternal mortality may be indicative of some of the largest inequalities encountered, falling under Sustainable Development Goal (SDG) Target 3.1 (WHO, n.d., c). According to the WHO, in 2020, low-income countries reported a Maternal Mortality Ratio (MMR) of 430 per 100,000 live births, compared to 12 per 100,000 live births in high-income countries" (WHO, n.d., b) This measure of frequency represents maternal death risk relative to live births (Scheinerman, E.R., 2000). Further, the analysis concluded that approximately "95% of all maternal deaths occurred in low and lower-middle income countries" (WHO, n.d., b). While the goal of maternal healthcare does not merely mean the absence of mortality, it is an important indicator as globally, maternal well-being is a key indicator for any nation's current and future well-being.

The WHO defines maternal mortality as, "The annual number of female deaths from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy" (WHO, n.d., a). As previously stated, the quantified 42 days post-partum, creates a standardized method for optimal data management practices. Any deaths resulting after 42 days and prior to 1-year post-partum are classified by the International Classification of Disease, Tenth Revision (ICD-10) (096 – 097) as "late maternal deaths" (WHO, n.d., a) (CDC, n.d., e). With 193 recognized countries, it is best practice for the WHO to receive 193 results utilizing identical metrics, if the ultimate goal is to analyze comparable trends (United Nations, n.d.). While "identical" is meticulous in nature and extremely difficult to bolster on a global scale, monitoring events is the bottom line that creates

coordinated responses. The WHO acknowledges limitations and challenges exist within the ICD-10 framework, complicating disease classifications (WHO, n.d., a).

Alternatively, there are several formulations of monitoring used within the US to evaluate maternal mortality. One is the National Vital Statistics System (NVSS), "the source for official mortality statistics" (Hoyert, et. al, 2020) This is the collective body that reports information to the WHO to be included in global statistics and follows the WHO's metric of pregnancy to 42 days postpartum (Hoyert, et. al, 2020). Another reporting system created in 1986 is the "The Pregnancy Mortality Surveillance System (PMSS) [which] defines a pregnancy-related death as a death while pregnant or within 1 year of the end of pregnancy from any cause related to or aggravated by the pregnancy" (CDC, n.d., h). Now, there is a 323-day difference between these two definitions, which is a 669.05% increase. This evidently affords more time for more maternal deaths to occur, ultimately leading higher inclusion of maternal deaths within the count, skewing rates.

The PMSS, believed that the National Vital Statistics System was underestimating the statistics leading to an additional monitoring tool on death records, the checkbox (Hoyert, et. al., 2020). The checkbox rolled out in 2003; however, it was slow to adopt by all states, leading to essentially unreliable from 2003 – 2017. In fact, there was a 56% rate of false positives identified in 2016 data (CDC, n.d., h). Moreover, half of the retrieved data was false or inaccurate. Inconsistencies of this scale drastically impact policies, by delaying or misguiding interventions.

National attention has been recently garnered with a National Public radio (NPR) release of a study that re-examined data sourced between 1999 – 2018 from the National Center for Health Statistics' (NCHS), finding the maternal mortality rate has, "…been overestimated" (Simmons-Duffin, 2024). The study compared the results of the NVSS within the time listed above to an

alternative method that included, “1 mention of pregnancy among the multiple causes of death on the death certificate” (Joseph, et. al., 2024). The findings yielded a death rate of 10.4 compared to the previous 32.9 per 100,000 live births (Joseph, et. al., 2024). This study helps to explain the efficacy of surveillance and raises awareness to future implications and use of NVSS data.

Maternal Mortality Review Committees (MMRC)

The Maternal Mortality Review Committees (MMRC) are state led committees that meet throughout the year to review any maternal deaths occurring in said state (CDC, n.d., c). It seemed necessary to fully review the national representation and strength of the Maternal Mortality Review Committees, considering the statistical significance of the results.

Table 2. State-by-State Maternal Mortality Review Committee Initiative & Funding

State	Committee Y/N	Year Established	# Committees	Erase MM Funding	State Funding
Alabama	Yes	2018	1	No	Yes
Alaska	Yes	1989	1	Yes	No
Arizona	Yes	2011	1	Yes	Yes
Arkansas	Yes	2019	1	Yes	No
California	Yes	2007	3	Yes	No
Colorado	Yes	2019	1	Yes	Yes
Connecticut	Yes	2018	1	Yes	No
Delaware	Yes	2011	1	Yes	No
Florida	Yes	1996	1	Yes	Yes
Georgia	Yes	2012	1	Yes	Yes
Hawaii	Yes	2017	1	Yes	No
Idaho	Yes	2019	1	No	No
Illinois	Yes	2000; 2015	2	Yes	No
Indiana	Yes	2018	1	Yes	Yes
Iowa	Yes	1970	1	Yes	No
Kansas	Yes	2018	1	Yes	No
Kentucky	Yes	2018	1	Yes	No
Louisiana	Yes	2010	1	Yes	No
Maine	Yes	2005	1	Yes	No

Maryland	Yes	2000	1	Yes	Yes
Massachusetts	Yes	1998	1	Yes	No
Michigan	Yes	1950	1	Yes	No
Minnesota	Yes	2011	1	Yes	Yes
Mississippi	Yes	2016	1	Yes	No
Missouri	Yes	2011	1	Yes	No
Montana	Yes	1997	Fetal, Infant, Child & Maternal Mortality Review (FICMMR) and Injury Prevention	Yes	No
Nebraska	No	2013	Added to Child Death Review Team	Yes	No
Nevada	Yes	2020	1	Yes	No
New Hampshire	Yes	2010	1	Yes	Yes
New Jersey	Yes	1932	1	Yes	Yes
New Mexico	Yes	2018	1	Yes	No
New York	Yes	2010	1	Yes	No
North Carolina	Yes	1945	1	Yes	No
North Dakota	Yes	2022	1	No	No
Ohio	Yes	2011	1	Yes	No
Oklahoma	Yes	2009	1	No	No
Oregon	Yes	2018	1	No	Yes
Pennsylvania	Yes	2019	1	Yes	No
Rhode Island	Yes	2021	1	Yes	No
South Carolina	Yes	2016	1	No	No
South Dakota	Yes	2021	1	Yes	No
Tennessee	Yes	2017	1	Yes	Yes
Texas	Yes	2013	1	Yes	No
Utah	Yes	1995	1	Yes	No
Vermont	Yes	2011	1	Yes	Yes
Virginia	Yes	2011	1	Yes	No
Washington	Yes	2016	1	Yes	Yes
West Virginia	Yes	2010	1	Yes	No
Wisconsin	Yes	1997	1	Yes	No
Wyoming	No	N/A	Combined with Utah	Yes	No
Developed between 2018 – 2024		**15**	**Total**	**Y = 46 44 States, 2 Territories [Guam & Puerto Rico]**	**Y = 15**

Independently reviewing each state and New York City, Washington D.C., provided insight into the resources available that comprise each committee. New York City and Washington D.C. were included based on the inclusion from the PMSS system in a 2017-2019

evaluation (CDC, n.d., h). The formation of committees extensively varies overtime and many states have merged committees with different committees evaluating other demographics. Only 15 states are funding their committees. Conversely, 44 states and 46 territories are receiving funding from Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM), a CDC initiative. These MMRC's are consistently referenced to validate state-specific maternal death counts varying throughout the year. Considering the gravity of a maternal death, a committee discussion to review the cause and effect is important. With limited state funding, the future composition of these committees is unknown.

Importantly, some committees have been implemented for over two decades; however, that is not the case for 15 states that have recently been implemented within the last six years. Except for Wyoming who joins Utah in their meeting, this is a marked achievement within the last several decades. The partnership between Wyoming and Utah implies a collaborative effort that presents an opportunity of future national Maternal Mortality collaborative committee conventions.

Chapter 3 | Methods

IRB Approval

Prior to conducting a literature review, IRB Approval was considered. The Non-Human Subject Determination Form determined that this project did not require approval, as there is no funding interest nor identified public information that would require Health Insurance Portability and Accountability Act (HIPPA).

Within the Spring 2023 semester at Nell Hodgson Woodruff School of Nursing, Emory University, the topic of maternal mortality was comprehensively assessed by Brenda Baker, PhD, RNC, FAAN within a Data Utilization course. As an example of the history of data collection methodologies, contributing sources of data, and interpretation of data, the interdisciplinary nature of this topic combined with the current unusual trends in maternal mortality necessitated further scholarly inquiry. With the innovations and investments into healthcare, the inverse relationship observed in maternal health raised legitimate questions and concerns. Combining public health and nursing science further spurred the need to research the origins of the increasing mortality trends.

Therefore, upon Dr. Baker's keen observations, this project initially began with a meticulous independent analysis of the CDC's Division of reproductive health (CDC, n.d., f). Most hyperlinks available on this CDC maternal mortality webpage was viewed, beginning with the data and statistics tab. The glossary linked to this page supports Dr. Baker's observation to the discrepancies in the definition of maternal mortality, showcasing conflict amongst the scope of (CDC, n.d, b). The page provides further information into the Pregnancy Risk Assessment Monitoring System (PRAMS) and PMSS. Sudden Unexpected Infant Death (SUID), Case Registry, Teen Pregnancy, and Legal Induced Abortion were excluded as they did not involve

the key phrase ‘maternal mortality’ information. Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM) and the PMSS. The ERASE MM webpage introduced the state-run Maternal Mortality Review Committees (CDC, n.d., c). Here, several notable statistics included: the definition of maternal mortality introduced a new caliber of measurement (pregnancy up to one year postpartum) – also introduced the term pregnancy-related deaths, 2017-2019 data only included 36 states, 30% of deaths occurred 43-365 days postpartum (expressed as “53% occurred 7-365 days postpartum”), mental health became the leading cause of death, and non-white Hispanic became the leading ethnic group of mortalities (accounting for close to 50%) (Trost, et. al, 9). Further, examination related to timing of death with data between 2003-2014 put mental health conditions as occurring more frequently between 42 to 365 days. This information leads non-Hispanic white women service members ahead of other ethnic groups (Romano, et al., 2022). By this point, there were many noticeable inconsistencies requiring further study. Surveillance systems leading prevention efforts, appear confusing with significant risk for effective planning for maternal mortality.

Further education was pursued through the completion of the Pan American Health Organization’s (PAHO) course called “Enhance the Visibility and Value of your research for health with reporting guidelines” (Organización Panamericana de la Salud (PAHO), n.d.). The course outlined key research and dissemination strategies. To mitigate potential methodological bias or systematic discrepancies, a more thorough academic search was conducted following the initial observation. Bias can be introduced into a research process when a formatted search pattern is not maintained (PAHO, n.d.). Therefore, the necessity of a transparent search effort is vital to the validity of research findings.

The Emory Libraries Database was leveraged to find published works on this topic. An interdisciplinary search effort is organized below.

Table 3. Summary Literature Search

Databases Searched	Included Terms	First Two Term Results	All Three Term Results	All Four Term Results
*Academic Search Complete *Medline *CINAHL *Health Source: Nursing/Academic Edition	"Maternal Mortality" AND "Trends" AND "US" AND "1987"	6,323	302	4
	"Maternal Mortality" AND "Pregnancy Checkbox" AND "Trends"	42	22	N/A
	"National Vital Statistics System" AND "Maternal Mortality" AND "World Health Organization"	72	2	N/A
	"Pregnancy Mortality Surveillance System" AND "Maternal Mortality" AND "World Health Organization"	73	1	N/A

The databases were chosen based on previous academic experience and their relation to the health field. These included Academic Search Complete, Medline, CINAHL and Health Source: Nursing/Academic Edition. These terms: "Maternal Mortality" AND "Trends" AND "US" AND "1987" AND "Maternal Mortality" AND "Pregnancy Checkbox" AND "Trends" AND "US" "National Vital Statistics System" AND "Maternal Mortality" AND "World Health Organization" AND "Pregnancy Mortality Surveillance System" AND "Maternal Mortality" AND "World Health Organization" were finalized following the initial search process to account for the systems involved with official maternal mortality records. To increase precision and relevancy, one search included four search terms.

Of the 6,510 initially populated results, 29 were reviewed and ultimately four were included as supporting evidence within the final review. Despite using the Emory library database, several of the 29 reviewed had restricted access that were unavailable through the

databases. Other reasons for exclusion included external countries, specificity of Louisiana data, predominant discussion regarding family planning and abortion.

One reference to the timing was addressed in the 'included terms' to specifically look for the inclusion and initiation of the PMSS system. Maternal mortality statistics in the US prior to this date are presumed to follow the NVSS and WHO definition. The dates refer to the 2018 National Vital Statistics Report, that report the introduction of the PMSS at 1986 (Hoyert, 2020). Of note, some sources site the PMSS as initiating in 1976. These terms were chosen following the initial search process to account for the multiple terms to visualize knowledge gaps in maternal mortality.

Limitations

Despite all efforts to minimize implicit bias and methodological errors, it is important to acknowledge that limitations persist. To begin, the years chosen to include, 1986 – 2024, may not adequately assess yearly revisions of the vitality system trends. There may be further information for changes that were described in earlier versions of the documents. Secondly, the search terms identified may have inadvertently missed important information to evaluate for better visualization of the historical reasoning. Notably, this project expands on health dissemination, the evaluation of statistical trends, global comparisons, epidemiological inquiries, and political impact evaluation. The extent and vastness of this project condensed into a semester could cause a lack of focus or attention to specific details. The choice to utilize sources available to the public and through the Emory databases could exclude external resources that may afford more information. The language of the search was also in English, potentially missing US data published in other languages, Puerto Rico for example. The initial process reliant on a hyperlink trial and error, could have led to conclusions before the literature review was completed. Overall,

addressing the gaps behind the ‘Maternal Health Crisis’ in the US does not delve into methodological bias, sampling errors, and systemic discrepancies.

Chapter 4 | Results

The ‘maternal mortality crisis’ set into motion by the executive government branch is reliant on unfinished and unreliable statistics. Frameworks of implementation science rests on the belief of accurate data. Unfortunately, evaluations utilizing the PMSS or checkbox data within the US since 1987 have a documented lack of accuracy; however, it is difficult to navigate and interpret. Further collaborative efforts need to decipher the multiyear inaccurate data to set standards for future use. How is decision making at federal and state levels supposed to implement public health recommendations based on inflated statistics? If every regard of human development within the US mimicked data practices like this, there would be an continual crisis.

A theoretical addition to the agenda tasked with reacting to the ‘crisis’ could invest in improving upon the current PMSS and checkbox standards so that future data is more reliable. The unreliability of the data led to a national suspension in 2017 by National Center for Health Statistics (NCHS) (CDC, n.d., g). The state based MMRC’s optimize resources necessary as a final check before data is published. The partnership between Wyoming and Utah lends opportunities for future regional or national conventions to ensure consistency at every level. Acting now is pivotal to preventing future suspensions and creating reliable data sources for future use.

Discussion

This research notably revealed how misinterpreting data can lead to policy changes. While there is evidence demonstrating reasoning for revising the systems tasked with monitoring maternal mortality in the US, ultimately, the initiation of various methods muddied the research, and consequently, the interpretation.

Efforts made to enhance recording of maternal deaths, in turn, have been used to compare apples to oranges, dramatically altering trends, and creating positively skewed data. Biostatistics utilize epidemiologic data to identify correlations, risk factors, impact and ultimately to inform public health policies. The seemingly "more is better" concept has leaked into the US public health surveillance systems. Demand for insight into inequalities within health records is high. Incorporation of more and more indicators of disease etiologies muddies collection interpretation. In other words, how has an epidemic in maternal mortality singularly occurred in the US amongst other high-income countries and why are policies conforming while data from the WHO does not reflect a crisis?

To refute, the impactful 'fourth trimester' extends the scope beyond the commonly thought of maternal period, quantified by pregnancy until 42-days postpartum. Monitoring mortality statistics is highly specific, and indicative of notable trends, offering insight into how lifesaving prevention can occur. Consequently, what vital information is missed by not extending the cut-off to one-year postpartum. This can be thought of in terms of health insurance coverage. Benefits are determined by income levels, based on a pre-determined federal poverty line. Inevitably, there are going to be people that fall directly above this pre-determined number. The pre-determined defined '42 days postpartum' is like the federal poverty line; however, updated surveillance additions expand this definition, casting a broader (323 day) net on those who are near the cut-off, while are realistically not intended to be included. Therefore, what is the cost-benefit analysis of having multiple record systems jointly collecting similar trends? Are false positives related to the numerous systems tracking deaths versus the NVSS following global standards?

Ultimately, what are the future implications of the US maternal mortality surveillance systems globally? Does verbiage like ‘maternal health crisis’ within a high-income country distract from low and low-middle income countries reporting 95% of all maternal deaths (WHO, n.d., b) How can collaboration be utilized to improve reporting amongst all income leveled countries. The volume of unanswered questions, tied with White House financial and reporting agendas, lends to the lack of awareness on data influence on the determination of how maternal mortality is addressed in the US.

Chapter 5 | Conclusion

This is a **call-to-action** for the US to prioritize clarifying the maternal mortality statistics. This project has revealed documented inconsistencies in following the data, ultimately creating disbelief in the sources responsible for public health information. The intent of this project is to bring awareness to the available evidence that justifies the un-informed trends, mis-interpreted by the executive branch. Current public health practices have demonstrated a need to bring awareness to the 'fourth trimester'. There must be more explicit labeling to account for the 323-day addition to PMSS, especially evident to policy makers. In most instances, labeling graphs with a legend or key has effectively facilitated navigating and understanding presented information. While complex data of global importance is intended to be interpreted by experts in the field, the addition of a label denoting metric changes is imperative to avoid any oversights for anyone interpreting data trends.

The dissemination of health information is a crucial aspect and step towards educating the public. Transparency throughout observed health patterns must be clear to follow and collaboratively addressed. The recently published systematic review lends insightful information by synthesizing the validity of available information. This critical and rigorous evaluation of longitudinal data interviewed the esteemed OB-GYN Steven L. Clark, an expert in the field. Among others, Clark could relate to the everyday observation and has been surprised by the statistics (Simmons-Duffin, 2024). As with most challenges encountered nationally and globally, leveraging primary sources initiate a resourceful dialogue to better understand current conditions. Therefore, the US is responsible for transparently reporting to the public, and ultimately collaborating with the WHO to best inform necessary interventions. Health inequalities are persistently evident in health data and largely hinder sustainable interventions.

In conclusion, maternal mortality is a key indicator of national and global importance. Quality monitoring and evaluation of trends outlines the trajectory for evidence-based practice and steers efforts towards the highest needs. Therefore, the 'Maternal Health Crisis', as coined by the White House in 2022, does not adequately represent the entirety of the current trajectories (Whitehouse, 2022). A mislabeled situation can lead to an overwhelmed response, desensitization, and misallocation of funds, among other consequences. Many funding sources are commonly required to include a detailed outline of the need and intended uses for receiving funds. A political landscape based on inflated statistics risks misallocating resources. The need for consistent and clear data could have profound, unforeseen impacts that could narrow inequality gaps in healthcare. The goal is not to neglect the important nature of maternal mortality, rather, it is to assess targeted areas for improvement. Emphasizing again that maternal deaths are preventable with adequate resources and training (The Commonwealth Fund, 2020).

Infographic Deliverable

Policy Brief Deliverable

CALL-TO-ACTION

Introduction:

Maternity. Motherhood. Parenthood. Words with so much meaning and resonance within every culture that there are holidays celebrated across the globe honoring this calling. The community-wide fervor and warmth associated with the birthing and raising of the next generation raises a challenging dilemma when the word "mortality" follows "maternity." In other words, when this life-changing milestone becomes a life-claiming tragedy, the very fabric of a society is threatened. Because no one should die a preventable death while having a baby, *monitoring the circumstances under which mothers die during pregnancy, during birth and in the postpartum period is the crucial intersection of maternal wellbeing and the health of nations in general*. The observations presented in this review primarily focus on maternal mortality statistical trends in the United States (US), recent changes in data collection have skewed and muddied statistical analysis and significantly changed political outcomes towards policies that will eventually negatively impact research concerning maternal mortality.

Current Situation:

1. Outlying increase in maternal mortality trends in the US over the past three decades, in comparison to other high-income countries → A maternal mortality rate of **32.9 / 100,000**
    a. Rates of other high-income countries average **11 / 100,000**
    b. Rates of low and low-middle-income countries average **450 / 100,000**
2. In 2022 the executive branch has alerted a 'maternal health crisis' and requested a $316 million budget
3. Further analysis into the statistical trends reveal historical inaccuracies that compute this data.

Policy Recommendations

1. *Transparency* in outlining lessons learned and adjustments to any datasets collected.
2. *Standardize* *Asterisk Key* depicting any confusing language and / or relevant data analytics.
3. *Continue* to fund monitoring & evaluation of maternal health outcomes, prioritizing resources to preventable maternal deaths.
4. *Direct* state-led Maternal Mortality Review Committees (MMRC) to ensure national congruency.

Conclusion:

The 'Maternal Health Crisis', as coined by the White House in 2022, does not adequately represent the entirety of the current trajectories. A mislabeled situation can lead to an overwhelmed response, desensitization, and misallocation of funds, among other consequences. The goal is not to neglect the important nature of maternal mortality, rather, to assess targeted areas for improvement.

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Appendix B. Articles Specifically Included in Literature Review

Fleszar, L. G., Bryant, A., Johnson, C. O., Blacker, B. F., Aravkin, A. Y., Baumann, M. M., Dwyer-Lindgren, L., Kelly, Y. O., Maass, K., Zheng, P., & Roth, G. A. (2023). Trends in State-Level maternal mortality by racial and ethnic group in the United States. *JAMA*, *330*(1), 52. https://doi.org/10.1001/jama.2023.9043Romano, C. J., Hall, C., Bukowinski, A. T., Gumbs, G. R., & Conlin, A. M. S. (2022). Pregnancy-associated and pregnancy-related deaths in the United States military, 2003–2014. *American Journal of Obstetrics and Gynecology*, *227*(3), 508.e1-508.e9. https://doi.org/10.1016/j.ajog.2022.04.020
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Tables

Table 1. Summary of White House Blueprint for Addressing 'Maternal Mortality Crisis'				
	Goal	Summarized Actions We Will Take	Estimated Costs	Percentage of Cost
1.	"Increase Access to and Coverage of Comprehensive High-Quality Maternal Health Services, Including Behavioral Health Services"	Maternal Health Insurance coverage expanded from 60 days postpartum to one-year postpartum, Veterans Affairs (VA), Mental health	$73 million	23.1%
2.	"Ensure Those Giving Birth are Heard and are Decision makers in Accountable Systems of Care"	Culturally appropriate healthcare training, limit allowable insurance reimbursement, empower pregnant people, breastfeeding initiatives	$153 million	48.4%
3.	"Advance Data Collection, Standardization, Transparency, Research, and Analysis"	Add additional states to the MMRC's (5 million), housing assistance, WIC participation, environmental stressors	$15 million	4.8%
4.	"Expand and Diversify the Perinatal Workforce"	Increase community health workers in underserved areas and birthing centers	$20 million	6.3%
5.	"Strengthen Economic and Social Supports for People Before, During, and After Pregnancy"	Veterans Affairs (VA), streamline awareness to federal programs, environmental risks	$55 million	17.4%
		Total	$316 million	100%

Table 2. State-by-State Maternal Mortality Review Committee Initiative & Funding					
State	**Committee Y/N**	**Year Established**	**# Committees**	**Erase MM Funding**	**State Funding**
Alabama	Yes	2018	1	No	Yes
Alaska	Yes	1989	1	Yes	No
Arizona	Yes	2011	1	Yes	Yes
Arkansas	Yes	2019	1	Yes	No
California	Yes	2007	3	Yes	No
Colorado	Yes	2019	1	Yes	Yes
Connecticut	Yes	2018	1	Yes	No
Delaware	Yes	2011	1	Yes	No
Florida	Yes	1996	1	Yes	Yes
Georgia	Yes	2012	1	Yes	Yes
Hawaii	Yes	2017	1	Yes	No
Idaho	Yes	2019	1	No	No

Illinois	Yes	2000; 2015	2	Yes	No
Indiana	Yes	2018	1	Yes	Yes
Iowa	Yes	1970	1	Yes	No
Kansas	Yes	2018	1	Yes	No
Kentucky	Yes	2018	1	Yes	No
Louisiana	Yes	2010	1	Yes	No
Maine	Yes	2005	1	Yes	No
Maryland	Yes	2000	1	Yes	Yes
Massachusetts	Yes	1998	1	Yes	No
Michigan	Yes	1950	1	Yes	No
Minnesota	Yes	2011	1	Yes	Yes
Mississippi	Yes	2016	1	Yes	No
Missouri	Yes	2011	1	Yes	No
Montana	Yes	1997	Fetal, Infant, Child & Maternal Mortality Review (FICMMR) and Injury Prevention	Yes	No
Nebraska	No	2013	Added to Child Death Review Team	Yes	No
Nevada	Yes	2020	1	Yes	No
New Hampshire	Yes	2010	1	Yes	Yes
New Jersey	Yes	1932	1	Yes	Yes
New Mexico	Yes	2018	1	Yes	No
New York	Yes	2010	1	Yes	No
North Carolina	Yes	1945	1	Yes	No
North Dakota	Yes	2022	1	No	No
Ohio	Yes	2011	1	Yes	No
Oklahoma	Yes	2009	1	No	No
Oregon	Yes	2018	1	No	Yes
Pennsylvania	Yes	2019	1	Yes	No
Rhode Island	Yes	2021	1	Yes	No
South Carolina	Yes	2016	1	No	No
South Dakota	Yes	2021	1	Yes	No
Tennessee	Yes	2017	1	Yes	Yes
Texas	Yes	2013	1	Yes	No
Utah	Yes	1995	1	Yes	No
Vermont	Yes	2011	1	Yes	Yes
Virginia	Yes	2011	1	Yes	No
Washington	Yes	2016	1	Yes	Yes
West Virginia	Yes	2010	1	Yes	No
Wisconsin	Yes	1997	1	Yes	No
Wyoming	No	N/A	Combined with Utah	Yes	No
Developed between 2018 – 2024		**15**	**Total**	**Y = 46 44 states, 2 territories [Guam & Puerto Rico]**	**Y = 15**

Table 3. Summary Literature Search

Databases Searched	Included Terms	First Two Term Results	All Three Term Results	All Four Term Results
*Academic Search Complete *Medline *CINAHL *Health Source: Nursing/Academic Edition	"Maternal Mortality" AND "Trends" AND "US" AND "1987"	6,323	302	4
	"Maternal Mortality" AND "Pregnancy Checkbox" AND "Trends"	42	22	N/A
	"National Vital Statistics System" AND "Maternal Mortality" AND "World Health Organization"	72	2	N/A
	"Pregnancy Mortality Surveillance System" AND "Maternal Mortality" AND "World Health Organization"	73	1	N/A