

Strategies to Reduce Maternal Mortality and Morbidity

Evidence Review Findings: Needs Further Study

Strategies to reduce maternal mortality and morbidity need further study to make a conclusion about their impact on outcomes for families during the prenatal-to-3 period. Observational studies suggest that some strategies may effectively reduce maternal mortality and morbidity, but causal study designs are necessary before a conclusion can be made. Further, these strategies have been studied primarily at the hospital level, rather than the state level; therefore, the evidence does not provide clear guidance for statewide action to reduce maternal mortality and morbidity.

Maternal mortality rates in the United States have increased significantly over the past two decades, despite declines in rates across other developing countries.^{1,2} Birth outcomes also vary considerably across racial groups – Black women in the United States are three to four times more likely than White women to die from pregnancy-related causes,⁴ and twice as likely to experience severe maternal morbidity.³ States can implement a number of different strategies at the systems-, hospital-, and individual-level to reduce maternal mortality and morbidity rates. Systems-level approaches engage state, hospital, public health, and other leaders to collectively implement comprehensive initiatives. Hospital-level approaches aim to improve medical practices to reduce the incidence of specific medical problems. Individual-level approaches focus on individual patients' unique social and situational factors. Because the underlying causes of maternal mortality and morbidity are complex, policy solutions can address the root causes at each of these levels to improve outcomes for women and reduce racial disparities in birth outcomes.

What Are Strategies to Reduce Maternal Mortality and Morbidity?

Rates of maternal mortality and morbidity are climbing in the United States,¹ and states across the country have begun to implement policies aimed at improving birth outcomes for mothers to prevent maternal mortality and morbidity. Maternal mortalityⁱ is defined as the death of a woman while pregnant, at delivery, or up to one year postpartum, with rates of mortality split approximately equally across these three time periods.² The leading medical causes of maternal mortality vary by time period, though heart disease and stroke are the leading causes of maternal deaths overall.² Cause of death also varies by race, with more Black women than White women dying from hypertension and embolisms.⁶ An estimated 60 percent of maternal deaths in the United States are considered preventable.⁷ Maternal morbidity is defined as health complications occurring during labor and delivery that result in significant negative consequences to a mother's health.³ Over the past 20 years, the national rate of maternal mortality in the United States has increased between 50 and 70 percent, and the rate of severe maternal morbidityⁱⁱ has more than doubled.¹ Although rates of maternal mortality and morbidity have increased in the United States, they have declined in other developing countries.²

To reduce rates of maternal mortality and morbidity, strategies at the federal and state levels have focused on addressing the complex causes of the problem. These strategies can be categorized as systems-, hospital-, and individual-level approaches. Systems-level approaches bring together state leaders, clinicians, hospital leaders, public health leaders, community members, insurers, and others for collective implementation of initiatives. These approaches act as an “umbrella” to strategies at the hospital and individual levels. One example of a systems-level approach is maternal mortality review committees (MMRCs), which operate at the state level to identify and analyze maternal deaths, disseminate findings, and develop recommendations.⁷ By collecting and analyzing a combination of vital statistics records and sources such as medical and social services records,⁸ MMRCs provide unique insights to inform quality improvement initiatives. Perinatal quality collaboratives (PQCs), another systems-level approach, are state networks of multidisciplinary teams that promote evidence-based clinical practices to improve maternal and infant health.⁹ PQCs are considered by some to be the “action arm” of MMRCs because they can translate MMRC findings into clinical reforms.¹⁰ Additionally, states can enroll in the Alliance for Innovation on Maternal Health (AIM), which aligns national-, state-, and hospital-level efforts to improve maternal health and safety using evidence-based patient safety bundles of medical practices.¹¹

Approaches at the hospital level focus on strategies that overhaul practices and procedures in hospitals. Toolkits and bundles aim to reduce rates of maternal mortality and morbidity by standardizing hospital care and practices and include articles, guidelines, and educational documents aimed at addressing specific medical causes of maternal mortality and morbidity, such as preeclampsia and obstetric hemorrhage.⁹ Because they are organized in a systematic manner, these tools should be easier for hospitals to implement successfully.⁹ With more protocolized responses to maternal health complications, some of the racial disparities in maternal mortality and morbidity may be addressed, as there should be less space for disparate medical treatment.¹² Another hospital-level approach to reducing maternal mortality and morbidity is anti-bias training, which aims to combat racism and unequal treatment in the health care system.⁷ Trainings teach current and aspiring medical professionals to be affirming of and sensitive to cultural differences.⁷ In theory, this training should make clinicians treat patients of color more equitably, thereby narrowing racial gaps in maternal health outcomes. AIM and the California Maternal Quality Care Collaborative (CMQCC) have begun to wrap anti-bias training into new toolkits, bundles, and quality improvement initiatives that are aimed at addressing racial and ethnic disparities in maternal and infant health outcomes.^{13,14}

Approaches at the individual level focus on addressing the unique needs of individual patients. One example is funding for doula services, such as through Medicaid, which can expand access to doula services for those who might not otherwise be able to afford such services. Doulas are trained, nonmedical professionals who provide physical, emotional, and

ⁱ Maternal mortality is defined by the Centers for Disease Control and Prevention (CDC) as “the death of a woman while pregnant or within 1 year of end of pregnancy—regardless of the outcome, duration, or site of pregnancy—from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.”

ⁱⁱ Severe maternal morbidity, according to the CDC, includes “unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a woman's health.” Examples of severe maternal morbidity include the following pregnancy-related health issues: obstetric hemorrhage with 4 or more units of red blood cells transfused, eclampsia and pre-eclampsia, any emergency/unplanned peripartum hysterectomy, deep vein thrombosis or pulmonary embolism, septic shock, peripartum cardiomyopathy, and epidural hematoma.

educational support to mothers before, during, and immediately following childbirth.¹⁵ They can work alongside medical professionals to help advocate for patients' needs. Doula services aim to be affirming and supportive of cultural differences, increasing attention to the needs of women of color, which may narrow racial disparities in adverse maternal health outcomes.

Who Is Affected by Strategies to Reduce Maternal Mortality and Morbidity?

Each year, approximately 700 US women die from pregnancy-related complications, and thousands more experience severe maternal morbidity.² Racial disparities are stark: Black women die from pregnancy-related causes at three to four times the rate of White women³ and are twice as likely as their White counterparts to experience severe maternal morbidity.⁴ These racial disparities persist across educational level and socioeconomic status.⁵

What Are the Funding Options for Strategies to Reduce Maternal Mortality and Morbidity?

Funding for strategies to reduce maternal mortality and morbidity can come from a range of providers, and can support systems-, hospital- and individual-level strategies. At the systems level, for example, states currently fund MMRCs, and federal grants also provide funding to establish and support existing MMRCs in states.¹⁶ Additional examples of funding for systems-level strategies include federal funding from the Maternal and Child Health Bureau (MCHB) to support AIM,¹¹ private funding to support public-private partnerships in California, and philanthropic funding from Merck for Mothers to support a range of systems-level initiatives in states across the country.¹⁷ At the hospital level, state, local, federal, and private funding can be used to fund efforts such as toolkits and bundles and anti-bias training. At the individual level, state Medicaid dollars can fund doula support in those states that allow Medicaid to reimburse for doula services. Philanthropic dollars can fund other individual-level initiatives, such as Merck for Mothers' funding for community-based organizations through its Safer Childbirth Cities initiative.¹⁸ Other individual-level approaches can be funded by state, local, federal, and corporate sources. Though funding sources can vary significantly by strategy, state, federal, and philanthropic funding play particularly substantial roles in supporting efforts to reduce maternal mortality and morbidity.

Why Should Strategies to Reduce Maternal Mortality and Morbidity Be Expected to Impact the Prenatal-to-3 Period?

Because the underlying causes are complex, maternal mortality and morbidity have no singular policy solution.⁷ Although many of the medical causes may be best addressed with hospital-level solutions, other underlying causes, including social risks that drive racial disparities in birth outcomes, may require systems- or individual-level interventions.¹ Systems-level approaches aim to address the underlying causes of maternal mortality and morbidity from a variety of angles by engaging a broad range of key players. By doing so, they may address a wide range of root causes that, collectively, may reduce maternal mortality and morbidity more holistically than standalone or targeted strategies. Hospital-level approaches rely upon more targeted interventions to address specific medical problems by improving medical practices; they tend to focus less upon preventative measures that may be better addressed by individual-level or even systems-level approaches. Finally, individual-level approaches tend to focus on social and situational factors that individual people face. They aim to increase advocacy and support the unique needs of individual mothers, which may be especially beneficial to women of color, to reduce maternal mortality and morbidity.

Decades of research in the field of child development have made clear the conditions necessary for young children and their families to thrive.¹⁹ These conditions are represented by our eight policy goals, shown in Table 1. The goals with which strategies to reduce maternal mortality and morbidity are theoretically aligned are indicated below.

Table 1: Policy Goals Theoretically Aligned with Strategies to Reduce Maternal Mortality and Morbidity

Aligned	Policy Goal
	Access to Needed Services
	Parents' Ability to Work
	Sufficient Household Resources
	Healthy and Equitable Births
	Parental Health and Emotional Wellbeing
	Nurturing and Responsive Child-Parent Relationships
	Nurturing and Responsive Child Care in Safe Settings
	Optimal Child Health and Development

What Impact Do Strategies to Reduce Maternal Mortality and Morbidity Have, and for Whom?

To date, there have been no studies on strategies to reduce maternal mortality and morbidity that meet the standards of strong causal evidence for this review. Additionally, no studies have evaluated the causal relationship between strategies to reduce maternal mortality and morbidity and reductions in racial disparities. Several observational studies point to correlations between specific strategies and reductions in maternal mortality and morbidity, but their findings should be interpreted with caution due to their study designs, analytic methods, and small sample sizes. Further, many studies on doulas examine outcomes other than maternal mortality and morbidity, such as maternal mental health, which are outside the scope of this evidence review. The observational evidence is the subject of the review below, which summarizes findings as relevant to our studied policy goals.

Healthy and Equitable Births

One observational study of California's efforts to reverse upward trends in maternal mortality showed that during a period of collaboration between the California Department of Public Health, the California Maternal Quality Care Collaborative, and the California Hospital Association, the maternal mortality rate in California fell by 50 percent while continuing to climb across the rest of the United States.⁹ Though the evidence is not from a rigorous evaluation, it is unlikely that such a dramatic change would have happened by chance, especially as rates continued to increase across the rest of the country. Additionally, it is difficult to design a rigorous evaluation of this kind of systems-level change, so observational data is especially important when considering the impact of such a collaboration on outcomes for mothers. Another observational study examining the effects of California's efforts explored the racial disparities in maternal mortality over time and found that although maternal mortality rates decreased for all racial groups, gaps between Black and White women did not narrow.¹

Two often-cited observational studies of toolkits and bundles in large hospital systems found reductions in rates of maternal morbidity at "pilot" versus "comparison" hospitals over time;^{23,24} however, these studies failed to sufficiently control for pre-existing differences in hospital characteristics between groups. Another observational study explored the effect of a bundle on racial disparities in post-cesarean surgical site infections and found no significant interaction by race, but the study was limited by a small sample size and lack of adequate controls.²⁵

An observational study of Medicaid-funded, doula-supported births among a predominantly Black sample of mothers found that doula-supported births had significantly lower odds of cesarean delivery, which can increase risk associated with birth, than births without doula support.²¹ The analyses in that study were limited by sample construction issues,

however, and should be interpreted with caution. Similarly, a comparison between doula-supported adolescent births and national rates showed that those with doula-supported births had lower rates of cesarean delivery and premature births than the national average.²⁸

Parental Health and Emotional Wellbeing

Observational studies suggest that MMRCs can play a role in properly identifying root causes of maternal deaths to create sound recommendations,^{1,26,27} but these studies did not employ designs that allow for causal conclusions, instead examining qualitative data or analyzing the implementation of such review committees. Key underlying causes identified by these committees include quality of hospital care,^{1,26} quality of prenatal education and care,^{26,27} and patient factors related to social determinants.^{1,27}

Is There Evidence That Strategies to Reduce Maternal Mortality and Morbidity Reduce Disparities?ⁱⁱⁱ

To date, no studies meeting the standards of causal evidence for this review have explored if strategies to reduce maternal mortality and morbidity also reduce racial disparities. Trend analysis in California found that reductions in maternal mortality and morbidity overall did not reduce racial disparities,¹ but methodologically rigorous research across a range of geographic locations is needed. The lack of impact on racial disparities in the California study may be in part due to the relative success California had in identifying the medical risks that lead to maternal mortality, compared with the challenge of identifying social risks, such as racism, that contribute to maternal mortality and morbidity among Black women. One observational study found positive effects of doula support among Black mothers covered by Medicaid,²¹ but differential effects of doula support on maternal mortality and morbidity by race have not been adequately examined in the literature.

Has the Return on Investment for Strategies to Reduce Maternal Mortality and Morbidity Been Studied?

No strong causal studies have investigated the return on investment associated with strategies to reduce maternal mortality and morbidity, but observational studies have modeled potential cost savings and found that such strategies can be cost effective. One observational study, which examined outcomes of Medicaid-funded doula-supported births in Minneapolis, conducted simulations of annual cost impacts of similar programs across the country based on: the number of Medicaid-funded births, the cesarean rate of those births, and annual Medicaid payments to hospitals for childbirth, assuming similar reductions in cesarean delivery in all states.²¹ Simulation results showed that at a \$100 reimbursement rate for doula services, three-quarters of states would see cost savings and that savings may be as high as \$9 million for half of states. For a \$200 reimbursement rate, researchers estimated half of states would see cost savings, with a quarter experiencing savings as high as \$2.5 million. Another observational study of doulas, which looked at professional in-hospital labor support doulas in Wisconsin, found that the program would yield an estimated \$424.14 in savings per delivery, and as much as \$530.89 per low-risk delivery, though researchers mentioned that Medicaid reimbursement rates would be necessary to estimate the overall return on investment of the program.²⁰ A more comprehensive analysis of the return on investment is forthcoming.

What Do We Know, and What Do We Not Know?

The body of research to date on strategies to reduce maternal mortality and morbidity does not meet the standards of causal evidence for this review. The study designs and analytic methods of the existing research prevent causal conclusions about the effectiveness of any one strategy at reducing these outcomes. Though there is observational evidence on the impact of toolkits and bundles in reducing maternal morbidity, the evidence is not sufficient to infer causality. It should be noted, however, that it is challenging to rigorously evaluate systems-level change of this kind. Natural variation among states implementing policies to address maternal mortality and morbidity may offer an opportunity to examine the impacts of different policies on outcomes for women. Forthcoming comprehensive reviews

ⁱⁱⁱ Disparities are defined here as differential outcomes by race, ethnicity, or socioeconomic status (SES).

will examine the impact of these strategies on outcomes other than maternal mortality and morbidity, but such potential impacts are outside the scope of this review.

Future research on strategies to reduce maternal mortality and morbidity should use more rigorous study designs and analytic methods to support causal conclusions, which can help to build a strong evidence base. Furthermore, research is needed on the indirect and direct pathways through which strategies such as doula support, anti-bias training, and other individual-level approaches may affect maternal mortality and morbidity, since existing studies largely focus on intermediate or proxy measures (e.g., cesarean delivery rates, protocol uptake). Additionally, recently enacted state policies (e.g., legislation mandating and funding MMRCs,²⁹ legislation mandating implicit bias training for perinatal health care professionals³⁰) should be rigorously evaluated to understand their impact on maternal mortality and morbidity.

The largest gap in the research on strategies to reduce maternal mortality and morbidity is the lack of evidence of their ability to reduce racial disparities. Future studies should examine if and how strategies at all levels close racial gaps in maternal health outcomes.

Are Strategies to Reduce Maternal Mortality and Morbidity an Effective Policy for Improving Prenatal-to-3 Outcomes?

To date, no rigorous evidence exists to draw a conclusion on the effectiveness of strategies to reduce maternal mortality and morbidity and therefore, improve outcomes for families in the prenatal-to-3 period. There has yet to be any strong causal evidence on this topic, nor any rigorous study of statewide policies to provide guidance to states. Observational studies, however, suggest that such strategies can be effective at reducing rates of maternal mortality and morbidity, and evidence from California may be informative to other states looking to implement similar policies. Further studies should investigate the relationship between statewide policies to address maternal mortality and morbidity and maternal mortality and morbidity outcomes, exploring the potential impact for families in the prenatal-to-3 period.

How Do Strategies to Reduce Maternal Mortality and Morbidity Vary Across the States?

States vary significantly in the initiatives they have employed to address maternal mortality and morbidity, though the majority of states have begun to work at the systems level by funding and developing PQC, participating in AIM, and funding and developing MMRCs. Today, MMRCs and PQC are fairly ubiquitous across the United States. As of 2020, 40 states^{iv} have active PQC and 44 states have active MMRCs (see table 2 below for details). On the other hand, progress on policies regarding doula care is still building across the country – only four states currently allow for Medicaid to reimburse for doula care.

California is the only state that has successfully reversed trends in maternal mortality. Between 2006 and 2013, while the maternal mortality rate continued to climb across the United States, California's rate dropped by 50 percent.⁹ The thoroughness of California's strategy, its use of rapidly updated and accessible data systems, and its ability to bring together a range of stakeholders under a shared vision may serve as a model to other states.⁹ To address persistent racial disparities in maternal mortality, the California Maternal Quality Care Collaborative launched the California Birth Equity Collaborative in January 2019, and an evaluation of this collaborative is ongoing.³⁰

^{iv} State counts included the District of Columbia.

Table 2: State Variation in Strategies to Reduce Maternal Mortality and Morbidity

State	Variation			
	State Has an Active Perinatal Quality Collaborative	State Has a Maternal Mortality Review Committee and Is Reviewing Cases	State Participates in the Alliance for Innovation on Maternal Health (AIM) Program	State Allows Medicaid Reimbursements for Doula Care
Alabama	Active	Yes	No	No
Alaska	Active	Yes	Yes	No
Arizona	Active	Yes	Yes	No
Arkansas	In development	Yes	No	No
California	Active	Yes	Yes	No
Colorado	Active	Yes	Yes	No
Connecticut	Active	Yes	No	No
Delaware	Active	Yes	Yes	No
District of Columbia	None	Yes	No	No
Florida	Active	Yes	Yes	No
Georgia	Active	Yes	Yes	No
Hawaii	Active	Yes	No	No
Idaho	None	Yes	No	No
Illinois	Active	Yes	Yes	No
Indiana	Active	Yes	Yes	Yes
Iowa	In development	Yes	No	No
Kansas	Active	Yes	No	No
Kentucky	In development	Yes	No	No
Louisiana	Active	Yes	Yes	No
Maine	Active	No	No	No
Maryland	Active	Yes	Yes	No
Massachusetts	Active	Yes	Yes	No
Michigan	Active	Yes	Yes	No
Minnesota	Active	Yes	No	Yes
Mississippi	Active	Yes	Yes	No
Missouri	Active	Yes	Yes	No
Montana	In development	Yes	No	No
Nebraska	Active	Yes	Yes	No
Nevada	In development	No	No	No
New Hampshire	Active	Yes	No	No
New Jersey	Active	Yes	Yes	Yes
New Mexico	Active	Yes	Yes	No
New York	Active	Yes	Yes	No
North Carolina	Active	Yes	Yes	No
North Dakota	In development	No	No	No
Ohio	Active	Yes	No	No
Oklahoma	Active	Yes	Yes	No
Oregon	Active	Yes	Yes	Yes
Pennsylvania	Active	Yes	No	No
Rhode Island	None	No	No	No

Table 2: State Variation in Strategies to Reduce Maternal Mortality and Morbidity (continued)

State	Variation			
	State Has an Active Perinatal Quality Collaborative	State Has a Maternal Mortality Review Committee and Is Reviewing Cases	State Participates in the Alliance for Innovation on Maternal Health (AIM) Program	State Allows Medicaid Reimbursements for Doula Care
South Carolina	Active	Yes	Yes	No
South Dakota	In development	No	No	No
Tennessee	Active	Yes	Yes	No
Texas	Active	Yes	Yes	No
Utah	Active	Yes	Yes	No
Vermont	Active	No	No	No
Virginia	Active	Yes	Yes	No
Washington	Active	Yes	Yes	No
West Virginia	Active	Yes	Yes	No
Wisconsin	Active	Yes	No	No
Wyoming	In development	No	No	No
State Count	40	44	29	4

PQC: Data as of January 2020. Centers for Disease Control and Prevention.

MMRC: Data as of May 22, 2020. Centers for Disease Control and Prevention.

AIM: Data as of May 2020. Council on Patient Safety in Women's Health Care.

Medicaid Reimbursement for doula care: Data as of February 20, 2020. National Health Law Program.

For additional source and calculation information, please refer to the Methods and Sources section of pn3policy.org.

How Did We Reach Our Conclusions?

Method of Review

This evidence review began with a broad search of all literature related to the policy and its impacts on child and family wellbeing during the prenatal-to-3 period. First, we identified and collected relevant peer-reviewed academic studies as well as research briefs, government reports, and working papers, using predefined search parameters, keywords, and trusted search engines. From this large body of work, we then singled out for more careful review those studies that endeavored to identify causal links between the policy and our outcomes of interest, taking into consideration characteristics such as the research designs put in place, the analytic methods used, and the relevance of the populations and outcomes studied. We then subjected this literature to an in-depth critique and chose only the most methodologically rigorous research to inform our conclusions about policy effectiveness. All studies considered to date for this review were released on or before March 31, 2020.

Standards of Strong Causal Evidence

When conducting a policy review, we consider only the strongest studies to be part of the evidence base for accurately assessing policy effectiveness. A strong study has a sufficiently large, representative sample, has been subjected to methodologically rigorous analyses, and has a well-executed research design allowing for causal inference – in other words, it demonstrates that changes in the outcome of interest were likely caused by the policy being studied.

The study design considered most reliable for establishing causality is a randomized control trial (RCT), an approach in which an intervention is applied to a randomly assigned subset of people. This approach is rare in policy evaluation because policies typically affect entire populations; application of a policy only to a subset of people is ethically and logistically prohibitive under most circumstances. However, when available, randomized control trials are an integral part of a policy's evidence base and an invaluable resource for understanding policy effectiveness.

The strongest designs typically used for studying policy impacts are quasi-experimental designs (QEDs) and longitudinal studies with adequate controls for internal validity (for example, using statistical methods to ensure that the policy, rather than some other variable, is the most likely cause of any changes in the outcomes of interest). Our conclusions are informed largely by these types of studies, which employ sophisticated techniques to identify causal relationships between policies and outcomes. Rigorous meta-analyses with sufficient numbers of studies, when available, also inform our conclusions.

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Prenatal-to-3 Policy Impact Center

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