HIGH SCHOOL EDITION
Journal of Student Research
Volume 13 Issue 4 (2024)

Factors Influencing High Infant Mortality Rate (IMR) in Indiana

Michael Moser[1] and Lora McGuire[#]

[1]Bishop Dwenger High School, USA
[#]Advisor

ABSTRACT

Infant mortality rate, or IMR, is a measure of the number of deaths that occur in the first year of life per 1,000 babies born. The IMR in the state of Indiana, 7.67, is much higher than the national IMR, which is 5.58 (Jang, 2022; Stratton, 2014). This literature review, including academic literature and government articles, discusses the various factors influencing the high Indiana IMR, including rurality, race, breastfeeding, and access to obstetric and child medical care. Proposed interventions to alleviate the high IMR in Indiana focus on income, education, and wealth. Finally, this review ends with an acknowledgment of the need for a holistic approach to addressing IMR because of the intersectional relationship between different influencing factors.

Introduction

The infant mortality rate, or IMR, measures the number of deaths in the first year of life per 1,000 babies born. Currently, the IMR in the United States is 5.58 (Jang, 2022). As healthcare and standards of living improved over the past 90 years, national IMRs also improved from about 60 in 1935, or 6%, to about 6 today, or 0.6%, which is considered to be a remarkable achievement (O'Neill, 2024). However, the U.S. lags behind many other developed countries in IMR, as the average IMR for comparable nations is 3.9 (O'Neill, 2024). Clearly, an opportunity for significant and meaningful improvement exists.

Indiana is home to nearly 7 million residents, representing 2% of the U.S. population. Only two major cities exist in the state, and many Hoosiers – the name given to residents of Indiana – live in rural areas far from medical centers. As a result, many Indiana residents lack access to healthcare, particularly in medical specialty areas – including obstetrics. Some parts of the state lack access to physicians, although pathways to improving access are beginning at the state level through increased deployment of midlevel providers such as nurse practitioners and physician assistants to rural areas. However, significant barriers persist among rural Hoosiers, including poverty and low education levels.

The IMR in Indiana is dramatically higher than in the United States overall. The state has the seventh-highest IMR in the nation, and the racial disparity is even more pronounced. At 6.9, the state's White IMR is 23% higher than the national average; the state's Black IMR is 12.3 – more than 200% higher than the national average (Stratton, 2014). This literature review looks at the different factors behind higher IMRs in Indiana.

Methods

The literature review for this study includes published academic articles as well as gray literature from state, national, and governmental publications on infant mortality rates in Indiana focused on the disparities between urban and rural areas, as well as disparities between Black and White populations. The dates of publication range from March 2014 to August 2024. Literature databases used were Google Scholar and MDPI. Key searched terms included "infant

mortality"; "disparities"; "rural"; "urban"; "Indiana." The literature selected specifically analyzed the causes for and disparities in infant mortality rates in Indiana. Topics chosen were rurality, race, socioeconomic factors, breastfeeding, and access to obstetric and child medical care. Twenty-five published articles were evaluated and twelve were included. Eight government articles were viewed and four were included. A discussion of findings within this research is below.

Results

Hoosiers have among the highest infant mortality rates in the United States (Stratton, 2014). This section summarizes some factors that influence higher IMRs in Indiana.

Rural Indiana

In Indiana, IMRs in more rural counties are 20% higher than in urban areas, following the national trend of declining IMRs with increasing urbanization (Ely, 2014). This illustrates a general disadvantage for mothers residing in rural areas. Rural mothers exhibit lower levels of completed education, higher body mass indexes, lower delivery age, and more prevalent use of tobacco when compared to national averages. All of these factors are positively correlated with higher infant mortality rates. Post-neonatal mortality (the number of deaths of infants after 28 days through 11 months) in Indiana also increases with rurality (Mohamoud, 2019). This is likely due to lower access to healthcare and the efficacy of in-place programs to address the issue (Stratton, 2014). Living in rural areas is clearly correlated with higher poverty rates, and the IMR for Indiana residents is higher among those living in poverty (Dagher, 2022). When viewing rurality through the lens of poverty, the correlation between higher IMRs and living in a rural area is magnified. Thus, those living in rural areas of Indiana and in poverty are at the highest risk for elevated IMRs.

Race

Overall infant mortality rates in the U.S. have declined but remain much higher for Black Americans. Infant death records analyzed from 2014 to 2016 reveal that the national mortality rate for all races was 5.58 deaths per 1000 live births, but was 10.8 deaths per live birth for Black infants (Jang, 2022). More recently, with preventive measures in place, the IMR for the non-Hispanic White population declined to 4.6, but the Black IMR persisted at 10.8 (Jang 2022). This is demonstrated in Figure 1 below.

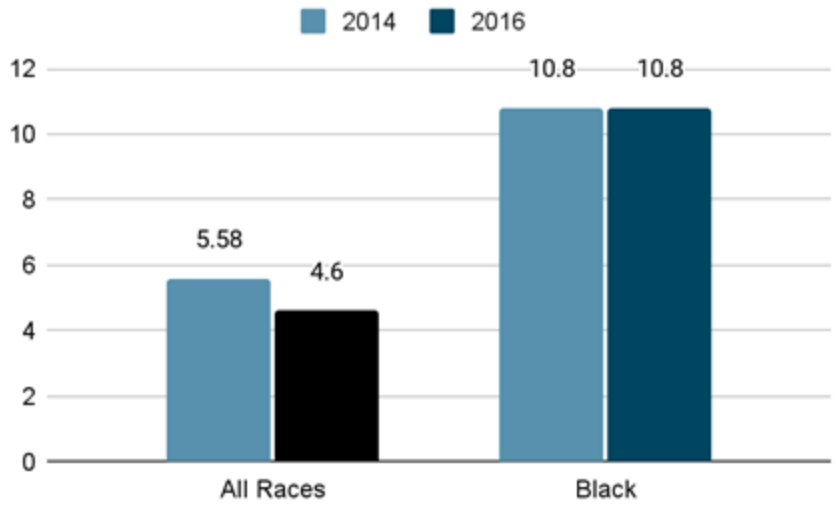

Figure 1. Infant Mortality in the United States (Jang, 2022).

Preterm births, defined as a gestation period of less than 37 weeks, are a leading cause of infant mortality and are highest among Black births. The overall preterm birth rate in the U.S. is 10.1%, but is 14.4% for Black communities (Jang, 2022). This gap can be attributed at least in part to social barriers such as racism and socioeconomic disadvantages experienced by Black communities. These factors increase stress levels for expectant mothers in this cohort, and higher stress is correlated with higher preterm births (Jang, 2022).

In Indiana, the gap between White and Black IMRs is even more pronounced. Even though a relatively small percentage of the population of Indiana is Black, the Black IMR is nearly double that of the White IMR (Indiana Department of Health, n.d.). Specifically, the IMR for White and Black Hoosiers is 6.9 and 12.3, respectively (Stratton, 2014). This is illustrated in Figure 2 below.

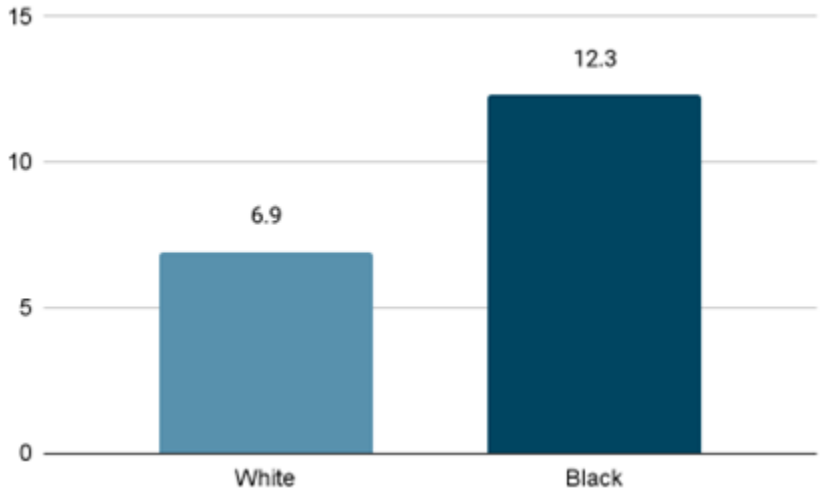

Figure 2. Infant Mortality in Indiana (Stratton, 2014).

Socioeconomic Factors and the Relationships Between Them

The unusually high and persistent infant mortality rates in Indiana can be attributed to socioeconomic disparities that exist between urban and rural areas, income levels, and Black and White populations. Factors considered to determine socioeconomic status include household income, home value, whether or not interest was earned, and education level (Ehrenthal, 2020). As stated in a previous section, there is generally poorer overall health among rural mothers. Another main socioeconomic obstacle that drives higher IMRs is income. Lower-income mothers, a prevalent group in rural Indiana, are often unable to take unpaid maternity leave. Combined with generally lower education levels inherent to this cohort, as well as decreased access to health insurance, this group is vulnerable to high IMRs (Dagher, 2022). Finally, low-income levels often prevent rural residents from moving to more urban areas with better healthcare resources, resulting in high IMR persistence.

Breastfeeding

The breastfeeding rate in Indiana is well below the national average (Adams, 2017). The inaccessibility of healthcare advice and assistance in rural and more poverty-stricken areas of Indiana has prevented many new mothers from receiving information about breastfeeding. Importantly, breastfeeding helps with long-term health and lowers the chances of death before the age of one (Ware, 2023). The correct use of breastfeeding is positively correlated with low IMRs, and although breastfeeding conduction and promotion varies geographically, this practice is a key component to lowering IMRs in the U.S. However, changing these perceptions would be difficult (Renbarger, 2023). Consistent standards for lactation among health providers in Indiana have largely prevented improvements in breastfeeding practices among Hoosiers, and major differences in both experiences and perceptions of breastfeeding persist between both patients and healthcare professionals, driving inconsistencies in messaging across the state (Adams, 2023).

Access to Obstetric Care and Child Medical Care

Access to obstetric care and child medical care presents challenges for rural Hoosiers. Obstetric healthcare specialists tend to be located within the few large cities in Indiana, and as a result, most other parts of the state are underrepresented (Dickinson, 2023). Rural residents, then, tend to have lower access to maternity care in Indiana than their urban counterparts. In fact, many expectant mothers residing in Indiana find themselves beyond a 30-minute commute to any hospital equipped for childbirth (Dickinson, 2023). While inaccessibility to child medical care itself contributes to higher IMRs, access to pediatric surgery specialists is particularly limited for rural Indiana patients. More specialized pediatric surgeries generally require a much greater travel distance than more common procedures (Anderson, 2024). As a result, higher IMRs persist for many rural Hoosiers.

Discussion and Proposed Solutions

In this literature review, several strong patterns emerged. The findings suggest that IMRs increase with rurality; IMR levels in Indiana are highest for Black infants; the socioeconomic factors of income, education, and wealth contribute to IMRs; and breastfeeding presents as a gateway to improving IMRs across populations. Interventions have been implemented to reduce IMRs, with varying degrees of efficacy.

The literature suggests that the strongest determinant of IMRs is income, regardless of where you live. Although other socioeconomic factors and resource accessibility impact infant survival, income can be viewed as an independent determinant. Raising income levels by any means would drastically lower infant mortality rates, with even a single dollar raise in the average minimum wage producing as much as a 4% decrease in postneonatal mortality nationwide (Komro, 2016). This implies that income-generating interventions would have the strongest impact on the effort to reduce infant mortality. This is demonstrated in Figure 3 below.

Figure 3. Projected Impact of Minimum Wage Increase on Indiana IMR (Komro, 2016).

Since it has been found that living in a rural area drives susceptibility to higher IMRs, there have been many government and community-created outreach groups focused on this topic. These groups have been largely ineffective due to a lack of funding partnerships and the difficulty of collecting timely data to track what resources are needed and where. A major statewide effort to improve education among healthcare providers, enacted and funded by the state and federal government, has also proven to have a low impact (Adams, 2017). The recipients are often not in the rural areas where the issue of high IMRs is most prominent, highlighting that a main obstacle to lowering IMRs in Indiana is the inaccessibility to healthcare providers educated on current trends in rural areas of the state (Obeng, 2019). Stronger statewide efforts to both educate providers on the severity of IMRs in Indiana and to fund their deployment in rural areas would provide more informed healthcare workers in areas that are most impacted.

Because of the racial disparities in IMRs in Indiana, targeted interventions should be implemented to address high IMRs among Black Hoosiers. Since significant disparities persist in Indiana between Black and non-Black populations regarding IMRs, many generalized interventions are largely ineffectual. A major reason this is a concern is that the high rates for Black IMRs are attributed to social constructs and systemic issues and not biological factors. Importantly, even as federal programs aimed at expanding Medicaid assistance to childbirth have been rolled out, many Black residents of Indiana have not benefited from increased access to healthcare coverage. As a result, the extension of existing programs to these populations is a potentially strong avenue to improve IMRs among the Black population of Indiana. Further, other programs, such as those aimed at increasing the adoption of maternity leave by employers for new mothers, have proven impactful at reducing IMRs overall, but not for Black Hoosiers. The equitable implementation of these and similar programs would likely result in much more significant improvements in IMRs. It is important that interventions targeting Black IMRs in Indiana are culturally informed and consider community factors and beliefs that influence IMRs, including the important role that families play in childcare and the belief that infant death is unpreventable (Renbarger, 2023), while also acknowledging and addressing systemic issues.

As for economic factors, with more wealth comes less struggle to afford care and other necessities for expectant and new mothers. The reviewed articles consistently used home ownership – as opposed to renting – as a measure of wealth, and additional less tangible benefits of owning a home, including increased stability and generally

safer environments for infants, benefit new mothers. Statewide policies, then, that promote home ownership would help in the effort to reduce IMRs. Another measure of wealth found was health insurance coverage, which has obvious benefits for at-risk populations. Although Indiana was one of the first states to expand Medicaid, additional resources deployed to increase health coverage for Hoosiers would drive lower IMRs in the state.

Because individual behavior factors such as smoking and consuming alcohol while pregnant contribute to high IMRs, improving basic education levels among at-risk mothers would dramatically increase awareness of how these factors affect health outcomes. One way to address this is to have government-funded or community-led educational interventions targeting new parents focused on sharing healthy gestational practices. Efforts to reduce infant mortality in Louisiana, which is the current state with the highest IMR, can be analyzed to predict their effectiveness if placed in similar contexts in Indiana. Outreach programs have been created to connect families regardless of income with local resources and care. Home visits by healthcare workers are also a part of this program. This outreach effort has proven effective in all aspects of the families' lives, both physically and mentally (New Orleans Health Department, n.d.). However, only 10% of families are able to receive this benefit due to struggles with Medicaid. It is important to consider when implementing similar ideas related to outreach efforts in Indiana that they are made more accessible to families in need.

Intersectionality

Importantly, individuals most impacted by high IMRs are affected by multiple and dynamic combinations of discrimination and many of the factors addressed in this paper, as expected when considering Professor Kimberlé Crenshaw's concept of intersectionality (Samie, 2023). This intersectionality makes it difficult to determine the best policies to improve IMRs across populations, since the complexities inherent to each person's experiences often make one policy very effective for one mother while having no impact on another. Therefore, it is vital to recognize that a multifaceted, holistic strategy would hold a higher probability of decreasing IMRs than would a large-scale "one size fits all" approach.

Acknowledgments

I would like to thank my advisor for the valuable insight provided to me on this topic.

References

Adams, J. M. (2017, October). *Breastfeeding and infant mortality in Indiana: Changing the culture and saving lives: A model for other states*. Breastfeeding medicine: the official journal of the Academy of Breastfeeding Medicine. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5651965/

Cassandra Anderson et al., Journal of Pediatric Surgery (2024). *How far We Go For Surgery: Distance to Pediatric Surgical Care in Indiana.* Science Direct. https://www.sciencedirect.com/science/article/abs/pii/S0022346824001593

Dagher, R. K., & Linares, D. E. (2022, March 10). *A critical review on the complex interplay between social determinants of health and maternal and infant mortality*. MDPI. https://www.mdpi.com/2227-9067/9/3/394

Dickinson, A., Vaughn, S., & Maxey, H. (2023). An Assessment of Indiana's Maternity Care Workforce: 2022 Report.

Ehrenthal, D. B., Kuo, H. H. D., & Kirby, R. S. (2020). Infant mortality in rural and nonrural counties in the United States. *Pediatrics*, *146*(5).

Ely, D. M., Driscoll, A. K., & Matthews, T. J. (2017). *Infant mortality rates in rural and urban areas in the United States, 2014* (Vol. 285). US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.

Indiana Department of Health. (2024, August 20). *Home*. https://www.in.gov/health/

Jang, C. J., & Lee, H. C. (2022, February 14). *A review of racial disparities in infant mortality in the US*. MDPI. https://www.mdpi.com/2227-9067/9/2/257

Komro, K. A., Livingston, M. D., Markowitz, S., & Wagenaar, A. C. (2016). The effect of an increased minimum wage on infant mortality and birth weight. *American journal of public health*, *106*(8), 1514-1516.

Mohamoud, Y. A., Kirby, R. S., & Ehrenthal, D. B. (2019, January 22). *Poverty, urban-rural classification and term infant mortality: A population-based multilevel analysis - BMC pregnancy and childbirth*. SpringerLink. https://link.springer.com/article/10.1186/s12884-019-2190-1#Abs1

New Orleans Health Department. *Healthy Start - City of New Orleans*. NOLA.gov. (n.d.). https://nola.gov/health-department/healthy-start/

Obeng, C., Barnes, P. A., Hunter, T., & Weinstein, M. (2019, April 1). *Infant mortality in Indiana: Perceived beliefs and attitudes of individuals living in the state.* International Journal of Child & Adolescent Health | EBSCOhost. https://openurl.ebsco.com/EPDB%3Agcd%3A9%3A14330217/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A137911109&crl=c

O'Neill, A. (2024, August 9). *United States: Infant mortality rate 1935-2020.* Statista. https://www.statista.com/statistics/1042370/united-states-all-time-infant-mortality-rate/#:~:text=Approximately%20six%20percent%20of%20children,six%20deaths%20per%20thousand%20births

Samie, A. (2023, December 20). intersectionality. Encyclopedia Britannica. https://www.britannica.com/topic/intersectionality

Stratton, R., Alley, A., Engle, B., Greuter, K., Herrmann, K., Kackley, D., Kathman, J., Martin, J., Morphew, P., Swigonski, N., & Winterheimer, L. (2014). Addressing Infant Mortality in Indiana: A Report to the IPQIC Governing Council. Indiana Perinatal Quality Improvement Collaborative. Retrieved from https://www.in.gov/health/mch/files/ipqic/Addressing_Infant_Mortality_in_Indiana.pdf

Ware, J. L., Li, R., Chen, A., Nelson, J. M., Kmet, J. M., Parks, S. E., Morrow, A. L., Chen, J., & Perrine, C. G. (2023). Associations between breastfeeding and post-perinatal infant deaths in the US. *American journal of preventive medicine*, *65*(5), 763-774.