

# HIV Sero Status and Associated Factors Among HIV-Exposed Infants' in Selected Health Facilities in Sidama Zone, Southern Ethiopia

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**Abstract:** MTC transmission of HIV is a major public health challenge in Ethiopia; however there were a shortage of evidence on HIV sero status of exposed infants in Sidama zone, Southern Ethiopia. Therefore, this study aimed to assess, the HIV sero status and associated factors among HIV-exposed infants in selected public health facilities. A cross-sectional study was conducted in 14 public health facilities at Sidama zone SNNPR state, Ethiopia from May 1- 30/2019Gc. Medical record cards of HIV-exposed infants and their mothers enrolled from January 2014 to January 2018 was extracted using data extraction checklist. Magnitude and associated factors of HIV sero status of exposed infants was computed using SPSS version 21.0 software. A total of 203 HIV-exposed infants who had HIV DNA/PCR test results were included in the study. The overall prevalence of HIV among HIV exposed infants were nearly 9% (95% CI: 4.4, 12.8) Infants born from mothers' with baseline CD4+ counts of mother less than 350, (AOR=5.629; 95% CI: 1.454, 21.79), Mothers who had WHO clinical stage I and II, (AOR=4.975; 95% CI: 1.342, 18.446), and Poor ART adherence (AOR=4.302; 95% CI: 1.100, 16.823) had an increased odds of HIV infection comparing to their counterparts. Conclusion and recommendation: The prevalence of HIV infection among infants born to HIV infected mothers was high in the study area. Baseline CD4+ counts, WHO clinical staging, and ART adherences of mothers are associated with their infants HIV status. Therefore, stakeholders including health care workers working at PMTCT centers should make create awareness on the effects of poor ART adherence and undertaking further rigorous longitudinal studies are recommended.

**Keywords:** HIV Sero Status, HIV Exposed Infants, DNA/PCR Test, OPTION B+ Strategy, Ethiopia

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## 1. Background

MTCT of HIV is transmission of human immunodeficiency virus from HIV infected mother to exposed infants during pregnancy, childbirth and post-natal period of the pregnancy [1, 2]. HIV infected infants' results in lifelong chronic health problems, such as premature morbidity and morbidity of the infants [4]. According to the United Nations Programmer on HIV/AIDS reported that in 2016 an estimated 160,000 children were newly infected, and

an projected 3.1 million children were living with HIV worldwide and there were nearby to 500,000 children infected with HIV through infected mother to exposed infants transmission each year [4]. And also According to USAID 2017 report, there were just about 1.4 million pregnant women, and 1.8 million children were livelihood with HIV/AIDS. It is also projected that 1.8 million individuals turn out to be newly infected, of which 180,000 will be under

15 years old children [10].

The Plan in the direction of eradicating new HIV infections among children by 2015 and provide an ultimate care to their mothers launched in 2011, and set a sequences of targets for 2015 to reduce new HIV infections among children through 90% in 2015. The successful international pressure groups recommended that all pregnant and breastfeeding women to be on antiretroviral therapy, nevertheless of CD4 T-cell count or clinical staging established the phase for the World Health Organization's properly named "Treat All" guidelines, eradicated numerous longstanding obstacles to treat HIV/AIDS [11].

In Ethiopia there were nearly 90,000 HIV positive pregnant women who live with HIV AIDS and a projected 14,000 HIV positive births in 2017 [12]. In similar years the pooled prevalence of mother to child transmission of HIV was 9.93% (3). To eradicate new HIV Infections among children, the Ethiopian MOH adopted PMTCT shift. In "August 2012, the country adopted WHO Prevention of mother to child transmission programmatic shift, option B+ strategy. The program recommends lifelong antiretroviral therapy (ART) for all HIV-positive women who are pregnant and breastfeeding, regardless of the CD4 count or clinical staging [13]. The post-2015 HIV priorities were high impact interventions that radically reduce the annual new infection and save many lives [14]. Studies conducted in Ethiopia have also shown that the magnitude of HIV-positive children in Ethiopia is still high [8]. Moreover, reducing infant death due to infected mother to exposed infants' transmission of HIV has been the matter of concern for Ethiopian Ministry of health for years. Ethiopia have adopted PMTCT programmatic shift, option B+ strategy from World Health Organization (WHO) as a comprehensive approach to reduce the transmission of HIV/AIDS to infants during pregnancy labour and delivery and through breast feeding [13]. But, detailed information on rate of Mother to child transmission of HIV/AIDS after end of follow up of exposed infant remains in short in Ethiopia, in spite of its harmful effects on child health [15]. Especially, the HIV sero status and the factors were not well studied in Ethiopia particularly in Sidama zone. Therefore, this study was conducted to determine the HIV sero status of infants and associated factors among HIV-exposed infants in selected health facilities in Sidama zone south.

The study would provide helpful information on HIV sero status and associated factors among exposed infant in Sidama zone. In addition; it may contribute to reduce infant and maternal morbidity and mortality associated with HIV/AIDS. It may also provide helpful information to modify and design nursing intervention for HIV exposed infants to eliminating new HIV infection among children while keeping children living with HIV alive and well. Additionally, it may give a base line data for interested researchers, policy makers and scientific knowledge.

## 2. Methods and Materials

### 2.1. Study Area and Period

The study was done in public health facilities found in Sidama zone, SNNPR, in the southern part of Ethiopia from May 1 to 30/2019Gc. Sidama Zone, is located in the eastern part of SNNPR covers about 6,538 km<sup>2</sup>. It is one of 15 zones found in SNNPR, Ethiopia. In 2017 Total population of Sidama zone around 4.5 million and there are around 0.75 million house hold. This zone is located between 3° 14' N latitude and 33° 48' E and it has 33 districts and two self-administration towns. This zone is bordered on the south by the Oromia Region, except for a short stretch in the middle where it shares a border with Gedeo zone, on the west by the Bilate River, which separates it from Wolieta zone, and on the north and east by the Oromia Region [24]. Hawassa is the capital city of Sidama and SNNPR, and situated 279 km from Addis Ababa capital city of Ethiopia. Sidama zone is the largest most populous and urbanizing zone in the SNNPR state of Ethiopia. Among adults ages 15-64 years HIV prevalence in urban area of SNNPR was 1.8% [2]. Sidama zone is one of the HIV/AIDS-affected regions in SNNPR state. In this zone there were total 361 HIV exposed infant and from total exposed 203 infants had DNA/ PCR test results from January 2014 to January 2018Gc. This zone has twelve primary hospitals, one zonal and one general public hospital [30].

### 2.2. Study Design, Sampling Technique and Procedures

Institution based cross sectional study design was used to investigate HIV sero status and associated factors among HIV-exposed infants using a census sampling technique. Participants for this study were HIV-exposed infants medical registration card which had DNA / PCR tested result enrolled from January 2014 to January 2018Gc. Study was conducted in selected health facilities which had been providing PMTCT service. From the total health facilities found in Sidama zone, fourteen [14] health facilities had ART clinic and had been providing PMTCT service linked with other health facilities to address services for the whole catchment area. In this zone from 2014 to 2018 there were 203 HIV positive women and exposed infants pair (mother –infant pair) who had PCR test result enrolled in PMTCT of selected health facilities. The data were extracted retrospective from PMTCT log book and maternal medical registration card by using data extraction checklist.

### 2.3. Study Population and Source Population

All HIV-exposed infants' medical records card having DNA/ PCR test result and enrolled in selected health facilities from January 2014 to January 2018Gc used as a study population. Medical records of HIV-exposed infants and their mothers enrolled from January 2014 to January 2018 in the study institutions were considered as a source population.

Eligibility criteria- All HIV-exposed infants medical

registration card which had HIV PCR test result were included while Exposed infants transfer out, lost and stopped treatment were excluded from the study.

**Study Variables:** Dependent variable- HIV sero-status of Baby (positive/negative) and the independent variables were Socio-demographic factors, Clinical characteristics of the mother, Obstetrics characteristics of the mother, and clinical Characteristics of exposed infants.

**Operational definitions-Exposed infants HIV status:** If the DNA/PCR test result indicated positive or negative for HIV during the follow-up period of 18 months as indicated by the infant registration card (15). While, HIV Positive: when the DNA/PCR test result for exposed infants indicated positive for HIV during the follow-up period of 18 months and HIV Negative: when the DNA/PCR test result for exposed infants indicated negative for HIV during the follow-up period of 18 months.

#### 2.4. Data Collection Instruments and Procedures

The data were extracted from PMTCT registration log book through using; data extraction format adopted from the national standard HIV exposed infant follow up formats [24]. All HIV-exposed infants and their mothers who started the Prevention of mother to child transmission service in selected health facilities during the study period were included in the study. HIV exposed infants and their mothers with incomplete data because of transfer out, lost and stopped treatment were excluded from the study. Some important variables incomplete in registration logbook during filtration of data were counted as missing variable. Data was collected by trained and experienced clinical nurses and diploma midwives who had at least 2 years of work experience in ART clinic.

#### 2.5. Data Quality Management

Data quality assurance mechanisms was carefully developed and implemented at various stages of the study. The quality of data may be affected at different points unless proper measures were taken throughout the study time. For all study areas, three data collectors and two supervisors who had ability to communicate in Amharic and local language were recruited after one day training about data collection technique. To ensure data quality, preliminary assessment was done to include all variables registered in infants PMTCT follow up log books and maternal medical registration card in similar health facility. At the end of the day filled questionnaires were checked for completeness and consistency of information by the supervisor and errors were manually edited. Any ambiguity and other problems of data collectors were addressed. Cronbach's alpha and collinearity was checked.

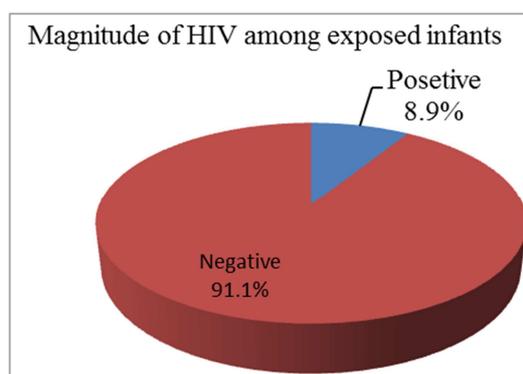
#### 2.6. Data Processing and Analysis Procedures

Data cleaning was performed to check for accuracy, consistencies of the data. The data collection was undertaken under rigorous daily checking to identify and correct errors. The investigator entered the data using Epi Data version 3.1

and exported to SPSS 21 statistical package for analysis. Descriptive statistics (frequency and percentage) were used to describe sero status of exposed infants and associated factors. Then bivariate logistic regression analysis was done to see the crude association between the independent variables and the dependent variables and the strength of association were expressed the odds ratio (OR). Eventually, results from bivariate analysis of  $p < 0.25$  were moved to multivariate analysis and done through backward variable selection logistic regression methods to control the effects of confounding and to identify predictors of HIV sero status of exposed infants. A P value of  $< 0.05$  used to determine the significance of association.

### 3. Results

**Magnitude of HIV among exposed infants:** The finding of this study show that among infants who had DNA/PCR test results, HIV sero status positive infants were 18 (8.9%) CI: (4.4, 12.8) and HIV sero status negative were 185 (91.1%) during the study period (Figure 1).



**Figure 1.** Magnitude of HIV among exposed infants in Sidama zone SNNPR Ethiopia, from 2014 - 2018Gc.

#### 3.1. Characteristics of Study Participants

The participants of this study were included from the 14 governmental hospitals found in Sidama zone SNNPR regional state in Ethiopia. A total of 203 HIV exposed infant who had DNA /PCR test results and maternal Medical follow up card, were included in this study. More than half of the mothers 106 (52.2%) were 25 to 34 years old. One hundred and eighteen (58.1%) mothers resided in urban areas and the remaining 85 (41.9%) lived in rural areas. The slightly more than half of HIV infected mothers, 107 (52.7%) were primary school and 122 (60.1%) mothers were House wife.

All mothers of HIV exposed infants were enrolled in obstetric care and support service during the last pregnancy. Among this 164 (80.8%) women had attended ANC during Pregnancy, and slightly more than half 108 (53.2%) had not completed TT5 immunization. Related to labour and delivery care service, 164 (80.8%) of them were gave birth at health facility, majority of women 198 (97.5%) had gave birth through spontaneous vaginal delivery (SVD), and 161 (79.3%) had gave birth at term for last pregnancy.

All HIV exposed infants who had DNA/PCR test results were enrolled in PMTCT of HIV care and support service during the follow-up period included in the study. From the study participants majority 162 (79.8%) of HIV-exposed infants were enrolled into HIV care within six weeks of life. And also, 150 (73.9%) of the infants were given ARV prophylaxis to prevent MTCT of HIV at birth. Most of HIV-exposed infants received co-trimoxazole preventive therapy (CPT), and 162 (79.8%) of infants started CPT at six weeks of being born. Regarding to infant feeding practice, 163 (80.3%) infants were exclusive breastfed before six months. Regarding to EPI (expanded programs of immunization) all HIV exposed infant were immunized. The majority of this 149 (73.4%) Infants were received Vitamin A. In this study all of HIV exposed infants mothers were enrolled in HIV care and support service during the last pregnancy. Out of these, 203 (100%) of them were taking highly active treatment, 146 (71.9%) of were known HIV status before PMTCT program Entry, 117 (57.6%) baseline CD4 count were 350 and above, 134 (66.0%) WHO clinical stages were Stage 3 and four during last pregnancy (Table 1).

### 3.2 Factors Associated with MTCT of HIV Among Exposed Infants

HIV disclosure status of mother, HIV Clinical stage of

mother, Baseline CD4 count of mother, ART adherence, mother attend ANC during Pregnancy, Place of delivery, infant's age at diagnosis, infants received Vitamin A, infants received NVP at birth, infant feeding practice before six months have shown a significant association with HIV sero status of baby in the bivariate analysis at P-value <0.25. After adjusting for common confounders, in the multivariate analysis, baseline CD4+ count of mother were less than 350, maternal WHO clinical stage I and II, Poor ART adherence and infants who didn't receive Vitamin A had significant association to HIV sero status of infant at P-value of < 0.05. Mothers whose baseline CD4 count less than 350 were 6 times (AOR=5.629; 95% CI: 1.454, 21.79) more likely to transmit HIV when compared with those with CD4 count greater than 350. Regarding to maternal WHO clinical staging, mothers who had WHO clinical stage I and II were 80% (AOR=0.201; 95% CI: 0.054, 0.745) less likely transmit HIV compared with those who had stage III and IV. According to ART adherence, mothers Poor adherence to ART were 4 times (AOR=4.302; 95% CI: 1.100, 16.823) more likely to HIV compared with those who had good ART adherence. Infants not receiving Vitamin A at nine months were seven times (AOR=7.184; 95% CI: 1.795, 28.759) more likely to have MTCT of HIV compared with Infants received Vitamin A at nine month of life. (Table 2)

**Table 1.** Socio demographic and clinical characteristics of HIV exposed infants and mothers in Sidama zone, SNNPR state, southern Ethiopia 2014-2018.

Variables		Frequency	Percentage
Age of Mother	15-24yr	46	22.7%
	25-34	106	52.2%
	35-44	51	25.1%
Residence of Mother	Urban	118	58.1%
	Rural	85	41.9%
Educational status of the Mother	Illiterate	54	26.6%
	Primary	107	52.7%
	Secondary	37	18.2%
	College and above	5	2.5%
Occupation of Mother	Farmer	12	5.9%
	Merchant	59	29.1%
	Government worker	10	4.9%
Religion of mothers	House wife	122	60.1%
	Orthodox	63	31.0%
	Muslim	84	41.4%
	Protestant	35	17.2%
	Catholic	21	10.3%
Marital status of Mother	Single	16	7.9%
	Married	178	87.7%
	Divorced	5	2.5%
	Windowed	4	2%

Variables	Frequency	Percentage
Obstetrics/ Reproductive Health history		
Mother attended ANC during Pregnancy		
Yes	164	80.8%
No	39	19.2%
Place of delivery		
Health facility	146	71.9%
Home delivery	57	28.1%
Mode of delivery		
SVD	198	97.5%
C/S	5	2.5%
Give birth at term pregnancy		

Variables	Frequency	Percentage
Yes	161	79.3%
No	42	20.7%
TT vaccination		
Complete (TT5)	95	46.8%
Not complete	108	53.2%

Variables	Frequency	Percentage	
<b>HIV and ART related History</b>			
Variables	Category	No.	%
Infant's age at diagnosis for HIV	At 6 weeks	162	79.8%
	After 6 weeks	41	20.2
Infants received NVP at birth	Yes	150	73.9%
	No	53	26.1%
Infant received CPT at 6 weeks	Yes	162	79.8%
	No	41	20.2%
Feeding practice before six months	EBF	163	80.3%
	Mixed feeding	40	19.7%
Infants received Vitamin A	Yes	149	73.4%
	No	46	22.7%
DBS (DNA/PCR) test result	Positive	18	8.86%
	Negative	185	91.13%
Mother were on ART during labour	Yes	128	63.1%
	No	75	36.9%
HIV disclosure status of mother	Yes	146	71.9%
	No	57	28.1%
Entry to PMTCT	During ANC	75	36.9%
	During labour	64	31.5%
	During PNC	64	31.5%
Baseline CD4 count of mother	Less than 350	86	42.4%
	350 and above	117	57.6%
Maternal WHO clinical stage	Stage 1 and 2	69	34.0%
	Stage 3 and four	134	66.0%
	HAART	203	100%
PMTCT intervention	None		
	> 4 weeks	46	22.7%
Duration of mother on ART treatment	≤4 weeks	157	77.3%
	Good	180	88.7%
ART adherence	Poor	23	11.3%

**Table 2.** Factors associated with HIV status among infants born to HIV positive mothers, in selected health facility of Sidama zones northern Ethiopia 2014 to January 2018Gc.

Variables	DBS PCR/DNA Result		COR (95% CI)	P-Value	AOR (95% CI)	P-Value
	Negative	Positive				
HIV disclosure status of mother						
Yes (Ref)	137 (93.8%)	9 (6.2%)				
No	48 (84.2%)	9 (15.8%)	2.85 (1.07, 7.61)	0.036		
HIV Clinical stage of mother						
WHO stage I and II (Ref)	59 (85.5%)	10 (14.5%)	0.37 (.141, 0.998)	0.050	0.2 (0.054, 0.75)	0.016*
WHO stage III and IV	126 (94.0%)	8 (6.0%)				
Baseline CD4 count of mother						
Less than 350	74 (86.0%)	12 (14.0%)	3.0 (1.07, 8.346)	0.035	5.63 (1.45, 21.79)	0.012*
350 and above (Ref)	111 (94.9%)	6 (5.1%)				
ART adherence						
Good (Ref)	168 (93.3%)	12 (6.7%)				
Poor	17 (73.9%)	6 (26.1%)	4.94 (1.65, 14.84)	0.004	4.3 (1.10, 16.82)	0.036*
Mother attend ANC during Pregnancy						
Yes (Ref)	153 (93.3%)	11 (6.7%)				
No	32 (82.1%)	7 (17.9%)	3.043 (1.1, 8.45)	0.033		
Place of delivery						
Health facility (Ref)	153 (93.3%)	11 (6.7%)				
Home delivery	32 (82.1%)	7 (17.9%)	3.04 (1.1, 8.45)	0.033		
Infant's age at diagnosis						
At 6 weeks	43 (81.1%)	10 (18.9%)	4.128 (1.5, 11.1)	0.005		
After 6 weeks (Ref)	142 (94.7%)	8 (5.3%)				
Infants received Vitamin A						
Yes (Ref)	140 (94.0%)	9 (6.0%)				

Variables	DBS PCR/DNA Result		COR (95% CI)	P-Value	AOR (95% CI)	P-Value
	Negative	Positive				
No Infants received NVP at birth	38 (82.6%)	8 (17.4%)	3.28 (1.18, 9.06)	0.022	7.18 (1.79, 28.8)	0.005**
Yes (Ref)	151 (93.2%)	11 (6.8%)				
No Infant feeding practice before six months	34 (82.9%)	7 (17.1%)	2.83 (1.02, 7.8)	0.045	3.43 (0.96, 12.26)	0.058
EBF (Ref)	152 (93.3%)	11 (6.7%)				
Mixed feeding	33 (82.5%)	7 (17.5%)	2.93 (1.057, 8.13)	0.039	3.3 (0.85, 12.8)	0.083

## 4. Discussion

Prevention of Mother to child transmission of HIV needs early HIV diagnosis and timely preventive management. Polymerase chain reaction (PCR)-based HIV DNA and HIV RNA assays have become the most widely used, even in resource-limited settings, for both diagnostic and monitoring purposes [31]. This study was conducted to find out the magnitude of HIV status and associated factors among HIV-Exposed Infants' in Sidama zone, SNNPR state, southern Ethiopia.

In this study, the prevalence of HIV infections among exposed infants was 18 (8.9%) 95% CI: [4.4-12.8]. This reflects that the morbidity and mortality of the children is high due to this diseases condition. If appropriate preventive measures are not taking place, the risk of HIV among exposed infants might be ranked as tope five of infants' mortality. This finding was slightly higher than compared to the global target in 2015, which was 5% among breastfeeding women [7] and also to be study conducted in East and West Gojjam Zones, Northwest Ethiopia shows that the prevalence of MTCT of HIV was 5.9% (3.9–7.9), [32] and the study conducted in Oromia Regional State 7.70% [23]. The possible explanation for this difference might be the difference in study design which most of them used cohort study design, sample size and study area. In addition to this, the gap might be due to the difference in the health care seeking behavior of infected mothers which in turn increases the recognition and prevention of MTCT. Despite the fact that the current health policy of Ethiopia focused on the implementation of option B+ and free PMTCT service for infected mother and exposed infants; the prevalence of MTCT of HIV in our study is higher than the 2015 global target but lower than the systematic review and meta-analysis study conducted in Ethiopia (9.93%; 95% CI, 7.29, 12.56) [3]. This gap might be due to the differences in the study period, sample size, geographical difference of the study areas and health seeking behavior of the HIV infected mothers.

This study also revealed that factors associated with MTCT of HIV are: baseline CD4 count, WHO clinical stage of mother, ART adherence, and received Vitamin A. Mothers baseline CD4+ count less than 350 were six (AOR=5.629; 95% CI: 1.454, 21.79) times more likely to have an increased MTCT of HIV compared to those of Baseline CD4+ count greater than or equal to 350. This reflects that having CD4+ count less than 350 increases the likelihood of MTCT of HIV. This finding was in line with the study conducted at

Zimbabwe which showed that maternal CD4 count less than 200 were more likely affect MTCT of HIV than counterpart (AOR=7.1; 95% CI: 2.6-17) [19]. Our study also illustrated that mothers who had WHO clinical stages I and II were 80% (AOR=0.201; 95% CI: 0.054, 0.745) less likely to be MTCT of HIV compared with clinical stages III and IV. This reflects that mother having clinical stages I and II have minimum chance of MTCT of HIV. In the same line, a study conducted at northwest Ethiopia showed those in clinical stages I and II were four (AOR=4.4 (CI: 1.5, 12) times more likely to prevent mother to child transmission of HIV compared with clinical stages III and IV [33]. Our study also demonstrated that poor ART adherence during last pregnancy four (AOR=4.302; 95% CI: 1.100, 16.823) times more likely affect MTCT of HIV compared to good ART adherence. This may indicate that there were significant numbers of women who might loss four and more doses within 60 days which could lead to poor ART adherence. This was incomparable with the study conducted in other area [23, 26]. The inconsistency might be due to the difference in the study area, study design, and health seeking behavior of the mothers. Numerous risk factors examined are strength of this study. Since the data was secondary, the information gathered was not complete in some infant's logbook and mother's medical registration card are limitations.

## 5. Conclusion

The prevalence of mother to child transmission of HIV was 18 (8.9%). ART poor adherence, clinical stages I and II and low maternal CD4+ counts were factors associated with MTCT of HIV among exposed infants. Therefore, relevant stakeholders should make efforts to reduce the magnitude of MTCT of HIV through strengthening the prevention of mother-to-child transmission (PMTCT) of HIV, and health education for infected mother on the importance of ART adherence and undertaking further study are recommended.

## List of Abbreviation / Acronym

- AIDS: Acquired immune deficiency virus
- ART: Ant retro viral therapy
- CD4+: Cluster of differentiation four plus
- HIV: Human immunodeficiency virus
- IRV: Institutional review board
- JU: Jimma University
- MTCT: Mother to child transmission o
- PMTCT: Prevention mother to child transmission

PCR: Polymerase chain reaction  
 SVD: Spontaneous vaginal delivery  
 UNSAID: Unitized state aid for international development  
 WHO: World health organization  
 SNNPR: South nation nationality and people region

## Ethics Approval and Consent to Participate

Ethical clearance for the study was obtained from the Jimma university, institutional review board (IRB) of Jimma University Ethical Review Board (Nu85/8050/2018Gc). The permission letter was obtained from SNNPR Health bureau and Sidama zone health bureau administrative office and delivered to the respective study institutions. Data were processed using unique identifiers for purpose of privacy and confidentiality.

## Authors' Contribution

YY, BT, JJ and SA, contributed to the planning and development of the study design. YY was responsible for the data collection. YY, BT, JJ and SA were involved in the data analysis and interpretation. YY wrote the first draft of the manuscript with significant contributions from all authors. All the co-authors edited and approved the final version.

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