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Tracking State-Level Racial Disparities in Stillbirth Rates, 2016-2021

By

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Epidemiology

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Tracking State-Level Racial Disparities in Stillbirth Rates, 2016-2021

By

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2023

Abstract

Tracking State-Level Racial Disparities in Stillbirth Rates, 2016-2021
By Sandra Maduforo

Background: Stillbirths are fetal deaths that occur at 20 or more weeks of gestation. In 2020, non-Hispanic Black, non-Hispanic Native Hawaiian, and other Pacific Islander mothers had the highest stillbirth rates, which were more than double the rate among non-Hispanic White mothers. These disparities are not new; however, whether and to what degree they have changed over time is unknown. Using 2016-2021 state-level stillbirth data, we assessed whether there was correlation between stillbirth rates and racial disparities, and explored trends in racial disparities.

Methods: Fetal death and live birth data (2016-2021) for the 50 US states and Washington D.C. were extracted from CDC WONDER. States were ranked by 2021 stillbirth rate and racial disparities. Stillbirth rates among non-Hispanic Black mothers were compared to two reference groups: non-Hispanic White, and all other races/ethnicities. The Pearson correlation coefficient was used to assess correlation between stillbirth rates and racial disparities in 2021. Using 3-year moving averages, the Mann-Kendall trend test was used to evaluate linear trends in racial disparities.

Results: There was no correlation between overall stillbirth rates and racial disparities in 2021. Stillbirth rates were highest in Nevada, Wyoming, and the Southeast region of the US. Racial disparities were most prominent in Massachusetts (RRs: 3.00 & 3.17, comparing NH-Black to all other races and NH-White, respectively), Kansas (RRs: 2.57 & 2.65), Iowa (RRs: 2.51 & 2.75), and Delaware (RRs: 2.97 & 3.98). Florida, Louisiana, Mississippi, Pennsylvania, and Wisconsin had a consistent decline in the 3-year moving averages of racial disparities, while Indiana, Massachusetts, Virginia, Washington, and Arizona experienced a consistent widening of the moving averages. Colorado and Louisiana had the largest percent decrease in racial disparities, while Washington experienced the largest percent increase. Most states had constant racial disparities (RRs: 1.40-2.97 & 1.49-3.98).

Conclusion: There is no correlation between overall stillbirth rates and racial disparities at the state-level, though some areas might experience overlap. While some states had evidence of increasing or decreasing trends in racial disparities in stillbirth rates, disparities remained stable in most places. Strategies to address stillbirth rates and racial disparities are needed to reduce negative stillbirth outcomes nationally.

Tracking State-Level Racial Disparities in Stillbirth Rates, 2016-2021, CDC WONDER

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INTRODUCTION

Stillbirths are fetal deaths that occur at 20 or more weeks of gestation. While the rate of stillbirths in the United States has steadily declined by 23% since 1990, this decline has slowed in recent years with approximately 21,000 stillbirths occurring in 2020.[1] According to the CDC, the 2020 rate of fetal deaths at 20 or more weeks of gestation did not significantly differ from the 2019 rate.

The prevalence of stillbirths varies by race and ethnicity, highlighting substantial racial disparities. In 2020, non-Hispanic Black, non-Hispanic Native Hawaiian, and other Pacific Islander mothers had the highest stillbirth rates (SR), which were more than double the rate for non-Hispanic White mothers.[1–7] The fetal death rate for American Indian and Alaska Native mothers also remains high compared to non-Hispanic Asian, non-Hispanic White and Hispanic mothers.[1,8] Additionally, there is evidence that the causes and timing of stillbirths vary by race and ethnicity.[2,9–12] These disparities have persisted over time. A review found that while the stillbirth rate among White mothers was 20.9 in 1945, non-White mothers did not attain the same rate until 1971, demonstrating a 26-year lag.[13] Racism and discrimination, which have been found to impact many health-related outcomes,[14,15] may contribute to racial disparities in stillbirths. For example, a study found that among African American mothers, those who delivered preterm low birth weight infants were more likely to report experiencing interpersonal racial discrimination than those who delivered infants with a normal birth weight at full term.[16] Another study concluded that indigenous, Hispanic, and African American women were most likely to report experiencing mistreatment by a healthcare provider, highlighting the burden of racial and ethnic discrimination in the same groups that experience higher rates of stillbirths.[17]

In addition to racial and ethnic disparities, geographic disparities also exist. In 2020, Mississippi, Georgia, and Alaska had the highest fetal mortality rates in the U.S.[1] Furthermore, an analysis of 2015-2017 fetal death data found that fetal mortality rates varied by maternal state of residence.[18] Overall, the Southern U.S. experienced higher fetal mortality rates, with Alabama having the highest rates among White and Hispanic mothers and New Jersey, West Virginia, and Mississippi having the highest rates among African American mothers.[18] These findings suggest that stillbirth outcomes may be associated with state-level characteristics, though more research is needed to understand this association.

Currently, stillbirth is an under researched topic and there remain many knowledge gaps. This is partially due to varying standards for stillbirth reporting at the state level. For example, while the majority of states require reporting of fetal deaths at 20 or more weeks of gestation, some states require reporting of fetal deaths based on birthweight, which may contribute to underreporting or overreporting of fetal deaths.[1,19] Fetal death reports also commonly have unspecified causes of death, despite the reporting requirement of having less than 50% of records assigned to an unspecified cause.[1,18] Additionally, a study examining stillbirth data quality in Utah found that the cause of death was correct on the death certificate approximately only 50% of the time, highlighting discrepancies between medical records and death certificates.[20] These differences in reporting impact data completeness and quality. Thus, it is important to consider how state-level differences in fetal death reporting might affect comparisons of stillbirth outcomes between states.

Though there is evidence of racial and geographic disparities in stillbirth outcomes, there is limited research on whether these disparities coincide. Using 2016-2021 state-level

stillbirth data, this paper will assess whether there is correlation between stillbirth rates and racial disparities, and will also explore trends in racial disparities during this time period.

METHODS

The data for this study were extracted from CDC WONDER,[21,22] a publicly available data source hosted by the US Centers for Disease Control and Prevention (CDC). Fetal death and live birth data for 2016-2021 were extracted for all 50 states and the District of Columbia (D.C.). Additionally, we extracted data on the distribution of fetal deaths and live births by the race of the mother. Due to reporting requirements for small numbers, some states suppressed data for race and were thus excluded from race-stratified analyses. Since this research used publicly available data, it was classified as non-human subjects research and was deemed exempt from IRB review by the Emory University IRB.

Fetal deaths included in the study were those that occurred at 20 or more weeks of gestation. Annual stillbirth rates per 1,000 deliveries were calculated by dividing the total number of fetal deaths by the sum of fetal deaths and live births for each year in the study period. Disparities in the stillbirth rates for non-Hispanic (NH) Black deliveries were evaluated using two different reference groups: 1) deliveries among all other races/ethnicities (NH-White, NH-American Indian/Alaska Native, NH-Asian, Asian, Native Hawaiian, and Other Pacific Islander (NHOPI), NH-more than one race, and Hispanic), and 2) deliveries among NH-White mothers. States were ranked by both stillbirth rate and disparities using those rates. Lastly, rate ratios were examined to identify whether there were trends in state-level racial disparities over time. In addition to assessing annual trends in racial disparities, we also considered 3-year moving averages of the rate ratios (i.e., 2016-2018, 2017-2019, 2018-2020, 2019-2021) to smooth fluctuations in the

data resulting from small counts. The moving averages were calculated by dividing the 3-year sum of fetal deaths by 3-year sum of fetal deaths and live births.

Statistical Analysis

The Pearson correlation coefficient was used to assess the statistical significance of the correlation between overall stillbirth rates and racial disparities at the state level. A trend analysis was conducted using the Mann-Kendall trend test to determine whether there were changes in the racial disparities during the study period. The data were analyzed in RStudio (R version 4.2.2).

RESULTS

Overall, the stillbirth rate per 1000 deliveries remained relatively constant during the study period (6.02 in 2016 and 5.73 in 2021). The 10 reporting areas with the highest stillbirth rates and highest racial disparities in 2021 are shown in Table 1. Georgia and Washington D.C. were among the top ten states for both highest overall stillbirth rate and racial disparities between NH-Black mothers and all other races/ethnicities, while Florida ranked among the top ten states for overall stillbirth rate and racial disparities between NH-Black and NH-White mothers (Table 1). There was no correlation between overall stillbirth rates and racial disparities for the reference group with deliveries among all other races/ethnicities (r: 0, 95% CI: [-0.33, 0.33]) and deliveries among NH-White mothers (r: -0.15, 95% CI: [-0.46, 0.19]) in 2021. Higher stillbirth rates were concentrated in Nevada, Wyoming, and the Southeast region of the US (Table 1; Figure 1). Racial disparities were most prevalent in Washington D.C. (RR, all other races: 3.73), Iowa (RR, all other races: 2.51; RR, NH-White: 2.75), Kansas (RR, all other races: 2.57; RR, NH-White: 2.65), Massachusetts (RR, all other races: 3.00; RR, NH-White: 3.17), and Delaware (RR, all other races: 2.97; RR, NH-White: 3.98; Figure 2).

When comparing stillbirth outcomes among NH-Black mothers to those of all other races/ethnicities, the following states had consistent decreases in the 3-year moving averages of their racial disparities: Florida (2016-2018: 2.12; 2019-2021: 2.01), Louisiana (2016-2018: 2.26; 2019-2021: 1.80), Mississippi (2016-2018: 2.74; 2019-2021: 2.20), Pennsylvania (2016-2018: 2.02; 2019-2021: 1.84), and Wisconsin (2016-2018: 1.77; 2019-2012: 1.85), while the following states experienced consistent increases: Indiana (2016-2018: 1.63; 2019-2021: 2.01), Massachusetts (2016-2018: 2.45; 2019-2021: 2.66), Virginia (2016-2018: 1.69; 2019-2021:1.91), and Washington (2016-2018: 1.54; 2019-2021: 2.29) (Table 2). When comparing stillbirth outcomes among NH-Black mothers to those of NH-White mothers, Louisiana (2016-2018: 2.37; 2019-2021: 1.81), Mississippi (2016-2018: 2.77; 2019-2021: 2.24), and Pennsylvania (2016-2018: 2.03; 2019-2021: 1.78) had consistent decreases in the 3-year moving averages, while racial disparities in Arizona (2016-2018: 1.90; 2019-2021: 1.97), Virginia (2016-2018: 1.69; 2019-2021: 1.91), and Washington (2016-2018: 1.54; 2019-2021: 2.21) consistently increased. All other states either had fairly constant or fluctuating racial disparities. There was not a significant linear trend in the 3-year moving averages for any state. Racial disparities in 2021 stillbirth rates hovered between 1.40-2.97 and 1.49-3.98, comparing NH-Black to all other races and NH-White, respectively.

There was variation in the percent change in the racial disparities across all reporting areas (2016-2018 vs. 2019-2021). Colorado had the largest percent decrease in racial disparities (all other races/ethnicities: -45%; NH-White: -43%) (Figure 3), followed by Louisiana (all other races/ethnicities: -28%; NH-White: -31%). Washington experienced the largest percent increase in disparities (all other races/ethnicities: 91%; NH-White: 85%).

Annual trends in racial disparities fluctuated more compared to trends in the moving averages (Table 3). Pennsylvania had consistent decreases in racial disparities across both racial groups, with a statistically significant downward trend when comparing NH-Black mothers to NH-White mothers.

DISCUSSION

In our study of racial disparities in stillbirth rates, we assessed whether there was a correlation between stillbirth rates and racial disparities, and explored trends in racial disparities over time. There was no correlation between overall stillbirth rates and racial disparities in 2021, though some states with higher rates also had higher racial disparities. Secondly, there was no evidence of an upward or downward trend overall; however, some states had evidence of consistent increasing or decreasing trends in racial disparities between 2016-2021. Most states had relatively constant racial disparities, hovering between 1.40-2.97 and 1.49-3.98, comparing NH-Black to all other races and NH-White, respectively.

Despite the lack of correlation mentioned above, Georgia, Washington D.C., and Florida each ranked in the top ten reporting areas for overall stillbirth rate and racial disparities in 2021. This suggests that while most states do not have a high burden of both outcomes simultaneously, some areas are experiencing overlap. Stillbirth rates were highest in the Southeast region of the U.S., which is consistent with previous findings.[18] Racial disparities were most prominent in Iowa, Kansas, Massachusetts and Delaware. The racial disparity in these states was larger when comparing NH-Black mothers to NH-White mothers, rather than all other races/ethnicities. This may be explained by the distribution of race in these states, such as a potentially higher population of NH-White mothers.[23–25]

Florida, Louisiana, Mississippi, and Wisconsin had consistent decreases in the moving averages of racial disparities in stillbirth rates, though these linear trends did not reach statistical significance. Pennsylvania experienced a statistically significant linear decline in annual racial disparities, as well as a consistent decrease in the 3-year moving averages. Indiana, Massachusetts, Virginia, Washington, and Arizona each had consistent increases in the moving averages of racial disparities. When comparing 2016-2018 and 2019-2021, Colorado had the largest percent decrease in racial disparities, while Washington had the largest percent increase. These findings are consistent with a review that found evidence of trends in racial disparities in the U.S. between 1990-2005, which included a widening racial gap for NH-Black deliveries.[13] The fact that some states did experience a decline in stillbirth racial disparities demonstrates that narrowing the racial gap in stillbirth outcomes is a realistic goal, and that action must be taken to avoid increasing disparities. However, it is important to note that risk factors for stillbirths can vary by race/ethnicity, which highlights a need for appropriate risk reduction interventions that are well-tailored to the population of interest.[4,8,11,11,16]

Given the limited knowledge about stillbirths in the US, this study contributes to the literature by highlighting where stillbirths and racial disparities are most prominent. Interestingly, states with the highest stillbirth rates are not necessarily those that also have the highest racial disparities. This finding highlights the importance of paying particular attention to racial disparities, even among states with lower stillbirth rates. Furthermore, this study's use of 2021 stillbirth data from CDC WONDER provides the most up-to-date snapshot of stillbirth in the United States. Finally, our use of two different reference groups allows for multiple comparisons to be made when assessing racial disparities in stillbirth rates, highlighting aspects of inequity, inequality, and social advantage.[26]

This study is not without limitations. All 50 states could not be included in the analysis of trends in racial disparities since some had data suppressed due to small counts. In addition, small counts across many states caused more fluctuation in trends, making it challenging to identify patterns of increasing or decreasing racial disparities. However, our findings indicate that racial disparities in stillbirth rates mostly remained stable during the study period, which illustrates that much progress is still needed to achieve equitable health outcomes for non-Hispanic Black women. Our ability to explore trends over a longer period was hampered due to changes in reporting of race and ethnicity that occurred in 2016, which prevent making comparisons to previous iterations. In addition, not all states use the same definition for reporting fetal deaths, which means that some stillbirths occurring closer to 20 weeks' gestation may not have been included.[1] Nevertheless, vital statistics data for stillbirth remain the only nationwide resource for stillbirth data, making it the most reliable data source for stillbirth research. Lastly, this study primarily focuses on racial disparities between NH-Black mothers and other races/ethnicities, however, there is evidence that disparities in stillbirth outcomes also exist in other historically disadvantaged populations, such as American Indian/Alaska Native mothers.[7,8] More research is needed to assess stillbirth outcomes and areas of intervention in such populations.

CONCLUSION

Our findings indicate that there is no correlation between overall stillbirth rates and racial disparities at the state-level, though some areas might experience overlap. While some states had evidence of increasing or decreasing trends in racial disparities in stillbirth rates, disparities remained relatively stable in most places, and were unacceptably high. Strategies to address both stillbirth rates and racial disparities are needed in order to reduce these tragic pregnancy outcomes nationally.

Table 1. States ranked by highest overall stillbirth rate and racial disparities in stillbirth rates

Rank	**Overall Stillbirth Rate**		**Racial Disparity (NH-Black vs. All Other Races/Ethnicities)**		**Racial Disparity (NH-Black vs. NH-White)**	
	Reporting Area	Stillbirth Rate[1]	Reporting Area	Risk Ratio	Reporting Area	Risk Ratio
1	Mississippi	10.00	D.C.	3.73	Delaware	3.98
2	Alabama	8.71	Massachusetts	3.00	Massachusetts	3.17
3	Wyoming	8.43	Delaware	2.97	Iowa	2.75
4	Arkansas	8.38	Kansas	2.57	Kansas	2.64
5	Nevada	8.24	Iowa	2.51	New York	2.37
6	Georgia	8.12	New York	2.24	New Jersey	2.27
7	D.C.	7.45	Georgia	2.21	Michigan	2.26
8	Florida	7.32	New Jersey	2.20	California	2.25
9	Hawaii	6.93	Washington	2.18	Alabama	2.15
10	Maryland	6.65	Michigan	2.16	Florida	2.13

[1]Stillbirth rate per 1,000 deliveries

Figure 1. Overall stillbirth rate, including all races/ethnicities (2021)

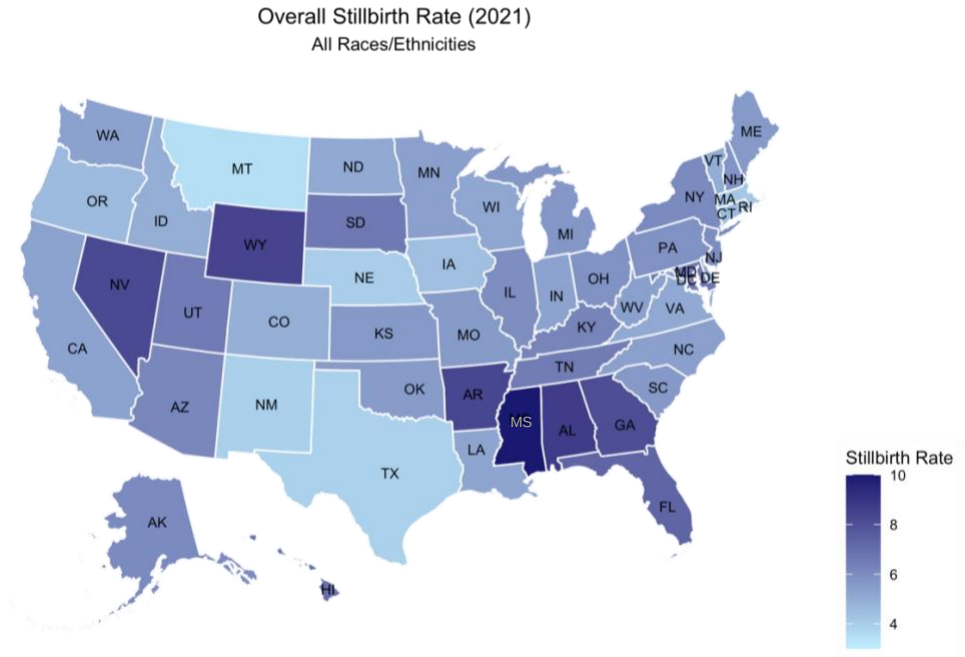


Figure 2, Panel A. Racial disparities in stillbirth rate, comparing NH-Black to all other races/ethnicities (2021)

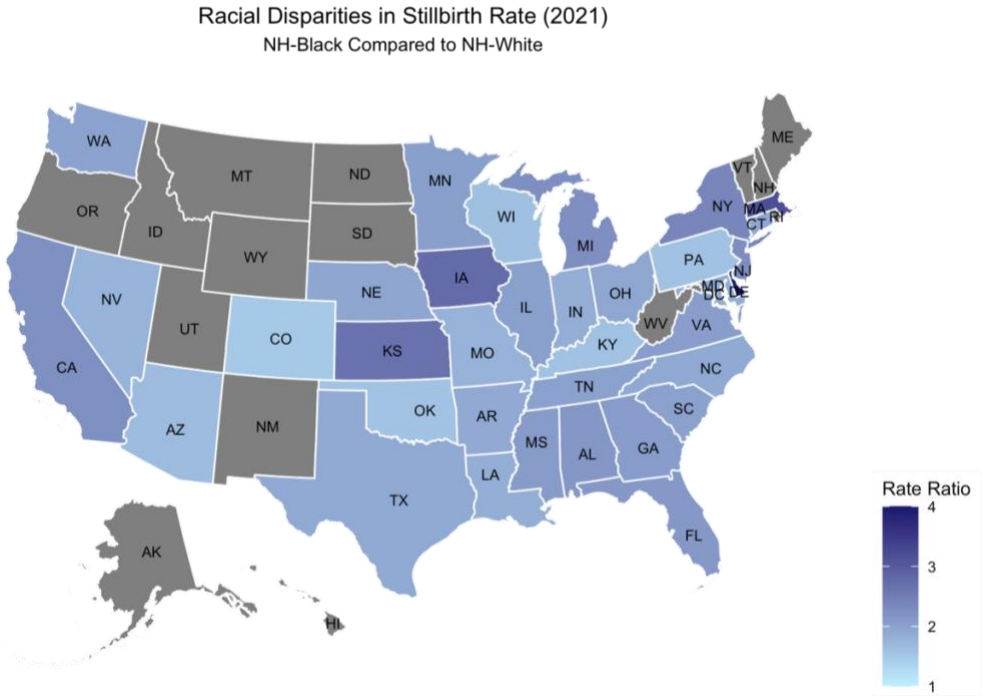


Figure 2, Panel B. Racial disparities in stillbirth rate, comparing NH-Black to NH-White (2021)

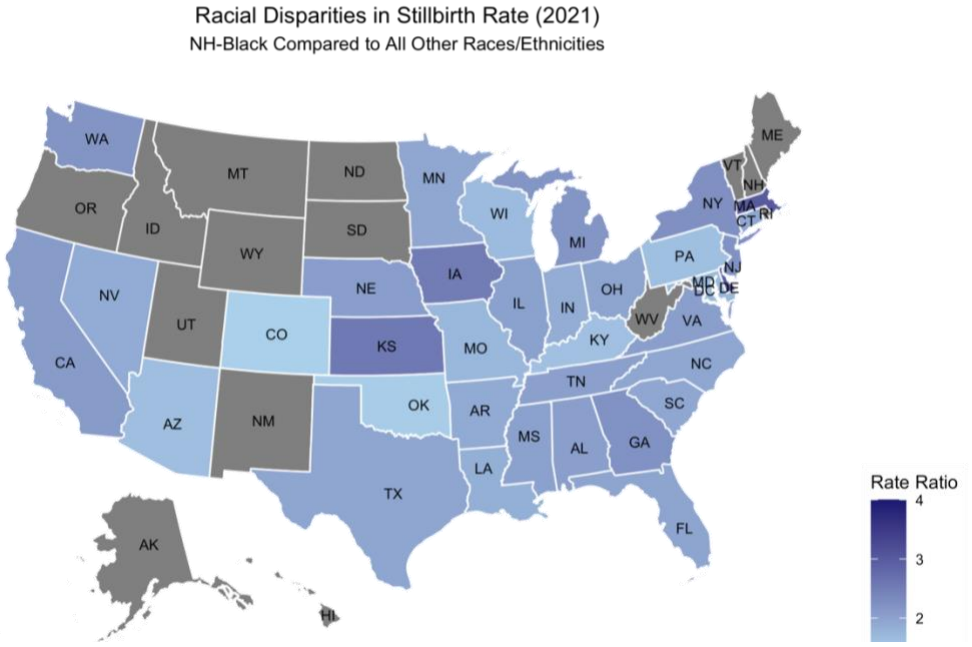


Table 2. Trend analysis of 3-year racial disparities in stillbirth rates using natural log of risk ratios

	NH-Black vs. All Other Races/Ethnicities					NH-Black vs. NH-White				
Reporting Area	**2016 -2018**	**2017 -2019**	**2018 -2020**	**2019 -2021**	**p-value**	**2016 -2018**	**2017 -2019**	**2018 -2020**	**2019 -2021**	**p-value**
Alabama	0.76	0.78	0.77	0.72	0.73	0.77	0.79	0.79	0.75	1.0
Arizona	0.60	0.61	0.59	0.61	0.73	0.64	0.65	0.67	0.68	0.09
Arkansas	0.78	0.72	0.76	0.71	0.31	0.73	0.68	0.74	0.70	1.0
California	0.82	0.83	0.78	0.74	0.31	0.86	0.91	0.87	0.82	0.73
Colorado	0.86	0.67	0.77	0.47	0.31	0.83	0.61	0.73	0.47	0.31
Connecticut[1]	--	--	0.91	0.85	--	--	--	0.92	0.82	--
Delaware	1.00	0.94	0.85	0.95	0.73	1.12	1.02	0.93	1.01	0.31
D.C. [1]	1.23	0.95	1.05	1.10	1.0	--	1.14	1.13	--	--
Florida	0.75	0.73	0.70	0.70	0.09	0.82	0.80	0.77	0.77	0.31
Georgia	0.75	0.75	0.76	0.76	0.09	0.77	0.75	0.75	0.73	0.31
Illinois	0.90	0.86	0.87	0.78	0.31	0.91	0.89	0.91	0.82	0.73
Indiana	0.49	0.49	0.56	0.62	0.09	0.49	0.48	0.56	0.62	0.31
Iowa	0.88	0.96	0.90	0.84	0.73	0.89	0.98	0.92	0.88	0.73
Kansas	0.63	0.49	0.63	0.83	0.73	0.67	0.52	0.73	0.91	0.31
Kentucky	0.61	0.58	0.67	0.62	0.73	0.62	0.59	0.68	0.62	0.73
Louisiana	0.82	0.71	0.60	0.59	0.09	0.86	0.72	0.61	0.60	0.09
Maryland	0.65	0.67	0.69	0.67	0.31	0.72	0.76	0.79	0.75	0.73
Massachusetts	0.90	0.91	0.94	0.98	0.09	1.04	1.04	1.10	1.10	0.31
Michigan	0.67	0.74	0.63	0.68	1.0	0.70	0.77	0.64	0.70	1.0
Minnesota	0.58	0.61	0.48	0.51	0.73	0.64	0.67	0.51	0.55	0.73
Mississippi	1.01	0.95	0.84	0.79	0.09	1.02	0.96	0.83	0.80	0.09
Missouri	0.67	0.77	0.73	0.66	0.73	0.66	0.76	0.73	0.68	1.0
Nebraska[1]	--	--	--	0.78	--	--	--	--	0.76	--
Nevada	0.59	0.77	0.79	0.75	0.73	0.59	0.85	0.89	0.81	0.73
New Jersey[1]	--	0.92	0.90	0.83	--	--	1.04	1.01	0.92	--
New York	0.96	0.92	0.88	0.90	0.31	1.22	1.05	0.93	0.95	0.31

North Carolina	0.73	0.73	0.82	0.80	0.31	0.78	0.79	0.90	0.87	0.31
Ohio	0.67	0.66	0.73	0.71	0.73	0.67	0.67	0.73	0.70	0.31
Oklahoma	0.58	0.57	0.63	0.54	0.73	0.57	0.60	0.62	0.59	0.73
Pennsylvania	0.70	0.68	0.67	0.61	0.09	0.71	0.67	0.66	0.58	0.09
South Carolina	0.71	0.74	0.91	0.85	0.31	0.75	0.77	0.97	0.92	0.31
Tennessee	0.77	0.83	0.90	0.86	0.31	0.72	0.78	0.88	0.87	0.31
Texas	0.66	0.64	0.65	0.65	1.0	0.70	0.66	0.66	0.63	0.31
Virginia	0.55	0.62	0.68	0.71	0.09	0.53	0.55	0.59	0.65	0.09
Washington	0.43	0.49	0.72	0.83	0.09	0.43	0.50	0.71	0.79	0.09
Wisconsin	0.57	0.56	0.54	0.50	0.09	0.58	0.58	0.56	0.51	0.31
Overall	0.78	0.78	0.78	0.76	0.31	0.67	0.66	0.66	0.64	0.09

[1]Trend test could not be conducted for reporting areas with suppressed data.
The following states were excluded due to suppressed data: Alaska, Hawaii, Idaho, Maine, Montana, New Hampshire, New Mexico, North Dakota, Oregon, Rhode Island, South Dakota, Utah, Vermont, West Virginia, and Wyoming.

Figure 3, Panel A. Percent change in racial disparities in stillbirth rate, comparing NH-Black to all other races/ethnicities (2016-2018 vs. 2019-2021)

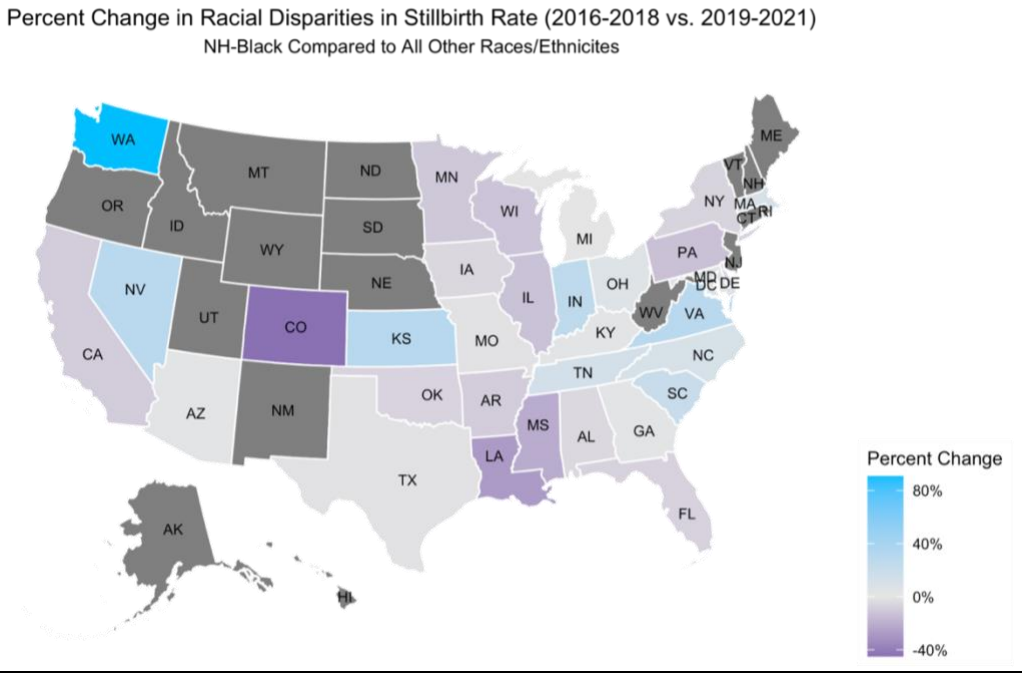


Figure 3, Panel B. Percent change in racial disparities in stillbirth rate, comparing NH-Black to NH-White (2016-2018 vs. 2019-2021)

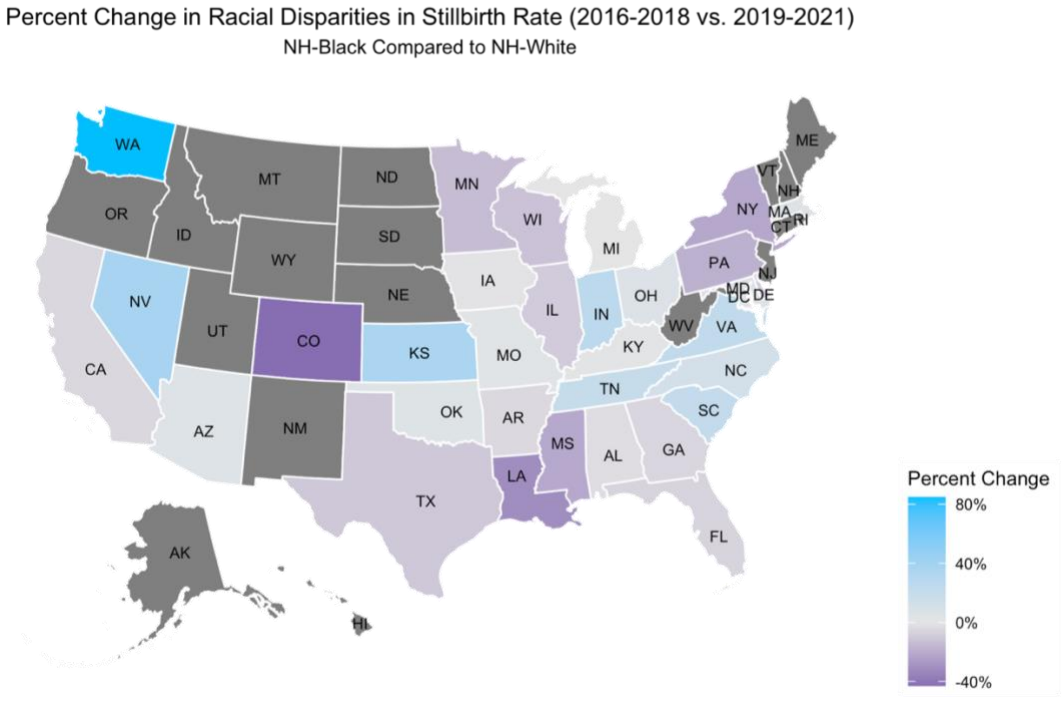


Table 3. Trend analysis of annual racial disparities in stillbirth rates using natural log of risk ratios

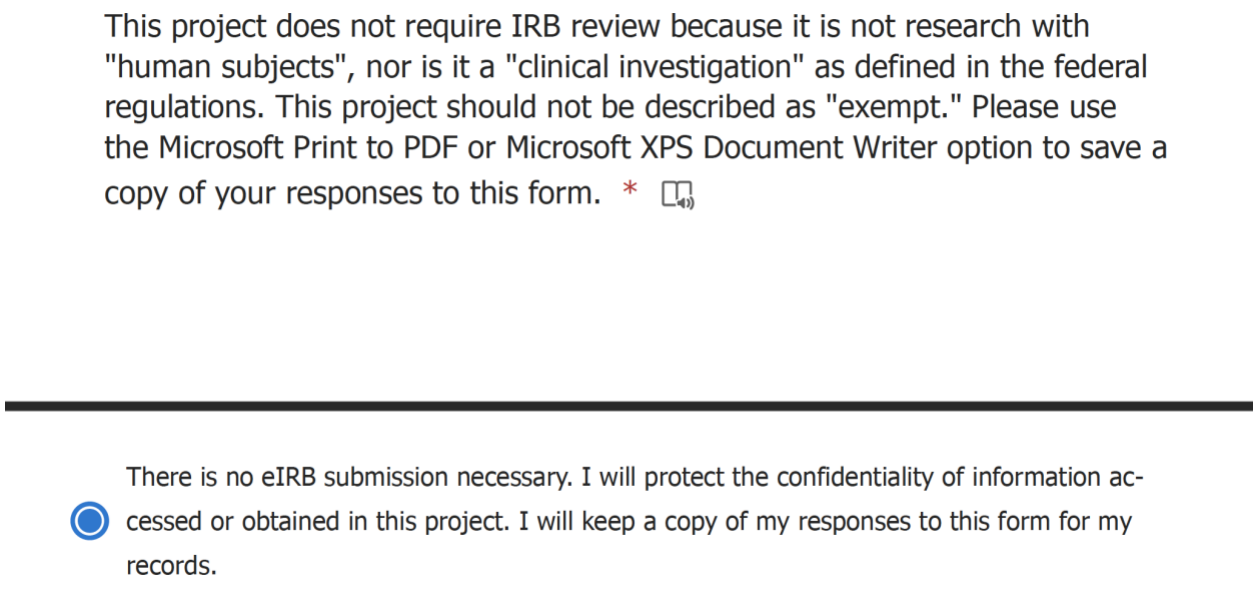
	NH-Black vs. All Other Races/Ethnicities						NH-Black vs. NH-White					
State	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Alabama	0.68	0.76	0.85	0.72	0.74	0.71	0.68	0.77	0.88	0.72	0.78	0.76
Arizona	0.78	0.61	0.41	0.77	0.56	0.49	0.83	0.63	0.45	0.83	0.67	0.50
Arkansas	0.87	0.69	0.79	0.69	0.80	0.63	0.85	0.59	0.76	0.68	0.76	0.64
California	0.79	0.80	0.86	0.82	0.67	0.73	0.77	0.87	0.96	0.90	0.75	0.81
Colorado	0.91	0.41	1.16	0.27	0.74	0.34	0.95	0.36	1.08	0.23	0.73	0.40
Connecticut[1]	--	--	0.83	1.02	0.90	0.66	--	--	0.93	0.89	0.95	0.65
Delaware	1.10	1.10	0.80	0.91	0.85	1.09	1.10	1.17	1.08	0.82	0.91	1.38
D.C.[1]	1.71	0.84	1.15	0.89	1.16	1.32	--	0.99	1.36	1.10	0.96	--
Florida	0.78	0.78	0.69	0.71	0.71	0.67	0.85	0.85	0.75	0.79	0.77	0.76
Georgia	0.74	0.73	0.78	0.75	0.75	0.79	0.80	0.74	0.78	0.73	0.74	0.73
Illinois	0.91	0.85	0.94	0.78	0.87	0.69	0.92	0.85	0.95	0.86	0.91	0.70
Indiana	0.64	0.37	0.45	0.64	0.60	0.62	0.67	0.35	0.44	0.64	0.59	0.61
Iowa	0.62	0.90	1.13	0.88	0.69	0.92	0.63	0.91	1.14	0.91	0.71	1.01
Kansas	0.95	0.42	0.35	0.68	0.87	0.94	1.02	0.37	0.43	0.75	1.02	0.97
Kentucky	0.69	0.54	0.61	0.60	0.79	0.47	0.68	0.55	0.62	0.62	0.78	0.45
Louisiana	0.87	0.93	0.64	0.55	0.61	0.60	0.96	0.99	0.64	0.52	0.65	0.61
Maryland	0.66	0.69	0.59	0.73	0.75	0.53	0.67	0.73	0.77	0.78	0.83	0.63
Massachusetts	0.81	0.89	0.99	0.82	1.01	1.10	0.98	1.00	1.15	0.95	1.19	1.15
Michigan	0.52	0.88	0.63	0.72	0.53	0.77	0.53	0.95	0.63	0.75	0.54	0.81
Minnesota	0.44	0.73	0.54	0.55	0.32	0.66	0.52	0.81	0.58	0.60	0.33	0.71
Mississippi	1.03	1.16	0.83	0.84	0.84	0.70	1.03	1.21	0.82	0.83	0.85	0.73
Missouri	0.60	0.65	0.78	0.89	0.54	0.54	0.59	0.63	0.76	0.88	0.55	0.57
Nebraska[1]	1.27	0.88	--	0.70	0.91	0.72	1.34	0.82	--	0.72	0.86	0.67
Nevada	0.35	0.68	0.71	0.92	0.74	0.62	0.31	0.72	0.76	1.09	0.84	0.57
New Jersey[1]	--	0.94	1.00	0.82	0.86	0.79	--	1.10	1.11	0.91	0.99	0.82
New York	1.23	1.08	0.75	1.01	0.88	0.81	1.86	1.55	0.81	1.08	0.91	0.87
North Carolina	0.82	0.65	0.73	0.83	0.91	0.66	0.85	0.72	0.78	0.88	1.08	0.64
North Dakota[1]	1.06	--	--	--	--	--	1.14	--	--	--	--	--
Ohio	0.67	0.60	0.74	0.65	0.81	0.67	0.65	0.60	0.75	0.66	0.79	0.66
Oklahoma	0.61	0.46	0.65	0.58	0.64	0.36	0.60	0.51	0.58	0.71	0.60	0.45
Oregon[1]	0.86	--	--	1.18	--	--	0.93	--	--	1.23	--	--

Pennsylvania	0.77	0.67	0.66	0.70	0.65	0.47	0.75	0.68	0.69	0.65	0.63	0.45 *
Rhode Island[1]	--	--	1.02	--	0.92	--	--	--	1.07	--	0.76	--
South Carolina	0.74	0.57	0.82	0.84	1.07	0.66	0.83	0.59	0.84	0.90	1.18	0.70
Tennessee	0.75	0.72	0.83	0.94	0.95	0.71	0.76	0.66	0.75	0.94	0.97	0.69
Texas	0.69	0.64	0.65	0.61	0.68	0.67	0.75	0.64	0.71	0.61	0.65	0.64
Utah[1]	--	--	1.06	--	--	--	--	--	1.02	--	--	--
Virginia	0.61	0.39	0.63	0.84	0.56	0.71	0.65	0.37	0.54	0.73	0.48	0.72
Washington	0.46	0.43	0.41	0.64	1.04	0.78	0.47	0.43	0.39	0.66	1.00	0.69
Wisconsin	0.57	0.54	0.61	0.54	0.45	0.51	0.59	0.51	0.62	0.60	0.44	0.47

[1]Risk ratios could not be calculated for some reporting areas due to suppressed data.
The following states were excluded due to suppressed data: Alaska, Hawaii, Idaho, Maine, Montana, New Hampshire, New Mexico, South Dakota, Vermont, West Virginia, and Wyoming.
* p-value <0.05

APPENDIX

Figure 4. Emory University IRB exemption


This project does not require IRB review because it is not research with "human subjects", nor is it a "clinical investigation" as defined in the federal regulations. This project should not be described as "exempt." Please use the Microsoft Print to PDF or Microsoft XPS Document Writer option to save a copy of your responses to this form. *

There is no eIRB submission necessary. I will protect the confidentiality of information accessed or obtained in this project. I will keep a copy of my responses to this form for my records.

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