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# Measles Case-Based Surveillance Data Analysis Report in Tigray Region, From September 2013 to August 2017

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## Abstract

*Measles is a highly contagious viral disease which transmitted primarily by respiratory droplets or airborne sprays to mucous membranes in the upper respiratory tract or the conjunctiva. We conducted this surveillance analysis to describe measles distribution by person, place, and time and recommend possible solutions. The Data was secondary data that collected from the National lab EPHI by using concept note that was blood sample sent from Tigray region from September 2013 up to August 2017. Distribution of cases by age and sex (person), description by place and time was made. There was a total of 668 Measles cases and no deaths. From the total of measles sample sent to National EPHI from 2013 to 2017 in Tigray Region the most affected age group is between 15-44 years of age 293(43.9%). The number of confirmed measles were found intermittently increasing and decreasing from year to year. And Measles surveillance system should be strengthening in the Region, especially woredas with high measles cases. But in the study, there were high measles case > 15 years than the underage this needs additional and further study in the region to better understand the age shift.*

**Keywords:** Measles, Tigray Region, Ethiopia, 2013-2017

## Background

Measles is an acute viral illness caused by a virus in the family Paramyxoviridae, genus Morbillivirus. Measles is characterized by a prodrome of fever (as high as 40 0C) and malaise, cough, coryza, and conjunctivitis, followed by a maculopapular rash. The rash usually appears 14 days after exposure and spreads from head to trunk to lower extremities. Approximately two to three deaths may occur for every 1,000 reported measles cases. Persons with measles are usually considered infectious from 4 days before until 4 days after onset of rash with the rash onset being considered as day zero [1, 2].

This highly contagious virus is transmitted primarily by respiratory droplets or airborne spray to mucous membranes in the upper respiratory tract or the conjunctiva [1, 2]. It usually does not kill children directly; however, as a result of its associated immune suppression, measles can lead to lethal complications, such as pneumonia, croup, and diarrhea. Measles can also lead to lifelong disabilities, including blindness, brain damage, and deafness The risk factors for measles virus infection include: infants who lose passive antibody before the age of routine immunization, children with vitamin A deficiency and immunodeficiency due to HIV or AIDS, leukemia, alkylation agents, or corticosteroid therapy, regardless of immunization status and children who travel to areas where measles is endemic or contact with travelers to endemic areas. Malnourished and young children are at higher risk of developing complications and mortality from measles infection [3].

In 1980, before widespread vaccination, measles caused an estimated 2.6 million deaths each year. Despite the availability of a safe and effective vaccine, measles remains one of the leading causes of death among young children globally. More than 95% of measles deaths occur in low-income countries with weak health infrastructures [4].

As of 2013, it was estimated that, measles caused some 40,000 deaths annually in the African Region. Measles remains among the top causes of death in children less than 5 years of age in many African countries. Before the widespread availability of measles vaccine, virtually all children contracted the disease [5].

Therefore, this analysis was undertaken to describe proportion of confirmed measles cases, vaccination status and determine the extent, distribution, and occurrence of measles in Tigray region. Surveillance is an essential component of enhanced measles control initiatives. And a case-based surveillance is also a surveillance that done on a laboratory based of selected cases/diseases. And Measles case-base surveillance was one of it. It involves immedi-

ate reporting and investigating any suspected case of measles by clinicians using standard case definition, evaluating immunization efforts and predicting outbreaks through the identification of geographical areas and age group at risk [6]. This study aimed to analyze measles surveillance data and describe proportion and its distribution in Tigray region from September 2013 to August 2017.

## Methods

### Study area

The study area is Tigray region which is one of the Regions of the 9 regions of Ethiopian . Tigray is situated between 12°-15° N and 36° 30' - 40° 30' E and); to the north, it borders to the state of Eritrea, to the west to northern Sudan, to the south to the Amhara, and to the east to the Afar. It is a very historic region noted for its custodianship of "… one of the powerful civilizations of the ancient world, [which] was centered here from at least 400 BC to the 10th century AD.

Tigray has an amazing landscape with the Tekeze Gorge at 550 meters above sea level and the mountains like Tsibet peaking at 3935 meters. Tigray region which is about 783 km far from Addis Ababa. The surveillance data analysis included secondary data reported from all woredas health offices and hospitals directly to the regional health bureau of Tigray.

### Study Design and Time Period

Cross-sectional retrospective surveillance data analysis was conducted from September 2013- August 2017.

### Study Period

The study was conducted from August to September 2018.

Source of data

Secondary data that was sample collected for any measles suspected patient with a case-based investigation form and specimen transported to the National Measles Lab in good condition to be tested for Measles IgM antibody by ELISA technique. The sample sent was from September 2013 up to August 2017 from all Districts/zone of Tigray region of all Health facilities.

### Data analysis

Descriptive statistical analysis was presented by frequency, Relative frequency (percent), cumulative frequency and cumulative relative frequency and a tool for data analysis was by Microsoft Excel 10.

## Result

There was a total of 668 Measles cases and no deaths. From the total of measles sample sent to National EPHI from 2013 to 2017 in Tigray Region the most affected age group is between 15-44 years of age 293(43.9%) followed by age group between 5 and 14 years of age 182(27.2%). From the total 50% of them were > 15 years of age. The mean and median ages of the patients were 14.3 and 14 years respectively.

**Table 1: Distribution of Measles case by different age group, Tigray Region from September 2013-August 2017**

| Age distribution | Frequency | Relative Frequency | Cumulative Frequency | Cumulative Relative Frequency |
|---|---|---|---|---|
| 0-4 | **153** | **22.9%** | **153** | **0.229** |
| 5-14 | **182** | **27.2%** | **335** | **0.501** |
| 15-44 | **293** | **43.9%** | **628** | **0.940** |
| >=45 | **40** | **6%** | **668** | **1.00** |
| Total | **668** | **100%** | | |

Concerning on cases distribution by sex the male affected was accounts 363(54.5%) and 2(0.3%) of them were missing.

**Table 2: Distribution of Measles case by Sex, East Tigray Region from September 2013-August 2017(n=666)**

| Sex | Frequency | percentage | Cumulative Frequency | Cumulative Relative Frequency |
|---|---|---|---|---|
| Male | 363 | 54.5% | 363 | 0.545 |
| Female | 303 | 45.5% | 666 | 1.00 |
| Total | 666 | 100% | | |

With regards to geographical distribution/district, the most affected area is Northwest Tigray District 152 (22.8%) followed by central Tigray 147(22%) and South Tigray 134 (20%). Whereas low sample cases sent to National laboratory from West Tigray 13(1.9%).

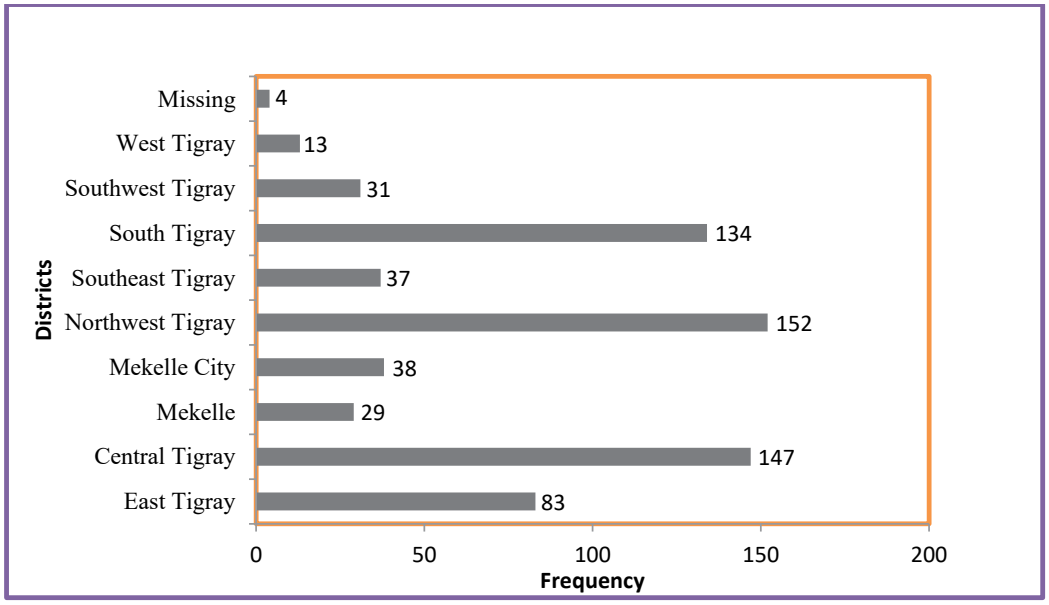


**Figure 1:** Measles distribution by District of Tigray Region, September 2013-August 2017

With regards to geographical distribution of weredas,the top ten most affected wereda were Mekelle City 38(5.7%) , Alemata Town 29 (4.3%)Asgede 23(3.4%), Tselmeti 21(3.1%) and the other are below (Table 3).But large percent was missed 185(27.7%) that do not write the wereda of the request sent.

**Table 3: Distribution of Measles case by Ten Top Most Affected Weredas, Tigray Region, and September 2013-August 2017**

| SNO | Wereda | Frequency | Relative Frequency | Cumulative Frequency | Cumulative Relative Frequency |
|---|---|---|---|---|---|
| 1 | Mekelle City | 38 | 5.7% | 38 | 0.568 |
| 2 | Alamata Town | 29 | 4.3% | 67 | 0.100 |
| 3 | Asgede Tsimbela | 23 | 3.4% | 90 | 0.135 |
| 4 | Tselemti | 21 | 3.1% | 111 | 0.166 |
| 5 | Axum Town | 18 | 2.7% | 129 | 0.193 |
| 6 | Adigrat Town | 17 | 2.5% | 146 | 0.219 |
| 7 | Medebey Zana | 17 | 2.5% | 163 | 0.244 |
| 8 | Ofla | 16 | 2.4% | 179 | 0.268 |
| 9 | Mereb Lehe | 16 | 2.4% | 195 | 0.292 |
| 10 | Maychew | 13 | 1.9% | 208 | 0.311 |

When we see the trends of the distribution of Measles case based on Time, the year 2014 is the time period where most the case 210(31.4%) had occurred and the least case happened was on 2016 58 (8.7%) and the trend then increase in 2017.

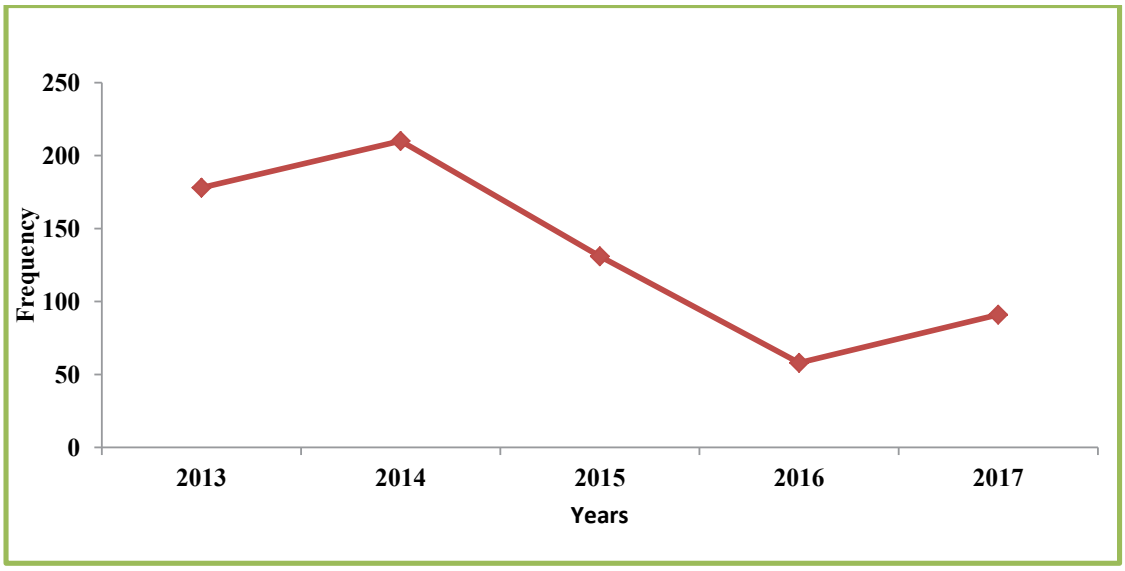


**Figure 2:** Trends of Measles case by Time (year) in Tigray Region, September 2013-August 2017.

## Distribution of Measles Cases by Month in Tigray Region, September 2013 to August 2017

The Monthly sample sent indicates that March 109(16.3%), January 79(11.8%), February 79(11.8%), April 63(9.4%) and December 59(8.8%) are the months that more than half of all case 389(58.2%) are occurred. (Figure 3)

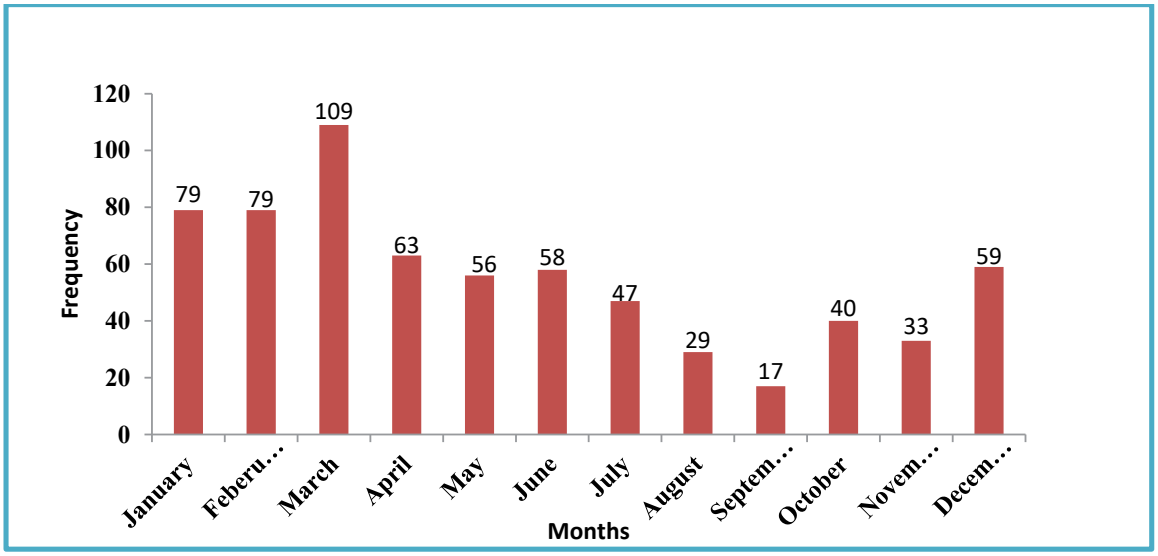


**Figure 3:** Distribution of Measles case by Time (Month), in Tigray Region, September 2013-August 2017

## Trends of Measles Cases by Year and Week in Tigray Region, September 2013 to August 2017

The trend of Measles distribution in Tigray region was highest in 2014 in the same year and in 13th week which is 16 cases followed by 2015 week4 which accounts 15 and followed by 2014 on 49th week's accounts 13.

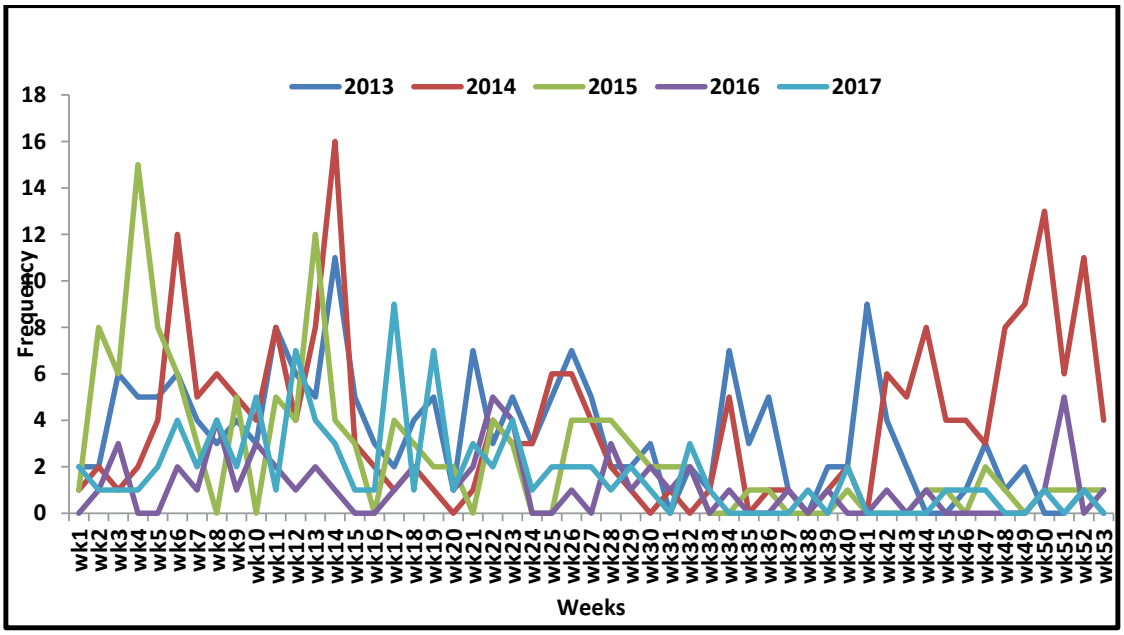


**Figure 4;** Trends of Measles Cases in Tigray Region, In year and Week, September 2013 to August 2017

### IgM Results of Measles Cases, Tigray Region, September 2013 to August 2017

Based on the results of the measles IGM Laboratory-confirmed was sent to National Laboratory from the total of 668 Negative result 348(52.1%) were the highest. From this male were 18.7% positive,26.6% Negative, 2.7% Epifocal (Neither positive nor Negative), 6.3% Missing not written the result and 0.1% not done and for female 14.2% positive, 25.3% negative, 0.9%Epifocal and 4.9% Missing.

**Table 4; Igm Results of Measles Cases, Tigray Region, September 2013 to August 2017**

| SNO | Igm Result | Frequency | Relative Frequency | Cumulative Frequency | Cumulative Relative Frequency |
|---|---|---|---|---|---|
| 1 | Not done | 1 | 0.1 | 1 | 0.001 |
| 2 | Epifocal | 24 | 3.6 | 25 | 0.037 |
| 3 | Missing | 75 | 11.2 | 100 | 0.149 |
| 4 | positive | 220 | 32.9 | 320 | 0.479 |
| 5 | Negative | 348 | 52.1 | 668 | 1.00 |
| | Total | 519 | | | |

### Status of Vaccination of Measles, Tigray Region, September 2013-August 2017

The status of vaccination that was sent to National laboratory from different district were most of them were missed 510(76.3%), others were vaccinated 82(12.3%) and very least of them were not vaccinated 17(2.5%).

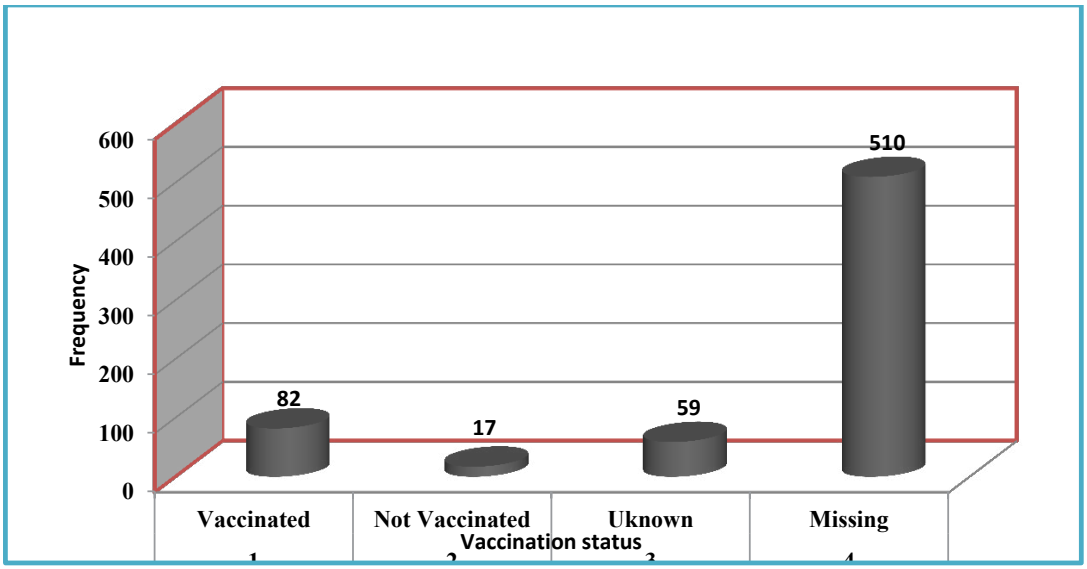


**Figure 5;** Measles Vaccination, Tigray Region, September 2013-August 2017

### Based on Associated with Epidemics of Measles, Tigray Region, September 2013- August 2015

Based on the sample sent from different district of Tigray region there are many Suspected measles outbreak: outbreak but not expressed or mention on the request that the sample they sent specially on associated with epidemics. Most of them were missed 510 (76.3%), some of them were not associated with epidemics 152 (22.8%) and 6(0.9%) were association with epidemics.

## Discussion

The study demonstrated that most of 43.9% affected age groups were the age b/n 15- 44 years, with 27.2% of them being children b/n 5-14 years and 22.9% of them are children less than 4 years and 6% of them were above the age of 45. This finding was lower than other African countries in which 72.5% of cases occur in children aged < 5 years and 27.5% of cases were aged >5 years of Southwest Nigeria [7]. But 50% of the total case was >15 In opposite to this finding. Adults were the most affected age grouped this is because of low immunity of the patients and probability of not taking MCV1 or more in their child age and also indicates the effectiveness of the vaccination campaigns which mainly focused on providing and boosting immunization in under five children.

The Monthly Report indicates that March 109(16.3%), January 79(11.8%), February 79(11.8%), April 63(9.4%) and December 59(8.8%) are the months that had above half of all case 389(58.1%) were occurred. When we compare with other finding of SNNPR January, October and November are the highest case were epidemic [8]. This might be related with the population movement and many traditional ceremonies (wedding, religious festivals) during this season that created a favorable condition for measles transmission. Seasonal variation in the hot dry season was also noted in a study finding in Nigeria and highest peak in March in India [7, 9].

When we see the trends of Measles case based on Time, the year 2014 is the time period where most the case 210(31.4%) had occurred followed by the year 2013 178(26.6%), In 2015 130(19.5%) but in 2016 and 2017 58(8.7%) and 91(13.6%) respectively relatively low case reported or sent the sample to National laboratory with in the study period. This is similar to that of the Ethiopian national increase of measles case from 2013 to 2014 then intermittently increases and decrease up to 2017 similar to Benin [10, 11].

Based on the results of the Igm measles that was sent to National Laboratory from the total of 668 Negative result 348(52.1%) followed by positive result 220(32.9%), Equivocal 24(3.6%) and the sample that was sent 1(0.1%) not done. In other region of Ethiopia (South nation nationality and people of Ethiopia) among tested samples, a total of 1507 (31.3%) samples were found positive for measles-specific IgM and the rest 3196 (66.4%) and 107 (2.2%) were negatives and equivocal (compatibles) respectively [8]. The result was the positive one was higher that of the SNNP region and the Negative one was lower than that of the SNNP region. This might be in the Region epidemics occurred in 2016.

## Conclusion and Recommendation

In Tigray Region, measles continued as an important public health problem. The number of confirmed measles was found intermittently increasing and decreasing from year to year mostly affecting >15 of years of age in opposite to this the adults are the most affected age grouped.

We also noted that a seasonal peak of measles case during January-March. And the Igm result of the positive one was higher than that of another region and the Negative one was lower than that of the other region.

With regards to geographical distribution, the most affected area/district was Northwest Tigray followed by Central and South Tigray respectively. And from weredas Mekele city, Alamata town and Tselemti were the highest affected areas.

I recommend conducting a wide age group vaccination campaign in the region for those < 15 years old and for those highly affected areas and weredas. And Measles surveillance system should be strengthening in this Region, especially woredas with high measles cases. But in the study, there were high measles case of > 15 than the underage this needs additional and further study in the region to better understand the age shift.

With regards of sample collection and request fulfillment like wereda, Age, sex, association with epidemics and Vaccination status much of them were Missed (not filled) when they sent there should be fulfilled the request when they come to National lab and a training or refreshment given to the health professionals about surveillance and lab technique.

Ethiopia gets closer to measles elimination targets the region should be evaluate and monitor the PHEM work and cased-based surveillance of measles.

## Abbreviations

AIDS Acquired Immunodeficiency Syndrome
CSA Central Statically Agency
ELISA Enzyme linked Immuno-Sorbent Assay
EPHI Ethiopia Public Health Institute
IgM Immunoglobulin M
HIV Human Immuno-Virus
MCV Measles Containing Vaccine
NICD National Institute for Communicable Diseases
PHEM Public Health Emergency Management
SNNP South Nation Nationality and People
WHO World Health Organization

## Data Availability

All data are available in the manuscript. The datasets used and analyzed during the current study are available from the corresponding author based on reasonable request.
The data "Measles Case-Based Surveillance Data Analysis Report in Tigray Region, From September 2013 to August 2017" used to support the findings of this study are included within the article.

## Ethical Approval

We obtained permission from EPHI Director prior to get the data from National laboratory or Virology department and to study. Names of patients were omitted from the analysis. Confidentiality was assured and maintained.

## Consent

Not Applicable.

## Conflicts of Interests

We have declared that we have no conflicts of interests.

## Authors' Contributions

AD designed the study data collection, performed analysis, interpretation of data, drafted the paper, and prepared the manuscript. ZA, HB, and EA assisted in the design, approved the proposal with some revisions, participated in data analysis, and commented drafts of the manuscript. All authors read and approved the final manuscript.


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