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Contraception as primary prevention: the role of reproductive autonomy in mitigating maternal mortality

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**CONTRACEPTION AS PRIMARY PREVENTION:
THE ROLE OF REPRODUCTIVE AUTONOMY IN MITIGATING MATERNAL
MORTALITY**

by

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ABSTRACT

The maternal mortality ratio (MMR) in the United States is significantly higher than in countries with similar healthcare spending per capita and continues to rise despite efforts to examine and prevent maternal deaths. Further, the burden of this increased MMR is disproportionately carried by non-Hispanic Black mothers and other race and ethnicity minority populations in the United States. Control over pregnancy is a primary prevention for maternal mortality, however, the examination of the role of contraception access in maternal mortality in the United States is limited. Given the complex history of contraception care in the United States, including a history of coercion and eugenics in minority and vulnerable populations, contraception access and uptake in the US is not simply an issue of supply matching demand. Rates of the most highly effective forms of contraception are lowest in the population of mothers most at risk for maternal mortality. Globally, the role of contraception uptake in lowering maternal mortality is well established and family planning generally is cited as the most powerful intervention to mitigate rising maternal mortality ratios. In the US, population statistics on the role of contraception in maternal mortality are difficult to measure given the relatively low number of deaths when compared to global studies. Instead, a case-by-case review of each maternal death occurs in most states by Maternal Mortality Review Committees

made up by inter-professional expert panels. Most committees use the Maternal Mortality Review Information Application (MMRIA), a common data collection application. The goal of MMRCs and the MMRIA is to identify actionable trends in maternal deaths that could produce policies that work to prevent future deaths. While the MMRIA documents detailed information about maternal death, including the factors which lead to death and how they could be prevented in the future, there is no examination of the role of reproductive choice. Examining access to family planning and contraception with every maternal death would inform prevention policy by identifying barriers to contraception use in cases that lead to pregnancy-related death. The first step in adding a pregnancy prevention section to the MMRIA is a stakeholder analysis to examine key stakeholders and their position on an additional section. The significance of this stakeholder analysis would go beyond this addition to the MMRIA and allow other researchers to suggest additions and changes to the information application with the goal of producing a data collection tool that best informs future maternal mortality prevention policy.

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LIST OF ABBREVIATIONS

ACA	Affordable Care Act
CDC	Center for Disease Control
CPR.....	Contraception Prevalence Rate
DHS.....	Demographic Health Surveys
ERASE MM.....	Enhancing Reviews and Surveillance to Eliminate Maternal Mortality
FPL.....	Federal Poverty Level
IRB	Institutional Review Board
LARC.....	Long-Acting Reversible Contraceptive
MCPR	Modern Contraception Prevalence Rate
MMEIG.....	Maternal Mortality Estimation Inter-Agency Group
MMR.....	Maternal Mortality Rate
MMRC	Maternal Mortality Review Committee
MMRIA.....	Maternal Mortality Review Information Application
NOFO.....	Notice of Funding Opportunity
TFR	Total Fertility Rate

INTRODUCTION

Background

Contraception care in the United States remains a politically charged, heavily debated aspect of a person's health that exists within a complex historical context marred by eugenics and abuse.¹⁻³ Disparities in access to contraception exist across intersectional social determinants of health including socioeconomic status as well as race and ethnicity, and inform a person's reproductive health choices including whether or not they use contraception.⁴ Rates of highly effective contraceptive use are lower in non-Hispanic Black and non-Hispanic White populations resulting in higher rates of contraception failure and unintended pregnancy.⁵

Meanwhile, pregnancy related deaths in the United States rose from 7.2 deaths per 100,000 live births in 1987 to 17.3 deaths per 100,000 live births in 2017.⁶ Countries with similar per capita healthcare expenditure to the US, such as Switzerland, Norway, and Iceland, have maternal mortality rates (MMRs) that are a fraction of the rate in the US – 5.0, 2.0 and 4.0 per 100,000 respectively.^{7,8} The burden of maternal mortality is also not carried equally by US mothers. Instead, it is deeply disparate by race and ethnicity with Non-Hispanic Black, Hispanic, American Indian and Alaskan Native mothers affected at rates 2 to 3 times that of Non-Hispanic White mothers⁶ with MMRs for non-Hispanic Black mothers reaching 39-49 per 100,000 live births in 2013 and 2014.⁹ Beyond mortality, severe maternal morbidity, including a life-threatening diagnosis or undergoing a lifesaving procedure associated with childbearing, occurs twice as often in the deliveries of Black mothers compared to White mothers.¹⁰

Disparities in contraception access and uptake have notable overlap with the disparities seen in maternal mortality ratios in the US. In the same populations where mothers carry a higher burden of maternal mortality, contraception is less financially and culturally accessible.^{4,11} Given that primary prevention for maternal mortality includes choice of whether to become pregnant, or timing pregnancy and child-bearing to when a person's health is optimized for the stress of these states, contraception as primary prevention for maternal mortality is perhaps the most effective way to reduce high MMRs. However, to see contraception access as simply a supply and demand mismatch is to oversimplify the complex historical and socio-political roots of the hurdles to true contraception access, hurdles that need to be identified and deconstructed to improve rates of highly effective contraception uptake in the population of people that carry the highest burden of maternal mortality.

Statement of the Problem

Current research in the US investigating the prevention of maternal mortality, including the review of maternal deaths on a case-by-case basis, focuses on clinical and social pathways from pregnancy to maternal death, but does not examine the potential role of contraception, and thus pregnancy prevention, as primary prevention for maternal death. This is despite the overlap in populations that carry the highest burdens of deaths and the lowest rates of highly effective contraception use.

Hypothesis

Given the overlap in populations who experience higher rates of maternal mortality and lower rates of contraceptive use in the United States, a review of pregnancy prevention as part of each maternal mortality review would increase understanding of barriers to equitable contraception access and guide future maternal mortality primary prevention efforts.

Objectives and Specific Aims

Primary prevention for maternal mortality includes preventing pregnancy, especially in populations where the physiological stress of pregnancy and childbearing puts patients at greater risk of death. Pregnancy intention, timing, and maternal health optimization before pregnancy all have implications in the survivability of the pregnancy, childbirth, and the postpartum period. In the United States, reviews of maternal deaths start with the first prenatal visit when the patient is already pregnant, leaving out discussions about how pregnancy intention and patient pregnancy optimization may have contributed to the maternal death. Introducing discussions about pregnancy prevention into maternal mortality reviews may result in public health initiatives focused on increasing equitable contraception access as a tool for potentially lowering the US MMR.

Specifically, this thesis aims to:

1. Establish the relationship between the populations carrying the greatest burden for maternal mortality and those with low rates of highly effective contraception use.
2. Demonstrate how increased contraception use has been shown to lower maternal mortality rates on a population scale both globally and domestically.

3. Analyze the potential for policy change to add a question about pregnancy prevention to the Maternal Mortality Review Information Application (MMRIA) to better understand the role of reproductive healthcare access in the US MMR on a case-by-case basis.

REVIEW OF THE LITERATURE

Overview

Maternal Mortality and Contraception

While the precise causative factors leading to rising maternal mortality rates (MMRs) in the US have not been identified, there are many factors that have been shown to contribute to these rising rates. These factors, and opportunities for improved contraception access to ameliorate these risks, can be identified in the three stages of a person's reproductive timeline – pre-conception, pregnancy, and postpartum.

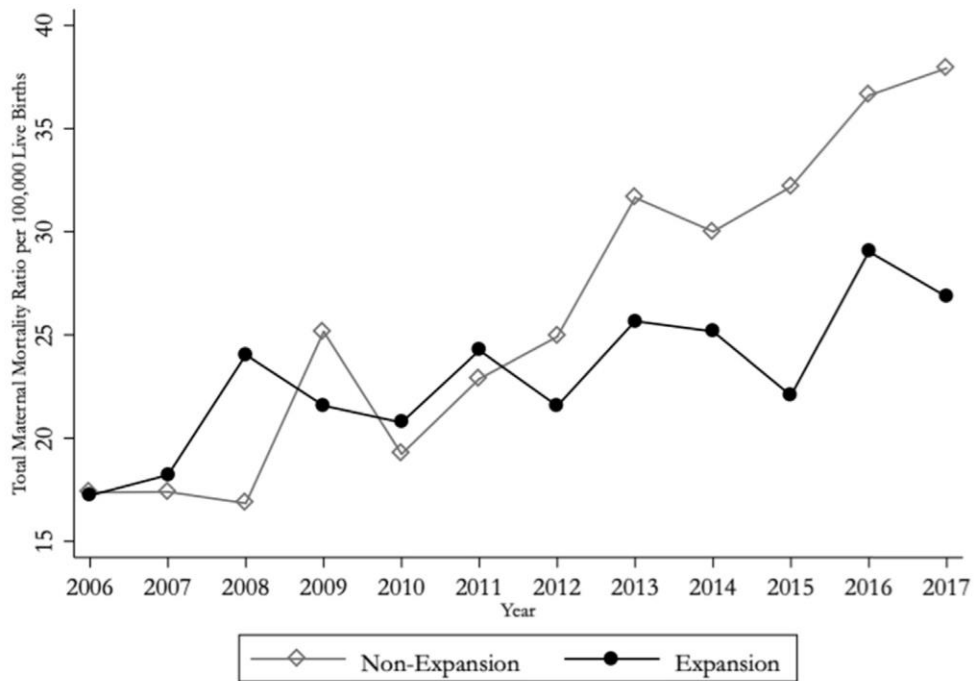
Pre-conception

Comorbidities are significant contributors to what makes a pregnancy high risk. The most commonly cited cause of pregnancy-related death in the US are cardiovascular conditions including cardiomyopathy, hypertension, and thrombotic pulmonary or other embolism.⁶ Pre-existing comorbidities like hypertension, diabetes, or obesity are associated with over 20% of all pulmonary embolisms in a nulliparous person¹² and essential hypertension is an established risk factor for peripartum cardiomyopathy.¹³ In the period, a person's fitness to withstand the stress of childbearing is directly related to their current state of health. With chronic illness in reproductive-aged people on the rise, high risk pregnancies are more common and maternal morbidity and mortality follow suit. Additionally, chronic illness in reproductive-aged people is more common in minority populations, contributing to disparities in maternal morbidity and mortality.^{11,14} However, people of reproductive age with chronic disease are less likely than those without comorbidities to receive prescription contraception.¹⁵ Additionally, people with

chronic medical conditions have higher rates of unintended pregnancy and cite the primary barrier to pre-conception care as conceiving faster than expected. This eliminates the ability to plan for pregnancies and manage chronic disease necessary to improve pregnancy outcomes in mothers with comorbidities.¹⁶

In the US, inadequate access to healthcare is a substantial risk factor contributing to the rising rates of chronic disease among reproductive aged people with unreliable insurance coverage being a main culprit. Uninsured people are generally less healthy; an increased prevalence of preconception health risk factors and a lower prevalence of health promoting indicators results in worse child birth outcomes.¹⁷ Before Medicaid expansion, coverage only applied when a person was already pregnant, often too late to give timely antenatal care and eliminating any opportunity for preconception care. Additionally, coverage ended 60 days after birth, missing 18% of maternal deaths that occur after that window. With the Affordable Care Act (ACA), Medicaid access in some states was expanded to the preconception period, lowering rates of comorbidities such as obesity, diabetes, and heart disease, and long-term coverage after the traditional 60-day post-partum period was made easier to secure. While maternal mortality rates in the US are still rising, states that adopted Medicaid expansion with the ACA had slower rates of increase (*Figure 1*). This effect is especially concentrated in non-Hispanic Black mothers, indicating that expansion is contributing to a reduction in the racial disparities in healthcare access that contribute to maternal mortality.¹⁷

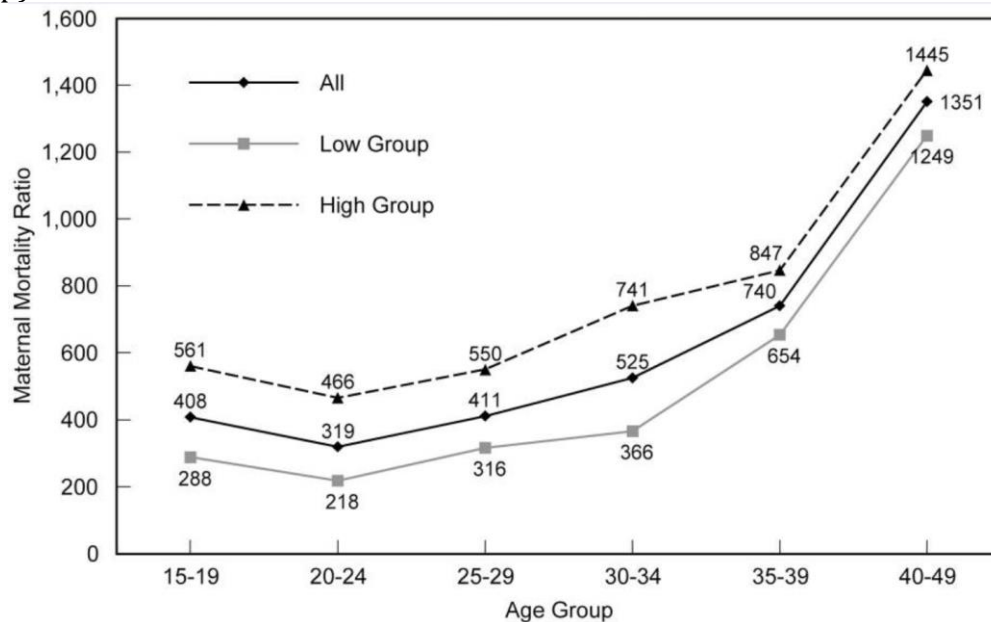
Figure 1. Total maternal mortality ratio by Medicaid expansion status and year.¹⁷



Maternal age is a well-established risk factor for maternal mortality with increased risk in people 30 years of age and older. The increase in the MMR rises steadily with maternal age and is associated with elevated rates of comorbid chronic conditions that make child bearing riskier.¹⁸ Even at extremely advanced maternal age (50-65 years), maternal outcomes are more favorable for healthier people when compared to those with pre-existing disease.¹⁹ While previously cited as a major risk factor for maternal mortality, more recent evidence indicated that the risk of adolescent child bearing (<20) is more dependent on socioeconomic than physiological factors. However, for those below the age of 15, physiological factors such as an underdeveloped pelvis

leading to high-risk deliveries are likely contributory to elevated maternal mortality risks in this age group. This creates a J-shaped curve association of MMR and age with a smaller peak for adolescent mothers than older mothers (*Figure 2*).¹⁸ Patterns in preconception health indicators, including chronic disease, physical activity, current cigarette smoking, and heavy alcohol use, are highest in older mothers, increasing rates of pregnancy complication and maternal mortality.¹⁴ For older people, contraception is seen as a reliable method for reducing high risks births - an increase in the modern contraception prevalence rates (MCPR) is significantly correlated with a decrease in high risk births associated with older maternal age.²⁰

Figure 2. Maternal mortality ratios, all countries, and low and high MMR groups.²¹ The maternal mortality ratio by age is shown for 38 developing countries combined (All) and for two sub-groups: countries where the overall MMR is >500 (High Group) and another that comprises countries where the overall MMR is <500 (Low Group).



Pregnancy

Unintended pregnancy is defined as a pregnancy that occurs when no children or no more children are desired, or the pregnancy is mistimed and occurs earlier than desired.²² Approximately half of US pregnancies are unintended and 37% of all births in the US are unintended.²³ Of these unintended births, a majority are associated with contraceptive nonuse; 60% of mothers in these unintended births did not use contraception in the month of conception.²³ Unintended pregnancy is associated with adverse maternal and infant outcomes including preterm labor, preterm rupture of membranes, premature birth, and low birthweight infants.^{16,24} Additionally, unintended pregnancy is associated with delayed initiation of prenatal care eliminating the opportunity for pre-conception health optimization and reducing the time available to provide specialized care for a pregnancy that may be high risk.²⁵

More than 10% of people at risk of pregnancy between 18-24 years old and 5% of all people with uteruses in the US experience an unplanned pregnancy each year. In 2011, nearly half (45%) of pregnancies were unintended with 27% of all pregnancies mistimed and 15% of all pregnancies unwanted.²⁶ This burden of unintended pregnancies is not shared evenly across racial-ethnic or socio-economic lines, with the Black population experiencing twice the rate of unplanned pregnancies as the White population. People living below 100% of the federal poverty level (FPL) who are at risk of pregnancy experience 5-times the rate of unplanned pregnancies as people with incomes >200% of the FPL. The overall unintended pregnancy rate, the number of unintended pregnancies per 1,000 women aged 15-44, decreased 18% between 2008 and 2011, likely due to an

overall increase in contraception use and an increase in use of highly effective contraception methods.²⁶

Unintended pregnancy and four or fewer prenatal visits are significantly associated with an increase in MMR, indicating that pregnancy intention has implications on pregnancy-related mortality ratios.⁹ Because a majority of unintended births are associated with contraception nonuse during the month of conception and because unplanned pregnancy is associated with adverse maternal outcomes, it can be concluded that poor contraception access, uptake, and unreliable use all contribute to the rising MMR in the US.

When contraception fails or when contraception needs are unmet, access to safe abortion is the next step in reducing maternal mortality. Abortion is a medically safe procedure with a risk of dying after abortion as low as 0.7 deaths per 100,000 pregnancies and 0.3 per 100,000 pregnancies if the abortion is performed in the first 8 weeks with medical professional oversight.¹⁸ Safe abortions in early pregnancy can be done in the primary care setting, in person or via telehealth, and by non-physician providers, increasing accessibility to abortion. However, unsafe abortion is a reality in the US due to increasing legal limitations including unrealistic and medically unfounded time limits or all out bans in some states as most recently and drastically seen with the overturning of *Roe v. Wade*. This overturn starts the wave of “trigger bans” that automatically go into effect to ban abortion in 13 states across the US, with a total of 26 states having foundations for near-complete bans.²⁷ Even in the remaining states that do not have restrictive laws against abortion, access is still hindered by availability of

abortion providers, stigma, and socioeconomic hurdles including cost of procedure, transit, and lost productivity.

Barriers to access as well as delay or denial in care are the main causes of abortion-related mortality globally.¹⁸ Non-evidence-based practices like mandatory waiting periods and required lab testing can delay abortions later into pregnancy, increasing the risk of complications. When an unsafe abortion goes wrong, access to non-judgmental, non-prosecutorial emergency care is not available everywhere but is a necessary step to prevent maternal deaths.^{18,28}

Postpartum

Shorter interbirth intervals are associated with higher risk of maternal mortality. A possible mechanism is a decrease in nutrition status during the post-partum period such as anemia related to pregnancy or blood loss during birth limiting tolerance to blood loss in the next pregnancy and birth.¹⁸ Other factors associated with short birth intervals include unstable lifestyle, low socioeconomic status, postpartum stress, and inadequate use of health care services, all of which are also associated with an increased risk of adverse pregnancy outcomes.²⁹ Short interbirth intervals are attributed to people having intercourse and resuming ovulation prior to their standard 6 week post-partum visit with an OBGYN, a visit where they would have the opportunity to discuss and choose a postpartum contraceptive method.³⁰

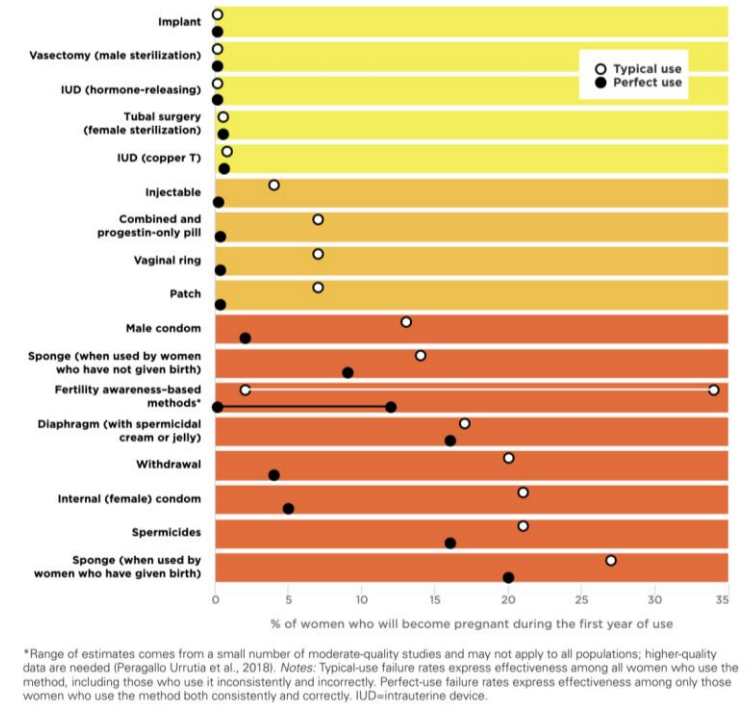
One component of family planning strategies is to prolong interbirth intervals to reduce MMRs. Increasing birth spacing to >18 months decreases the risk of adverse

maternal outcomes, especially in mothers >35 years old.³¹ Contraception use at any time after birth increases the length of the next birth interval by 60%.²⁰ In mothers with chronic medical conditions, mothers in whom unintended pregnancy is extremely high risk, immediate Long-Acting Reversible Contraceptives (LARC) insertion in those who qualify was found to be the most cost effective and efficient method of preventing short birth intervals, optimizing maternal health ahead of future pregnancies. This demonstrates a clear opportunity for post-partum contraception use to increase interbirth intervals and decrease adverse maternal outcomes resulting from a subsequent pregnancy and childbearing.^{18,32}

Contraception Access in the US

Through the lenses of clinical medicine and public health, the potential cost saving benefits and the ability of contraception to provide reproductive autonomy are well established.³³ However, not all contraception methods are equally reliable with effectiveness depending on user error, as well as a person's child-bearing history. With typical use, or use adjusted for user error, the percentage of people who will be pregnant during the first year of contraception use is highly variable, depending on factors such as which method is used and the patient's reproductive history. In people who use the sponge barrier method after giving birth, and therefore have changes in vaginal and uterine anatomy, 27% of people will be pregnant in the first year. This is compared to implantable contraceptives which eliminate user error resulting in only 0.1% of pregnancies in the first year (*Figure 3*).³⁴

Figure 3. Contraceptive failure rates. ³⁴



Contraception failure is measured by this fraction of people who become pregnant in the first year of use. The typical use and perfect use failure rates for contraceptives is higher with barrier methods, like the condom or spermicides, when compared to Long-Acting Reversible Contraceptives (LARCs) that rely on implantation with or without hormone release. Less effective methods of contraception are user dependent with the average typical use rate being 6.29% less than the perfect use rate. Sterilization is also extremely effective with vasectomy having a typical use failure rate of 0.15% while tubal ligation carries a typical use failure rate of 0.5%. Moderately effective methods include hormonal contraceptives that are either injected, taken by mouth, or delivered via transdermal or transmucosal absorption as a patch or a ring. These methods are also user

dependent and have typical use failure rates that average 5.98% lower than their perfect use rates.³⁴

A person's access to contraception in the United States is dictated by many aspects of their identity – the state they live in, their race and ethnicity, community, income, education level, and their own understanding of contraception. Minority and low socioeconomic status people are 2-to-3-times more likely to experience unintended pregnancy due to decreased rates of contraceptive use and increased rates of contraception failure. Adverse family planning outcomes, including abortion, unplanned birth, and teen pregnancy also occur more commonly in minority populations.⁴ Additionally, efforts aimed at improving unintended pregnancy rates, including improving contraception access, disproportionately benefit those of higher socioeconomic status and White people.³⁵ Disparities in access to contraception can be explained by the influence of three main factors – patient preferences and behaviors, provider-related factors, and healthcare system factors.

Patient preferences and behaviors

Contraception is a personal choice, one that is influenced by desired fertility as well as side effect profile. While a nearly fail-safe option, such as an IUD, may be preferable to some people, a more easily reversible method like the pill or non-hormonal method like barrier methods are preferred for many people. Beyond personal choice, the cultural context and history of family planning in the United States has a complexity that sets reproductive equity apart from other disparities in health outcomes. People of low

socioeconomic status and minority groups in the US experience worse outcomes in family planning, disproportionately carrying disparities in both undesired and desired fertility.⁴ The US faces a history of discriminatory beliefs toward low-socioeconomic and minority populations, contributing to family planning programs and policies aimed at reducing the reproductive abilities of discriminated populations including nonconsensual sterilization of poor, minority, mentally ill, and immigrant women.¹ Coercive family planning programs damage the relationship between communities and family planning providers.^{2,3}

Attitudes and understanding about both contraception and pregnancy are seeded in this history and may contribute to disparities in family planning outcomes. Apprehensions surrounding safety concerns and side effects of contraception appear more prevalent in minority communities.³⁶ In the population of people who identify as Black, safety concerns stem from the history of contraception as a population-control tool and from wariness of being used as test subjects to try out new birth control methods.^{2,37} Concern for side effects in the Black-identifying population include menstrual irregularities caused by hormonal contraception and loss of menstruation as a fertility indicator. These concerns differ in the Hispanic-identifying population where people cite emotional changes secondary to hormonal contraception use as their top concern.^{37,38}

The choice of which contraceptive method to use and its variation among racial and ethnic populations may also contribute to varying rates of contraceptive failure. Compared to non-Hispanic White people, people who identify as non-Hispanic Black, Latina and Asian Pacific Islander were more likely to report that the ability to stop using

a method at any time, using a method only during intercourse, and the requirement that the method does not change their menstrual periods as factors that were extremely important for their contraception to have.³⁹ This parallels the finding that Black and Hispanic populations are more likely to report using less effective contraceptive methods compared to the White population seeing that less effective methods are often more user augmentable.⁴⁰

Concerns surrounding contraception, including perceptions about the difficulty or safety of use, may be related to broad societal factors that influence where people get information regarding contraceptive health. Many people in minority communities rely more on information from peers and family when it comes to reproductive health than healthcare professionals, amplifying misinformation and mistrust toward the healthcare system.⁴ Beyond the source of information, it has been found that a lower education level and thus health literacy in low socioeconomic and minority populations is related to a reduced understanding of contraceptives, further exacerbated by the fact that patient information provided regarding contraception is at a high school reading level or above.⁴ However, this may be an over simplification given that even on college campuses, people attribute “not knowing enough” as the greatest perceived barrier to LARC use.⁴¹ Misinformation or lack of general understanding about contraception options can be identified as an intersectional barrier to use.

Provider-related factors

Across the field of healthcare, providers' diagnostic and treatment decisions are influenced by their patients' race or ethnicity, likely contributing to disparities in health outcomes.⁴² Additionally, low socioeconomic status patients are judged more negatively and treated differently than their higher socioeconomic status counterparts.^{43,44} Overall, minority patients and patients with lower levels of education rate their family planning visits more negatively, naming pressure to use contraception and limit their family size as a contributing factor.⁴⁴ These negative patient experiences surrounding contraception and family planning likely contribute to disparities in outcomes; patients who are more satisfied with their relationship with their providers and method of contraception are more likely to continue to consistently use contraception.^{5,45}

Additionally, the varying preferences in the delivery of family planning services also may contribute to disparities in contraceptive use by influencing continuation of care. Poor perception of service quality leading to higher rates of dissatisfaction with family planning care may be related to varying cultural values among racial and ethnic groups. Preferences in clinician gender and clinician continuity are held more strongly in the Latinx population when compared to the White population, likely influenced by values of modesty and the importance of personal social relationships within the culture.⁴⁴ In the ultimate selection of a contraceptive method, in the absence of medical contraindications, how a person wants their provider to participate in the decision making process varies by racial and ethnic groups. Black and Spanish speaking Latinx people, compared to White and English-speaking Latinx people, are more likely to feel that

providers should only share their opinion if it is elicited by the patient. This differential demonstrates the provider's role in individualizing contraception counseling in a way that reflects the patient's unique priorities.⁴⁶

Healthcare systems factors

The unmet need for contraception in the United States continues to be a major cause of unplanned pregnancy. Even with the introduction of Medicaid expansion and Title X programs, a large demand for publicly funded contraception remains. Of all sexually active cis-gender females, it is estimated that half need publicly funded contraception but only 50% of these people are reached under current services. Low socioeconomic and minority cis-gender females are more likely to be uninsured in the US, resulting in a higher likelihood that they will not have access to contraception which largely contributes to the disparities in unintended pregnancy.^{47,48} Elimination of the unmet need for contraception is a cost-effective way to limit unintended pregnancies as seen in the Family PACT program in California. Anyone who can get pregnant and is <200% the Federal Poverty Level (FPL) in CA has free access to family planning services including their choice of contraceptive method. The program's effectiveness is demonstrated in the over 100,000 unintended pregnancies averted each year in California alone. If universal coverage of contraceptive care were expanded to across the US, unintended pregnancy rates would decrease 17% overall, and 28% in the low socioeconomic population.⁴

The Affordable Care Act made strides to expand coverage for prescription contraceptives by eliminating additional cost sharing for people with commercial insurance for at least one FDA approved contraceptive in each category (i.e. pill, ring, IUD, cervical cap, implantation, and sterilization). However, even the ACA expansion of coverage has limitations including slow uptake of new methods, as well as cumbersome pre-approval documentation that requires the provider to obtain approval from insurance before prescribing.⁴⁹

Before the Affordable Care Act, up to 44% of a person's out-of-pocket health care spending went towards contraceptives. For those without commercial insurance, Pregnant Women Medicaid may be their first opportunity for coverage of contraception. For people below the FPL that qualify them for Pregnant Women Medicaid in their state - qualifying income is state dependent and ranges from 133 to 300% FPL - Medicaid coverage begins with pregnancy and ends 60 days after birth. This income qualification is often higher than the one that qualifies a non-pregnant person for Medicaid Expansion in a states that adopted it, making it easier to qualify as a pregnant person.⁵⁰ Federal statute requires that Pregnancy Medicaid covers family planning services, providing an opportunity to increase contraception use for mothers of the 42.1% of US births Medicaid covers. However, this limited timeline of coverage beginning at pregnancy removes any opportunity for pre-conception contraception coverage and truncates postpartum contraception planning and administration.⁵¹

Existing Research

While both the individual topics of contraception use and maternal mortality are well studied on a global scale, the role of contraception use in mitigating maternal mortality in the US is not well established. Existing research focuses on contraception and its benefit on the maternal mortality ratio in lower resource countries and highlights the immense opportunity for contraception access to help reduce the high rates of maternal mortality in these countries. This is likely because the number of maternal mortality cases in lower resource countries is much higher, making it possible to statistically analyze maternal deaths at a population level. This analysis does not extend to higher resource nations likely due to the rarity of maternal mortality in comparison.

More precisely, access to family planning is a form of primary prevention. Thus, to calculate the number of deaths avoided by family planning or to assign the absence of access to family planning as the cause of a maternal death is not possible without sophisticated synthetic estimations that rely on a large sample size. The analytical conundrum of measuring something that has been avoided, or alternatively measuring the impact of a missing factor on an outcome, makes analyzing the specific role of contraception and reproductive autonomy in maternal mortality difficult.

When examining data in the US, contraception is often combined with other measures of reproductive health access, making it difficult to understand the role of contraception access in mitigating the rising maternal mortality rate in the US. Additionally, studies that assess the association between reproductive health access and maternal mortality do not describe how deaths can be averted at the individual level.

Evidence from other countries

Multiple studies have investigated the role of contraception and, more broadly, family planning in averting maternal deaths. Studies examining contraception access, as well as unmet need and their implications on the MMR, in lower resource countries often use the Demographic Health Surveys (DHS) Program. This program has a multi-year history of collecting data using surveys to study health and population trends in over 90 countries. Surveys cover fertility, family planning, maternal and child health, gender, HIV/AIDS, malaria, and nutrition.⁵²

Using data from DHSs from 1985-2013, one study examined trends in high-risk births and their association with the pace of progress in modern contraception prevalence rate (MCPR) in 57 developing countries. This study further broke down contributing factors to MCPR progress using the Blinder-Oaxaca decomposition technique. Results demonstrated that those countries with the fastest progress in MCPR experienced the greatest decrease in high-risk births. High-risk births in a population are directly proportional to the population's maternal mortality rate, thus, a decrease in high-risk births results in a proportional decrease in the MMR. The speed of progress in MCPR was found to be most impacted by family planning programs (63%), followed by economic development (21%) and advancement in women's education (17%). The strengths of this study are in its emphasis on modern contraception, represented by the MCPR, as a specific measure and its relationship with high-risk births. Separating

modern contraception from family planning generally, while also breaking down the contributors to this MCPR, has implications in future policy and research as it points to a specific arm of family planning to focus on. The limitations of this paper lie in its broad assessment of multiple countries simultaneously, eliminating the possibility for analysis of the relationship between MCPR and high-risk birth categories in the context of each country's unique socio-political climate.⁵³

A study by Stover & Ross also used the DHS Project data to examine the relationship between contraception prevalence and high-risk births, this time looking at the distribution of births by risk factors. This was done using both cross sectional and time series comparisons looking at the total fertility rate (TFR) and the distribution of births across risk factor categories followed by an examination of the factors that affect the TFR, including the contraception prevalence rate (CPR). Results found that, as TFR decreases, there is a significant reduction in births with multiple risk factors, high parity births and births to mothers >35 years of age. The effect of contraception use on the percentage of births that are high risk were then estimated. The change in proportion of high-risk births from 75% to nearly 35% resulted in an estimated drop in MMR by 450 – a reduction in maternal deaths per 100,000 directly related to contraception use. This paper importantly identifies the specific role of contraception in reducing high risk births, and thus maternal mortality. The limitations of this paper are again in the ecological fallacy that suggests that because contraception use and improved access to family planning reduce the MMR, contraception use at the individual level would prevent individual maternal death.⁵³

Beyond DHS data, another study applied the counterfactual modeling approach using the Maternal Mortality Estimation Inter-Agency Group (MMEIG) database, the UN World Contraception Use 2010 database, and the UN World Population Prospects 2010 database to measure maternal deaths averted by contraception in 172 countries. Results indicated a 44% decrease in maternal deaths averted by contraception across these 172 countries in the year 2008 alone. Additionally, an added 29% decrease in maternal death could be achieved by satisfying the unmet need for contraception in this population. This study utilized data from many countries, including the US, which revealed that 60.7% maternal deaths were avoided by contraception in the US. While this paper broke down maternal deaths averted from country to country, emphasizing the disparity in contraception access across low and high resource countries, as well as the potential for maternal mortality ratio reduction if this disparity was rectified, its limitations are again in the details. Broadly, the reduction of maternal deaths because of contraception were measured in these 172 countries however the specific mechanism of decreasing maternal deaths with contraception was not identified, thus direct evidence of causality is not possible. This limits the practical applications of this data because specific risk factors for maternal mortality are not identified and thus cannot be targeted by equitable contraception.⁵⁴

Evidence from broader studies in the United States

A quasi-experimental, population-based, difference-in-differences study used National Vital Statistic System microdata mortality files from 2007-2015 to investigate the impact of state-level factors that could be linked to maternal mortality in the US. Particularly, this study examined how fiscal and legislative changes in states that reduce access to family planning and reproductive health services in Planned Parenthood clinics contribute to rising maternal mortality rates in these states. States with a 20% reduction in the proportion of Planned Parenthood clinics were found to have an 8% increase in their maternal mortality. These Planned Parenthood clinic closures impacted people of all racial and ethnic groups, increasing maternal mortality by 6-15%. Planned Parenthood clinics offer family planning and reproductive health services, and closures of these clinics represent consequences of the political, economic, and social climate surrounding reproductive health in the US. This paper successfully demonstrated how state level decisions impact maternal health through the lens of Planned Parenthood clinics but is limited in ability to identify how or when these closures affect a person's decisions related to family planning and reproductive health. Data on how closure of these clinics affects contraception use or birth rates would help determine the specific role of state level policy in maternal mortality.⁵⁵

Evidence from Medicaid Expansion

Medicaid expansion under the Affordable Care Act was associated with an increase in long-acting reversible contraception use among people at risk of pregnancy, as demonstrated by a participant-level retrospective cross-sectional study comparing receipt of contraception before (2013) and after (2014 and 2016) Medicaid expansion. Utilizing electronic health records of patients 15-44 at risk of pregnancy, this study assessed changes in contraception use during ambulatory care visits at community health centers in both expansion and non-expansion states. Medicaid expansion was associated with an absolute adjusted increase in use of LARC methods, especially in adolescents. People who visited a Title X clinic in expansion states had a higher percentage of both moderately effective and most effective contraceptive method use. This increase in LARC method use increased in the years following expansion, with a 0.8 percentage point increase in 2014 from 2013, followed by a 1.6 percentage point increase in 2016 from 2013. The limitations of this study are in its potential bias; populations that utilize the US safety net system from community health centers may not be generalizable.⁵⁸

An increase in LARC use in expansion states has implications in maternal mortality, including extending inter-birth-interval and reducing unintended pregnancies and births. In a different study, the effect of Medicaid expansion under the Affordable Care Act on maternal mortality in the United States was examined through a difference in differences study followed by race/ethnicity stratification between non-Hispanic Black, non-Hispanic White, and Hispanic people. A reduction in maternal mortality by 7.01 maternal deaths per 100,000 live births was found in expansion states relative to non-

expansion states. These effects were concentrated among non-Hispanic Black mothers, emphasizing Medicaid expansion's role in decreasing disparities in maternal mortality. Notably, this paper found that Medicaid expansion lowered maternal mortality in expansion states including and excluding late maternal deaths, identifying the life-saving value of Medicaid past the 60 day Pregnancy Medicare window.¹⁷

Case Only Studies

A study by Berg et al examined 108 pregnancy related deaths reviewed by the North Carolina Pregnancy-Related Mortality Review Committee between 1995-1999. The preventability of these deaths and the method of prevention was determined and then grouped into 4 prevention categories: preconception care, patient actions, system factors, and quality of care. Focusing on preconception care, where deaths were potentially preventable through preconception health optimization and counseling about the risk of pregnancy before conception, this study identified that preconception care could have potentially prevented more than half of the deaths among those with chronic medical conditions. This specific population of people with chronic medical conditions, a population that is growing as the average maternal age increases, require preconception care that may include the recommendation to avoid pregnancy or proceed with an informed decision including the realistic risks of childbearing. Although this paper does not mention contraception by name, primary prevention of pregnancy is discussed as a life saving measure particularly for people with severe chronic disease where pregnancy

is contraindicated. Given the examination of a small number of deaths, and the case-only design, neither association nor causality can be concluded. Future research is warranted on a larger scale, perhaps nation-wide, to assess the preventability of maternal mortality specifically with improved preconception care.⁵⁶

A review of data from the Maternal Mortality Review Information App (MMRIA or Maria) analyzed the findings of 14 Maternal Mortality Review Committees between 2008 and 2017. Key findings included that 2 out of 3 deaths were determined by review panels to be preventable. The proportion of deaths determined to be preventable did not differ significantly between non-Hispanic Black, Hispanic, and non-Hispanic White mothers. This indicates that a majority of deaths reviewed by these 14 committees were preventable independent of race and ethnicity. Leading underlying clinical causes of pregnancy related deaths did, however, differ by race and ethnicity with cardiomyopathy and cardiovascular conditions being the leading causes among non-Hispanic Black mothers and mental health conditions being the leading cause among non-Hispanic White mothers. Data was not sufficient to determine the leading cause in Hispanic mothers. This data's generalizability is limited as it only looks at data from 14 committees as not every state uses MMRIA which biases data toward states that voluntarily adopted this practice. While it does differentiate leading causes of pregnancy related death by race-ethnicity, further research is required to identify methods of prevention.⁵⁷

Summary of Research and Implications

These papers together demonstrate how healthcare coverage may be instrumental in preventing maternal deaths. Both through primary prevention of pregnancy as well as care throughout pregnancy and childbearing, Medicaid expansion allowed people to receive healthcare at all stages of the reproductive timeline. Across the world, family planning, specifically access to modern contraception, decrease the prevalence of high-risk births thus reducing the MMR. In the US, when access to family planning is removed, such as when Planned Parenthood Clinics close, maternal mortality increases. When pregnancy is contraindicated, preconception care, including contraception, is lifesaving. The relationship between contraception access and use is seen in these studies as a part of healthcare or family planning access generally.

In the US, evidence of contraception use as part of maternal mortality prevention research is limited. Despite a high MMR given US healthcare spending per capita, the number of deaths related to pregnancy is small compared to lower resource countries which limits researchers' ability to conduct statistically significant population-based studies.⁶ However, this small *n* does allow for individual case reviews of each maternal death that occurs within one year of pregnancy, as conducted by Maternal Mortality Review Committees across the United States. While preventability of death and the factors relating to the death are determined, the preventability of the pregnancy as a means of preventing maternal death is not discussed.^{59,60} Given one primary prevention of maternal death is to prevent pregnancy, closer inspection of the role of contraception access in maternal mortality is warranted.

METHODS

Study design

This study will be qualitative stakeholder analysis using purposive and snowball sampling to conduct semi-structured interviews with stakeholders in the Maternal Mortality Review Information Application (MMRIA) to identify key players and their stance on the addition of a pregnancy-prevention section to the MMRIA.

Study population and sampling

Identifying initial stakeholders to interview will be achieved by purposive sampling involving compiling a list of key players in the ERASE MM initiative, including the CDC (*appendix 1*). The “snowball” technique will be utilized to identify other stakeholders asking purposively sampled stakeholders to identify other important stakeholders who could aid, or limit, the introduction of this additional section to the MMRIA at the end of the initial interview. This will be done until data saturation is achieved, likely after 75 stakeholders have been interviewed.

Recruiting a wide array of stakeholders from multiple levels, from the CDC to state MMRCs to patient advocacy groups to OBGYN providers in Maternal-Fetal Medicine departments at multiple hospital systems will allow for a diversity in opinion. Stakeholder interviews will be conducted individually or in focus groups, depending on the level of stakeholder and whether a group setting would more accurately reflect a diversity in thought where a single consensus may not be as complete (i.e. a group of OBGYN providers). Stakeholders will be excluded if they are unable to give informed

consent, are non-English speaking, or are part of a vulnerable group (under 18, incarcerated, or in a dependent relationship).

Intervention

The Maternal Mortality Review Information Application (MMRIA) is a quantitative and qualitative data collection tool that was developed by the CDC to create a common language among maternal mortality review committees (MMRC). MMRCs are state-based multidisciplinary committees made up of experts in public health, OBGYN, maternal-fetal medicine, nursing, midwifery, forensic pathology, mental and behavioral health, as well as patient advocacy groups and community-based organizations. These expert panels review each death that occurs within one year of the end of pregnancy and decides whether the death was pregnancy related, if it was preventable, and how it may have been prevented. The goal is to generate recommendations to prevent future deaths and the MMRIA helps standardize this data across states.⁶¹ While MMRCs exist in some form in 49 states, only 42 states use this standardized MMRIA CDC system to review deaths.⁶² The MMRIA and the MMRCs that use it are part of a broader initiative by the CDC, Enhancing Reviews and Surveillance to Eliminate Maternal Mortality (ERASE MM) which stands as an independent Notice of Funding Opportunity (NOFO) within the CDC.

The MMRIA is split into quantitative and qualitative sections housed on an online database, which MMRCs apply to access. The quantitative section compiles data from sources like previous health records and the death certificate, collecting information

about the person's comorbidities, previous healthcare interventions, previous hospitalizations, and the birth itself. Additionally, information such as the person's race, ethnicity, and level of education are also documented. Under a section labeled "Intendedness," data is collected about whether the patient was on birth control, the method, and whether the pregnancy was planned. This data is then condensed to form "Case Narratives" that are presented to interprofessional expert panels.

The qualitative data is represented by the "Maternal Mortality Review Committee Decisions Form" which houses sections that document the committee's discussions about the pregnancy-relatedness and preventability of the death. The preventability of the death is documented both as a "yes" or "no", as well as on a "Chance to Alter Outcome" scale ranging from "Good Chance" to "No Chance." This allows for the degree of preventability to be captured. Deaths are considered preventable if the committee decides that there was at least some chance the death could have been averted by one or more changes to a documented contributing factor.⁶⁰ Contributing factors to the death are determined, as well as the level the factor operates (patient, provider, facility, system, or community level). The panel then recommends a prevention and its expected impact (small to giant).^{63,59}

Data from the MMRIA has generated 2 reports since its creation that summarize qualitative data generated by the MMRC's decision form over multiple years and states. Notably, discussions about the preventability data in both reports are the shortest of all the sections, focusing on percentage of deaths that were determined to be preventable without commenting on trends found in the types of preventive measures recommended.

Given that the focus of the MMRIA is to generate ideas on how to prevent future deaths, the lack of qualitative data analysis about the methods of prevention is a missed opportunity, likely secondary to the relative newness of this data. Both reviews note that a goal for future reviews should be to assess the factors of these deaths that could have been prevented and the methods of future prevention. ^{60,63}

The proposed intervention is to add an additional prevention question to the MMRC's decision form that asks the expert panel the following question: "Was this pregnancy preventable?". Following the existing format of determination of preventability of death, this yes/no question would be followed by an additional scaled question: Chance to prevent this pregnancy with "Good Chance," "Some Chance," "No Chance," and "Unable to Determine" as the proceeding options. This would be followed by a contributing factor worksheet that again mimics the existing preventability of death worksheet including a list of contributing factors and the level they belong to (*appendix 2*). The addition of this question and contributing factors worksheet would allow the panel to focus on the patient's interaction with the healthcare system before this pregnancy to explore what factors lead to the person becoming pregnant. Conversation would be aided by the "Intendedness" portion of the quantitative data section, which documents the person's contraception status and intention of pregnancy. This would allow for a case-by-case review of how primary prevention of pregnancy failed, which would inform committees about the role of contraception in prevention of future deaths.

Study variables and measures

The nature of a stakeholder analysis is to allow the stakeholder to guide the hypothesis. This allows for initial communication with the stakeholder to be open-ended, thus revealing issues that may not be identified by the researcher.⁶⁴ However, setting research goals serves as a guide for stakeholder interviews and helps determine the scope of data collection. The goals of this stakeholder analysis are to identify key stakeholders in the MMRIA and the capacity of their role in implementing changes to the MMRIA questionnaire.

A semi-structured interview format will be used to allow for a baseline degree of standardization in initial communication with stakeholders. The interview guide will be a check list that serves to structure the conversation with stakeholders in a way that is most likely to fulfill the research goal (*appendix 3*). However, interviews will be conducted using open-ended questions with the goal of the interview to operate like a natural conversation. As initiated by the stakeholder, the variability in stakeholder-specific interview topics that will be covered will allow for identification of themes across stakeholders regarding their impressions and concerns about the addition of a pregnancy prevention section of the MMRIA.

Recruitment

Initial contact to stakeholders is a key step in stakeholder analysis as it sets the tone for the rest of the relationship between stakeholder and researcher. Presentation of the research must be strategic in demonstrating a level of viability that allows the

stakeholder to deem the interaction a useful time expenditure. Additionally, the researcher must be deemed independent enough from stakeholders to limit bias in participation and responses.⁶⁴ An initial recruitment email will be sent which presents the researcher as a member of the Boston University School of Medicine and Graduate Medical Sciences and outlines the function of this stakeholder analysis as a means to evaluate the plausibility of adding to the MMRIA. If a response is not received after an initial email, a follow-up email will be sent after the duration of 2 weeks along with a phone call to discuss the importance of the interview. One follow-up email will be sent 2 weeks later if a response is still missing.

Data collection

Qualitative data will be collected using semi-structured interviews. One researcher will meet with an individual stakeholder or a focus group. The interview will be digitally recorded and transcribed verbatim. Before the interview begins, desired anonymity will be determined and how the data collected from the interview will be used will be outlined. The interviewer will guide the conversation to ensure all topics on the checklist are covered but will focus on using open-ended questions to allow for the stakeholder to raise concerns independently. Interviews will last 45 minutes to an hour and will occur face-to-face whenever possible. When impossible, interviews will be conducted using Zoom, Skype or telephone.

As interviews are conducted, secondary documents will arise that were not available to the researcher before meeting with the stakeholder. Secondary documents

include published and unpublished documents, reports, policy statements, internal regulations of organizations, etc. These documents will be analyzed to identify key informants who may act as stakeholders in the MMRIA. Secondary documents will aid in the snowball sampling to identify stakeholders beyond those initially identified.

After the conclusion of the interview, the transcription will be analyzed for emerging themes and the stakeholder's opinions on check-list topics will be summarized. The stakeholder will be given an opportunity to confirm and expand on their opinions by reviewing and responding to a feedback summary document listing their stance on emerging themes and check-list topics. This secondary review allows for clarification and affirmation of the stakeholder's positions.

Data analysis

Verbatim transcripts and feedback summary responses will be analyzed by the primary investigator and one co-investigator who do not have pre-existing relationships with stakeholders. Multiple viewpoints by independent auditors will reduce bias and lean toward a more objective review. Transcriptions and feedback summary responses will be reviewed by each individual analyst and answers to checklist questions will be translated into a Likert scale as outlined in the appendix. Additionally, stakeholder concerns that fall outside the checklist will undergo a thematic analysis, as outlined by Braun and Clarke.⁶⁵ These emerging themes would be added to the checklist questions and scaled using the Likert scale.

This checklist and thematic analysis data, as quantified by the Likert scale, will then be organized into a matrix table that highlights the stakeholder's involvement in the issue, as well as their Likert score correlating with each theme which ultimately represent stakeholder characteristics: interest in an issue, importance the stakeholder gives the issue, positions adopted, and influence (*appendix 4*). The goal of this matrix is to identify each stakeholder's role in the MMRIA and how this role may affect their stance on the addition of a pregnancy prevention section.

Timeline and resources

Boston University Medical Center Institutional Review Board (IRB) approval is estimated to take 2 months. The recruitment of stakeholders and the subsequent interviews is estimated to take 8 months. Simultaneous data analysis will take place to allow for determination of data saturation. Digital recording and transcription technology will be purchased for data collection and subsequent analyzation.

One primary investigator and one co-investigator will be needed to oversee all stakeholder interviewers and act as data analyzers. Three stakeholder interviewers will undergo 5 hours of training to conduct open-ended interviews that collect all checklist data. Interviewers will be responsible for initiating contact with stakeholders, securing interviews, acquiring agreements on anonymity and data usage, and successfully digitally recording the interview. The primary investigator and co-investigator will analyze each interview using the recording and transcription data. Full analysis of data will take 8

months with a final deliverable prepared for dissemination ready 12 months after initiating the study.

Institutional Review Board

The outlined study meets criteria for expedited review by the Boston University Medical Center IRB as it consists of interviews and surveys that involve minimal risk to participants. Therefore, this study meets 45 CFR 46.110 Category 9 criteria for expedited review.

CONCLUSION

Discussion

Maternal Mortality Review Committees are a newer state-run initiative with many states introducing specific review committees in just the last 5 years. In the United States, there is little understanding of why the MMR is relatively elevated given the country's high per-capita healthcare spending and why this elevated MMR is not distributed equally among racial, ethnic, and socio-economic lines. A key limiting factor is that the total number of deaths per year nationwide remains low, limiting statistical analysis of population data. The content of case-by-case review of maternal deaths by MMRCs varied significantly before the introduction of the MMRIA as a common language and data-entry platform, limiting cross comparison between data surrounding maternal deaths in different states. With the MMRIA, review of data can occur between years and across geographic lines, somewhat ameliorating the difficulties of a small sample size.

Data collected by the MMRIA has already contributed significantly to understanding of maternal mortality in the US as evidenced in the two reviews published thus far. However, data surrounding preventability is relatively limited when compared to data about causes of maternal death. The determined preventability of death is described but qualitative analysis on trends of factors contributing to death is missing from reviews. Specifically, the prevention of pregnancy, a primary prevention for maternal mortality, is left out. Actionable preventability data that could be used to lower the MMR in the US is limited despite the aim of the MMRIA to formulate such data. A stakeholder analysis is the first step in identifying how changes to the MMRIA can include preventability data

and how key stakeholders would benefit from a proposed pregnancy-prevention review section of the MMRIA.

A strength of this approach is the generalizability of the resulting data given this analysis would allow for future researchers to more efficiently target key stakeholders to suggest changes in the MMRIA that may perhaps result in more robust data surrounding maternal mortality and, therefore, more informed future prevention policy. The MMRIA's use as a common language data collection tool for maternal mortality review is becoming more widely adopted, making it the appropriate target for improved preventability data collection because aggregation of data from across state lines makes the cumulative data potentially more robust. But a stakeholder analysis is only the first step in this process, closely followed by additional research focused on determining the validity of the proposed preventability section. The limitations of this study are in the purposive sampling which, despite efforts to establish familiarity with the issue, is limited by the researcher's understanding of maternal mortality review in the US.

Summary

The United States has a relatively high MMR compared to countries with the same per-capita healthcare expenditure and burden of this high MMR falls disproportionately on minority racial and ethnic groups. Equitable contraception access, including financial access, autonomous patient understanding of available methods, and availability of culturally competent healthcare providers, is also not ensured in the United States. The populations who lack access to equitable contraception care overlap with

those that carry higher burdens of maternal mortality in the United States. On a global scale, contraception and family planning efforts have been found to have a significant role in lowering maternal mortality ratios and maternal deaths averted by contraception are significant.

On the domestic scale, the role of contraception in preventing maternal deaths is more difficult to quantify because of the relatively small number of maternal deaths, making statistical significance difficult to obtain. However, methods are in place to gather qualitative data in the form of Maternal Mortality Review Committees (MMRCs) that use the common Maternal Mortality Review Information Application (MMRIA). This qualitative data collection tool serves as a common language used among MMRCs to document details about maternal deaths including whether they were pregnancy related, if they could have been prevented, and the factors of each death that could have been prevented. Discussion about pregnancy prevention, a primary prevention for maternal mortality, is not included in the MMRIA and, thus, information about pregnancy intention, barriers to contraception use, or contraception failure are not part of these expert panels recommendations for preventing future maternal deaths.

Public health significance

A stakeholder analysis to examine key stakeholders in the MMRIA and their stance on adding a pregnancy prevention section to the MMRIA is the first step in gathering qualitative data about contraception access, limits to such access, and the implications of these limits on maternal mortality in the United States. By identifying

stakeholders and their respective influence, interest, and position regarding the addition of a new section, a better understanding of how changes to the MMRIA may be made will be obtained. With this information, the MMRIA tool may be altered to better fulfill its goal of producing targetable data for public health initiatives that prevent maternal mortality, starting with equitable contraception access as primary prevention.

In today's uncertain environment surrounding reproductive autonomy, especially considering the Supreme Court's decision on *Dobbs v. Jackson Women's Health Organization*, contraception is an even more important tool in promoting reproductive autonomy and reducing maternal mortality. When safe, accessible, and affordable abortions are no longer available, prevention of pregnancy to reduce the number of mistimed, unplanned, and unwanted pregnancies becomes the most important health promotion tool we have in mitigating the risk of maternal mortality significantly increased in these pregnancies. Across America, *Dobbs v. Jackson* removes access to abortion, making contraception the only guaranteed method of control over pregnancy for many people. Given this development, a more robust understanding of the failings of contraception and pregnancy prevention in cases of maternal death, and how such cases can be better prevented in the future, becomes more vital than ever in mitigating future maternal deaths.

APPENDIX 1

Purposive sampling of stakeholders in the ERASE MM initiative.⁶¹

United States Government Organizations	Center for Disease Control: Division of Reproductive Health
	42 Maternal Mortality Review Committees the use the MMRIA ^{62,66}
	The Alabama Maternal Mortality Review Committee
	The Alaska Maternal and Child Death Review
	The Arizona Maternal Mortality Review Committee
	The Arkansas Maternal Mortality Review Committee
	The Colorado Maternal Mortality Prevention Program
	The Connecticut Maternal Mortality Review Committee
	The Delaware Maternal Mortality Review Panel
	The Georgia Maternal Mortality Review Committee
	The Hawaii Maternal Mortality Review Committee
	The Idaho Maternal Mortality Review Committee
	The Illinois Maternal Mortality Review Committee
	The Illinois Maternal Mortality Review Committee on Violent Deaths
	The Indiana Maternal Mortality Review Committee
	The Iowa Maternal Mortality Review Committee
	The Kansas Maternal Mortality Review Committee
	The Kentucky Maternal Mortality Review Program
	The Louisiana Pregnancy Associated Mortality Review
	The Maryland Maternal Mortality Review Committee
	The Massachusetts Maternal Mortality & Morbidity Review Committee
	The Michigan Maternal Mortality Surveillance
	The Minnesota Maternal Mortality Review
The Mississippi's Maternal Mortality Review Committee	
The Missouri Pregnancy Associated Mortality Review Board	
The Nebraska Child and Maternal Death Review Team: Maternal Mortality Review Sub-Committee	
The New Hampshire Maternal Mortality Review Committee	
The New Jersey Maternal Mortality Review Committee	
The New Mexico Maternal Mortality Review Committee	
The New York Maternal Mortality Review Initiative	
The New York City Department of Health and Mental Hygiene: Maternal Mortality and Morbidity Review Committee	
The North Carolina Maternal Mortality Review Committee	

	The Ohio Pregnancy-Associated Mortality Review
	The Oklahoma Maternal Mortality Review Committee
	The Oregon Maternal Mortality and Morbidity Review Committee
	The Pennsylvania Maternal Mortality Review Committee
	The Rhode Island Pregnancy and Post-Partum Death Review Committee
	The South Carolina Maternal Mortality and Morbidity Review Committee
	The Tennessee Maternal Mortality Review Program
	The Utah Perinatal Mortality Review
	The Virginia Maternal Mortality Review Team
	The Washington State Maternal Mortality Review Panel
	The West Virginia Infant and Maternal Mortality Review Process
	The Wisconsin Maternal Mortality Review Team
	National Center for Fatality Review and Prevention: Fetal and Infant Mortality Review
	Building US Capacity to Review and Prevent Maternal Deaths
	Maternal and Child Health Bureau: Health Resources and Services Administration
Special Interest Groups	Childbirth Connection Program
	Preeclampsia Foundation
	Merk for Mothers Program
Professional Membership Groups	Association for Maternal and Child Health Programs
	Association of Women’s Health, Obstetrics, and Neonatal Nurses
	American Hospital Association
	American Medical Association
	American College of Nurse Midwives
	American College of Obstetrics and Gynecologists: Alliance for Innovation of Maternal Health
Clinical Teams	Hospital-based departments of Maternal and Fetal Medicine in states where the MMRIA is used
Patient Advocacy Groups	The National Birth Equity Collaborative
	March of Dimes: Equitable Maternal Health Coalition
	Maternal Mortality and Morbidity Advocates (MoMMA)

APPENDIX 2

MMRIA qualitative section on committee determination of preventability of death.

MATERNAL MORTALITY REVIEW COMMITTEE DECISIONS FORM v19 2																																											
COMMITTEE DETERMINATION OF PREVENTABILITY <small>A death is considered preventable if the committee determines that there was at least some chance of the death being averted by one or more reasonable changes to patient, family, provider, facility, system and/or community factors.</small>																																											
WAS THIS DEATH PREVENTABLE? <input type="checkbox"/> YES <input type="checkbox"/> NO																																											
CHANCE TO ALTER OUTCOME <input type="checkbox"/> GOOD CHANCE <input type="checkbox"/> SOME CHANCE <input type="checkbox"/> NO CHANCE <input type="checkbox"/> UNABLE TO DETERMINE																																											
CONTRIBUTING FACTORS AND RECOMMENDATIONS FOR ACTION (Entries may continue to grid on page 5)																																											
CONTRIBUTING FACTORS WORKSHEET <small>What were the factors that contributed to this death? Multiple contributing factors may be present at each level.</small>	RECOMMENDATIONS OF THE COMMITTEE <small>If there was at least some chance that the death could have been averted, what were the specific and feasible actions that, if implemented or altered, might have changed the course of events?</small>																																										
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #2c3e50; color: white;"> <th style="width: 10%;">LEVEL</th> <th style="width: 25%;">CONTRIBUTING FACTORS (choose as many as needed below)</th> <th style="width: 25%;">DESCRIPTION OF ISSUE (enter a description for EACH contributing factor listed)</th> <th style="width: 20%;">COMMITTEE RECOMMENDATIONS [Who?] should [do what?] [when?] Map recommendations to contributing factors.</th> <th style="width: 10%;">PREVENTION LEVEL (choose below)</th> <th style="width: 10%;">EXPECTED IMPACT (choose below)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">PATIENT/FAMILY</td> <td></td> <td></td> <td></td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> </tr> <tr> <td style="text-align: center;">PROVIDER</td> <td></td> <td></td> <td></td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> </tr> <tr> <td style="text-align: center;">FACILITY</td> <td></td> <td></td> <td></td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> </tr> <tr> <td style="text-align: center;">SYSTEM</td> <td></td> <td></td> <td></td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> </tr> <tr> <td style="text-align: center;">COMMUNITY</td> <td></td> <td></td> <td></td> <td style="text-align: center;">▼</td> <td style="text-align: center;">▼</td> </tr> </tbody> </table>	LEVEL	CONTRIBUTING FACTORS (choose as many as needed below)	DESCRIPTION OF ISSUE (enter a description for EACH contributing factor listed)	COMMITTEE RECOMMENDATIONS [Who?] should [do what?] [when?] Map recommendations to contributing factors.	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APPENDIX 3
Semi-structured interview checklist.

<i>Characteristic</i>	Stakeholder:	<input type="checkbox"/> Individual <input type="checkbox"/> Group	Level: <ul style="list-style-type: none"> <input type="checkbox"/> US Government Organization <input type="checkbox"/> Special Interest Group <input type="checkbox"/> Professional Membership Group <input type="checkbox"/> Clinical Team <input type="checkbox"/> Patient Advocacy Group
<i>Involvement in the Issue</i>	Describe your role in preventing Maternal Mortality.		
<i>Interest in the issue</i>	How do you use the data produced by the MMRIA?		
	What do you find most useful about the MMRIA?		
	How is qualitative data about prevention of maternal death useful to you?		
<i>Influence/power</i>	Describe your involvement with the MMRIA.		
	What would you change about the MMRIA? How would you make that change?		
<i>Position</i>	After reviewing the proposed addition to the MMRIA, how likely are you to support these changes?		
	How would you alter the addition to be more useful to you?		
<i>Impact of issue on actor</i>	How would an addition to the expert panel discussion form change the way you use the MMRIA?		
	How would you use data about the preventability of pregnancies that resulted in maternal death?		

APPENDIX 4

Stakeholder matrix with Likert Scales.

Stakeholder	Involvement	Interest in issue	Influence/power	Position	Impact of issue on
	<i>Free text</i>	<input type="checkbox"/> Low <input type="checkbox"/> Low-medium <input type="checkbox"/> Medium <input type="checkbox"/> Medium-high <input type="checkbox"/> High	<input type="checkbox"/> Low <input type="checkbox"/> Low-medium <input type="checkbox"/> Medium <input type="checkbox"/> Medium-high <input type="checkbox"/> High	<input type="checkbox"/> Opposed <input type="checkbox"/> Non-mobilized <input type="checkbox"/> Supportive with major changes <input type="checkbox"/> Supportive with minimal changes <input type="checkbox"/> Supportive	<input type="checkbox"/> Low <input type="checkbox"/> Low-medium <input type="checkbox"/> Medium <input type="checkbox"/> Medium-high <input type="checkbox"/> High

LIST OF JOURNAL ABBREVIATIONS

Am J Obstec Gynecol	American Journal of Obstetrics and Gynecology
Am J Prev Med	American Journal of Preventative Medicine
Am J Public Health	American Journal of Public Health
Ann Epidemiol	Annals of Epidemiology
Curr Opin Obstet Gynecol	Current Opinion in Obstetrics and Gynecology
Health Educ Behav	Health Education and Behavior
Health Policy Plann	Health Policy and Planning
Fam Plann Perspect	Family Planning Perspectives
Int Fam Plan Perspect	International Family Planning Perspectives
Int J Gynaecol Obstet	International Journal of Gynaecology and Obstetrics
JAMA	Journal of the American Medical Association
Matern Child Health J	Maternal and Child Health Journal
MMWR Surveill Summ	Morbidity and Mortality Weekly Report Surveillance Summaries
Obstet Gynecol	Obstetrics and Gynecology
Perspect Sex Reprod Health	Perspectives on Sexual and Reproductive Health
PLOS ONE	The Public Library of Science
Pract Res Clin Obstet Gynaecol	Best Practice and Research Clinical Obstetrics and Gynaecology
Semin Perinatol	Seminars in Perinatology

Soc Sci Med

Social Science and Medicine

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CURRICULUM VITAE

