



# Incarceration Exposure During Pregnancy and Infant Health: Moderation by Public Assistance

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**Objectives** To assess the relationship between exposure to incarceration during pregnancy and adverse infant health outcomes: low birth weight (<2500 g), very low birth weight (<1500 g), preterm birth (<37 weeks), and very preterm birth (≤33 weeks), and to evaluate the moderating role of receiving public assistance benefits (Special Supplemental Nutrition Program for Women, Infants, and Children and Medicaid) during pregnancy in this process.

**Study design** The current study employs data from the Pregnancy Risk Assessment Monitoring System, 2009–2017. Logistic regression models were used to assess the association between incarceration of a woman or her partner in the year before birth, the receipt of public assistance during pregnancy, and postpartum infant health. Moderation analyses were conducted by interacting forms of public assistance and incarceration exposure.

**Results** Exposure to incarceration either personally or vicariously through a partner increased all 4 adverse infant health outcomes. However, moderation analyses demonstrated that public assistance benefits and incarceration have a negative interaction, indicating that public assistance might buffer against the harmful effects of incarceration exposure during pregnancy on infant health.

**Conclusions** Incarceration exposure during pregnancy poses a significant risk for adverse infant health outcomes. However, the receipt of public assistance benefits including Special Supplemental Nutrition Program for Women, Infants, and Children and Medicaid may mitigate this risk. Expanded access to public assistance for women exposed to incarceration during pregnancy holds promise to improve infant health outcomes. (*J Pediatr* 2020;226:251–7).

Since the 1970s, the incarceration rate in the US has increased by approximately 400%.<sup>1</sup> As a result of this massive expansion of the penal population, a growing number of parents and pregnant women are increasingly exposed to incarceration.<sup>2–4</sup> Correspondingly, an emergent body of research has explored the various ways that incarceration is consequential for the health and well-being of both people experiencing incarceration and their family members.<sup>5–9</sup>

Although experiencing incarceration is a significant stressor, the deleterious health consequences of incarceration may be particularly profound for certain segments of the population. Emerging research finds that incarceration of oneself or a spouse or partner occurring during pregnancy carries negative consequences for infant health outcomes.<sup>10–17</sup> Specifically, incarceration—whether it is experienced personally or vicariously through a partner—is theorized to be linked to low birth weight and preterm birth, as incarceration is a well-documented chronic stressor for incarcerated persons and their families, and both low birth weight and preterm birth are influenced by in utero stressors.<sup>5,6,16–23</sup> Notably, incarceration of a spouse or partner during pregnancy may be an especially detrimental stressor, because it is a largely unexpected shock to family life that can remove a key source of material and instrumental support from the household. Prior research finds that the incarceration of a family member worsens economic hardship and compels families to more heavily rely on public assistance programs.<sup>18,24</sup>

Participation in public assistance programs including Medicaid and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) have been shown to yield benefits to infant health.<sup>25–28</sup> In particular, enrollment in public assistance programs can provide economic support, as well as supplemental food, nutrition education, and expanded access to medical care, which can buffer against health adversities stemming from stressful events that occur during pregnancy.<sup>25,29</sup> Given that incarceration is a stressful and unanticipated event that can elevate the likelihood of poor infant health outcomes, and households experiencing incarceration are more likely to draw on public assistance benefits, this raises an important question as to whether enrollment in public assistance can buffer against the adverse consequences of incarceration during pregnancy for newborn health.<sup>10–16,24</sup> In prior research, we surmised that “since incarceration represents an unexpected disruption to family life, extending public assistance benefits to pregnant women with an incarcerated partner may be a beneficial policy initiative that can buffer against this shock to financial resources.”<sup>27</sup> The purpose of the current study was to investigate whether any relationship between exposure to incarceration during pregnancy and adverse infant health outcomes are moderated by access to public assistance benefits during pregnancy.

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PRAMS Pregnancy Risk Assessment Monitoring System  
WIC Special Supplemental Nutrition Program for Women, Infants, and Children

## Methods

This study uses data from the Pregnancy Risk Assessment Monitoring System (PRAMS), an ongoing, population-based surveillance system developed by the Centers for Disease Control and Prevention and state health departments. The PRAMS survey uses state birth certificates to conduct an annual probability sample in participating states. State samples range between 1300 and 3400 women per year. Recent mothers are first contacted approximately 3 to 6 months after childbirth by mail. If there is no response after repeated mailing contacts, women are then contacted and interviewed by telephone. PRAMS data are weighted to adjust for the complex survey design, noncoverage, nonresponse, and are representative of women delivering a live infant birth in each sampled state.<sup>30</sup> The current study draws from 37 state surveys conducted from 2009 to 2017. The sample was restricted to states that included questions on incarceration history, birth weight, and gestational age, as well as relevant covariates.

### Dependent Variables

Low birth weight is a binary variable that measures whether a newborn's birth weight was <2500 g, and very low birth weight is an indicator of infants <1500 g (1 = yes, 0 = no). Preterm birth is a binary indicator of whether a birth occurred at <37 weeks and very preterm birth classifies births occurring at ≤33 weeks (1 = yes, 0 = no).

### Independent Variables

Incarceration exposure is a binary variable based on a survey item asking respondents whether in the 12 months before birth, "I or my husband or partner went to jail" (1 = yes, 0 = no). Based on the wording of the survey item, this measure captures incarceration that was either experienced directly by the mother, or vicariously through her partner. Although we are unable to extricate who experienced incarceration, in most cases the incarcerated person is likely to be the recent mothers' partner, given that 90% of the correctional population are males.<sup>31</sup>

### Moderating Variables

Public assistance measures enrollment in 2 public assistance programs available during pregnancy: Medicaid and WIC. Medicaid benefits are measured with a binary item where a value of 1 identifies women who reported having Medicaid as their form of health insurance during the month before conception. WIC is a dichotomous variable where a value of 1 identifies women who were enrolled in the WIC program during their most recent pregnancy, and a value of 0 represents women who were not enrolled in the WIC program during their most recent pregnancy. The presence of these 2 forms of public assistance are summed into a scale where 0 represents having no benefits, a value of 1 represents women with 1 form of public assistance, and 2 represents women who had both Medicaid and WIC. Among the

analytic sample, 54.5% did not receive public assistance benefits, 25.8% received only WIC, 4.9% received only Medicaid, and 14.8% received both WIC and Medicaid. Participation in WIC and Medicaid are moderately correlated ( $r = 0.358$ ).

### Covariates

We control for several measures capturing socio-demographics characteristics, including maternal race/ethnicity (white, black, Hispanic, other race/ethnicity), maternal age at birth (≤17, 18-24, 25-29, 30-34, and ≥35 years), whether the mother was a college graduate (1 = ≥16 years of education, 0 = <16 years), marital status (1 = currently married, 0 = not currently married), number of prior births (0, 1, 2, ≥3), if the mother reported trying to become pregnant (1 = yes, 0 = no), income levels (<\$10 000, \$10 000-14 999, \$15 000-19 999, \$20 000-24 999, \$25 000-34 999, \$35 000-\$49 999, ≥\$50 000), and body mass index before the pregnancy (underweight [ $<18.5$ ], normal [ $18.5-24.9$ ], overweight [ $25.0-29.9$ ], and obese [ $\geq 30$ ]). Finally, all models include dummy variables for the state of residence and year of birth to account for variation in infant birth outcomes across time and place.

### Analytic Approach

We begin by presenting the weighted summary statistics of the variables in the analysis. Separate logistic regression models are used to assess the interaction between incarceration and the infant health outcomes (low birth weight and preterm birth). Models include base terms of incarceration exposure, the public assistance scale, and a product term between these 2 measures. All logistic regression models were weighted for the complex survey design using the SVY command in Stata 15, and are adjusted for the covariates described elsewhere in this article.<sup>32</sup> An assessment of variance inflation factors were <2.5 across all models, indicating acceptable levels of multicollinearity.<sup>33</sup>

## Results

The descriptive statistics for the analytic sample are presented in **Appendix 1** (available at [www.jpeds.com](http://www.jpeds.com)). Approximately 4.4% of the sample reported incarceration exposure during pregnancy. The incarceration exposed sample were more likely to report low birth weight (9.9% vs 6.7%), very low birth weight (1.7% vs 1.1%), preterm birth (11.3% vs 8.3%), and very preterm birth (3.0% vs 2.2%), as well as be more likely to report receipt of 1 (47.6% vs 30.0%) or 2 forms of public assistance (35.1% vs 14.1%). Among covariates, incarceration exposed populations are more likely to be black (23.6% vs 11.6%), less likely to be a college graduate (6.0% vs 35.9%), less likely to be married (21.8% vs 64.9%), and less likely to earn ≥\$50 000 per year (5.1% vs 40.2%).

**Table 1** presents the results of the logistic regression models assessing the interaction between incarceration

**Table 1. Logistic regression model: low birth weight and preterm birth on Incarceration exposure × Public assistance interaction (n = 200 219)**

Variables	Model 1: Low birth weight		Model 2: Preterm birth	
	OR	95% CI	OR	95% CI
Incarceration	1.453*	(1.217-1.735)	1.530*	(1.229-1.904)
Public assistance	1.043†	(1.008-1.079)	1.043	(0.999-1.089)
Incarceration × Public assistance	0.846‡	(0.746-0.959)	0.820†	(0.703-0.957)

Models control for maternal race, maternal age, college graduate, married, number of prior births, pregnancy planned, prepregnancy body mass index, income levels, state of residence, and year of birth.

\* $P < .001$ .

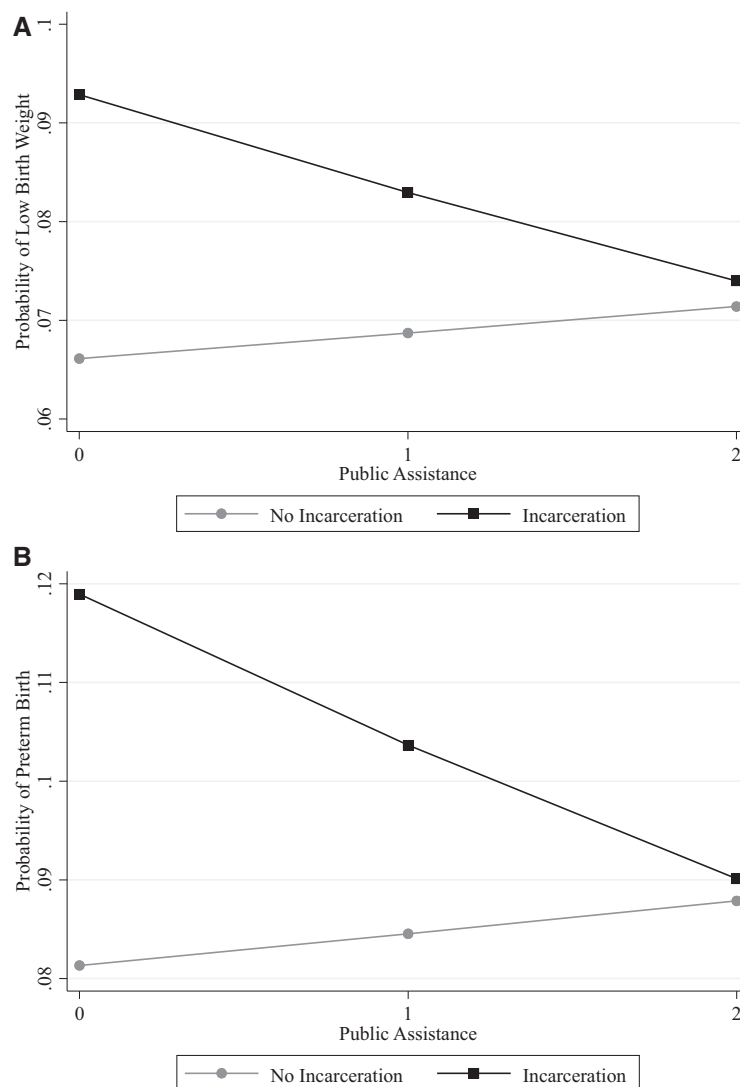
† $P < .05$ .

‡ $P < .01$ .

exposure and receiving of public assistance on infant health outcomes. The results in model 1 shows that

incarceration-exposed women have a higher likelihood of delivering a low birth weight infant; however, the negative interaction term indicates that receiving public assistance attenuates the impact of incarceration on low birth weight (OR, 0.846; 95% CI, 0.746-0.959). The results of this model are graphically displayed in **Figure 1, A**. Expressed as predicted probabilities, among women reporting no public assistance 9.3% of incarceration-exposed women delivered a low birth weight infant, compared with 6.6% of those without incarceration exposure. However, for those with both forms of public assistance (Medicaid and WIC), the probability of low birth weight decreased to 7.4% for incarceration-exposed women compared with 7.1% for non-incarceration-exposed women.

**Table 1** model 2 provides the results regarding preterm birth. Incarceration-exposed women have a higher likelihood of preterm birth as indicated by the positive base term, and public assistance serves to moderate this



**Figure 1. A**, Interaction of low birth weight on Incarceration exposure × Public assistance interaction (n = 200 219). **B**, Interaction of preterm birth on Incarceration exposure × Public assistance interaction (n = 200 219).

association as indicated by the negative interaction term (OR, 0.820; 95% CI, 0.703-0.957). The results displayed in **Figure 1, B**, show that, in the absence of public assistance, 11.9% of incarceration-exposed women have a preterm birth, compared with 8.1% of those not exposed to incarceration. However, among those reporting both forms of public assistance, approximately 9.0% of incarceration-exposed and 8.8% of non-incarceration-exposed women report a preterm birth.

**Table II** displays the results assessing very low birth weight and very preterm birth. The results show similar patterns as incarceration-exposed women are more likely to experience both adverse infant health outcomes, but receiving public assistance moderates the impact of incarceration exposure on both very low birth weight (OR, 0.692; 95% CI, 0.509-0.939) and very preterm birth (OR, 0.775; 95% CI, 0.627-0.957). The results of these models displayed in **Figure 2, A**, show that about 2.1% of incarceration-exposed mothers with no public assistance deliver a very low birth weight infant, compared with 1.2% of those without incarceration exposure. Among those with both forms of public assistance, this rate decreases to 0.8% of incarceration-exposed mothers and 1% of non-incarceration-exposed mothers. **Figure 2, B**, demonstrates a similar pattern; 3.3% and 2.3% of incarceration exposed and non-incarceration-exposed mothers, respectively, had a very preterm birth infant at levels of no public assistance, yet this rate decreases to 1.8% for incarceration-exposed women and 2.1% for non-incarceration-exposed women with both sources of public assistance.

### Supplementary Analyses

A series of supplemental analyses were conducted. First, we reestimated the models controlling for a series of life events and health behaviors occurring during pregnancy that may confound the association between incarceration, public assistance, and infant health outcomes. A description of the additional variables included are reported in **Appendix 2** (available at [www.jpeds.com](http://www.jpeds.com)). The results of the supplemental analyses are reported in **Appendix 3** and

**Appendix 4** (available at [www.jpeds.com](http://www.jpeds.com)). The results of the supplementary analyses displayed a negative interaction between incarceration and public assistance that was of a similar magnitude to the findings reported in the main analysis. We conducted additional analyses investigating the impact of WIC and Medicaid separately to determine if enrollment in either program yielded uniquely protective effects for infant health. The results revealed no substantive difference between WIC and Medicaid. Rather, the greatest benefits occurred for incarceration-exposed women who had both forms of public assistance. Finally, we conducted an additional set of robustness checks that controlled for measures of maternal health during pregnancy (hypertension, gestational diabetes, and gestational weight gain) and the results remained similar to those reported in the main text.

## Discussion

Poor birth outcomes, including low birth weight and preterm birth, are serious public health issues that result in billions of dollars in both short-term medical costs, as well as longer term societal costs.<sup>34,35</sup> Prematurity and low birth weight carry high social costs, contributing to approximately 36% of infant mortality in 2013, as well as being linked to a variety of adverse developmental outcomes over the life-course.<sup>36-38</sup>

A large body of research has documented how stressful life events can elevate the risk of poor birth outcomes, as well as how access to public assistance benefits may serve as a protective factor that can decrease the likelihood of adverse birth outcomes among those most at risk.<sup>19-23,25-28</sup> Drawing on an emerging body of research that documents how incarceration—a stressful event that touches the lives of millions of Americans—may be associated with poor birth outcomes, as well as research demonstrating that incarceration of a family member is associated with increased reliance on public assistance, the current study investigated how the relationship between incarceration exposure and infant health is moderated by the receipt of public assistance benefits.<sup>10-17,24</sup>

The results revealed several key findings. First, consistent with prior research, the results demonstrated that, net of covariates, incarceration-exposed women are more likely to deliver an infant who is low birth weight or preterm.<sup>11,16</sup> These findings build on a growing body of literature that demonstrates that incarceration experienced during pregnancy is a stressful life event that carries harmful repercussions for infant development. Next, the results demonstrated that the relationship between incarceration and infant health is moderated by receiving multiple forms of public assistance. These findings highlight the importance for public assistance programs as a key form of support that can buffer against the harmful effects of incarceration for infant health.

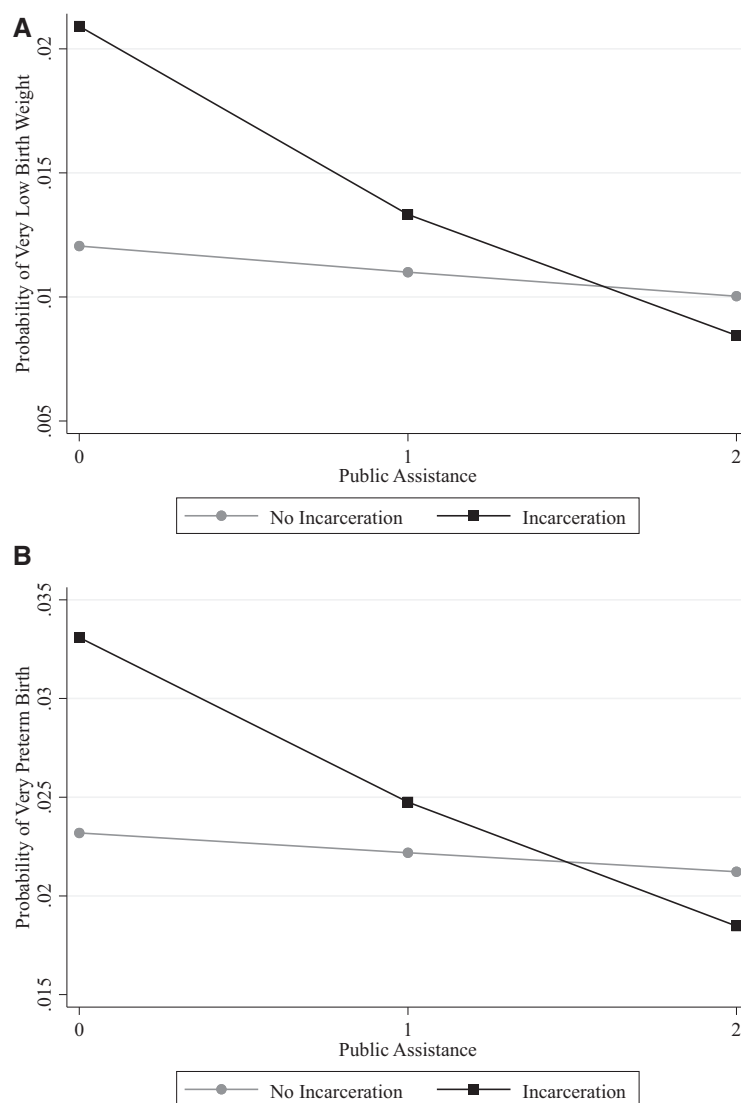
Our results echo a pattern in the broader literature pointing to incarceration as a key source of social stratification in health outcomes, including infant health outcomes. Given

**Table II. Logistic regression model: Very low birth weight and very preterm birth on Incarceration exposure × Public assistance interaction (n = 200 099)**

Variables	Model 1: Very low birth weight		Model 2: Very preterm birth	
	OR	95% CI	OR	95% CI
Incarceration	1.758*	(1.134-2.726)	1.445*	(1.061-1.968)
Public assistance	.911*	(.845-0.982)	.955	(.897-1.017)
Incarceration × Public assistance	.692*	(.509-0.939)	.775*	(.627-0.957)

There were 120 cases omitted because South Dakota had zero cases of very low birth weight or preterm birth in the analytic sample. Models control for maternal race, maternal age, college graduate, married, number of prior births, pregnancy planned, prepregnancy body mass index, income levels, state of residence, and year of birth.

\* $P < .05$ .



**Figure 2.** **A**, Interaction of very low birth weight on Incarceration exposure  $\times$  Public assistance interaction ( $n = 200\,099$ ). **B**, Interaction of very preterm birth on Incarceration exposure  $\times$  Public assistance interaction ( $n = 200\,099$ ).

this pattern of findings, as well as the present findings, steps should be taken to mitigate the health risks for this vulnerable subset of the population. One way to achieve this goal is to ensure adequate access to medical care, food, nutrition education, and other fundamental health resources for incarceration-exposed families. Improved access to such benefits, and the expansion of such benefits, is vital, given that >600 000 people are released from state and federal prisons every year, many of whom struggle to meet the basic necessities of survival pertaining to health care, food, and housing.<sup>31,39</sup>

Unfortunately, legislative efforts have placed diverse forms of public assistance benefits for formerly incarcerated individuals in jeopardy. Many states restrict access to public assistance benefits for those convicted of felony crimes and often states with the highest rates of incarceration are also those with the least comprehensive social welfare programs.<sup>40,41</sup>

Moreover, individuals can have benefits either terminated or suspended while they are incarcerated, and because the reenrollment process is challenging and time consuming, benefits can be lost for extended periods even after release.<sup>39,42</sup> Even in cases where a woman's husband or partner was incarcerated, a pregnant woman may still face barriers to enrolling in public assistance programs, even if she is financially eligible, because there are several barriers to enrollment, including general time constraints, challenges navigating a complicated enrollment process, knowledge about eligibility, uncertainty about future income, and feelings of stigma of becoming a welfare recipient.<sup>24</sup> Our findings suggest that policymakers should seek to expand public assistance benefits both by extending eligibility and streamlining the enrollment process in an effort to both improve public health and decrease barriers to successful reentry. Even so, it is important to recognize that public health programs likely

have a limited reach given the deep-seeded inequities and limited access to adequate coverage in the US health care system. Therefore, maximizing the benefits from public assistance programs may only come to fruition after a more equitable distribution of health care access is achieved.

To the extent that public assistance aids in the successful reentry of incarcerated persons and their families—which is partly facilitated by the health and well-being of the entire family—these efforts could have important collateral benefits in the form of decreased recidivism and decreased incarceration rates over time.<sup>43</sup> In this sense, public health policy and criminal justice policy are intimately connected at this nexus, and should therefore be considered in tandem. Although our findings point to the benefits of public assistance in mitigating the risk to infant health among incarceration-exposed families, they also raise questions about the broader social costs of incarceration. To illustrate, incarceration increases the risk of various adverse (and costly) health outcomes that put a strain on our healthcare system, while also ultimately necessitating the expansion of public assistance benefits, which put a strain on taxpayers and state governments.<sup>24</sup> Thus, from a criminal justice policy perspective, the findings speak to the need for a more judicious and measured use of incarceration (eg, when the risk and costs associated with public safety are high) and a more thoughtful analysis of the social and health costs associated with incarceration.

There are a few limitations with this study that can be expanded on in future research. The measure of incarceration asks specifically about incarceration in jail. However, the measure is used as a proxy for incarceration in any correctional facility given that terms jail and prison are often used interchangeably among the general public.<sup>7</sup> This study uses a binary measure of incarceration that differentiates those exposed to incarceration from those who were not exposed. Future work can investigate other features of incarceration that may be impactful, such as how long an individual was sentenced to incarceration. As previously noted, the item in the PRAMS survey does not indicate whether incarceration was experienced by the mother herself or by her spouse or partner. Because >9 out of 10 incarcerated persons in the US are male, it is likely this is most often a woman's partner, rather than herself.<sup>31</sup> It is important to consider the role of maternal incarceration, given that the percentage of women who experience incarceration who are single mothers is higher than the general population, and compared with incarcerated fathers, incarcerated mothers are more likely to have lived with a child and report taking care of their child before incarceration.<sup>2</sup> Unfortunately, the current data could not capture characteristics, such as whether the mother was a lone parent. Although prior research suggests that incarceration can adversely impact maternal and infant well-being whether a woman experiences incarceration herself or her partner is incarcerated, future research comparing whether the impact of incarceration on infant health differs if the mother or father is incarcerated would be useful.<sup>4-6,10,18</sup>

We used the cut-off for very preterm birth provided in PRAMS dataset ( $\leq 33$  weeks). However, this definition differs slightly from the gestational age cut-off at 32 weeks as defined by the World Health Organization and other public health groups. Fifth, this study measured multiple forms of common public assistance, including Medicaid and WIC. Still, there are other public assistance programs such as the Supplemental Nutrition Assistance Program or Temporary Assistance for Needy Families that could be impactful but were not measured in the PRAMS survey. Future work should continue to explore the potentially protective effects of other types of public assistance programs beyond those examined in the current study. In addition, it would also be beneficial to further investigate useful alternatives to incarceration, especially those that can be used for pregnant women to minimize any harm to both mothers and infants. The timing of the measures of Medicaid and WIC slightly differ in the current study, because recent mothers were asked if they had Medicaid in the month before they became pregnant, whereas they were asked if they have had WIC during pregnancy. We conducted additional analyses using an alternative item that asks if Medicaid was used to pay for prenatal care and found substantively similar results. Finally, the focus of this study was on the consequences of incarceration exposure during pregnancy for infant health outcomes. However, future research should also consider the ways that incarceration exposure bodes for maternal health as well.<sup>16,44</sup>

Our study demonstrated that women exposed to incarceration during pregnancy either personally or vicariously through their partner had an increased likelihood of delivering a low birth weight or preterm infant. Nonetheless, the disparities in infant health outcomes between incarceration-exposed and non-incarceration-exposed women were markedly diminished when incarceration-exposed women received multiple forms public assistance benefits during pregnancy, including WIC and Medicaid. These findings suggest that expanding access to public assistance programs to women exposed to incarceration during pregnancy holds promise as an avenue to improve newborn health among this vulnerable population. States and localities that move to limit public assistance benefits among justice-involved populations may be jeopardizing infant health. ■

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## Appendix

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