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Race and Place Matter: Inequity in Prenatal Care for Reservation-Dwelling American Indian People

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Abstract

Early initiation and consistent use of prenatal care is linked with improved health outcomes. American Indian birthing people have higher rates of inadequate prenatal care (IPNC), but limited research has examined IPNC among people living on American Indian reservations. The current study uses birth certificate data from the state of Montana ($n = 57,006$) to examine predictors of IPNC. Data on the community context is integrated to examine the role of community health in mediating the associations between reservation-status and IPNC. Results suggest that reservation-dwelling birthers are more likely to have IPNC, an association partially mediated by community health. Odds of IPNC are higher for reservation-dwelling American Indian people compared to reservation-dwelling white birthers, highlighting intersecting inequalities of race and place.

Keywords

American Indians, community health, prenatal care, racial health disparities, reservations

Nationally, pregnancy-related mortality rates among American Indian/Alaskan Native (AI/AN) people are twice the rate of white people (29.7 vs 12.7 per 100,000 live births; Petersen et al. 2019). Despite declining AI/AN maternal death rates, this gap has widened over time (Kozhimannil et al. 2020). Pregnancy-related deaths are largely considered preventable, with complications related to cardiovascular conditions, hemorrhage, and hypertensive disorders higher among AI/AN people compared to white people (Heck et al. 2021). Likewise, AI/AN infants have higher rates of preterm birth and low birth weight and die nearly twice the rate of white infants (March of Dimes 2022). Accessing healthcare during pregnancy (prenatal care; PNC) can lead to the detection and treatment of complications found during pregnancy and improved patient education. AI/AN birthing people experience fewer prenatal visits (Osterman and Martin 2018), enter PNC later in their pregnancy (Sebens and Williams 2022), and report less satisfaction with their PNC timing (NCSL 2021) compared to their white counterparts. Reservation-dwelling AI/AN people face greater community health obstacles that are known to affect timely and adequate PNC access (Baldwin et al. 2002; ACIMM 2022).

Access to care is a critical element to improving health; however, disparities exist with AI/AN birthing people experiencing elevated rates of inadequate prenatal care utilization (IPNC) compared to their non-Hispanic white counterparts (Johnson, Call, and Blewett 2010; Osterman and Martin 2018). Yet, little is known on this topic such as: (1) whether living on an American Indian reservation is associated with less adequate PNC; (2) how reservation-residence is linked to IPNC for people with different racial identities; and (3) whether dimensions of the community's health may explain elevated rates of IPNC among AI/AN and reservation-dwelling people. The current study aims to address these gaps in the literature using logistic regression models to predict the odds that a person experiences IPNC. Birth certificate data from the state of

Montana are leveraged, with measures of community health integrated to examine mechanisms underlying disparities in PNC utilization facing AI/AN and reservation-dwelling people.

BACKGROUND

Adequate versus Inadequate Prenatal Care

Healthy pregnancies are key to promoting healthy people, births, and babies. Ideally prenatal care (PNC) is initiated in the first trimester, helping to educate pregnant individuals, identify perinatal risk factors, alleviate preventable risks leading to the dyad's morbidity and mortality, and treat complications (ACOG 2017). The three-delay conceptual model integrates individual, provider, and system factors to articulate that delay in the provision of timely and appropriate medical treatment is a contributing factor for maternal mortality, with delays occurring across three realms: delay in seeking care, delay in arrival at an adequate health care facility, and delays in receiving adequate care (Thaddeus and Maine 1994). Delays in initiating and maintaining consistent care throughout pregnancy reduce the adequacy of PNC. Prenatal care is said to be adequate when it is initiated during the first trimester and utilization meets the recommended number of care visits following care initiation (Kotelchuck 1994). Inadequate PNC has been linked with increased risk of poor birth outcomes, including preterm delivery and infant mortality (Partridge et al. 2012).

Root Causes of Perinatal Disparities

Much of the current knowledge surrounding AI/AN disparities within PNC examines individual factors including culture, geographic location, and socioeconomic status (Burns, DeAtley, and Short 2023). Emerging scholarship on perinatal health disparities endeavors to understand root causes, largely focusing on Black perinatal health inequities (Davis 2019; Gadson, Akpovi, and Mehta 2017). Root causes of health inequity, including inequitable PNC among AI/AN people,

are likely found at the intersections of social determinants of health and structural inequities (structural racism) (Baciu et al. 2017). The racist legacy of colonialism that has gravely impacted the AI/AN population historically manifests today through disparate maternal and infant outcomes, as characterized by Palacios and Portillo (2009) wherein daily ongoing disenfranchisement (Weathering) and reverberating collective historical atrocities (Historical Trauma) negatively impact AI/AN perinatal health.

For reservation-dwelling AI/AN people, structural inequities and structural racism are manifested in *place*, through historical and contemporary policies and practices that continues to constrain the health of AI/AN people. Underlying structural inequities become “the context in which health inequities exist” (Baciu et al. 2017). Community health encompasses dimensions of the contextual environment of a *place* that may affect the health and health care utilization of individuals residing in these environments, including socioeconomic resources, access to and quality of health care, and patterns of health behaviors and outcomes in the community (Hillemeier et al. 2003). Integrating information about community health situates individuals within the environments they live in to better understand how intersecting inequities related to *place* and *race* impact health. Intersectionality highlights how interconnected, overlapping, and interdependent social identities and social locations shape individual experiences and systematic inequities (Crenshaw 2017). Accounting for place, in this case reservation residence, reflects the potential of *situated intersectionality* to understand health inequities (Bambra 2022), including in PNC utilization.

Prenatal Care Disparities

Racial disparities exist within the adequacy of PNC. Nationally, AI/AN people enter PNC during the first trimester at lower rates than white people (63% vs 82.3%, respectively), have higher

rates of late PNC (9.2% vs 3.3%) and no PNC (3.3% vs 1.1%; Osterman and Martin 2018), and are more likely to report being dissatisfied with the timing of initiation (Sebens and Williams 2022). Between 2017 and 2019, 64.4% of childbearing AI/AN individuals entered early PNC accounting for the lowest rate of early PNC entrance of U.S. racial groups including white (82.4%), Asian (80.5%), Hispanic (72.4%), and Black (67.3%) birthing people (NCSL 2021). Nationally, rates of IPNC are twice as high among AI/AN individuals compared to white individuals (44.6% versus 23.9%, respectively, in 2000 to 2002), with states in the West and Midwest experiencing even larger disparities (Johnson et al. 2010) and AI/AN individuals living in rural areas at greatest risk (Baldwin et al. 2002).

While adequate PNC is not the panacea for racial disparities found within perinatal outcomes (Thurston, Fields, and White 2021), research suggests that elevated rates of IPNC help to explain higher rates of preterm birth among AI/AN and other racially minoritized people (Sparks 2009). Gadson and colleagues (2017) suggest that social determinants of health and racism account for lower PNC utilization and poor birthing outcomes among Black birthing people. Structural racism is also believed to account for much of the general poor health outcomes among AI/AN people (Solomon et al. 2022). AI/AN strength and resilience belies their continued presence and striving for thriving family and community health. This resilience is a dynamic, fluid process, evident throughout the life course, and accessed through cultural knowledge and practice (Oré et al. 2016) manifesting within social support, cultural engagement, a holistic worldview, navigating dual cultural identities, and avoiding the victim identity through cultural strength (Teufel-Shone et al. 2018). Despite the wealth of resilience and strength, reservation-based AI/AN people face systemic barriers when accessing PNC, including social, economic, political, and geographic factors. IPNC has been linked to individuals who are

younger, uninsured, less educated, experience unintended pregnancies, engage in substance use, live in more economically deprived areas, and have previous live births (Gadson et al. 2017; Partridge et al. 2012). AI/AN history is marked by centuries of systemic racism, discrimination, and systematic disenfranchisement from culture, religion, economic, environmental, and bodily sovereignty that has contributed to heightened rates of poverty and unemployment, lower rates of education, and higher rates of self-medication through substance use (ACIMM 2022; Huyser, Takei, and Sakamoto 2014); thereby, elevating their risk for IPNC. Furthermore, AI/AN birthers are more likely to be younger, uninsured, unmarried, have unplanned pregnancies, and less likely to have private insurance (Osterman et al. 2023; Raglan et al. 2016).

Reservations and Systemic Barriers to Prenatal Care

Reservations embody the collective AI/AN history in a physical form and serve as a reminder of historical and political practices aimed at isolating and marginalizing this population. From extermination, assimilation to termination, reservations are the physical expression of a living history that has repercussions today. The historical and contemporary trauma of Indigenous peoples due to colonization, genocide, forced relocation, systemic racism, and cultural erasure has profound consequences for the health of AI/AN people and reservation communities, including through its impact on healthcare utilization (Palacios and Portillo 2009; Pool and Stauber 2020). For example, the legacy of reproductive control (e.g., forced government sponsored sterilization) and infant separation policies (infants separated from substance-using parents) contribute to contemporary mistrust between AI/AN people and care providers (Call et al. 2006; Johnson 2020). Empirical research has not examined how residence on American Indian reservations is associated with experiences of IPNC, although research points to several barriers to seeking perinatal care for reservation-dwelling individuals (Hanson 2012; Johnson

2020; Thorsen et al. 2022; Sebens and Williams 2022). Qualitative research has identified several obstacles to PNC for AI/AN birthing people including lack of reliable transportation, competing economic and/or familial concerns, dissimilar communication styles, provider mistrust, long wait times, inconsistency of providers, and scarce access to culturally congruent care (Brooks-Cleator, Phillipps, and Giles 2018; Hanson 2012; Johnson 2020; Sebens and Williams 2022).

Geographic barriers to perinatal care for AI/AN and reservation-dwelling birthers are substantial across several metrics (Johnson et al. 2010; Rayburn, Richards, and Elwell 2012; Thorsen et al. 2022, 2023). The U.S. government forced relocation of AI/AN peoples onto reservations, lands that were strategically chosen for geographical isolation and low resources, and the continual lack of economic and social development in these areas have contributed to persistent social and economic marginalization of reservation-dwelling AI/AN people residing in these geographically remote areas. Labor market opportunities are limited, unemployment and underemployment abound, wages are meager, and poverty is omnipresent (Davis, Roscigno, and Wilson 2016), which impacts food security, housing, and health coverage. These sources of structural racism manifest in challenges accessing care and experiencing optimal health. Birthing people residing on reservations live within and among these circumstances. These factors converge and compound. AI/AN *race* and community context (accounting for exposure to social, economic, political, and geographical determinants of health), represented as *place*, shape access to early and consistent PNC. To understand how place impacts health and healthcare utilization for AIAN people, a focus on reservation residence is warranted. The current study considers how the context of community health on reservations impedes the adequacy of PNC for people residing on them.

Indian Health Service as a Barrier to Adequate Prenatal Care

In exchange for signing treaties that ceded land to the U.S. government, the Indian Health Service (IHS) was created to provide care for tribally enrolled AI/ANs living within IHS service areas. Yet chronic inadequate funding of IHS clinics and facilities has consistently been cited as a key contributing factor to poor health outcomes among AI/AN people (Warne and Frizzell 2014). Challenges with the IHS health care delivery system erode patient–provider continuity in care and case management support for complex cases (Cromer, Wofford, and Wyant 2019). For those relying upon IHS health coverage for PNC, geographic remoteness, dwindling IHS clinic sites, long wait times, provider vacancies, fear of reported substance use in pregnancy, substandard care, and lack of provider accountability likely contribute to later initiation of PNC (ACIMM 2022; Raglan et al. 2016).

Prior research confirms regional differences in rates of IPNC among rural and urban AI/AN populations living within different IHS service areas, while AI/AN individuals residing in non-IHS serving counties were found to have the lowest rate of IPNC (Baldwin et al. 2002). This previous study, however, uses birthers' county of residence to identify IHS service regions, which includes areas both on- and off-reservation, and did not examine birthers' residence on reservation. The current study uses self-reported residence on an American Indian reservation to help identify inequities in the adequacy of PNC for reservation-dwelling birthers, enabling insight into the intersecting inequities of race and place.

Current Study

The current study uses data from Montana to examine how racial identity, rurality, and reservation residence (and their intersections) are associated with the likelihood of experiencing IPNC. Montana is a useful case study to examine PNC inadequacy for these populations. The

majority of Montana's population lives in rural areas (65%), compared to the minority of the U.S. population (14%; United States Department of Agriculture 2020). Montana has a large AI/AN population (6.7% of the population; 78,000 people) with twelve federally recognized tribal nations and seven American Indian Reservations (Montana Governor's Office of Indian Affairs n.d.; United States Census Bureau 2020). Many tribally enrolled members (43 to 73%) in Montana live on or near their tribal reservation (Montana Governor's Office of Indian Affairs n.d.).

Perinatal care access in Montana is quite limited and marked by racial inequities. Fifty percent of counties in Montana lack a birth center, obstetric provider, or hospital offering obstetric care, compared to 32.6% of counties across the United States (Brigance et al. 2022). Relative to other states in the contiguous United States, birthing people in Montana drive the farthest on average to access obstetric care (Rayburn et al. 2012), with disparities in access for AIAN and reservation-dwelling people (Thorsen et al. 2022, 2023). Previous research leveraging IHS service region status as a proxy for reservation status identified the Billings service region (which includes Montana) as the area with the highest rate of IPNC (Baldwin et al. 2002). Together, these results situate Montana as a useful site for examining how aspects of place, including rurality and reservation-dwelling, intersect with racial identity to shape the utilization and adequacy of PNC. Results from this study may provide insight for scholars, public health policy makers, and practitioners that serve rural American Indian populations and work with reservation communities.

Our study addresses several research gaps. First, limited research has examined IPNC for reservation-dwelling birthers. Prior research has only examined residence in IHS service sites (which cover wide geographic areas including non-reservation land; Baldwin et al. 2002), while

this study utilizes self-reported residence on a reservation. Second, our study furthers previous nuanced findings of contributing factors leading to heightened rates of IPNC for AI/AN birthers across different geographic areas (Johnson et al. 2010; Raglan et al. 2016), by considering geographical and maternal factors. Finally, this study integrates data on the health of the community context in which birthers reside to examine whether higher rates of IPNC for AI/AN and reservation-dwelling birthers are mediated by exposure to social, economic, and geographical determinants of health, which has not been examined.

DATA AND METHODS

Data

Montana birth certificates from 2014 to 2018 ($n = 60,461$) constituted the data on individuals who gave birth during this period. Non-residents of Montana ($n = 964$; 1.6%) and those missing values on the dependent or independent variables ($n = 2,494$; 4.1%) were excluded using listwise deletion for a final sample size of 57,006. Stratified models were further limited to non-Hispanic white ($n = 47,408$) and AI/AN ($n = 6,485$) birthers, as well as non-Hispanic white or AI/AN birthers living on- ($n = 5,305$) or off-reservation ($n = 48,588$). County-level data about the health and well-being of birthers' residential county were derived from the Robert Wood Johnson Foundation (RWJF) County Health Rankings 2018 dataset. This dataset integrates county-level data from a variety of sources including: the National Center for Health Statistics ([NCHS] mortality and natality files), Behavioral Risk Factor Surveillance System, and Area Health Resource File, among several others. For full information on data sources see online Appendix A and <https://www.countyhealthrankings.org/>. The sample for models incorporating county-level health metrics was further restricted to those with non-missing data on county health variables (n

= 56,471). County-level data was linked to individual birthing people based on the reported county of residence at the time of the birth.

Measures

Dependent variable. Access to PNC was measured by the Kotelchuck adequacy of prenatal care index, which factors the month PNC was initiated and comparison between the actual number of visits from initiation to delivery with the expected number of visits based on ACOG recommendations; a ratio of less than 0.5 is considered inadequate (Kotelchuck 1994). The dependent variable, derived from this index, measured whether or not a birther was reported on the birth certificate to have received *inadequate prenatal care* (IPNC; 0 = no, 1 = yes). Birthers with a value of 0 “no PNC” or 1 “inadequate PNC” on this index were classified as having IPNC. Supplementary analyses were conducted limiting the sample to those who received some PNC. Results were similar and available upon request.

Independent variables. Data for individual-level variables came from birth certificates. Sociodemographic characteristics included self-reported maternal *race-ethnicity* (AI/AN, non-Hispanic white, non-Hispanic Black, non-Hispanic Asian, and Hispanic), *education* (less than high school, high school, some college, college graduate or more), and *age* (in years). Two measures of location were used: whether the mother reported on the birth certificate to be living on an American Indian *reservation* (0 = no, 1 = yes) and *rurality* of residence, measured at the county level using the Rural–Urban Continuum Code (RUCC), which classifies counties based on both population size and remoteness. Information on the associated RUCC of the county of residence reported on the birth certificate was derived from the U.S. Department of Agriculture (n.d.) RUCC classification data. Six RUCC categories existed in our data and are described in table notes. Two binary measures captured aspects of social support available to the birthers:

whether the birther used the Supplemental Nutrition Program for Women, Infants, and Children (WIC) and if they were *married* at any time during pregnancy or birth. Characteristics of the pregnancy reported on the birth certificate include binary indicators of whether the birther had any *pregnancy risk factors* (e.g., gestational diabetes) or the birth was to *multiples* (e.g., twins; 0 = no, 1 = yes) as well as a continuous measure of the *number of previous live births*. *Payment source* for the birth was measured with separate binary indicators of payment source(s) used as reported on the birth certificate (self-pay, private insurance, Medicaid, military insurance, Indian Health Services [IHS], and other sources [e.g., health care cost-sharing]). A control for the *year of birth* (2014 to 2018) was included in all models.

To capture information on birthers' surrounding community, county-level measures of community health were integrated from the RWJF County Health Rankings database. Four county-level measures were used: health outcomes, health behaviors, clinical care, and social and economic environment. The *health outcomes* index measured both the length and quality of life for the county's population. The *health behaviors* index measured the tobacco use, diet and exercise, alcohol and drug use, and sexual activity of the county's population. The *clinical care* index measured both access to health care and the quality of care for the county's population. The *social economic environment* index measured several dimensions of education, employment, income, family and social support, and community safety for the county's population. Counties were ranked on these metrics and placed into quartiles. The quartile rankings of a birthers' residential county were used as measures of the health of their surrounding community. Sensitivity analyses produced similar results when using deciles and raw ranking values. Additional information on community health measures is available online in Appendix A.

Analytic Strategy

Logistic regression models predicted the likelihood that a birther received IPNC during their pregnancy. These models were conducted first on the overall sample of all birthers and then on stratified samples by reservation-status and race (limited to non-Hispanic white and AI/AN birthers). A final set of logistic regression models predicting IPNC incorporated indicators of county-level health. Mediation analyses examining the role of county health indicators as mediators of the association between reservation-status, race-ethnicity, and IPNC were tested using the causal mediation approach of Imai, Keele, and Tingley (2010), which enables examination of mediation with non-linear outcomes.

RESULTS

Most birthers reported having adequate PNC, with only 16.8% reporting IPNC. However, when looking across race and reservation status, clear inequities emerge. A much larger share of AI/AN birthers (46.4%) reported IPNC, compared to white birthers (12.6%), Black birthers (17.1%), Asian birthers (13.9%), and Hispanic birthers (20.2%). Many more reservation-based birthers experienced IPNC (43.4%) compared to those living off-reservation (14.0%). Additional descriptive information about the sample, along with racial and reservation status differences in measures, is provided online in Appendix B.

Table 1 presents the results of multivariate logistic regression models predicting the odds that birthers experienced IPNC during their pregnancy (Model 1; odds ratios). AI/AN birthers had significantly higher odds of experiencing IPNC compared to white (59.9% higher odds), Black (55.2% higher odds), Asian (43.0% higher odds), and Hispanic birthers (46.0% higher odds), controlling for all other variables. Compared to birthers residing off-reservation, birthers living on-reservation had 39.4% higher odds of experiencing IPNC. Those with lower levels of education, younger ages, and residence in more remote rural areas all had significantly higher

odds of IPNC compared to birthers who were college-educated, older, and urban-dwelling. Significantly lower odds of IPNC were found among married individuals and those using WIC compared to unmarried birthers and those not using WIC. Compared to individuals financing their birth with private medical insurance, those paying with Medicaid, IHS, Military insurance, self-payers, and other payment sources were more likely to have IPNC (86.0% higher odds ratio, 81.9% higher, 51.7% higher, 154.4% higher, and 111.0% higher, respectively). Experiencing at least one health risk during pregnancy (compared to none) translated into 10.3% lower odds of having IPNC and birthers delivering multiples were marginally less likely to have IPNC compared to singleton births (12.2% less likely). For every additional previous live birth, birthers had 19.1% higher odds of experiencing IPNC in their current pregnancy. Finally, births occurring more recently had lower odds of experiencing IPNC (3.2% lower odds ratio for every additional year later).

<Table 1 about here>

To further explore variation in the odds of IPNC among reservation-dwelling birthers, interaction effects were tested. Results presented in Table 1, Model 2 indicate that the higher odds of IPNC among reservation-dwelling birthers are significantly higher for AI/AN reservation-dwelling birthers compared to white reservation-dwelling birthers. While most reservation-dwelling birthers are AI/AN (74.1%), white birthers are the second largest racial group to reside on reservations (21.8%). Supplementary post-estimation analyses were conducted to estimate marginal effects, the predicted probability of IPNC by reservation and race (online Appendix C). According to these results, white birthers living on- (14.4%) and off-reservation (13.9%) had a similar predicted probability of experiencing IPNC, while AI/AN birthers living

on-reservation had a significantly higher predicted probability of IPNC compared to AI/AN birthers living off-reservation (34.2% versus 25.9%).

Payment type was also associated with the adequacy of PNC in different ways for birthers living on- and off-reservation. Results presented in Table 1, Model 3 indicate that the higher likelihood (odds ratio) of experiencing IPNC when using IHS coverage relative to private insurance was more pronounced for birthers who lived off-reservation but used IHS coverage to pay for their birth. Supplementary post-estimation analyses were conducted to estimate marginal effects, the predicted probability of IPNC by reservation and IHS coverage (online Appendix C). Those relying on IHS coverage living off-reservation had a statistically significantly higher predicted probability of IPNC (29.9%) compared to those using IHS living on-reservation (29.0%) and birthers paying with private insurance who lived on-reservation (20.5%) and off-reservation (15.9%). Results rotating the reference group for payment type (online Appendix D) further highlight the higher likelihood of IPNC for birthers using IHS coverage when living off-reservation.

Nested regression models (available upon request) indicated that the association between WIC receipt and the likelihood of IPNC changed once controlling for payment source. Further examining this, interaction terms between WIC and payer source were tested. Results presented in Table 1, Model 4 indicate that the receipt of WIC reduced the likelihood of IPNC, but only for those paying with Medicaid or IHS coverage. Supplementary post-estimation analyses were conducted to estimate marginal effects, the predicted probability of IPNC by WIC receipt and payer type (online Appendix C). According to these results, birthers who did not have Medicaid had a similarly low likelihood of IPNC whether or not they were enrolled in WIC (14.1% and 13.7% predicted probability of IPNC, respectively). For birthers on Medicaid, using WIC was

associated with a lower predicted probability of IPNC (17.9%) relative to those who were not enrolled in WIC (23.0%). A similar pattern emerged in the interaction between WIC and IHS coverage. Birthers without IHS coverage had a lower predicted probability of IPNC whether or not they were enrolled in WIC (15.9% and 18.0%, respectively). However, for birthers using IHS coverage, having WIC was associated with a significantly lower predicted probability of IPNC (18.4%) relative to birthers on IHS who did not have assistance through WIC (30.9%). These findings suggest that WIC receipt is associated with a reduced likelihood of IPNC, but only for those birthers on Medicaid or IHS. This finding may reflect the concentration of WIC receipt among birthers on Medicaid and IHS, with a much larger proportion of birthers paying with Medicaid (59.0%) and IHS (61.1%) enrolled in the WIC program relative to self-paying birthers (13.1%) and those birthers with private (7.9%), military (19.5%), or other insurance forms (22.1%).

Results of multivariate models with the full sample (Table 1) demonstrate distinct differences in the likelihood of experiencing IPNC for white versus AI/AN birthers, as well as birthers living on- and off-reservation. To further explore these dynamics, stratified models were run by race (White vs AI/AN) and reservation status (see Table 2; odds ratios). First, focusing on race differences, we see that living on reservation was associated with a higher likelihood of IPNC for AI/AN birthers but not white birthers (Table 2, Models 1 and 2). Larger differences were noted for AI/AN versus white birthers when comparing the likelihood of IPNC for people living in more rural versus urban areas. The likelihood of IPNC rose as individuals resided in more rural counties and nearly doubled among AI/AN birthers (41.3% to 76.8% higher odds ratios) compared to white birthers (no differences, 32.4%) among RUCCs 6 through 9. The association between payment type and IPNC also varied for white versus AI/AN birthers. No

significant differences were found in the odds of IPNC for white birthers paying with IHS versus private insurance (largely due to the small number of white birthers meeting IHS eligibility requirements; $n = 72$), while AI/AN birthers paying with IHS coverage had 74.2% higher odds of IPNC compared to AI/AN birthers paying with private insurance. Further, AI/AN birthers paying with military or other insurance did not have elevated rates of IPNC compared to AI/AN birthers paying with private insurance, while the odds of IPNC were 60.8% and 127.9% higher for white birthers paying with these insurance forms, respectively, compared to white birthers using private insurance. White and AI/AN birthers paying with Medicaid had similarly higher odds of IPNC relative to white and AI/AN birthers paying with private insurance (83.4% and 80.2% higher odds ratios, respectively). AI/AN birthers who relied on self-pay compared to private insurance had much higher odds of IPNC (228.9% higher odds) compared to white birthers using self-pay (145.2% higher odds). Enrollment in WIC was more strongly associated with having a lower likelihood of IPNC for AI/AN birthers (42.8% lower odds) than white birthers (15.3% lower odds) compared to their counterparts who were not enrolled in WIC. Having a pregnancy health risk was associated with lower odds of experiencing IPNC for white birthers (11.3% lower) but was not associated with IPNC among AI/AN birthing people. Finally, over the period of study (2014 to 2018) there is an observed reduction in the likelihood of experiencing IPNC for white but not AI/AN birthers, suggesting that rates of IPNC are improving for white people in Montana, but not AI/AN people.

<Table 2 about here>

Turning to models stratified by reservation status, distinct differences were observed among reservation-dwelling birthers (Table 2, Models 3 and 4). Amongst those living on-reservation, AI/AN birthers had larger differences in the elevated likelihood of IPNC relative to

White birthers (224.4% higher odds of IPNC). Off-reservation AI/AN birthers also experienced an elevated likelihood of IPNC relative to white counterparts (124.9% higher odds), albeit a smaller difference. Educational inequities in the odds of IPNC appear larger for reservation-dwelling birthers. Again, the association between WIC receipt and IPNC appears to be substantively stronger for reservation-dwelling birthers. Statistically significant rurality differences in the odds of IPNC were more prevalent among birthers living off-reservation when comparing birthers residing in non-metro, urban areas to birthers from urban areas. However, reservation-dwelling birthers residing in the most remote, rural areas (RUCC 9) had much higher likelihoods of IPNC compared to urban birthers (123.4% higher odds) than the same comparison for non-reservation dwelling birthers (30.3% higher odds). The concentration of reservation-dwelling birthers in rural regions may be contributing to the lack of observed statistically significant differences in IPNC for this group (online Appendix B). Following results from Table 1, Model 3, findings presented in Table 3, Models 3 and 4 also indicate that birthers using IHS coverage who live off-reservation had substantially higher odds of having IPNC relative to birthers using private insurance (161.5% higher odds) compared to birthers living on reservation with IHS coverage (72.4% higher odds). Other payment-type differences by reservation status largely follow the results of racially stratified models, reported above. Finally, birthers residing off-reservation experienced improvements in the risk of IPNC over the period while no such improvements were observed among reservation-dwelling birthers.

To examine possible mechanisms underlying the elevated rates of IPNC among AI/AN and reservation-dwelling birthers, we examined the role of community health using county-level health indicators. The odds of experiencing IPNC are 38.7% higher for reservation-dwelling birthers, controlling for race, rurality, sociodemographic characteristics, social support, payer

type, and pregnancy and birth characteristics (Table 3, Model 1). For AI/AN birthers, the odds of experiencing IPNC are 60.0%, 55.5%, 43.5%, and 45.9% higher compared to white, Black, Asian, and Hispanic birthers, respectively, controlling for reservation status, rurality, sociodemographic characteristics, social support, payer type, and pregnancy and birth characteristics. After controlling for community health factors, these associations were reduced across Models 2 to 6. Tests of mediation (Imai et al. 2010) indicated that these were statistically significant reductions in the association between reservation status and IPNC, mediated by county health factors (results available upon request). However, while there were reductions in the magnitude of race coefficients when models included county health indicators, mediation analyses did not find evidence that county health indicators mediated the association between race and IPNC (results available upon request).

Birthers residing in counties ranked in lower quartiles for community health were more likely to have IPNC. Birthers living in counties with higher rates of poor health outcomes (Table 3, Model 2), poorer healthcare access and lower quality clinical care (Table 3, Model 3), elevated rates of unhealthy behaviors (Table 3, Model 4), and more social and economic disadvantage (Table 3, Model 5) were more likely to have IPNC, as indicated by higher odds ratios. After controlling for these four dimensions of community health, reservation-dwelling birthers had only 18.5% higher odds of experiencing IPNC, relative to birthers living off-reservation (Table 3, Model 6). This is a 52.2% reduction in the association between reservation-status and IPNC from model 1. Mediation analyses examining the individual contributions of county health indicators in mediating the association between reservation status and IPNC (Models 2 to 5) suggest that county-level health outcomes mediated 45.3%, clinical care access and quality mediated 37.3%, health behaviors mediated 44.1%, and socioeconomic environment mediated

26.6% of the total effect of reservation status on IPNC. Reservation-dwelling birthers are more likely to have IPNC, in part, because they reside in communities characterized by poorer health outcomes, poorer clinical care, elevated rates of poor health behaviors, and more social and economic disadvantage.

<Table 3 about here >

DISCUSSION

Race and place matter. Consistent with other studies, AI/AN birthers in our study report the highest rates of IPNC, compared to other racial and ethnic groups (Johnson et al. 2010). Among Montanan AI/AN birthing people, our study found that 46.4% received IPNC, higher than historical IHS data ranging from 18.9% to 27.1% among AI/AN individuals (Baldwin et al. 2002). AI/ANs living on- and off-reservation had significantly higher rates of IPNC versus whites living on- (224.4% higher odds), and off-reservation (124.9% higher odds). Race is a proxy for the effects of structural racism and is not employed in this paper to attribute unique biological differences to one's ability to access care. Race, in this sense, demonstrates how the reference group, white race, benefits from systemic structures that were created to privilege power and resources in their favor (Braveman et al. 2022). Systematic disenfranchisement and racial discrimination have significant consequences for the health of individuals and their offspring (Williams 2018). In the current study, AI/AN race reflects intergenerational processes and outcomes that have targeted this group to disenfranchise them from power and resources.

Findings from this study demonstrate that considerable disparities exist between AI/AN and white birthers' PNC use, and residence on American Indian reservations increases the likelihood that AI/AN birthers experience IPNC. This highlights the *intersecting inequities* of

race and place, such that the location where people live further contributes to their experience of social, political, economic, and geographical disenfranchisement that leads to IPNC.

Land is sacred. Land holds memories. For many AI/AN tribes relocated from ancestral lands and territories onto reservations, land holds special cultural meaning and can be a repository for ancestral land memory of communal loss. Reservations are, for the most part, concentrated communities of AI/AN people that were geographically selected by the federal government to isolate Indigenous people from white settlers and the growing U.S. economic society onto lands with few resources. Repercussions from segregation policies continue today resulting in differential education, employment, and health care access—all manifestations of structural racism. As such, health outcomes may reflect those inherited from intergenerational trauma from a brutal colonized and forced assimilation history (Brave Heart et al. 2011), as well as ongoing daily effects of systemic racism (Palacios and Portillo 2009) that have gravely affected AI/AN maternal and infant outcomes (ACIMM 2022).

Living on a reservation was not protective, but rather associated with a three times higher rate of IPNC (43.4%) compared to those living off reservation (14.0%). All reservations within Montana reside in rural geographically isolated areas. If rurality uniformly affects prenatal access, one might suspect white birthers to have similar rates of IPNC after accounting for rurality; yet very few differences were observed among white birthers' rates of IPNC who live on- (14.4%) or off-reservation (13.9%), similar to national rates (14.8%; NCHS 2021). For white birthers IPNC is stable, suggesting similar underlying social, political, economic, and geographic determinants of health, regardless of place. Perhaps geographical separation from resources may help explain the 8.3%-point difference between IPNC among AI/AN birthers living on- (34.2%)

to those living off-reservation (25.9%); however, we believe that disparate systems and structures exist that facilitate one population's greater ability to access PNC

For low-income pregnant people, WIC is meant to enhance health and nutrition through education, supplemental food, referral to PNC, and support for high-risk pregnancies. Research suggests WIC is related to fewer incidences of late PNC entry (Venkataramani et al. 2022). We found WIC to be protective against IPNC among those using Medicaid or IHS, as when birthers using these payers did not use WIC, they often had the highest rates of IPNC. It is unknown how and when birthers access WIC; however, there is room for standard policies to connect birthers from these payers to WIC. Utilizing WIC fully, including referrals to PNC and specialty services, may improve maternal outcomes.

Reservations uniquely demonstrate the intersection of race and place for AI/AN birthers, as well as the cumulative effects of systemic racism and structural policies that have distanced this population from optimal health. Findings from the current study indicate that the health of the community context, and associated exposures to social determinants of health, help to explain elevated rates of IPNC among AI/AN reservation-dwelling birthers. Structural barriers in the community environment, such as poverty, education, employment, access to insurance, and access to resources (food security, reliable transportation, etc.) are obstacles that affect PNC access and therefore adequacy of use. While this study finds that aspects of community health help to partially explain elevated rates of IPNC on reservations, future research should continue to explore additional measures of the community context to improve our understanding of these mechanisms. Further, public health offices should consider including a measure of reservation-status on birth certificates and other data collection tools monitoring maternal and infant health.

Compounding these structural barriers are reverberations from historical atrocities (e.g. coercive sterilization campaign) mal-aligned policies (universal drug screening of all childbearing aged AI/AN women, regardless of state statutes and consequences for infant/child placement; ACOG 2018), and ongoing frustrations with IHS (ACIMM 2022). At the intersections of an inherited history, place, and race, Hanson's (2012) qualitative study revealed PNC use among Sioux birthers was affected by mistrust in providers and the healthcare system, access to reliable transportation, competing priorities, system barriers related to provider continuity, and absent cultural and/or gender congruence. Future research should continue to explore the barriers to PNC use facing AI/AN and reservation-dwelling birthers, but also those factors that promote timely and adequate PNC. Grassroots Indigenous organizations such as the Alaska Native Birthworkers Community (2023), Hummingbird Indigenous Family Services (2023), and Changing Woman Initiative (2023), led by AI/AN doulas, midwives, and lactation consultants are reclaiming healthcare for AI/AN families and communities by offering services rich in cultural teachings while providing culturally and racially congruent care. In addition to financial and policy support for Indigenous-focused programs, qualitative research is needed to examine both barriers to care and how these programs center AI/AN birthing people, to best understand, identify, and create optimal paths to care for reservation-based AI/ANs.

Limitations

There are limitations to self-report on birth certificate data, including inaccuracies in data entry. This is common, especially in the misclassification of race and ethnicity among AI/AN people, where AI/AN people are usually undercounted when not allowed to self-report, nor counted when they report multiple races (Jim et al. 2014). Our study uses a bridged race methodology that includes self-report single and multiple maternal race and ethnicity (NCHS 2004), a

preferred methodological practice to better approximate AI/AN health outcomes (Urban Indian Health Institute n.d.). “American Indian/Alaska Native” is a political term that has legal implications regarding tribal enrollment. In research, this term has been used interchangeably with those meeting strict enrollment criteria to those who self-identify. It is not the focus of this paper to debate the term’s use, but we acknowledge that birth certificate data allowed birthers to self-identify, and regardless of meeting specific legal requirements, those who identified as AI/AN still experienced differential health outcomes and experiences. Our study’s measure of health insurance is limited to the payer(s) for delivery. Therefore, we are not able to capture changes in insurance coverage over the course of pregnancy, which may impact engagement with care and adequacy of PNC (Daw et al. 2017). Further, we lack information regarding health care provider type providing PNC for people in our study (e.g., family physician, obstetrician, midwife), and therefore we cannot statistically control for variation in adequacy of PNC across provider-type. Finally, county-level health indicators are the best approximation of how healthy reservations are, although reservations may encompass more than one county and blending these county-level health indicators may under- or over-represent health outcomes.

CONCLUSION

To improve the adequacy of PNC and help address persistent inequities in maternal and infant health, policies must address structural and social determinants of health that impede PNC utilization for AI/AN people. Community-based home visiting programs may improve early initiation or access to PNC (Johnson 2020) and could be a useful intervention to address unmet social determinants of health needs. Increasing the workforce diversity, both in provider diversity as well as expanding the type of perinatal services offered (e.g., social work, mental health, midwives, doulas, family medicine physicians, lactation consultants, etc.) are considered key

strategies to improve patient utilization of perinatal services and improve perinatal health among AI/AN birthing people (ACIMM 2022). Offering racially concordant (racially matched) and culturally congruent (culturally matched) care, like Changing Woman Initiative, Hummingbird Indigenous Family Services, and the Alaska Native Birthworkers Community, allow birthing people options for choosing more familiar providers while improving trust in the healthcare system (Jeffers et al. 2023).

At a minimum, healthcare providers and systems must provide culturally safe care, self-reflective care aimed at examining and dismantling power dynamics between providers and patients (Curtis et al. 2019). Qualitative research suggests that asymmetrical power dynamics between providers and patients negatively impact the childbirth process for racially marginalized birthing people (West and Bartkowski 2019). Implicit bias training is a practical tool to help facilitate culturally safe care among clinicians, and evidence demonstrates implicit biases are stronger across intersectional identities such as a low socioeconomic AI/AN woman (Meidert et al. 2023).

Additionally, integrating novel PNC delivery methods (e.g., telemedicine) and expanding health insurance may improve access to PNC and therefore use (Sebens and Williams 2022). Finally, implementation of group PNC models that integrate peer support along with risk assessment and education may help increase fidelity to PNC for AI/AN populations, as group models have been shown to increase PNC utilization among high-risk and racially marginalized populations (Mazzoni and Carter 2017).

The United States is approaching Healthy People 2030, which aims for 84.3% of all pregnant individuals to enter PNC within the first trimester (Healthy People n.d.), and presently AI/AN birthing people are lagging far behind. Perinatal disparities will persist until existing

disparities affecting social determinants of health are addressed, including those that manifest within particular community environments.

SUPPLEMENTARY MATERIAL

Additional supporting information may be found in the online version of this article.

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NOTES

1. Throughout this paper, we refer to “birthing people” and “birthers” to be inclusive of the range of possible gender identities of people who are pregnant and give birth.

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TABLES

Table 1: Reservation-Dwelling and Odds of Inadequate Prenatal Care (Odds Ratios)

	Model 1	Model 2	Model 3	Model 4
<i>Race (AI/AN is ref)</i>				
White	.401*** (.02)	.433*** (.02)	.404*** (.02)	.401*** (.02)
Black	.448*** (.06)	.466*** (.07)	.450*** (.07)	.447*** (.07)
Asian	.570*** (.06)	.607*** (.07)	.574*** (.07)	.565*** (.07)
Hispanic	.540*** (.04)	.565*** (.04)	.544*** (.04)	.536*** (.04)
Lives on Reservation	1.394*** (.07)	1.550*** (.09)	1.421*** (.07)	1.398*** (.07)
<i>Maternal Education (college ref)</i>				
Less than High School	2.402*** (.12)	2.410*** (.12)	2.405*** (.12)	2.363*** (.11)
High School	1.555*** (.07)	1.560*** (.07)	1.557*** (.07)	1.523*** (.06)
Some College	1.257*** (.05)	1.259*** (.05)	1.258*** (.05)	1.235*** (.05)
<i>Maternal Age (Years)</i>				
	.988*** (.00)	.988*** (.00)	.988*** (.00)	.988*** (.00)
<i>Maternal WIC Use</i>				
	.766*** (.02)	.766*** (.02)	.766*** (.02)	1.057 (.06)
<i>Birthers Was Married</i>				
	.651*** (.02)	.651*** (.02)	.651*** (.02)	.661*** (.02)
<i>Rurality (RUCC 3 Ref)</i>				
5	1.051 (.04)	1.048 (.04)	1.051 (.04)	1.054 (.04)
6	1.120* (.06)	1.142** (.06)	1.112* (.06)	1.114* (.06)
7	1.286*** (.05)	1.272*** (.05)	1.284*** (.05)	1.290*** (.05)
8	1.378*** (.09)	1.372*** (.09)	1.377*** (.09)	1.376*** (.09)
9	1.400*** (.07)	1.379*** (.07)	1.393*** (.07)	1.408*** (.07)
<i>Insurance (Private Insurance Ref)</i>				
Medicaid	1.860*** (.06)	1.861*** (.06)	1.856*** (.06)	2.042*** (.08)
IHS	1.819*** (.15)	1.785*** (.14)	2.538*** (.48)	2.348*** (.29)
Military insurance	1.517*** (.15)	1.513*** (.15)	1.517*** (.15)	1.471*** (.14)

Self-Pay	2.544*** (.13)	2.546*** (.13)	2.544*** (.13)	2.527*** (.13)
Other	2.110*** (.31)	2.125*** (.31)	2.139*** (.31)	2.043*** (.30)
<i>Has Pregnancy Health Risk Factor(s)</i>	.897*** (.03)	.897*** (.03)	.897*** (.02)	.896*** (.02)
<i>Number of Previous Live Births</i>	1.191*** (.01)	1.190*** (.01)	1.191*** (.01)	1.188*** (.01)
<i>Birth Was to Multiples</i>	.878^ (.06)	.876^ (.06)	.877^ (.06)	.880^ (.06)
<i>Birth Year</i>	.968*** (.01)	.968*** (.01)	.969*** (.01)	.969*** (.01)
<i>Race × Reservation (AI/AN, on Res Is Ref)</i>				
White, on Res.		.675*** (.07)		
Black, on Res		1.256 (.63)		
Asian, on Res		.970 (.53)		
Hispanic, on Res		1.108 (.20)		
<i>Reservation × IHS (Off Res, with IHS Is Ref)</i>				
On res, with IHS			.670^ (.14)	
<i>WIC × Medicaid (No WIC, with Medicaid Is Ref)</i>				
WIC, with Medicaid				.672*** (.05)
<i>WIC × IHS (No WIC, with IHS Is Ref)</i>				
WIC, with IHS				.521*** (.08)
Constant	.000*** (.00)	.000*** (.00)	.000*** (.00)	.000*** (.00)
Pseudo R ²	.131	.132	.131	.132
BIC	45044.7	45070.5	45051.9	45026.9

Note: Coefficients are odds ratios; standard errors are in parentheses. *N* = 57,006 births to birthers who were residents of Montana at the time of birth. Data are from Montana birth certificates (2014 – 2018). RUCC codes: 3 “metro, population < 250,000,” 5 “nonmetro, urban population > 20,000, nonadjacent to metro area,” 6 “nonmetro, urban population between 2,500 and 19,999, adjacent to metro area,” 7 “nonmetro, urban population between 2,500 and 19,999, nonadjacent to metro area,” 8 “nonmetro, completely rural or less than 2,500 urban population, adjacent to metro area,” and 9 “nonmetro, completely rural or less than 2,500 urban population, nonadjacent to metro area.” AI/AN = American Indian/Alaskan Native. WIC = Supplemental

Nutrition Program for Women, Infants, and Children. RUCC = Rural-Urban Continuum Code. IHS = Indian Health Service.

[^] $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 2: Odds of Inadequate Prenatal Care, Stratified by Race and Reservation Status (Odds Ratios)

	[Model 1] White	[Model 2] AI/AN	[Model 3] Off-Reservation	[Model 4] On-Reservation
<i>Lives on Reservation</i>	1.066 (.10)	1.350*** (.10)		
<i>American Indian/Alaskan Native (White ref)</i>			2.249*** (.11)	3.244*** (.33)
<i>Maternal education (college ref)</i>				
Less than High School	2.605*** (.15)	2.645*** (.41)	2.480*** (.14)	3.161*** (.54)
High School	1.599*** (.07)	1.760** (.26)	1.580*** (.07)	1.953*** (.32)
Some College	1.242*** (.06)	1.584*** (.23)	1.252*** (.05)	1.693*** (.27)
<i>Maternal Age (Years)</i>	.993* (.00)	.982** (.01)	.991** (.00)	.986^ (.01)
<i>Maternal WIC Use</i>	.847** (.03)	.572*** (.03)	.812*** (.03)	.590*** (.04)
<i>Birthier Was Married</i>	.656*** (.02)	.680*** (.05)	.656*** (.02)	.643*** (.05)
<i>Rurality (RUCC 3 Ref)</i>				
5	1.049 (.04)	.846 (.13)	1.043 (.04)	1.085 (.61)
6	1.094 (.07)	1.413*** (.15)	1.291*** (.08)	1.474 (.49)
7	1.261*** (.06)	1.556*** (.16)	1.245*** (.05)	1.911^ (.59)
8	1.382*** (.09)	1.616^ (.46)	1.371*** (.09)	2.412* (1.04)
9	1.324*** (.08)	1.768*** (.20)	1.303*** (.08)	2.234* (.78)
<i>Insurance (Private Insurance Ref)</i>				
Medicaid	1.834*** (.07)	1.802*** (.20)	1.848*** (.07)	1.961*** (.24)
IHS	1.528 (.53)	1.742*** (.23)	2.615*** (.50)	1.724*** (.25)
Military Insurance	1.608*** (.17)	.253 (.26)	1.540*** (.17)	1.501 (1.25)
Self-Pay	2.452*** (.13)	3.289*** (.65)	2.464*** (.13)	2.900*** (.60)
Other	2.279*** (.36)	1.092 (.56)	2.353*** (.37)	1.029 (.51)
<i>Has Pregnancy Health Risk Factor(s)</i>	0.887***	0.901	0.903**	0.871*

	(.03)	(.05)	(.03)	(.06)
<i>Number of Previous Live Births</i>	1.162*** (.01)	1.270*** (.03)	1.172*** (.01)	1.267*** (.03)
<i>Birth Was to Multiples</i>	.828* (.07)	.751^ (.12)	.795* (.07)	.857 (.16)
<i>Birth Year</i>	.967** (.01)	.988 (.02)	.963*** (.01)	1.007 (.02)
Constant	.000** (.00)	.000 (.00)	.000*** (.00)	.000 (.00)
Pseudo R ²	.066	.078	.084	.138

Note: coefficients are odds ratios; standard errors in parentheses. Stratified samples of births to birthers who were residents of Montana at the time of birth and either Non-Hispanic White or AI/AN (Total $N = 53,310$) [Non-Hispanic White ($n = 46,989$) and AI/AN ($n = 6,321$) birthers; Non-Hispanic White or AI/AN birthers living on- ($n = 5,155$) or off-reservation ($n = 48,155$)]. Data are from Montana birth certificates (2014 – 2018). RUCC codes: 3 “metro, population < 250,000,” 5 “nonmetro, urban population > 20,000, nonadjacent to metro area,” 6 “nonmetro, urban population between 2,500 and 19,999, adjacent to metro area,” 7 nonmetro, urban population between 2,500 and 19,999, nonadjacent to metro area,” 8 “nonmetro, completely rural or less than 2,500 urban population, adjacent to metro area,” and 9 “nonmetro, completely rural or less than 2,500 urban population, nonadjacent to metro area.” AI/AN = American Indian/Alaskan Native. WIC = Supplemental Nutrition Program for Women, Infants, and Children. RUCC = Rural-Urban Continuum Code. IHS = Indian Health Service.

^ $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 3: Odds of Inadequate Prenatal Care, Mediation of Reservation-Dwelling by County Health Indicators (Odds Ratios)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Lives on Reservation</i>	1.387*** (.07)	1.284*** (.07)	1.238*** (.06)	1.216*** (.06)	1.308*** (.06)	1.185** (.06)
<i>Race (AI/AN is ref)</i>						
White	.400*** (.02)	.411*** (.02)	.416*** (.02)	.417*** (.02)	.415*** (.02)	.427*** (.02)
Black	.450*** (.06)	.461*** (.07)	.469*** (.07)	.469*** (.07)	.470*** (.07)	.482*** (.07)
Asian	.565*** (.07)	.582*** (.07)	.588*** (.07)	.590*** (.07)	.589*** (.07)	.605*** (.07)
Hispanic	.541*** (.03)	.551*** (.04)	.561*** (.04)	.567*** (.04)	.566*** (.04)	.581*** (.04)
<i>County Measures of Health (Quartiles)</i>						
Health Outcomes		1.076*** (.02)				.995 (.02)
Clinical Care			1.154*** (.03)			1.080** (.03)
Health Behaviors				1.130*** (.02)		1.061* (.02)
Social and Economic Environment					1.130*** (.02)	1.084*** (.02)
Pseudo R ²	.132	.132	.133	.133	.133	.134

Note: coefficients are odds ratios; standard errors in parentheses. $N = 56,471$ births to birthers who were residents of Montana at the time of birth, with non-missing data on county health indicators. Data are from Montana birth certificates (2014 – 2018), and county health data from the Robert Wood Johnson Foundation County Health Rankings 2018 dataset. All models control for: maternal education, maternal age, maternal WIC use, maternal marital status, rurality (RUCC), payer type (Medicaid, IHS, etc.), pregnancy risk factors, number of previous live births, plurality, and birth year. AI/AN = American Indian/Alaskan Native. WIC = Supplemental Nutrition Program for Women, Infants, and Children. RUCC = Rural-Urban Continuum Code. IHS = Indian Health Service.

^ $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Online Supplement

Appendices

Appendix Table A. Information about Measures in the County Health Indicators (RWJF 2018 data)

<i>Measure</i>	<i>Focus Area</i>	<i>Indicator</i>	<i>Data element</i>	<i>Weight of indicator for measure</i>	<i>Data Source</i>	<i>Year(s)</i>	<i>Average value in Montana counties</i>	<i>Min and Max Values in Montana counties</i>
Health Outcomes								
Length of life (50%)		Premature age-adjusted mortality	Years of potential life lost before age 75 per 100,000 population (age-adjusted)	50%	CDC WONDER mortality data	2014-2016	8864	4265; 22873
		Poor or fair health	Percentage of adults reporting fair or poor health (age-adjusted)	10%	Behavioral Risk Factor Surveillance System	2016	14.6%	11; 26
Quality of life (50%)		Poor physical health days	Average number of physically unhealthy days reported in past 30 days (age-adjusted)	10%	Behavioral Risk Factor Surveillance System	2016	3.6 days	3; 5
		Poor mental health days	Average number of mentally unhealthy days reported in past 30 days (age-adjusted)	10%	Behavioral Risk Factor Surveillance System	2016	3.5 days	3; 5
		Low birthweight	Percentage of live births with low birthweight (< 2500 grams)	20%	National Center for Health Statistics - Natality files	2010-2016	7.5%	4; 13
Health Behaviors								
Tobacco use (33.3%)		Adult smoking	Percentage of adults who are current smokers	33.3%	Behavioral Risk Factor Surveillance System	2016	17.2%	13; 30
Diet and exercise (33.3%)		Adult obesity	Percentage of adults that report a BMI of 30 or more	16.7%	CDC Diabetes Interactive Atlas	2014	27.2%	16; 38
		Food environment index	Index of factors that contribute to a healthy food environment, 0 (worst) to 10 (best)	6.7%	USDA Food Environment Atlas, Map the Meal Gap from Feeding America	2015	6.9	4; 9

	Physical inactivity	Percentage of adults age 20 and over reporting no leisure-time physical activity	6.7%	CDC Diabetes Interactive Atlas	2014	25.0%	13; 31
	Access to exercise opportunities	Percentage of population with adequate access to locations for physical activity	3.3%	Business Analyst, Delorme map data, ESRI, & US Census Tigerline Files	2010 & 2016	55.3%	0; 100
Alcohol and drug use (16.7%)	Excessive drinking	Percentage of adults reporting binge or heavy drinking	8.4%	Behavioral Risk Factor Surveillance System	2016	20.1%	17; 26
	Alcohol-impaired driving deaths	Percentage of driving deaths with alcohol involvement	8.4%	Fatality Analysis Reporting System	2012-2016	45.1%	0; 100
Sexual activity (16.7%)	Sexually transmitted infections	Number of newly diagnosed chlamydia cases per 100,000 population	8.4%	National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention	2015	278.4	90; 1412
	Teen births	Number of births per 1,000 female population ages 15-19	8.4%	National Center for Health Statistics - Natality files	2010-2016	32.5	11; 95
Clinical Care							
	Uninsured	Percentage of population under age 65 without health insurance	25%	Small Area Health Insurance Estimates	2015	16.4%	10; 25
Access to care (50%)	Primary care physicians	Ratio of population to primary care physicians (rate per 100,000 population)	15%	Area Health Resource File/American Medical Association	2015	Ratio avg = 1806.2 : .83 Rate avg = 59.8	Rate 0; 131
	Dentists	Ratio of population to dentists (rate per 100,000 population)	5%	Area Health Resource File/National Provider Identification file	2016	Ratio avg = 2156.1 : .76 Rate avg = 41.5	Rate 0; 114
	Mental health providers	Ratio of population to mental health providers (rate per 100,000 population)	5%	CMS, National Provider Identification	2017	Ratio avg = 1071.3 : .94 Rate avg = 155.6	Rate 0; 538

Quality of care (50%)	Preventable hospital stays	Number of hospital stays for ambulatory-care sensitive conditions per 1,000 Medicare enrollees	25%	Dartmouth Atlas of Health Care	2015	53.7	27; 139
	Diabetes monitoring	Percentage of diabetic Medicare enrollees ages 65-75 that receive HbA1c monitoring	12.5%	Dartmouth Atlas of Health Care	2014	79.6%	37; 97
	Mammography screening	Percentage of female Medicare enrollees ages 67-69 that receive mammography screening	12.5%	Dartmouth Atlas of Health Care	2014	58.1%	35; 73
<i>Social and Economic Environment</i>							
Education (25%)	High school graduation	Percentage of ninth-grade cohort that graduates in four years	12.5%	EDFacts	2014-2015	84.2%	65; 93
	Some college	Percentage of adults ages 25-44 with some post-secondary education	12.5%	American Community Survey, 5-year estimates	2012-2016	61.3%	43; 81
Employment (25%)	Unemployment	Percentage of population ages 16 and older unemployed but seeking work	25%	Bureau of Labor Statistics	2016	4.4%	2; 9
Income (25%)	Children in poverty	Percentage of children under age 18 in poverty	18.8%	Small Area Income and Poverty Estimates	2016	19.1%	9; 35
	Income inequality	Ratio of household income at the 80th percentile to income at the 20th percentile	6.3%	American Community Survey, 5-year estimates	2012-2016	4.3	3; 6
Family and social support (12.5%)	Children in single-parent households	Percentage of children that live in a household headed by single parent	6.3%	American Community Survey, 5-year estimates	2012-2016	25.9%	0; 50
	Social associations	Number of membership associations per 10,000 population	6.3%	County Business Patterns	2015	14.7	0; 34
Community safety (12.5%)	Violent crime	Number of reported violent crime offenses per 100,000 population	6.3%	Uniform Crime Reporting - FBI	2012-2014	207.6	0; 541

Injury deaths	Number of deaths due to injury per 100,000 population	6.3%	CDC WONDER mortality data	2012-2016	112.9	54; 240
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Note: All information comes from the Robert Wood Johnson Foundation County Health Rankings 2018 data, available here: <https://www.countyhealthrankings.org/explore-health-rankings/rankings-data-documentation/national-data-documentation-2010-2019>

Appendix B. Descriptive Information about the Sample of Births in Montana

	Overall Mean/%	By Reservation-status			By Race-Ethnicity					Race ANOVA
		On-Res	Off-Res	Res ANOVA	A. AI/AN	B. White	C. Black	D. Asian	E. Hispanic	
Has inadequate prenatal care (IPNC)	16.8%	43.4%	14.0%	*	46.4%	12.6%	17.1%	13.9%	20.2%	a>b,c,d,e; e>b,d
<i>Race</i>										
AI/AN	11.1%	73.4%	4.6%	*						
White	82.4%	22.4%	88.7%	*						
Black	.7%	.4%	.7%	*						
Asian	1.2%	.4%	1.3%	*						
Hispanic	4.6%	3.4%	4.7%	*						
Lives on reservation	9.4%				62.5%	2.6%	5.3%	3.1%	7.0%	a>b,c,d,e; e>b,d
<i>County measures of health</i>										
Health Outcomes (quartiles)	2.20	3.81	2.03	*	3.44	2.04	2.44	1.97	2.33	a>b,c,d,e; c>b,d; e>b,d
Clinical Care (quartiles)	1.61	3.47	1.41	*	2.93	1.44	1.35	1.30	1.44	a>b,c,d,e; a>d; e>d
Health Behaviors (quartiles)	2.24	3.90	2.06	*	3.49	2.07	2.36	2.05	2.18	a>b,c,d,e; c>b,d,e; e>b,d
Social and Economic Environment (quartiles)	2.26	3.53	2.13	*	3.26	2.14	2.14	2.00	2.14	a>b,c,d,e; b>d; e>d
<i>Maternal education</i>										
Less than HS	10.6%	26.3%	9.0%	*	28.8%	7.9%	10.8%	5.3%	16.7%	a>b,c,d,e; c>d; e>b,c,d
Highschool	28.4%	32.1%	28.0%	*	33.2%	27.4%	38.8%	20.8%	34.9%	a>b,d; b>d; c>b,d; e>b,d

Some college	31.2%	32.5%	31.0%	*	32.6%	31.0%	33.2%	27.7%	30.5%	
College or more	29.8%	9.0%	32.0%	*	5.3%	33.6%	17.1%	46.2%	17.9%	b>a,c,d; c>a; d>a,b,c,e; e>a
Maternal age (years)	28.17	26.22	28.37	*	25.84	28.52	26.48	30.59	27.07	b>a,c,e; d>a,b,c,e; e>a
Maternal WIC use	29.6%	58.1%	26.7%	*	62.6%	24.6%	40.3%	21.8%	40.9%	a>b,c,d,e; c>b,d; e>b,d
Birth mother was married	64.1%	29.0%	67.7%	*	22.1%	70.2%	50.9%	79.7%	52.8%	b>a,c,e; c>a; d>a,b,c,e; e>a
<i>Rurality</i>										
RUCC 3	36.4%	1.3%	40.0%	*	20.0%	37.5%	63.0%	46.7%	49.0%	b>a; c>a,b,d,e; d>a,b; e>a,b
RUCC 5	28.9%	1.1%	31.8%	*	4.4%	32.4%	16.6%	34.6%	25.0%	b>a,c,e; c>a; d>a,c,e; e>a,c
RUCC 6	8.5%	42.2%	5.0%	*	25.0%	6.3%	5.3%	4.4%	9.9%	a>b,c,d,e; e>b,c,d
RUCC 7	16.1%	39.9%	13.6%	*	35.8%	13.9%	9.8%	9.4%	10.0%	a>b,c,d,e; b>d,e;
RUCC 8	3.7%	1.6%	3.9%	*	1.0%	4.1%	2.5%	2.7%	2.2%	b>a,e; e>a
RUCC 9	6.5%	13.9%	5.7%	*	13.7%	5.7%	2.8%	2.3%	3.9%	a>b,c,d,e; b>d,e
<i>Insurance</i>										
Private insurance	50.6%	14.7%	54.3%	*	8.5%	57.2%	27.0%	60.0%	34.2%	b>a,c,e; c>a; d>a,c,e; e>a,d
Medicaid	40.0%	38.6%	37.0%	*	76.5%	34.5%	52.4%	25.3%	52.5%	a>b,c,d,e; b>d; c>b,d; e>b,d
IHS	1.5%	13.1%	.3%	*	11.9%	.1%	.3%	.3%	.7%	a>b,c,d,e
Military insurance	2.1%	.2%	2.3%	*	.3%	2.0%	14.4%	6.0%	4.8%	b>a; c>a,b,d,e; d>a,b; e>a,b
Self-pay	5.5%	3.2%	5.8%	*	2.8%	5.8%	5.5%	6.8%	7.1%	b>a; d>a; e>a
Other	.5%	.5%	.5%	*	.3%	.5%	.5%	.2%	.9%	a>d; b>d; e>a
Has pregnancy health risk factor(s)	27.4%	33.8%	26.7%	*	33.3%	26.5%	23.9%	32.6%	28.2%	a>b,c,e; d>b,c
Number of previous live births	1.20	1.70	1.15	*	1.79	1.13	1.19	0.94	1.18	a>b,c,d,e; b>d; c>d; e>d
Birth was to multiples	3.2%	2.9%	3.2%		3.0%	3.2%	1.8%	3.3%	2.8%	

Notes: ANOVA one-tail test results indicate statistically significant difference in mean at $p < .05$ level, letters are used to indicate racial differences in means while the asterisk symbol * is used to indicate a reservation-status difference in means; RUCC codes: 3 “metro, population < 250,000”, 5 “nonmetro, urban population > 20,000, nonadjacent to metro area”, 6 “nonmetro, urban population between 2,500 and 19,999, adjacent to metro area”, 7 “nonmetro, urban population between 2,500 and 19,999, nonadjacent to metro area”, 8 “nonmetro, completely rural or less than 2,500 urban population, adjacent to metro area”, and 9 “nonmetro, completely rural or less than 2,500 urban population, nonadjacent to metro area.”

**Appendix C. Marginal Effects of Interactions
with Reservation Status – Predicted Probability of
Receiving Inadequate Prenatal Care**

	Margin
[Model 2]	
<i>Reservation X Race</i>	
No Res AND white	.139***
No Res AND AI/AN	.259***
No Res AND black	.148***
No Res AND Asian	.181***
No Res AND Hispanic	.171***
Yes Res AND white	.144***
Yes Res AND AI/AN	.342***
Yes Res AND black	.243**
Yes Res AND Asian	.254**
Yes Res AND Hispanic	.253***
[Model 3]	
<i>Reservation X IHS Insurance</i>	
No Res AND No IHS	.159***
No Res AND Yes IHS	.299***
Yes Res AND No IHS	.205***
Yes Res AND Yes IHS	.290***
[Model 4]	
<i>WIC X Medicaid</i>	
No WIC AND No Medicaid	.137***
No WIC AND Yes Medicaid	.230***
Yes WIC AND No Medicaid	.141***
Yes WIC AND Yes Medicaid	.179***
<i>WIC X IHS</i>	
No WIC AND No IHS	.180***

No WIC AND Yes IHS	.309***
Yes WIC AND No IHS	.159***
Yes WIC AND Yes IHS	.184***

Notes: coefficients are predicted probabilities; n = 57,006 births to birthers who were residents of Montana at the time of birth; ^
p < .1 * p < .05 ** p < .01 *** p < .001

Appendix D. Marginal effects of interactions with reservation status – rotated reference groups for payment type – Predicted probability of receiving inadequate prenatal care	
Private Insurance ref (see Table 1, model 3)	
No Res AND No IHS	.159***
No Res AND Yes IHS	.299***
Yes Res AND No IHS	.205***
Yes Res AND Yes IHS	.290***
Military Insurance ref	
No Res AND No IHS	.160***
No Res AND Yes IHS	.238***
Yes Res AND No IHS	.206***
Yes Res AND Yes IHS	.227***
Self-pay ref	
No Res AND No IHS	.162***
No Res AND Yes IHS	.170***
Yes Res AND No IHS	.208***
Yes Res AND Yes IHS	.159***
Other insurance ref	
No Res AND No IHS	.161***
No Res AND Yes IHS	.205***
Yes Res AND No IHS	.207***
Yes Res AND Yes IHS	.194***