Twin Research and Human Genetics
Volume 18 ▮ Number 1 ▮ pp. 100–107 ▮ © The Author(s) 2014 ▮ doi:10.1017/thg.2014.82

Multiple Births in Sub-Saharan Africa: Epidemiology, Postnatal Survival, and Growth Pattern

Samson Gebremedhin
School of Public and Environmental Health, Hawassa University, Hawassa, Ethiopia

The study endeavored to assess the epidemiology, postnatal survival, and growth pattern of multiple births in Sub-Saharan Africa (SSA). It was based on the data of 25 demographic health surveys conducted in the subcontinent since 2008. The records of 213,889 children born in the preceding 59 months of the surveys were included. The multiple birth rate was computed as the number of multiple confinements per 1,000 births. Factors associated with multiple births were identified using logistic regression and their survival pattern was assessed using the Kaplan–Meier method. The multiple birth rate was 17.1 (95% confidence interval: 17.7–16.6) and showed considerable variation across the 25 countries included in the study. Odds of multiple births were significantly increased with advanced maternal age, parity, and maternal height but not with wealth index, age at first birth, and month of birth. At the end of the fourth year of age, the cumulative survival probability was as low as 0.77 in multiple births as compared to 0.93 in their counterparts. The odds of neonatal, infant and under-five mortality were 5.55, 4.39, and 3.72 times increased in multiple births, respectively. Multiple births tend to be malnourished than singletons and the odds of wasting, stunting, and underweight were 1.31, 1.83, and 1.73 times raised, consecutively. Nevertheless, multiple births regain their weight-for-age (WFA) and height-for-age (HFA) deficits by the end of the fourth year of age. Counseling pregnant mothers with multiple gestation to give birth at a health institution and providing close medical follow-up during and after the neonatal period can improve the survival of multiple births.

■ **Keywords:** multiple birth rate, twin birth rate, Sub-Saharan Africa

Multiple pregnancy is the result of complex interactions between genetic and environmental factors. Apart from hereditary factors, its unequivocal risk factors are the use of assisted reproductive technology (ART), older maternal age, and advanced parity (Bortolus et al., 1999). Monozygotic twinning appears to be constant (approximately 4/1,000 births) but dizygotic twinning varies significantly across races, and demonstrates geographical and temporal trends (Bortolus et al., 1999; Piontelli, 2002).

Multiple gestation is considered at high risk as it is linked with various obstetric complications, including spontaneous abortion, hypertensive disorders, placenta previa, abruption, mal-presentation, malformations, and cerebral palsy (Choi et al., 2010). Further, multiple births have increased risk of prematurity and low birth weight, and suffer from the consequences (Choi et al., 2010; Pharoah et al., 2010). Multiple births have substantially higher risk of perinatal mortality and globally account for 14% of all infant deaths (Collins, 2007).

Multiple births account for 3% of all births worldwide (Pharoah et al., 2010). Globally, recent decades have seen a major increase in multiple births rates (Martin et al., 2012; Pison & D'Addato, 2006). From 1980 to 2009 in the United States, the number of twins has doubled and the twinning rate has risen by more than 75% (Collins, 2007). Similar increasing trends have also been observed in Western Europe and other countries (Pison & D'Addato, 2006). Older maternal age accounts for about one third of the growth in the twinning rate, and the increased use of infertility treatments is likely to explain much of the remainder of the rise (Martin et al., 2012).

RECEIVED 5 October 2014; ACCEPTED 27 October 2014. First published online 29 December 2014.

ADDRESS FOR CORRESPONDENCE: Samson Gebremedhin, PO Box 12485, Addis Ababa, Ethiopia. E-mail: samsongmgs@yahoo.com

Spontaneous multiple birth (i.e., multiple birth not related to ART) is high in Africa. Studies conducted as early as 1960s witnessed the high incidence of multiple births in Western Africa, especially in Nigeria (Cox, 1963; Nylander, 1971). A study concluded that in 1999, out of 2.8 million twins born worldwide, nearly 1.1 million (41%) were born in Africa as compared to 39% in Asia, 13% in America and 6% in Europe (Pison, 2000). Another study found very high twinning rates (above 18/1,000 births) in many Central, Western, and South-Eastern Africa countries (Smits & Monden, 2011). Studies conducted in Nigeria (Akinboro et al., 2010), Ghana (Mosuro et al., 2001), and Kenya (Musili & Karanja, 2009) concluded the same. Nevertheless, population-based data regarding the epidemiology, postnatal survival, and growth pattern of multiple births in the continent are still limited.

Accordingly, the present study — an analysis of 25 demographic and health surveys (DHS) conducted in SSA since 2008 — is intended to assess the magnitude, risk factors, postnatal survival, and growth pattern of multiple births in the subcontinent.

Methods and Materials

Study Setting

SSA consists of 49 of Africa's 55 states that are fully or partially located south of the Sahara Desert. The subcontinent covers an area of 24.2 million km^2. According to the 2010 World Bank estimate, the region is the most underdeveloped part of the world, with GDP per capita of 2,235 USD. The population nears 900 million and the annual population growth rate is as high as 2.5%. Life expectancy at birth is 56 years (World Bank, 2014).

Study Design

A cross-sectional study was conducted based on the secondary data of 25 DHS surveys in the subcontinent since 2008.

Inclusion and Exclusion DHS Surveys

All DHS survey types, including Standard DHS, Continuous DHS, Malaria Indicator Survey (MIS), and Standard AIDS Indicator Survey (AIS), conducted since 2008 in the region were considered for the analysis. Survey datasets that were yet to be released have not been used. In the presence of multiple surveys for a country, the most recent standard DHS was used (Table 1).

Data Extraction

For all of the surveys, the 'child record' dataset, which contains information about every alive birth that happened to the selected mothers in the preceding 5 years of the surveys, was used. From the datasets, variables related to maternal socio-demographic characteristics, utilization of maternity services, type of birth (singleton or multiple), survival status of the babies, basic characteristics of the babies who were alive at the time of the surveys, and anthropometric status of the mothers and the babies were extracted. All the DHS survey types had complete information regarding the aforementioned variables; nevertheless, MIS and AIS lacked anthropometric measurement and maternity service utilization related variables.

TABLE 1
List of 25 Demographic and Health Surveys Included in the Study

Country	Type of DHS survey	Year of data collection	Sample size
Angola	MIS	2011	8,242
Benin	Standard DHS	2011–12	13,407
Burundi	MIS	2012	4,267
Burkina Faso	Standard DHS	2010	15,044
Cameroon	Standard DHS	2011	11,732
Comoros	Standard DHS	2012	3,149
Congo republic	Standard DHS	2011–12	9,329
Côte d'Ivoire	Standard DHS	2011–12	7,776
Ethiopia	Standard DHS	2011	11,654
Gabon	Standard DHS	2012	6,067
Guinea	Standard DHS	2012	7,039
Kenya	Standard DHS	2008–09	6,079
Lesotho	Standard DHS	2009	3,999
Liberia	MIS	2011	3,319
Madagascar	MIS	2013	5,477
Malawi	MIS	2012	2,283
Mozambique	Standard DHS	2011	11,102
Niger	Standard DHS	2012	12,558
Nigeria	Standard DHS	2013	31,482
Rwanda	Standard DHS	2010	9,002
São Tomé and Príncipe	Standard DHS	2008–09	1,931
Senegal	Continuous DHS	2012–13	6,862
Tanzania	Standard AIS	2011–12	8,648
Uganda	Standard DHS	2011	7,878
Zimbabwe	Standard DHS	2010–11	5,563

Note: DHS = demographic health surveys.

Sample Size

The adequacy of the available sample size in each country for estimating the multiple birth rate was evaluated using single proportion formula. The sample was found to be sufficient to estimate the rate at the level of 99% confidence level, 0.2% margin of error, expected rate of 18/1,000 births (Smits & Monden, 2011) and design effect of 2. The sample was also adequate to compare the survival pattern of multiple and singleton births with effect size of 0.5 and power of 99%.

Sampling Technique Used in DHS

The DHS surveys utilized a stratified two-stage cluster sampling procedure designed to generate a representative sample at national, place of residence (urban–rural) and regional/state levels. At the first stage, a stratified sample — based on place of residence and region/state — of enumeration areas (EAs) were drawn from recent national census files using a probability proportional to size procedure. In each stratum, a sample of a predetermined number of EAs was selected; consecutively, in every selected EA, a household listing was conducted. At the second stage, fixed numbers of households were selected using a systematic random sampling technique. All eligible women (15–49 years) in

https://doi.org/10.1017/thg.2014.82 Published online by Cambridge University Press

the selected households were included in the study (ICF International, 2012a, 2012b).

DHS Data Collection

Data were collected by trained and experienced interviewers and supervisors. Field editors were also deployed to check the consistency of the completed questionnaires. In all of the surveys an intensive training lasting for 3–4 weeks was provided. Data were gathered using standard questionnaires that have been translated into the major local languages in which interviews were conducted. Prior to the surveys, pretesting had been conducted in a small number of EAs that have not been selected for the main surveys. Reproduction history was gathered from all eligible women (15–49 years) in the selected households. For this specific study, records of births in the preceding five years of the surveys were used.

Data Management and Analysis

Data management and analysis were conducted using SPSS and STATA statistical packages, respectively. From all of the surveys, the 'child record' dataset was downloaded from the DHS program website in SPSS format. Then the unnecessary variables were dropped and the datasets were merged.

All the statistical indicators were computed using weighted analysis. The 'sampling weight' variable found in the datasets were further corrected for the population size of the countries and used as the ultimate weight. Multiple birth rate was computed as number of multiple confinements per 1,000 births. The monozygotic and dizygotic twining rates were estimated using the Weinberg rule (Fellman & Eriksson, 2006). Factors associated with multiple births were identified using binary logistic regression model. The survival pattern in multiple and singleton births were compared using the Kaplan–Meier survival curves and Cox proportional hazard model. The assumptions of the models were tested.

Ethical Considerations

The datasets were accessed after receiving permission from the DHS program. The primary data were collected in line with international ethical guidelines. For all the surveys, ethical clearance was provided by local institutional review boards and ICF Macro. Informed consent was taken from study participants following standard procedure.

Results

Socio-Demographic Information

The records of 213,889 children born in the preceding 59 months of the surveys were included in the analysis. The proportion of males (50.6%) was slightly higher than that of females (49.6%). The median birth order was 3, with an inter-quartile range of 3. About 3.6% of all the babies were born as multiple births. Nearly three quarters of the children (71.6%) were sampled from rural areas. The mean (±*SD*) maternal age during the delivery was 26.9 (±17.1) years and nearly half (45.0%) of mothers had no formal education. Among 93.1% of the babies who were alive at the time of the surveys, the mean age (±*SD*) was 28.5 (±17.1) months (Table 2).

TABLE 2

Socio-Demographic Characteristics of the Children Included in the Analysis, Sub-Saharan Africa, 2008–2013

Socio-demographic characteristics	Frequency	Percentage
Sex (*n* = 213,889)		
Male	108,246	50.6
Female	105,643	49.4
Birth order (*n* = 213,889)		
1	50,762	23.7
2	42,526	19.9
3	32,350	15.1
4	25,616	12.0
5 or more	62,635	29.3
Maternal age during baby's birth (year) (*n* = 199,097)		
12–19	27,923	14.0
20–34	140,161	70.4
35–47	31,013	15.6
Maternal education status (*n* = 213,852)		
No education	96,200	45.0
Primary	73,253	34.3
Secondary	39,553	18.5
Higher	4,846	2.3
Place of residence (*n* = 213,889)		
Urban	60,664	28.4
Rural	153,225	71.6
Multiple birth baby (*n* = 213,889)		
Yes	7,859	3.7
No	206,030	96.3

Magnitude of Multiple Birth Rate

The multiple birth rate was estimated based on 209,943 deliveries reported in the reference period. The weighted rate was 17.1 (95% CI: 17.7–16.6) per 1,000 births. Nearly all (99.0%) of the multiple births were twins while the remaining 1.0% were higher order births. The weighted twinning rate was 17.0 (95% CI: 17.5–16.4). The monozygotic and dizygotic twinning rates were 2.9 and 14.9/1,000 births, respectively. The multiple birth rate showed considerable variation across the 25 countries. The highest and lowest were reported in Benin and Ethiopia (Table 3).

Factors Associated With Occurrence of Multiple Births

The relationship between the occurrence of multiple births and selected characteristics (maternal height, age during the first birth, age and parity during the delivery, and household wealth index), was appraised. In the multivariate logistic model adjusted for the aforementioned variables and country of residence, all characteristics except age at first birth and wealth index were significantly associated with the outcome.

Regarding maternal age, the rate sharply rose from the lowest of 3.2/1,000 births in girls younger than 16 years to 20.1/1,000 births among women in their late twenties. Later, it plateaued throughout the thirties and subsequently declined in older age groups. In the multivariate logistic model, compared to the youngest age group, the odds of

https://doi.org/10.1017/thg.2014.82 Published online by Cambridge University Press

TABLE 3
Multiple Birth Rate in 25 Sub-Saharan Africa Countries, 2008–2013

Country	Multiple birth rate (per 1,000 births)
Benin	25.1
Ivory cost	23.9
Malawi	23.1
Guinea	22.3
Sao Tomé and Príncipe	21.7
Cameron	21.4
Gabon	21.3
Comoros	20.5
Senegal	20.6
Liberia	19.5
Burkina Faso	19.7
Congo-Brazzaville	20.2
Mozambique	19.1
Niger	17.7
Nigeria	17.6
Tanzania	16.9
Uganda	16.4
Angola	15.7
Lesotho	15.7
Rwanda	14.9
Madagascar	14.0
Burundi	13.0
Kenya	13.3
Zimbabwe	13.5
Ethiopia	11.7
All	17.1

multiple births in the age groups 20–24 and 25–29 were significantly raised by 1.63 and 2.08 folds. Likewise, women in the age groups 30–34, 35–39, and 40–44 years had 2.41, 2.32, and 2.05 times increased odds, respectively.

The multiple birth rate showed an approximate inverse relationship with parity. The highest rate (26/1,000 births) was reported among women with parity of 4. As compared to primiparas, women with parity of 1, 2, and 3 had 1.37, 1.51, and 1.54 times increased odds of multiple births, respectively. Women with parity of 4 and 5 or more also had 1.85 and 1.64 times increased odds.

Maternal height demonstrated a direct relationship with multiple birth rate. Compared to women from the first height quartile, those in the second, third, and fourth had 1.24, 1.21, and 1.52 times increased odds, respectively (Table 4).

With the intention of assessing seasonal variation in the occurrence of multiple birth, the multiple birth rates were compared across 12 months using a bivariate logistic regression model. However, no significant variation was found.

Survival of Multiple Birth Babies

The survival pattern among multiple births was compared with that of singletons. The cumulative survival of multiple births was significantly lower (log rank $\chi^2 = 3{,}004.195$, $p < 0.000$) and the risk of under-five years' mortality was increased four-fold, hazard ratio = 3.92 (95% CI: 3.73–4.12). Especially, survival probability declined sharply in multiple births soon after birth and reached 0.85 at the end of the neonatal period. At the end of the fourth year of age, the cumulative survival probability was as low as 0.77 in multiple births compared to 0.93 in their counterparts (Figure 1).

Among all 213,889 children included in the study, the level of neonatal (NMR), infant (IMR), and under-5 (U5MR) mortality rates were 33, 56, and 81 per 1,000 live births, respectively. Among singleton births, the rates were 29, 52, and 75, respectively. The corresponding mortality rates in multiple births were extremely high. NMR was as high as 141. IMR and U5MR were 193 and 233 per 1,000 live births, respectively. Compared to singletons, the odds of neonatal, infant, and under-5 mortality were 5.55 (95% CI: 4.26–7.23), 4.39 (95% CI: 3.49–5.52), and 3.72 (95% CI: 3.01–4.60) times increased, respectively. The odds of post-neonatal infant and child mortality rates were over twice (2.63 (95% CI: 2.37–2.90) and 2.07 (95% CI: 1.85–2.32), respectively) as high in multiple births as in singletons.

Among all neonatal, infant, and under-5 deaths that occurred in the preceding five years of the surveys, 14.6%, 11.5%, and 9.7% happened in multiple birth babies, respectively. Among all deaths of multiple birth babies, more than one in three (34.5%) occurred in the early neonatal period (0–7 days of age) and an additional 7.1% happened in late neonatal period (8–28 days). The remaining 30.3% and 28.1% took place between 1–11 months and 12–59 months, respectively.

Delivery at a Health Institution as a Strategy for Reducing Neonatal Mortality in Multiple Births

The association between place of delivery and neonatal death was assessed separately for multiple and singleton births, with the intention of evaluating whether health institution delivery had an additional benefit for multiple births as compared to singletons.

In the multivariate model adjusted for place of residence (urban or rural), maternal education and wealth index, health institution delivery reduced the odds of neonatal mortality by a higher proportion of 44%, OR = 0.56 (95% CI: 0.45–0.69), in multiple births as compared to 19%, OR = 0.81 (95% CI: 0.76–0.87), in singletons.

Nutritional Status and Growth Pattern of Multiple Births

Among children who were alive during the survey, 54.9% had comprehensive anthropometric data. The prevalence of wasting (15.5%), underweight (32.9%), and stunting (49.5%) in multiple births were significantly higher than the corresponding figures in singletons (12.4%, 21.5%, and 36.9%, respectively). In the logistic model adjusted for household wealth index, maternal age, education status, and parity; multiple births had 1.31 (95% CI: 1.20–1.45), 1.83 (95% CI: 1.70–1.97), and 1.73 (95% CI: 1.62–1.85) times increased odds of wasting, stunting, and underweight, respectively.

https://doi.org/10.1017/thg.2014.82 Published online by Cambridge University Press

TABLE 4

Association of Multiple Births with Selected Maternal Characteristics Sub-Saharan Africa, 2009–2013

Maternal characteristics	Multiple birth rate (per 1,000 births)	COR (95% CI)	AOR (95% CI)
Age during birth (year)			
15–19	6.1	1[r]	1[r]
20–24	11.7	1.92 (1.62–2.27)*	1.63 (1.27–2.08)*
25–29	18.0	2.97 (2.52–3.50)*	2.08 (1.58–2.75)*
30–34	20.8	3.45 (2.92–4.09)*	2.41 (1.76–3.28)*
35–39	21.5	3.57 (2.99–4.26)*	2.32 (1.64–3.26)*
40–44	18.8	3.10 (2.49–3.88)*	2.05 (1.38–3.05)*
45–49	15.5	2.15 (1.32–3.50)*	1.54 (0.80–2.98)
Parity during the index pregnancy			
0	11.8	1[r]	1[r]
1	15.6	1.33 (1.19–1.48)*	1.37 (1.13–1.65)*
2	20.2	1.72 (1.54–1.93)*	1.51 (1.23–1.86)*
3	22.0	1.88 (1.68–2.12)*	1.54 (1.22–1.94)*
4	26.0	2.23 (1.98–2.51)*	1.85 (1.44–2.38)*
5 or more	23.4	2.01 (1.81–2.22)*	1.64 (1.25–2.15)*
Current height (quartile group)			
First quarter (<154.5 cm)	15.6	1[r]	1[r]
Second quarter (154.5–158.5 cm)	19.0	1.22 (1.08–1.38)*	1.24 (1.08–1.42)*
Third quarter (158.6–162.8 cm)	19.0	1.22 (1.09–1.38)*	1.21 (1.05–1.39)*
Fourth quarter (>162.8 cm)	23.8	1.54 (1.37–1.73)*	1.52 (1.32–1.74)*
Age at the first birth (years)			
<20	17.4	1[r]	1[r]
20–24	21.4	1.24 (1.15–1.33)*	1.10 (0.98–1.24)
25–29	22.5	1.30 (1.15–1.47)*	1.23 (0.99–1.50)
30–34	19.8	1.14 (0.86–1.52)	1.02 (0.68–1.54)
35–49	34.1	1.99 (1.19–3.34)*	1.87 (0.92–3.82)
Wealth index			
Poorest	18.2	1[r]	1[r]
Poorer	18.8	1.03 (0.94–1.14)	1.02 (0.88–1.17)
Middle	18.2	1.00 (0.91–1.11)	1.00 (0.86–1.15)
Richer	19.8	1.09 (0.99–1.20)	1.08 (0.94–1.24)
Richest	18.4	1.01 (0.91–1.12)	1.01 (0.87–1.19)

As compared to singletons, the mean standardized WFA and HFA scores for multiple births remains inferior throughout early childhood. However, especially from the 18th and 30th months of age onwards respectively, the WFA and HFA deficits start to be abridged and by the end of the fourth year, the differences reach a statistically insignificant level ($p < 0.05$). The difference in the standardized WFH score remains insignificant beyond the 24th month of age.

Discussion

The multiple birth rate in SSA (17/1,000 births) appears to be higher compared to the level in other developing countries where the magnitude is unlikely to be affected by ART. A study reported that in many South and South-East Asian countries, including China, India, Indonesia, and Pakistan, the twinning rates remains below 10/1,000 births; likewise, the incidence in Latin American countries is similarly low (less than 9/1,000 births; Smits & Monden, 2011). The rate is also higher than the 1980s pre-ART multiple birth incidence in England and Wales (9.6/1,000 births) and several other West European countries (less than 10/1,000 births; Pison & D'Addato, 2006).

Multiple birth rates appear to vary substantially across the 25 countries included in the study. In general, the rate was higher in Central and West Africa countries and lower in Eastern and Southern Africa countries. The lowest (12/1,000 births) and highest (25/1,000 births) figures were reported in Ethiopia and Benin, respectively. The disparity can be likely due to genetic differences as variations in risk factors of multiple pregnancy (e.g., age and parity) across the countries are unlikely to be substantial.

In the current study, multiple birth rates increased with advancing age, remained constant between 30–39 years, and declined thereafter. This is roughly consistent with the pattern witnessed in other studies. This has been attributed to the rise in the level of gonadotrophins with age, with maximum follicular stimulation occurring in late thirties and subsequent decline in ovarian function taking place at older ages (Bortolus et al., 1999).

Increasing birth order is an unequivocal risk factor of multiple births and the same is witnessed here. In the present study, the highest multiple birth rate was observed in a parity group of 4. Two studies in India also reported higher risks in high parities and the rate picked at parity of 4 (Rao, 1978; Sharma, 1997). Another study in India found a twinning rate of 6/1,000 deliveries among mothers with pregnancy order of 1 and the rate increased significantly to reach 19/1,000 in women with birth order of 4 or more (Satija et al., 2008).

A positive relationship was witnessed between maternal height and occurrence of multiple pregnancy.

https://doi.org/10.1017/thg.2014.82 Published online by Cambridge University Press

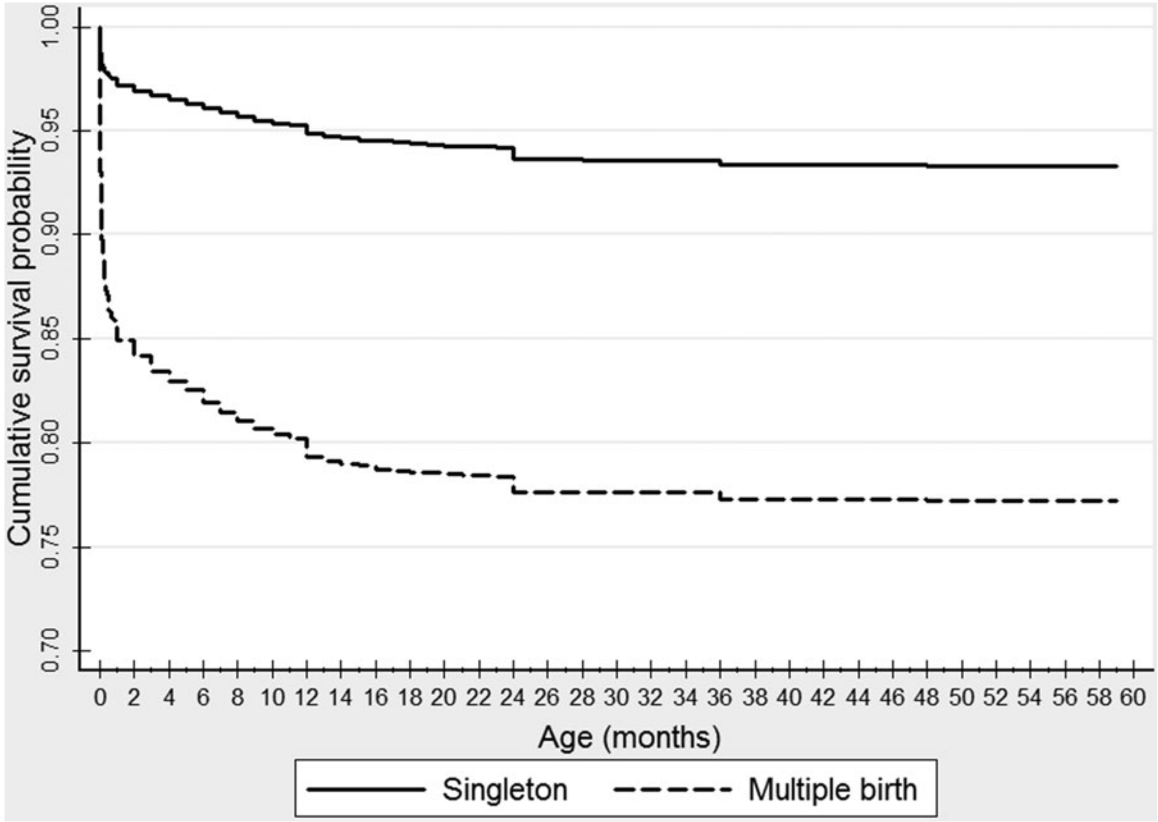

FIGURE 1

Cumulative survival probability of singleton and multiple birth babies in Sub-Saharan Africa, 2009–2014.

Previous studies also reported the same. Analysis of the Danish national birth registry showed that the odds of dizygotic twining was 1.36 times higher in women taller than 173 cm compared to those shorter than 165 cm (Basso et al., 2004). A hospital-based study conducted in United States also concluded that the odds of dizygotic twinning was increased by 1.66 times in women taller than 165 cm compared to women shorter than 157.5 cm (Reddy et al., 2005). A study based on the Netherland twin registry concluded likewise (Hoekstra et al., 2010). The biological mechanism by which maternal height affects incidence of multiple pregnancy has not been described well.

Information regarding the seasonality variation of multiple birth is equivocal (Bortolus et al., 1999). In Japan, higher twinning rates were reported in April (Imaizumi et al., 1980) whereas in Denmark peak rates were observed in May, June, and December (Bonnelykke et al., 1987). A study in the United States also reported a surge in triplet births in April and May (Elster & Bleyl, 1991). However, in the current study, parallel to a comparative study conducted in Nigeria and Scotland (Nylander, 1981), no significant seasonal variation had been observed.

The study found that the rate of mortality of multiple birth babies was extremely high. Compared to singletons, the mortality remains significantly higher not only during neonatal period, but also in infancy and subsequent childhood ages. In the current study, the odds of neonatal and infant mortality were 5.55 and 4.39 times increased in multiple births. Studies conducted in developing countries reported comparable figures. A study in Nepal found that the risk of neonatal mortally was 7.32 times increased (Katz et al., 2001), whereas a study in Nigeria reported that children born from multiple births were more than twice as likely to die during infancy as infants born as singletons (Uthman et al., 2008).

The reduced survival probability in multiple births, especially in the early stage of life, is likely to be due to the immediate complications of prematurity and low birth weight, including respiratory and immunologic problems. The reduced survival during infancy and childhood can be due to consequences of low birth weight and a higher prevalence of under-nutrition. Under-nutrition is known to contribute to more than half of all deaths in children in the developing world (Caulfield et al., 2004).

The study showed that multiple births tend to catch up their WFA and HFA deficits and become comparable to singletons at the end of the fourth year of age. Many studies concur on the existence of compensatory growth in twins but contradict on the age at which the full recovery is achieved. A longitudinal study conducted in the United

https://doi.org/10.1017/thg.2014.82 Published online by Cambridge University Press

States concluded that compared to singletons, twins were substantially smaller and shorter at birth, but later showed a recovery until they ultimately achieve the singleton norms at eight years (Wilson, 1979). A study in Japan also found the size deficit was fully recovered over the first six years of age (Ooki & Asaka, 1993). A Budapest longitudinal twin study reported the weight and height deficit of twins was recouped by the age of two and three years, respectively (Bodzsár et al., 2014).

The findings of the analysis should be interpreted with considerations of the strengths and limitations of the study. The typical strength emanates from the use of large and nationally representative data collected across 25 countries. Further, the article discussed various aspects of multiple birth including the epidemiology, survival, and growth pattern. In contrast, the risk factors have not been disaggregated based on zygosity. Further, the survival rates were not separately estimated for the number of multiple births as the sample size for triplet and higher order births were too small for detailed analysis.

Conclusion

Based on the 25 SSA countries studied, the multiple birth rate was 17.1 (95% CI: 17.7–16.6) per 1,000 births. The rate showed considerable variation across the countries. The odds of multiple births were significantly increased with advanced maternal age, parity, and maternal height but not with wealth index, age at first birth, and month of birth. As compared to singletons, the survival probability of multiple births was lower throughout the first five years of age. Likewise, multiple birth babies tend to be more malnourished than singletons although they catch up their growth deficit by the end of their fourth year of age.

Counseling mothers with multiple gestation pregnancy to give birth at health institution and proving close medical follow-up during and beyond neonatal period can improve the survival of multiple births.

Acknowledgment

The author acknowledges the Measure DHS Program for granting access to the data.

References

Akinboro, A., Azeez, M. A., & Bakare, A. A. (2008). Frequency of twinning in southwest Nigeria. *Indian Journal of Human Genetics*, *14*, 41–47.

Basso, O., Nohr, E. A., Christensen, K., & Olsen, J. (2004). Risk of twinning as a function of maternal height and body mass index. *Journal of the Medical American Association*, *291*, 1564–1566.

Bodzsár, E. B., Zsákai, A., & Susanne, C. H. (2014). Growth pattern of body weight and height of twins up to the age of 10 years. *Anthropology*, *7*, 223–232.

Bonnelykke, B., Sogaard, J., & Nielsen, J. (1987). Seasonality in twin birth rates, Denmark, 1936–84. *Journal of Epidemiology and Community Health*, *41*, 338–343.

Bortolus, R., Parazzini, F., Chatenoud, L., Benzi, G., Bianchi, M. M., & Marini, A. (1999). The epidemiology of multiple births. *Human Reproduction Update*, *5*, 179–187.

Caulfield, L. E., de Onis, M., Blössner, M., & Black, R. E. (2004). Undernutrition as an underlying cause of child deaths associated with diarrhea, pneumonia, malaria, and measles. *American Journal of Clinical Nutrition*, *80*, 193–198.

Choi, S. H., Park, Y. S., Shim, K. S., Choi, Y. S., Chang, J. Y., Hahn, W. H., . . . Bae, C. W. (2010). Recent trends in the incidence of multiple births and its consequences on perinatal problems in Korea. *Journal of Korean Medical Science*, *25*, 1191–1196.

Collins, J. (2007). Global epidemiology of multiple birth. *Reproductive Biomedicine Online*, *15*, 45–52.

Cox, M. L. (1963). Incidence and etiology of multiple births in Nigeria. *BJOG: The Journal of Obstetrics and Gynaecology of the British Commonwealth*, *70*, 878–884.

Elster, A. D., & Bleyl, J. (1991). Seasonality of triplet births in the United States. *Human Biology*, *63*, 711–718.

Fellman, J., & Eriksson, A. W. (2006). Weinberg's differential rule reconsidered. *Human Biology*, *78*, 253–275.

Hoekstra, C., Willemsen, G., van Beijsterveldt, C. E., Lambalk, C. B., Montgomery, G. W., & Boomsma, D. I. (2010). Body composition, smoking, and spontaneous dizygotic twinning. *Fertility and Sterility*, *93*, 885–893.

ICF International. (2012a). *Demographic and health surveys methodology*. Calverton, Maryland: Author.

ICF International. (2012b). *Demographic and health surveys sampling and household listing manual*. Calverton, MD: Author.

Imaizumi, Y., Asaka, A., & Inouye, E. (1980). Analysis of multiple birth rates in Japan: Seasonal and social class variations in twin births. *Japanese Journal of Human Genetics*, *25*, 299–307.

Katz, J., West, K. P. Jr., Khatry, S. K., LeClerq, S. C., Christian, P., Pradhan, E. K., . . . Shrestha, S.R. (2001). Twinning rates and survival of twins in rural Nepal. *International Journal Epidemiology*, *30*, 802–807.

Martin, J. A., Hamilton, B. E., & Osterman, M. J. K. (2012). *Three decades of twin births in the United States, 1980–2009. NCHS data brief, number 80*. Hyattsville, MD: National Center for Health Statistics.

Mosuro, A. A., Agyapong, A. N., Opoku-Fofie, M., & Deen, S. (2001). Twinning rates in Ghana. *Twin Research*, *4*, 238–241.

Musili, F., & Karanja, J. G. (2009). Multifoetal pregnancies at a maternity hospital in Nairobi. *East African Medical Journal*, *86*, 162–165.

Nylander, P. P. (1981). The factors that influence twinning rates. *Acta Geneticae Medicae et Gemellologiae*, *30*, 189–202.

Nylander, P. P. (1971). Ethnic differences in twinning rates in Nigeria. *Journal of Biological Science*, *3*, 151–158.

Ooki, S., & Asaka, A. (1993). Physical growth of Japanese twins. *Acta Geneticae Medicae et Gemellologiae*, *42*, 275–287.

Pharoah, P. O. D., Glinianaia, S. V., & Rankin, J. (2010). Congenital anomalies in multiple births after early loss of a conceptus. *Human Reproduction*, *24*, 726–731.

Piontelli, A. (2002). *Twins from fetus to child*. London: Routledge.

Pison, G. (2000). Nearly half of the world's twins are born in Africa. *Population and Societies*, *360*, 1–4.

Pison, G., & D'Addato, A. V. (2006). Frequency of twin births in developed countries. *Twin Research and Human Genetics*, *9*, 250–259.

Rao, T. V. (1978). Maternal age, parity, and twin pregnancies. *Progress in Clinical and Biological Research*, *24*, 99–103.

Reddy, U. M., Branum, A. M., & Klebanoff, M. A. (2005). Relationship of maternal body mass index and height to twinning. *Obstetrics and Gynecology*, *105*, 593–597.

Satija, M., Sharma, S., Soni, R. K., Sachar, R. K, & Singh, G. P. (2008). Twinning and its correlates: Community-based study in a rural area of India. *Human Biology*, *80*, 611–621.

Sharma, K. (1997). The epidemiological characteristics of twinning in Northwest India. *International Journal of Anthropology*, *12*, 39–49.

Smits, J., & Monden, C. (2011). Twinning across the developing world. *PLoS ONE*, *6*, e25239.

Uthman, O. A., Uthman, M. B., & Yahaya, I. (2008). A population-based study of effect of multiple birth on infant mortality in Nigeria. *BMC Pregnancy and Childbirth*, *8*, 41.

Wilson, R. S. (1979). Twin growth: Initial deficit recovery and trends in concordance from birth to nine years. *Annals of Human Biology*, *6*, 205–220.

World Bank. (2014). *Data: Sub-Saharan Africa*. Retrieved from http://data.worldbank.org/region/SSA.