Research Article

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Comparing Urban and Rural Mothers in Pregnancy in Southeastern United States: A Retrospective Study

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ABSTRACT

Background: *Maternal health outcomes differ significantly between rural and urban populations. Rural mothers often face higher risks of pregnancy complications, limited access to obstetric care, and increased maternal morbidity and mortality. This study aims to compare maternal health outcomes between rural and urban populations, focusing on postpartum hemorrhage (PPH) and the prevalence of gestational and chronic diseases.*

Methods: *A retrospective analysis was conducted at a community hospital in North Carolina, evaluating postpartum blood loss and maternal comorbidities in urban and rural mothers. The incidence of PPH and gestational diseases, such as gestational diabetes, gestational hypertension, and preeclampsia were examined. Chronic conditions, including type 2 diabetes mellitus and chronic hypertension, were also assessed. Chi-square testing was used to determine if the differences between the two populations were statistically significant.*

Results: *PPH rates did not significantly differ between urban and rural mothers for both vaginal (7.9% vs. 8.1%, $p = 0.82$) and cesarean deliveries (7.7% vs. 8.8%, $p = 0.203$). However, rural mothers exhibited a higher rate of gestational hypertension (10.7% vs. 9.15%, $p = 0.006$) and preeclampsia (11.9% vs. 10.75%, $p < 0.00001$), suggesting a greater risk for hypertensive disorders in pregnancy. No statistically significant differences were found in rates of gestational diabetes, type 2 diabetes, or chronic hypertension between the two groups.*

Conclusion: *While PPH rates were comparable across geographic settings, the higher rate of gestational hypertension in rural mothers underscores the need for targeted interventions to mitigate risk factors associated with hypertensive disorders in pregnancy. This study contributes to the growing body of research emphasizing maternal health disparities and highlights the necessity of improving access to quality prenatal care in rural communities.*

Keywords
Urban vs. Rural Pregnancy, Rural Healthcare, Obstetric Care, Chronic diseases.

Introduction
Significant disparities exist in maternal health outcomes between rural and urban populations. Rural mothers often experience difficulty accessing care, higher rates of pregnancy complications, and increased maternal morbidity and mortality [1-4]. Generally, women in rural areas experience poorer health outcomes than those in urban areas. Women in rural areas experience higher rates of cardiovascular deaths, obesity, and cancer [5,6]. Regarding pregnancy, it has been documented that women living in rural areas experience higher rates of hospitalization due to pregnancy complications when compared to their urban living counterparts [7]. Geographic isolation, provider shortages, and limited access to high-acuity obstetric care contribute to these inequities, placing rural mothers at a higher risk for adverse outcomes [8,9].

In contrast, urban populations generally have greater access to healthcare facilities, including specialized perinatal and high-risk obstetric care, which can improve maternal and neonatal outcomes [10,11].

A measurable factor to evaluate pregnancy morbidity is postpartum hemorrhage (PPH). PPH is defined as a postpartum blood loss of more than 500 ml for a vaginal delivery and 1000 ml for cesarean delivery, or signs and symptoms of hypovolemia within 24 hours after delivery [12]. PPH is the leading cause of maternal mortality worldwide [13]. The most common causes of PPH are uterine atony, tissue trauma/laceration, retained placenta, and coagulation disorders [14].

Gestational diseases, such as gestational diabetes mellitus (GDM), gestational hypertension (GHTN), and preeclampsia (PreE), are other important factors affecting maternal health. GDM is the most common disease recorded in pregnancy [15]. It is estimated that over 20 million mothers globally are affected by diabetes during pregnancy, which is assumed to be around 16% of global pregnancies [2,16]. In developed countries, like America and Australia, rates of GDM have tripled over the last decade [17,18]. Management of diabetes in pregnancy is important for both maternal and neonatal health. Mothers with GDM experience higher rates of preeclampsia in pregnancy, as well as a type 2 diabetes mellitus (T2DM) diagnosis later in life [8,19,20]. Neonates born to mothers with GDM are at increased risk of hypoglycemia, hyperbilirubinemia, shoulder dystocia, birth trauma, and death [21,22].

Moreover, comorbidities in the hypertensive spectrum, including Preeclampsia (PreE) and GHTN, are a leading cause of maternal and neonatal death. These disorders are responsible for 9-26% of maternal deaths, depending on geographic location [23,24]. Both conditions occur after the 20th week of gestation and are differentiated by proteinuria, which is increased protein in the urine, in PreE [25]. Furthermore, the diagnosis of chronic/essential hypertension (CHTN) is made before pregnancy or before the 20th week of gestation. CHTN rates have increased significantly over the decade between 2000 to 2009. The rate of CHTN during this period increased 67% overall and an even larger increase was seen in African American women at 87% [26,27]. Managing CHTN in the pre-pregnancy stage is crucial to avoid the teratogenic effects of antihypertensive medications, such as ACE inhibitors, which can cause low birth weights and preterm delivery [26,28].

This study aims to explore these disparities by comparing maternal health outcomes between rural and urban populations, specifically examining blood loss during delivery, and the rate of gestational and chronic diseases. Research suggests that rural mothers are more likely to experience inadequate prenatal care, delayed interventions, and higher rates of preventable pregnancy-related complications [29]. Additionally, structural barriers, such as fewer hospital-based delivery options and longer travel distances to healthcare facilities, may further exacerbate maternal health risks [30]. By analyzing these key variables, this study seeks to highlight the specific challenges faced by rural mothers and identify the most significant disparities in maternal care. Understanding these differences is essential for developing targeted interventions, improving healthcare accessibility, and ultimately reducing maternal health inequities between rural and urban populations.

Methods

This is a retrospective cohort study comparing live singleton births between January 1, 2020, and December 31, 2024, at Cape Fear Valley Health (CFVH) in Fayetteville, North Carolina. Data was extracted from electronic medical records using the Slicer Dicer function in EPIC. A total of 23,047 singleton births were recorded during this timeframe from mothers older than 18 years of age.

The US Census Bureau zip code was used to differentiate between rural and urban data. It defined "urban" as a high population density, having 2,000 or more housing units or 5,000 or more residents within its area. Similarly, the "rural" zip codes were defined as having a significantly lower population density, falling below those thresholds. The counties included in the data analysis were Cumberland, Bladen, Duplin, Sampson, Robeson, Hoke, and Harnett, all of which surround the CFVH hospital [31].

From the 23,047 total births recorded during this time frame, 5,030 were excluded from the analysis because they were either not from local zip codes, or their zip codes were not recorded. The remaining 18,017 deliveries were separated by urban and rural categories, with 14,662 deliveries in the urban group and 3,355 deliveries in the rural group.

Only singleton births were included in the data analysis to avoid confounding variables associated with pregnancies of multiples, which are known to have increased rates of comorbidities. Modes of delivery included spontaneous vaginal, which included vaginal birth after cesarean section (VBAC) and breech deliveries, operative vaginal which included forceps or vacuum, and cesarean delivery which included primary, repeat, emergency, low transverse, and classical.

The vaginal delivery group used to analyze postpartum blood loss included both spontaneous and operative vaginal deliveries. When measuring the rates of gestational diseases, such as GHTN, GDM, and PreE, each condition was analyzed independently in cases where patients had multiple comorbidities. However, a mother could not have both GHTN and PreE at the time of delivery, since these diagnoses are mutually exclusive.

The chronic diseases analyzed in this study were CHTN and T2DM. During data collection, mothers with CHTN were excluded from the gestational hypertension group. Likewise, mothers with T2DM or type 1 diabetes mellitus (T1DM) were excluded from the gestational diabetes group. The preeclampsia group included all forms of preeclampsia, such as preeclampsia with severe features, chronic hypertension with superimposed preeclampsia, etc.

A Chi-Square Test of Independence was conducted to determine whether there was a statistically significant difference between the two cohorts, using a significance threshold of $p \leq 0.05$.

Results

Postpartum Blood Loss from All Vaginal deliveries

There was an average postpartum blood loss of 270 mL from all vaginal deliveries in the urban cohort, with a maximum of 3,894 mL. The rural cohort had an average of 276 mL postpartum blood loss from vaginal delivery, with a maximum of 2,961 mL.

The urban vaginal delivery cohort had the following postpartum blood loss: 8,313 cases (88.7%) with less than 500 mL, 537 cases (5.7%) with 500-1000 mL, 114 cases (1.2%) of 1000-1500 mL, and 88 cases (0.9%) with more than 1500 mL. There were 320 urban vaginal deliveries with no recorded blood loss. In total, there were 739 vaginal deliveries with PPH, comprising 7.9% of vaginal deliveries in the urban group (Figure 1).

Alternatively, the rural vaginal delivery cohort had the following recorded postpartum blood loss: 1,800 cases (89%) with less than 500 mL, 111 cases (5.4%) with 500-1000 mL, 28 cases (1.4%) with 1000-1500 mL, 25 cases (1.2%) with more than 1500 mL. In 58 cases, no blood loss was recorded following vaginal deliveries. In total, there were 164 vaginal deliveries in the rural cohort with PPH, which was 8.1% of the total vaginal deliveries in the group (Figure 1).

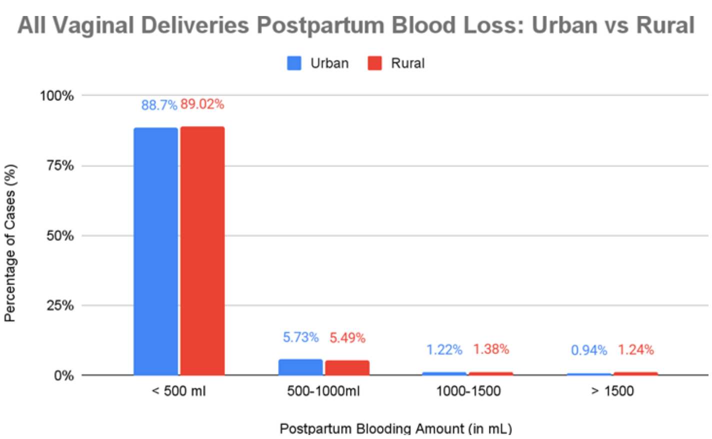

Figure 1: Chart illustrating ranges of postpartum bleeding following vaginal delivery in urban and rural cases.

In summary, the urban cohort had 739 cases of PPH out of 9,052 vaginal deliveries, and the rural cohort had 164 cases of PPH out of 1,964 vaginal deliveries. The chi-square analysis of independence yielded a chi-square statistic of $\chi^2(1, N = 11{,}016) = 0.052$, $p = 0.82$. This was not statistically significant using a significance threshold of $p \leq 0.05$.

Blood Loss from Cesarean Deliveries

In the urban cohort, there was an average of 684 mL postpartum blood loss from all cesarean deliveries, with a maximum of 12,500 mL. The rural cohort had an average of 688 mL, with a maximum postpartum blood loss of 4,500 mL.

The urban cesarean delivery cohort had the following postpartum blood loss: 247 cases (4.7%) with less than 500 mL, 4,429 cases (84.1%) with 500-1000 mL, 245 cases (4.6%) with 1000-1500 mL, and 159 cases (3%) with more than 1500 mL. There were 185 urban cesarean deliveries where no blood loss was recorded. In total, there were 404 cases (7.7%) of PPH in the urban cesarean delivery cohort (Figure 2).

Alternatively, the rural cesarean delivery cohort had the following postpartum blood loss: 62 cases (4.7%) with less than 500 mL, 1,108 cases (83.6%) with 500-1000 mL, 73 cases (5.5%) with 1000-1500 mL, and 44 cases (3.3%) with more than 1500 mL. There were 39 rural cesarean deliveries where no blood loss was recorded. In total, there were 117 cases (8.8%) of PPH in the rural cesarean delivery cohort (Figure 2).

In summary, the urban cohort had 404 cases of PPH out of 5,080 total cesarean deliveries, and the rural cohort had 117 cases of PPH out of 1,287 total cesarean deliveries. The chi-square analysis of independence yielded a chi-square statistic of $\chi^2(1, N = 6{,}367) = 1.622$, $p = 0.203$. This was not statistically significant using a significance threshold of $p \leq 0.05$.

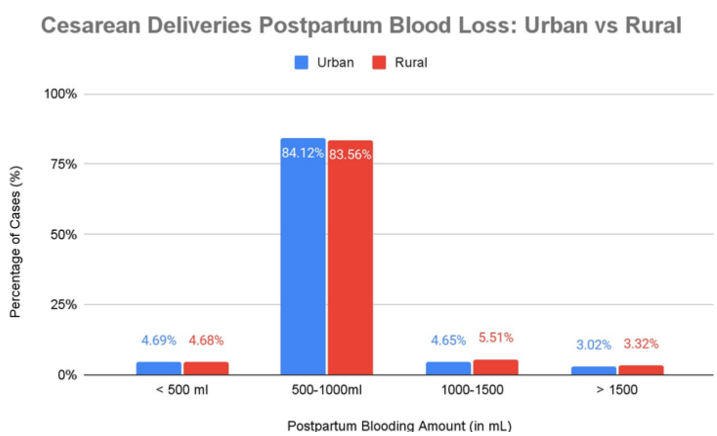

Figure 2: Bar graph illustrating ranges of postpartum bleeding following cesarean delivery in urban (blue) and rural (red) cases.

Gestational Diseases

The gestational diseases assessed in this study were gestational diabetes mellitus (GDM), gestational hypertension (GHTN), and pre-eclampsia (PreE). Three separate cohorts were analyzed in this section, including the general, urban, and rural populations. The general population represents all deliveries at CFVH, including those that did not fit into urban or rural categories based on zip code.

Gestational Diabetes Mellitus (GDM)

The rates of GDM in each cohort were as follows: 1,878 cases (8.15%) in the general population, 1,189 cases (8.1%) in the urban population, and 286 cases (8.5%) in the rural population. The rural population had the highest rate of GDM compared to the general and urban population (Figure 3).

The Chi-Square Test of Independence yielded a chi-square statistic of $\chi^2(1, N = 18{,}017) = 0.626$, $p = 0.429$. Using a significance threshold of $p \leq 0.05$, this indicates that there was not a statistically significant difference in rates of GDM between the urban and rural populations.

Gestational Hypertension (GHTN)

The rates of GHTN in each cohort were as follows: 2,181 cases (9.5%) in the general population, 1,342 cases (9.15%) in the urban population, and 359 cases (10.7%) in the rural population. Again, the rural cohort had the highest rate of GHTN when compared to the general and urban populations (Figure 3).

The Chi-Square Test of Independence yielded a chi-square statistic of $\chi^2(1, N = 18{,}017) = 7.468$, $p = 0.006$. Using a significance threshold of $p \leq 0.05$, this indicates a statistically significant difference in rates of GHTN exists between the rural and urban populations at CFVH during the time of data analysis.

Pre-eclampsia (PreE)

The rates of PreE in each cohort were as follows: 2,521 cases (10.9%) in the general population, 1,577 cases (10.75%) in the urban population, and 399 cases (11.9%) in the rural population. Again, this comparison shows that the rural population experienced PreE at higher rates than both the general and urban populations. (Figure 3).

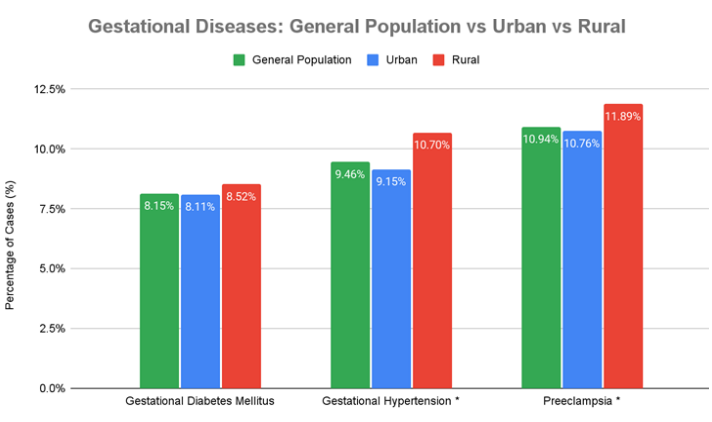

Figure 3: Bar graph illustrating rates of gestational diseases (Gestational Diabetes Mellitus, Gestational Hypertension, and Preeclampsia) with green representing the general population, blue representing the urban population, and red representing the rural population. Asterisks on the horizontal axis denote statistical significance

The Chi-Square Test of Independence yielded a chi-square statistic of $\chi^2(1, N = 18{,}017) = 56.5$, $p < 0.00001$. Using a significance threshold of $p \leq 0.05$, this indicates a statistically significant difference in rates of PreE exists between the rural and urban populations at CFVH during the time of data analysis.

Chronic Diseases

The chronic diseases assessed in this study were chronic hypertension (CHTN) and type 2 diabetes mellitus (T2DM). The same three cohorts were analyzed, including the general, urban, and rural populations. The general population represents all deliveries at CFVH, including those that did not fit into urban or rural categories based on zip code.

Type 2 Diabetes Mellitus (T2DM)

The rates of T2DM were as follows: 323 cases (1.4%) in the general population, 201 cases (1.37%) in the urban population, and 56 cases (1.67%) in the rural population. While a higher rate of T2DM was observed in the rural population, the Chi-Square Test of Independence yielded a chi-square statistic of $\chi^2(1, N = 18{,}017) = 1.73$, $p = 0.189$. Using a significance threshold of $p \leq 0.05$, this indicates that the difference in rates of T2DM between the urban and rural populations was not statistically significant (Figure 4).

Chronic Hypertension (CHTN)

The rates of CHTN were as follows: 555 cases (2.41%) in the general population, 361 cases (2.46%) in the urban population, and 77 cases (2.3%) in the rural population. In this case, the rural population had the lowest rate of chronic hypertension when compared to the general and urban populations. The Chi-Square Test of Independence yielded a chi-square statistic of $\chi^2(1, N = 18{,}017) = 0.3213$, $p = 0.571$. This indicates no statistically significant difference between the rates of CHTN in the rural and urban populations when using a significance threshold of $p \leq 0.05$ (Figure 4).

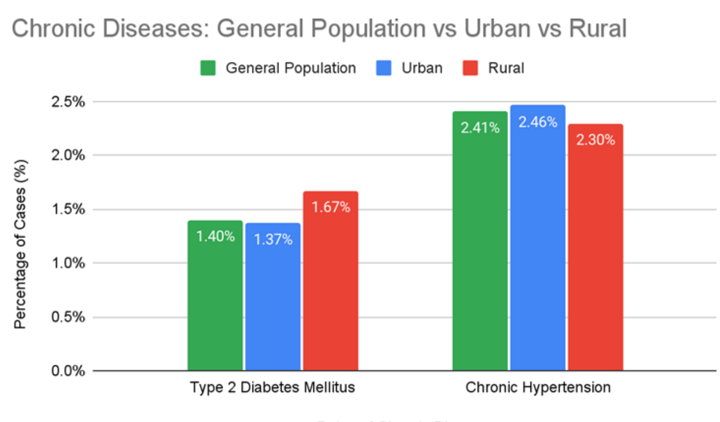

Figure 4: Bar graph illustrating rates of chronic diseases (Type 2 Diabetes Mellitus and chronic/ essential Hypertension), with green representing the general population, blue representing the urban population, and red representing the rural population.

Discussion

Our study aimed to explore the differences in PPH, gestational, and chronic diseases among rural and urban populations. The results regarding postpartum blood loss from vaginal deliveries demonstrate that urban and rural mothers had similar postpartum blood loss of 270 mL and 276 mL, respectively. The overall PPH rate was similar between the two groups, with 7.9% of urban vaginal deliveries and 8.1% of rural vaginal deliveries experiencing PPH. A Chi-square test found no statistically significant difference in PPH rates ($p = 0.82$), indicating that geographic setting does not significantly impact PPH risk for vaginal births.

For cesarean deliveries, urban and rural mothers had an average postpartum blood loss of 684 mL and 688 mL, respectively. The rate of PPH following cesarean delivery was 7.7% among urban mothers and 8.8% among rural mothers. Again, a Chi-square test found no statistically significant difference in PPH rates between urban and rural cesarean deliveries ($p = 0.203$), further supporting that the mother's location does not appear to be a major factor in cesarean-related hemorrhage risk.

When evaluating gestational diseases, rural mothers had slightly higher rates of GDM (8.5% vs. 8.1%), GHTN (10.7% vs. 9.15%), and PreE (11.9% vs. 10.75%) compared to urban mothers. However, only GHTN and PreE showed a statistically significant association with geographic location ($p = 0.006$ & $p < 0.00001$), suggesting that rural mothers may be at a higher risk for developing hypertension during pregnancy. GDM did not show statistically significant differences between urban and rural populations.

For chronic conditions, rural mothers had a slightly higher rate of T2DM (1.67% vs. 1.37%), while CHTN was slightly more common in urban mothers (2.3% vs. 2.46%). However, Chi-square analyses revealed no statistically significant differences for either condition, suggesting that geographic settings do not play a significant role in the rate of these chronic diseases during pregnancy.

One of the key strengths of this study is the demographic makeup of our study population, with a significant proportion of participants being African American. According to the 2023 U.S. Census, African Americans comprise 42.3% of the population in Fayetteville, North Carolina, followed by White individuals at 38.3%, Hispanic/Latino individuals at 13%, and less than 1% identifying as American Indian [29]. This demographic representation is particularly important, as many large-scale studies on PPH often struggle to include minority groups, resulting in gaps in knowledge about how this condition affects diverse populations. By analyzing data from a predominantly African American cohort, our findings add valuable insights into a group that has been historically underrepresented in obstetric research. This improved representation enhances the relevance of our results for similar populations and underscores the ongoing need for greater diversity in maternal health studies.

Another notable aspect of this research is that it was conducted at a community hospital, which presents both advantages and challenges. Compared to academic medical centers, community hospitals may have less standardized protocols and more variability in clinical practices, potentially introducing differences in management approaches. While this variability could be seen as a limitation, it also serves as a strength by offering a real-world perspective on postpartum hemorrhage care in settings where the majority of patients receive treatment. These findings help bridge the gap in understanding how PPH is managed across different healthcare environments and highlight the importance of developing interventions that can be effectively applied in a variety of clinical settings.

An additional major strength of this study lies in its objective approach to analyzing gestational and chronic disease rates within our population. While some findings did not reach statistical significance, it is essential to recognize that behind every data point is a woman—someone's mother, daughter, or partner—whose life and well-being are profoundly affected by this condition. Rates of gestational and chronic diseases are not just clinical statistics; they can impact the health of the mother's pregnancy, alter a woman's future, jeopardize her health, her ability to care for her children, and even her survival. The consequences extend beyond the mother, impacting families, communities, and society at large. Maternal morbidity and mortality have rippling effects, influencing child development, family stability, and economic security. By documenting these rates, our study highlights the urgent need for continued efforts in early recognition, prevention, and improved management of gestational and chronic diseases. These are not just numbers—they represent lives, and every effort to reduce maternal complications is an investment in the well-being of future generations.

Despite these strengths, this study has several limitations. The retrospective nature of the study introduces potential biases associated with medical record documentation. Additionally, the geographic specificity of the study may limit generalizability to other populations. Another limitation is the potential influence of unaccounted confounding variables, such as socioeconomic status, access to prenatal care, and underlying health disparities that may contribute to the observed differences in gestational hypertension and preeclampsia rates.

Overall, the findings suggest that while rates of postpartum hemorrhage do not significantly differ between urban and rural mothers, there is a notable difference in the rate of GHTN and PreE, with rural mothers experiencing a higher rate. This highlights the need for targeted interventions and improved prenatal care in rural settings to address potential risk factors for hypertensive disorders in pregnancy. Further research should explore the underlying causes of these disparities and develop strategies to improve maternal health outcomes across different geographic populations.

Conclusion

In conclusion, this study provides valuable insights into higher rates of GHTN and PreE in rural mothers underscoring the need for targeted interventions to address maternal health disparities in rural settings. Ultimately, this study reinforces the importance of early recognition, prevention, and management of maternal health conditions, recognizing that behind every data point is a mother whose well-being directly impacts families and communities. Future research should explore the underlying causes of these disparities and develop strategies to improve maternal health outcomes across different geographic populations.

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