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Advancing Maternal Age and Its Association with Gestational and Chronic Diseases: A Retrospective Review

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ABSTRACT

Background: *In recent decades, more women are delaying childbirth, with advanced maternal age linked to higher risks of adverse pregnancy outcomes. Prior studies have shown associations between older maternal age and gestational diabetes (GDM), gestational hypertension (GHTN), type 2 diabetes (T2DM), chronic hypertension (CHTN), and preeclampsia (PreE).*

Objective: *This study assessed whether maternal age remains a significant predictor of gestational and chronic diseases in a Southeastern U.S. urban area with a large African American population.*

Study Design: *A retrospective analysis of 22,730 singleton live births (2020–2024) was conducted using electronic medical records from Epic. Maternal age was analyzed categorically. Odds ratios measured disease likelihood across age cohorts, and chi-square tests examined associations between race and disease development.*

Results: *The odds of developing GDM increased with age. Among White women, those aged 30–34 (OR 1.58), 35–39 (OR 1.96), and over 40 (OR 2.91) had higher odds compared to ages 18–29. Similar trends appeared in African American women aged 30–34 (OR 1.71), 35–39 (OR 2.83), and over 40 (OR 3.68). No significant association was found between maternal age and GHTN. White women over 40 had higher odds of PreE (OR 1.8). African American women aged 34–39 (OR 1.19) and 35–39 (OR 1.57) also had increased PreE risk. Both groups over age 30 had higher odds of T2DM and CHTN.*

Conclusion: *Advanced maternal age is significantly associated with increased risk of GDM, T2DM, CHTN, and PreE. As delayed childbirth trends continue, targeted prenatal care and early detection are critical to manage risks. Future prospective studies are needed to clarify mechanisms and develop interventions to improve outcomes.*

Keywords

Advanced Maternal Age, Chronic Hypertension, Gestational Diabetes, Gestational Hypertension, Pre-eclampsia, Type 2 Diabetes Mellitus.

Introduction

The American College of Obstetrics and Gynecology defines advanced maternal age (AMA) as women who are 35 years or older at the estimated date of delivery [1]. This threshold was established based on 1981 research linking increased genetic abnormalities and fertility decline to women over 35 [2]. Recent studies, such as the FASTER trial and the NBDPS, confirm a significant association between AMA and chromosomal abnormalities. However, research suggests that 35 is not a strict cutoff, but part of a continuum of increasing risks [3,4].

In the U.S., childbearing at older ages is becoming more common [5]. The CDC reported that in 2022, birth rates declined for women aged 15-24, rose for those 25-29 and 35-49, and remained stable for those 30-34 [6]. The average age of first-time mothers increased from 25.4 years in 2010 to 27.4 years in 2022 [6]. This trend is influenced by social determinants of health, as women with higher socioeconomic status and education levels tend to delay pregnancy [5]. Advancements in reproductive healthcare, including contraception and fertility treatments, have also contributed [5]. However, disparities in access persist, with socioeconomic status playing a key role. Additionally, workplace policies, childcare costs, and inadequate parental leave may discourage early childbearing [5].

Understanding delayed childbearing is critical, as AMA is linked to heightened maternal and fetal risks. Increased maternal age is associated with gestational diabetes mellitus (GDM), gestational hypertension (GHTN), and preeclampsia (PreE) [5,7]. GDM is characterized by carbohydrate intolerance during pregnancy, while GHTN and PreE are hypertensive disorders occurring after 20 weeks of gestation [8,9]. PreE is defined as hypertension with proteinuria or other complications such as thrombocytopenia, renal insufficiency, or organ dysfunction [9].

Research confirms that AMA increases the likelihood of GDM, GHTN, and PreE [7,10]. The 2022 National Vital Statistics Report showed that GDM prevalence rises with age, from 4.46% in mothers aged 20-24 to 15.05% for those 40-54 [11]. Similarly, GHTN and PreE rates increased from 9.56% in mothers aged 20-24 to 11.32% for those 40-54 [11]. Additionally, racial disparities exist, with Black mothers experiencing higher prevalence of these complications across all age groups [11]. It is important to note that this data reflects the general U.S. population, which is predominantly composed of 75.3% White individuals and 13.6% Black individuals [12].

These complications pose additional risks. Women with GDM are more likely to develop PreE and require cesarean delivery [13,14]. They also have a 70% chance of developing diabetes later in life [15]. GHTN increases the likelihood of PreE which can lead to organ damage, pregnancy loss, and severe maternal complications [9,16].

Given the increasing maternal age and associated risks, this study examines whether age remains a predictor of adverse outcomes in a Southeastern U.S. urban area, where 38.3% of the population is White and 42.3% African American/Black [17]. This analysis will stratify age groups to capture the gradation of risks across the reproductive lifespan.

Materials and Methods

This is a retrospective review that was conducted among women who delivered live births between January 1, 2020, and December 31, 2024. Data was extracted from electronic medical records using the Slicer Dicer function in EPIC. A total of 23,047 births were recorded during this timeframe from mothers older than the age of 18, and 22,730 were singleton births. Age ranges were divided into women ages 18 to 29, 30 to 34, 35 to 39, and older than 40 years old. Additionally, women were stratified by the race they identified as on maternal demographic form from EPIC, wither "White" or "African American/Black' (AA).

This retrospective review analyzed three gestational diseases, including GDM, GHTN, and PreE, and two chronic diseases, including Type 2 Diabetes Mellitus (T2DM) and Chronic/Essential Hypertension (CHTN).

Patients diagnosed with both GDM and GHTN or PreE were counted as independent cases for statistical analysis, ensuring that each condition was analyzed separately, as mothers can have both GDM and GHTN or PreE. However, a mother could not have either GHTN or PreE. In addition, care was made to exclude mothers with chronic hypertension in groups with gestational hypertension. Likewise, mothers with T2DM were not included in the GDM group. Lastly, this data collection included various diagnoses of PreE, such as chronic hypertension with superimposed PreE and PreE with severe features, recognizing that PreE is a gestational disorder with multiple clinical manifestations.

Odds ratios were calculated with 95% confidence intervals. In addition, Chi-square test of independence was conducted to examine the association between the development of gestational and chronic diseases between the two groups of mothers. Using the significance level of $p < 0.05$ to determine significance. This study was reviewed and determined to be exempt from Institutional Review Board oversight as defined by 45 CFR45.104, Category 4.

Results

This retrospective cohort study analyzed a total of 23,047 births. Of these 22,730 were singleton births, 9,462 births were from AA mothers (41.63% of all deliveries) and 7,679 births from White mothers (33.78% of all deliveries). There was a total of 5,589 births from mothers who did not identify as white or AA (24.59%). This paper assesses the effects of maternal age on the risk of developing gestational and chronic diseases. In the total population, 14,046 deliveries (60.95%) were from mothers aged 18-29, 5,465 births (23.71%) were from mothers 30-34 years, 2,605 births (11.3%) from mothers 35-49 years ago, and 614 deliveries (2.66%) were from mothers older than 40.

Gestational Diseases

Gestational Diabetes Mellitus

The first gestation disease being assessed in this research is GDM. There were 2,019 diagnoses made for GDM in the total pregnant population (8.9%).

Among White mothers, 596 cases of GDM were identified out of 7,679 deliveries (7.76%). When stratified by age, GDM prevalence increased with maternal age: 6.00% in mothers aged 18–29, 9.49% in those 30–34, 11.76% in those 35–39, and 17.44% in mothers over 40 (Figure 1).

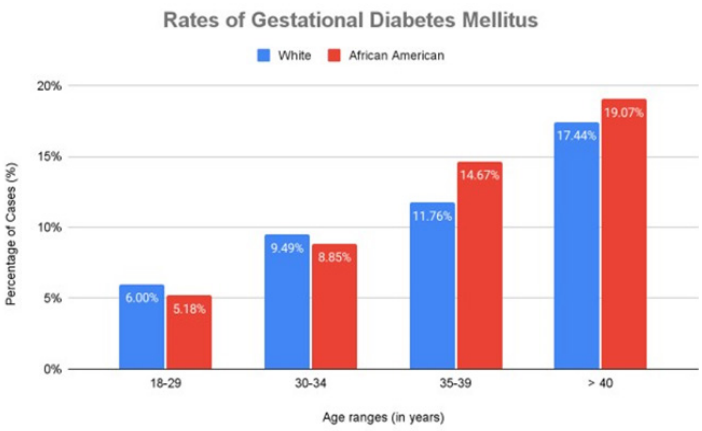

Figure 1: Bar graph illustrating the rates of Gestational Diabetes Mellitus comparing White mothers (Blue) and African American mothers (Red).

The odds of developing GDM in White mothers increase with maternal age. Compared to women aged 18–29, those aged 30–34 have 1.58 (95% CI 1.31–1.92) times higher odds, women aged 35–39 have 1.96 (95% CI 1.54–2.49) times higher odds, and those over 40 have 2.91 (95% CI 1.94–4.37) times higher odds (Table 1).

In the AA cohort, 712 mothers were diagnosed with GDM out of 9,462 deliveries (7.5%). GDM prevalence increased with maternal age, 5.18% in mothers aged 18–29, 8.85% in those 30–34, 14.67% in those 35–39, and 19.07% in mothers over 40. (Figure 1).

In AA mothers, the risk of developing GDM increases with age. Compared to women aged 18–29, those aged 30–34 have 1.71 (95% CI 1.41–2.05) times higher odds, women aged 35–39 have 2.83 (95% CI 2.31–3.74) times higher odds, and those over 40 have 3.68 (95% CI 2.65–5.1) times higher odds (Table 1).

A Chi-square test of independence was conducted to examine the association between the development of GDM between the two racial groups of mothers. The Chi-square test of independence revealed no statistically significant associations between the development of GDM and maternal age groups (18-29, 30-34, 35-39, and >40), as summarized in Table 2. The overall analysis across all age groups also showed no significant association ($\chi^2(1, N = 17,141) = 0.337$, $p = 0.562$) (Table 2).

Gestational Hypertension

The second gestational disease being assessed in this research is GHTN. In the general population, there were a total of 2,244 diagnoses of GHTN out of a total population of 22,730 (9.43%). Among White mothers, 806 cases of GHTN were identified out of 7,679 deliveries (10.49%). Prevalence by age was 10.83% in mothers aged 18–29, 9.96% in those 30–34, 10.2% in those 35–39, and 8.72% in mothers over 40 (Figure 2).

The odds of developing GHTN in White mothers decrease with age. Compared to women aged 18–29, those aged 30–34 have 0.92 (95% CI 0.77–1.09) times lower odds, women aged 35–39 have 0.94 (95% CI 0.74–1.2) times lower odds, and those over 40 have 0.81 (95% CI 0.47–1.38) times lower odds (Table 1).

Table 1: Odds Ratios of Developing Gestational or Chronic Diseases stratified by age group. Women aged 18-29 were used as a reference group. An asterisk indicates a statistically significant result.

Gestational or Chronic Disease	Age Group	White Women	African American Women
Gestational Diabetes Mellitus	18-29 years old	1.00	1.00
	30-34 years old	1.58 (95% CI 1.31-1.92)*	1.71 (95% CI 1.41-2.05)*
	35-39 years old	1.96 (95% CI 1.54-2.49)*	2.83 (95% CI 2.31-3.74)*
	Over 40 years old	2.91 (95% CI 1.94-4.37)*	3.68 (95% CI 2.65-5.1)*
Gestational Hypertension	18-29 years old	1.00	1.00
	30-34 years old	0.92 (95% CI 0.77-1.09)	0.82 (95% CI 0.69-0.97)
	35-39 years old	0.94 (95% CI 0.74-1.2)	0.87 (95% CI 0.7-1.09)
	Over 40 years old	0.81 (95% CI 0.47-1.38)	1.00 (95% CI 0.66-1.51)
Pre-eclampsia	18-29 years old	1.00	1.00
	30-34 years old	1.02 (95% CI 0.86-1.21)	1.19 (95% CI 1.03-1.37)*
	35-39 years old	1.14 (95% CI 0.9-1.43)	1.57 (95% CI 1.32-1.86)*
	Over 40 years old	1.8 (95% CI 1.21-2.67)*	1.23 (95% CI 0.86-1.75)
Type 2 Diabetes Mellitus	18-29 years old	1.00	1.00
	30-34 years old	2.57 (95% CI 1.41-4.69)*	2.93 (95% CI 2.08-4.14)*
	35-39 years old	4.8 (95% CI 2.56-9.09)*	3.41 (95% CI 2.28-5.12)*
	Over 40 years old	3.9 (95% CI 1.16-13.32)*	4.77 (95% CI 2.59-8.78)*
Chronic Hypertension	18-29 years old	1.00	1.00
	30-34 years old	1.32 (95% CI 1.11-1.57)*	1.79 (95% CI 1.56-2.05)*
	35-39 years old	1.75 (95% CI 1.41-2.17)*	2.51 (95% CI 2.14-2.94)*
	Over 40 years old	2.55 (95% CI 1.76-3.7)*	3.45 (95% CI 2.68-4.46)*

Table 2: Association Between Gestational and Chronic Diseases and Maternal Age by Racial Group.

Gestational or Chronic Disease	Age Group	X^2 (Degrees of Freedom)	N	P-Value
Gestational Diabetes Mellitus	18-29 years old	3.30	10,583	0.069
	30-34 years old	0.515	4,210	0.473
	35-39 years old	3.46	1,919	0.063
	>40 years old	0.181	429	0.67
	Overall	0.337	17,141	0.562
Gestational Hypertension	18-29 years old	1.45	10,583	0.228
	30-34 years old	3.57	4,210	0.059
	35-39 years old	1.07	1,919	0.300
	>40 years old	0.232	429	0.630
	Overall	4.48	17,141	0.034*
Pre-eclampsia	18-29 years old	7.66	10,583	0.0057*
	30-34 years old	13.16	4,210	0.0003*
	35-39 years old	17.76	1,919	0.000025*
	>40 years old	1.02	429	0.3135
	Overall	28.83	17,141	<0.0001*
Type 2 Diabetes Mellitus	18-29 years old	12.81	10,583	0.00034*
	30-34 years old	18.80	4,210	0.000015*
	35-39 years old	3.61	1,919	0.0575
	>40 years old	3.15	429	0.07583
	Overall	37.26	17,141	<0.0001*
Chronic Hypertension	18-29 years old	7.94	10,583	0.0048*
	30-34 years old	38.59	4,210	<0.00001*
	35-39 years old	31.48	1,919	<0.00001*
	>40 years old	8.55	429	0.0035*
	Overall	70.09	17,141	<0.0001*

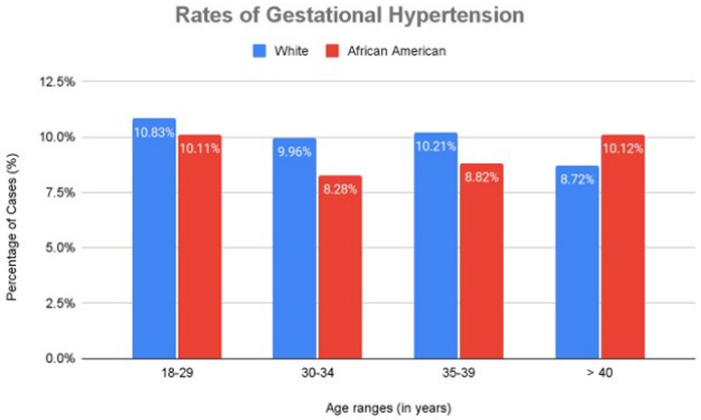

Figure 2: Bar graph illustrating the rates of Gestational Hypertension comparing White mothers (Blue) and African American mothers (Red).

In the AA cohort, 901 mothers were diagnosed with GHTN out of 9,462 deliveries (9.52%). Prevalence by age was 10.1% in mothers aged 18–29, 8.28% in those 30–34, 8.82% in those 35–39, and 10.11% in mothers over 40. (Figure 2).

In AA mothers, the risk of developing GHTN generally increases with age. Compared to women aged 18–29, those aged 30–34 have 0.82 (95% CI 0.69–0.97) times lower odds, women aged 35–39 have 0.87 (95% CI 0.7–1.09) times higher odds, and those over 40 have the same risk as the reference group with an OR of 1 (95% CI 0.66–1.51) (Table 1).

The Chi-square test of independence showed no statistically significant differences in GHTN prevalence between the two racial groups across individual maternal age ranges (18-29, 30-34, 35-39, and >40). However, the overall analysis across all age groups revealed a statistically significant increase in GHTN cases among AA mothers compared to White mothers ($\chi^2(1, N = 17,141) = 4.48$, $p = 0.034$) (Table 2).

Preeclampsia

The third and last gestational disease being assessed in this research is PreE. In the general population, there were a total of 2,625 diagnoses of PreE out of 22,730 deliveries (11.54%). Among White mothers, 799 were diagnosed with PreE out of 7,679 deliveries (10.4%). Prevalence by age was 10% in mothers aged 18–29, 10.21% in those 30–34, 11.4% in those 35–39, and 18.02% in mothers over 40 (Figure 3).

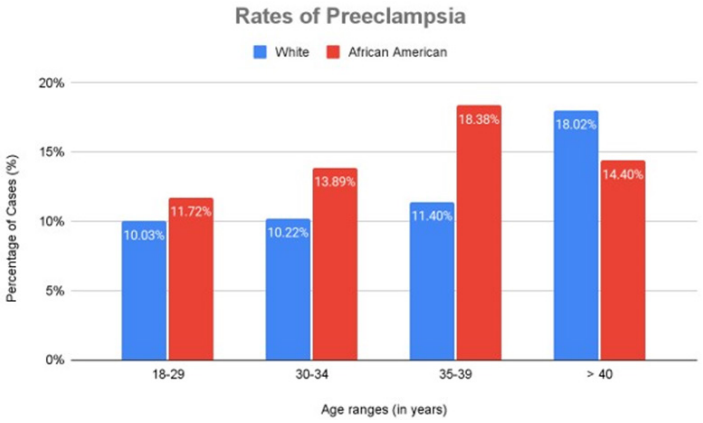

Figure 3: Bar graph illustrating the rates of Preeclampsia comparing White mothers (Blue) and African American mothers (Red).

In White mothers, the odds of developing PreE increase with maternal age. Compared to women aged 18–29, those aged 30–34 have 1.02 (95% CI 0.86–1.21) times higher odds, women aged 35–39 have 1.14 (95% CI 0.9–1.43) times higher odds, and those over 40 have 1.8 (95% CI 1.21–2.67) times higher odds (Table 1).

In the AA cohort, 1,237 mothers were diagnosed with PreE out of 9,462 deliveries (13.07%). Prevalence by age was 11.72% in mothers aged 18–29, 13.9% in those 30–34, 18.38% in those 35–39, and 14.4% in mothers over 40 (Figure 3).

In AA mothers, the odds of developing PreE increase up to age 39 and then decrease. Compared to women aged 18–29, those aged 30–34 have 1.19 (95% CI 1.03–1.37) times higher odds, women aged 35–39 have 1.57 (95% CI 1.32–1.86) times higher odds, and those over 40 have 1.23 (95% CI 0.86–1.75) times higher odds (Table 1).

A Chi-square test of independence showed a statistically significant increase in PreE rates among AA mothers across all age groups except those over 40. AA mothers aged 18-39 had significantly higher rates of PreE compared to White mothers (p-values < 0.01). However, among mothers over 40, White mothers had a higher PreE rate, though this difference was not statistically significant (p = 0.3135). Overall, AA mothers had a significantly increased risk of PreE compared to White mothers ($\chi^2(1, N = 17,141) = 28.83$, $p < 0.0001$) (Table 2).

Chronic Diseases

Type 2 Diabetes Mellitus

The first chronic disease being assessed in this research is T2DM. There were a total of 383 mothers out of 22,730 who had the diagnosis of T2DM (1.7%). Among White mothers, 64 were diagnosed with T2DM before or during pregnancy (0.83%). Prevalence by age was 0.44% in mothers aged 18–29, 1.14% in those 30–34, 2.14% in those 35–39, and 1.74% in mothers over 40 (Figure 4).

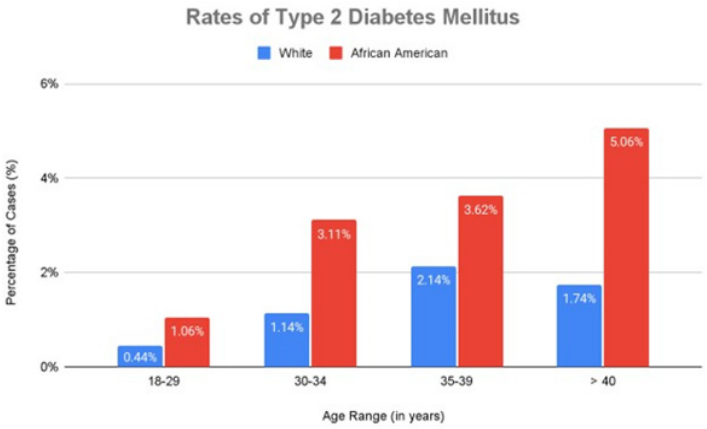

Figure 4: Bar graph illustrating the rates of Type 2 Diabetes Mellitus comparing White mothers (Blue) and African American mothers (Red).

In White mothers, the odds of developing T2DM increase with maternal age. Compared to women aged 18–29, those aged 30–34 have 2.57 (95% CI 1.41–4.69) times higher odds, women aged 35–39 have 4.8 (95% CI 2.56–9.09) times higher odds, and those over 40 have 3.9 (95% CI 1.16–13.32) times higher odds (Table 1).

In the AA cohort, 185 mothers were diagnosed with T2DM before or during pregnancy out of 9,462 deliveries (1.96%). Prevalence by age was 1.06% (62/5,846) in mothers aged 18–29, 3.11% (71/2,282) in those 30–34, 3.62% (39/1,077) in those 35–39, and 5.06% (13/257) in mothers over 40 (Figure 4).

In AA mothers, the odds of developing T2DM increase with age. Compared to women aged 18–29, those aged 30–34 have 2.93 (95% CI 2.08–4.14) times higher odds, women aged 35–39 have 3.41 (95% CI 2.28–5.12) times higher odds, and those over 40 have 4.77 (95% CI 2.59–8.78) times higher odd (Table 1).

A Chi-square test of independence showed a statistically significant increase in T2DM rates among AA mothers aged 18-34 (p-values < 0.001). However, no significant differences were found in mothers aged 35 and older. Overall, AA mothers had a significantly higher rate of T2DM compared to White mothers ($\chi^2(1, N = 17,141) = 37.26$, $p < 0.0001$) (Table 2).

Chronic/Essential Hypertension

The last chronic disease being assessed in this research is CHTN. There was a total of 2,716 mothers who had a diagnosis of CHTN in the total pregnant population (11.95%). Among White mothers, 774 were diagnosed with CHTN before or during pregnancy out of 7,679 deliveries (10.08%). Prevalence by age was 8.42% in mothers aged 18–29, 11.1% in those 30–34, 14.73% in those 35–39, and 21.51% in mothers over 40 (Figure 5).

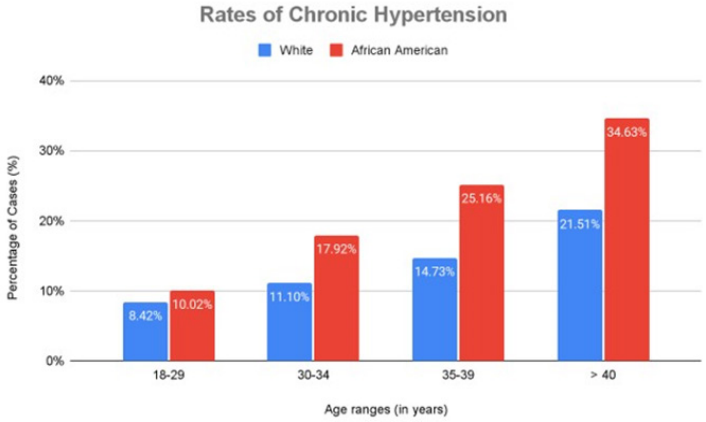

Figure 5: Bar graph illustrating the rates of Chronic Hypertension comparing White mothers (Blue) and African American mothers (Red).

In White mothers, the odds of developing CHTN increase with maternal age. Compared to women aged 18–29, those aged 30–34 have 1.32 (95% CI 1.11–1.57) times higher odds, women aged 35–39 have 1.75 (95% CI 1.41–2.17) times higher odds, and those over 40 have 2.55 (95% CI 1.76–3.7) times higher odds (Table 1).

In the AA cohort, 1,355 mothers were diagnosed with CHTN before or during pregnancy (14.32%). Prevalence by age was 10% in mothers aged 18–29, 17.92% in those 30–34, 25.2% in those 35–39, and 34.63% in mothers over 40 (Figure 5).

In AA mothers, the odds of developing CHTN increase with maternal age. Compared to women aged 18–29, those aged 30–34 have 1.79 (95% CI 1.56–2.05) times higher odds, women aged 35–39 have 2.51 (95% CI 2.14–2.94) times higher odds, and those over 40 have 3.45 (95% CI 2.68–4.46) times higher odds (Table 1).

A Chi-square test of independence revealed a statistically significant increase in CHTN rates among AA mothers across all age groups compared to White mothers. The disparity was most pronounced in the 30-39 age range ($p < 0.00001$). Overall, AA mothers exhibited significantly higher CHTN rates across all age

groups ($\chi^2(1, N = 17,141) = 70.09$, $p < 0.0001$), underscoring persistent racial disparities in maternal health (Table 2).

Conclusion

This study examined the relationship between maternal age and the development of pregnancy-related conditions, including GDM, GHTN, PreE, T2DM, and CHTN, while also assessing racial disparities between AA and White mothers. Advancing maternal age was significantly associated with increased odds of GDM, T2DM, and CHTN in both racial groups, whereas its impact on GHTN and PreE varied by race. These findings underscore the complex role of maternal age in pregnancy-related health risks, highlighting both biological and social determinants that contribute to disparities in maternal outcomes.

Chi-square analysis revealed no significant racial differences in GDM or GHTN within individual age groups. However, AA mothers had significantly higher rates of PreE across all age groups except those over 40, where White mothers exhibited a higher but non-significant rate. This suggests that while advanced age is a known risk factor for PreE, racial differences in the timing and severity of the condition may be influenced by preexisting health conditions, systemic disparities in healthcare access, or genetic predispositions. Similarly, T2DM rates were significantly higher in AA mothers under 35, though no differences were observed among older groups. The most pronounced disparity was seen in CHTN, where AA mothers experienced significantly higher rates across all ages, further supporting previous research that has linked racial differences in chronic hypertension to social determinants of health, stress, and underlying cardiovascular risk factors.

These findings align with existing literature on maternal age as a risk factor for GDM, T2DM, and CHTN [18-21]. However, the lack of association between age and GHTN contrasts with some studies, suggesting additional factors such as genetic predisposition, prenatal care disparities, or environmental influences may play a role in hypertensive disorders [22,23]. Regarding PreE, the observation that White women over 40 and AA women in their 30s exhibiting higher odds of developing PreE is consistent with the literature [24]. The racial disparities in PreE and CHTN emphasize the need for targeted interventions to address maternal health inequities. Improving access to early screening, preventive care, and comprehensive prenatal management for high-risk populations could help mitigate these disparities and improve outcomes for both mothers and infants.

A key strength of this study is its diverse population, particularly its large proportion of AA participants, an often underrepresented group in maternal health research. Conducted in a Southeastern U.S. urban setting, the study provides valuable real-world clinical insights into an understudied population. However, its retrospective design presents limitations, including potential data inaccuracies, missing information, and an inability to establish causality. Additionally, the study's regional specificity may limit the generalizability of findings to broader populations, particularly those in rural areas or with different healthcare access patterns.

Our study's demographic composition, including a significant proportion of AA mothers, highlights the need for more research on underrepresented populations. Conducted at a community hospital, it provides real-world clinical insights. The findings emphasize the critical importance of early detection and management of pregnancy-related complications, particularly as AMA becomes more common and racial disparities persist. Targeted interventions addressing both physiological and socio-economic factors are essential, and further research is needed to explore the complex interplay of race, age, and social determinants to ensure equitable maternal healthcare. Future research should explore the complex interactions between race, age, and socio-economic determinants in maternal health to ensure equitable care and improved outcomes for all pregnant individuals.

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