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CLINICAL ARTICLE

Predictors and outcomes of low birth weight in Lusaka, Zambia☆

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ABSTRACT

Objective: To determine factors associated with low birth weight (LBW) in an urban Zambian cohort and investigate risk of adverse outcomes for LBW neonates. *Methods:* The present retrospective cohort analysis used data recorded between February 2006 and December 2012 for singletons and first-born twins delivered in the public health system of Lusaka, Zambia. Routine clinical data and generalized estimating equations were used to examine covariates associated with LBW (<2500 g) and describe outcomes of LBW. *Results:* In total, 200 557 neonates were included, 21 125 (10.5%) of whom were LBW. Placental abruption, delivery before 37 weeks, and twin pregnancy were associated with LBW in multivariable analysis ($P<0.01$ for all). Compared with neonates weighing more than 2500 g, LBW neonates were at higher risk of stillbirth (adjusted odds ratio [AOR] 8.6, 95% confidence interval [CI] 6.5–11.5), low Apgar score (AOR 5.7, 95% CI 4.6–7.2), admission to the neonatal intensive care unit (AOR 5.4, 95% CI 3.5–8.3), and very early neonatal death (AOR 6.2, 95% CI 3.7–10.3). *Conclusion:* LBW neonates are at increased risk of adverse outcomes, including stillbirth and neonatal death, independent of pregnancy duration at delivery and multiple pregnancy. These findings underscore the need for early, comprehensive, and high-quality prenatal care.

1. Introduction

Most cases of low birth weight (LBW; <2500 g) result from preterm birth (either spontaneous or indicated), intrauterine growth restriction, or, less commonly, congenital anomalies. LBW neonates—particularly those born prematurely—are at risk of mortality, severe morbidity, and developmental problems [1], which could in turn have long-term effects on health during adulthood and on socioeconomic outcomes, including education and income [2]. Despite improvements in newborn and child health indicators over the past two decades [3], LBW births remain common, particularly in low- and middle-income countries (LMICs) [4], where approximately 10%–20% of neonates meet the criteria for LBW [1].

Globally, LBW is associated with various maternal and obstetric factors, such as malnutrition and poor weight gain, infection (including malaria and HIV), prepartum hemorrhage, chronic hypertension and hypertensive disorders of pregnancy, diabetes, abnormal placentation, multiple pregnancy, and preterm birth [5]. Some of these factors are modifiable through early and comprehensive prenatal care. Examples include nutritional supplementation, screening and treatment for infectious diseases, progesterone for the prevention of recurrent preterm birth, and smoking cessation. Socioeconomic factors—including education, income, and inequality—and access to prenatal care are also important determinants of pregnancy outcomes and birth weight [6,7]. Because of its association with multiple markers of poor health and limited access to care, LBW has long been considered an important public health indicator [1]. However, published data from Sub-Saharan African cohorts remain scarce.

The use of birth weight rather than pregnancy duration as an outcome measure is particularly relevant in LMIC settings, where it is difficult to accurately determine the length of pregnancy because women often present for care late in pregnancy [8], and obstetric ultrasonography is not commonly available or is not used to establish the estimated delivery date [9]. As a result, distinguishing between intrauterine growth restriction and preterm birth is often challenging.

The aims of the present study were to determine factors associated with LBW among Zambian women receiving care in an urban public health system and to investigate whether LBW neonates were at higher risk of adverse perinatal outcomes compared with neonates weighing 2500 g or more at birth.

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2. Materials and methods

The present retrospective cohort analysis used prenatal, delivery, and postnatal data from the public Maternal, Newborn, and Child Health (MNCH) system in Lusaka, Zambia, recorded between February 1, 2006, and December 31, 2012. Ethics approval for the present analysis was obtained from the University of Zambia Biomedical Research Ethics Committee (Lusaka, Zambia) and the institutional review board of the University of North Carolina at Chapel Hill (Chapel Hill, NC, USA). Because this was a secondary analysis of routinely collected clinical data, a waiver of consent was granted by the ethics committees.

Lusaka—Zambia's capital and largest city—has an extensive network of primary health clinics where MNCH services are mostly provided free from user fees. Primary health clinics are staffed by midwives and nurses, who provide prenatal, delivery, and postnatal services to low-risk women and neonates. High-risk pregnancies are referred to the University Teaching Hospital in Lusaka and attended by general medical officers, obstetrician–gynecologists, pediatricians, and other specialists. Clinical MNCH data are captured in an electronic medical record known as the Zambia Perinatal Records System (ZEPRS) [8], which was introduced in 2006.

The analysis included singletons and first-born twins delivered in a primary health clinic or at the University Teaching Hospital for whom the pregnancy duration estimate was deemed "reliable" and for whom a minimum complement of delivery information (date of birth, birth weight, and birth outcome) was recorded in ZEPRS. Because ultrasonography is not commonly used to determine a woman's estimated delivery date in Zambia, clinical dating criteria—last menstrual period (LMP) and symphysis–fundal height—were applied to estimate the pregnancy duration. Women were included only if their LMP had been recorded and if, when appropriate, the estimated pregnancy duration based on the symphysis–fundal height did not differ by more than 3 weeks from that estimated by the LMP method. Mothers with twins were counted once and only the birth weight of the first twin was considered. The analysis was limited to viable deliveries, defined as a pregnancy duration of 28 weeks or more and a birth weight of 1000 g or more, as is customary in the Zambian setting.

The present study had two objectives. The first was to determine demographic, socioeconomic, and/or obstetric factors associated with LBW in singleton and twin pregnancies. The second was to quantify the relative risk of adverse perinatal outcomes in LBW neonates compared with neonates weighing more than 2500 g.

For the first objective, the primary outcome measure was LBW. The following information was obtained from ZEPRS: maternal age, parity, obstetric history (prior stillbirth and prior preterm birth), medical history (pregestational hypertension [systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg] and pregestational diabetes), and prenatal care (pregnancy duration at first visit prenatal care visit, singleton or twin pregnancy, body mass index, hemoglobin concentration, syphilis serostatus, HIV serostatus, hypertension, and placental abruption). Perinatal HIV infection was confirmed by cross-referencing ZEPRS data with the electronic database at the laboratory that had performed the neonatal HIV test. Pregnancy duration was calculated by combining information on LMP and symphysis–fundal height, if appropriate. Predictors of LBW were investigated in both univariable and multivariable analyses using generalized estimating equations to account for clustering.

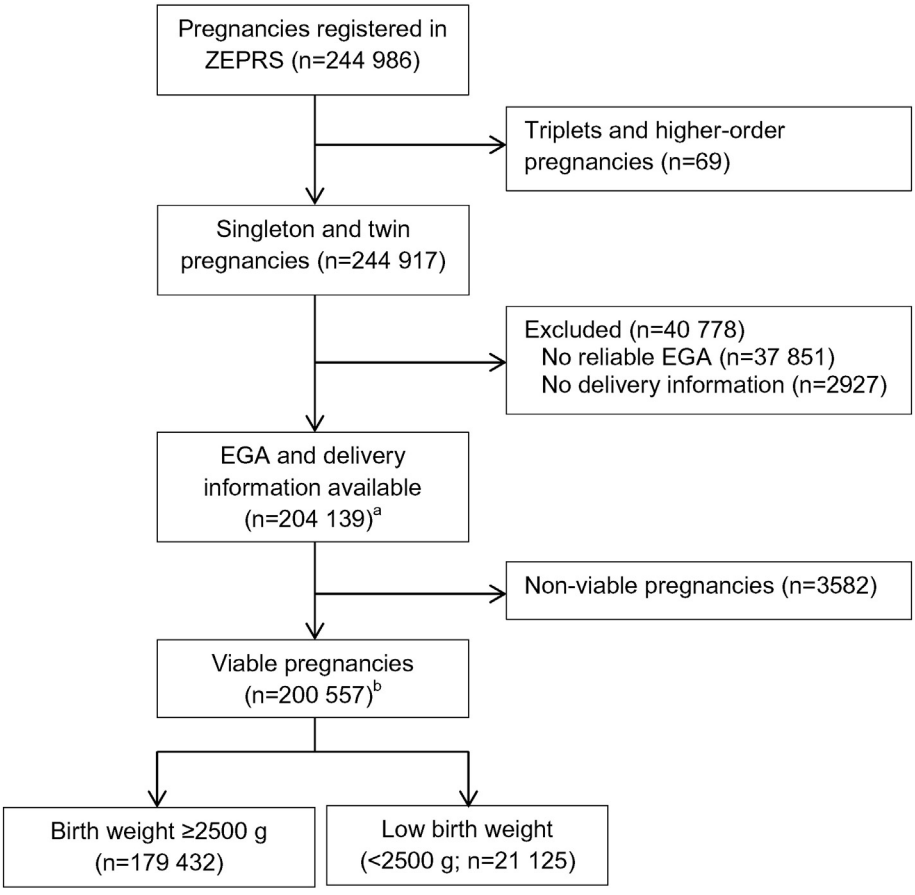

Fig. 1. Flow of patients through the study. Abbreviations: ZEPRS, Zambia Perinatal Records System; EGA, estimated gestational age. [a] For twin deliveries, information for first-born twin included. [b] Pregnancy duration ≥28 weeks and birth weight ≥1000 g.

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