ORIGINAL RESEARCH ARTICLE

Prevalence, trends, and determinants of short birth intervals among women of reproductive age in Ethiopia: Evidence from the 2000-2016 demographic and health survey

DOI: 10.29063/ajrh2026/v30i6.9

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Abstract

Short birth intervals are associated with increased risk of adverse health outcomes for mothers and children. The World Health Organization recommends an inter-birth interval of at least 33 months. This study examines the prevalence, trends, and determinants of short birth intervals among women of reproductive age in Ethiopia. Data from the Ethiopia Demographic and Health Surveys (2000-2016) with a weighted sample of 37,686 women were used. Binary logistic regression analysis determined the factors predicting short birth intervals. Over 40% of women experienced a short birth interval over the years. The key predictors of short birth intervals included age, antenatal care, household wealth, ideal number of children, marital status, media exposure, religion, survival of the preceding birth, year of survey, place of residence, and region. Improving family planning services as well as targeted awareness campaigns, especially in the Afar and Somali regions, are essential to promoting optimal birth spacing in Ethiopia. *(Afr J Reprod Health 2026; 30 [6]: 88-104).*

Keywords: birth interval, short birth interval, reproductive age, binary regression, Ethiopia

Résumé

Des intervalles courts entre les naissances sont associés à un risque accru de problèmes de santé chez les mères et les enfants. L'Organisation mondiale de la Santé recommande un intervalle inter-naissances d'au moins 33 mois. Cette étude examine la prévalence, les tendances et les déterminants des intervalles courts entre les naissances chez les femmes en âge de procréer en Éthiopie. Les données proviennent des Enquêtes démographiques et de santé d'Éthiopie (2000-2016), menées auprès d'un échantillon pondéré de 37 686 femmes. Une analyse de régression logistique binaire a permis d'identifier les facteurs prédictifs de ces intervalles courts. Plus de 40 % des femmes ont connu un intervalle court entre leurs naissances au cours de ces années. Les principaux facteurs prédictifs incluent l'âge, les soins prénatals, le niveau de vie du ménage, le nombre idéal d'enfants, la situation matrimoniale, l'exposition aux médias, la religion, la survie de l'enfant né précédemment, l'année de l'enquête, le lieu de résidence et la région. L'amélioration des services de planification familiale et la mise en place de campagnes de sensibilisation ciblées, notamment dans les régions Afar et Somali, sont essentielles pour promouvoir un espacement optimal des naissances en Éthiopie. *(Afr J Reprod Health 2026; 30 [6]: 88-104).*

Mots-clés: intervalle entre les naissances, intervalle court entre les naissances, âge de procréer, régression binaire, Éthiopie

Introduction

Short birth intervals are associated with a higher risk of adverse health outcomes for both mothers and children in diverse countries worldwide.[1] Each year, around 2.6 million babies are stillbirths[2], with sub-Saharan Africa responsible for 67% of these deaths universally.[3,4] In 2017, the maternal mortality rate in sub-Saharan Africa was 542 deaths per 100,000 live births, representing almost two-

thirds of all maternal deaths all over the world.[5,6] The region remains among the highest in the world for maternal and infant mortality rates.[7] The Sustainable Development Goals (SDGs) highlight the critical need to reduce maternal and child mortality, alongside the implementation of targeted approaches to achieve these objectives.[8-11] Nonetheless, maternal mortality rates in this region surpass the target set by Goal 3, Target 3.1 of the Sustainable Development Goals (SDGs), which aims for fewer than 70 deaths per 100,000 live births by 2030.[6] To minimise the risk of negative maternal and child health outcomes, the World Health Organization (WHO) advises upholding an inter-birth interval of at least 33 months between successive live births.[12,13] Adequate spacing allows women to recover physically and psychologically while mitigating risks such as nutritional depletion, anaemia, pre-eclampsia, haemorrhage, low birth weight, and developmental delays in children.[14-18] Ethiopia faces a major challenge with adverse birth outcomes, reporting nearly 412 maternal deaths per 100,000 live births. [19,20] Short birth intervals increased from 11% in 2000 to 14% in 2019.[21] Regardless of the government's efforts in implementing programs intended at improving reproductive health and reducing maternal and neonatal mortality, including initiatives related to reproductive, maternal, new-born, and child health (RMNCH), challenges persist in Ethiopia.[22]

Trends across sub-Saharan Africa show many women giving birth at intervals of less than 24 months, with notable variation between countries—Ethiopia (24.9%), Nigeria (25%), Rwanda (20%), and Uganda (25.9%).[23-25] Gaps exist in understanding short birth interval trends over time, particularly in Ethiopia, where studies often lack nationally representative data or fail to explore influencing factors comprehensively.

This study addresses these gaps by analysing Demographic and Health Survey (DHS) data to assess prevalence, trends, and determinants of short birth intervals among women of reproductive age.This paper is based on the Socio-Ecological Model (SEM) developed by Urie Bronfenbrenner in the 1980s.[26] The model examines interactions among individual, interpersonal, community, societal, and environmental factors that affect health and behaviour.[27] The significance of the socio-ecological model in this study lies in its ability to

clarify the complex interactions between individuals and their environments that influence health outcomes and behaviours. The elements of the socio-ecological theory utilised in this study incorporate factors at both the individual and community levels that affect health behaviour. Findings will provide insights for targeted interventions and inform policymakers to improve maternal and child health outcomes. The study aimed to examine the prevalence, trends, and determinants of short birth intervals among women of reproductive age in Ethiopia.

Methods

Data source

The data for this study was obtained from the Ethiopia Demographic and Health Surveys (EDHS) conducted in 2000, 2005, 2011, and 2016. The initial survey was the 2000 EDHS, followed by the second survey in 2005, the third in 2011, and the fourth in 2016, which represents the most recent nationally representative Demographic and Health Survey in the country.[20,28,29] These datasets were pooled to examine the determinants of short birth intervals among women of reproductive age in Ethiopia. This paper utilised the birth recode dataset (BR file), which includes one record for each child born to women who participated in the survey interviews within the five years preceding the study. The selection was also impacted by the availability of data from 2000 to 2016. The analysis comprised women aged 15 to 49 years at the time of the survey who had experienced non-first births in Ethiopia. Women who had never given birth, had only one child, or did not meet this criterion were excluded from the analysis.

Sampling techniques

The survey employed a two-stage stratified cluster sampling method. In the first stage, Enumeration Areas (EAs) are typically taken from the census records. In the second stage, a sample of households is selected from an updated list within each chosen EA. The complete EDHS report provides a

comprehensive description of the sampling procedure.[20]

Study variables

Outcome variable

The outcome variable for this study is birth interval (BI), which is categorised into two groups and coded as a binary variable. In this analysis, birth intervals are classified as follows: 0 = Not short, 1 = Short. In this study, short birth spacing was operationalised as an inter-birth/ pregnancy spacing of less than 33 months between two consecutive live births.

Explanatory variables

The study incorporated fourteen explanatory variables. These variables were age, antenatal care, contraceptives use, education, employment status, household wealth, ideal number of children, marital status, media exposure, place of residence, region, sex of the preceding birth, and survival of the preceding birth. A brief overview of these variables is presented in Table 1. Furthermore, these variables were selected due to their previously established statistically significant correlation with short birth intervals in earlier studies.[23,30,31]

Analytical methods

Data analysis was conducted using Stata version 16.[32] The univariate analysis displayed the percentage distribution of background characteristics, while bivariate analysis with a chi-square test was employed to determine the relationship between the dependent and independent variables. Furthermore, at the multivariate level, the study used binary logistic regression to control for confounding variables in the study. Additionally, the level of significance was established using a 95% confidence interval (CI) with a significance level set at 5%. To address the potential effects of under- or oversampling, the data was weighted during the analysis.

Binary logistic regression

The study employed binary logistic regression analysis to determine the factors that predict short birth intervals among women of reproductive age. This statistical approach is especially useful for exploring the relationship between a binary outcome, like the incidence of short birth intervals, and multiple independent variables. The model is represented as:

$$\text{Logit}\,(P) = \beta_0 + \beta_1 X_1 + \beta_2 + \ldots + \beta_k X_k + e_{ij}$$

In the framework of binary logistic regression, p denotes the probability of a short birth interval, while X_1 ,……, X_k are independent variables. The intercept, indicated by β_0, reflects the log-odds of having a short birth interval when all predictor variables are equal to zero. The coefficients $\beta_1, \beta_2, \ldots\ldots\ldots \beta_k$ correspond to each independent variable. Furthermore, e_{ij} represents the error term related with individual observations, accounting for the variability that the model does not explain.

Ethical consideration

The DHS is managed by ICF and to obtain the data from the website, a written request was submitted to Measure DHS, and consent to use the data for this survey was allowed upon approval of the request. The study further used publicly available datasets that are completely unspecified and do not include any identifying data relating to those who contributed. The data can only be utilised for the registered project. Additional information regarding the ethical procedures from the DHS is available here: https://dhsprogram.com/methodology/Protecting-thePrivacy-of-DHS SurveyRespondents.cfm.

Results

Socio-demographic characteristics of study participants

Table 2 presents the socio-demographic characteristics of the study participants from 2000 to 2016, revealing consistent trends alongside gradual shifts. Between 2000 and 2011, women aged 20–29 formed the largest proportion of respondents, accounting for 42.9%; however, by 2016, the dominant age group shifted to women aged 30–39 who made up 46.4%.

Table 1: Description of the study variables

Variable name	Variable description	Variable code
Age	Mother's age at birth	1= 15-19 2= 20-39 3= 30-39 4=40-49
Antenatal care	Number of antenatal visits during pregnancy	0= Not attended 1 = Attended
Contraceptives use	Contraceptive use and intention	0= Not using 1= Using
Education	Highest educational level	0= No education 1= Primary 2= Secondary 3=Higher
Employment Status	Respondent's occupation	0= Not employed 1= Employed
Household wealth	Wealth index of respondents	0= Poor 1= Average 2= Rich
Ideal number of children	Respondent's ideal number of children	0=0 1= 1 2= 2 3=3 4=4 5=5+
Marital status	Respondent's current marital status	0= Not married 1= Married 2= Cohabiting
Media exposure	Respondent's media knowledge	0= No 1= Yes
Place of residence	Respondent's type of place of residence	1= Urban 2= Rural
Region	Respondent's region of residence	1=Tigray 2=Afar 3=Amhara 4=Oromia 5= Somali 6=Benishangul-Gumuz 7=SNNPR 8= Gambela 9=Harari 10=Addis Ababa and 11=Dire Dawa
Sex of the preceding birth	Respondent's sex of the preceding birth	1 = Male 2 = Female
Survival of the preceding birth	Respondent's child survival status	1 = Not alive 2 = Alive

Table 2: Socio-demographic characteristics of study participants

Variable	2000		2005		2011		2016	
	n	%	n	%	n	%	n	%
Age groups								
15-19	92	0.9	144	1.6	98	1.0	43	0.5
20-29	4254	42.9	4002	43.4	4401	45.8	3800	42.4
30-39	4183	42.2	3930	42.6	4052	42.2	4150	46.4
40-49	1380	13.9	1150	12.5	1048	10.9	960	10.7
Antenatal care								
Not attended	8216	82.9	7589	82.3	6996	72.9	5326	59.5
Attended	1693	17.1	1638	17.8	2603	27.1	3627	40.5
Contraceptive use								
Not using	9162	92.5	8133	88.2	7388	77.0	6272	70.1
Using	747	7.5	1093	11.8	2210	23.0	2681	29.9
Educational level								
No education	8272	83.5	7459	80.8	7100	74.0	6619	73.9
Primary	1259	12.7	1462	15.8	2310	24.1	1961	21.9
Secondary	366	3.7	277	3.0	117	1.2	246	2.7
Higher	11	0.1	29	0.3	72	0.8	127	1.4
Employment status								
Not employed	3630	36.6	6530	70.8	4467	46.5	4924	55.0
Employed	6279	63.4	2697	29.2	5132	53.5	4029	45.0
Household wealth								
Poor	4403	44.4	4035	43.7	4442	46.3	4342	48.5
Average	2097	21.2	2070	22.4	2028	21.1	1896	21.2
Rich	3408	34.4	3122	33.8	3129	32.6	2715	30.3
Ideal number of children								
0	1831	18.5	2289	24.8	2382	24.8	2210	24.7
1	35	0.4	20	0.2	31	0.3	29	0.3
2	270	2.7	264	2.9	269	2.8	263	2.9
3	315	3.2	265	2.9	327	3.4	282	3.1
4	1956	19.7	1966	21.3	2359	24.6	1923	21.5
5+	5501	55.5	4422	47.9	4231	44.1	4246	47.4
Marital status								
Not married	675	6.8	419	4.5	596	6.2	336	3.8
Married	9171	92.6	8719	94.5	8520	88.8	8529	95.3
Cohabiting	63	0.6	89	1.0	483	5.0	88	1.0
Media exposure								
No	9903	99.9	9215	99.9	9566	99.7	8900	99.4
Yes	5	0.1	11	0.1	32	0.3	53	0.6
Religion								
Orthodox	4861	49.1	3761	40.8	3552	37.0	2965	33.1
Catholic	63	0.6	104	1.1	93	1.0	75	0.8
Protestant	1597	16.1	1868	20.2	2257	23.5	1877	21.0
Muslim	3016	30.4	3258	35.3	3467	36.1	3818	42.6
Traditional	351	3.5	153	1.7	95	1.0	122	1.4
Other	20	0.2	83	0.9	135	1.4	96	1.1
Sex of preceding birth								
Male	5163	52.1	4712	51.1	4920	51.3	4613	51.5
Female	4745	47.9	4515	48.9	4679	48.7	4340	48.5

Survival of preceding birth								
Not alive	1870	18.9	1214	13.2	986	10.3	645	7.2
Alive	8038	81.1	8013	86.9	8613	89.7	8307	92.8
Place of residence								
Urban	921	9.3	551	6.0	1058	11.0	802	9.0
Rural	8987	90.7	8675	94.0	8541	89.0	8151	91.0
Region								
Tigray	656	6.6	578	6.3	599	6.2	542	6.1
Afar	95	1.0	87	0.9	98	1.0	89	1.0
Amhara	2614	26.4	2109	22.9	2110	22.0	1681	18.8
Oromia	4047	40.8	3719	40.3	4093	42.6	4007	44.8
Somali	120	1.2	402	4.4	319	3.3	441	4.9
Benishangul	96	1.0	83	0.9	112	1.2	100	1.1
SNNPR	2099	21.2	2093	22.7	2070	21.6	1885	16.0
Gambela	21	0.2	25	0.3	29	0.3	20	0.2
Harari	19	0.2	16	0.2	22	0.2	20	0.2
Addis Ababa	112	1.1	86	0.9	117	1.2	135	1.5
Dire Dawa	30	0.3	28	0.3	29	0.3	34	0.4
Total	**9908**	**100**	**9226**	**100**	**9599**	**100**	**8953**	**100**

Antenatal care coverage improved steadily, increasing from 17.1% in 2000 to 40.5% in 2016, though the overall utilization remained relatively low. A similar trend was observed in contraceptive use, which rose from 7.5% to 29.9% over the same period, indicating gradual uptake but continued high rates of non-use. Moreover, educational attainment showed only slight improvement, with over 70% of women still reporting no formal education in each survey year, while access to higher education remained minimal, peaking at just 1.4% in 2016. Likewise, employment rates fluctuated, reaching a high of 70.8% in 2005 before declining to 45% in 2016. Furthermore, the majority of respondents consistently came from poor households, underscoring a persistent skew in wealth distribution. Interestingly, fertility preferences reflected a strong inclination toward larger families, with most women in all four years expressing a desire for five or more children. Meanwhile, the proportion of women preferring to remain childless remained steady, accounting for nearly a quarter of respondents in the latter surveys.

The table also highlights patterns related to marital status, religion, media exposure, and geographic distribution. Marriage remained the overwhelmingly dominant marital status across all years, consistently accounting for over 88% of respondents, while cohabitation remained minimal. Additionally, religion evolved over time, with Orthodox women representing the majority in 2000 (49.1%), though by 2016, Muslims had become the largest group at 42.6%. Media exposure showed only gradual progress, increasing from 0.1% in 2000 to just 0.6% in 2016, indicating very limited access to mass communication. Further to that, the sex of the previous birth was fairly balanced but leaned slightly toward male births across all years. Child survival improved steadily, with 81.1% of preceding births alive in 2000 and 92.8% by 2016. On the other hand, the vast majority of participants consistently resided in rural areas, with rural residency exceeding 89% throughout the study period. Regionally, the highest proportion of respondents came from Oromia each year; rising from 40.8% in 2000 to 44.8% in 2016, followed by Amhara and SNNPR regions, while areas such as Harari, Gambela, and Dire Dawa remained the least represented.

Prevalence and trends of short birth intervals

The trends of short birth intervals (SBI) across various years in Ethiopia are displayed in Figure 1. The graph shows significant differences in the last year (2016), while the trend in the first two years remained nearly identical at approximately 48%. The highest percentages were recorded in 2000 and 2005, at 47.9% and 48.0%, respectively, followed by a decline to 47.3% in 2011 and further down to 45.7% in 2016.

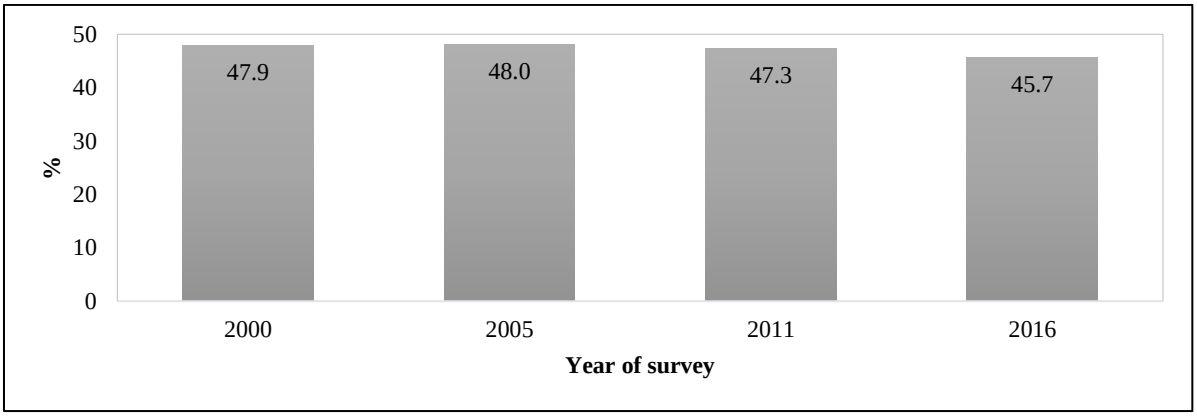

Figure 1: Prevalence of short birth intervals by year of survey

Table 3: Prevalence of short birth intervals among women of reproductive age in Ethiopia, 2000-2016

Variable	2000		2005		2011		2016	
	%	CI	%	CI	%	CI	%	CI
Age groups	***		***		***		***	
15-19	74.9	[59.8-85.7]	75.1	[62.7-84.4]	63.9	[49.9-75.8]	83.2	[65.0-93.0]
20-29	56.3	[53.5-59.0]	54.0	[51.4-56.6]	53.2	[50.3-56.0]	52.4	[48.6-56.1]
30-39	42.6	[40.5-44.7]	44.6	[42.1-47.0]	44.1	[41.2-47.0]	41.6	[38.4-44.8]
40-49	36.2	[32.6-40.1]	35.3	[31.2-39.7]	34.0	[29.8-38.4]	35.6	[30.5-41.0]
Antenatal care	***		***		***		***	
Not attended	49.0	[47.0-51.0]	50.1	[48.0-52.2]	52.1	[49.8-54.4]	52.4	[49.0-55.7]
Attended	42.4	[38.8-46.0]	38.2	[35.2-41.4]	34.5	[31.7-37.5]	35.9	[33.0-38.9]
Contraceptive use			***		***		***	
Not using	47.8	[45.8-49.7]	48.7	[46.6-50.8]	48.1	[45.7-50.5]	49.1	[45.9-52.3]
Using	49.3	[43.7-54.9]	42.5	[38.9-46.3]	44.8	[41.2-48.5]	37.8	[34.1-41.6]
Educational level			***		***		***	
No education	47.2	[45.2-49.1]	47.8	[45.7-49.8]	49.0	[46.6-51.5]	47.2	[43.9-50.5]
Primary	51.7	[47.1-56.3]	50.6	[46.3-54.9]	43.7	[40.4-47.1]	43.2	[39.0-47.5]
Secondary	51.7	[43.5-59.9]	42.4	[35.3-49.7]	24.1	[14.2-37.8]	30.4	[23.6-38.2]
Higher	34.1	[16.7-57.3]	23.9	[10.7-45.3]	32.5	[19.3-49.3]	35.6	[24.0-49.2]
Employment status	***		***		***		***	
Not employed	52.2	[49.1-55.2]	49.8	[47.5-52.1]	49.9	[47.0-52.8]	49.3	[46.1-52.4]
Employed	45.4	[43.4-47.4]	43.5	[40.8-46.3]	45.1	[42.5-47.8]	41.4	[37.4-45.4]
Household wealth			***		***		***	
Poor	46.4	[44.1-48.7]	49.5	[46.7-52.2]	48.9	[46.2-51.6]	50.6	[47.3-53.8]
Average	51.3	[47.9-54.7]	47.3	[43.8-50.9]	46.3	[42.5-50.3]	46.3	[41.0-51.7]
Rich	47.7	[44.5-50.8]	46.5	[44.0-49.0]	45.7	[42.0-49.5]	37.5	[33.6-41.5]
Ideal number of children	***		***		***		***	
0	47.5	[43.4-51.7]	50.1	[46.9-53.3]	49.6	[46.1-53.1]	51.4	[46.2-56.6]
1	56.0	[39.9-71.0]	75.6	[39.7-93.6]	44.9	[19.0-73.9]	44.2	[24.6-65.8]
2	45.6	[36.9-54.6]	46.8	[38.1-55.6]	31.3	[23.6-40.1]	40.8	[31.5-50.8]
3	41.3	[31.6-51.7]	48.5	[41.0-56.1]	34.7	[27.4-42.8]	31.1	[22.7-41.1]
4	46.1	[42.6-49.6]	44.1	[40.8-47.4]	43.4	[39.4-47.6]	38.9	[35.1-42.9]
5+	49.1	[46.8-51.3]	48.5	[45.6-51.4]	50.2	[47.2-53.2]	47.1	[43.9-50.3]

marital status	***		***		***		***	
Not married	30.7	[25.6-36.3]	35.8	[29.2-42.9]	31.2	[25.4-37.7]	35.9	[28.0-44.7]
Married	49.3	[47.4-51.2]	48.6	[46.7-50.6]	48.3	[46.0-50.6]	46.0	[42.9-49.1]
Cohabiting	24.7	[15.6-36.8]	43.2	[30.6-56.7]	49.7	[42.5-56.9]	56.5	[38.2-73.2]
Media exposure	***		***				***	
No	47.9	[46.0-49.8]	48.0	[46.1-49.9]	47.4	[45.2-49.6]	45.8	[42.8-48.8]
Yes	8.7	[1.3-41.4]	8.4	[2.3-26.4]	29.9	[14.4-51.8]	33.8	[22.3-47.7]
Religion	***		***		***		***	
Orthodox	43.5	[41.0-46.0]	40.7	[38.4-43.0]	37.6	[34.4-40.9]	32.3	[28.9-36.0]
Catholic	46.4	[30.8-62.8]	54.3	[38.9-68.9]	46.5	[35.7-57.7]	45.8	[34.1-58.0]
Protestant	50.4	[46.5-54.3]	50.8	[47.0-54.5]	50.5	[46.8-54.2]	46.5	[42.3-50.8]
Muslim	53.3	[49.5-56.9]	54.8	[51.5-58.0]	55.1	[52.2-58.0]	55.2	[50.6-59.7]
Traditional	50.3	[44.2-56.3]	47.2	[37.7-56.9]	53.5	[40.8-65.8]	57.6	[38.1-74.9]
Other	63.6	[40.0-82.1]	41.4	[28.1-56.2]	46.3	[35.9-57.0]	51.3	[39.7-62.7]
Sex of preceding birth								
Male	47.5	[45.3-49.8]	48.0	[45.6-50.4]	47.0	[44.6-49.5]	45.9	[42.5-49.3]
Female	48.3	[45.9-50.6]	47.9	[45.6-50.3]	47.6	[44.8-50.5]	45.5	[42.0-49.1]
Survival of preceding birth	***		***		***		***	
Not alive	59.8	[56.3-63.2]	64.8	[60.9-68.5]	60.0	[55.3-64.5]	64.8	[58.1-70.9]
Alive	45.1	[43.1-47.1]	45.4	[43.5-47.4]	45.9	[43.5-48.3]	44.2	[41.1-47.4]
Place of residence	***		***		***		***	
Urban	42.9	[36.2-49.9]	40.2	[35.4-45.3]	35.3	[30.2-40.9]	31.0	[24.6-38.1]
Rural	48.4	[46.5-50.3]	48.5	[46.5-50.4]	48.8	[46.6-51.1]	47.2	[44.0-50.3]
Region	***		***		***		***	
Tigray	43.9	[39.9-48.1]	43.0	[38.6-47.5]	39.7	[35.8-43.7]	32.6	[28.3-37.4]
Afar	52.5	[46.8-58.2]	58.7	[49.6-67.4]	54.7	[49.5-59.9]	63.4	[58.6-67.9]
Amhara	37.4	[34.1-40.8]	36.0	[33.0-39.1]	34.6	[31.0-38.3]	27.1	[23.4-31.2]
Oromia	54.8	[51.8-57.8]	55.5	[52.4-58.6]	54.8	[51.6-58.0]	51.9	[46.9-57.0]
Somali	58.0	[53.3-62.6]	57.1	[50.3-63.7]	64.9	[61.0-68.6]	73.2	[70.1-76.0]
Benishangul	45.6	[39.0-52.4]	52.9	[47.5-58.3]	50.0	[45.3-54.6]	50.7	[45.5-55.9]
SNNPR	48.7	[45.8-51.6]	46.4	[43.3-49.5]	46.0	[42.1-50.0]	46.7	[42.6-50.8]
Gambela	26.6	[20.8-33.3]	34.1	[28.2-40.6]	35.4	[31.4-39.6]	37.0	[31.5-43.0]
Harari	57.2	[49.9-64.3]	53.6	[47.6-59.6]	55.2	[49.1-61.2]	50.0	[43.8-56.1]
Addis Ababa	36.7	[31.0-42.7]	31.1	[24.6-38.5]	21.3	[14.4-30.2]	26.0	[20.2-32.8]
Dire Dawa	55.4	[49.2-61.5]	54.9	[47.6-62.1]	49.5	[42.6-56.4]	50.9	[46.1-55.7]
Total	**47.9**	**[46.0-49.8]**	**48.0**	**[46.1-49.9]**	**47.3**	**[45.1-49.5]**	**45.7**	**[42.7-48.7]**

Note: *** = P<0.001; CI: Confidence Interval

Determinants of short birth intervals

Although there is a slight reduction in these figures over the years, the data still indicates that the prevalence of short birth intervals remains significantly high in the country.Own computations from the Ethiopian 2000, 2005, 2011 and 2016 DHS.Table 3 presents the pooled prevalence and trends of short birth intervals (SBI) among women of reproductive age in Ethiopia across four survey years (2000–2016). Over time, several sociodemographic and reproductive health variables showed statistically significant associations with SBI. In 2000, factors such as age,

ANC, employment status, ideal number of children, marital status, media exposure, religion, survival of the preceding birth, residence, and region were significant.

By 2005, contraceptive use, educational status, and household wealth emerged as additional correlates, a pattern that remained largely consistent through 2016. Notably, younger women consistently showed the highest prevalence of SBI: in 2000, women aged 15–19 had a prevalence of 74.9% (95% CI: 59.8–85.7), which rose to 83.2% (95% CI: 65.0–93.0) by 2016, far exceeding older age groups. ANC utilization, contraceptive use, and education demonstrated strong inverse relationships with SBI across all years. For example, in 2016, SBI prevalence among women who did not attend ANC was 52.4% (95% CI: 49.0–55.7), compared to 35.9% (95% CI: 33.0–38.9) for those who did. Similarly, women using contraceptives had a lower SBI prevalence of 37.8% (95% CI: 34.1–41.6) versus 49.1% (95% CI: 45.9–52.3) among non-users. Educational disparities were also noticeable; in 2016, women with no formal education had a SBI prevalence of 47.2% (95% CI: 43.9–50.5), whereas those with secondary and higher education had significantly lower rates at 30.4% (95% CI: 23.6–38.2) and 35.6% (95% CI: 24.0–49.2), respectively. Moreover, SBI was consistently higher among unemployed women than employed women across all survey years, with gaps ranging from about 4% to 8%. Wealth also played a role, with the poorest women demonstrating a 50.6% prevalence (95% CI: 47.3–53.8) compared to 37.5% (95% CI: 33.6–41.5) among the wealthiest.Furthermore, across all years, married and cohabiting women consistently reported higher SBI prevalence than unmarried women, with cohabiting women showing 56.5% (95% CI: 38.2–73.2) in 2016.

Interestingly, the desire for fewer children did not always correspond with longer birth intervals; in 2005, women preferring one child had the highest SBI prevalence at 75.6% (95% CI: 39.7–93.6). Additionally, media exposure appeared protective; SBI prevalence among exposed women was as low as 8.4% (95% CI: 2.3–26.4) in 2005, compared to 48.0% (95% CI: 46.1–49.9) in those without exposure. Religion also influenced outcomes, with Muslim and Traditionalist women showing higher SBI prevalence than Orthodox women throughout the years. Moreover, the prevalence of SBI also varied slightly by the sex of the preceding child, with women having female children showing a marginally higher SBI in 2000 (48.3%, 95% CI: 45.9–50.6) and 2011 (47.6%, 95% CI: 44.8–50.5), while those with male children had higher SBI in 2005 (48.0%, 95% CI: 45.6–50.4) and 2016 (45.9%, 95% CI: 42.5–49.3). Further to that, survival of the preceding child strongly influenced SBI rates; women whose children had died consistently displayed much higher SBI prevalence, such as 59.8% (95% CI: 56.3–63.2) in 2000 and 64.8% (95% CI: 58.1–70.9) in 2016, compared to women with surviving children (e.g., 45.1%, 95% CI: 43.1–47.1 in 2000). Residence also played a role, with rural women showing higher SBI prevalence than urban women across all years, for example, 48.4% (95% CI: 46.5–50.3) versus 42.9% (95% CI: 36.2–49.9) in 2000 and 47.2% (95% CI: 44.0–50.3) versus 31.0% (95% CI: 24.6–38.1) in 2016. Lastly, regional disparities were significant and persistent, with Somali and Afar regions consistently having the highest SBI prevalence, peaking in Somali at 73.2% (95% CI: 70.1–76.0) in 2016, while Addis Ababa had the lowest rates, declining to 26.0% (95% CI: 20.2–32.8) by 2016.

Table 4 presents a binary logistic regression analysis of short birth intervals among women of reproductive age. The findings showed that women aged 15-19 years were significantly more likely to have short birth intervals, with an odds ratio (AOR) of 2.75 (CI: [2.12, 3.56]), compared to the reference group of women aged 20-29 years. In contrast, women aged 30-39 years and 40-49 years had lower odds of experiencing short birth intervals, with AORs of 0.66 (CI: [0.63, 0.69]) and 0.47 (CI: [0.44, 0.51]), respectively. Additionally, women who attended antenatal care were less likely to have short birth intervals (AOR = 0.64; CI: [0.61, 0.68]) than those who did not, while those with average household wealth also showed a slight reduction in likelihood (AOR = 0.93; CI: [0.87, 0.99]). Regarding the ideal number of children, having two (AOR = 0.71; CI: [0.62, 0.83]), three (AOR = 0.71; CI: [0.62, 0.82]), or four children (AOR = 0.78; CI: [0.72, 0.84]) significantly decreases the odds of short birth intervals.

Table 4: Pooled binary logistic regression of the determinants of short birth spacing among women of reproductive age in Ethiopia

Birth interval	AOR	Std. Err.	P>t	95% CI
Age groups				
15-19	2.75	0.36	0.000	[2.12-3.56]
20-29®	1			
30-39	0.66	0.02	0.000	[0.63-0.69]
40-49	0.47	0.02	0.000	[0.44-0.51]
Antenatal care				
Not attended®	1			
Attended	0.6	0.02	0.000	[0.61-0.68]
Contraceptive Use				
Not using®	1			
Using	0.96	0.03	0.263	[0.90-1.03]
Education				
No education®	1			
Primary	0.97	0.03	0.385	[0.91-1.04]
Secondary	1.04	0.07	0.531	[0.91-1.19]
Higher	1.16	0.15	0.253	[0.90-1.50]
Employment status				
Not employed®	1			
Employed	0.97	0.02	0.207	[0.92-1.02]
Household wealth				
Poor®	1			
Average	0.93	0.03	0.021	[0.87-0.99]
Rich	0.99	0.03	0.703	[0.93-1.05]
Ideal number of children				
0®	1			
1	1.42	0.28	0.082	[0.96-2.10]
2	0.71	0.05	0.000	[0.62-0.83]
3	0.71	0.05	0.000	[0.62-0.82]
4	0.78	0.03	0.000	[0.72-0.84]
5+	0.96	0.03	0.122	[0.90-1.01]
Marital status				
Not married®	1			
Married	1.51	0.08	0.000	[1.37-1.67]
Cohabiting	1.49	0.14	0.000	[1.24-1.80]
Media exposure				
No®	1			
Yes	0.66	0.14	0.049	[0.44-1.00]
Religion				
Orthodox	0.78	0.03	0.000	[0.72-0.84]
Catholic	1.03	0.13	0.828	[0.80-1.33]
Protestant	0.94	0.04	0.175	[0.87-1.03]
Muslim®	1			
Traditional	0.90	0.08	0.221	[0.75-1.07]
Other	0.88	0.11	0.325	[0.69-1.13]

Birth interval	AOR	Std. Err.	P>t	95% CI
Sex of the preceding birth				
Male®	1			
Female	1.01	0.02	0.622	[0.97-1.06]
Survival of the preceding birth				
Not alive	2.10	0.07	0.000	[1.96-2.25]
Alive®	1			
Year of survey				
2000	0.87	0.03	0.000	[0.81-0.93]
2005	0.88	0.03	0.000	[0.82-0.94]
2011	0.90	0.03	0.001	[0.84-0.95]
2016®	1			
Place of residence				
Urban®	1			
Rural	1.25	0.06	0.000	[1.14-1.37]
Region				
Tigray®	1			
Afar	1.32	0.08	0.000	[1.16-1.49]
Amhara	0.70	0.03	0.000	[0.63-0.77]
Oromia	1.30	0.07	0.000	[1.18-1.44]
Somali	1.90	0.12	0.000	[1.68-2.15]
Benishangul	1.07	0.06	0.225	[0.96-1.20]
SNNPR	1.05	0.06	0.345	[0.95-1.17]
Gambela	0.63	0.04	0.000	[0.55-0.72]
Harari	1.33	0.09	0.000	[1.16-1.53]
Addis Ababa	0.90	0.08	0.264	[0.76-1.08]
Dire Dawa	1.41	0.1	0.000	[1.22-1.62]

Note: ® = reference category; CI; confidence interval; AOR; adjusted odds ratio

Conversely, married women (AOR = 1.51; CI: [1.37, 1.67]) and cohabiting women (AOR = 1.49; CI: [1.24, 1.80]) were more likely to experience short birth intervals than their unmarried counterparts. Media exposure was associated with lower odds of short birth intervals (AOR = 0.66; CI: [0.44, 1]), while Orthodox individuals also showed reduced odds (AOR = 0.78; CI: [0.72, 0.84]). Notably, women whose preceding child did not survive had significantly higher odds of experiencing short birth intervals (AOR = 2.10; CI: [1.96, 2.25]). The analysis also indicated that from the years 2000 to 2011, there were significant reductions in the odds of short birth intervals across all years studied compared to the reference year 2016, with rural residents showing higher odds (AOR = 1.25; CI: [1.14, 1.37]) compared to urban residents. Regionally, areas such as Afar (AOR = 1.32), Somali (AOR = 1.90), and Dire Dawa (AOR = 1.41) displayed significantly increased odds of short birth intervals compared to the reference region Tigray.

Discussion

This study assessed the prevalence, trends, and determinants of short birth intervals (SBI) among women of reproductive age in Ethiopia. The findings revealed that SBI remains consistently high across survey years (2000, 2005, 2011, and 2016), with Ethiopia showing a higher prevalence compared to neighbouring countries such as Uganda (13.4%), Rwanda (20%), and Cameroon (21.3%).[23,24] Within Ethiopia, SBI rates ranged from 43.4% to 46%, highlighting a persistent public health challenge. [33-35] Limited availability and use of family planning services have been identified as major contributors to the high prevalence of SBI in

African countries.[14,36] The study identified significant correlations between various factors such as age, antenatal care, contraceptive use, education level, employment status, household wealth, ideal number of children, marital status, media exposure, place of residence, region, religion, and the survival of the preceding birth. These factors have persistently impacted short birth intervals over the years. The results indicated that in 2000, 2005, 2011 and 2016, women aged 15-19 were more likely to experience short birth intervals. Younger women have less capacity for making independent decisions about their reproductive goals compared to their older counterparts. Additionally, fertility typically declines with age, and older women may have already completed their preferred family sizes.[23] The results align with research conducted in Bangladesh, the Democratic Republic of Congo, and Uganda, which demonstrated that younger women are more prone to having short birth intervals compared to older women.[23,24,37] However, these findings contradict studies conducted in Iraq, where younger women were associated with longer birth intervals.[38] In 2000, 2005, 2011 and 2016, women who did not attend the required antenatal visits had higher odds of short birth intervals. This may stem from insufficient information on family planning and health education provided during antenatal care visits, together with limited access to healthcare facilities.[39] This is in line with previous studies that found that mothers who missed antenatal visits during their previous pregnancies were more likely to practice short birth intervals.[40-42] Moreover, the study revealed that in 2005, 2011 and 2016, women who were not using contraceptives were more likely to have short birth intervals compared to their counterparts who uses them. This can be ascribed to the conflict women face from their partners concerning birth control, as well as the impact of religious and cultural beliefs and uncertainties about the side effects of contraceptives.[40] This finding is supported by previous studies that demonstrated that the lack of contraceptive use increases the likelihood of experiencing short birth intervals.[1,43]

The study's findings indicated that in 2005, 2011 and 2016, women with no education or only primary education were more likely to experience short birth intervals. This occurs because less educated women may lack knowledge or be misinformed about the various contraceptive options, leading to unplanned pregnancies and poorly spaced births.[44] This finding was observed in other studies.[14,45] Additionally, in 2000, 2005, 2011 and 2016, unemployed women were more likely to experience short birth intervals as compared to employed women. This is because their reliance on partners for financial support may diminish their ability to make decisions about family planning, resulting in increased rates of unintended pregnancies and shorter intervals between births.[46] This finding was comparable with a study conducted by Shifti and colleagues[33] which revealed higher odds of short birth intervals among unemployed women. The study further reported that in 2005, 2011 and 2016, women from poor households had higher odds of short birth intervals. This can be attributed to the fact that women living in communities with high poverty and low literacy rates may face additional challenges in accessing healthcare services.[33] This aligns with findings from similar studies that show a higher prevalence of short birth intervals in low-income households.[14,28]

In 2000 and 2005, women who desired only one child had greater odds of experiencing short birth intervals compared to their counterparts. In contrast, in 2011, women who preferred five or more children were linked to shorter birth intervals. Conversely, in 2016, women who indicated an ideal number of zero children showed higher rates of short birth intervals. Women who intended to have no children or only one may face limited access to effective contraceptive methods, increasing the risk of unintended pregnancies and consequently leading to shorter birth intervals.[47] Moreover, individuals who desire five or more children may be influenced by cultural norms that favour larger families, leading them to prioritise having several children in rapid succession.[48] These findings were detected in other studies.[49-51] The study's results further indicated that in 2000 and 2005, married women had a higher likelihood of experiencing short birth intervals. However, in 2011 and 2016, women who were cohabiting showed increased rates of short birth intervals. This is because in numerous cultures, there is significant pressure to

have multiple children shortly after marriage as a way to demonstrate fertility and they are less inclined to use contraceptive methods.[48,52] Also, financial pressures may lead cohabiting women to have children in quicker succession, as they might view larger families as advantageous for sustenance or work.[53] This was validated by studies indicating that married women have closely spaced births compared to those who have never been married.[25]

Moreover, this study noted that in 2000, 2005, and 2016, women who lacked media exposure were more likely to experience short birth intervals compared to those who were exposed to media. This could be explained by that women who do not have access to media may struggle to obtain information about family planning and the potential health risks of short birth intervals; this dearth in knowledge can result in unintended pregnancies and closer intervals between births.[35] This is supported by previous research which found women without media exposure being more likely to have short birth intervals than those with media exposure. [1,54] In 2000, 2005, 2011 and 2016, women residing in rural areas were more likely to experience short birth intervals as compared to urban women. This is due to rural women often having limited access to healthcare services, such as family planning and prenatal care.[25] This aligns with findings from similar studies that show a higher prevalence of short birth intervals in rural areas than urban regions.[55-57] The study found that in 2000, 2011, and 2016, women from the Somali region were more likely to experience short birth intervals compared to those from other regions. In contrast, in 2005, women from Afar had higher rates of short birth intervals than their counterparts. This could be that women in the Somali region encounter considerable obstacles in accessing sufficient maternal healthcare; the health-seeking behaviour and service utilization of the Somali regional state are among the poorest health indicators in the country.[58] On the other hand, in Afar, the majority of women do not use contraceptives because they prioritise having more children; it is common in the community for women to have birth intervals of less than one year.[59] These findings are in line with previous studies that shown higher odds of short birth intervals in both Afar and Somali region.[35,60]

In 2000, the study revealed that women from other religious groups were more likely to experience short birth intervals. However, in 2005 and 2011, Muslim women showed a higher likelihood of having shorter birth spacing. By 2016, women from traditional backgrounds were more likely to have short birth intervals. This is because women from other religions may place a high value on having large families and see having children in close succession as a way to build up family connections.[61] On the other hand, in Islam, this may be attributed to the lack of contraceptive use among Muslim followers.[62] Conversely, Traditional beliefs often emphasise the importance of having large families.[48] These results are consistent with earlier research.[40,62,63] Lastly, the study found that in 2000, 2005, 2011 and 2016, women whose children had died had higher rates of short birth intervals as compared to those whose children were alive. This could be due to sociocultural influences and limited access to contraceptive methods and also some women may have a resilient urge to have another child soon after losing one, seeking to fill the emptiness left by their loss.[64-66] This finding is consistent with studies that revealed that mothers who lost their last child were more likely to experience short birth intervals compared to those with living children.[40,66,67]

Policy implications

The study's findings highlight several important policy and practical implications. Addressing the widespread occurrence of short birth intervals, particularly among younger women and those with limited education, requires strengthened government policies to expand access to family planning and reproductive health services, with a focus on rural and underserved regions such as Afar and Somali. It is essential to increase antenatal care coverage and ensure compliance with the National Antenatal Care Guideline, emphasizing regular check-ups during pregnancy. Socioeconomic empowerment initiatives, including poverty reduction efforts and employment opportunities, can help women make informed reproductive choices. Public awareness campaigns should be tailored to different cultural and religious contexts, with engagement of community and religious

leaders to foster acceptance of family planning methods. Increasing media exposure and improving educational opportunities for women will further enhance awareness and uptake of reproductive health services. Community-based outreach and culturally sensitive interventions are crucial for reducing regional disparities in birth spacing practices. Aligning these strategies with the national health agenda will strengthen progress toward improved maternal and child health and advance Ethiopia's Sustainable Development Goals for reproductive health.

Study strengths and limitations

A key strength of the study is its use of weighted data from the EDHS, which ensures representation at both national and regional levels. As a result, the findings can be generalised to all women of reproductive age in Ethiopia. This analysis offers a clear and concise overview of factors influencing the prevalence, trends, and determinants of short birth intervals in the country. It serves as a valuable resource for policymakers in developing targeted interventions and allocating resources successfully. Among the limitations is the cross-sectional nature of the study which cannot measure causation between the variables. Furthermore, there may have been instances of under-reporting or over-reporting of short or long birth intervals, which could potentially interfere with the study's results.

Conclusion

The study has provided valuable perceptions regarding the prevalence, trends and determinants of short birth intervals among women of reproductive age in Ethiopia to guide policy and practice. Short birth intervals were more common among women aged 15-19, women who did not receive antenatal care, did not use contraceptives, had no education or only primary education, were unemployed, from poor households, had an ideal number of children of 0, 1, or 5 or more, were unmarried, had no media exposure, lived in rural areas, were from the Afar and Somali regions, identified as Muslim, Traditional, or other religions, and whose preceding child did not survive. Although the prevalence was stable from 2000 to 2005 and declined by 1% from 2005 to 2016, it remains high. Binary logistic regression identified age, marital status, survival status of preceding birth, place of residence, and region as significant determinants. Improving family planning services, antenatal care, women's education, media exposure, and addressing socioeconomic inequalities, particularly in rural, Afar, and Somali regions are essential to reduce short birth intervals and improve maternal and child health outcomes.

Acknowledgements

The author wishes to express gratitude to Dr. Mhele and Dr. Tsawe for their guidance and support on this paper. Additionally, I would like to thank the DHS staff and Measure DHS for producing the EDHS data and for granting me permission to download and utilise this data for my study.

Author contributions

This paper is part of MMM's PhD thesis. MMM was involved in conceptualizing the manuscript as well as analysing and interpreting the data.

Conflict of interests

The author has no competing interests to disclose.

Funding

The researcher is funded by the National Research Foundation (https://www.nrf.ac.za/). The NRF did not play a role in the development of this manuscript, and the opinions expressed are solely those of the author.

References

1. Damtie Y, Kefale B, Yalew M, Arefaynie M, and Adane B. Short birth spacing and its association with maternal educational status, contraceptive use, and duration of breastfeeding in Ethiopia. A systematic review and meta-analysis. *PLoS One* 2021;16(2):e0246348.
2. Lawn JE, Blencowe H, Waiswa P, Amouzou A, Mathers C, Hogan D, Flenady V, Frøen JF, Qureshi ZU, and Calderwood C. Stillbirths: rates, risk factors, and acceleration towards 2030. *The Lancet* 2016;387(10018):587-603.
3. Alkema L, Chou D, Hogan D, Zhang S, Moller A-B, Gemmill A, Fat DM, Boerma T, Temmerman M, and

Mathers C. Global, regional, and national levels and trends in maternal mortality between 1990 and 2015, with scenario-based projections to 2030: a systematic analysis by the UN Maternal Mortality Estimation Inter-Agency Group. *The lancet* 2016;387(10017):462-74.
4. Kassa EM. Clinical Profile and Out Come of Pregnancies with NRFHR in Labor at Three Teaching Hospitals, Addis Ababa, Ethiopia. 2018,
5. Musarandega R, Nyakura M, Machekano R, Pattinson R, and Munjanja SP. Causes of maternal mortality in Sub-Saharan Africa: a systematic review of studies published from 2015 to 2020. *Journal of Global Health* 2021;11,
6. WHO U. UNFPA, World Bank Group. United Nations Population Division Maternal Mortality Estimation Inter-Agency Group: Maternal mortality in 1990-2015 Papua New Guinea. In. 2016. *World Health Organization [Internet] Geneva: World Health Organization Available from: https://www who int/gho/maternal_health/countries/phl pdf* 2017,
7. Aliyu LD, Kadas AS, Mohammed A, Abdulllahi HM, Farouk Z, Usman F, Attah RA, Yusuf M, Magashi MK, and Miko M. Impediments to maternal mortality reduction in Africa: a systemic and socioeconomic overview. *Journal of Perinatal Medicine* 2023;51(2):202-07.
8. Yaya S, and Ghose B. Global inequality in maternal health care service utilization: implications for sustainable development goals. *Health Equity* 2019;3(1):145-54.
9. McArthur JW, Rasmussen K, and Yamey G. How many lives are at stake? Assessing 2030 sustainable development goal trajectories for maternal and child health. *Bmj* 2018;360,
10. Reinke E, and Haier J. Maternal mortality as a Millennium Development Goal of the United Nations: a systematic assessment and analysis of available data in threshold countries using Indonesia as example. *Journal of global health* 2017;7(1),
11. Kyei-Nimakoh M, Carolan-Olah M, and McCann TV. Millennium development Goal 5: progress and challenges in reducing maternal deaths in Ghana. *BMC pregnancy and childbirth* 2016;16:1-9.
12. Wakeyo MM, Kebira JY, Assefa N, and Dheresa M. Short Birth Interval and Its Associated Factors among Multiparous Women in Mieso Agro-Pastoralist District, Eastern Ethiopia: A Community Based Cross-sectional Study. *Frontiers in Global Women's Health* 2022:105.
13. World Health Organization. Born too soon: decade of action on preterm birth: World Health Organization 2023.
14. Pimentel J, Ansari U, Omer K, Gidado Y, Baba MC, Andersson N, and Cockcroft A. Factors associated with short birth interval in low-and middle-income countries: a systematic review. *BMC pregnancy and childbirth* 2020;20(1):1-17.
15. Ganatra B, and Faundes A. Role of birth spacing, family planning services, safe abortion services and post-abortion care in reducing maternal mortality. *Best Practice & Research Clinical Obstetrics & Gynaecology* 2016;36:145-55.
16. Singal N, Setia G, Taneja BK, and Singal KK. Maternal outcome in pregnant women with anaemia. *Bangladesh Journal of Medical Science* 2018;17(3):446.
17. Lassi ZS, Padhani ZA, Rabbani A, Rind F, Salam RA, and Bhutta ZA. Effects of nutritional interventions during pregnancy on birth, child health and development outcomes: a systematic review of evidence from low-and middle-income countries. *Campbell Systematic Reviews* 2021;17(2):e1150.
18. Wondemagegn AT, and Mulu A. Effects of Nutritional Status on Neurodevelopment of Children Aged Under Five Years in East Gojjam, Northwest Ethiopia, 2021: A Community-Based Study. *International Journal of General Medicine* 2022:5533-45.
19. Gedefaw G, Alemnew B, and Demis A. Adverse fetal outcomes and its associated factors in Ethiopia: a systematic review and meta-analysis. *BMC pediatrics* 2020;20(1):1-12.
20. Central statistical Agency I. Central Statistical Agency (CSA)[Ethiopia] and ICF. Ethiopia Demographic and Health Survey, Addis Ababa. *Central Statistical Agency* 2016,
21. Ethiopian Public Health Institute. Ethiopian public health Institute (EPHI)[Ethiopia] and ICF. *Ethiopia Mini Demographic and Health Survey 2019: Key Indicators* 2019,
22. Federal Ministry of Health E. Health Sector Transformation Plan. Addis Ababa: Ethiopia: FMoH E, 2015.
23. Aleni M, Mbalinda S, and Muhindo R. Birth intervals and associated factors among women attending young child clinic in Yumbe Hospital, Uganda. *International journal of reproductive medicine* 2020;2020,
24. Chirwa TF, Mantempa JN, Kinziunga FL, Kandala JD, and Kandala N-B. An exploratory spatial analysis of geographical inequalities of birth intervals among young women in the Democratic Republic of Congo (DRC): a cross-sectional study. *BMC pregnancy and childbirth* 2014;14(1):1-10.
25. Wegbom AI, Bademosi A, Edet CK, Green KI, Sapira-Ordu L, Fagbamigbe AF. Rural–urban disparities in birth interval among women of reproductive age in Nigeria. *Scientific Reports* 2022;12(1):17488.
26. Bronfenbrenner U. Ecology of the family as a context for human development: Research perspectives. *Developmental psychology* 1986;22(6):723.
27. Sallis JF, Owen N, and Fisher E. Ecological models of health behavior. *Health behavior: Theory, research, and practice* 2015;5(43-64),
28. Shifti DM, Chojenta C, Holliday EG, and Loxton D. Socioeconomic inequality in short birth interval in Ethiopia: a decomposition analysis. *BMC public health* 2020;20(1):1-13.
29. Central Statistical Agency I. Central Statistical Agency (CSA)[Ethiopia] and ICF. Ethiopia Demographic and Health Survey 2016. Addis Ababa, Ethiopia, and

Rockville, Maryland, USA: CSA and ICF; 2016, 2017.
30. Ajayi AI, and Somefun OD. Patterns and determinants of short and long birth intervals among women in selected sub-Saharan African countries. *Medicine* 2020;99(19),
31. Hailu D, and Gulte T. Determinants of short interbirth interval among reproductive age mothers in Arba Minch District, Ethiopia. *International journal of reproductive medicine* 2016;2016,
32. Stata Statistical Software: Release 16 [program]. College Station, TX: StataCorp LLC, 2019.
33. Shifti DM, Chojenta C, G. Holliday E, and Loxton D. Individual and community level determinants of short birth interval in Ethiopia: a multilevel analysis. *PloS one* 2020;15(1):e0227798.
34. Aklil MB, Anteneh KT, Debele TZ, and Temesgan WZ. Short birth interval and associated factors among women who gave birth in the last three years in Dembecha district, Northwest Ethiopia. *Plos one* 2022;17(8):e0272612.
35. Aychiluhm SB, Tadesse AW, Mare KU, Abdu M, and Ketema A. A multilevel analysis of short birth interval and its determinants among reproductive age women in developing regions of Ethiopia. *Plos one* 2020;15(8):e0237602.
36. Mohamed M. Factors influencing the utilization of reproductive health services among Somali men in Kisenyi slum, Kampala District-Uganda. International Health Sciences University., 2016.
37. Saha UR, and van Soest A. Contraceptive use, birth spacing, and child survival in Matlab, Bangladesh. *Studies in family planning* 2013;44(1):45-66.
38. Fallahzadeh H, Farajpour Z, and Emam Z. Duration and determinants of birth interval in Yazd, Iran: a population study. *Iranian journal of reproductive medicine* 2013;11(5):379.
39. Mihretie GN, Getie SA, Shiferaw S, Ayele AD, Liyeh TM, Kassa BG, and Asferie WN. Interbirth interval practices among reproductive age women in rural and Urban kebeles in Farta Woreda: Case-control study. *Plos one* 2022;17(1):e0256193.
40. Mihretie GN, Yenealem Beyene F, Getnet Kassa B, Degu Ayele A, Muche Liyeh T, and Minuye Birihane B. Determinants of short birth interval among women in South Gondar, Ethiopia: community-based unmatched case-control study. *Archives of Public Health* 2021;79(1):1-10.
41. Nausheen S, Bhura M, Hackett K, Hussain I, Shaikh Z, Rizvi A, Ansari U, Canning D, Shah I, and Soofi S. Determinants of short birth intervals among married women: a cross-sectional study in Karachi, Pakistan. *BMJ open* 2021;11(4):e043786.
42. Elioba JL, Hakizimana T, Atuhaire S, Ishimwe MP, Naranjo UA, and Ramirez FP. Predictors of short birth interval among women of reproductive age attending the young child clinic at a tertiary hospital in Western Uganda: a cross-section study. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology* 2023;12(12):3453.
43. Tsegaye D, Shuremu M, and Bidira K. Practice of child spacing and its associated factors among women of child bearing age (15 to 49 years) in Illubabor zone, South West Ethiopia. *International Journal of Nursing and Midwifery* 2017;9(7):102-08.
44. Bellizzi S, Mannava P, Nagai M, and Sobel HL. Reasons for discontinuation of contraception among women with a current unintended pregnancy in 36 low and middle-income countries. *Contraception* 2020;101(1):26-33.
45. Muhindo R, Okonya JN, Groves S, and Chenault M. Predictors of contraceptive adherence among women seeking family planning services at Reproductive Health Uganda, Mityana Branch. *International Journal of Population Research* 2015;2015(1):574329.
46. Who Is Financially Constrained in Their Choice of Contraceptive Method? Lessons from M-CARES. AEA Papers and Proceedings; 2024. American Economic Association 2014 Broadway, Suite 305, Nashville, TN 37203.
47. Lince-Deroche N, Pleaner M, Morroni C, Mullick S, Firnhaber C, Harries J, Sinanovic E, Mulongo M, and Holele P. Achieving universal access to sexual and reproductive health services: the potential and pitfalls for contraceptive services in South Africa. *South African Health Review* 2016;2016(1):95-108.
48. Gurmu E, and Etana D. Age at first marriage and first birth interval in Ethiopia: analysis of the roles of social and demographic factors. *African Population Studies* 2014;28(3):1332-44.
49. Belachew TB, Asmamaw DB, and Negash WD. Short birth interval and its predictors among reproductive age women in high fertility countries in sub-Saharan Africa: a multilevel analysis of recent Demographic and Health Surveys. *BMC Pregnancy and Childbirth* 2023;23(1):81.
50. Tesema GA, Wolde M, Tamirat KS, Worku MG, Fente BM, Tsega SS, Tadesse A, and Teshale AB. Factors associated with short birth interval among reproductive-age women in East Africa. *Women's Health* 2023;19:17455057231209879.
51. White K, Teal SB, and Potter JE. Contraception after delivery and short interpregnancy intervals among women in the United States. *Obstetrics & Gynecology* 2015;125(6):1471-77.
52. AFRICA UNIS-S. DHS COMPARATIVE REPORTS 44. 2017,
53. Manning WD. Cohabitation and child well-being. Family and child well-being after welfare reform: Routledge 2017:113-28.
54. Islam MZ, Islam MM, Rahman MM, and Khan MN. Prevalence and risk factors of short birth interval in Bangladesh: Evidence from the linked data of population and health facility survey. *PLOS Global Public Health* 2022;2(4):e0000288.
55. Molitoris J, Barclay K, and Kolk M. When and where birth spacing matters for child survival: an international

comparison using the DHS. *Demography* 2019;56(4):1349-70.
56. Nisha MK, Alam A, Islam MT, Huda T, and Raynes-Greenow C. Risk of adverse pregnancy outcomes associated with short and long birth intervals in Bangladesh: evidence from six Bangladesh Demographic and Health Surveys, 1996–2014. *BMJ open* 2019;9(2):e024392.
57. Arega GG, Mitku AA, and Fenta HM. Spatio-temporal pattern of short birth interval and associated factors on women in Ethiopia: Using Ethiopian demographic and health surveys 2000–2016. *Frontiers in Medicine* 2023;10:1131794.
58. Jalu MT, Ahmed A, Hashi A, and Tekilu A. Exploring barriers to reproductive, maternal, child and neonatal (RMNCH) health-seeking behaviors in Somali region, Ethiopia. *PLoS one* 2019;14(3):e0212227.
59. Medhanyie AA, Alemayehu M, Hadush Z, Berhanu K, Gebremariam Y, Hailu T, Beyene SA, Ahmed M, and Mulugeta A. Barriers to the uptake of reproductive, maternal and neonatal health services among women from the pastoralist communities of Afar, Ethiopia: A qualitative exploration. *The Ethiopian Journal of Health Development* 2018;32(Special Is),
60. Shifti DM, Chojenta C, Holliday EG, and Loxton D. Application of geographically weighted regression analysis to assess predictors of short birth interval hot spots in Ethiopia. *PloS one* 2020;15(5):e0233790.
61. Dollahite DC. Christianity and families. *Encyclopedia of Family Studies* 2016;1,
62. Gebrehiwot SW, Abera G, Tesfay K, and Tilahun W. Short birth interval and associated factors among women of child bearing age in northern Ethiopia, 2016. *BMC women's health* 2019;19(1):1-9.
63. Tuz-Zahura F, Sen KK, Nilima S, and Bari W. Can women's 3E index impede short birth interval? evidence from Bangladesh Demographic and Health Survey, 2017–18. *Plos one* 2022;17(1):e0263003.
64. Mayanja Ronald M, Mubiru Musa M, MasembeSezalio M, and Nkonwa I. Factors associated with short births intervals among women delivering at Mbarara Hospital. *Age* 2016;15(19):20-30.
65. De Jonge HC, Azad K, Seward N, Kuddus A, Shaha S, Beard J, Costello A, Houweling TA, and Fottrell E. Determinants and consequences of short birth interval in rural Bangladesh: a cross-sectional study. *BMC pregnancy and childbirth* 2014;14(1):1-7.
66. Ejigu AG, Yismaw AE, and Limenih MA. The effect of sex of last child on short birth interval practice: the case of northern Ethiopian pregnant women. *BMC research notes* 2019;12:1-6.
67. Hassen TA, Chojenta C, Khan MN, Shifti DM, and Harris ML. Short birth interval in the Asia-Pacific region: A systematic review and meta-analysis. *Journal of Global Health* 2024;14,