Rzeszów University Press 2025
ISSN 2544-1361 (online)
doi: 10.15584/ejcem.2025.3.15

http://www.ejcem.ur.edu.pl
European Journal of Clinical and Experimental Medicine
Eur J Clin Exp Med 2025; 23 (3): 614–625

ORIGINAL PAPER

Determinants of time to first birth among women of childbearing age in Somalia – a survival analysis model

Abdirahman Osman Alin [1], Abdisalam Hassan Muse [2]

[1] Planning Office, Department of Statistics, Somali National University, Muqdisho, Somalia
[2] School of Postgraduate Studies and Research, Amoud University, Amoud Valley, Borama, Somalia

ABSTRACT

Introduction and aim. The study evaluated factors and the significant indicators of time to first birth for reproductive aged women (aged 15–49 years) in Somalia.

Material and methods. The study considered SDHS, 2020. The log-rank test was used to assess the statistical significance of the observed difference between waiting time for first birth and various socioeconomic and demographic factors. The Cox proportional hazard model was applied to identify the influential factors for the waiting time to the first birth.

Results. The study established that about 71.19% of the respondents got married before the age of 20, while 28.81% did marry after the 20 years of age. Survival analysis revealed that the place of residence, region, age at first marriage, respondent's education, employment status, and Wealth quintile were statistically significant determinants of waiting time to first birth. The majority of the respondents (64.56%) of the total had their first birth between the ages of 15 and 24. Among these age groups, the highest number of first births occurs at the age of 19 years, with 11.98% of respondents falling into this category. The study also found that the different age groups revealed significantly lower hazards for first births as the age increased. Regarding regional differences, the study found significant variations in the probability of survival of the first birth. In particular, the Togdheer region exhibited a higher hazard ratio (HR=1.132979, p=0.030), indicating an increased risk of experiencing the first birth compared to the reference category. Other regions, such as Galgaduud (HR=1.140067, p=0.029) and Bay (HR=1.199272, p=0.018), also showed higher hazards. On the contrary, Woqooyi Galbeed did not show significant difference in survival probabilities (HR=0.972095, p=0.604) compared to the reference category.

Conclusion. Raising the minimum age for the first childbirth and promoting women's education are crucial for reducing child marriage rates in Somalia.

Keywords. age at first birth, reproductive age women, Somalia, survival analysis

Introduction

The decision to begin childbearing and the timing of the first birth represent two important transitions in female life.[1] The time to first birth varies from one woman to another, due to different individual, sociocultural, economic and environmental factors. We know that the first child is one of the most important events in a woman's life, often influenced by these factors. It indicates the beginning of intensive responsibilities of maternity and childcare. Around 1 in 10 childbirths worldwide is contributed by young mothers, with developing countries accounting for the majority of these cases, 95% of the share. Girls under 15 years of age account for 2 million (27%) of the 7.3 million births that occur in 18-year-

Corresponding author: Abdirahman Osman Alin, e-mail: alin@snu.edu.so, gculay@gmail.com

Received: 27.11.2024 / Revised: 11.04.2025 / Accepted: 13.04.2025 / Published: 30.09.2025

Alin AO, Muse AH. Determinants of time to first birth among women of childbearing age in Somalia – a survival analysis model. *Eur J Clin Exp Med.* 2025;23(3):614–625. doi: 10.15584/ejcem.2025.3.15.

old adolescent girls in developing countries.[2] The age at which a woman begins to have children has a direct impact on the total number of children she will have during her reproductive years, assuming no active use of fertility control methods, in regions such as sub-Saharan Africa, where contraceptive use is relatively low compared to developed nations, a younger age at the first birth tends to increase the likelihood of a higher number of children for a woman, as highlighted.[3,4]

The United Nations Population Fund (UNFPA) report states that early pregnancy can have severe consequences for adolescent girls.[5] In fact, globally, about 14 percent of adolescent girls and young women gave birth before the age of 18 years in 2021. It prevents them from continuing their education and livelihoods, in addition to affecting their health adversities that, in turn, delay their overall healthy development into adulthood. Especially, adolescent girls in the early stages of adolescence are at greater risk of health complications during pregnancy and delivery. About one in six young women globally gives birth before the age of 18 years.[5]

The report states that in South Asia, approximately 10% of adolescent girls and young women gave birth before age 18 between 2015 and 2021, while on the African side, this has more than doubled in sub-Saharan Africa. More than a quarter of adolescent girls and young women in western and Central Africa and Eastern and southern Africa have given birth before the age of 18 from the same period. That would be approximately 11 million young women in both regions.

Somalia has one of the highest rates of child marriage worldwide, with more than 1 million child brides.[6] This translates into the fact that the majority of girls in Somalia are married before they reach the age of maturity. This report further shows that four out of every ten young women in Somalia were married when they were children. Child marriage is more common in rural areas than in urban areas of Somalia, which means that it is more practiced in nonurban environments.

Except for Burkina Faso, the fertility rates fell in nearly all eight sub-Saharan African countries under observation during the period between the two surveys. Data indicate that this proportion decreased in all countries except Burkina Faso. In particular, Mali had the highest rate of teenage childbearing at 45%. On the contrary, Ghana, Kenya, and Zimbabwe had a considerably lower percentage with less than 25% of girls giving birth at an early age. Côte d'Ivoire recorded the biggest decline in the proportion of early first births between the surveys, falling from 41% to 28%. In Mali, the difference was only minor.[4]

The time to first birth among women of childbearing age varies between different regions and countries with median ages ranging from 15 to 20 years according to studies.[2,7–10] In Ethiopia, the median age at first birth was found to be 20 years, which is lower than the optimal age to give birth. Factors associated with early childbirth in Ethiopia include early age at first marriage, early sexual intercourse, high spousal age difference, and being Muslim.[7] The percentage of women who begin child delivery before reaching age 18 is approximately 36.80% in Nigeria. Some of the factors associated with the younger maternal age at the first birth in Nigeria include the place of residence in the North East region, Islamic religion, and the low literacy level in the community.[8] In Ghana, the median age at which women gave birth for the first time increased from 17 years in 1998 to 19 years in 2014.[8] Most women in most of the selected sub-Saharan African countries had optimally spaced, although a high proportion of births in Chad and the Democratic Republic of Congo had short birth intervals. In eastern and Southern African countries, long birth spacing was more common, with the highest rate expressed in Zimbabwe.[11] he residence in rural areas, occupation, early sexual intercourse, early age at first marriage, high spousal age gap, and unmet need for family planning factors are some of the factors associated with early child marriages, consequently leading to early births in Africa.[12,13]

Socioeconomic factors are considered contributing factors to the timing of first birth among women in sub-Saharan Africa. Some studies have established that variables such as educational status, age, residence, economic status, and knowledge about maternal health care determine the use of maternity care among adolescent mothers in the region.[14] The promoting female education can help delay the age of first birth, highlighting the significant role of education in shaping fertility behavior.[15] Further, in the matter of family formation, which differs throughout sub-Saharan Africa, differences in socioeconomic status have been shown to be related to the age at first marriage and first birth between different socio-economic status groups.[16] Furthermore, early childbirth, especially before full physical maturity, was associated with a higher risk of maternal death, evidence that the effect of early age at first birth impacts maternal health outcomes.[15] Budu et al. found that young women who gave birth for the first time between ages 20 and 24 years had a higher proportion of delivery with skilled birth attendance, emphasizing that the timing of first birth plays an important role in accessing obstetric care.[17]

On the other hand, Neonatal mortality remains a major challenge in sub-Saharan Africa, with 99% of the world's neonatal deaths occurring in poorer regions, particularly in sub-Saharan Africa and South Asia.[18] In 2018, sub-Saharan Africa had a neonatal mortality rate of 28 deaths per 1,000 live births.[18] Despite efforts to reduce neonatal mortality, disparities exist across the region. in Kenya, the rate of neonatal mortality in 2018 was 19.6 deaths per 1,000 live births, a decrease from 35.4 in 1975, while South Africa saw a more substantial

reduction from 27.9 to 10.7 deaths per 1,000 live births during the same period.[18] The main causes of neonatal deaths in both countries are preterm birth complications and intrapartum-related events.[18] Birth asphyxia is also a significant contributor, with the combined prevalence in sub-Saharan Africa estimated at 17.28%.[19] Factors such as low birth weight, primigravida status, and meconium-stained amniotic fluid were significantly associated with birth asphyxia.[19] To address these challenges, community-based breastfeeding promotion programs play a crucial role in improving neonatal survival.[18] Studies show varying prevalence rates for early initiation and exclusivity of breastfeeding across the region, with Southern Africa showing the highest rates.[18–20] However, regions like West and Central Africa show lower rates of early initiation and exclusive breastfeeding, both of which are crucial for improving neonatal health outcomes. Interventions should focus on increasing breastfeeding practices, particularly in regions with low rates, to reduce neonatal deaths and improve survival outcomes.

While global standards call for the legal age of marriage to be 18 years or older and for pregnancies to occur at an age that minimizes health risks for both mother and child, the opposite seems true in Somalia. By the age of 15 years, according to the Somali Health and Demographic Survey (SHDS) report 2020.[21] the percentages of married women aged 20-49 years are 16%. Another 34% in this age group were married by age 18 years, while 44% were married by the age of 20 years. The median age at first marriage among women aged 25 49 years is 20 years. These figures indicate that the early marriage rate in Somalia is quite high. This study tries to fill the knowledge gap by analyzing determinants of the timing of the first birth among young married women in Somalia. It will provide an understanding of what factors cause variation in this behavior; such knowledge is necessary to develop interventions that may eventually bring the ideal and actual situations closer to each other, thus improving reproductive health outcomes for women in Somalia.

Aim

The aim of this paper is to investigate the determinants that influence the time to first birth among young married women in Somalia, with a specific focus on identifying key sociodemographic, economic and cultural factors. Using survival analysis techniques, the study aims to understand how variables such as education level, marital age, employment status, and access to healthcare affect the age at which women have their first child. In addition, the paper explores contextual influences, including societal norms and regional disparities, to provide a comprehensive analysis of the factors that shape reproductive behavior.

Significance and novelty of the study

This study is novel, as it is the first to utilize SHDS data to analyze the timing of first births among Somali women. By applying survival analysis, it reveals critical socioeconomic and regional disparities influencing first-birth risks. These findings fill a significant research gap, providing actionable insights to improve maternal and newborn health outcomes, contributing directly to SDG 3.

Material and methods

Study area

Somalia is located in the Horn of Africa and covers a total area of 637,657 square kilometers. It consists of diverse landscapes, including plains, plateaus, and mountains. Somalia has the longest coastline in Africa, stretching approximately 3,333 kilometers from the northern tip, known as the Gulf of Aden, to the east and south, bordering the Indian Ocean. It shares borders with Kenya in the southwest, Ethiopia to the west, and Djibouti to the north, with few seasons fluctuations and regular temperatures ranging from 30°C to 40°C. Therefore, the study encompassed Somalia as a whole (including Somaliland), including its urban, rural and nomadic areas, as well as all geographic regions.

Study design and data source

The study will use a data set acquired from the Somalia National Bureau of Statistics (SNBS), which was obtained from the published reports of the Somali Demographic and Health Survey 2020.[21] The survey data collection began in February 2018 and was completed in January 2019 for urban and rural areas. The focus of the survey was limited to women aged 15 to 49 years who were of reproductive age. This survey, which is the first of its kind in Somalia, was conducted as part of the global DHS project. The data collected in this survey will provide detailed information on the determinant of time to first birth among women of childbearing age in Somalia. The study utilizes a survival analysis model. The author used secondary data from the SHDS.

Variables of the study

Dependent variable

The outcome variable in this research was the age in years at which a woman had her first child. The occurrence of a woman giving birth for the first time was considered an event.

Independent variables

This study examined several independent variables, including age at first marriage, education level, employment status, socioeconomic status, and community level factors including place of residence, health access, geographical region, and others.

Operational definitions
Event: giving first birth. (2) Censored: not giving first birth. (3) Survival time: the time is taken in years (age) from birth to give her first birth.

Sampling methods and sample size
The SHDS 2020 interviewed 16,486 women-11,876 married women and 4,610 never-married women, after cleaning; the final sample size is 11,579 ever-married women used in this Study.

Statistical analysis
Survival analysis is a collection of statistical procedures for the analysis of data in which the outcome variable of interest is time until an event occurs. By event, we mean birth, death, disease incidence or any designated experience of interest that may happen to an individual.[22–25] In summarizing survival data, two key functions are of central interest: the survivor function and the hazard function.

Survivor function
The survivor function is the probability that individuals or groups of individuals will survive beyond a particular time point, t; it is usually denoted as S(t). It gives an estimate of the survival probability over time. The usual practice is to estimate the survivor function non-parametrically using the Kaplan-Meier estimator, which calculates the probability of survival at each observed time. The survivor function is decreasing as time passes, which reflects the fact that survival is less and less likely to happen.

Consider a random variable, denoted "T," which is associated with survival times. The actual survival times are represented by the variable "t," and the probability density function of these survival times is denoted as "f(t)." We can define the cumulative distribution function, denoted as "F(t)".[26] which represents the probability that a randomly chosen subject will have a survival time less than a specified value"t" which is given by:

$$F\left(t\right) = P\left(T < t\right) = \int_0^t f(u)du, \quad where \quad t \geq 0 \tag{1}$$

Where
F(t) = P(that a woman has her first Birth before the time t),
The survivor function, represented by "S (t)," refers to the probability that a subject, chosen randomly, will survive for a time duration greater than or equal to a specified value "t," then

$$S(t) = P(T \geq t) = 1 - F(t), \text{ where } t \geq 0, \tag{2}$$

The survivor function "S(t)" is defined as the complement of the cumulative probability "P" that a woman has her first child before time "t."

So, $S(t) = 1 - P(a\ women\ has\ her\ first\ Birth\ before\ the\ time\ t)$ (3)

The relationship between the probability density function "f(t)" and the survivor function "S(t)" can be derived from equations. (2) and (3).

$$f\left(t\right) = \frac{d}{dt}(F(t)) = \frac{d}{dt}(1 - S(t)) = -\frac{d}{dt}S(t), \quad where \quad t \geq 0 \tag{4}$$

The hazard function h(t)
It is usually applied as a measure that quantifies the risk or probability of an individual experiencing the event of interest-a particular event like death-at a given time point. It is derived from the probability that an individual will experience the event at time t, since the individual has survived up to that time. In different fields, it is referred to by various names, such as conditional failure rate in reliability, force of mortality in demography, intensity function in stochastic processes, age-specific failure rate in epidemiology, inverse of the Mill ratio in economics, or simply the hazard rate. The hazard function provides information about the instantaneous potential for the event to occur per unit of time, given that the individual has survived up to time.

The hazard function $h(t|z)$ or simply $h(t)$ is defined mathematically as:

$$h\left(t\right) = \lim_{\Delta t \to 0+} \frac{1}{\Delta t} P\left\{t \leq T \leq t + \Delta t | T \geq t, Z = z\right\} \tag{5}$$

Where,
Z = m-Dimensional vector of covariates;
$h(t)$ = Hazard Function;
P = Conditional probability of failure;
t = Survived up to time;
T = random variable representing the survival time, which is nothing but the time-to-event;
t = given a small time period and
(t + Δ) = Time interval
Thus, the hazard rate and survival function are closely related by:

$$h\left(t\right) = \frac{f(t)}{S(t)} = -\frac{d}{dt} log(S(t)), \tag{6}$$

Or, to put it the other way around

$$S\left(t\right) = exp\left(-\int_0^t h(t)dt\right. \tag{7}$$

The integral in the expression above is known as the cumulative hazard function.[27] The cumulative hazard function can be expressed mathematically in different ways depending on the specific survival model used. Here are a few common expressions:

Non-parametric estimation (Kaplan-Meier method)
In nonparametric estimation, the cumulative hazard function is estimated using the Kaplan-Meier method.

The expression for the cumulative hazard function at time t is given by the following:

$$H(t) = -\log[S(t)] \quad (8)$$

where S (t) is the estimated survival function, representing the probability of surviving beyond time t.

Cox proportional hazard ratio

Cox regression A semi-parametric technique that is commonly used for survival data analysis that allows one to simultaneously assess the association between multiple covariates and survival, also termed Cox proportional hazards model.[28] The researcher used STATA version14 software to extract and process the data in order to perform survival analysis. To find missing values, the extracted data was subjected to a series of recording and cleaning procedures, such as frequency analysis, listing, and sorting. The Kaplan-Meier method, which is a nonparametric method to estimate survival probabilities over time, can be employed to estimate the median time to first birth and visualize the survival experience across different subgroups.[28,29] Moreover, when comparisons of two or more groups were made for survival experiences, the difference in the Kaplan-Meier survival plot was tested by a logarithmic rank test for its statistical significance. The logarithmic ranking test tells whether the survival curves of different groups differ significantly differ from each other.

Results

A total of 11,579 married women were interviewed in the SHDS 2020 data. Most of respondents (95.41%) had their first birth, while a small percentage (4.59%) had not yet given birth yet. The majority of the respondents (64.56%) of the total had their first birth between the ages of 15 and 24. Among these age groups, the highest number of first births occurs at the age of 19 years, with 11.98% of respondents falling into this category (Table 1).

Regarding the level of education, significant majority of respondents "uneducated" – meaning that they have no formal education, are the first to give their first child (84.37%), primary school is the next (11.89%), while women who have reached higher education are the last to give birth to their first child with only (0.79%). In terms of residence, Nomadics are the first to give birth for the first time, while rural residents are the next, and urban residents are the last to get their first birth (Fig. 1, Fig. 2).

The different age groups revealed significantly lower hazards for first births as the age increased. The risk levels for women aged 20–24, 25–29, 30–34, 35–39, 40–44, and 45–49 were 0.5025168, 0.3491268, 0.2619968, 0.1797551, 0.1313247, and 0.0845131, respectively, ($p<0.001$). These findings highlight the decreasing risk of first birth as women age (Table 3). The estimates for the age group 25 29 years are far lower in both the adjusted and unadjust-

Table 1. Univariate analysis of Socio-demographic distribution of the first birth among women of childbearing age in Somalia, SDHS, 2020 (n=11,579)

Variables	Categories	Weighted frequency	Weighted percent (%)
Age of first birth	0 (have first birth)	11,047	95.41
	1 (no birth)	532	4.59
	Total	11,579	100
Age group	15–19	399	3.45
	20–24	2,158	18.64
	25–29	3,537	30.55
	30–34	2,533	21.88
	35–39	2,063	17.82
	40–44	665	5.74
	45–49	224	1.93
	Total	11,579	100
Region	Awdal	630	5.44
	Woqooyi Galbeed	896	7.74
	Togdheer	955	8.25
	Sool	1,040	8.98
	Sanaag	1,001	8.64
	Bari	614	5.30
	Nugaal	709	6.12
	Mudug	717	6.19
	Galgaduud	581	5.02
	Hiraan	530	4.58
	Middle Shabelle	559	4.83
	Banadir	1,121	9.68
	Bay	260	2.25
	Bakool	736	6.36
	Gedo	578	4.99
	Lower Juba	652	5.63
	Total	11,579	100
Type of place of residence	Rural	3,130	27.03
	Urban	4,742	40.95
	Nomadic	3,707	32.01
	Total	11,579	100
Highest educational level	No education	9,769	84.37
	Primary	1,377	11.89
	Secondary	341	2.94
	Higher	92	0.80
	Total	11,579	100
Listening radio	At least once a week	772	6.67
	Less than once a week	283	2.44
	Not at all	10,524	90.89
	Total	11,579	100
Watching television	At least once a week	931	8.04
	Less than once a week	274	2.37
	Not at all	10,374	89.59
	Total	11,579	100
Wealth quintile	Lowest	2,796	24.15
	Second	2,440	21.07
	Middle	2,207	19.06
	Fourth	2,202	19.02
	Highest	1,934	16.70
	Total	11,579	100

ed models than the reference group of 15- 19 years. This is supported by the unadjusted risk ratio, which is 0.264 at a p<0.001 with a 95% CI of (0.235, 0.297); therefore, it is approximately 73.6% lower. In the fully adjusted model, the risk ratio increases slightly to 0.35, also with a p<0.001 and a 95% CI of (0.311, 0.393), which also represents a hazard ratio of -65% relative to the reference group. It shows that adjusting the HR from 0.264 to 0.35, after accounting for other factors, the risk is still significantly lower, but part of the reduction seen in the unadjusted model may be due to the effects of other covariates that have been introduced into the model.

The result shows that more than 70 % (> 8,243) of Somali women marry under the age of 20 while the rest marry over 20 year age (Table 2). Most of them reported that the husband had attended school at 82.25%, while 17.75% responded that their husband did not attend any school. On employment, 45.66% of the respondent husbands were employed in the last 12 months, while 54.34% were not. However, only a small proportion (0.92%) of the respondents themselves had worked during that period. Otherwise, (1.91%) of the respondents used contraceptive, while the majority (98.09%) were nonusers Table 2.

Regarding regional differences, the study found significant variations in the probability of survival of the first birth. In particular, the hazard ratio increases Togdheer, HR=1.123179, p=0.030; thus, this region is at a higher risk of having the first birth than the reference category. Correspondingly, Galgaduud with an HR of 1.140067 and a p-value of 0.029, and Bay with an HR of 1.199272 and a p-value of 0.018, also recorded higher hazards. On the contrary, Woqooyi Galbeed did not show significant difference in survival probabilities (HR=0.972095, p=0.604) compared to the reference category.

The influence of residence on first birth survival probabilities was also examined. The urban residence category did not demonstrate a significant difference (HR=0.9877183, p=0.629). However, the nomadic residence category showed a higher hazard ratio (HR=1.077211, p=0.004), suggesting an increased risk compared to the reference category.

Table 2. Distribution of reproductive factors of married female youths in Somalia, SDHS, 2020 (n=11,579)

Variables	Categories	Weighted frequency	Weighted percent (%)
Contraceptive use and intention	Users	221	1.91
	Non-users	11358	98.09
Age at first marriage	Less than 20 years	8243	71.19
	20 and more	3336	28.81
Husband worked in last 12 months	Yes	5287	45.66
	No	6292	54.34
Respondent worked in last 12 months	Yes	107	0.92
	No	11472	99.08

Table 3. Bivariate analysis of the sociodemographic distribution of first birth among women of childbearing age in Somalia, SDHS, 2020 (n=11,579)

Characteristics	Event observed	Event expected	Chi square	Df	p
Age in 5-year groups			3592.39	6	<0.001
15–19	329	85.660			
20–24	2041	997.420			
25–29	3344	2761.400			
30–34	2421	2553.120			
35–39	2031	2889.120			
40–44	657	1199.640			
45–49	224	560.640			
Total	11047	11047.000			
Region			150.17	15	<0.001
Awdal	587	692.560			
Woqooyi Galbeed	835	957.750			
Togdheer	921	865.810			
Sool	979	1000.380			
Sanaag	961	889.760			
Bari	596	550.360			
Nugaal	682	629.890			
Mudug	709	757.400			
Galgaduud	561	470.880			
Hiraan	509	628.700			
Middle Shabelle	523	500.620			
Banadir	1081	1081.710			
Bay	258	202.420			
Bakool	696	633.110			
Gedo	548	538.590			
Lower Juba	601	647.050			
Total	11047	11047.000			
Type of place of residence			51.25	2	<0.001
Rural	3011	3173.810			
Urban	4555	4693.430			
Nomadic	3481	3179.760			
Total	11047	11047.000			
Educational level			82.85	3	<0.001
No education	9319	9530.570			
Primary	1312	1099.140			
Secondary	327	285.070			
Higher	89	132.220			
Total	11047	11047.000			
Listening radio			2.52	2	0.2833
At least once a week	700	665.500			
Less than once a week	262	268.580			
Not at all	10085	10112.910			
Total	11047	11047.000			
Watching television			7.70	2	0.0213
At least once a week	872	899.150			
Less than once a week	255	220.510			
Not at all	9920	9927.340			
Total	11047	11047.000			
Wealth quintile			21.86	4	0.0002
Lowest	2704	2813.100			
Second	2325	2316.960			
Middle	2059	1916.740			
Fourth	2120	2094.050			

Highest	1839	1906.140			
Total	11047	11047.000			
Contraceptive use and intention			3.34	1	0.0677
Users	209	186.780			
Non-users	10838	10860.220			
Total	11047	11047.000			
Smokes cigarettes			2.77	1	0.0959
Everyday	77	64.920			
Not at all	10970	10982.080			
Total	11047	11047.000			
Age at first marriage			4327.16	1	<0.001
Less than 20 years	7753	4931.650			
20 and more	3294	6115.350			
Total	11047	11047.000			
Husband ever attended school			16.70	1	<0.001
Yes	9086	9228.710			
No	1961	1818.290			
Total	11047	11047.000			
Husband worked in last 12 months			24.51	1	<0.001
Yes	5030	4799.370			
No	6017	6247.630			
Total	11047	11047.000			
The respondent worked in last 12 months			7.32	1	0.0068
Yes	105	82.880			
No	10942	10964.120			
Total	11047	11047.000			

Discussion

The study identified key factors influencing the timing of first births among Somali women. Most of respondents (95.41%) had given birth, with the majority of first births occurring between 15 and 24, and the highest percentage (11.98%) at 19 years old. Educational attainment, type of residence, and age significantly impacted the timing of the first birth. Uneducated women had the first births (84.37%), followed by primary school graduates (11.89%), while higher educated women had the latest (0.79%). Nomadic women had the highest risk of early first births, followed by rural and urban residents. The risk of first births decreased significantly as age increased, with the adjusted risk ratio for the 25–29 age group being 65% lower than the reference group. Furthermore, significant regional variations were observed, with the Togdheer, Galgaduud, and Bay regions showing higher risks of first birth, while urban residence did not show a significant effect. Most women (more than 70%) married before age 20, and contraceptive use was minimal (1.91%). These findings underscore the influence of sociodemographic, regional, and behavioral factors on the timing of first birth in Somalia.

The proportional hazards model revealed that the probability of first birth decreased significantly with increasing age, as demonstrated by lower hazard ratios in older age groups. Women in regions such as Togdheer, Galgaduud and Bay were identified as having a higher risk for early first births compared to others. Similarly, contraceptive use was almost negligible (1.91%), reflecting further cultural and systemic barriers to family planning in the population. The same result applies in this research to a similar context in Uganda, Ethiopia and Nigeria.[8,13,30]

The median age at first birth among Somali Women is 18 years, so this study has reinforced the following studies.[2,7–10,12] all these studies have been done in Ethiopia, Sub-Saharan Africa Countries, On the other hand, factors associated with delayed first birth included higher education level and being within the richest wealth index. This finding was in line with the findings of Ethiopia Nigeria, Bangladesh and Iran.[7,8,10,13,31] The results for the age group 25-29 years indicate a significant reduction in hazard both in unadjusted and adjusted models compared to the reference group of 15-19 years. Unadjusted HR of 0.264, with a $p<0.001$ and a 95% CI of 0.235, 0.297, suggests approximately 73.6% lower risk. After adjusting for other variables, this result is similar to the studies in Ethiopia[12] and Bangladesh.[30]

Women living in rural areas are more likely than urban individuals to have children at a younger age, and early motherhood can be a desirable option in rural areas as an alternative to education, and the authors are similar in the results to research carried out in Uganda, Bangladesh and Ethiopia Respectively.[2,31,32]

The authors found different from most studies conducted in Africa as most of them classified regions by religion (Muslim, Christian, etc.), or Ethnic.[8,10,31] But this research is based on a Muslim community (for all of the regions of Somalia), and this is the reason behind the lack of contraceptive, because around 2% use contraceptive and 98% nonusers in the Somali community compared to Ethiopia (35% contraceptive users), Iran (76% contraceptive users) and Bangladesh (62% are contraceptive users) that have different religious approaches to Islam.[10,13,32] It leads to a decrease in its use, the Somali community's understanding of contraceptives is very low, and the lack of community awareness in addition to that, the culture of Somali society is very strict. Contraceptive use, age at marriage and husband's fertility desires show significant effects, reflecting cultural and personal behavior impacts.

Regional disparities in maternal and neonatal health risks are pronounced in areas such as Togdheer, Galgaduud, and Bay due to different socioeconomic and environmental factors. Early marriages and pregnancies are more prevalent in these regions, with many girls starting to have children at ages 15–19, a group at increased risk for pregnancy complications due to physical immaturity and limited access to healthcare. Rural settings exacerbate these challenges with inadequate medical facilities and emergency care, leading to increased rates of birth complications and neonatal mortality.

Table 4. Proportional hazard model on the determinants of time to first birth for the significant socioeconomic and demographic covariates, SDHS-2020

Background characteristics	Number of women	n= 11,579		Number of women	n=11,579	
	Unadjusted HR	p	95% CI	Adjusted HR	p	95% CI
Age in 5-year group	(ref: 15–19)					
20–24	0.492	<0.001	(0.438, 0554)	0.507	<0.001	(0.451, 0.571)
25–29	0.264	<0.001	(0.235, 0297)	0.35	<0.001	(0.311, 0.393)
30–34	0.193	<0.001	(0.171, 0.217)	0.26	<0.001	(0.23, 0.293)
35–39	0.132	<0.001	(0.117, 0.149)	0.178	<0.001	(0.157, 0.201)
40–44	0.096	<0.001	(0.084, 0.111)	0.13	<0.001	(0.113, 0.15)
45–49	0.063	<0.001	(0.053, 0.075)	0.084	<0.001	(0.07, 0.1)
Region						
Woqooyi Galbeed	1	0.583	(0.927, 1.145)	1	0.452	(0.862, 1.068)
Togdheer	1.03	0	(1.135, 1.396)	0.96	0.0750	(0.99, 1.22)
Sool	1.259	0.005	(1.045, 1.282)	1.1	0.517	(0.87, 1.072)
Sanaag	1.157	<0.001	(1.153, 1.416)	0.966	0.487	(0.935, 1.152)
Bari	1.278	<0.001	(1.144, 1.438)	1.038	0.101	(0.981, 1.236)
Nugaal	1.283	<0.001	(1.148, 1.432)	1.101	0.3450	(0.944, 1.181)
Mudug	1.282	0.073	(0.991, 1.233)	1.056	0.8740	(0.903, 1.128)
Galgaduud	1.105	<0.001	(1.257, 1.585)	1.009	0.0490	(1, 1.265)
Hiraan	1.412	0.428	(0.846, 1.073)	1.125	<0.001	(0.681, 0.869)
Middle Shabelle	.95300	<0.001	(1.098, 1.391)	0.7690	0.682	(0.91, 1.155)
Banadir	1.236	0.001	(1.069, 1.307)	1.025	0.068	(0.993, 1.226)
Bay	1.182	<0.001	(1.305, 1.75)	1.103	0.027	(1.02, 1.381)
Bakool	1.512	<0.001	(1.166, 1.453)	1.187	0.073	(0.99, 1.237)
Gedo	1.302	0.002	(1.071, 1.352)	1.107	0.42	(0.932, 1.183)
Lower Juba	1.203	0.111	(0.979, 1.229)	1.05	0.681	(0.869, 1.096)
Type of place of residence	1.097			0.976		
Urban	1	0.333	(0.977, 1.071)	1	0.829	(0.946, 1.046)
Nomadic	1.023	<0.001	(1.099, 1.212)	0.994	0.002	(1.031, 1.142)
Frequency of listening radio	1.154			1.085		
Less than once a week	1	0.298	(0.805, 1.069)	1	0.2	(0.78, 1.054)
Not at all	0.927	0.173	(0.878, 1.024)	0.906	0.733	(0.908, 1.07)
Frequency of watching television	0.948			0.986		
Less than once a week	1	0.013	(1.037, 1.371)	1	0.264	(0.938, 1.261)
Not at all	1.193	0.397	(0.961, 1.104)	1.088	0.594	(0.94, 1.115)
Wealth quintile	1.030			1.024		
Second	1	0.128	(0.988, 1.104)	1	0.249	(0.912, 1.024)
Middle	1.044	0.000	(1.055, 1.184)	0.966	0.386	(0.914, 1.035)
Fourth	1.118	0.073	(0.995, 1.115)	0.973	0.012	(0.867, 0.982)
Highest	1.053	0.901	(0.946, 1.065)	0.923	0.064	(0.866, 1.004)
Contraceptive use and intention	1.004			0.932		
Non-users	1	0.101	(0.778, 1.023)	1	0.098	(0.771, 1.022)
Age at first marriage	0.892			0.888		
20 and More	1	0.000	(0.262, 0.287)	1	<0.001	(0.288, 0.316)
Husbands desire	0.274			0.302		
More children	1	0.119	(0.988, 1.106)	1	0.008	(1.021, 1.146)
Fewer children	1.046	0.795	(0.845, 1.246)	1.082	0.023	(0.651, 0.968)
Don't know	1.026	0.169	(0.987, 1.074)	0.794	<0.001	(1.056, 1.152)
Husband/partner work	1.030			1.103		
No	1	0.000	(0.884, 0.953)	1	0.152	(0.929, 1.011)
Respondent worked	1			1		
No	0.78765	0.015	(0.649, 0.954)	0.85	0.101	(0.699, 1.032)
Highest educational	1		.	1		
Primary	1.223	0.000	(1.154, 1.296)	0.995	0.872	(0.935, 1.059)
Secondary	1.174	0.004	(1.052, 1.311)	0.894	0.062	(0.794, 1.006)
Higher	0.687	0.000	(0.557, 0.846)	0.54	<0.001	(0.435, 0.67)
Mean dependent var	19.802		SD dependent var		3.722	
Pseudo r-squared	0.030		Number of obs		11579	
Chi-square	5582.964		Prob > chi2		0.000	
Akaike crit. (AIC)	180563.538		Bayesian crit. (BIC)		180865.173	

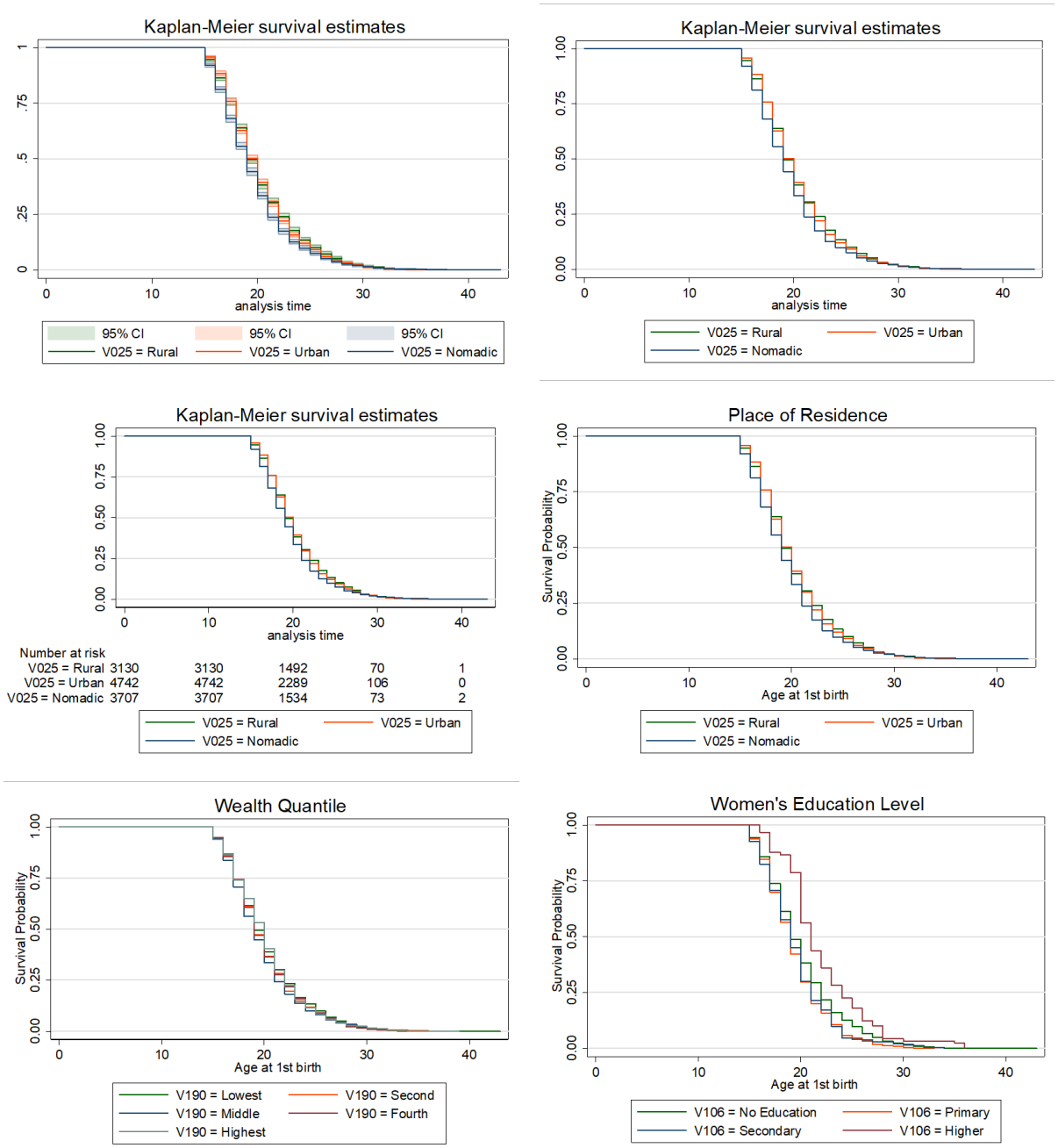

Fig. 1. Kaplan-Meier survival curves of timing at first birth by the characteristics of the selected respondents

This paper is the first from the SHDS to explore time to first birth among childbearing age women in Somalia, adding significant strengths to its contribution. However, due to security concerns, all strata in the Lower Shebelle and Middle Juba regions, along with the rural and nomadic segments in the Bay region, were omitted from the survey, which is the limitation of the paper.

When addressing the limitations of the Cox proportional hazards model in survival analysis, researchers have several alternative statistical methods and models at their disposal. Parametric Survival Models Accelerated Failure Time (AFT) Model, Bayesian Survival Analysis. These methodologies expand the analytical capabilities of researchers, allowing for more tailored and insightful survival analyses.

Conclusion

The paper explores 71.19% of the respondents who got married before the age of 20, while 28.81% did married after the age of 20 years. Survival analysis revealed that the place of residence, region, and age at the first marriage, respondent's education; employment status and the wealth quartile were statistically significant determinants of the waiting time to first birth.

This significant reduction in risk for women aged 25-29 years is statistically robust, suggesting a majority

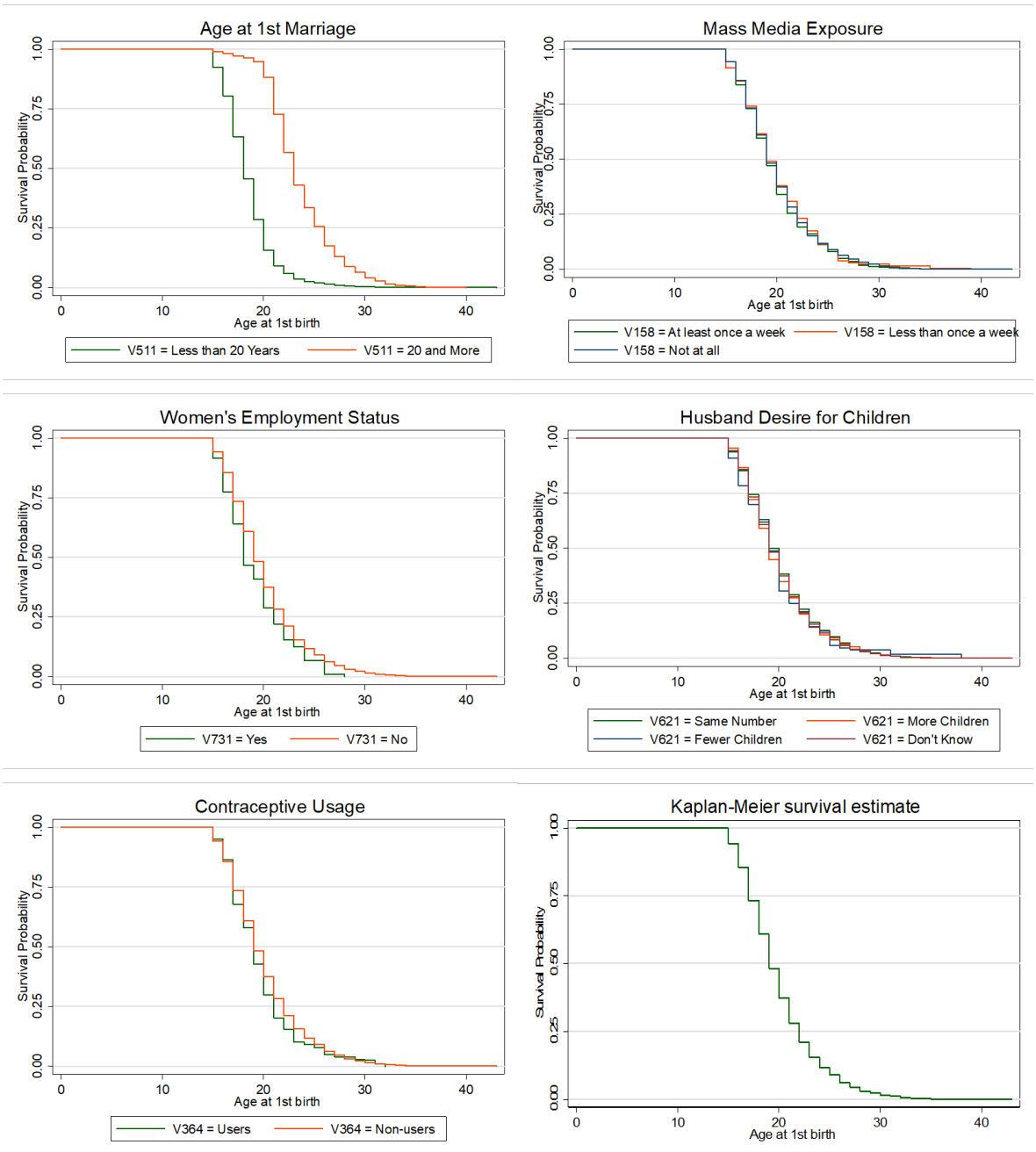

Fig. 2. Kaplan-Meier survival curves of timing at first birth by the characteristics of the selected respondents

protective effect that could be attributed to factors such as increased maturity, lifestyle changes, or other demographic characteristics prevalent in this age group. These findings are very important and could inform targeted interventions or further investigations of protective factors among this age group. I recommend setting this age as the lowest age of marriage in Somali society, so that you can find women who are highly educated, fully aware of the responsibilities of motherhood, and experienced in household and childbirth responsibilities.

For the Bay and Bakool, the survival analysis consistently reveals consistently higher risks, even after adjustments for other variables. Bay has a significantly higher unadjusted HR of 1.182 with statistically significant (p=0), and the risk remains significant with an adjusted HR of 1.103 and a (p=0.027). Similarly, Bakool shows the highest unadjusted HR of 1.512, also significant with a (p<0.001), which decreases slightly to an adjusted HR of 1.187 with a (p=0.073), yet remains elevated. These previous findings suggest that both regions still face higher risks than the reference region, highlighting the need for targeted health interventions and further research into the factors that drive these disparities.

According to the United Nations report on trends in Maternal Mortality (2000–2020), Somalia faces critical challenges, with one of the highest maternal mor-

tality ratios globally – 621 maternal deaths per 100,000 live births – accompanied by poor newborn outcomes, including 36 newborn deaths per 1,000 live births and 28 stillbirths per 1,000 births.[33] These alarming statistics underscore the urgency of addressing maternal and newborn health. In particular, the median age at first birth among Somali women is 18 years. Our study highlights that older maternal age correlates with significantly lower risks associated with first births. Combined with enhanced health interventions, this finding underscores the potential to improve maternal and newborn health outcomes in Somalia, directly contributing to the achievement of the Sustainable Development Goal 3.

This study underscores the prevalence of early childbirth among Somali women, with education and residential status emerging as significant determinants. Women without formal education and those living in nomadic settings are at increased risk of early first births. The findings also highlight considerable regional disparities, with specific regions exhibiting increased risks. Policymakers should prioritize interventions aimed at education and access to reproductive health services to delay first births, particularly in high-risk regions and among marginalized populations. Future research should adopt longitudinal designs and incorporate broader sociocultural factors to better understand and address the determinants of early childbearing in Somalia.

The authors advise that promoting education, especially completion of education up to the university level, not only delays the age at first birth, but also equips women with knowledge and resources to make informed decisions, ultimately improving maternal and child health outcomes. This study contributes to factors that influence the probability the understanding of survival of the first birth survival probabilities. The findings emphasize the importance of considering age, region, and residence when addressing maternal and child health outcomes. Policy makers and healthcare professionals should tailor interventions to target vulnerable age groups and regions with higher risks.

Declarations

Funding

The authors declare that they did not receive any funds during the preparation of this manuscript.

Author contributions

Conceptualization, A.O.A; Methodology, A.O.A and A.H.M.; Software, A.O.A and A.H.M.; Validation, A.O.A and A.H.M.; Formal Analysis, A.O.A and A.H.M; Investigation, A.O.A; Resources, A.O.A; Data Curation, A.O.A and A.H.M.; Writing – Original Draft Preparation A.O.A; Writing – Review & Editing, A.O.A; Visualization, A.O.A.; Supervision, A.O.A and A.H.M.; Project Administration, A.O.A.

Conflicts of interest

The authors declare that they have no competing interests related to this study.

Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics approval

Ethical approval was not required for this study as it utilized publicly available, de-identified data obtained with permission from the Demographic and Health Surveys (DHS) Program. The data can be accessed at: https://microdata.nbs.gov.so/index.php/catalog/50

References

1. Dewau R, Mekonnen FA, Seretew WS. Time to first birth and its predictors among reproductive-age women in Ethiopia: inverse Weibull gamma shared frailty model. *BMC Womens Health*. 2021;21(1):113. doi: 10.1186/s12905-021-01254-z
2. Dewau R, Muche A, Fentaw Z, et al. Time to initiation of antenatal care and its predictors among pregnant women in Ethiopia: Cox-gamma shared frailty model. *PLoS One*. 2021;16(2):e0246349. doi: 10.1371/journal.pone.0246349
3. Anuwoje I, Albert L. Survival Analysis of Time to First Birth after Marriage. *Res Humanit Soc Sci*. 2013;3(12):117-126.
4. Gupta N, Mahy M. Adolescent childbearing in sub-Saharan Africa: Can increased schooling alone raise ages at first birth? *Demogr Res*. 2003;8:93-106. doi: 10.4054/DemRes.2003.8.4
5. UNFPA. Report on the regional forum on adolescent pregnancy, child marriage and early union in South-Asia and Mongolia. 2018;(April):1-89. https://www.unicef.org/eap/media/3696/file/Adolescent pregnancy.pdf. Accessed September 20, 2024.
6. UNICEF-United Nations Children's Fund. Child marriage in Eastern and Southern Africa. https://reliefweb.int/report/world/child-marriage-eastern-and-southern-africa. Accessed September 20, 2024.
7. Negash WD, Asmamaw DB. Time to first birth and its predictors among reproductive age women in high fertility countries in Sub-Saharan Africa: Inverse Weibull gamma shared frailty model. *BMC Pregnancy Childbirth*. 2022;22(1):1-10. doi: 10.1186/s12884-022-05206-9
8. Bolarinwa OA, Ahinkorah BO, Seidu AA, et al. Predictors of young maternal age at first birth among women of reproductive age in Nigeria. *PLoS One*. 2023;18(1):1-14. doi: 10.1371/journal.pone.0279404
9. Alazbih NM, Kaya AH, Mengistu MY, Gelaye KA. Determinants of time to first marriage and birth intervals among women of child bearing age in Dabat Health and demographic surveillance system site, Northwest Ethiopia. *PLoS One*. 2023;18(2):1-17. doi: 10.1371/journal.pone.0281997

10. Dehesh T, Malekmohammadi N, Dehesh P. Associated factors of first-birth interval among women in reproductive age, addressing maternal and child health. *Reprod Health*. 2022;19(1):1-7. doi: 10.1186/s12978-022-01346-5
11. Baruwa OJ, Amoateng YA. Socio-demographic correlates and trends in the timing of the onset of parenthood among women of reproductive age in Ghana: evidence from three waves of the demographic and health surveys. *F1000Research*. 2023;12:157. doi: 10.12688/f1000research.130349.1
12. Alemu YM, Gobena MG. Determinants of age at first birth among women in Ethiopia using cox proportional hazards model. *J Hum Growth Dev*. 2022;32(2):214-222. doi: 10.36311/jhgd.v32.13145
13. Bitew DA, Habitu YA, Gelagay AA. Time to first birth and its determinants among married female youths in Ethiopia, 2020: survival analysis based on EDHS 2016. *BMC Womens Health*. 2021;21(1). doi: 10.1186/s12905-021-01414-1
14. Mekonnen T, Dune T, Perz J. Maternal health service utilisation of adolescent women in sub-Saharan Africa: A systematic scoping review. *BMC Pregnancy Childbirth*. 2019;19(1). doi: 10.1186/s12884-019-2501-6
15. Bongaarts J, Mensch BS, Blanc AK. Trends in the age at reproductive transitions in the developing world: The role of education. *Popul Stud (NY)*. 2017;71(2):139-154. doi: 10.1080/00324728.2017.1291986
16. Ahinkorah BO, Kang M, Perry L, Brooks F, Hayen A. Prevalence of first adolescent pregnancy and its associated factors in sub-Saharan Africa: A multi-country analysis. *PLoS One*. 2021;16(2):1-16. doi: 10.1371/journal.pone.0246308
17. Budu E, Chattu VK, Ahinkorah BO, et al. Early age at first childbirth and skilled birth attendance during delivery among young women in sub-Saharan Africa. *BMC Pregnancy Childbirth*. 2021;21(1):1-12. doi: 10.1186/s12884-021-04280-9
18. Masaba BB, Mmusi-Phetoe RM. Neonatal Survival in Sub--Sahara: A Review of Kenya and South Africa. *J Multidiscip Healthc*. 2020;13:709-716. doi: 10.2147/JMDH.S260058
19. Techane MA, Alemu TG, Wubneh CA, et al. The effect of gestational age, low birth weight and parity on birth asphyxia among neonates in sub-Saharan Africa: systematic review and meta-analysis: 2021. *Ital J Pediatr*. 2022;48(1):114. doi: 10.1186/s13052-022-01307-5
20. I Issaka AI, Agho KE, Renzaho AM. Prevalence of key breastfeeding indicators in 29 sub-Saharan African countries: a meta-analysis of demographic and health surveys (2010-2015). *BMJ Open*. 2017;7(10):e014145. doi: 10.1136/bmjopen-2016-014145
21. SHDS. and Demographic Survey 2020. *SHD Surv 2020 Somalia*. Accessed September 20, 2024.
22. Rossi E. *Introduction to Survival Analysis*. 2022. doi: 10.52787/agl.v52i1.164. Accessed September 20, 2024.
23. Mohamed M, Abdelaal A, Hossam S, Ahmed E. Modeling Survival Data by Using Cox Regression Model. 2015;4(6):504-512. doi: 10.11648/j.ajtas.20150406.21
24. Kleinbaum DG, Klein M. Survival Analysis. A Self-Learning Text, Third Edition. 2012.
25. Clark TG, Bradburn MJ, Love SB, Altman DG. Survival Analysis Part I: Basic concepts and first analyses. *Br J Cancer*. 2003;89(2):232-238. doi: 10.1038/sj.bjc.6601118
26. Kitaw TA, Haile RN. Time to first childbirth and its predictors among reproductive-age women in Ethiopia: survival analysis of recent evidence from the EDHS 2019. *Front Reprod Health*. 2023;5:1165204. doi: 10.3389/frph.2023.1165204
27. Du M, Zhao H, Sun J. A unified approach to variable selection for Cox's proportional hazards model with interval-censored failure time data. *Stat Methods Med Res*. 2021;30(8):1833-1849. doi: 10.1177/09622802211009259
28. Schober P, Vetter TR. Survival analysis and interpretation of time-to-event data: The tortoise and the hare. *Anesth Analg*. 2018;127(3):792-798. doi: 10.1213/ANE.0000000000003653
29. Støvring H, Wang MC. A new approach of nonparametric estimation of incidence and lifetime risk based on birth rates and incident events. *BMC Med Res Methodol*. 2007;7:1-11. doi: 10.1186/1471-2288-7-53
30. Sobhan A, Moinuddin M, Hossain MM. Investigating time to first birth among women of reproductive age in Bangladesh: a survival analysis of nationwide cross-sectional survey data. *J Health Popul Nutr*. 2024;43(1):2. doi: 10.1186/s41043-023-00492-1
31. Mugarura A, Kaberuka W, Atuhaire R. Factors determining the age at first birth in Uganda. *Issues Sci Res*. 2016;1(5):61-66.
32. Mohammad Fazle Rabbi A, Imrul Kabir MHM. Factors Influencing Age at First Birth of Bangladeshi Women- A Multivariate Approach. *Am J Public Heal Res*. 2013;1(7):191-195. doi: 10.12691/ajphr-1-7-8
33. Sudan S. Maternal & Newborn Health Country Profile. https://www.healthynewbornnetwork.org/resource/nigeria-maternal-newborn-health-country-profile/. Accessed September 20, 2024.