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CLINICAL ARTICLE

A population-based cohort study of stillbirth among twins in Lusaka, Zambia

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A B S T R A C T

Objective: To determine rates of stillbirth and the associated risk factors for stillbirth among twins delivered in Lusaka, Zambia. *Methods:* A retrospective cohort analysis was conducted of singletons and twins delivered at 26 public sector facilities between February 1, 2006, and May 31, 2013. Data were obtained from the Zambian Electronic Perinatal Record System. Risk of stillbirth was estimated using logistic regression. *Results:* Overall, 260 657 singletons and 4021 twin pairs were included. There were 5105 stillbirths; 317 twins were stillborn. The crude stillbirth rate for twins was 39.4 per 1000 births (95% confidence interval [CI] 35.2–43.7) whereas the rate for singletons was 18.4 per 1000 births (95% CI 17.9–18.9; $P < 0.001$). Factors associated with stillbirth among twins were increased interval between delivery (>60 minutes), low birth weight (<2500 g), birth order (being the second-born), and difference in birth weights (>30% discordance). *Conclusion:* Twins were at an increased risk of stillbirth. Improved understanding of factors associated with stillbirth in this population could help to improve perinatal outcomes globally.

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1. Introduction

The incidence of twins in high-income countries such as the USA has increased from 18.9 per 1000 live births to 33.9 per 1000 live births during the past 20 years, largely owing to a marked rise in the use of assisted reproductive technologies [1]. Globally, twin birth outcomes are consistently worse than are those of singletons [2,3]. Twins represent 2% of all births in the USA [4]; however, this population comprises 12% of preterm births, 15% of neonatal deaths, and 10% of stillbirths [5]. Factors known to be associated with increased stillbirth rates among twins born in high-income countries include monochorionicity [6], a difference in fetal weights of more than 20% [7], and continuation of pregnancies beyond certain gestational ages according to chorionicity [6,8]. For example, a national US consensus panel on timing of twin births recommended delivery at 38 weeks for dichorionic twins and 34–37 weeks for monochorionic/diamnionic twins [9]. However, stillbirth rates among twins in high-income countries have progressively

decreased over the past 30 years, possibly owing to improved detection of chorionicity with increased fetal surveillance and uptake of scheduled deliveries rather than spontaneous labor [10–13]. Numerous studies from the USA and Canada [10–14] suggest that elective early delivery of twin gestations correlates with overall reductions in stillbirths, but the trade-off is increased rates of prematurity.

An increasing amount of information is available on twin gestation and stillbirth in low-resource countries [3,15,16]. However, reported risk factors associated with twin pregnancy and stillbirths in this setting do not always correlate with those identified in the USA. Enhanced understanding of risk factors associated with stillbirth among twin pregnancies could help low-income countries to develop specific surveillance strategies and interventions to improve outcomes. The aim of the present study was, therefore, to investigate the risk of stillbirth among twin gestations in Zambia and to identify specific risk factors for stillbirth in this group.

2. Materials and methods

A retrospective cohort analysis was conducted of twin and singleton births at public sector facilities in Lusaka, Zambia. The routine clinical data used in this analysis had been collected by the Zambia Electronic Perinatal Record System (ZEPRS) between February 1, 2006, and May

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31, 2013. Approval for the present study was obtained from the ethical review committees of the University of Zambia (Lusaka, Zambia) and the University of North Carolina at Chapel Hill (Chapel Hill, NC, USA). Individual informed consent was not obtained because ZEPRS was considered programmatic; however, personally identifying information was removed before data analysis.

The ZEPRS database, and the large public sector system that it serves, have been described in detail elsewhere [17]. Briefly, ZEPRS is a patient-level electronic medical record system that serves women receiving prenatal care and delivery services in 25 public health facilities and one referral hospital (University Teaching Hospital) in Lusaka, which is the capital city of Zambia. The database captures demographic information, past and present medical and obstetric history, delivery data, results of laboratory tests, and limited postnatal data on both mothers and their newborns. The main purposes of ZEPRS are monitoring, quality improvement, reporting, and research [17].

Women were included if they delivered either a singleton or twins during the study period. Women were excluded from the present study if they had carried higher-order multiples (triplets, quadruplets, or quintuplets), no delivery information was available, they had an implausible estimated date of delivery, they delivered neonates had a birth weight of less than 1000 g, no vital status was recorded, no birth weight was recorded, or they had a pregnancy duration of less than 28 weeks.

Because of its limited availability, ultrasonography is not often used in Zambia to establish gestational age. In the present study, estimates of gestational age were mainly based on the last menstrual period and the symphysis–fundal height. Stillbirth was defined as a fetus with no signs of life at delivery and no attempt at resuscitation. Two subtypes of stillbirth were evaluated in the present study. A recent (fresh) stillbirth showed no degenerative skin changes and death was considered to have occurred within 12 hours before delivery. A macerated stillbirth had degenerative skin changes recorded by the delivering clinician and death was presumed to have occurred at least 12 hours before delivery.

The data were analyzed using SAS version 9.3 (SAS Institute, Cary, NC, USA). The Pearson χ^2, Fisher exact, or Wilcoxon rank-sum tests were used as appropriate to compare maternal characteristics and infant birth outcomes among singletons versus twins. For birth outcomes, the individual infant was used as the unit of analysis, accounting for clustering of outcomes within mothers. Logistic regression was used to estimate the crude odds ratios of stillbirth with the corresponding 95% confidence interval (CI). To account for correlation between sibling twins owing to maternal effects, models were fitted with generalized estimating equations, using an unstructured correlation matrix. Ignoring cluster dependency among twin gestations can affect precision and lead to potentially incorrect interpretation of results [18]. All factors identified as statistically significant in the univariate analyses ($P \leq 0.05$) were included in a multiple logistic regression model to generate adjusted odds ratios.

3. Results

The total number of pregnant women who presented to the participating facilities for prenatal care during the present study period was 389 613 (Fig. 1). Among 268 699 neonates in the primary analysis cohort, 260 657 (97.0%) were singletons and the remaining 8042 (3.0%) were members of a twin pair. The crude twin delivery rate was 15.2 per 1000 births (95% CI 14.7–15.7).
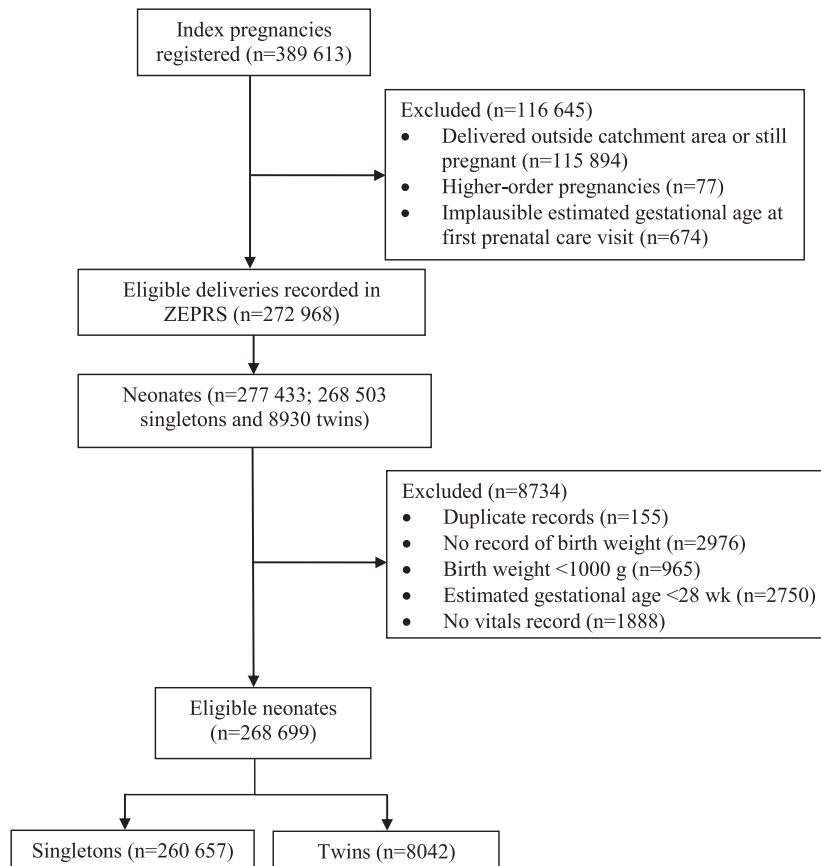

Fig. 1. Flow diagram of included individuals.