



## Editor's Choice

# Adoption of Medicaid Expansion Is Associated with Lower Maternal Mortality



Erica L. Eliason, MPH\*

Columbia University School of Social Work, New York, New York

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## A B S T R A C T

**Objectives:** This study explores the effect of Medicaid expansion under the Affordable Care Act on the maternal mortality ratio in the United States.

**Methods:** A difference-in-differences research design was used to analyze the effect of Medicaid expansion on maternal mortality. Maternal mortality was defined with and without late maternal deaths, to substantiate the contribution of increased preconception and postpartum insurance coverage. To examine whether there was a racial difference in the effects of Medicaid expansion, models were stratified by the woman's race/ethnicity for non-Hispanic Black women, non-Hispanic White women, and Hispanic women.

**Results:** Medicaid expansion was significantly associated with lower maternal mortality by 7.01 maternal deaths per 100,000 live births ( $p = .002$ ) relative to nonexpansion states. When maternal mortality definitions excluded late maternal deaths, Medicaid expansion was significantly associated with a decrease in maternal mortality per 100,000 live births by 6.65 ( $p = .004$ ) relative to nonexpansion states. Medicaid expansion effects were concentrated among non-Hispanic Black mothers, suggesting that expansion could be contributing to decreasing racial disparities in maternal mortality.

**Conclusions:** Although maternal mortality overall continues to increase in the United States, the maternal mortality ratio among Medicaid expansion states has increased much less compared with nonexpansion states. These results suggest that Medicaid expansion could be contributing to a relative decrease in the maternal mortality ratio in the United States. The decrease in the maternal mortality ratio is greater when maternal mortality estimates include late maternal deaths, suggesting that sustained insurance coverage after childbirth as well as improved preconception coverage could be contributing to decreasing maternal mortality.

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The United States has the highest maternal mortality ratio in the developed world, and has seen rising deaths with a ratio that more than doubled from 1987 to 2014 (Centers for Disease Control and Prevention, 2019; World Health Organization, 2015). There are substantial racial and socioeconomic disparities in maternal mortality, with non-Hispanic Black women and women living in poverty dying at significantly higher rates (Centers for Disease Control and Prevention, 2019; Creanga, Syverson, Seed, & Callaghan, 2017; MacDorman, Declercq, Cabral, & Morton, 2017; Ronsmans & Graham, 2006). As of

2017, Medicaid coverage was responsible for financing 43% of the births in the United States (Martin, Hamilton, Osterman, Driscoll, & Drake, 2018). Since 1989, Medicaid has been available to any pregnant citizen with a gross family income of up to 133% of the federal poverty level for the duration of her pregnancy and for 60 days after the birth (Medicaid and CHIP Payment and Access Commission, 2016). Despite this mandate, the medical services and income eligibility for pregnancy-related Medicaid coverage varies by states (Medicaid and CHIP Payment and Access Commission, 2017). In addition, the process for obtaining Medicaid once pregnant can cause delays in access to immediate prenatal care once insured. Furthermore, women's loss of coverage 60 days after birth can leave women without access to care and at greater risk for untreated pregnancy complications after childbirth.

Studies have found that lacking preconception health insurance is associated with lower levels of pregnancy care use,

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\* Correspondence to: Erica L. Eliason, MPH, Columbia University School of Social Work, 1255 Amsterdam Avenue, New York, NY 10027-5927. Phone: (510) 384-4648; fax: (212) 851-2330.

E-mail address: [Ele2115@columbia.edu](mailto:Ele2115@columbia.edu)

including later prenatal care initiation and lower levels of adequate prenatal care consumption ([Medicaid and CHIP Payment and Access Commission, 2018](#)). Research shows that women uninsured before pregnancy have a higher prevalence of preconception health risk factors as well as a lower prevalence of health-promoting indicators ([Robbins et al., 2018](#)). These risk factors are associated with worse childbirth outcomes, providing evidence that decreased access to the health care system before conception may be associated with worse preconception health and potentially worsened maternal and infant health outcomes. Coverage loss during the postpartum period for recent mothers could additionally be contributing to the poor maternal outcomes seen in the United States. One report from Maternal Mortality Review Committees found that 18% of pregnancy-related deaths are late maternal deaths, occurring between 43 days and 1 year after the end of pregnancy, and that 58.3% of these deaths are considered to be preventable ([Maternal Mortality Review Committees, 2018](#)). In this report, improving access to care was one of the most common themes identified as a feasible action to avert maternal deaths ([Maternal Mortality Review Committees, 2018](#)). Despite these important pathways through which increased insurance access could have an impact on maternal mortality outcomes, there is currently little evidence on the effects of increased preconception and postpartum insurance resulting from the Affordable Care Act (ACA) Medicaid expansions on maternal mortality in the United States.

Studies have shown that the ACA Medicaid expansions have resulted in improved preconception coverage for pregnant women, some improvements in preconception health for women of reproductive age, and a significant reduction in the infant mortality rate ([Bhatt & Beck-Segue, 2018](#); [Clapp, James, Kaimal, & Daw, 2018](#); [Margerison, MacCallum, Chen, Zamani-Hank, & Kaestner, 2019](#)). These findings imply that, despite the pregnancy-related Medicaid coverage that existed, Medicaid expansion could be contributing to improved pregnancy health, early access to care, and birth outcomes. As such, it is possible that similar improvements could be seen for maternal mortality after Medicaid expansion. Increased access to Medicaid coverage before pregnancy could improve women's health risk factors, such as obesity, diabetes, and heart disease, which can often contribute to maternal mortality; improve timeliness of prenatal care and access to a greater breadth of covered services for pregnancy care; and improve insurance for women past 60 days postpartum, increasing access to sustained insurance coverage during the period of late maternal deaths. This study examines the association between the ACA Medicaid expansions and the maternal mortality ratio in the United States, including and excluding late maternal deaths. By using these two definitions of maternal mortality, this approach can shed light on the potential pathways through which the ACA Medicaid expansions could be having an effect and substantiate the contribution of increased preconception or postpartum insurance availability on maternal deaths. In addition, this study stratifies models by race/ethnicity to examine if effects vary by racial or ethnic group owing to the large racial disparities in maternal mortality.

## Methods

This study uses the publicly available Underlying Cause of Death 2006–2017 data files from the National Center for Health Statistics, accessed through the Centers for Disease Control and Prevention WONDER Online Database. Total maternal mortality considered all deaths assigned ICD-10 codes A34 (Obstetrical

tetanus) and O00 to O99 (Chapter XV Pregnancy, childbirth, and the puerperium), which captures maternal deaths owing to obstetrical tetanus, maternal deaths up to 42 days after delivery, and late maternal deaths. Some definitions of maternal mortality exclude late maternal deaths occurring more than 42 days after delivery, so an additional definition of maternal mortality was used with the more restricted definition of maternal causes (A34, O00–O95, and O98–O99), which excludes late maternal deaths. By using both definitions of maternal mortality, this approach can highlight whether the improved postpartum coverage is driving effects of Medicaid expansion on the maternal mortality ratio or if changes in maternal mortality are driven by increased preconception insurance access. The maternal mortality ratio was calculated as the number of maternal deaths per 100,000 live births, using 2006–2017 state-year publicly available birth data from the National Center for Health Statistics Natality dataset, accessed through the Centers for Disease Control and Prevention WONDER Online Database. To examine whether there was a racial difference in the effects of Medicaid expansion, models are stratified by the woman's race/ethnicity and results are presented separately for non-Hispanic Black women, non-Hispanic White women, and Hispanic women. The final analytic data include the 31 states and the District of Columbia that expanded their Medicaid programs under the ACA by 2017 and 19 that did not, for a total of 612 state-year observations ([Appendix 1](#)).

This study uses a difference-in-difference research design, comparing the maternal mortality ratio in states that expanded their Medicaid programs with states that did not expand Medicaid during the timeframe of the study. The unadjusted and adjusted models for the main analyses are specified in detail in [Appendix 2](#). The effect of expansion is estimated as changes in maternal mortality among women in a Medicaid expansion state relative to a nonexpansion state after policy implementation, allowing for the staggered adoption of Medicaid expansion that occurred under the ACA ([Angrist & Pischke, 2009](#); [Zewde et al., 2019](#)). The parallel trends assumption for the difference-in-difference model was tested and there was no significant difference in the trends in the maternal mortality ratio before Medicaid expansion for expansion and nonexpansion states, demonstrating that the parallel trends assumption was suitable for the difference-in-difference model ([Appendix 3](#)). All models include state fixed effects and year fixed effects, with robust standard errors clustered by state. Models are weighted for number of live births in each state, similar to other studies on the impact of Medicaid expansion on mortality rates that weight for population size ([Sommers, Baicker, & Epstein, 2012](#)). Unweighted models for the main results are available in [Appendix 4](#). Adjusted and unadjusted estimates are presented for all models, with adjusted models including controls for yearly unemployment rates for women at the state level and whether or not a state had adopted the pregnancy checkbox for reporting maternal deaths in that year. The state-level women's unemployment rate is available from the U.S. Department of Labor Bureau of Labor Statistics and is used as a control because insurance coverage in the United States is largely tied to employment status. The inclusion of pregnancy checkboxes on death certificates was an optional decision for states, introduced to increase classification of maternal deaths in the United States, which led to increased reports of maternal deaths in states that introduced this reporting mechanism compared with states that did not ([Davis, Hoyert, Goodman, Hirai, & Callaghan, 2017](#); [MacDorman et al., 2016](#)). Whether or not a state had adopted this pregnancy checkbox in that year is used as a control in the models owing to

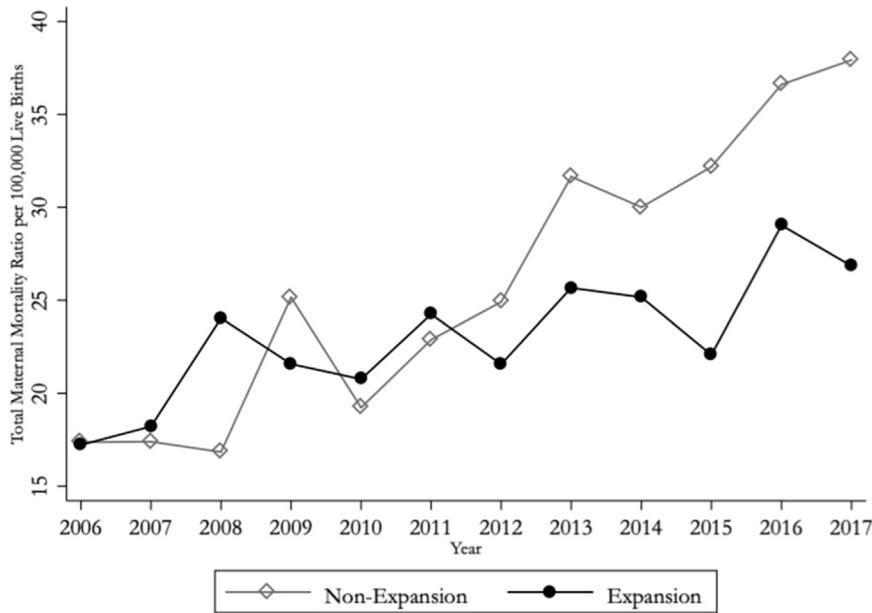


Figure 1. Total maternal mortality ratio by Medicaid expansion status and year.

this systematic reporting difference in the states, consistent with other literature on maternal mortality in the United States (Nelson, Moniz, & Davis, 2018; MacDorman et al., 2016).

**Results**

After Medicaid expansion implementation, the maternal mortality ratios in expansion and nonexpansion states diverge as expansion states see a visibly lower total maternal mortality ratio compared with nonexpansion states (Figure 1).

Table 1 presents adjusted and unadjusted difference-in-difference estimates for maternal mortality deaths per 100,000 live births, with and without the inclusion of late maternal deaths. The adjusted difference-in-difference regression estimate suggests that Medicaid expansion was significantly associated with 7.01 ( $p = .002$ ) fewer total maternal deaths per 100,000 live births relative to nonexpansion states. When late maternal deaths were excluded, Medicaid expansion was significantly associated with 6.65 ( $p = .004$ ) fewer maternal deaths per 100,000 live births relative to nonexpansion states. The effects of the control variables and year fixed effects for the main adjusted models are available in Appendix 5.

When stratifying by race/ethnicity, the effect size is greatest among non-Hispanic Black mothers, with Medicaid expansion significantly associated with a lower total maternal rate per 100,000 live births by 16.27 ( $p = .022$ ) maternal deaths relative to nonexpansion states among non-Hispanic Black mothers (Table 2). Effects are additionally significant among Hispanic mothers, with Medicaid expansion associated with a lower total maternal rate per 100,000 live births by 6.01 ( $p = .001$ ) maternal deaths relative to nonexpansion states for Hispanic mothers (Table 2). Medicaid expansion is only marginally significant in adjusted models for non-Hispanic White women (Table 2).

When graphed, a consistently small separation in maternal mortality does seem to be visible for non-Hispanic White mothers between expansion and nonexpansion states (Figure 2). A clear divergence is also notable for non-Hispanic Black mothers, although maternal mortality remains much higher among this group and continues to increase more than among non-Hispanic White mothers. The trends in maternal mortality are more variable for Hispanic mothers, because there is a large separation in maternal mortality in 2015 between expansion and nonexpansion states, but a more similar maternal mortality ratio in expansion and nonexpansion states for 2016 that separates again in 2017 (Figure 2).

**Table 1**  
Estimates of the Effects of Medicaid Expansion on the Maternal Mortality Ratio per 100,000 Live Births

Dependent Variable	Total Maternal Mortality Ratio per 100,000 Live Births	Maternal Mortality Ratio per 100,000 Live Births, Excluding Late
Unadjusted difference-in-differences		
After expansion	-8.41 (2.68)	-7.73 (2.43)
<i>p</i>	.003*	.003*
Adjusted difference-in-differences		
After expansion	-7.01 (2.19)	-6.65 (2.18)
<i>p</i>	.002*	.004*

Note: The sample consists of state-by-year observations. The robust standard error for difference-in-difference estimates is presented in parentheses and clustered by state. Adjusted models include controls for pregnancy checkbox adoption and the state-level women's unemployment ratio. Mortality data are from the Centers for Disease Control and Prevention, National Center for Health Statistics Underlying Cause of Death data files, retrieved from CDC WONDER Online Database. Data on live births is from Centers for Disease Control and Prevention, National Center for Health Statistics Natality data files, retrieved from CDC WONDER Online Database. Models are weighted for the number of live births in each state.

\*  $p < .05$ .

**Table 2**  
Estimates of the Effects of Medicaid Expansion on the Maternal Mortality Ratio per 100,000 Live Births, Stratified by Race/Ethnicity

Dependent Variable	Total Maternal Mortality Ratio per 100,000 Live Births		
	Non-Hispanic Black	Hispanic	Non-Hispanic White
Unadjusted difference-in-differences			
After expansion	−19.67 (7.22)	−6.54 (2.10)	−4.87 (2.32)
<i>p</i>	.009*	.003*	.041*
Adjusted difference-in-differences			
After expansion	−16.27 (6.87)	−6.01 (1.69)	−3.74 (1.96)
<i>p</i>	.022*	.001*	.062

Note: The sample consists of state-by-year observations. The robust standard error for difference-in-difference estimates is presented in parentheses and clustered by state. Adjusted models include controls for pregnancy checkbox adoption and the state-level women's unemployment ratio. Mortality data are from the Centers for Disease Control and Prevention, National Center for Health Statistics Underlying Cause of Death data files, retrieved from CDC WONDER Online Database. Data on live births is from Centers for Disease Control and Prevention, National Center for Health Statistics Natality data files, retrieved from CDC WONDER Online Database. Models are weighted for the number of live births in each state for each ethnic/racial group.

\*  $p < .05$ .

Visible outliers are present in 2012 for non-Hispanic Black women and in 2011 for Hispanic women. Figures without these outliers are presented to display the sensitivity of these trends to those specific outliers, as both outlier points occur in non-expansion states (Appendix 6). Both of these outliers are caused by single deaths in states that are predominantly non-Hispanic White, with lower numbers of births among non-Hispanic Black women and Hispanic women. Because these maternal deaths were occurring in states that otherwise usually had no maternal deaths among these groups, an increase of even one maternal death in states with lower numbers of births among these populations led to a disproportionately high maternal mortality ratio for that year. The removal of these outliers does not meaningfully change the trends in maternal mortality among non-Hispanic Black women and Hispanic women (Appendix 6).

## Discussion

Although the maternal mortality ratio overall continues to rise in the United States, maternal mortality in Medicaid expansion states has risen much less than in nonexpansion states, with a clear divergence in the trends between expansion and nonexpansion states (Figure 1). Medicaid expansion was implemented as early as 2010 under the ACA and states continue to adopt Medicaid expansion, with the majority of expansion states implementing Medicaid expansion in 2014 (Kaiser Family Foundation, 2012, 2019). Trends in maternal mortality among expansion and nonexpansion states have a slight separation that starts after the early Medicaid expansion period, with effects seen as early as 2012. This separation continues throughout the duration of the study period, with a greater divergence occurring between expansion and nonexpansion states beginning in 2015, the year after the majority of expansion states extended their Medicaid programs (Figure 1). These results suggest that Medicaid expansion could be contributing to a relative decrease in the maternal mortality ratio in the United States compared with nonexpansion states, whereas maternal mortality overall continues to rise. Adjusted difference-in-difference estimates suggest a significantly lower total maternal mortality ratio associated with Medicaid expansion in the range of 6 to 7 maternal deaths per 100,000 live births. As the Natality data files indicate a total of 3,805,306 live births among adult women in 2017, these results estimate a reduction of more than 200 maternal deaths associated with Medicaid expansion when applied to the U.S. total in 2017.

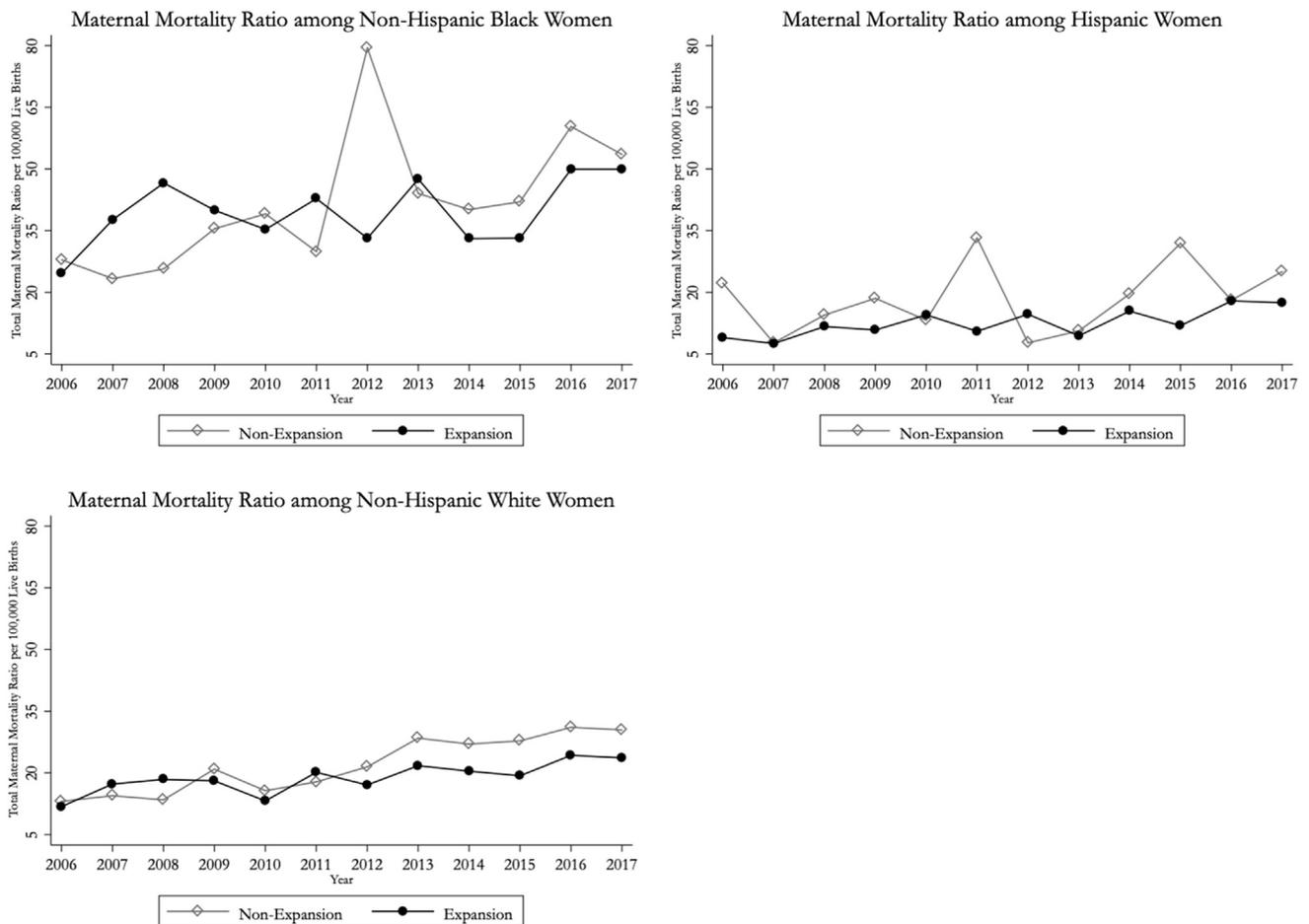
The effect of Medicaid expansion on maternal mortality was concentrated among non-Hispanic Black mothers, indicating

that Medicaid expansion could be contributing to a reduction in the large racial disparity in maternal mortality faced by Black mothers (Table 2). This finding is consistent with research that indicated a reduction in relative disparities in infant health outcomes for Black infants (Brown et al., 2019). Taken together, this research could suggest that improvements in pregnancy health associated with Medicaid expansion may be having larger effects for non-Hispanic Black mothers. Despite this improvement, the maternal mortality ratio continues to increase the most among non-Hispanic Black mothers, who already have consistently higher maternal deaths than non-Hispanic White mothers or Hispanic mothers. These results reaffirm that health insurance access is a part of the narrative around the high U.S. maternal mortality rate, but several other variables are contributors.

There are multiple pathways through which Medicaid expansion could be driving decreases in maternal mortality despite the existing availability of pregnancy-related coverage. First, as some research suggests, earlier Medicaid access could improve women's preconception health, which could in turn improve maternal health outcomes and reduce maternal mortality (Margerison et al., 2019). Second, improvements in the timeliness of prenatal care or increases in covered benefits during the gestational period could be improving women's health during pregnancy and therefore decreasing maternal deaths. Last, improved postpartum insurance access could be decreasing late maternal deaths through sustained coverage after childbirth.

The difference-in-difference estimates of the lower maternal mortality ratio are larger when maternal mortality estimates include late maternal deaths, suggesting that sustained insurance coverage after childbirth could be contributing to decreasing maternal mortality. Furthermore, Medicaid expansion was significantly associated with a decrease in maternal mortality when late maternal deaths were excluded, indicating that earlier coverage through preconception health or timely pregnancy care is additionally playing a role. By separately identifying the magnitude for both definitions of maternal mortality, these findings highlight that both the improved preconception coverage and the increased postpartum coverage are likely contributing to the significantly lower maternal mortality seen in Medicaid expansion states.

There are several limitations to this research. This study could not account for any reporting differences not captured by controlling for the pregnancy checkbox that may have occurred during the timeframe and affected the reporting of maternal mortality. Furthermore, because of the small numbers of live births that occur among Hispanic women and non-Hispanic



**Figure 2.** Total maternal mortality ratio by Medicaid expansion status and year, stratified by race/ethnicity.

Black women in some states, these estimates are more variable and there are visible outliers for some years. Last, this study does not prove causality and there may be other unexplained reasons for the difference in trends among expansion and nonexpansion states. There are numerous factors influencing maternal mortality in the United States and the causes behind the rising trend are poorly understood (Molina & Pace, 2017). Further research is necessary to understand the role of various contributors to maternal mortality in the United States and the pathways through which insurance coverage could be affecting maternal mortality.

### Implications for Policy and/or Practice

It is critically important to address the staggering maternal mortality ratio in the United States, and this study suggests that improving health insurance access is a potential step that can be taken to save mothers' lives. In addition, the reduction in late maternal deaths associated with Medicaid expansion highlights a specific role for improved postpartum insurance coverage. Policymakers should consider extending postpartum insurance coverage for pregnancy-related Medicaid coverage past 60 days, as has been included in recent legislative efforts such as the Maximizing Outcomes for Moms through Medicaid Improvement and Enhancement of Services (MOMMIES) Act, the Mothers and Offspring Mortality and Morbidity Awareness (MOMMA's)

Act, and the Healthy MOMMIES Act (S. 3494, 2018; H.R. 1897, 2018; H.R. 2062, 2019).

### Conclusions

This study suggests that Medicaid expansion could be contributing to a lower maternal mortality ratio in the United States among expansion states relative to nonexpansion states, including and excluding late maternal deaths. As effects were concentrated among non-Hispanic Black mothers, Medicaid expansion could be associated with reducing the stark racial disparities in maternal mortality in the United States. However, despite this improvement, maternal mortality continues to rise and remains the highest among non-Hispanic Black mothers. The United States has the worst maternal mortality ratio among high-income nations, and although many determining factors may lie outside of the health care system, these results indicate that improving Medicaid access could contribute to reducing maternal deaths. The findings in this study underscore the importance of health insurance coverage in improving maternal outcomes and the crucial role that expanded Medicaid access could be playing in decreasing devastating disparities in maternal mortality in the United States.

### Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.whi.2020.01.005>.

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## Author Descriptions

Erica Eliason is a Social Policy Analysis and Economics PhD candidate at Columbia University School of Social Work. Her research focuses on the effects of health insurance eligibility policies and financial exposures in health care on maternal, child, and reproductive health outcomes.