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Structural racism, racial inequities and urban–rural differences in infant mortality in the US

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ABSTRACT

Background While evidence shows considerable geographic variations in county-level racial inequities in infant mortality, the role of structural racism across urban–rural lines remains unexplored. The objective of this study was to examine the associations between county-level structural racism (racial inequity in educational attainment, median household income and jail incarceration) and infant mortality and heterogeneity between urban and rural areas.

Methods Using linked live birth/infant death data provided by the National Center for Health Statistics, we calculated overall and race-specific 2013–2017 5-year infant mortality rates (IMRs) per 1000 live births in every county. Racially stratified and area-stratified negative binomial regression models estimated IMR ratios and 95% CIs associated with structural racism indicators, adjusting for county-level confounders. Adjusted linear regression models estimated associations between structural racism indicators and the absolute and relative racial inequity in IMR.

Results In urban counties, structural racism indicators were associated with 7%–8% higher black IMR, and an overall structural racism score was associated with 9% greater black IMR; however, these findings became insignificant when adjusting for the region. In white population, structural racism indicators and the overall structural racism score were associated with a 6% decrease in urban white IMR. Both absolute and relative racial inequity in IMR were exacerbated in urban counties with greater levels of structural racism.

Conclusions Our findings highlight the complex relationship between structural racism and population health across urban–rural lines and suggest its contribution to the maintenance of health inequities in urban settings.

INTRODUCTION

Infant mortality, a global indicator of population health and well-being, is defined as the death of an infant during the first year after the birth.[1] While over the last decades infant mortality in the USA has declined, prominent disparities remain across racial/ethnic groups and geographical areas.[2–4] In 2017, the total population infant mortality rate (IMR) was 5.79 per 1000 live births. For infants of non-Hispanic (NH) white mothers, the rate was 4.67 per 1000 births and more than double for NH black mothers at 10.97 per 1000 births.[5] Additionally, IMR varies by urbanisation level, and recent studies have shown that IMR declines as urbanisation levels increase, from 6.55 deaths per 1000 births in rural counties to 5.44 in large urban counties.[2] Furthermore, while in the last two decades the USA made significant improvements in reducing black infant mortality, the state-level progress in eliminating black–white inequities has been minimal.[6] A better understanding of factors contributing to infant mortality and the observed racial inequity remains an important public health concern in the US.

To date, research has largely focused on individual-level maternal characteristics thus attributing racial inequities in infant mortality to differences in personal behaviours, socioeconomic status and healthcare access between black and white women.[5 7] Given a significant portion of the black–white infant mortality gap that remains unexplained by individual characteristics and risk behaviors,[7 8] a growing body of research has turned to investigating the impact of societal conditions and state-level policies on persisting racial inequities in adverse birth outcomes.[9 10] For example, recent studies have documented associations between infant mortality and macro-level factors including state-level income inequality,[11] per capita federal transfers[12] and structural racism.[13–15] Structural racism, defined as the myriad ways in which society fosters differential access to resources and opportunities by race as well as policies, laws and practices that reinforce racial inequity, has been recognised as a fundamental cause of racial health inequities.[16–18]

While evidence confirms considerable geographic variations in county-level racial inequities in IMR,[4 19] the impact of structural racism across urban–rural lines remains unexplored. The incidence of adverse birth outcomes, including infant mortality, is highest in rural areas and lowest in large urban communities, with black IMR in rural counties reaching over 12 deaths per 1000 births in 2016.[2] However, it is not known whether and through what pathways structural racism contributes to the racial inequities in IMR in rural as opposed to urban communities. Examining the history and establishment of structural practices and conditions that shape the allocation of opportunities and resources for people of different race in urban versus rural areas may offer an explanation to the vast place and race-based disparities in population health.[20 21] Previous research has identified the unique health needs and challenges faced by rural communities and demonstrated that non-white racial/ethnic populations in rural areas suffer worse physical and mental health, are more likely to be uninsured and have limited access to and lower quality healthcare than white

people in the same communities.[22–25] Furthermore, research has pointed to a 'rural mortality penalty', in which rural residents, particularly from black communities, have higher death rates than their urban counterparts.[26]

Our study builds on previous evidence suggesting that area-level structural racism—measured by the degree of population-level racial inequality across socioeconomic and judicial domains—may be contributing to racial inequity in infant mortality.[14 15] The current analysis extends prior research by using most recent (2013–2017) linked live birth/infant death data to investigate structural racism and race-stratified models of IMR across US counties. Furthermore, we explore urban–rural differences that may otherwise be masked by state-level analyses. Drawing on the growing literature documenting the impact of structural racism on population health,[15–17 27] we hypothesise that greater racial inequity in socioeconomic and judicial indicators will be associated with higher IMRs among NH black but not NH white population (black and white, hereafter) and broader relative and absolute racial inequities in IMR. However, it is possible that whites may potentially benefit from the unequal and exploitative processes inherent in structural racism and experience health advantages (ie, lower IMR).[28 29] Second, we examine the associations between structural racism and IMR across urban–rural lines and hypothesise that given the vast differences in cross-county historical, policy and socioeconomic contexts as well as the history of systemic oppression, the association between structural racism and IMR will vary across urban–rural settings.

METHODS

This study is a retrospective ecological analysis of the 2013–2017 period linked live birth/infant death datasets provided by the National Center for Health Statistics (NCHS). These include all live birth records issued in the US from 2013 to 2017 (n=19 700 127) and linked death records for those where infant death occurred prior to 1 year of age (n=115 611) across a total of 3148 US counties. For the purposes of exploring black–white racial inequities in IMR, we limited the dataset to counties that had at least 100 live births and 5 infant deaths among black population in the study period. We used these data to estimate overall and race-specific 2013–2017 5-year IMRs per 1000 live births in every county. Our final analytic sample was 16 469 521 births in 1211 counties.

Outcome

Our outcomes of interest included: total population IMR (defined as the number of deaths per 1000 live births of children under 1 year of age), black and white IMRs and absolute (black IMR – white IMR) and relative (black IMR/white IMR) racial inequity in IMR.

Measures

County-level structural racism indicators were characterised by population-level racial inequity in educational attainment, median household income and jail incarceration.[27 28 30] Selection of these indicators was framed by available county-level data by race required to develop racial inequality measures and our objective to retain substantial number of counties with available data on all measures. Data on educational attainment (proportion of the population age 25 years and older with a bachelor's degree (BA) or higher) and median household income by race/ethnicity were obtained from the US Census Bureau's American Community Survey (ACS) 2013–2017 5-year estimates for each county. The Vera Institute provided 2013–2017 annual estimates of jail incarceration by race and county, based on data obtained through the National Corrections Reporting Program (NCRP) and data collected directly from state departments of correction, when NCRP data were not available or were unreliable.[31]

For each county, we calculated 5-year annual average values (2013–2017) and operationalised educational and median household income inequality as white-to-black ratio and jail incarceration as black-to-white ratio so that the higher rate ratio indicated higher degree of structural racism. We then dichotomised all indicators at the 75th percentile to define the highest or more extreme level of structural racism[27] across counties (ie, values above 75th percentile represent high levels of racial inequity, whereas values below the 75th percentile represent the reference group or low levels of racial inequity in education, income and incarceration). Additionally, we derived a structural racism 'overall score' to capture racial inequity simultaneously across socioeconomic and criminal justice domains by dichotomising the summed score of structural racism indicators (the total score ranging from 0 to 3) into the values ≥2 (75th percentile) referring to high levels of overall structural racism in the county.

We used the 2010 Census Urban–Rural Classification Scheme data to link geographic (FIPS) codes to assign urban–rural classification for all counties in the US based on maternal county of residence. In the Census classification scheme, counties with <50% of the population living in rural areas were classified as 'mostly urban', counties with 50%–99.9% were classified as 'mostly rural' and 100% rural were classified as 'completely rural'. We combined the latter two categories into 'rural' and used a dichotomous indicator (1=urban, 0=rural) in our analysis.

Statistical analysis

We conducted descriptive analysis to characterise the variation of county-level IMR for the total, black and white populations and contextual indicators across all counties and then stratified by urban/rural status. We then ran separate models for the total IMR, black IMR, white IMR, absolute IMR inequities and relative IMR inequities. Due to overdispersion, we fit ecological county-level generalised linear negative binomial models with robust standard errors to examine the relationship between structural racism indicators and IMR for the total, white and black populations. We estimated adjusted rate ratios (aRR) and 95% confidence intervals (CI) controlling for county-level poverty and the absolute (total population) levels of education and incarceration within each county (data derived from ACS 2013–2017 5-year estimates). We then ran urban/rural area-stratified models to examine the associations between structural racism and infant mortality across urban–rural counties in greater detail. In addition, we fit a set of linear regression models to estimate the associations between structural racism indicators and the absolute (black–white) and relative (black/white) IMR inequity, adjusting for the same set of covariates. Finally, we conducted sensitivity analysis to test the robustness of our findings when adjusting for the US region (Northeast, Midwest, South and West). All analyses were conducted with SAS V.9.4.

RESULTS

Across the 1211 counties included in the analysis, the total population 5-year IMR averaged 7.19 deaths per 1000 live births, whereas black IMR (12.63) was double the white IMR of 5.71 deaths per 1000 live births (see table 1). IMRs varied by urban–rural status and were higher in rural counties: overall rural IMR

Table 1 Descriptive statistics by county's urban–rural status, USA, 2013–2017

	All counties (n=1211)		Urban counties (n=775)		Rural counties (n=436)	
	M (SD)	Range	M (SD)	Range	M (SD)	Range
IMR (deaths per 1000 live births)	7.19 (2.74)	2.22–21.60	6.47 (2.20)	2.21–19.66	8.68 (3.14)	3.25–21.60
Black IMR	12.63 (4.71)	3.97–48.78	11.91 (4.01)	3.97–36.58	14.72 (5.83)	5.19–48.78
White IMR	5.71 (2.42)	1.12–30.44	5.17 (1.91)	1.12–18.52	7.42 (3.02)	2.67–25.64
Absolute racial inequity in IMR (black IMR – white IMR)	6.73 (4.32)	−7.48–30.44	6.74 (3.89)	−7.48–30.44	6.65 (5.94)	−7.09–25.97
Relative racial inequity in IMR (black IMR/white IMR)	2.44 (1.09)	0.58–12.45	2.51 (1.04)	0.58–12.45	2.10 (1.24)	0.59–10.43
White-to-black ratio in educational attainment	2.10 (1.04)	0.57–12.53	1.93 (0.91)	0.64–12.57	2.39 (1.20)	0.57–10.29
White-to-black ratio in median household income	1.74 (0.43)	0.61–4.40	1.71 (0.45)	0.61–4.40	1.81 (0.40)	0.99–3.76
Black-to-white ratio in jail incarceration	4.77 (5.33)	0.04–100.44	5.31 (6.08)	0.23–100.44	3.81 (3.45)	0.04–46.98
Poverty, %	17.37 (6.86)	3.6–48.2	15.34 (6.15)	3.60–48.20	20.98 (6.57)	5.30–47.00
College graduates, %	23.96 (10.97)	7.5–74.1	28.49 (10.61)	8.10–74.10	15.92 (5.75)	7.50–60.70
Incarceration rate per 1000	4.20 (8.02)	0.13–138.15	3.37 (6.29)	0.25–138.15	5.69 (10.24)	0.13–129.43

IMR, infant mortality rate; M, mean; SD, standard deviation.

was 8.68 (urban IMR=6.47), rural black IMR reached 14.72 (urban black IMR=11.91) and rural white IMR was 7.42 deaths per 1000 live births (urban white IMR=5.17). The average of absolute racial inequity in IMR across all counties was 6.73 excess black infant deaths for every white infant death per 1000 live births and similar across urban and rural counties (6.74 and 6.65, respectively). Relative racial inequity in IMR averaged 2.44 in the total sample of counties and was higher in urban than rural counties (2.51 and 2.10, respectively). Except for the absolute racial inequity in IMR, all mean differences between urban and rural counties were statistically significant (p<0.01).

Values of structural racism indicators also varied widely across counties (table 1). For example, racial inequity in educational attainment across all counties was 2.10 and higher in rural counties as compared with urban counties (the white/black ratio in BA or higher degree is 2.39 and 1.93, respectively). Racial inequity in median household income was 1.74 across all counties and higher in rural as compared with urban counties with whites earning nearly twofold higher incomes on average (1.81 and 1.71, respectively). The greatest degree of racial inequity was evident in jail incarceration rates, where incarceration among black population was on average 4.77 times higher than that the white incarceration rate, fluctuating from 3.81 in rural counties to 5.31 in urban counties. These differences in urban/rural mean values were statistically significant (p<0.01).

Associations between structural racism and IMR

In adjusted models, only higher levels of racial inequity in jail incarceration was associated with IMR for the total population (aRR=0.95, 95% CI 0.93 to 0.99, see table 2). Within the black population, racial inequity in jail incarceration and the overall structural racism score were associated with 7% and 6% higher IMR, respectively (aRR=1.07, 95% CI 1.02 to 1.12 and

Table 2 Overall and race-specific IMR ratios (RR) and 95% CIs for associations with structural racism indicators among the total county population and by urban–rural areas in the USA, 2013–2017

	Overall IMR		Black IMR		White IMR	
	aRR	95% CI	aRR	95% CI	aRR	95% CI
All counties (n=1221)						
Educational attainment	1.00	(0.96 to 1.04)	1.02	(0.97 to 1.08)	0.94*	(0.90 to 0.98)
Median household income	1.02	(0.98 to 1.06)	1.05	(0.99 to 1.09)	0.95*	(0.92 to 0.99)
Jail incarceration rate	0.95*	(0.92 to 0.98)	1.07*	(1.02 to 1.12)	0.94†	(0.91 to 0.98)
Overall structural racism	0.99	(0.95 to 1.03)	1.06†	(1.01 to 1.12)	0.94†	(0.90 to 0.99)
Urban counties (n=775)						
Educational attainment	1.02	(0.97 to 1.06)	1.04	(0.99 to 1.10)	0.94†	(0.90 to 0.99)
Median household income	1.01	(0.97 to 1.06)	1.08*	(1.03 to 1.14)	0.96	(0.92 to 1.00)
Jail incarceration rate	0.93*	(0.89 to 0.97)	1.07†	(1.01 to 1.13)	0.94*	(0.90 to 0.98)
Overall structural racism	1.00	(0.96 to 1.05)	1.09†	(1.03 to 1.16)	0.94†	(0.89 to 0.99)
Rural counties (n=436)						
Educational attainment	0.98	(0.91 to 1.06)	1.01	(0.89 to 1.14)	1.00	(0.90 to 1.12)
Median household income	0.99	(0.91 to 1.07)	0.95	(0.84 to 1.06)	0.97	(0.87 to 1.08)
Jail incarceration rate	1.00	(0.89 to 1.02)	1.07	(0.96 to 1.19)	0.89*	(0.81 to 0.97)
Overall structural racism	0.95	(0.86 to 1.04)	0.95	(0.84 to 1.08)	0.92	(0.81 to 1.05)

*P<0.01.
†P<0.05.
aRR, rate ratios adjusting for county-level poverty, population with a bachelor's degree or higher, and county incarceration rate; CI, confidence intervals; IMR, infant mortality rate.

aRR=1.06, 95% CI 1.01 to 1.12). Within the white population, all structural racism indictors and the overall structural racism score were associated with 5%–6% lower IMR (aRR=0.94, 95% CI 0.90 to 0.98).

Subsequent models stratified by county's rural–urban status revealed that observed associations were only significant in urban counties where racial inequity in jail incarceration and median household income was associated with 7% and 8% increase in black IMR, respectively (aRR=1.07, 95% CI 1.03 to 1.14 and aRR=1.08, 95% CI 1.03 to 1.14) (table 2). Additionally, urban counties with higher prevalence of structural racism had 9% greater black IMR on average (aRR=1.09, 95% CI 1.03 to 1.16). These patterns of association were opposite within urban white population. That is, urban counties with higher racial inequity in educational attainment and jail incarceration rates had 6% lower white IMR (aRR=0.94, 95% CI 0.90 to 0.99). High levels of the overall structural racism score were associated with 6% decrease in urban white IMR (aRR=0.94, 95% CI 0.89 to 0.99). In rural counties, only racial inequity in jail incarceration was associated with 11% decrease in white IMR (aRR=0.89, 95% CI 0.81 to 0.97).

The results of the sensitivity analysis, in which we additionally controlled for the US region, were consistent for the total and white population but changed for the black population. That is, while structural racism indicators remained associated with 5%–7% lower white IMR, previously significant associations between racial inequity in jail incarceration and the overall structural racism score and urban black IMR disappeared when adjusting for region of residence (online supplemental appendix table 1).

Associations between structural racism and racial inequities in IMR

As observed in previous models, the associations between the absolute and relative racial inequity in IMR and structural racism indicators were only significant in urban counties (table 3). For example, racial inequity in jail incarceration was most strongly associated with absolute racial inequity in IMR (absolute IMR difference beta=1.60, 95% CI 0.66 to 2.54), whereas racial inequity in educational attainment was the strongest predictor of relative racial inequities in IMR (relative IMR difference beta=0.46, 95% CI 0.17 to 0.75). In addition, the overall structural racism in the county was associated with an additional excess of 1.77 black deaths for every 1 white death per 1000 live births (absolute IMR difference beta=1.77, 95% CI 0.74 to 2.79) and with a 49% increase in risk experienced by the black population relative to whites (relative IMR difference beta=0.49, 95% CI 0.23 to 0.75). These findings remained consistent when adjusting for region of residence (online supplemental appendix table 2).

Table 3 Linear regression coefficients (B) and 95% CI for the associations between structural racism indicators and the absolute and relative racial inequity in IMR across all study counties and by urban–rural areas in the USA, 2013–2017

	Absolute racial inequities in IMR (black–white IMR difference)		Relative racial inequities in IMR (black/white IMR ratio)	
	B	95% CI	B	95% CI
All counties (n=1221)				
Educational attainment	1.68*	(0.56 to 2.79)	0.46*	(0.17 to 0.75)
Median household income	1.11†	(0.26 to 1.96)	0.33*	(0.11 to 0.55)
Jail incarceration rate	1.16†	(0.05 to 2.27)	0.40*	(0.19 to 0.61)
Overall structural racism	1.84*	(0.83 to 2.85)	0.49*	(0.23 to 0.75)
Urban counties (n=775)				
Educational attainment	1.44*	(0.39 to 2.48)	0.46*	(0.17 to 0.75)
Median household income	1.32*	(0.51 to 2.12)	0.33*	(0.11 to 0.55)
Jail incarceration rate	1.60*	(0.66 to 2.54)	0.40*	(0.19 to 0.61)
Overall structural racism	1.77*	(0.74 to 2.79)	0.49*	(0.23 to 0.75)
Rural counties (n=436)				
Educational attainment	1.59	(−1.57 to 4.75)	0.08	(−0.36 to 0.51)
Median household income	−0.04	(−2.79 to 2.71)	0.17	(−0.34 to 0.68)
Jail incarceration rate	2.39	(−0.33 to 5.10)	0.37	(0.18 to 0.92)
Overall structural racism	2.72	(−0.35 to 5.79)	0.52	(−0.09 to 1.12)

*P<0.01.
†P<0.05.
B, linear regression coefficient adjusting for county-level poverty, population with a bachelor's degree or higher, and county incarceration rate; CI, confidence intervals; IMR, infant mortality rate.

DISCUSSION

Using the most recently available linked live birth/infant death data, we estimated the associations between county-level structural racism and infant mortality among the total and race-stratified populations across urban–rural counties. While our study is among the first ones to specifically focus on county-level racial inequities *and* urban–rural differences in infant mortality, our findings are consistent with previous studies highlighting the link between area-level factors and infant mortality.[9 11 32 33] Importantly, our study contributes to the growing body of literature documenting the detrimental health effects of structural racism for black but not white population[14 15] by demonstrating that, across all counties, higher levels of overall structural racism were associated with 6% increase in black IMR and 6% decrease in white IMR. Furthermore, we observed significant urban–rural differences in infant mortality and its associations with structural racism indicators suggesting that, in urban but not rural counties, structural racism indicators were associated with a 7%–9% increase in black IMR and 6% decrease in white IMR. These findings have several important implications.

First, the relationships between structural racism and infant mortality among black and white populations in urban counties may indicate how population health is shaped by societal systems that socially, economically and ideologically benefit whites and disadvantages others.[29 34] As such, inverse associations between structural racism and white IMR versus black IMR is an illustration of racial population health inequity resulting from differential access to material and social advantages and privileges.[29] Several pathways through which systemic discrimination exerts an impact on black maternal and child health have been identified in the literature, including psychosocial stress and anxiety resulting from limited access to health-enhancing resources, such as affordable healthcare, steady employment and safe living environment.[16 18] Conversely, white advantage in health outcomes (ie, lower IMR) results from the accumulation of greater socioeconomic resources and higher perceived standing in the social hierarchy that positively shape white people's health through individual material resources and social advantages, psychological assets and prevailing beliefs and narratives of whiteness.[34–36] Future research should further investigate how structural racism acts through these mediating mechanisms to become embodied and manifest as racial health inequities at a population level.

Second, while we observed a rural health disadvantage across all models (higher IMR in rural versus urban counties for total population, black and white racial groups), we did not find significant associations between structural racism and IMR in rural settings. High rates of poverty, limited access to health resources and services, and generally poorer health among rural populations may more strongly drive IMR among residents of rural counties.[37] While white and black residents of urban counties may have more diverging experiences in accessing affordable and quality healthcare, their rural counterparts generally live in areas with fewer collective resources, higher levels of socioeconomic disadvantage and lower access and use of high quality healthcare.[22 23] Due to the limited and dispersed healthcare providers, rural residents—regardless of their race/ethnicity—face multiple barriers in accessing health services and thus are more vulnerable to adverse health outcomes.[22 26]

In addition, our lack of finding associations between structural racism and IMR in rural areas may indicate that measures of structural racism commonly used in the literature—area-level ratio-based measures representing the systemic exclusion of people of colour from access to socioeconomic resources and opportunities—may be ill-fitted to capture and reflect rural realities. While these measures have been widely used in previous studies,[14 27 28 38] our findings highlight the need to expand the ways we operationalise structural racism within different contexts. Furthermore, the structural racism–black IMR association became insignificant when adjusting for the regional area, indicating that to fully understand how structural racism has shaped the health of rural (and urban) communities, it is critical to recognise the broader regional and historical context in which it has occurred, connecting it to the present realities playing out in black communities.[21] For example, in the Southern region, many rural, predominantly black towns have historically been the target for environmental injustices such as the building of toxic waste facilities negatively impacting the health of local communities.[39] Future studies should further examine the role of regional influences in understanding how structural racism affects population health.

Finally, our findings suggest that, of all measures included in this study, structural racism related to educational attainment and criminal justice system are particularly prominent contributing factors underlying IMR and racial inequities in infant mortality. This is consistent with the results of previous ecological and multilevel studies that identified racial inequity in educational attainment as a leading risk factor for infant mortality and adverse birth outcomes.[14 15 27] Furthermore, our findings add to the growing evidence indicating that differential exposure to socioeconomic resources (eg, education, income and employment) generate health gains for white people while erode the health of black population.[35 36] For instance, we found that educational attainment played a strong protective role on the white IMR, whereas sustained socioeconomic disadvantage, experienced by black people through racial inequity in income and jail incarceration, contributed to increased black infant mortality. Additionally, our results support a recent study in which state-level structural racism in incarceration was significantly associated with increased odds of neonatal and infant mortality for black compared with white population.[14] Together, this emerging evidence highlights the need to target systemic racism in criminal justice and higher education systems to reduce racial inequity in infant mortality.

Our findings have important implications for policy interventions suggesting that solutions to eliminate racial health inequities must be rooted in the material conditions in which these inequities persist.[40] While efforts to reduce infant mortality should encompass policies that improve conditions for all women (eg, paid family leave, universal access to healthcare and higher minimum wage), public and health policy strategies employed to address persistent racial inequities in IMR and substantially higher black IMR require systematic reforms that go *beyond* equalising access to socioeconomic resources and centre on eradicating structural barriers that black communities face.[18 36] Therefore, key steps in addressing structural changes should entail implementing a set of local, regional and national policy interventions that regard income redistribution, antidiscriminatory policies, considerable investment in the healthcare system and the criminal justice reform as central policy strategies. Enduring failure to address the underlying systemic barriers and constrains that systematically disadvantage black communities will perpetuate the unequal gain of resources among black and white populations thus contributing to persistent and pervasive racial inequities in population health.

The strength of this study was the use of most recently available county-level data to uncover cross-county differences in the association between structural racism and IMR previously undetected by state-level analyses.[14 15] Our study has several limitations. First, this study is a cross-sectional investigation of aggregate-level population data and thus we cannot explore causality nor draw inferences about individual-level associations. Second, we acknowledge the potential for residual confounding as we could not control for all county-level factors potentially associated with both structural racism and IMR. Third, while we examined urban-rural differences using two urbanicity categories, we recognise the vast variations in social and health inequities within each category that warrants further investigation on intra-rural and intra-urban differences in health.[21] In addition, we used a limited number of structural racism measures pertaining only to socioeconomic and judicial domains, and thus, future studies should replicate our findings by using different measures of structural racism and by testing these measures across different area-level units such as regions and municipalities. Finally, we

What is already known on this subject

- Previous evidence has shown considerable geographic variations in county-level racial inequities in infant mortality.
- Emerging literature has suggested that area-level structural racism—measured by the degree of population-level racial inequity across socioeconomic and judicial domains—may be contributing to racial inequity in infant mortality.

What this study adds

- A higher prevalence of structural racism is associated with 6% increase in black infant mortality rate (IMR) and 6% decrease in white IMR in urban but not rural counties.
- Further research is needed to develop valid and historically informed measures of structural racism and investigate the ways that structural racism plays out in rural contexts.
- Our findings suggest that reducing racial inequities in population health will require directly addressing systemic inequities, including unequal access to higher education and mass incarceration, products and perpetuators of structural racism.

recognise that considerably smaller sample of rural (n=436) versus urban counties (n=775) may have contributed to limited power to detect significant associations in rural areas.

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Data availability statement All of the county linked infant birth-death files used in this study are available by application from the National Center for Health Statistics.

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