Racial and Ethnic Disparities in Pregnancy-related Complications: Findings at Mansa General Hospital and 2nd Affiliated Hospital of Nanjing Medical University

Kasonde Chanda¹, Liang Sheng Lian², Kong Yi Yan², Huang Qian², Gulidiya Abulikem¹, Royd Nkalamo Nonde¹ and Ying Xiao Yan²*

¹Department of Obstetrics and Gynecology, Mansa General Hospital, Mansa District, Luapula Province, Zambia
²Department of Obstetrics and Gynecology, 2nd Affiliated Hospital of Nanjing Medical University, Nanjing City, Jiangsu Province, PR China

Abstract

Background: 800 women die and 2.6 million stillbirths occur worldwide related to pregnancy complications. Racial/ethnic disparities in pregnancy-related mortality have continued to be significantly higher among black than whites due to various factors. We sought to investigate complications among pregnant women of different race/ethnicity.

Methods: Cross-sectional observational study of 2030 obstetric cases randomly selected for the period January 1 to December 31, 2021. Data was collected from the hard copy and electronic inpatients’ records. Analysis was performed using SPSS version 23. Descriptive statistics analyzed the pregnancy complication frequencies, standard deviations, range, minimum and maximum values. Maternal characteristics were analyzed using an independent samples t-test. Maternal characteristics were evaluated using the two samples t-test. The odds ratios and confidence intervals were calculated as measures of association between ethnicity/race and pregnancy complications using a binary logistic regression model. Confidence interval was set at 95% and p < 0.05 (2-tailed) was considered statistically significant.

Results: 76.25% of Chinese and 67.86% of Zambians were affected by one or more complications. The mean ± standard deviation for MGH [age (26.69 ± 7.33), gravidity (3.35 ± 2.08), and parity (2.07 ± 1.68)] and for 2nd affiliated hospital was [age (30.04 ± 4.29), gravidity (2.19 ± 1.38) and parity (0.45 ± 0.55)]. Prevalence of top five pregnancy complications in the Chinese group was gestational diabetes mellitus at 18.41%, hypothyroidism at 15.91%, oligohydramnios at 14.39%, premature rupture of membranes at 12.17%, and anemia at 5.73%. The prevalence of the top five pregnancy complications in the Zambian group was preeclampsia at 13.80%, PIH at 12.74%, PROM at 12.45%, eclampsia at 7.53%, and placenta abruption at 7.43%. Statistical significance findings were noted as follows: Oligohydramnios [OR 0.02, CI (0.01 - 0.05), p = 0.000], placenta praevia [OR 0.08, CI (0.01 - 0.61), p = 0.015], preeclampsia [OR 13.10, CI (7.22 - 23.78), p = 0.000], placenta abruptio [OR 79.73, CI (11.07 - 574.38), p = 0.000], PIH [OR 11.95, CI (6.57 - 21.73), p = 0.005], eclampsia [OR 162.90, CI (10.08 - 2631, p = 0.000), PPROM [OR 0.03, CI (0.00 - 0.45), p = 0.012], GDM [OR 0.11, CI (0.07 - 0.17), p = 0.000], hypothyroidism [OR 0.01(0.00-0.03), p = 0.000], anemia [OR 0.18, CI (0.92-0.34), p = 0.000], ICP [OR 0.03, CI (0.00 - 0.48), p = 0.013], syphilis [OR 7.17, CI (2.14 - 24.02), p = 0.001], UTI [OR 0.06, CI (0.00 - 1.11), p = 0.059].

Conclusion: Highest odds for obstetrical and infection-related pregnancy complications were associated with Zambian cases. The highest odds for medical complications were associated with Chinese cases.
Introduction

Various complications occur in pregnancy ranging from mild to life-threatening diseases. These complications can range from mild to severe, sometimes life-threatening illnesses. The complications can be caused by or can be made worse by being pregnant. Some of the common complications include cardiovascular diseases, infections, hypertensive disorders, preterm labor, gestational diabetes, hyperemesis gravidarum, anemia, thromboembolism, depression and anxiety disorders [1,2].

Standard maternal health care is important for maternal and newborn health, so as the health status of that nation [3]. Several countries consider maternal and child health as an important indicator to measure the development of that country [4]. In 2000, 189 countries signed a Millennium Declaration committing them to achieve eight-millennium development goals. Millennium Development Goal number 5 was to reduce maternal mortality ratio by 75% between 1990 and 2015 [5].

Research on common medical and surgical complications has been done for women in mainland China of which PROM and anemia had the highest incidence among the obstetric and medical complications respectively [6-8]. Research done at UTH revealed that the commonest causes of maternal deaths were preeclampsia and eclampsia, septicemia, hemorrhage, and ruptured uterus [9].

In the past 10 years, there has been more reduction in child mortality than in neonatal mortality [8]. In children below 5 years, newborn mortality accounts for over 40%. About 2.6 million stillbirths happen worldwide per year, of which over 40% are pregnancy related [8,10].


Our study aims to evaluate the prevalence of pregnancy complications among racially and ethnically different women admitted at the two referral hospitals. This study may highlight the need for prevention of pregnancy complications; provide a reliable basis for health administrative departments to devise policies to control obstetrical and neonatal diseases and allow better allocation of medical resources.

Methodology

Subjects

This was a two-center, cross-sectional observational study of 2030 obstetrical cases. 994 and 1036 obstetrical cases were randomly selected from the 2nd affiliated hospital of Nanjing medical university and Mansa general hospital respectively during the period January 1, 2021, to December 31, 2021. The selection was done by probability sampling methods which included simple random sampling and systematic sampling methods. Our study included all patients admitted to the hospital's obstetrics ward. Only pregnant patients with newly diagnosed complications were recruited in the study regardless of their age, gestational age, or site of pregnancy. Information about the cases was electronically and manually recorded, including general conditions, medical history, pregnancy history, and complications.

Data extraction

Data was collected from the hard copy files and electronic inpatients’ medical records. These records had all the information required for the study including patient history, physical examination, investigations, and relevant management. For analysis purposes, pregnancy complications were categorized into infection related, obstetric, and medical.

Diagnosis of the complications

This was performed in accordance with the standards in the 24th Edition of the Williams Obstetrics textbook.

Statistical analysis

Statistical analysis was performed using SPSS software version 23. Continuous variables were summarized using descriptive statistics, including the number of subjects, mean, standard deviation, median, and confidence intervals with minimum and maximum values. Demographic characteristics were expressed as numbers and frequency distributions for categorical variables. Maternal characteristics were evaluated using the two samples t-test. The odds ratios and confidence intervals were calculated as measures of association between ethnicity/race using a binary logistic regression model. Confidence interval was set at 95% and p < 0.05 (2-tailed) was considered statistically significant.

Ethics statement: The study was approved by the Hospital research committee of the second affiliated hospital of Nanjing Medical University and Mansa general hospital.

Results

758/994 (76.25%) Chinese and 703/1036 (67.86%) Zambian sampled patients were affected by one or more pregnancy complications.

Subjects characteristics

The summary of patient characteristics is shown in Table 1.

Maternal age: Age records for all the admitted pregnant women were documented. The mean age was 30.04 and 26.69 years in Chinese and Zambians respectively. Our research reviewed that the peak delivery ages for Zambian cases were younger (18 - 25 years old, 467/1036 cases 45.08%) as compared to Chinese cases (26 - 30 years old, 42.35%).

https://doi.org/10.29328/journal.cjog.1001131
Pregnancy complications

Women (<18 years, 3/994 cases 0.30% and >35 years, 6.08% and > 35 years, 159/1036 cases 15.35%) as compared to Chinese women. In Chinese women than in Zambian women. No significant increase in hepatitis B virus (p = 0.039) and group B streptococcal infection (p = 0.059) was seen. There was no statistical significance in vagina candidiasis and chorioamnionitis between the groups (Table 2).

Discussion

The determinants of population health status and the primary explanations of disparities among population groups lie in the social, physical, and economic environments, which in turn are determined by the larger society’s norms, values, social stratification systems, and political economy (King, 1996; Menefee, 1996). Black/white disparities in health status have consistently been attributed to such variables as racial and ethnic differences in income, education, housing, and community resources, which lie at the root of disparities in health and life expectancy. Table 1: Maternal characteristics.

Table 1: Maternal characteristics.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total n (%)</th>
<th>Mean ± SD</th>
<th>t</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total patients</td>
<td>1036(100%)</td>
<td>1036(100%)</td>
<td>30.04 ± 4.29</td>
<td>26.69 ± 7.33</td>
<td>-12.60</td>
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<tr>
<td>Age (years)</td>
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<tr>
<td>&lt;18</td>
<td>994 (100%)</td>
<td>1036(100%)</td>
<td>30.04 ± 4.29</td>
<td>26.69 ± 7.33</td>
<td>-12.60</td>
</tr>
<tr>
<td>18 - 25</td>
<td>3 (0.30)</td>
<td>63 (6.08)</td>
<td>146 (45.08)</td>
<td>177 (17.08)</td>
<td>170 (16.41)</td>
</tr>
<tr>
<td>26 - 30</td>
<td>323 (32.48)</td>
<td>467 (45.08)</td>
<td>177 (17.08)</td>
<td>170 (16.41)</td>
<td>159 (15.35)</td>
</tr>
<tr>
<td>31 - 35</td>
<td>114 (11.47)</td>
<td>170 (16.41)</td>
<td>159 (15.35)</td>
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<tr>
<td>&gt;35</td>
<td>159 (15.35)</td>
<td>159 (15.35)</td>
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<td></td>
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<tr>
<td>GRAVIDITY</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Gravida &gt;3</td>
<td>255 (24.61)</td>
<td>210 (20.27)</td>
<td>416 (40.15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravida 3</td>
<td>225 (21.96)</td>
<td>155 (14.96)</td>
<td>416 (40.15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravida 2</td>
<td>283 (27.42)</td>
<td>155 (14.96)</td>
<td>416 (40.15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravida 1</td>
<td>396 (38.64)</td>
<td>255 (24.61)</td>
<td>255 (24.61)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PARITY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Para 1</td>
<td>396 (38.64)</td>
<td>255 (24.61)</td>
<td>255 (24.61)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Para 0</td>
<td>578 (55.15)</td>
<td>390 (38.2)</td>
<td>255 (24.61)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parity &gt;1</td>
<td>26 (2.62)</td>
<td>155 (14.96)</td>
<td>627 (60.42)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 - 35</td>
<td>323 (32.48)</td>
<td>467 (45.08)</td>
<td>177 (17.08)</td>
<td>170 (16.41)</td>
<td>159 (15.35)</td>
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<tr>
<td>26 - 30</td>
<td>114 (11.47)</td>
<td>170 (16.41)</td>
<td>159 (15.35)</td>
<td></td>
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</tr>
<tr>
<td>18 - 25</td>
<td>994 (100%)</td>
<td>1036(100%)</td>
<td>30.04 ± 4.29</td>
<td>26.69 ± 7.33</td>
<td>-12.60</td>
</tr>
<tr>
<td>&gt;35</td>
<td>159 (15.35)</td>
<td>159 (15.35)</td>
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</tbody>
</table>

The youngest and oldest admitted cases were found to be higher among the Zambian women (<18 years, 63/1036 cases 6.08% and > 35 years, 159/1036 cases 15.35%) as compared to Chinese women (<18 years, 3/994 cases 0.30% and >35 years, 114/994 cases 11.47%). Overall, there was a significant difference in mean age between the Zambians and the Chinese women (p = 0.000).

Gravida: The mean gravidity was 2.19 and 3.35 in Chinese and Zambian women respectively. Patients with gravidity of ≥3 were higher in Zambian cases than in Chinese cases. There was a significant difference in mean gravidity between the Zambians and the Chinese women (p = 0.000).

Parity: The mean parity was 0.45 and 2.07 among Chinese and Zambian cases respectively. 627 cases (60.42%) have had a parity of >1 in Zambian cases compared to Chinese women (26/994 cases 2.62%). Maximum parity was 8 (in Zambian cases) and 3 (in Chinese cases). There was a significant difference in mean parity between the Zambians and the Chinese women (p = 0.000).

Pregnancy complications

Pregnancy complications were grouped into obstetrical, medical, and infection-related [Table 2].

Obstetrical complications: Statistical significance findings were seen (p = 0.000) among the two ethnic groups with oligohydramnios (p = 0.000), placenta praevia (p = 0.015), Preeclampsia (p = 0.000), Placenta abruption (p = 0.000), Pregnancy induced hypertension (p = 0.005), Eclampsia (p = 0.000) and PPROM (p = 0.012) (Table 2). The odds of developing oligohydramnios, placenta praevia, and preterm premature rupture of membranes were higher in Chinese women than in Zambian women. No significant findings were seen in premature rupture of membranes, preterm labor, polyhydramnios, and abortions between the Zambians and the Chinese women. In Chinese women, there was an increased proportion of oligohydramnios (143/994 cases, 14.39%), preterm labor (56/994 cases, 5.63%), placenta praevia (12/994 cases, 1.21%) and abortions (6/994 cases 0.60%) than in Zambians. Preeclampsia (143/1036 cases 13.80%), placenta abruption (77/1036 cases 7.43%), pregnancy-induced hypertension (132/1036 cases, 12.74%), premature rupture of membranes (121/1036 cases 12.45%) and eclampsia (78/1036 cases, 7.53%) were higher in Zambian than in Chinese cases. The highest proportion was oligohydramnios (143/994 cases, 14.39%) among the Chinese patients, while for Zambian patients it was preeclampsia (143/1036 cases, 13.80%) (Figure 1).

Medical: In this study, a high proportion of cases were found in the Chinese than in Zambians. Gestational diabetes mellitus (183/994 cases, 18.41%) had the highest proportion in this category and our overall study (Figure 2). Gestational diabetes mellitus, hypothyroidism, anemia and ICP had increased significantly (p = 0.000). The odds of having Gestational diabetes mellitus, hypothyroidism, anemia, and ICP was higher in Chinese women than in Zambian women (p = 0.000).

Infection-related complications: High proportions of urinary tract infections were noted among Zambians (23/1036 cases, 2.22%) than Chinese (1/994 cases, 0.10%) patients (Figure 3). Syphilis was higher in Zambians (22/1036 cases, 2.12%) than in Chinese (3/994 cases 0.30%). A significant increase in syphilis (p = 0.001) and urinary tract infection (p = 0.002) among the Zambian cases was seen. A significant increase in hepatitis B virus (p = 0.039) and group B streptococcal infection (p = 0.059) was seen. There was no statistical significance in vagina candidiasis and chorioamnionitis between the groups (Table 2).
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There is evidence for all of these variables. Another explanation is the lack of black people's access to health care, particularly the lack of either public or private health insurance (Blendon, et al. 1989; Weinick, Zuvekas, and Cohen, 2000).

The common possible reasons for racial and ethnic disparities are Cultural and language barriers; Time limitations imposed by the pressures of clinical practice; Distrust by

### Table 2: Frequencies and proportions of maternal complications by hospital.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Mansa general hospital</th>
<th>2nd affiliated hospital of NMU</th>
<th>OR (CI)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total patient's N (100%)</td>
<td>1036(100%)</td>
<td>994(100%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obstetrical complications:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oligohydramnios</td>
<td>3(0.29)</td>
<td>143(14.39)</td>
<td>0.96(0.73 - 1.25)</td>
<td>0.732</td>
</tr>
<tr>
<td>Premature rupture of membranes</td>
<td>12(1.16)</td>
<td>6(0.60)</td>
<td>0.16(0.02 - 1.32)</td>
<td>0.089</td>
</tr>
<tr>
<td>Premature labor</td>
<td>2(0.20)</td>
<td>1(0.10)</td>
<td>79.73(11.07 - 574.38)</td>
<td>0.000</td>
</tr>
<tr>
<td>Placenta praevia</td>
<td>22(2.12)</td>
<td>0(0.00)</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Abortion</td>
<td>0(0.00)</td>
<td>17(1.71)</td>
<td>0.03(0.00 - 0.45)</td>
<td>0.012</td>
</tr>
<tr>
<td>Medical complications:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational diabetes mellitus</td>
<td>143(14.39)</td>
<td>183(18.41)</td>
<td>0.11(0.07 - 0.17)</td>
<td>0.000</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>11(1.06)</td>
<td>57(5.73)</td>
<td>0.10(0.16 - 6.01)</td>
<td>0.031</td>
</tr>
<tr>
<td>Anemia</td>
<td>1(0.10)</td>
<td>2(0.20)</td>
<td>0.48(0.04 - 5.29)</td>
<td>0.540</td>
</tr>
<tr>
<td>ICP</td>
<td>3(0.30)</td>
<td>0(0.00)</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Infection-related complications:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaginal candidiasis</td>
<td>2(0.20)</td>
<td>1(0.10)</td>
<td>22.55(3.04 - 17.26)</td>
<td>0.002</td>
</tr>
<tr>
<td>Syphilis</td>
<td>23(2.22)</td>
<td>9(0.91)</td>
<td>0.05(0.00 - 0.86)</td>
<td>0.039</td>
</tr>
<tr>
<td>Viral hepatitis B</td>
<td>0(0.00)</td>
<td>7(0.70)</td>
<td>0.30(0.01 - 7.48)</td>
<td>0.465</td>
</tr>
<tr>
<td>UTI:Urinary Tract Infection</td>
<td>0(0.00)</td>
<td>1(0.10)</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>PPROM: Preterm Premature Rupture of</td>
<td></td>
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</tr>
<tr>
<td>Membranes</td>
<td>18(1.75)</td>
<td>3(0.30)</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

OR = 0 no outcome event for the ethnicity
OR = 1 exposure does not affect the odds of the outcome
OR > 1 exposure associated with higher odds of the outcome
OR < 1 exposure associated with lower odds of the outcome
The covariates included in the logistic regression model were ethnicity.
many minority patients; A woeful lack of minority physicians who may be more culturally sensitized to the needs of their patients; Conscious or subconscious biases, prejudices, and negative racial stereotypes or perceptions that affect the way providers deliver care.

To address, advance action, and promote change the following can be done: Raise the visibility of racial and ethnic health disparities as a national problem; Promote the development of programs and strategies to reduce disparities; Foster leadership to effect change; and Track promising activities and developments in minority health care that could lead to dramatically reducing or eliminating disparities.

To the best of our knowledge, this is the first study comparing the common pregnancy complications between racially and ethnically different Chinese and Zambian gravid women.

**Subject characteristics**

**Maternal age:** Women aged 26 years – 30 years (426/994 cases, 42.86%) formed the majority of admissions for Chinese patients. The findings are consistent with the childbearing age of China which is 27.4 years [12]. Some of the reasons for increased pregnancies among this age group are financial stability, improved mental strength, and family pressure to get married and have children, and by then, many could have attended tertiary education. The proportion of younger teenage (< 18 years) pregnancies was 0.30% (3/994 cases) as compared to the Chinese adolescent rate of 3.4% in 2019 [13]. An increase in the number of teenage pregnancies has been noted among Chinese women. This may be due to early marriage, poverty, or inadequate use of contraceptives. Children people live in a conservative society where sexual health discussions are minimal leading to inadequate sexual education which eventually can lead to low levels of sexual knowledge, unprotected sexual intercourse, and unwanted pregnancies. Women who were >35 years accounted for 11.47% of the admissions similar to the findings of the multicenter Chinese study done in 2011 (10.05%) [14]. Many maternal, fetal, and neonatal bad outcomes have been associated with advanced maternal age [15]. For Zambians admitted at Mansa general hospital, the majority of cases were 18 years – 25 years (467/1036 cases, 45.08%). This hospital is located in the rural province of Zambia called Luapula. Initial sexual intercourse which 50% were repeated [23,24].

**Gravidity:** Gravida ≤2 patients were high in Chinese than in Zambian cases. The one-child policy which was introduced by the Chinese government is still being practiced by many Chinese families; hence the low number of pregnancies. Other reasons include long working hours with less family time and the notion of having many children leading to more expenses. For Zambian women, cases with gravidity ≥ 3 were higher than for the Chinese. In Zambia, especially in rural areas, some cultures allow men to marry more than one wife, there is no limitation on the number of children a couple may have. Rooted traditions are still active and well-anchored, with poor access to contraception [18].

**Parity:** Parity ≤1 was predominant among Chinese patients while those with parity >1 were high in Zambian patients. The steady rise in parity among women in China has been noted. According to the 2020 Chinese census, the number of babies born was less than those in 2019. This led the government to permit couples to have three children [19]. High parity is a major health concern among developing countries, especially in rural areas where MGH is located. High parity is a risk factor for several maternal complications and neonatal outcomes [20]. Some factors may influence the parity and health status of women. These include poverty, level of education, early marriages, unemployment, and cultural factors [21].

**Previous abortions:** The number of abortions was significantly higher among Chinese (0.60%) than in Zambian (0.10%) cases (Table 2). Abortions occur at a rate of 37 abortions per 1000 women in poor countries for women aged 15 years - 44 years [22]. In Zambia, it is legal to abort to protect the health status of a pregnant woman or any of her children [9]. Abortions are only provided in registered hospitals, approved by three medical doctors of whom one must be a specialist obstetrician [9]. This process hinders women to opt for abortion on most occasions. Induced abortion as a mode of family planning in China is widely used. Official data in 2019 reviewed about 9.76 million abortions of which 50% were repeated [23,24].

**Pregnancy complications**

758/994 (76.26%) sampled Chinese and 703/1036 (67.86%) Zambian patients were affected by one or more pregnancy complications.

a) **Medical complications**

**Gestational diabetes mellitus:** Prevalence worldwide is 1-45% of pregnancies [25,26]. According to a study done in 2019, the total incidence of GDM in mainland China was 14.8% (95% CI 12.8% - 16.7%) [27]. The incidence in our study was 18.41% (183/994 cases) and there was a significant association of GDM with the Chinese than Zambian cases. Various ethnicities and genetic makeup have different rates of gestational diabetes mellitus [28-31]. Many differences in the diagnosis of GDM result in variations in incidences [32-34].
Data sources used in the calculation of prevalence may have an impact on the reporting of GDM [35,36]. Inadequate case findings and lack of equipment to use for the diagnosis of GDM among Zambian cases can be one of the factors affecting the results in this group.

**Hypothyroidism:** Prevalence in Asia than Western countries. If left untreated, it can increase the risk of various pregnancy ailments [37]. Prevalence in pregnancy is about 2.5% according to the Western literature [38]. In our study, the prevalence was 15.91% in Chinese patients, higher than the global prevalence; the prevalence in Zambian patients was 0.10%. The odds were higher in Chinese than in Zambian cases. The reason for this variance may be due to the prioritized screening of hypothyroidism to all pregnant women admitted to our hospital and also the ethnicity of the women under study. No collective agreement has been made universally to screen and treat this complication in pregnancy.

According to the American College of Obstetricians and Gynecologists, examination of thyroid function is only done in women with symptoms of thyroid disease, women with a history of thyroid disease, and other associated diseases [37,39]. The size of the thyroid gland increase in pregnancy by 10% in countries with sufficient iodine than in iodine deficiency countries [40]. Physiologically, the thyroid hormone production and iodine requirement all increase by about 50% during pregnancy [41]. Stressful events for the thyroid gland lead to hypothyroidism in women with inadequate thyroid reserve or iodine.

**Anemia:** The global prevalence of anemia for women of reproductive age was 29.4%, 38.2% in pregnant women, and 29.0% in non-pregnant women [42]. In China, the prevalence of anemia in pregnancy was 19.8% [43]; the World Bank puts the prevalence of anemia in pregnancy in Zambia at 39.1% [44]. In our study, the prevalence of anemia among Chinese was 5.73% (57/994 cases) and 1.06% (11/1036 cases) in Zambian cases. Our prevalence was lower than the global prevalence. The odds of developing anemia were higher in Chinese than in Zambian cases. Reasons for the differences could be due to the socio-demographic characteristics of pregnant women [45], variations across geographic regions in China and other countries which might be due to differences in the kind of food eaten and cultural beliefs about the food to eat during pregnancy [46].

**Intrahepatic cholestasis of pregnancy:** Disorder with features of itching, raised serum liver enzymes and bile acid levels, onset in the second or third trimester, and spontaneous relief of signs and symptoms within two to three weeks after delivery [47,48]. Globally it ranges from < 1 to 27.6% [49,50]. It is common in South Asia, South America, and Scandinavia people. The cause of ICP during pregnancy is due to many factors. It may be associated with raised estrogen levels and compromised hepatobiliary transport proteins during pregnancy [51,52]. Studies have shown its association with spontaneous and iatrogenic preterm delivery [53-55]. Chinese prevalence in our research was 1.61% (16/994 cases) within the global range. The odds of developing anemia were higher in Chinese than in Zambian cases.

**b) Obstetric complications**

**Oligohydramnios:** A condition is commonly seen after the first trimester with an Amniotic Fluid Index (AFI) less than 5 cm [24]. In a study done in 2011 involving 39 Chinese hospitals, the incidence of oligohydramnios was found to be 4.4% [25]. In our current study, oligohydramnios incidence was 14.39% (143/994 cases) in Chinese patients, higher than the global incidence which is 1% - 5% of pregnancies at term [26]. Zambian patients had an incidence of 0.29%. This difference may be related to the different diagnostic accuracy modalities in various regions of mainland China and the world. Another reason may be the increased surveillance with the use of ultrasound to diagnose this condition among Chinese patients. The odds of developing oligohydramnios were higher in Chinese than in Zambian cases.

**Premature rupture of membranes (PROM):** Globally, the prevalence of PROM IS 5% - 10% [59]. It is associated with poor perinatal and neonatal outcomes [60]. Based on the current study, PROM accounted for 12.45% (121/1036 cases) in Zambian and 12.17% (103/994 cases) in Chinese cases. These rates are similar to the global trend. PROM significantly increases the chances of developing intrauterine infection (chorioamnionitis) [61]. Early identification and management of bacterial vaginosis and E. coli infection in pregnancy may reduce the risk of PROM [62]. Overall, no statistical significance was found in our study between the groups (p = 0.732).

**Preterm labor:** Preterm births range from 5% in developed countries to 25% in poor countries [63]. In our study, the incidence was found to be 5.63% (56/994 cases) among Chinese higher than 5.02% (52/1036 cases) in Zambian patients. These rates are similar to the range of developed countries which has been stable at 5% - 10% for many years. Our findings differ from other research findings which have shown black women have increased rates of preterm births [63]. Ethnic differences can only explain a very small proportion of global preterm births. Some factors associated with preterm labor include infections, hypertension, preeclampsia, IUGR, and heavy physical work [63]. There was no statistical significance found in our study between the groups (p = 0.538).

**Preeclampsia:** 2% - 8% of pregnancies worldwide are affected by this condition [64]. 9% of maternal deaths in developing countries in Africa and Asia are associated with preeclampsia [65]. In Zambia, Lusaka, prevalence is at 18.9% [66] higher than our findings of 13.80% among the Zambian cases in the Mansa district. Research in 2021 showed that
the prevalence of preeclampsia was 2.2% in Chinese women [67], similar to our research findings of 1.21% in Chinese patients. In our study, the odds were high in Zambian than in Chinese cases. Several biophysical and demographic factors are associated with preeclampsia. Some of the risk factors include chronic hypertension, chronic kidney disease, insulin-dependent diabetes, and previous preeclampsia. Other factors comprise in vitro fertilization, family history of preeclampsia, advanced maternal age, obesity, multiple pregnancy, and nulliparity [68-70]. Research has revealed that black women have an increased risk of developing preeclampsia [70]. Poor maternal socioeconomic status increases the risk of preeclampsia [71]. A study in Lusaka, Zambia, has reviewed that low level of education, previous history of preeclampsia in the previous pregnancy, being single, divorced or widowed, and having parity of three more were attributed to preeclampsia. Daily vegetable intake, fruit intake, and nutritional counseling during antenatal care have been shown to be protective modalities against preeclampsia [72].

**PIH:** About 6% - 10% of pregnancies are affected [73]. It is defined as raised Systolic Blood Pressure (SBP) >140 mmHg and diastolic blood pressure (DBP) >90 mmHg. It is classified into mild, moderate, and severe [74]. Women with hypertension, collagen vascular disease, obesity, black race, insulin resistance, diabetes mellitus, gestational diabetes, increased serum testosterone concentrations, and thrombophilia are at risk of developing PIH [74,75]. Our research showed a higher proportion among black Zambians (12.74%) above global rates than in Chinese (1.21%). Odds were higher among Zambians than in Chinese cases. Studies have shown that black women have a high risk of hypertensive disorders in pregnancy while Asian women have a low risk [76]. It has been hypothesized that the causes of hypertensive disease in pregnancy HDP could be due to problems of placental implantation and the level of trophoblastic invasion [77]. Several studies worldwide have been done showing variations among people with different geographical and ethnicities [78].

**Eclampsia:** Globally, the rate range from 1 case per 100 pregnancies to 1 case per 1700 pregnancies [79]. It has a high burden on maternal and neonatal mortality and morbidity. The prevalence of eclampsia among the Chinese was higher than among Zambians for our study. According to a survey done in China on the six subtypes of hypertensive disease in pregnancy, eclampsia was at a rate of 0.89% [80] similar to our research findings. Eclampsia is one of the worst outcomes of hypertensive diseases in pregnancy because of its unpredictable evolution as well as its potentially severe complications. Many pregnant women die from preeclampsia due to eclampsia [81]. Numerous improvements in the management of the disease have been made but, we still have high rates of maternal and perinatal mortality [82-84]. The frequency of eclampsia varies with the level of development across different countries. This frequency is linked to the quality of antenatal care. Well-organized health systems are able to significantly reduce this complication of preeclampsia, given that precursor signs tend to occur much earlier in pregnancy. Odds were higher among Zambians than in Chinese cases.

**Placenta abruption:** Complete or partial separation of a normally implanted placenta before delivery. The cause is multifactorial and its etiopathogenetic mechanism is not yet entirely understood [85]. Incidence in developing countries ranges from 4% - 6% with increased risk of maternal and fetal morbidity and mortality [86,87]. Many risk factors have been attributed to placenta abruption. Some examples are previous history of placenta abruption, advanced maternal age, previous cesarean section, grand multiparity, twin pregnancies, diabetes mellitus, cigarette smoking, chronic hypertension, preeclampsia, premature rupture of membranes, abdominal trauma, and polyhydramnios [88-90].

In our study, the prevalence among Zambians (7.43%) was higher than in the Chinese patients (0.10%). The 0.10% is similar to the study done in Hebei province of China (0.31%) [91], and lower than the global range. The rate in the Zambian patients (7.42%) was higher than the global range. Similar to our research, some studies have shown that black race is a risk factor for placenta abruption. Studies have shown that black births were complicated by placental abruption, compared to White births [92]. In our study, the odds were higher among Zambians than in Chinese cases.

c) **Infection related**

82.5% of UTIs are caused by Escherichia coli [93]. Other bacteria which may be seen are Klebsiella pneumoniae, Staphylococcus, Streptococcus, Proteus, and Enterococcus species. A high proportion (2.22%) of urinary tract infections was seen among Zambians than among Chinese (0.10%). Findings for MGH were lower than the research findings done in Zambia involving 203 cases with a UTI prevalence of 60% (95% CI: 53.3% - 66.7%) [94]. Factors influencing the development of UTIs are immunological changes during pregnancy, changes in the urinary tract by ureter and renal calyces dilatation, reduced bladder capacity, and vesicoureteral reflux all due to progesterone-related smooth muscle relaxation. Other factors are low socioeconomic status, anemia, and sexual activity [95].

Our study showed limitations. A significant proportion of disease data were missing or not recorded due to differences in the criterion by which diagnoses were arrived at between the Mansa general hospital and the second affiliated hospital of Nanjing medical university.

**Conclusion**

For obstetric complications, hypertensive disorders of pregnancy and placenta abruption were significantly high in Zambian women. While oligohydramnios, placenta praevia,
and PROM were significantly high in Chinese patients. Medical conditions which include GDM, hypothyroidism, anemia, and intrahepatic cholaeostasis of pregnancy were significantly high in Chinese patients. Infections namely syphilis and UTIs were high among Zambian women why viral hepatitis was common among the Chinese. Surveillance, early identification and management of these pregnancy complications are very paramount in ensuring the safety of the mother and the fetus. This could yield benefits for improving maternal outcomes, but could also reduce perinatal mortality rates. A comprehensive antenatal care approach is critical in identifying these risk pregnancies. Furthermore, future reassert maybe be required to study the genetic differences between black women and white women.

**Ethics approval and consent to participate**

The study and raw patient data access were approved by the hospital research committees. Informed consent for patients was waived because of the retrospective nature of the study. The data used in the study was anonymized before its use.

**Availability of data and materials**

Data presented in this study can be provided upon request from the corresponding author. Due to public restrictions, data is not publicly available.

**Competing interests:** There are no conflicts of interest regarding the publication of this paper.

**Author contribution**

Concept, design, and data analysis with interpretation were done by KC and YXY. The original draft of the manuscript was done by KC. WY, LSL, KYY, HMY, GYS, and HQ were involved in the interpretation of clinical data from the Chinese language to the English language. RNN was responsible for the collection and organization of patient data for Mansa general hospital cases. After the review of the manuscript content by all authors, it was agreed that the final version be submitted for publication.

**Acknowledgement**

We are thankful to all the doctors and nurses in the Department of Obstetrics and Gynecology at the second affiliated hospital of Nanjing Medical University and Dr. Royd Nkalamo Nonde of Mansa general hospital for the support rendered in this study.

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