



Contents lists available at ScienceDirect

Annals of Medicine and Surgery

journal homepage: www.elsevier.com/locate/amsu

Cross-sectional Study

Determinant factors of under-five mortality in rural Ethiopia

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ARTICLE INFO

Keywords:

Under-five mortality
Rural Ethiopia
EMDHS 2019

ABSTRACT

Background: Under-five mortality is a crucial sign of how well a country's healthcare system is performing. Despite a slight drop, Ethiopia's under-five mortality rate is still high in the nation's rural areas. So this study aimed to identify determinant factors of under-five mortality in rural Ethiopia.

Methods: A cross-sectional community-based survey was carried out. A total of 4414 weighted under-five children from nine geographical regions and one administrative city of Ethiopia were included in the EMDHS 2019 dataset by removing urban residents. The statistical program SPSS version 26 was used to examine the data. To determine if the dependent and independent variables are associated with one another, binary and multivariable logistic regression was utilized.

Results: Out of 4414 total under-five children, 267(6%) of them were dead before the age of five years. Of all, 4414 (46.6%) respondents were from Tigray, Oromia, Amhara, and SNNP. Nearly Three-fourth of respondents were in the age group between 15–34 years (78%). The odd ratio of under-five mortality of Elementary school attended women was 0.31(AOR = 0.31, 95% CI= (0.16, 0.62)) times less likely than No educated women. Women who attended Secondary school was 0.09(AOR = 0.09, 95% CI= (0.05, 0.15)), Women who attended Higher school was 0.27(AOR = 0.09, 95% CI= (0.13, 0.58)) times less likely than women had no formal education.

Conclusion: Conclusion: From the current study the researcher Conclude that under-five mortality was very high in rural Ethiopia. The mothers' educational level, Ages of mothers, marital status, breastfeeding, birth type, Source of water, toilet facility and Place of delivery were major determinant factors of under-five mortality. This research suggests that encouraging women to birth in health facilities and expanding possibilities for mothers' education for rural residents will assist to lessen the burden of under-five mortality.

1. Introduction

Under-five mortality refers to infant deaths that occur before they turn 5 years old [1]. Even while under-five mortality has decreased globally, from 5.9 million fatalities in 2015 to 5.3 million in 2018, there is still a high mortality rate in African nations, notably Ethiopia (81 per 1000 live births), which is around seven times higher than in the European region [1,2].

Under-five mortality in Africa accounts for 14% of the global burden of child death, and in sub-Saharan Africa, it accounts for about 50% of child mortality despite making up only 11% of the global population. One child in every 13 live births in Sub-Saharan African nations dies before the age of five, which is 15 times greater than in high-income nations. In 2018, half of all these deaths happened in five nations: India, Nigeria, Pakistan, Ethiopia, and the Democratic Republic of the Congo [3].

Ethiopian research revealed that children in rural areas have a higher

risk of passing away before turning five than children in metropolitan areas [4]. The location of residence significantly affected the risk of under-five mortality, according to a survival analysis of under-five mortality in Nigeria [5]. Living in a rural area is more frequently associated with a higher risk of under-five mortality, according to numerous studies [6,7]. The previous review showed that rural disadvantage still exists in U5M. The rural location has consistently been associated with greater U5M, hence policies and programs aimed at eradicating rural disadvantage need to be evaluated [8,9]. This may be attributed to poor child care procedures, limited access to appropriate medical treatment, poor transportation, a lack of community health awareness, and delays experienced by rural households seeking medical care.

Even while research suggests that Ethiopia's under-five mortality rate is gradually declining, it is still high in the nation's rural areas [10–12]. Researchers have discovered numerous risk factors for child mortality based on the traits of mothers, fathers, and children as well as the various circumstances of birth. However, the level of risk factors

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<https://doi.org/10.1016/j.amsu.2022.104371>

Received 13 July 2022; Received in revised form 1 August 2022; Accepted 11 August 2022

Available online 23 August 2022

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varied between rural and urban populations, particularly in the presence of subpar infrastructure, low-income groups, and restricted information flow in rural settings, which made the level of risk factors there estimated to be high. Most studies in Ethiopia restricted their analyses to the entire death of children under the age of five in the country.

At least 80% of Ethiopians lived in rural areas, and their life expectancy and average age were both quite low [13,14]. The benefits of lowering the U5M were also unevenly distributed between and within areas. As an illustration, in 2019 the U5MR in Ethiopia varied from 29 in Addis Abeba to 74 per 1000 live births in the Afar Region [15]. One of the most serious issues that need to be highlighted is under-five mortality in rural Ethiopia [16]. For the majority of middle- and lower-income nations, Millennium Development Goal (MDG) 4 which sought to reduce under-five mortality by two-thirds was still on the unfinished list [3]. Achieving the Sustainable Development Goal (SDG), which calls for reducing under-five mortality to 25 deaths per 1000 live births by 2030 [17], is challenging given Ethiopia's current rates of under-five mortality. Therefore, the aim of this study aimed to determine the factors of under-five mortality in rural Ethiopia.

2. Methods

2.1. Study setting, population and data source

In Ethiopia, a cross-sectional community-based survey was carried out. The 2019 Ethiopia Mini Demographic and Health Survey (2019 EMDHS) was carried out between March 21 and June 28, 2019, and it was coordinated by the Technical Working Group. The Ethiopian Public Health Institute (EPHI) collaborated with the Central Statistical Agency (CSA) and the Federal Ministry of Health (FMOH) to carry out the survey (TWG). The Technical Working Group organized the 2019 Ethiopia Mini Demographic and Health Survey (2019 EMDHS), which was conducted between March 21 and June 28, 2019. To conduct the survey, the Federal Ministry of Health (FMOH), Central Statistical Agency (CSA), and the Ethiopian Public Health Institute (EPHI) worked together (TWG). The data set was restricted to under-fives in rural areas, and it documented the ages of the deceased at death as well as the ages of the surviving.

Dataset is from https://www.dhsprogram.com/data/dataset_admin/login_main.cfm.

2.2. Population and sample

The EMDHS comprised 5753 total children under the age of five. A total of 4414 weighted under-five children from nine geographical regions and one administrative city of Ethiopia were included in the EMDHS 2019 dataset by removing urban residents. Two phases of stratification and selection were used for the 2019 EMDHS sample. There were 21 sampling strata created in the first step after stratification was done by region and then by urban and rural areas within each region. With a probability proportional to EA size in each sampling stratum, 305 EAs enumeration areas 93 in urban regions and 212 in rural areas were chosen. All of the chosen EAs underwent a household listing operation.

2.3. Inclusion and exclusion criteria

Included all under-five children in rural Ethiopia and excluded those who resided in urban.

2.4. Study variable

2.4.1. Dependent variable

The dependent variable was Mortality under the age of five in rural Ethiopia.

2.4.2. Independent variable

Using several literature reviews, region, education of mothers, wealth index of HH, marital status, sex of the child, place of delivery, types of birth, breastfeeding, and source of water and toilet facility [4, 16,18].

2.4.3. Operational definition

Under-five mortality: was defined as a child's death within the five years before the guy who was under the age of 60 months.

The region is administrative region, division, or district is the basic organizational unit of local administration.

Education of Mothers: a measure of mother's educational attainment.

Wealth index of household: An overall measure of a family's standard of living in wealth index.

Marital status is the legal definition of marriage.

Sex of child: Baby's gender.

Place of Delivery: a woman's place of delivery is where she gives birth to her children.

Types of birth: is the total number of offspring produced by a single pregnancy.

Breastfeeding: The procedure through which a kid is fed human breast milk is known as breastfeeding or nursing.

2.5. Data analysis

The statistical program SPSS version 26 was used to examine the data. The background characteristics of the sample were summarized using descriptive statistics, such as frequencies and percentages. To determine if the dependent and independent variables are associated with one another, binary logistic regression was utilized. To account for potential confounders, all variables in the bivariate analysis with a p-value less than 0.25 were chosen for the multivariable logistic regression. Factors with a p-value of less than 0.05 were considered significant predictors. **Research Ethics.**

The Ethiopian Health and Nutrition Research Center (EHNRI) Review Board, the National Research Ethics Review Committee (NRERC) at the Ministry of Science and Technology, the Institutional Review Board of Inner City Fund (ICF) International and the centres for Disease Control and Prevention provided ethics clearance and consent to participate in the 2019 EMDHS (CDC). The Ethiopian Health and Nutrition Research Center (EHNRI) Review Board waived the need for obtaining informed consent, however, the information was kept private and anonymous. The Helsinki Declaration carried out this investigation. The work has been reported according to STROCSS criteria [19].

researchregistry8090 (<https://www.researchregistry.com/browse-the-registry/#home/>).

3. Results

In this study, a total of 4414 under-five children were included. Of the total under-five children, 267(6%) of them were dead before the age of five years while 4147(94%) of them were not dead before the age of five years (Fig. 1).

3.1. Characteristics of the study participants

Of all, 4414 (46.6%) respondents were from Tigray, Oromia, Amhara, and SNNP. Nearly Three-fourth of respondents were in the age group between 15–34 years (78%). Nearly more than half (52.3%) of mothers had no formal education. The poorest and poorer wealth index comprises more than half (60.5%) of the total respondents. The majority of the child were male 2290(51.9). The majority of the respondents were married women (94.2%).

A higher percentage of Under-five mortality was observed in the al of Benishangul gumuz Region (9.1%) while a lower percentage of under-

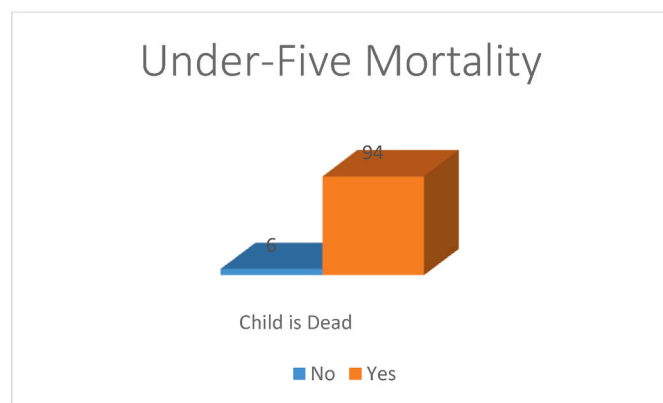


Fig. 1. The Prevalence of Under-five Mortality in rural Ethiopia.

five mortality was observed in the rural Tigray Region (2.4%). The under-five mortality decreases with an increased level of education for mothers. It was the highest percentage of under-five mortality among children whose mothers were not educated (7.2%) while smaller percentages of under-five mortality were observed among children whose mothers attended higher school (4.1%). The percentage of under-five mortality among two woman women married/Never in the union was higher (63.5%) than a wen who were married women (5.2%). A higher percentage of under-five mortality was observed among male children (6.6%) than female children (5.4%). A higher percentage of under-five mortality was observed among children who had no breastfeeding (11.4%) as compared to children who had breastfeeding (2.9%). Nearly more than half of women delivered to their children at home (58.5%) while only 25.1% were delivered to their children at government health centres (Table 1).

The multivariable logistic regression analysis (Table 2) revealed that educational level, Ages of mothers, Marital status, Types of birth, place of delivery and breastfeeding status were statistically significant determinant factors of under-five mortality at a 5% level of Significance.

The odd ratio of under-five mortality of Elementary school attended women was 0.31(AOR = 0.31, 95% CI= (0.16, 0.62)) times less likely than No educated women. Women who attended Secondary school was 0.09(AOR = 0.09, 95% CI= (0.05, 0.15)), Women who attended Higher school was 0.27(AOR = 0.09, 95% CI= (0.13, 0.58)) times less likely than women had no formal education.

The likely hood of under-five mortality in women aged 20 to 24 was 0.27(AOR = 0.27, 95% CI= (0.13, 0.58)), women aged 25 to 29 was 0.38 (AOR = 0.38, 95% CI= (0.18, 0.80)) times less likely than women aged 15 to 19. The odds ratio of under-five mortality of married women was 0.31(AOR = 95% CI= (0.16, 0.62)), living with a partner was 0.09(AOR = 95% CI= (0.05, 0.15)) times less likely than Never married women. The likely hood of under-five mortality of the first multiple was 22.58 (AOR = 95% CI= (4.82–105.86)), the second multiple was 22 (AOR = 95% CI= (5.98, 81.04)) and the third multiple was 10.10(4.86, 24.7)) times more likely than a single birth.

The likely hood of under-five mortality of delivered children at the Health institution was 0.66(AOR = 0.66, 95% CI= (0.44, 0.98)) times less likely than delivered children at home. The likely hood of under-five mortality in breastfeeding children was 4.31(AOR = 4.31, 95% CI= (3.29, 5.66)) times less likely than no breastfeeding children.

4. Discussion

This study aimed to determine factors of under-five mortality in rural Ethiopia. The major Determinant factors of Under-five mortality in rural Ethiopia were the educational level of mothers, Ages of mothers, marital status, Source of water, toilet facility breastfeeding, birth type and Place of delivery was major determinant factors of under-five mortality. This

Table 1

The Predictors characteristics of under-five mortality in Rural Ethiopia (N = 4414).

Variables Category		Frequency (%)	Child is alive	
			No	Yes
Region	Tigray	370(8.4)	9(2.4%)	361 (97.6%)
	Afar	546(12.4)	31 (5.7%)	515 (94.3%)
	Amhara	456(10.3)	22 (4.8%)	434 (95.2%)
	Oromia	632(14.3)	39 (6.2%)	593 (93.8%)
	Somali	527(11.9)	36 (6.8%)	491 (93.2%)
	Benishangul	461(10.4)	42 (9.1%)	419 (90.9%)
	SNNPR	601(13.6)	27 (4.5%)	574 (95.5%)
	Gambela	355(8.0)	30 (8.5%)	325 (91.5%)
	Harari	243(5.5)	14 (5.8%)	229 (94.2%)
	Dire Dawa	223(5.1)	17 (7.6%)	206 (92.4%)
Age in 5-year groups	15–19	248(5.6)	23 (9.3%)	225 (90.7%)
	20–24	858(19.4)	59 (6.9%)	799 (93.1%)
	25–29	1405(31.8)	69 (4.9%)	1336 (95.1%)
	30–34	934(21.2)	48 (5.1%)	886 (94.9%)
	35–39	600(13.6)	34 (5.7%)	566 (94.3%)
	40–44	276(6.3)	15 (5.4%)	261 (94.6%)
	45–49	93(2.1)	19 (20.4%)	74 (79.6%)
Highest educational level	No education	2310(52.3)	166 (7.2%)	2144 (92.8%)
	Primary	1832(41.5)	89 (4.9%)	1743 (95.1%)
	Secondary	198(4.5)	9(4.5%)	189 (95.5%)
	Higher	74(1.7)	3(4.1%)	71 (95.9%)
Current marital status	Never in union	52(1.2)	33 (63.5%)	19 (36.5%)
	Married	4156(94.2)	215 (5.2%)	3941 (94.8%)
	Living with partner	28(0.6)	2(7.1%)	26 (92.9%)
	Widowed	41(0.9)	3(3.3%)	38 (92.7%)
	Divorced	95(2.2)	13 (13.7%)	82 (86.3%)
	No longer living together/separated	42(1.0)	1(2.4%)	41 (97.6%)
Sex of child	Male	2290(51.9)	152 (6.6%)	2138 (93.4%)
	Female	2124(48.1)	115 (5.4%)	2009 (94.6%)
Currently breastfeeding	No	1623(37.3)	185 (11.4%)	1438 (88.6%)
	Yes	2727(62.7)	79 (2.9%)	2648 (97.1%)
Place of delivery	Respondent's home	2583(58.5)	169 (6.5%)	2414 (93.5%)
	Another home	67(1.5)	4(6.0%)	63 (94.0%)
	PUBLIC SECTOR	1109(25.1)	0(0.0%)	0(0.0%)
	Government hospital	333(7.5)	32 (9.6%)	301 (90.4%)
	Government health centre	1109(25.1)	42 (3.8%)	1067 (96.2%)
		203(4.6)		

(continued on next page)

Table 1 (continued)

Variables Category	Frequency (%)	Child is alive		
		No	Yes	
Government health post		12 (5.9%)	191 (94.1%)	
Other	68(1.5)	8 (11.8%)	60 (88.2%)	
Wealth Index	Poorest	2172(43.5)	102 (4.8%)	2038 (95.2%)
	Poorer	849(17)	56 (6.6%)	793 (93.4%)
	Middle	671(13.4)	35 (5.2%)	636 (94.8%)
	Richer	526(10.5)	31 (5.9%)	495 (94.1%)
	Richest	196(3.9)	11 (5.6%)	185 (94.4%)

Table 2

Binary logistic regression analysis of under-five Mortality in Rural Ethiopia.

Variables	Estimate	COR 95% CI	AOR 95% CI	P-Value
Education Level				
No Education				.00
Elementary	-.76	.47(.22-.99)	.31(0.16-0.62)	.00
Secondary	-1.97	.14(.08-.26)	.09(0.05-0.15)	.00
Higher	-1.91	.15(.051-.43)	.27 (0.13-0.58)	.00
Ages of Mother				
15-19	1.33	3.77(1.80-7.89)		.00
20-24	-1.9	.149(.05-.43)	.27 (0.13-0.58)	.00
25-29	-1.22	.3(.10-.85)	.38(0.18-0.79)	.02
30-34	.60	1.81 (.68-4.90)	1.89(1.12-3.19)	.24
35-39	.83	2.29(1.06-4.90)	1.70 (0.98-2.95)	0.03
40-44	0.81	2.26 (0.96-5.31)	1.78(0.91-3.50)	0.06
45-49	0.77	2.16(1.14-4.12)	398(0.21-0.77)	0.02
Marital Status				
Never in Union	3.93	50.63 (24.00-106.78)	31.84 (17.81-56.91)	.00
Married	-.76	.47(.22-.99)	.31(0.16-0.62)	.04
Living with partner	-1.97	.14(.08-.26)	.09(0.05-0.15)	.00
Widowed	3.03	20.63(7.86-54.16)	10.10(4.86-24.7)	.00
Divorced	4.63	102.66 (11.91-885.09)	71.21 (9.05-560.09)	.00
Types of birth				
Single Birth				.00
First Multiple	3.79	44.17 (8.27-235.94)	22.58 (4.82-105.86)	.00
Second Multiple	3.84	46.37 (10.91-196.89)	22 (5.97-81.04)	.00
Third Multiple	3.03	20.63(7.86-54.16)	10.10(4.86-24.7)	.00
Place of Delivery				
Home				.47
Health institution	-.14	.87(.52-0.90)	.66(0.44-0.98)	.02
Breastfeeding				
No				0.00
Yes	-1.40	0.25(0.18-0.33)	4.31(3.29-5.66)	0.00
Constant	-.68	.51	0.78	.25
Source of drink				
Piped water				.253
Public tap	1.946	2.02(0.70-5.82)	6.99(0.99-49.28)	.051
Tube well water	2.267	2.25(0.80-6.36)	9.65(1.21-77.30)	.033
Dug well	2.421	2.33(0.84-6.50)	11.26 (1.42-89.52)	.022
Unprotected	2.160	2.71(1.02-7.23)	8.67(1.17-64.49)	.035
River/dam	2.120	.97(0.21-4.54)	8.34(1.15-60.29)	.036
Toilet Facilities				
No				.006
Yes	-1.556	1.85(0.55-6.30)	.21(0.02-2.20)	.194
Not a dejure residents	-1.009	2.81(0.83-9.60)	.37(0.4-3.73)	.395
Constant	17.561		42332769.817	1.000

study found the prevalence of under-five mortality in rural Ethiopia was 6% (60/1000) of death per one thousand live children in rural Ethiopia. This result showed that under-five mortality was less than in the study conducted Previous in rural Ethiopia [16]. This indicates under-five mortality in rural Ethiopia rate is somewhat declining, and access to and utilization of health care is improving.

The results of the current study indicated that maternal education was a significant predictor of death among children under the age of five in rural Ethiopia. According to this study, educated women have a decreased risk of under-five mortality than uneducated women. This is because moms who have had more education are more likely to have higher incomes, a greater understanding of health issues, and the ability to make wiser decisions regarding their own and their children's health. This is consistent with the results of earlier studies [20]. The likelihood of parents' children surviving will increase as their educational backgrounds do. According to earlier studies, women with higher levels of education are more aware of baby health and hygiene resources. As a result, the death rate for children under the age of five has reduced in sub-Saharan African nations [21], Madagascar [22], Tanzania [22], and Nigeria [23].

The results of the current study indicated that marital status was a key determinant of death among children under the age of five in rural Ethiopia. The conclusion was corroborated by a prior study [24]. These results showed that women who had been married had a lower risk of under-five mortality than women who had never been married. It makes sense that mothers in stable marriages would receive support from their partners during prenatal and postnatal care, as demonstrated by our findings, which can reduce the risk of under-five mortality. However, there haven't been many studies on the effect of a mother's marital status on under-five mortality. Additionally, marriage may have advantages such as the pooling of resources to employ quality medical services or to properly care for young children's nutritional needs.

The current study showed mothers' age was a major determinant factor of under-five mortality in rural Ethiopia. For instance, it has been discovered that Burundi's poor living conditions, such as overcrowding and poor housing conditions, inadequate sanitation, and unsafe water, where less than 50% of the population has access to potable water, are to blame for the finding that under-five morbidity is higher in children born to mothers whose first childbirth occurred before 20 years, compared to those whose mothers' first childbirth occurred at 20 years and above [18]. Other studies have linked the nation's high rates of under-five mortality among adolescent mothers to factors including political unrest and armed conflict, weakened healthcare systems, inadequate coverage of interventions, policies that deprive women of their rights, and gaps in the continuum of care [25-27].

The current study showed that the Place of delivery was a major significant factor in under-five mortality in rural Ethiopia. Compared to children born in a health institution, those born at home had a higher risk of dying before the age of five. This result agrees with the finding of the previous study [4,28,29]. This might be because babies born at home are more likely to have infections.

The current study showed that breastfeeding is a major determinant factor of under-five mortality in rural Ethiopia. It was discovered that infants who were breastfed had reduced death rates among children under the age of five than those who were not. This result is consistent with the results of previous studies [2,30,31]. This might be explained by the fact that breast milk strengthens and supports a baby's immune system, which protects the body from intruders like viruses and germs.

The current study showed that birth type was a major determinant factor of under-five mortality. Multiple births were found to carry a greater risk of under-five mortality than single births. This is consistent with the findings of the previous studies [2,32-34]. This might be the case because the main risk factors for under-five mortality are growth retardation and preterm, which can result from multiple deliveries [35]. Additionally, having twins or triplets increases the risk of undernutrition due to insufficient breast milk as well as infections from improper

formula feeding and cow's milk consumption.

The current study showed the source of water is a major determinant factor of under-five mortality in rural Ethiopia. A newborn born into a family without access to piped drinking water was at a high risk of dying before the age of five. According to Mutunga's research conducted in Kenya, the source of drinking water is a deciding factor [36]. According to a Chinese study, having access to clean water in rural areas decreased the risk of child mortality by roughly 34% [37]. This could help to explain why children are more prone to develop diarrheal diseases when exposed to water sources that are more likely to be contaminated, such as river water.

5. Strengths and limitations

The inclusion of nationally representative datasets from rural Ethiopian nations and the size of the sample, which allowed for the implementation of advanced statistical techniques, is the study's main strengths. Despite this strength, it's important to note several restrictions. First, because of the cross-sectional design used in the DHS, causal interpretations of the results cannot be proven. Second, because first childbirth age was self-reported, there is a chance that some data may have been under or over-reported.

6. Conclusion

From the current study, the researcher concludes that under-five mortality was very high in rural Ethiopia. The educational level of mothers, Ages of mothers, marital status, Source of water, toilet facility breastfeeding, birth type and Place of delivery were major determinant factors of under-five mortality. This research suggests that encouraging women to birth in health facilities and expanding possibilities for mothers' education will assist to lessen the burden of under-five mortality. These results lead me to the conclusion that targeted initiatives with a focus on the reduction of under-five mortality must specifically address the needs and welfare of women. Final the government and all stockholders should give attention to clean water and facility for toilets in rural areas.

The implication of the study

The study's conclusions have the potential to increase awareness and highlight the need for appropriate policies and programs to address adolescent childbearing and child morbidity in rural Ethiopia.

Ethical approval

The Ethiopian Health and Nutrition Research Center (EHNRI) Review Board, the National Research Ethics Review Committee (NRERC) at the Ministry of Science and Technology, the Institutional Review Board of Inner City Fund (ICF) International and the centres for Disease Control and Prevention provided ethics clearance and consent to participate in the 2019 EMDHS. The Ethiopian Health and Nutrition Research Center (EHNRI) Review Board waived the need for obtaining informed consent, however, the information was kept private and anonymous. The Helsinki Declaration carried out this investigation. The work has been reported according to STROCCS criteria.

Sources of funding

No funded

Author contribution

The lead author, Getahun Dejene Yemane, is responsible for the study's conception, data analysis, interpretation, and preparation and finalization of the article.

Registration of research studies

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1. Unique Identifying number or registration ID: researchregistry8090.

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Consent

Not Applicable.

Declaration of competing interest

The research, writing, and/or publication of this paper were all done with no potential conflicts of interest, according to the author(s).

Acknowledgement

The Ethiopian Public Health Institute and the Ethiopian Mini Demographic and Survey have to be sincerely thanked for collecting and supplying the data, respectively.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2022.104371>.

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