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Article

Twin Births in 42 Sub-Saharan African Countries from 1986 to 2016: Frequency, Trends and Factors of Variation

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Abstract

Since the 1970s, twin birth rates have increased sharply in developed countries. In Africa, where the rate is the highest globally, its evolution and variation are poorly understood. This article aims to estimate the twinning rate in sub-Saharan African (SSA) countries throughout 1986–2016 and analyze its spatial, temporal, and ethnic variations. It also seeks to identify social and demographic factors associated with a high probability of twin births and outline a forecast of the twinning rate. We used data from 174 Demographic and Health Surveys from 42 countries. We supplemented them with the UN World Population Prospects (WPP). The twinning rate was calculated by reporting the number of twin births per thousand total births. We used logistic regression to analyze the factors associated with twin births. We projected the twinning rate based on WPP. The overall SSA twinning rate is 17.4 per 1000, but it has changed very little over time, and we expect it will grow a little between 2015 and 2050, increasing at most from 17.4 per 1000 to 18.4 per 1000. We also show significant differences in the twinning rate in SSA according to mother ethnicity. Most ethnic groups with high twinning rates belong to the large Bantu ethnic family. SSA remains the 'land of twins', with the twinning rate changing slowly. However, specific health policies must target twin births in SSA to address the public health challenges they present.

Keywords: Twins; Twin births; Twinning rate; Associated factors; Ethnicity; Projections; Sub-Saharan Africa

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Twin births, which are associated with an elevated risk of preterm birth, low birth weight, cesarean section, and numerous other health complications, represent a significant public health challenge (Bjerregaard-Andersen et al., 2014; Blondel, 2009; Boubkraoui et al., 2016; Pison, 2000; Schenker et al., 1981). This situation is of particular concern in sub-Saharan Africa (SSA), as this region has the highest rate of twin births worldwide (Smits & Monden, 2011). Furthermore, the mortality rate for children in SSA is higher than in other regions (World Health Organization [WHO], 2018). This situation necessitates a more comprehensive understanding of the twinning rate in SSA countries, including its trends and the factors influencing this variation.

There is considerable variation in the twin birth rate, or twinning rate, between continents. The current twinning rate in SSA is approximately 17 per thousand (per 1000), as reported by Monden et al. (2021) and Ouedraogo (2020). In the 1980s and 1990s, the twinning rate in SSA was 4 to 5 times higher than in Asia and almost twice as high as in Europe (Pison, 1992). These disparities are currently being narrowed, although they remain significant (Monden et al., 2021).

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Several factors contribute to the spatial and temporal variations in twin birth rates. For instance, the twinning rate in developed countries increased significantly between 1970 and 2010, from less than 8 to almost 16 per 1000 (Pison et al., 2015). This significant increase can be attributed to two factors: an increase in fertility treatments and the age of motherhood (Pison & Couvert, 2004; Pison et al., 2015; Terzera, 2002). In developing countries, particularly in SSA, where twin birth rates are exceptionally high, it is presumed that advanced fertility treatments, such as in vitro fertilisation (IVF), are not widely utilized. However, other factors, such as a high fertility rate, a high number of births at later ages, and genetic and ethnic characteristics (Bomsel-Helmreich & Al Mufti, 2005; Mbarek et al., 2024; Nylander, 1971), may contribute to maintaining these high twin birth rates (Ouedraogo, 2020).

Statistics on twinning in SSA are scarce, and the extent of variation between regions and countries remains poorly known. There have been studies on the geographical and spatial variations in twinning rates in SSA (Monden et al., 2021; Smits & Monden 2011). However, few have conducted comprehensive analyses in multiple countries to examine these geographical and temporal variations. Additionally, research on the main factors influencing SSA's twinning rates is scarce. Furthermore, although some researchers (Bomsel-Helmreich & Al Mufti, 2005; Nylander, 1971) have analyzed the relationship between ethnicity and twinning

rates in SSA, their studies focused only on specific ethnic groups, such as the Yoruba in Nigeria (Nylander, 1971). It remains to be demonstrated whether these situations are specific to certain groups or whether they can be observed throughout SSA. Finally, examining the future dynamics of twinning rates is essential in the current context of rapid population growth in sub-Saharan Africa.

The first objective of this study is to estimate the prevalence of twin births in 42 countries on the African continent between 1986 and 2016. This will be achieved by analysing the spatial, temporal and ethnic variations in twin birth rates. The second objective is identifying social and demographic factors associated with a high probability of twin births in SSA. Finally, the third objective is to provide a baseline projection of twin birth rates at the SSA continental level up to 2050.

Literature Review

Biology of Twinning: Two Types of Twin Births

There are two types of twins: monozygotic (MZ) or identical twins and dizygotic (DZ) or fraternal twins (Hall, 2003). MZ twins result from fertilization of a single egg by a single sperm, with the egg splitting in two in the first few days after fertilization. MZ twins are necessarily of the same sex and have a similar genotype. The MZ twinning rate is constant at around 3.5 to 4 per 1000, independent of maternal age, birth order number, geographic or ethnic origin, and medically assisted reproduction (MAR; Long & Ferriman, 2016; Pison et al., 2015).

DZ twins are the product of fertilizing two different eggs by two different sperm. In contrast to MZ twins, DZ twins are not inherently of the same sex. The frequency of DZ births is subject to the influence of the aforementioned factors (Bulmer, 1970; Pison, 1992).

This article does not distinguish between the types of twins, as this information is unavailable.

Twinning Rate Variation Factors

Maternal age. A substantial body of research has demonstrated that the likelihood of a twin birth increases with maternal age (Blondel, 2009; Bulmer, 1970; Gabler & Voland, 1994; Pison et al., 2015; Satija et al., 2008; Sear et al., 2001). In a study conducted by Pison et al. (2015), the maternal age range of 35—39 years had the highest twinning rates in Japan, England & Wales, France and the US. This was observed before the spread of MAR.

Bomsel-Helmreich and Al Mufti (2005) posit that follicle-stimulating hormone (FSH) is necessary for follicle development and triggers ovulation. As the average FSH level increases, so does the likelihood of double ovulation and double fertilization in the same cycle (Couvert, 2011; Mbarek et al., 2024; Mbarek et al., 2016; Nylander, 1981). It has been demonstrated that FSH concentration increases with age, which explains the rise in the twin birth rate with maternal age.

Birth order number (parity). The birth order number is another maternal characteristic associated with the probability of twin births. This link has been the subject of several studies, including that by Duncan (1865). His work demonstrated that the number of twin pregnancies in women increases with maternal age and birth order number. These results were confirmed by Bulmer (1970), who found that despite the apparent correlation between maternal age and birth order number, each factor has an independent effect on the probability of twin births. Daguet (2002) and Couvert (2011) also observed that at the same maternal age, women with a high birth order number are more likely to give birth to twins than nulliparous women or women with a small number of births.

Medically assisted reproduction (MAR). The phenomenon of MAR represents a significant and novel factor influencing the prevalence of twinning rates across the globe (Smits & Monden, 2011). The likelihood of multiple births is significantly increased by MAR (Terzera 2002; Pison & Couvert 2004; Vitthala et al., 2009). In industrialized countries, the advancement of human reproductive technology is currently the primary driver behind the significant increase in the twinning rate associated with delayed maternity (Pison et al., 2015). In SSA, the development of MAR is still in its infancy (Bonnet, 2016). Although not yet documented, it is likely that its impact on twinning rates is minimal.

Geographical and ethnic factors. There is considerable geographical variability in the frequency of twin births between subregions in Africa. Pison (1992) demonstrated that the twinning rate was higher in countries bordering the Gulf of Guinea, with an increase from inland to the coast. Additionally, Smits and Monden (2011) have shown that this African area with a high incidence of twin births extends to some central and eastern African countries. They also demonstrated that Benin had the highest national twinning rate, estimated at 28 per 1000, while Madagascar had the lowest rate, at approximately 10.6 per 1000.

The high twinning rates observed in SSA have been attributed to a genetic predisposition of women from particular ethnic groups. The geographical distribution of these ethnic groups could thus explain the regional disparities in twinning rates. Bomsel-Helmreich and Al Mufti (2005) demonstrated that Yoruba women had a significantly higher concentration of FSH in their blood than in Aberdeen (Scotland), which may explain the higher rate of twin births among Yoruba women. In this article, we will consider the role of ethnicity. However, we will not analyze the effect of genetics due to the lack of information in the surveys studied.

The preceding literature review indicates that the twinning rate of the SSA is the highest. Furthermore, the literature contains studies examining the factors contributing to the variation in the twinning rate within the SSA context. In addition to corroborating certain factors (e.g., geographical variations in the twinning rate), this study extensively examines the temporal variations in the twinning rate across 42 countries on the continent. Moreover, while research has demonstrated ethnic variations in the twinning rate in SSA, this association is most often investigated at the localized scale of one or two countries, predominantly in Nigeria. Consequently, an additional novel aspect of our methodology is the examination of ethnic disparities in the twin birth rate in SSA, encompassing a broader geographical scope. Another area of interest in our research is the study of socio-demographic factors associated with the likelihood of having twin births. This represents a novel contribution, as it extends beyond existing descriptive analyses. It proposes an investigation at the sub-Saharan level, which will mobilize several factors to reach more robust conclusions. It is also observed that there is a paucity of research on the projected twinning rate in Africa. Consequently, the baseline forecast of the twinning rate up to 2050, proposed by the present approach, will contribute to the demographic analysis of the twinning rate.

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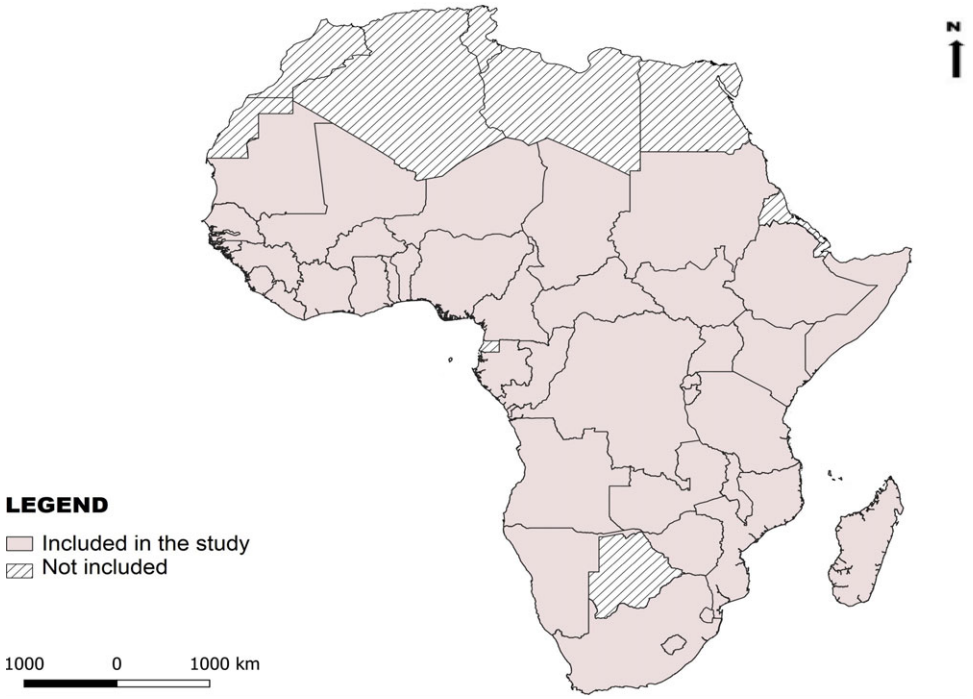

Figure 1. Geographical coverage of the study.

Methods

Data Source

The data used in this study were obtained from 174 Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS) (see Appendix A) conducted in 42 SSA countries[1] (Figure 1) between 1986 and 2016. These are retrospective cross-sectional surveys with national coverage. The DHS (https://www.dhsprogram.com/) and the MICS (https://mics.unicef.org/) are national surveys collecting information on a range of topics, including the fertility of women aged 15–49. They employ a multistage stratified sampling design and are nationally representative. DHS and MICS data are typically divided into several datasets, including the 'Births' file, which records the complete reproductive history of every woman aged 15–49. A specific variable on twin births is available in almost all datasets (see an extract of the questionnaire in Appendix B). Nevertheless, to guarantee the quality of this information, we created another variable entitled 'twin', using a matching method that considers the woman's identification number (ID) and the child's date of birth.

One hundred seventy-four surveys were analyzed, with data extracted and pooled from all. The data included deliveries in the 10 years preceding each survey (between t and t−10 years, where t is the survey year). This 10-year selection was made to compensate for the low annual number of twin births. A pooled sample of 2,479,385 deliveries was obtained, of which 44,035 were multiple births and 2,435,350 were single births. This pooled sample was used to estimate twinning rates using surveys, ethnic groups, countries, subregions, and an SSA-aggregated scale.

The analysis of factors associated with twin births was restricted to a survey period covering as many countries as possible (2000–2010). One survey per country was considered, with only those countries that collect information on ethnicity included, as this is a variable of interest in the analysis. The final subsample consisted of 25 surveys, encompassing 488,083 deliveries, 9160 multiple births, and 478,923 single births.

Additional data from the 2019 United Nations World Population Prospects (WPP; United Nations, Department of Economic and Social Affairs, Population Division, 2019) (https://population.un.org/wpp/) — specifically, the projections of deliveries by maternal age group — were used to draw up the projection of the twinning (only for the SSA-aggregated scale) up to 2050. The three main UN projection scenarios were considered: low fertility, medium fertility, and high fertility.

Statistical Analysis

The twinning rate was calculated by applying the following formula:

$$\text{Twinning rate} = \left(\frac{\textbf{Number of multiple births}}{\textbf{All births}}\right) * 1000$$

Given that the twinning rate depends on maternal age (Smits & Monden, 2011), it was standardized using the standard age distribution of births from women aged 15–49 in SSA, as provided by the United Nations, Department of Economic and Social Affairs, Population Division (2019).

A weighting was applied to estimate the twinning rate for all 42 countries and its distribution by subregion, considering the share (weight) of each country's births in the total births of the 42 countries.

As triplets and more are relatively uncommon (0.21 per 1000 in our data), they were included in the analysis alongside twin births.

Bivariate tabulations explored the unadjusted relationship between the response and each independent variable. Subsequently, a multivariate logistic regression was employed to construct an adjusted model. Logistic regression is a semi-parametric method that can be employed to identify the factors that influence the probability of having twins, assuming that all other variables are held constant. The response was a categorical variable indicating whether the delivery was a twin birth or not.

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The independent variables included *Maternal age, Birth order number, Maternal ethnic group, Household wealth quintile, African subregion,* and *Year of childbirth*. To ascertain which of the two factors, maternal age or birth order number, was the most strongly associated with twin births, we also evaluated their respective contributions to the model's parsimony.

The twinning rate projection method was straightforward and elementary. The twinning rate for each maternal age group (estimated from DHS and MICS) was multiplied by the projected number of deliveries (obtained from WPP) in that age group. Then, we calculated the projected number of twin births by maternal age group and subsequently determined the total projected number of twin births by country by summing these values. The number of twin births in the SSA region was estimated by aggregating the data from the 42 countries included in the study. The projected twinning rate is calculated by dividing the number of twin births by the total number of deliveries.

For each country, we assumed:

- p: the projection period
- G_{15-19}, G_{20-24}, …, G_{40-49}: the twinning rates by age group calculated from DHS and MICS
- N_{15-19}, N_{20-24}, …, N_{40-49}: projected births by age group from UN World Population Prospects
- TRp: the projected twinning rate for the period p.

$$TR_p = \frac{(G_{15-19} * N_{15-19}) + (G_{20-24} * N_{20-24}) + \ldots + (G_{40-49} * N_{40-49})}{(N_{15-19} + N_{20-24} + \ldots + N_{40-49})}$$

Results

Twinning Rate

The average standardized twinning rate for all 42 countries between 1986 and 2016 was 17.4 per 1000 (95% CI [17.2, 17.6]), with a median of 18.2 per 1000. The twinning rate is typically higher than the global (world) average of 11.3 per 1000 in 2010 (Pison et al., 2017), except for Madagascar (10.6 per 1000), Burundi (10.6 per 1000) and Somalia (5.5 per 1000). Benin is the African country with the highest twinning rate, estimated at more than 27 per 1000 (25–30). Table 1 presents the mean twinning rate by subregion in SSA. The twinning rate in West Africa is the highest, 20 per 1000 (19.5–20.1), while that in Southern Africa is the lowest, 13 per 1000 (12.1–13.7). Further details regarding the twinning rate by survey and country can be found in Appendix A. The map in Figure 2 also illustrates the mean twinning rates for each country and subregion. The region exhibiting the highest twinning rate is situated near the Gulf of Guinea, extending in a band traversing Africa from the Democratic Republic of the Congo in the west to Tanzania and Mozambique in the east.

Figure 3 illustrates the fluctuations in the twinning rate at the continental level and for each country over time (from 1986 to 2016). The observed trends differ according to the countries under consideration but appear relatively stable in almost all of these countries, starting in the 2000s.

Ethnic Variation in the Twinning Rate in SSA

Figure 4 illustrates the variability in the twinning rate across 102 ethnic groups in some countries in SSA for which the DHS and MICS collected data on ethnicity. These findings corroborate the existence of notable disparities in the twinning rate across different ethnic groups. However, the confidence intervals are large due to the limited number of twin births. The ethnic groups with the highest twinning rates (per 1000) are Fon (29) from Benin; Bamileke (28), Beti (27.6) and Grassfields (27.5) from Cameroon; Mbochi (28) and Teke (25) from Congo; 'Burkinabe' (28) of Cote d'Ivoire; Kota-Kele (30) from Gabon; Ewe (25) from Ghana; Balanta (25) from Guinea-Bissau; Tonga (27), Tumbuka (25) and Yao (25) from Malawi; Ndau (30) and Tswa (28.6) from Mozambique; Fulani (26) from Nigeria; Kuranko (26,4) and Kono (25,6) from Sierra Leone; Kabye (26) from Togo; Baganda (25) from Uganda; and Lunda (25,6) from Zimbabwe.

Table 1. Variation of the twinning rate by subregion in sub-Saharan Africa

Sub-regions	Twinning rate average (per 1000)	
	Standardized rate	95% CI
Classic grouping		
West Africa	19.8	19.5, 20.1
Central Africa	18.6	18.1, 19.1
East Africa	15.3	15.1, 15.5
Southern Africa	12.9	12.1, 13.7
Specific grouping[a]		
Gulf of Guinea	19.8	19.5, 20.1
Sahel	17.6	17.2, 18.0
East Africa	15.5	15.2, 15.8
Southern Africa and Madagascar	13.0	12.5, 13.5

Note: [a]Sahel: Burkina Faso, Mali, Mauritania, Niger, Senegal, Chad; Gulf of Guinea: Angola, Benin, Cameroon, Congo, Cote d'Ivoire, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Nigeria, DR Congo, Sao Tome, Sierra Leone, Togo; East Africa: Burundi, Comoros, Kenya, Malawi, Mozambique, Uganda, Rwanda, South Sudan, Tanzania, Zambia; Southern Africa and Madagascar: Lesotho, Madagascar, Namibia, Swaziland, Zimbabwe. Source: Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS); authors' calculation.

Twin Births Associated Factors in SSA

In our sample, 47% of births were from women under 25 years of age (Table 2), 43% were from women who had already given birth three or more times, nearly 50% were from women living in countries around the Gulf of Guinea, almost 50% were from women in the poorest or poorest squared households, and 32% were from women belonging to the aggregated ethnic Bantu group.

Bivariate analysis indicates that the primary factors associated with twinning are maternal age and birth order number. The twinning rate increases with maternal age until it reaches a maximum around 39–43 years of age, with a rate of approximately 32 per 1000 births. An independence test of Rao-Scott's chi-square demonstrates the association between maternal age (recoded into an age group) and twinning, with a p value less than .001. Similarly, a positive correlation was found between twinning rate and birth order number ($p < .001$). The rate is greater than 34 per 1000 for births at order 10 and above, compared to 8 per 1000 for first births.

The bivariate results also demonstrated associations between the twinning rate and other explanatory variables, including the country's geographical sub-region (p value $< .001$), the household wealth quintile (p value $= .02$) and the mother's ethnic group (p value $< .001$).

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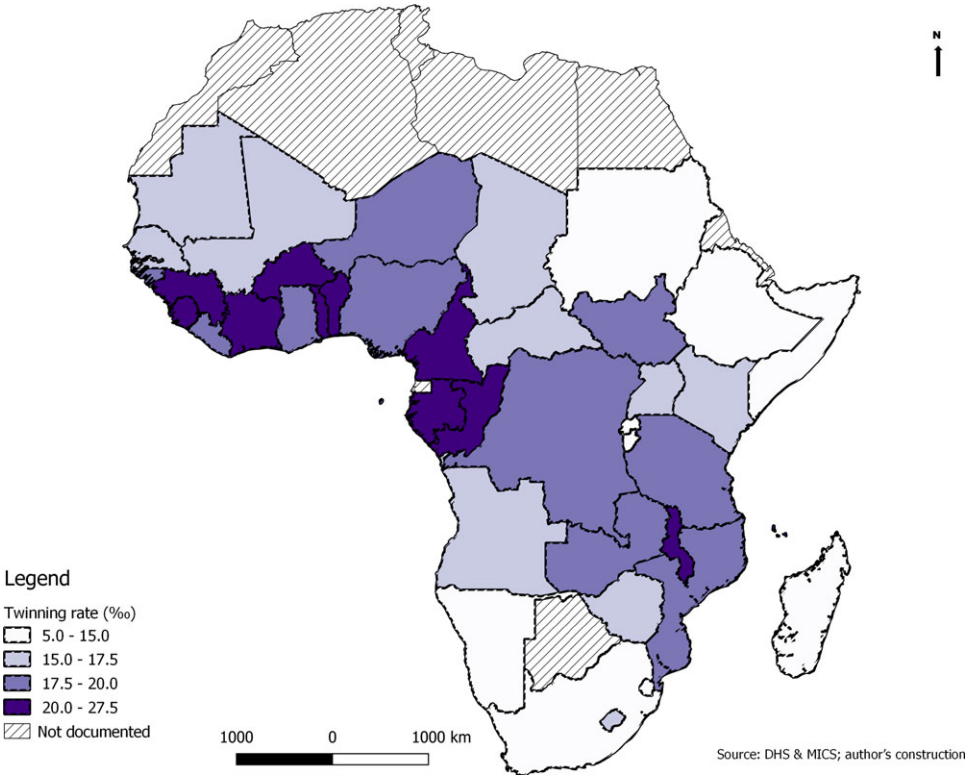

Figure 2. Map of the twinning rate[a] (average) in sub-Saharan Africa.
Note: [a]Maternal age-standardized twinning rates.

The logistic regression results (Table 2) demonstrate that assuming all other variables remain constant, the probability of giving birth to twins is significantly higher among older women, regardless of the birth order number. Compared to women aged 20–25, the likelihood of twin births is 1.16 times higher (p value < .01) among women in the 35 and over age group. Concerning the birth order number, the adjusted odds ratios indicate that the probability of twin births is 2.92 times higher (p value < .01) for births of the sixth order or higher than first births.

The influence of birth order number on the probability of twin births appears to be greater than that of maternal age, as evidenced by its higher odds ratio (OR) and its more significant contribution to lowering the Akaike information criterion (AIC) in the adjusted model.

For the remaining covariates, the probability of twin births is significantly higher among women belonging to the aggregated Bantu ethnic group compared to women from the following ethnic groups: Arabs and Related ($OR = 0.75$; $p < .001$), Fulani and Related ($OR = 0.82$; $p < .001$), Saharans ($OR = 0.66$; $p < .01$), Mandes ($OR = 0.84$; $p < .01$), and Ubangian-Adamaouans ($OR = 0.8$; $p < .05$). The probability of twin births increases with the household's wealth quintile. The following ORs are observed: 2nd quintile ($OR = 1.1$, $p < .01$); 3rd quintile ($OR = 1.15$, $p < .001$); 4th quintile ($OR = 1.17$, $p < .001$); 5th quintile ($OR = 1.2$, $p < .001$). Additionally, a high probability of twin births is observed in Gulf of Guinea countries ($OR = 1.3$, $p < .001$). Finally, there is a low positive correlation between twin births and the year of birth ($OR = 1.013$, $p < .01$), indicating a slight increase in the probability of a twin birth over time.

Projected Twinning Rate in SSA up to 2050

For aggregated SSA, our primary projections indicate that between 2015 and 2050, the twinning rate is not expected to change appreciably (Figure 5). The low-fertility scenario projects that between 2015 and 2050, the twinning rate in SSA will increase from 17.4 to 18.4 per 1000, representing a growth of less than 0.16% per year. Considering the medium-fertility scenario, the twinning rate in SSA is projected to increase from 17.4 per 1000 in 2015 to 18.1 per 1000 by 2050, representing an annual growth of only 0.11%. Concerning the high-fertility scenario, the twinning rate is anticipated to increase by approximately 0.08% annually between 2015 and 2050 (from 17.4 to 17.9 per 1000).

Discussion

Confirming the High Twinning Rate in Africa

This study corroborates the high twinning rates observed in SSA. The twinning rate of 17.4 per 1000 we found is consistent with the findings of other researchers, including Monden et al. (2021), Gebremedhin (2015), Smits and Monden (2011), and Pison (1992). The spatial variations observed are consistent with the results of previous studies, which have shown a higher rate of twin births around the Gulf of Guinea and in some central and eastern African countries, including Southern Sudan, Malawi, Mozambique, Comoros, Zambia, and Tanzania. Our study has also examined the temporal trends in the twinning rate. While Monden et al. (2021) and Smits and Monden (2011) have addressed this aspect, they have not done so systematically. This study has mobilized more national surveys for each country, enabling us to construct significant and robust trends. This approach allowed us to highlight the slow variation in the twinning rate in SSA. This slight variation could be explained by a kind of equilibrium resulting from the decline in the fertility rate (including births at older ages), which draws the twinning rate down, and a slow increase in the average maternal age, which slowly pulls the twinning rate upwards. If the decline in the fertility rate on the continent

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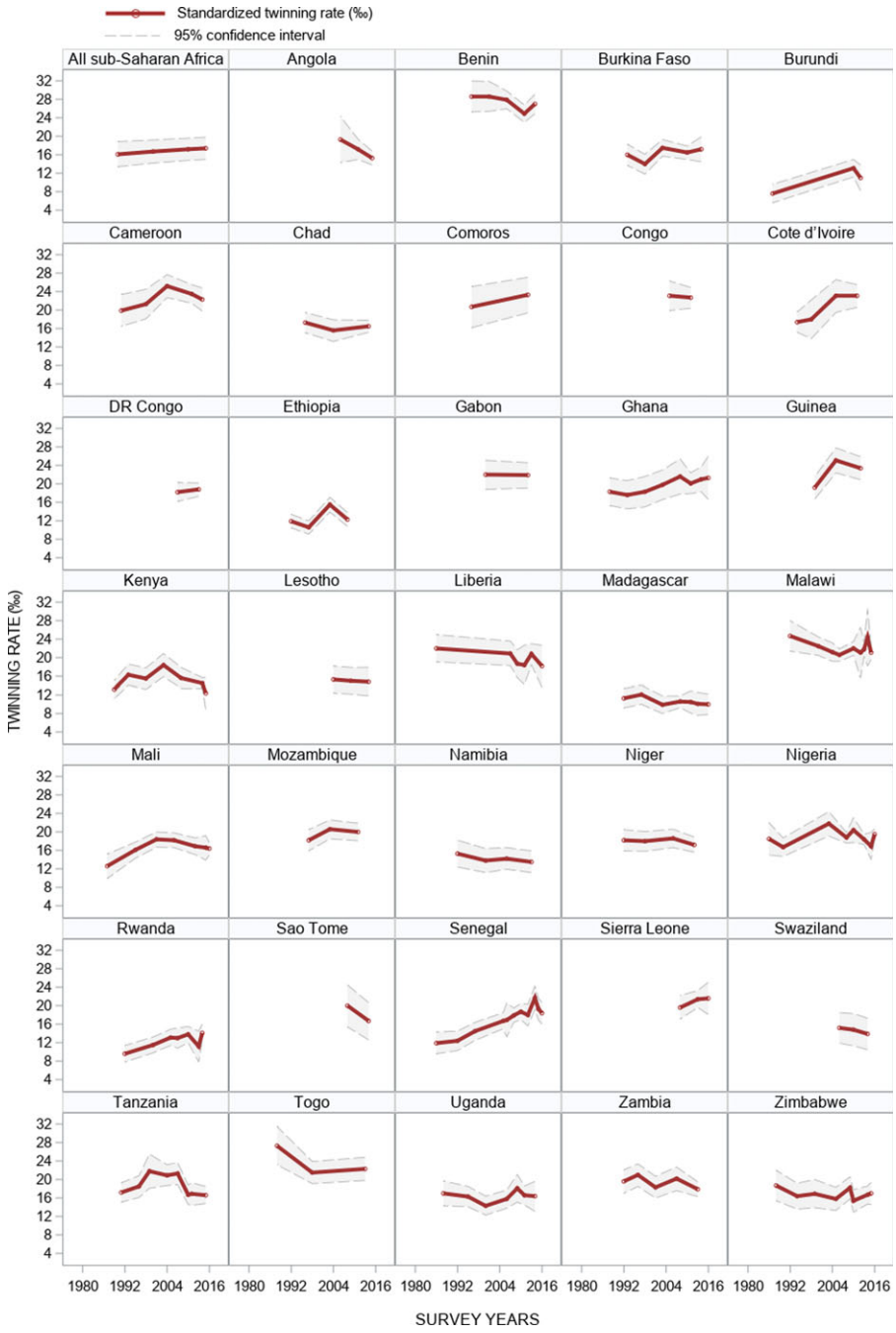

Figure 3. Trends of the standardized twinning rate in sub-Saharan African countries.
Source: Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS); authors' calculation.

outweighs the increase in the average age of motherhood, an absolute reduction in the twinning rate is expected in the coming years. MAR, which could increase the twinning rate, is limited to a small proportion of the sub-Saharan population and is unlikely to have affected the twinning rate (Bonnet, 2016).

Significant Variations in Twinning Rates by Ethnic Group in SSA

A significant disparity in the twinning rate has been observed between ethnic groups in SSA. While for some ethnic groups, the twinning rate aligns with the national rate, this is not the case for the following groups: the Bamileke, Beti and Grassfields (Cameroon); Mbochi (Congo); 'Burkinabe' (Cote d'Ivoire); Kota-Kele (Gabon); Ewe (Ghana); Balanta (Guinea-Bissau); Tonga (Malawi); Ndau and Tswa (Mozambique); Fulani (Nigeria); Kuranko and Kono (Sierra Leone); and Baganda (Zimbabwe). In comparison to the national rates, the twinning rates for these ethnic groups are significantly higher. Excepting West African countries, the majority of ethnic groups with high twinning rates belong to the Bantu ethnic group, which is one of the largest in Africa. Conversely, among the Biu-Mandara (from Cameroon), Somalis (from Kenya), and Makua (from Mozambique), the twinning rates observed were significantly lower than the national rates.

For example, our findings are consistent with Pollard (1996), who reported an extraordinarily high twinning rate among the Tumbuka from Malawi. However, our study did not find an exceptionally high twinning rate among the Yoruba of Nigeria.

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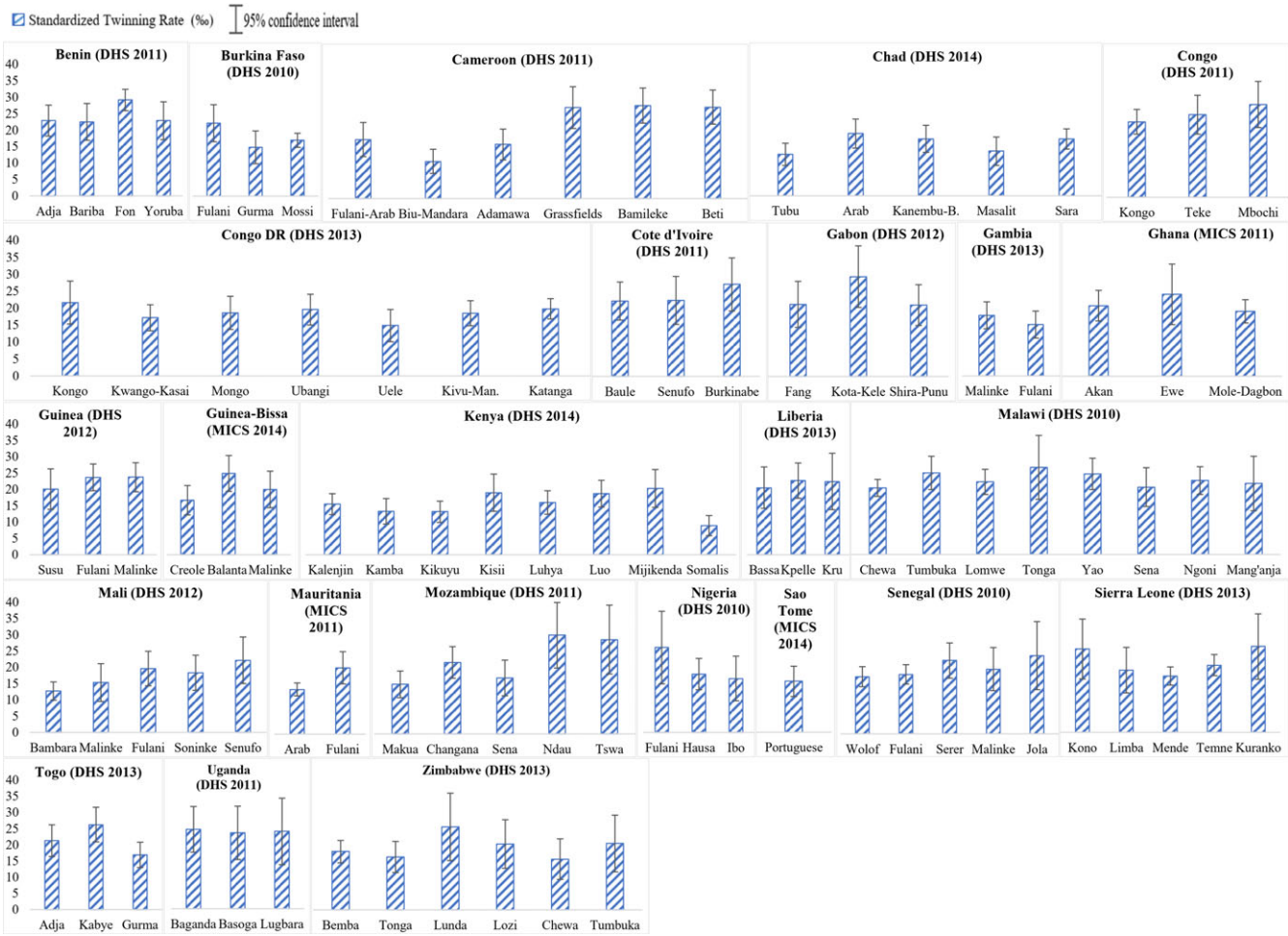

Figure 4. Variation in the standardized twinning rate by selected ethnic groups in some sub-Saharan African countries.
Source: Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS); authors' calculation.

This is in contrast to Nylander (1971). Nevertheless, this study has allowed us to examine the relationship between ethnicity and twinning rates in SSA more broadly than previously. Indeed, we conducted a comprehensive analysis of the variation in the twinning rate across 102 ethnic groups, whereas existing studies have focused on specific ethnic groups. However, it should be noted that SSA comprises over 2000 ethnic groups (Elamé, 2016), and therefore, our analysis was limited to the most represented ethnic groups in our data set. Additionally, it is important to acknowledge that almost half of the SSA countries no longer collect ethnicity information in their surveys. In light of the above, our approach has not exhausted the distribution of the twinning rate according to ethnic groups in SSA.

Researchers have put forth two principal explanations for the potential correlation between the probability of twin births and ethnicity. The first is genetic. There is evidence to suggest that women of certain ethnic groups may have a genetic predisposition to experiencing twin pregnancies. This was demonstrated by Bomsel-Helmreich and Al Mufti (2005) in their study of the Yoruba in Nigeria. The present study did not specifically address this issue due to the lack of consistent data. However, our findings that most ethnic groups with very high twinning rates belong to the large family of Bantu ethnicities could provide further evidence to support the genetic link hypothesis. The second reason given was the lifestyle, particularly dietary. In this context, Creinin and Keith (1989) identified a correlation between yam consumption and an elevated risk of twin pregnancies. Steinman (2017) highlighted the potential role of dairy products in this process. The authors posit that certain foods contain hormones that induce multiple ovulations. Whereas these studies offer a novel perspective, the high twinning rates observed in numerous ethnic groups across the continent do not confirm a specific dietary pattern as a causal factor in twin births. However, further investigation is needed to test this hypothesis, which was not the focus of our study.

Birth Order Number is a Leading Factor More Associated With Twin Births Than Maternal Age

Our findings indicate that the birth order number is the primary factor associated with twin births, in contrast to the maternal age observed by Couvert (2011) for France. It is postulated that the discrepancy between the results of this study and those of Couvert (2011) can be attributed to differences in the fertility rates of the countries under consideration. Given that fertility rates in SSA are three to four times higher than in France, it can be concluded that the birth order number is more strongly associated with the probability of twin births in countries with high fertility rates (Ouedraogo & Jean Simon, 2021). Nonetheless, the impact of the birth order number on the likelihood of twin births may be

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Table 2. Factors associated with twin births: A univariate, bivariate and multivariate analysis

	Number of births		Unadjusted *OR*		Adjusted *OR*	
Variables and modalities	*N*	%	*OR*	95% CI	*OR*	95% CI
Maternal age (in years; Median=25.4, Q1=20.9 and Q3=31.0)						
< 20	95,035	19.47	0.63***	0.574, 0.699	0.882 *	0.788, 0.987
20–25	137,139	28.10	Reference group			
25–30	114,618	23.48	1.408***	1.309, 1.514	1.115 **	1.030, 1.208
30–35	81,661	16.73	1.709***	1.583, 1.845	1.185 ***	1.078, 1.302
>= 35	59,630	12.22	1.803***	1.660, 1.958	1.159 **	1.040, 1.292
Birth order number (Median=order 3, Q1=order 2 and Q3=order 5)						
Order 1	104,992	21.51	Reference group			
Order 2	93,643	19.19	1.926***	1.730, 2.144	1.774***	1.582, 1.991
Order 3	79,125	16.21	2.297***	2.068, 2.551	2.006***	1.775, 2.267
Order 4	64,533	13.22	2.804***	2.521, 3.120	2.484***	2.181, 2.828
Order 5	49,666	10.18	3.077***	2.754, 3.438	2.587***	2.251, 2.973
Order 6 or more	96,124	19.69	3.506***	3.178, 3.869	2.917***	2.543, 3.346
Mother's ethnic group [b]						
Arab & related groups	22,083	4.52	0.792**	0.690, 0.910	0.749***	0.639, 0.878
Fulani & related groups	40,786	8.36	0.928	0.841, 1.025	0.821***	0.731, 0.921
Saharan groups	9,126	1.87	0.746*	0.587, 0.949	0.665**	0.515, 0.857
Sudanese groups	26,083	5.34	0.859*	0.753, 0.980	0.883	0.772, 1.011
Mande groups	54,326	11.13	0.943	0.861, 1.033	0.839**	0.752, 0.936
Voltaic groups	44,844	9.19	1.013	0.921, 1.114	0.905	0.807, 1.016
Ubangian-Adamaouans groups	17,903	3.67	0.890	0.744, 1.064	0.795*	0.66, 0.957
Atlantic groups	73,601	15.08	1.126**	1.042, 1.216	0.985	0.895, 1.084
Bantu groups	157,200	32.21	Reference group			
Other groups	42,131	8.63	0.960	0.960, 0.865	0.900*	0.805, 1.006
Wealth quintile[a]						
1st quintile	130,199	26.68	Reference group			
2nd quintile	108,734	22.28	1.099*	1.018, 1.186	1.107**	1.026, 1.195
3rd quintile	98,275	20.13	1.124**	1.038, 1.217	1.149***	1.061, 1.244
4th quintile	86,232	17.67	1.098*	1.011, 1.193	1.165***	1.071, 1.267
5th quintile	64,643	13.24	1.052	0.962, 1.151	1.200***	1.094, 1.315
Geographical area						
Sahel	121,196	24.83	1.002	0.929, 1.081	1.111*	1.000, 1.233
Gulf of Guinea	232,299	47.59	1.202***	1.126, 1.282	1.265***	1.161, 1.379
East Africa	134,588	27.57	Reference group			
Year of delivery (continuous variable)						
Year of delivery	488,083	100	1.020***	1.011, 1.029	1.013**	1.003, 1.022

Note: *OR*, odds ratio; CI, confidence Interval; ***p value < .001, **p value < .01, *p value < .05. [a]*The household wealth quintile employed in this study is based on the standardised wealth index, which permits comparisons across time and countries.* [b]The construction of these aggregated ethnic groups is an adaptation of a primary linguistic division (Malherbe, 2000) of the peoples of sub-Saharan Africa: http://www.cosmovisions.com/Afrique-Carte-Langues.htm Source: Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS); authors' calculation.

attributable to the fact that the genes that predispose mothers to higher fecundity are likely to be the same genes that predispose them to the occurrence of DZ twin births (Couvert, 2011; Mbarek et al., 2024).

The Twinning in SSA Will Probably not Increase Much by 2050

One of our study's original features is the twinning rate projection. However, this preliminary analysis demonstrated that in the optimal scenario (low fertility scenario), the twinning rate would

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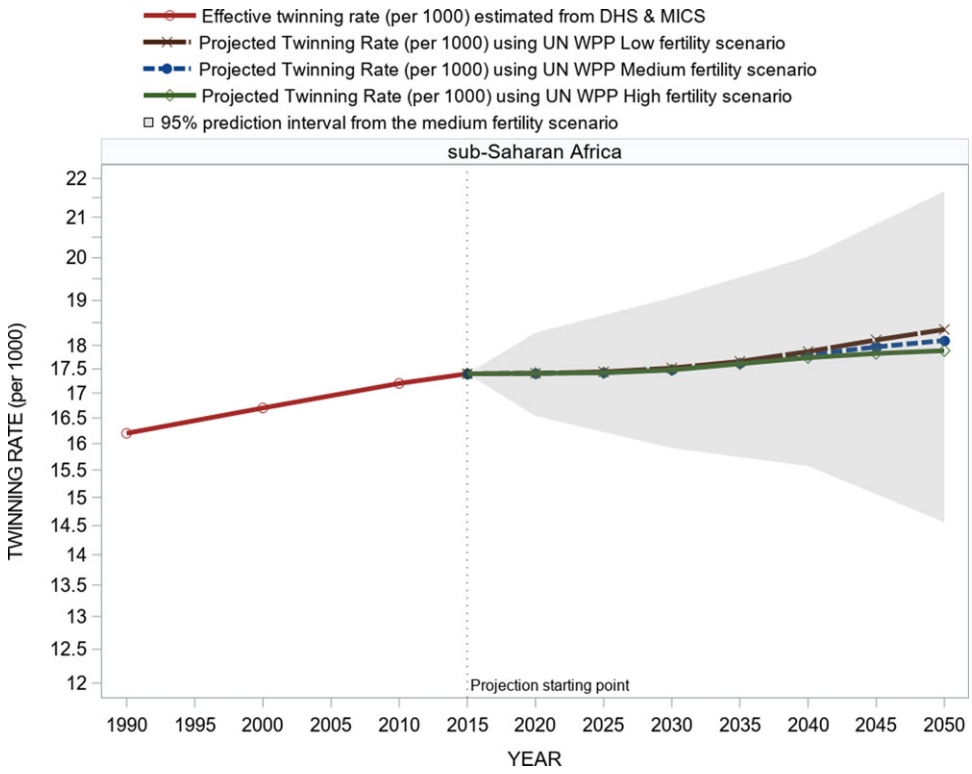

Figure 5. Projected Twinning Rate in sub-Saharan Africa.
Source: UN World Population Prospects, Demographic and Health Surveys (DHS), and Multiple Indicator Cluster Surveys (MICS); authors' calculation.

increase from 17.4 per 1000 in 2015 to 18.4 per 1000 in 2050. The observation that the low fertility scenario predicts higher growth in the twinning rate than the other projection scenarios is intriguing. A reduction in fertility at both younger and older ages is anticipated under low fertility scenarios, with the decline being more pronounced at younger ages. This will result in a reconfiguration of the maternal age structure, with the average age at childbirth increasing slightly, thereby exerting a slight growth effect on the twinning rate. It should be noted, however, that this projection does not consider the potential expansion of MAR on the continent.

The World Population Prospects (WPP) considers changes in the maternal age structure but does not incorporate assumptions about the possible expansion of MAR in SSA, which is an essential factor in the future dynamics of the twinning rate. The effective utilization of MAR by 2050 would significantly increase the projected twinning rate, exceeding the predicted levels. However, by 2050, it remains to be seen whether MAR will expand to such an extent in SSA that it will significantly impact the twinning rate. Given the statistics on MAR on the continent, this possibility seems unlikely to become a reality. Indeed, Dyer, Archer et al. (2019), Dyer, Chambers et al. (2016) and the ICMART (International Committee for Monitoring Assisted Reproductive Technologies) have demonstrated that Africa recorded fewer than 2000 pregnancies resulting from MAR in 2010. Concurrently, our projections indicate that an average of 260 million births per year is anticipated in SSA by 2050, including approximately 4.7 million twin births per year. Consequently, even if we assume that 500,000 births will result from MAR pregnancies by 2050, this will not alter the projected twinning rate by 2050.

The conclusions drawn in this study regarding the projected twinning rate on a continental scale by the year 2050 are consistent with those previously outlined by Lee and Barclay (2025). By extending the projection to the year 2100, these authors have underscored the potential for substantial increases in the twinning rate in certain countries, including Benin, Malawi, Mozambique, Niger, Nigeria, and Togo. However, it is essential to note that projections of the twinning rate at the country level and over a prolonged period (to 2100) are potentially unreliable. Consequently, in this study, we have opted to estimate the twinning rate on a continental scale and have limited our analysis to the year 2050. Still, the findings of Lee and Barclay (2025) and the results of this article are in accordance with the conclusion that if there is to be a substantial increase in the twinning rate in SSA in the forthcoming decades, it will be attributable to the combined impact of two factors: the extensive recourse to MAR and the maintenance of fertility at relatively high levels with an increase in late motherhood.

Conclusion

Given the high prevalence of twin births in the region, this study's findings can potentially inform health policies in SSA. The increased fragility of twin children, due to their lower birth weight and higher frequency of prematurity, poses significant obstetric challenges and contributes to elevated risks of foetal and neonatal mortality. It is, therefore, crucial to implement effective monitoring strategies for pregnancies in large multiparous women, with the aim of early diagnosis and prevention of multiple pregnancies and their associated adverse outcomes. This health challenge was analyzed in another article that addressed the excess mortality among twins in SSA.

Limitations

The key limitation of this study is the potential for reliability issues in the data utilized, with the DHS not accounting for stillbirths, which could lead to an underestimation of twin births due to the heightened probability of stillbirth in twin pregnancies. However, extant studies have concluded that this bias's impact is negligible or limited. Another potential source of reliability in DHS data related

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to twins is the existence of voluntary under-reporting of twin births by some families, either because they have ambivalent or negative perceptions of twins or because they do not want to evoke painful memories related to the (more frequent) death of their twin babies.

Added Value of this Study

The principal contribution of this work concerns its geographical scope, in that it reports on the level and evolution of the twinning rate in 42 countries, thus providing a broad 'geographical view' and allowing for various comparisons (e.g., ethnic groups, countries, subregions). A notable strength of the study lies in its extensive coverage of twinning rates across a diverse array of 102 sub-Saharan ethnic groups, a feat that is particularly significant given the paucity of studies that have hitherto focused on such a wide range of ethnic groups in the region. Furthermore, the study's (summary) projections of the twinning rate in SSA by the year 2050 represent a new and valuable addition to the existing body of knowledge on the subject.

Note

[1] The 48 countries in sub-Saharan Africa, with the exception of Botswana, Cape Verde, Equatorial Guinea, Eritrea, Mauritius and Seychelles, for which no survey was available.

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Appendix A. Twinning rate in 42 countries of sub-Saharan Africa — Data: standard Demographic and Health Surveys (DHS), Malaria Indicators Survey (MIS), AIDS Indicator Survey (AIS) and Multiple Indicator Cluster Surveys (MICS)

Country	Survey years	The period used for rates calculation	Data source	All births	Twin births	Twinning rate (per 1000) and 95% Confidence interval (CI)				Country average standardised rate (per 1000)[b]	
						Crude rate[c]	95% CI	Standardised rate[d]	95% CI	Rate	95% CI
Angola	2015–16	2006–2015	Standard DHS	25,131	369	**14.7**	13.2, 16.2	**15.3**	13.8, 16.8	**17.3**	14.4, 20.2
	2011	2002–2011	MIS DHS	13,832	223	**16.1**	14.0, 18.2	**17.2**	15.0, 19.4		
	2006–07	2001–2007*	MIS DHS	2,878	54	**18.8**	13.8, 23.8	**19.3**	14.3, 24.3		
Benin	2014	2005–2014	MICS UNICEF	23,624	657	**27.8**	25.7, 29.9	**27.0**	24.9, 29.1	**27.4**	24.9, 29.9
	2011–12	2002–2011	Standard DHS	25,681	640	**24.9**	23.0, 26.8	**24.9**	23.0, 26.8		
	2006	1997–2006	Standard DHS	30,027	841	**28.0**	26.1, 29.9	**27.9**	26.0, 29.8		
	2001	1992–2001	Standard DHS	10,093	292	**28.9**	25.6, 32.2	**28.6**	25.4, 31.9		
	1996	1987–1996	Standard DHS	9,758	288	**29.5**	26.1, 32.9	**28.6**	25.3, 32.0		
Burkina Faso	2014	2008–2014*	MIS DHS	8,703	150	**17.2**	14.5, 19.9	**17.2**	14.5, 19.9	**20.3**	14.1, 18.3
	2010	2001–2010	Standard DHS	28,956	531	**18.3**	16.8, 19.8	**16.5**	15.0, 17.9		
	2003	1994–2003	Standard DHS	20,848	372	**17.8**	16.0, 19.6	**17.5**	15.7, 19.3		
	1998–99	1989–1998	Standard DHS	11,568	164	**14.2**	12.0, 16.4	**14.0**	11.8, 16.1		
	1993	1984–1993	Standard DHS	11,196	175	**15.6**	13.3, 17.9	**16.0**	13.7, 18.3		
Burundi	2012	2006–2012*	MIS DHS	5,466	61	**11.2**	8.4, 14.0	**11.0**	8.2, 13.8	**10.6**	8.3, 12.8
	2010	2001–2010	Standard DHS	13,776	182	**13.2**	11.3, 15.1	**13.1**	11.2, 15.0		
	1987	1978–1987	Standard DHS	7,055	57	**8.1**	6.0, 10.2	**7.6**	5.6, 9.6		
Cameroon	2014	2005–2014	MICS UNICEF	13,839	303	**21.9**	19.5, 24.3	**22.3**	19.8, 24.8	**21.4**	19.7, 25.2
	2011	2002–2011	Standard DHS	21,680	492	**22.7**	20.7, 24.7	**23.5**	21.5, 25.5		
	2004	1995–2004	Standard DHS	14,860	351	**23.6**	21.2, 26.0	**25.2**	22.7, 27.7		
	1998	1989–1998	Standard DHS	7,700	157	**20.4**	17.2, 23.6	**21.3**	18.1, 24.5		
	1991	1982–1991	Standard DHS	6,276	117	**18.6**	15.3, 21.9	**19.9**	16.5, 23.4		
Centrafrica	1994–95	1985–1994	Standard DHS	9,186	130	**14.2**	11.8, 16.6	**15.4**	12.9, 17.9	**15.4**	12.9, 17.9
Chad	2014–15	2005–2014	Standard DHS	37,372	579	**15.5**	14.2, 16.8	**16.5**	15.2, 17.8	**16.5**	14.5, 18.4
	2004	1995–2004	Standard DHS	10,967	164	**15.0**	12.7, 17.3	**15.6**	13.2, 17.9		
	1996–97	1987–1996	Standard DHS	13,938	227	**16.3**	14.2, 18.4	**17.3**	15.1, 19.5		
Comoros	2012	2003–2012	Standard DHS	5,967	144	**24.1**	20.2, 28.0	**23.3**	19.4, 27.1	**22.0**	17.8, 26.1
	1996	1987–1996	Standard DHS	3,922	82	**20.9**	16.4, 25.4	**20.7**	16.2, 25.1		
Congo	2011–12	2002–2011	Standard DHS	16,804	375	**22.3**	20.1, 24.5	**22.7**	20.4, 24.9	**22.9**	20.2, 25.6
	2005	1996–2005	Standard DHS	8,597	194	**22.6**	19.5, 25.7	**23.1**	19.9, 26.3		
Congo DR	2013–14	2004–2013	Standard DHS	33,620	628	**18.7**	17.3, 20.1	**18.8**	17.3, 20.2	**18.5**	16.8, 20.3
	2007	1998–2007	Standard DHS	16,144	293	**18.1**	16.0, 20.2	**18.2**	16.2, 20.3		
Cote d'Ivoire	2011–12	2002–2011	Standard DHS	14,503	326	**22.5**	20.1, 24.9	**23.1**	20.6, 25.5	**20.4**	17.3, 23.5
	2005	1996–2005	AIS DHS	6,814	145	**21.3**	17.9, 24.7	**23.1**	19.5, 26.6		
	1998–99	1989–1998	Standard DHS	3,818	66	**17.3**	13.2, 21.4	**18.0**	13.8, 22.2		
	1994	1985–1994	Standard DHS	13,472	222	**16.5**	14.3, 18.7	**17.4**	15.2, 19.6		
Ethiopia	2008	1999–2008	Standard DHS	21,201	266	**12.5**	11.0, 14.0	**12.3**	10.8, 13.8	**12.6**	11.1, 14.0
	2003	1994–2003	Standard DHS	23,221	359	**15.5**	13.9, 17.1	**15.5**	13.9, 17.1		
	1997	1988–1997	Standard DHS	19,955	204	**10.2**	8.8, 11.6	**10.6**	9.1, 12.0		
	1992	1983–1992	Standard DHS	21,329	257	**12.0**	10.5, 13.5	**11.9**	10.5, 13.4		

(*Continued*)

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(*Continued*)

Country	Survey years	The period used for rates calculation	Data source	All births	Twin births	Twinning rate (per 1000) and 95% Confidence interval (CI)				Country average standardised rate (per 1000)[b]	
						Crude rate[c]	95% CI	Standardised rate[d]	95% CI	Rate	95% CI
Gabon	2012	2003–2012	Standard DHS	10,885	228	**20.9**	18.2, 23.6	**21.9**	19.1, 24.6	**21.9**	19.0, 24.9
	2000	1991–2000	Standard DHS	8,230	169	**20.5**	17.4, 23.6	**22.0**	18.8, 25.1		
Gambia	2013	2004–2013	Standard DHS	14,699	236	**16.1**	14.1, 18.1	**16.1**	14.1, 18.1	**16.1**	14.1, 18.1
Ghana	2016	2011–2016*	MIS DHS	3,649	82	**22.5**	17.7, 27.3	**21.3**	16.6, 26.0	**19.7**	16.5, 23
	2014	2005–2014	Standard DHS	11,111	249	**22.4**	19.6, 25.2	**21.0**	18.3, 23.7		
	2011	2002–2011	MICS UNICEF	14,830	336	**22.7**	20.3, 25.1	**20.1**	17.9, 22.4		
	2008	1999–2008	Standard DHS	5,702	128	**22.4**	18.6, 26.2	**21.6**	17.8, 25.4		
	2003	1994–2003	Standard DHS	7,269	152	**20.9**	17.6, 24.2	**19.8**	16.6, 23.0		
	1998	1989–1998	Standard DHS	6,427	123	**19.1**	15.8, 22.4	**18.3**	15.0, 21.6		
	1993	1984–1993	Standard DHS	7,045	126	**17.9**	14.8, 21.0	**17.6**	14.6, 20.7		
	1988	1979–1988	Standard DHS	7,544	139	**18.4**	15.4, 21.4	**18.3**	15.3, 21.3		
Guinea	2012	2003–2012	Standard DHS	13,696	307	**22.4**	19.9, 24.9	**23.4**	20.9, 25.9	**22.5**	20, 25.1
	2005	1996–2005	Standard DHS	12,940	326	**25.2**	22.5, 27.9	**25.1**	22.4, 27.8		
	1999	1990–1999	Standard DHS	11,784	223	**18.9**	16.4, 21.4	**19.2**	16.7, 21.6		
Guinea-Bissau	2014	2005–2014	MICS UNICEF	14,373	262	**18.2**	16.0, 20.4	**18.4**	16.2, 20.6	**18.4**	16.2, 20.6
Kenya	2015	2010–2015*	MIS DHS	3,962	46	**11.6**	8.3, 14.9	**12.4**	8.9, 15.8	**15.1**	12.9, 17.4
	2014	2005–2014	Standard DHS	41,973	599	**14.3**	13.2, 15.4	**14.5**	13.4, 15.7		
	2008–09	1999–2008	Standard DHS	11,392	172	**15.1**	12.9, 17.3	**15.6**	13.4, 17.9		
	2003	1994–2003	Standard DHS	10,866	186	**17.1**	14.7, 19.5	**18.4**	15.9, 20.9		
	1998	1989–1998	Standard DHS	11,026	166	**15.1**	12.8, 17.4	**15.5**	13.2, 17.8		
	1993	1984–1993	Standard DHS	12,175	193	**15.9**	13.7, 18.1	**16.3**	14.1, 18.6		
	1989	1980–1989	Standard DHS	13,292	173	**13.0**	11.1, 14.9	**13.2**	11.2, 15.1		
Lesotho	2014	2005–2014	Standard DHS	5,906	80	**13.5**	10.6, 16.4	**14.8**	11.8, 17.9	**15.1**	12.1, 18
	2009	2000–2009	Standard DHS	7,095	98	**13.8**	11.1, 16.5	**15.0**	12.2, 17.9		
	2004	1995–2004	Standard DHS	6,828	101	**14.8**	11.9, 17.7	**15.3**	12.4, 18.2		
Liberia	2016	2011–2016*	MIS DHS	3,314	58	**17.5**	13.0, 22.0	**18.2**	13.6, 22.7	**19.8**	16.6, 23.1
	2013	2004–2013	Standard DHS	15,146	307	**20.3**	18.1, 22.5	**20.8**	18.5, 23.0		
	2011	2004–2011*	MIS DHS	3,848	69	**17.9**	13.7, 22.1	**18.4**	14.2, 22.7		
	2009	2000–2009	MIS DHS	7,705	140	**18.2**	15.2, 21.2	**18.7**	15.7, 21.7		
	2007	1998–2007	Standard DHS	10,914	225	**20.6**	17.9, 23.3	**20.9**	18.3, 23.6		
	1986	1977–1986	Standard DHS	9,670	201	**20.8**	18.0, 23.6	**22.0**	19.1, 25.0		
Madagascar	2016	2011–2016*	MIS DHS	7,555	72	**9.5**	7.3, 11.7	**10.0**	7.8, 12.2	**10.6**	8.6, 12.7
	2013	2007–2013*	MIS DHS	6,319	64	**10.1**	7.6, 12.6	**10.1**	7.6, 12.6		
	2011	2004–2011*	MIS DHS	6,908	72	**10.4**	8.0, 12.8	**10.5**	8.1, 12.9		
	2008–09	1999–2008	Standard DHS	24,887	255	**10.2**	9.0, 11.4	**10.6**	9.3, 11.8		
	2003–04	1994–2003	Standard DHS	10,595	100	**9.4**	7.6, 11.2	**9.9**	8.0, 11.8		
	1997	1988–1997	Standard DHS	11,268	131	**11.6**	9.6, 13.6	**12.1**	10.0–14.1		
	1992	1983–1992	Standard DHS	9,794	112	**11.4**	9.3, 13.5	**11.3**	9.2, 13.4		
Malawi	2015–16	2006–2015	Standard DHS	33,738	683	**20.2**	18.7, 21.7	**21.1**	19.6, 22.7	**22.2**	19.4, 24.9
	2014	2008–2014*	MIS DHS	2,380	50	**21**	15.2, 26.8	**24.4**	18.2, 30.6		
	2013	2004–2013	MICS UNICEF	37,508	769	**20.5**	19.1, 21.9	**21.8**	20.3, 23.3		
	2012	2005–2012	MIS DHS	2,618	54	**20.6**	15.2, 26.0	**21.1**	15.6, 26.6		
	2010	2001–2010	Standard DHS	37,823	791	**20.9**	19.5, 22.3	**22.0**	20.5, 23.5		

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Country	Survey years	The period used for rates calculation	Data source	All births	Twin births	Twinning rate (per 1000) and 95% Confidence interval (CI)				Country average standardised rate (per 1000)[b]	
						Crude rate[c]	95% CI	Standardised rate[d]	95% CI	Rate	95% CI
	2006	1997–2006	MICS UNICEF	44,683	853	**19.1**	17.8, 20.4	**20.6**	19.2, 21.9		
	2004	1995–2004	Standard DHS	19,444	380	**19.5**	17.6, 21.4	**21.2**	19.2, 23.2		
	2000	1991–2000	Standard DHS	21,437	453	**21.1**	19.2, 23.0	**22.5**	20.5, 24.5		
	1992	1983–1992	Standard DHS	8,489	203	**23.9**	20.7, 27.1	**24.7**	21.4, 28.0		
Mali	2015b	2006–2015	MICS UNICEF	31,795	518	**16.3**	14.9, 17.7	**16.4**	15.0, 17.7	**16.4**	14.5–18.4
	2015a	2009–2015*	MIS DHS	8,942	145	**16.2**	13.6, 18.8	**16.6**	13.9, 19.2		
	2012–13	2003–2012	Standard DHS	19,540	315	**16.1**	14.3, 17.9	**16.9**	15.1, 18.7		
	2006	1997–2006	Standard DHS	27,486	481	**17.5**	15.9, 19.1	**18.2**	16.6, 19.8		
	2001	1992–2001	Standard DHS	25,523	456	**17.9**	16.3, 19.5	**18.4**	16.7, 20.0		
	1995–96	1986–1995	Standard DHS	19,958	315	**15.8**	14.1, 17.5	**16.1**	14.3, 17.8		
	1987	1978–1987	Standard DHS	6,684	78	**11.7**	9.1, 14.3	**12.6**	9.9, 15.2		
Mauritania	2011	2002–2011	MICS UNICEF	18,049	287	**15.9**	14.8, 17.0	**15.3**	13.6, 17.2	**15.3**	13.6, 17.2
Mozambique	2011	2002–2011	Standard DHS	20,187	385	**19.1**	17.2, 21.0	**20.0**	18.1, 21.9	**19.6**	17.5, 21.7
	2003	1994–2003	Standard DHS	19,292	373	**19.3**	17.4, 21.2	**20.6**	18.5, 22.6		
	1997	1988–1997	Standard DHS	13,207	229	**17.3**	15.1, 19.5	**18.2**	15.9, 20.5		
Namibia	2013	2004–2013	Standard DHS	9,253	127	**13.7**	11.3, 16.1	**13.5**	11.2, 15.9	**14.2**	11.7, 16.8
	2006–07	1997–2006	Standard DHS	9,715	134	**13.8**	11.5, 16.1	**14.2**	11.9, 16.6		
	2000	1991–2000	Standard DHS	7,637	104	**13.6**	11.0, 16.2	**13.8**	11.2, 16.4		
	1992	1983–1992	Standard DHS	7,093	110	**15.5**	12.6, 18.4	**15.3**	12.4, 18.2		
Niger	2012	2003–2012	Standard DHS	24,602	417	**16.9**	15.3, 18.5	**17.2**	15.6, 18.9	**18.0**	16.0, 20.0
	2006	1997–2006	Standard DHS	18,200	329	**18.1**	16.2, 20.0	**18.6**	16.6, 20.6		
	1998	1989–1998	Standard DHS	15,067	262	**17.4**	15.3, 19.5	**18.0**	15.8, 20.1		
	1992	1983–1992	Standard DHS	13,187	222	**16.8**	14.6, 19.0	**18.2**	15.9, 20.5		
Nigeria	2016–17	2007–2016	MICS UNICEF	54,030	1,072	**19.8**	18.6, 21.0	**19.5**	18.3, 20.7	**19.8**	16.7, 21.0
	2015	2010–2015*	MIS DHS	7,507	125	**16.7**	13.8, 19.6	**16.9**	14.0, 19.9		
	2013	2004–2013	Standard DHS	60,142	1,119	**18.6**	17.5, 19.7	**18.4**	17.3, 19.5		
	2010	2001–2010	MIS DHS	10,608	215	**20.3**	17.6, 23.0	**20.4**	17.7, 23.1		
	2008	1999–2008	Standard DHS	54,141	1,007	**18.6**	17.5, 19.7	**18.8**	17.6, 19.9		
	2003	1994–2003	Standard DHS	11,250	236	**21.0**	18.4, 23.6	**21.8**	19.1, 24.4		
	1990	1981–1990	Standard DHS	15,491	251	**16.2**	14.2, 18.2	**16.7**	14.7, 18.7		
	1986	1977–1986	Special–Ondo	5,619	111	**19.8**	16.2, 23.4	**18.5**	15.0, 22.0		
Rwanda	2014–15	2005–2014	Standard DHS	15,579	226	**14.5**	12.6, 16.4	**14.1**	12.3, 16.0	**12.3**	10.3, 14.4
	2013	2007–2013*	MIS DHS	3,797	48	**12.6**	9.1, 16.1	**11.2**	7.8, 14.5		
	2010	2001–2010	Standard DHS	17,220	250	**14.5**	12.7, 16.3	**13.8**	12.0, 15.5		
	2007–08	1998–2007	Interim DHS	10,095	146	**14.5**	12.2, 16.8	**13.0**	10.8, 15.2		
	2005	1996–2005	Standard DHS	16,295	229	**14.1**	12.3, 15.9	**13.1**	11.4, 14.9		
	2000	1991–2000	Standard DHS	14,567	186	**12.8**	11.0, 14.6	**11.5**	9.8, 13.2		
	1992	1983–1992	Standard DHS	10,877	109	**10.0**	8.1, 11.9	**9.6**	7.8, 11.4		
Sao Tome	2014	2005–2014	MICS UNICEF	3,773	60	**15.9**	11.9, 19.9	**16.7**	12.6, 20.7	**18.3**	14.0, 22.6
	2008–09	1999–2008	Standard DHS	3,608	70	**19.4**	14.9, 23.9	**20.0**	15.4, 24.5		
Senegal	2016	1997–2016	Continuous	12,686	235	**18.5**	16.2, 20.8	**18.4**	16.0, 20.7	**17.0**	14.7, 19.2
	2015	2006–2015	Continuous	13,065	256	**19.6**	17.2, 22.0	**19.3**	16.9, 21.6		
	2014	2005–2014	Continuous	12,490	271	**21.7**	19.1, 24.3	**21.7**	19.2, 24.3		
	2012–13	2003–2012	Continuous	12,515	225	**18.0**	15.7, 20.3	**18.0**	15.6, 20.3		

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Country	Survey years	The period used for rates calculation	Data source	All births	Twin births	Twinning rate (per 1000) and 95% Confidence interval (CI)				Country average standardised rate (per 1000)[b]	
						Crude rate[c]	95% CI	Standardised rate[d]	95% CI	Rate	95% CI
	2010–11	2001–2010	Standard DHS	22,823	428	**18.8**	17.0, 20.6	**18.7**	17.0, 20.5		
	2008–09	1999–2008	MIS DHS	28,686	504	**17.6**	16.1, 19.1	**17.9**	16.4, 19.5		
	2006	2001–2006*	MIS DHS	4,727	81	**17.1**	13.4, 20.8	**16.9**	13.2, 20.6		
	2005	1996–2005	Standard DHS	20,524	348	**17.0**	15.2, 18.8	**16.7**	15.0, 18.5		
	1997	1988–1997	Standard DHS	14,354	212	**14.8**	12.8, 16.8	**14.5**	12.5, 16.4		
	1992–93	1983–1992	Standard DHS	10,906	138	**12.7**	10.6, 14.8	**12.4**	10.3, 14.5		
	1986	1977–1986	Standard DHS	8,148	93	**11.4**	9.1, 13.7	**11.9**	9.6, 14.3		
Sierra Leone	2016	2011–2016*	MIS DHS	6,742	145	**21.5**	18.0, 25.0	**21.6**	18.1, 25.1	**20.9**	18.3, 23.5
	2013	2004–2013	Standard DHS	23,750	499	**21.0**	19.2, 22.8	**21.4**	19.6, 23.3		
	2008	1999–2008	Standard DHS	11,241	211	**18.8**	16.3, 21.3	**19.6**	17.1, 22.2		
Somalia	2006	1997–2006	MICS UNICEF	12,581	69	**5.5**	4.2, 6.8	**5.5**	4.2, 6.7	**5.5**	4.2, 6.7
South Africa	1998	1989–1998	Standard DHS	10,287	131	**12.7**	10.5, 14.9	**12.7**	10.6, 14.9	**12.7**	10.6, 14.9
Sudan	1989–90	1980–1989	Standard DHS	12,959	195	**15.0**	12.9, 17.1	**15.0**	12.9, 17.1	**15.0**	12.9, 17.1
Sud Sudan	2010	2001–2010	MICS UNICEF	17,401	342	**19.7**	17.6, 21.8	**19.9**	17.8, 22.0	**19.9**	17.8, 22.0
Swaziland	2014	2005–2014	MICS UNICEF	4,571	60	**13.1**	9.8, 16.4	**13.9**	10.5, 17.3	**14.7**	11.3, 18.1
	2010	2001–2010	MICS UNICEF	4,603	63	**13.7**	10.3, 17.1	**14.8**	11.3, 18.3		
	2006–07	1997–2006	Standard DHS	5,269	75	**14.2**	11.0, 17.4	**15.2**	11.9, 18.5		
Tanzania	2015–16	2006–2015	Standard DHS	18,852	315	**16.7**	14.9, 18.5	**16.6**	14.8, 18.5	**18.7**	16.3, 21.1
	2011–12	2004–2012	AIS DHS	10,825	186	**17.2**	14.8, 19.6	**16.9**	14.4, 19.3		
	2010	2001–2010	Standard DHS	14,841	249	**16.8**	14.7, 18.9	**16.7**	14.6, 18.8		
	2007–08	1998–2007	AIS DHS	13,728	293	**21.3**	18.9, 23.7	**21.3**	18.9, 23.7		
	2004–05	1995–2004	Standard DHS	15,619	322	**20.6**	18.4, 22.8	**20.9**	18.7, 23.2		
	1999	1990–1999	Standard DHS	6,022	127	**21.1**	17.5, 24.7	**21.8**	18.1, 25.5		
	1996	1987–1996	Standard DHS	12,687	231	**18.2**	15.9, 20.5	**18.5**	16.1, 20.8		
	1991–92	1982–1991	Standard DHS	14,849	246	**16.6**	14.5, 18.7	**17.2**	15.1, 19.3		
Togo	2013–14	2004–2013	Standard DHS	13,594	311	**22.9**	20.4, 25.4	**22.3**	19.8, 24.8	**23.7**	20.7, 26.7
	1998	1989–1998	Standard DHS	13,755	306	**22.2**	19.7, 24.7	**21.5**	19.1, 23.9		
	1988	1979–1988	Standard DHS	5,853	158	**27.0**	22.8, 31.2	**27.3**	23.2, 31.5		
Uganda	2014–15	2008–2015*	MIS DHS	5,930	91	**15.3**	12.2, 18.4	**16.4**	13.1, 19.6	**16.3**	13.9, 18.8
	2011	2002–2011	Standard DHS	14,829	242	**16.3**	14.3, 18.3	**16.6**	14.5, 18.6		
	2009	2000–2009	MIS DHS	7,398	129	**17.4**	14.4, 20.4	**18.1**	15.1, 21.1		
	2006	1997–2006	Standard DHS	15,725	241	**15.3**	13.4, 17.2	**15.8**	13.8, 17.7		
	2000–01	1991–2000	Standard DHS	13,021	176	**13.5**	11.5, 15.5	**14.3**	12.3, 16.4		
	1995	1986–1995	Standard DHS	12,858	195	**15.2**	13.1, 17.3	**16.3**	14.1, 18.5		
	1988–89	1980–1989	Standard DHS	8,858	143	**16.1**	13.5, 18.7	**17.0**	14.3, 19.7		
Zambia	2013–14	2004–2013	Standard DHS	25,653	444	**17.3**	15.7, 18.9	**17.9**	16.3, 19.5	**19.4**	17.1, 21.7
	2007	1998–2007	Standard DHS	11,543	223	**19.3**	16.8, 21.8	**20.2**	17.6–22.7		
	2001–02	1992–2001	Standard DHS	12,623	217	**17.2**	14.9, 19.5	**18.3**	16.0, 20.7		
	1996	1987–1996	Standard DHS	12,906	255	**19.8**	17.4, 22.2	**21.0**	18.5, 23.4		
	1992	1983–1992	Standard DHS	11,572	213	**18.4**	16.0, 20.8	**19.6**	17.0, 22.1		

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Country	Survey years	The period used for rates calculation	Data source	All births	Twin births	Twinning rate (per 1000) and 95% Confidence interval (CI)				Country average standardised rate (per 1000)[b]	
						Crude rate[c]	95% CI	Standardised rate[d]	95% CI	Rate	95% CI
Zimbabwe	2015	2006–2015	Standard DHS	11,060	185	**16.7**	14.3, 19.1	**17.0**	14.6, 19.4	**16.9**	14.3, 19.5
	2014	2005–2014	MICS UNICEF	16,840	276	**16.4**	14.5, 18.3	**16.7**	14.7, 18.6		
	2010–11	2001–2010	Standard DHS	9,839	142	**14.4**	12.0, 16.8	**15.4**	12.9, 17.8		
	2009	2000–2009	MICS UNICEF	12,259	212	**17.3**	15.0, 19.6	**18.2**	15.8, 20.6		
	2005–06	1996–2005	Standard DHS	9,664	143	**14.8**	12.4, 17.2	**15.8**	13.3, 18.3		
	1999	1990–1999	Standard DHS	6,811	110	**16.2**	13.2, 19.2	**16.9**	13.9, 20.0		
	1994	1985–1994	Standard DHS	8,044	129	**16.0**	13.3, 18.7	**16.4**	13.6, 19.2		
	1988	1979–1988	Standard DHS	6,464	118	**18.3**	15.0, 21.6	**18.7**	15.4, 22.0		

Note: *Data with possible bias: short period (less than 10 years) and reproductive histories limited to 5 entries (5 deliveries) per woman. [a]Countries not included because of lack of data: Botswana, Cape Verde, Djibouti, Equatorial Guinea, Eritrea, Mauritius, and Seychelles. [b]By dividing the sum of a country's standardized rates by the number of its surveys. [c]Bold type indicates the number of double births per 1000 deliveries. [d]Bold type indicates that given the positive correlation between twinning and maternal age, rates were standardized using the age distribution of births of women aged 15–49 in SSA from 2000–2010 (source: United Nations). Source. DHS and MICS; authors' calculations

Appendix B. Extract from the birth section of the Women's Questionnaire 15–49 years old Source. Demographic and Health Survey Ghana 2014

211 Now I would like to record the names of all your births, whether still alive or not, starting with the first one you had.
RECORD NAMES OF ALL THE BIRTHS IN 212. RECORD TWINS AND TRIPLETS ON SEPARATE ROWS.
(IF THERE ARE MORE THAN 12 BIRTHS, USE AN ADDITIONAL QUESTIONNAIRE, STARTING WITH THE SECOND ROW).

212 What name was given to your (first/next) baby? RECORD NAME. BIRTH HISTORY NUMBER	213 Is (NAME) a boy or a girl?	214 Were any of these births twins?	215 In what month and year was (NAME) born? PROBE: What is his/her birthday?	216 Is (NAME) still alive?	217 IF ALIVE: How old was (NAME) at his/her last birthday? RECORD AGE IN COMPLETED YEARS.	218 IF ALIVE: Is (NAME) living with you?	219 IF ALIVE: RECORD HOUSEHOLD LINE NUMBER OF CHILD (RECORD '00' IF CHILD NOT LISTED IN HOUSEHOLD).	220 IF DEAD: How old was (NAME) when he/she died? IF '1 YR', PROBE: How many months old was (NAME)? RECORD DAYS IF LESS THAN 1 MONTH; MONTHS IF LESS THAN TWO YEARS; OR YEARS.	221 Were there any other live births between (NAME OF PREVIOUS BIRTH) and (NAME), including any children who died after birth?
01	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . . 2 → 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (NEXT BIRTH)	DAYS . . . 1 MONTHS 2 YEARS . . 3	
02	BOY 1 GIRL 2	SING 1 MULT 2	MONTH YEAR	YES . . 1 NO . . . 2 → 220	AGE IN YEARS	YES . . . 1 NO 2	HOUSEHOLD LINE NUMBER (GO TO 221)	DAYS . . . 1 MONTHS 2 YEARS . . 3	YES . . . . 1 ADD BIRTH NO . . . . . 2 NEXT BIRTH

Source. Demographic and Health Survey Ghana 2014.

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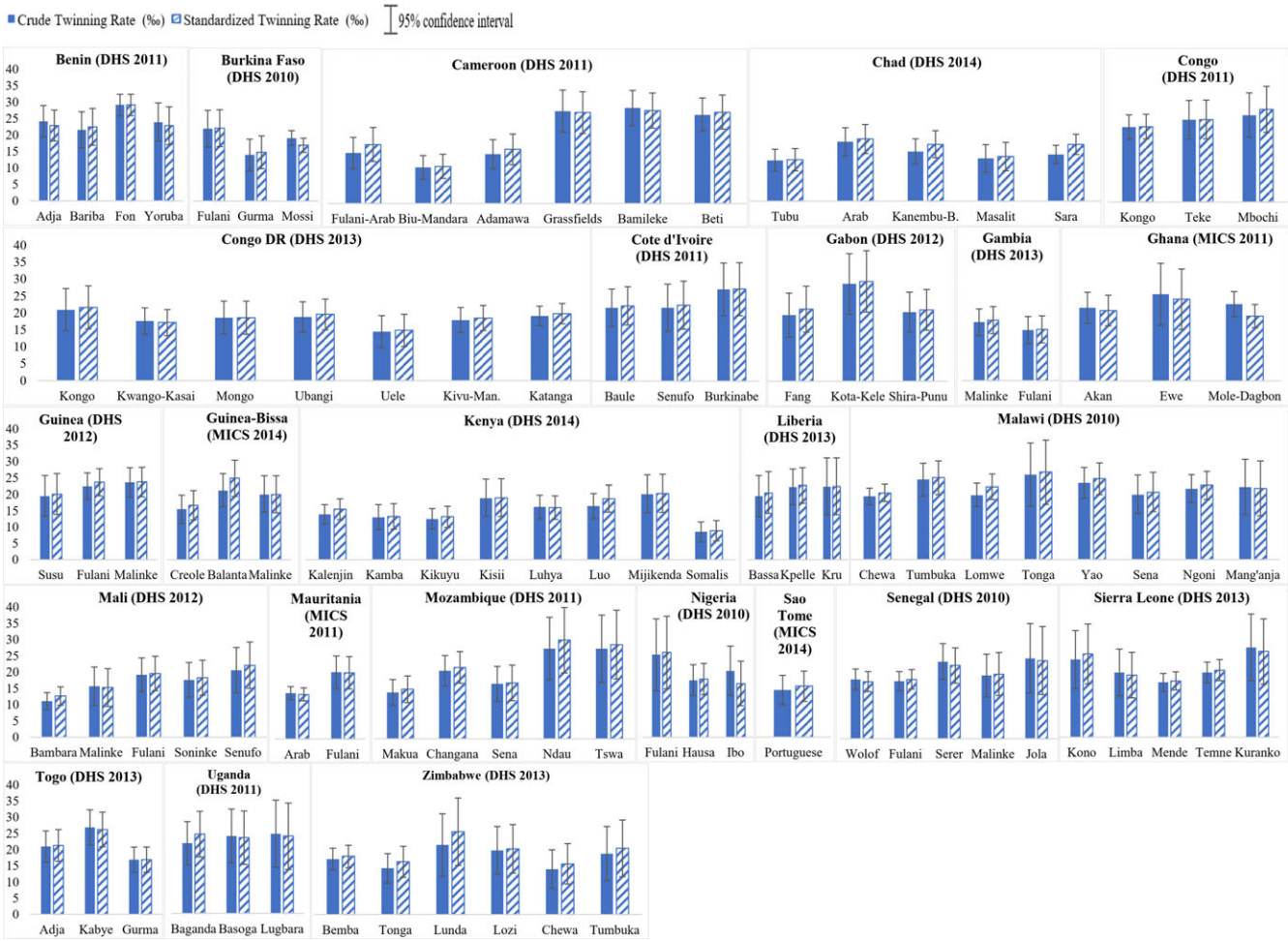
Appendix C. Variation in the crude and standardized twinning rates by selected ethnic groups in some sub-Saharan African countries



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