Epidemiology of Measles in Bale Zone South East Ethiopia 2019

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Research Article

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Abstract

Background: - Measles remains causes of vaccine preventable death in children worldwide. Cases comes to health facilities after complication developed, and miss diagnosed as the complication than measles, which is a reason for under reporting of measles cases and number of reported cases represents small proportion of expected cases. While aim of this study is to analyze seven years (2013-2019) measles surveillance data of Bale zone and to indicate measles surveillance related gaps.

Method: - Cross sectional study conducted from May 25-June 25/2019. Study population and sample was all measles cases reported to bale zone from 2013-2019. Data abstracted by reviewing seven years measles line list and case-based report by investigator using data abstraction check list. Data entered and analyzed by Microsoft excel. Tables, graph and percent presented the data.

Result: - Overall, 4241 measles cases were reported with a case fatality of 3.07/1000 population. About 248(5.8%) were measles IgM confirmed. Mean age of the case patients were 7.15 and 2147 (50.6%) were males. The most affected age group were <4 years, 1685 (39.7%) of cases. The highest prevalence rate 141 / 100,000 populations reported in 2019.Unvaccinated and unknown status were 890(21%) and 731(17.2%). The highest numbers of cases reported from Ginir and Gololcha. Measles cases increase in autumn season of the year and reaches peak in May.

Conclusion: - Measles is the major causes of morbidity and Mortality in Bale zone due to poor immunization coverage, 890(21%) of case patients were un vaccinated. Though community death is not included case fatality is high. Ginir reported the highest number of cases. Increasing vaccine coverage of the zone, early preparedness before annual cycle and strengthening measles case-based surveillance is mandatory.

Introduction

Measles is one of the most contagious diseases for humans caused by a virus in the family paramyxovirus, genus Morbillivirus. The incubation period for measles is 10–14 from exposure to symptom onset. Measles characterized by fever, malaise, cough, coryza, and conjunctivitis, followed by a maculopapular rash(1)(2). Complications of measles are most common among children younger than 5 years of age and 30% of reported measles cases result in complications such as pneumonia, diarrhea and encephalitis, and death (3).

Measles resulted in 90,000 and 110 000 deaths annually, in 2016 and 2017 respectively. In high income regions of the world, measles causes death 1 in 5000 cases, but greater than 1 in 100 may reach 25% will die in developing countries (8) . Measles is still a common and often fatal disease in developing countries (3). In 2013, 171,178 cases were reported from Africa region of world health organization WHO(11) and resulted in high attack rates among children less than one year. Measles is the leading cause of blindness in African children(3). According to a WHO report, measles still remains a public health priority disease and is associated with high morbidity and mortality. Most of the associated deaths

occur in children aged five years and younger. It is a leading cause of vaccine preventable death and endemic in low vaccine coverage countries. Measles follows a seasonal pattern, with increasing incidence in the dry season, i.e. from reported November to May (7) and in Ethiopia reach peak during the late-early part of the year (December to February)(12).

Measles is still one of the major causes of death and sickness of children in Ethiopia and outbreak reported annually(12) (4). Ethiopia is committed to achieve the elimination of measles by 2020 and measles incidence in Ethiopia is 50 cases/1,000,000 per year, which is above the national set targets for measles elimination by 2020 <1/1,000,000 per year in 2017(6). Case-fatality rate is between 3% and 6%; In certain high-risk populations, case-fatality rates as high as 30% have been reported in infants aged less than 1 year of age in Ethiopia(4). According to measles surveillance data analysis of 2012-2016 conducted in Oromia regional state of Ethiopia 26908 cases and 288 deaths were reported(13).

The risk factors for measles is inadequate vaccination, Malnourished, children with vitamin A deficiency and immunodeficiency due to HIV or AIDS, leukemia, alkyl ting 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 are at high risk of(4).

As a result of the existence of highly effective measles vaccine (5) four million measles related deaths are averted from 2012-2014 (6) . Measles vaccine is a live attenuated virus vaccine and two doses recommended by world health organization to provide protection from measles (14). According to WHO-AFRO region of 2015 Status of the measles Elimination in the African Region, Ethiopia is among the eleven countries with major challenges, large population, insecurity, and high incidence of measles, frequent outbreaks and leadership gaps(14).

According to WHO Ethiopia is among the six countries with the most unvaccinated infants of (1.1million) in 2017(25). Ethiopia is among the nations with low measles containing vaccine (MCV1) coverage and MCV2 was given by supplementary immunization activities until recent time. To get extra immunity the government launched measles vaccine second dose (MCV2) vaccination into the routine immunization program in the second year of life in February 2019. Measles antibodies develop in approximately in 95% of children vaccinated at 9-12 months of age and 98% of children vaccinated at 15 months of age(3)(18).

According to WHO, measles surveillance is a key element to achieving elimination goal (9). The objectives of measles surveillances are detecting ,identify, investigate, and manage outbreaks identifying geographic areas and age groups at high-risk and Evaluate vaccination strategies in order to improve measles control(4). In Ethiopia Measles, case-based surveillance is part of the national public health emergency management (PHEM) system.

Case-based measles surveillance was initiated in Ethiopia in 2003. Measles is one of the weekly reportable diseases in Ethiopia and the number of reported cases represents only a small proportion of the expected cases. Measles case usually comes to health facilities often after they develop complication. As a result, they are diagnosed as the complication rather than measles, which is one of the

reasons for under reporting of measles cases(12). And the aim of this study was to analyze seven years (2013-2019) measles surveillance data of Bale zone by person, place and time. The analysis includes vaccination status, laboratory confirmation and case fatality rate among cases.

Methods And Materials

Study Area

Bale zone is among twenty-one administrative zones of Oromia regional state. It is located in the Southeastern part of Oromia and is situated between 5°11´03´´N to 8°09´27´´North latitudes and 38°12´04´´E to 42°12´47´´East longitudes with an altitude ranges from 300 to 4377 meters above sea level. The Somali Region borders Bale on the south by the Guji zone, on the west by the West Arsi Zone, on the north by Arsi, on the northeast by the west Hararghe and East Hararghe, and on the east. Robe, the capital of the zone situated at 430km from Addis Ababa. Bale zone have 19 districts and two city administrations. About 383 health post,83 health center and four hospitals are found the zone. The total population projected for 2019 was 1963416.

Study period -Measles surveillance data of past seven years (2013-2019G.C) was analyzed from 27/5/2019-25/6/2019 G.C

Study design- Cross-sectional study design

Source Population- All peoples in Bale zone during the study period

Study Population- All confirmed, epidemiologically linked and clinically compatible measles cases reported to Bale zone from 2013-2019.

Inclusion and Exclusion Criteria

Inclusion criteria: Complete line lists and case-based reports of measles recorded in the database of Bale zone public health emergency management (PHEM) from 2013 to 2019 was included.

Exclusion criteria: Line lists and case-based reports registered prior to January 2013 and after December 2019 as well line lists with incomplete data elements were excluded.

Sample Size and Sampling procedure.

All 4241 measles cases reported to Bale zone PHEM department from 2013 to 2019G.C.

Data Collection Procedure and Tool

Secondary data of measles from 2013-2019 was abstracted by using a format developed for this purpose. Data were collected from line list, case based and Weekly IDSR report. Data abstracted in

terms of person, place, time, case classification, vaccination status and final outcome. Data abstracted by the investigator.

Data processing and analysis

The abstracted data entered and analyzed using Microsoft Excel, Pivot software. Arch JIS version 10.1 software was used to locate area and spot map of cases. Descriptive statistics median, standard deviation, and percentages was used to analyze measles surveillance data during 2013—2019. Prevalence, case fatality and vaccination status also calculated. Data were described by person, place and time. Tables' graph and figures presented the results.

Operational definition

Suspected measles case: Any person with fever and maculopapular generalized rash and cough, coryza or conjunctivitis OR any person in whom a clinician suspects measles **2. Confirmed measles case**: A case with laboratory confirmation (positive IgM antibody) or epidemiologically linked to confirmed cases**.** **Epidemiologically linked case:** A suspected measles case living in the same or in adjacent district with a laboratory confirmed case where there is a likelihood of transmission; onset of rash of the two cases being within 30 days of each other.**4. Measles death:** Any death from an illness that occurs in a confirmed case or epidemiologically linked case of measles within one month of the onset of rash.**5. Discarded**: A suspected measles case that has been completely investigated, including the collection of adequate blood specimen (5 ml), but lacks serologic evidence of recent measles virus infection (that is, IgM negative). **6. Clinical / Compatible:** A suspected measles case that has not had a blood specimen taken for serologic confirmation, and cannot be epidemiologically linked to a laboratory-confirmed case.

Ethical Issues

An official letter obtained from Bale Zone PHEM department, and Jimma university school of Public Health. Then after a 7 years zonal Measles data was accessed to carry out this analysis.

Result

Measles Case Distribution by Age, Sex and Place

A total of, 4241 measles cases were reported from 475 Health facilities and twenty districts to Bale zone from 2013-2019. From total cases 2147(50.6%) are male and 2094(49.4%) ware females. Mean age of

case patients are 7.15 and standard deviation is 8.95. Age group 1-4years were 1685 (39.7%) followed by 5-15and 16-35 with 1260(29%) and 649(15.3%) respectively. (Table 1)

Table 1 Measles cases by age categories and sex 2013-2019 Bale zone

Age category	Male	Percent	Female	Percent	Total	Percent
<1	235	5.5	268	6.3	503	11.9
1_4	759	17.9	923	21.8	1682	39.7
5_15	771	18.2	502	11.8	1260	29.7
16-35	303	7.1	333	7.9	649	15.3
36_49	74	1.7	52	1.2	126	3.0
>50	5	0.1	16	0.4	21	0.5
Total	2147	50.6	2094	49.4	4241	100

From total reported measles cases 2147(50.6%) were males and 2094(49.4%) were females. Female to male ratio was 1:1.04. Sex specific prevalence rate was calculated and the highest prevalence rate was among male with 2.27/1000 slight lower among females 2.2/1000. The trained shows almost cases are equal among both sexes with slight difference in 2013, 2015 and 2019 as shown in figure 2

Measles Age specific prevalence by Time

Prevalence was high in under one year's children during 2013-1019 with the highest PR 30/1000 reported in 2019. The Second most affected age group was 1-4 age categories highest PR 4.29/1000 in 2019. The prevalence rate was low among greater than 15 years with greatest Prevalence of 0.73/1000 observed in 2019 (Table 2).

Table 2 Age specific prevalence/10000 population of measles Bale zone

Years	Prevalence Rate (PR)/1000 in age groups					
< 1	1_4	5_15	16-35	36-49	<50	
2013	1.17	0.31	0.09	0.08	0.03	0.02
2014	2.96	0.31	0.09	0.13	0.00	0.00
2015	5.31	0.42	0.22	0.09	0.03	0.03
2016	6.36	0.35	0.12	0.02	0.02	0.02
2017	3.47	0.21	0.06	0.01	0.00	0.00
2018	2.34	0.33	0.13	0.10	0.01	0.01
2019	29.80	4.29	1.32	0.73	0.01	0.01
Total	51.41	6.21	2.04	1.16	0.10	0.10

Prevalence of measles by place

From 4241 cases the highest proportion of measles prevalence were reported from Ginir district followed by Gololcha and Lega Hidha by 77/10000, 45.4/10000 and 38.4/10000 population respectively. The lowest proportions of measles prevalence were reported from Gura dhamole, Gasara, Agarfa, and Berbere with a prevalence of 0.6/10000, 0.9/10000, 1.4/10000 and 1.6/10000 population respectively as shown in (figure3).

Geographical distributionof measles

Regarding measles cases by place of residence the highest number of cases are reported from rural areas of the zone 3 642(85.8%) cases and low among urban residents 599(14.1%)

Trend of measles by month

The highest number of measles cases are reported during autumn ((June 1344(31.6%), May 934(22%) and April 545(12%)) Season of the year and reaches peak level in May. Low number of cases were reported in summer season (October November and September with 85(2%), 41(0.97%) and 98(2.3%)) cases respectively as shown in Figure 5.

Trend of Measles prevalence by Time

From 2013-2019 the highest suspected measles cases prevalence rates were seen in 2019 and 2015 accounted for 141 per 100,000 and 21 per 100,000 populations respectively. While remarkable decrement of suspected measles case was reported in year 2017 which is 7.2 / 100000 and in 2013 which was 11.4 / 100000 populations (figure 6)

Measles Final Case Classifications

From a total of 4241 measles cases reported during the study period only 248(5.8%) cases were confirmed by laboratory for measles IgM and 3060 (72.1%) were epidemiologically linked. Clinically compatible cases are 497(11.3%) of total cases.

Measles laboratory result

During 2013-2019, 993 samples were sent to central laboratory for confirmation and about 248(24.9%) were measles IgM positive and the highest numbers of samples are discarded 375 (37.7%). Only 137(13.8%) cases are negative for measles IgM. (Figure 8)

Inpatient and Outpatient cases

From 2013-2019 years periods 582 (13.2%) measles cases were admitted and 3659 (86.2%) suspected measles cases were treated as an outpatient level. The overall admission rate from the cases was 15.9 %.

Measles Case Fatality Rate

Case fatality by sex

From 2013-2019G.C there are 4241measles suspected cases were reported with a case fatality rate of 3 .07/1000 population. The highest CFR was reported in 2016 among females with CF of 6.6/1000 and in 2015 greatest CF among male cases was occurred 4.7/1000. Fatality was high among females than males with CCFR of 3.3/1000 among females and 2.8/1000 among males respectively. There was no death reported in 2013, 2017 and 2018. From reported death the highest numbers of deaths are reported in 2019 among both sexes 4(66.6%) of death among male and 5(71.4%) of death among females. Regarding mortality of measles by place the highest numbers of measles related deaths are reported from Ginir 9(69.2 %%), D/serer4 (30.8%) and Sewena 15(15.4%).

Case Fatality by Age

Case fatality by age group showing of high case fatality rate of 4/1000 among less than one year of age followed by 3.8/1000 case fatality among 5-15 age category and low among age group of greater than 16 years. As age increase, the fatality of the case is decrease.

Trend of measles CF by Year

Regarding the trend of measles mortality, the greatest case fatality was occurred during 2015, which was 5.4/1000, and in 2014 4.4/1000 populations. The fatality was zero in 2013, 2017 and 2018. (Figure 10)

Vaccination status

Out of the 4241 total case patients 2620(62%) of cases are vaccinated from which 1480(34.4%) ,1032(24.3%) and 108(2.5%) have received a single, two and three doses respectively. There were

890(21%) case patients with no vaccination history and 731(17.2%) of the case patients have unknown vaccination status. (Table 3)

Table 3 Table showing vaccination status of measles cases by sex from 2013-2019 Bale Zones 2019 G.C

vaccination status of reported cases	Sex	Total	Percent	
Male	Female			
Vaccinated	1296	1323	2619	61.8
Unvaccinated	484	406	890	21.0
unknown	369	363	732	17.3
Total	**2149**	**2092**	**4241**	

Vaccination Status by Place

Regarding unknown vaccination status 390(53.4%) are from Ginir and 107(14.6%) are from Gololcha. From vaccinated Ginir, Gololcha and Sewena reported 981(37.4%), 400(15.3) and 213(8.1%) Sewena respectively. The highest proportion of zero doses are reported from Ginir 443 (44.3%), 88 (9.9%) from Dawe Serer and 82(92%) from Lega hida

Vaccination Status by Time

Concerning vaccination status of measles cases, from a total of 890 un vaccinated cases the highest percentage of unvaccinated cases are reported in 2019 and 2014 with 73.3% and 8.7% respectively. Regarding those who have vaccination history the highest percentage of single dose and two doses are reported in 2019 and 2015 with 67.9%, 68% and 7.2% and 14% respectively. Lower percentage of single dose and two doses are reported in 2014 2% single dose and 1.5% of two doses. Forty one percent of unknown vaccination statuses also reported in 2019.

Measles Data Type

From 4241 suspected measles cases, 903 (21%) of the cases were reported by case based an3d 3312(64.9%) by line list.

Discussion

From 4241 cases reported the highest measles cases are observed among age group of 1-4years 1685 (39.7%) followed by 5-15, 16-35 and Less than one years by 1260(29%), 649(15.3%) and 503(11%).This

finding is in line with the study conducted in Guji zone which shows all age groups, even older than 15 years are affected(20) and national measles surveillance data analysis finding of the age group 1 to 4 years was the most affected population by measles from all other age categories(21). This is because of malnutrition and inadequate vaccination status.

From 2013-2019 the highest measles prevalence rates were seen in 2015 and 2019 accounted for 21 per 100,000 and 141 per 100,000 populations respectively. The study finding is higher compared to study conducted in Nigeria , incidence was estimated at 19/100,000 population/year(22), in Ethiopia the incidence was more than 2 / 100,000 populations/year for five years (21). The deference is possibly due to high accumulation of susceptible person and outbreak occurs frequently in the zone.

During 2013-2019 a total of 993 (24%) of total measles cases samples were sent to central laboratory for confirmation and about 248(24.9%) were measles IgM positive ,375 (37.7%) are discarded and 137(13.8%) are negative cases. This finding is in line with study conducted in south Ethiopia and Oromia region with 1507 (31.3%) samples were positive for measles (23) and 36% of samples were positive for Measles IgM respectively(13) . And greater than national confirmed cases in 2008 and 2009 only 10.7 and 9.1% are confirmed respectively(21) . These shows strength of surveillance system of the zone

From 2013-2019 years periods 582 (13.2%) measles cases were admitted and 3659 (86.2%) suspected measles cases were treated as an outpatient level. The overall admission rate from the cases was 15.9 %. The admitted cases were lower as compared to study conducted in Addis Ababa among 1787 measles cases; 1442 (84%) were outpatient visits while the rest 276 (16%) were inpatient (18). This is due to there is a limited resource among patients and inadequacy of admission rooms in the study area

Case fatality rate was 3.07/1000 population and high among children less than 1-year 4/1000 followed by 5-15 years with 3.8/1000. Fatality was high among females than males with CCFR of 3.3/1000 among females and 2.8/1000 among males respectively. The fatality of the zone was low as compared to study in Niger CRF of 9.7% and highest CFR was among infants (15.7%) (24). The expected Case-fatality rate in Ethiopia is between 3% and 6%; In certain high-risk populations, case-fatality rates reach 30% in infants aged less than 1 year of age in Ethiopia (4). This is because CFR of measles decrease with increasing age and fatal in under five.

Out of the 4241 total cases patients 2620(62%) of cases are vaccinated. There were 890(21%) case patients with no vaccination history and 731(17.2%) of the case patients have unknown vaccination status. Study finding is greater compared to study conducted in Ethiopia 380 (22%) were received at least one dose of measles containing vaccine (MCV) while 415 (24%) were not vaccinated and the rest 923 (54%) vaccination status were not known (18) .The study finding is lower than the study conducted in Oromia region 29% measles cases were not vaccinated and 46.4% of cases were unknown for vaccination status (13) .And study conducted in Guji zone a proportion (77%) of measles cases were unvaccinated(20) .

Over all from 4241 suspected measles cases were reported, 376 (27%) of suspected measles cases were reported by case based. while 3841(73%) were reported by line list from these the majority2753 (71.7%) was reported in 2019 because of outbreak. There were no reported measles cases by line list during 2018 and 2017 year this shows there is sensitivity of the surveillance system and case notification is good. Measles case-based surveillance is part of the national PHEM system and a key component of the measles control program. It is a system whereby every suspected measles case should be detected, reported and undergo laboratory investigation(21).

Regarding seasonal pattern of measles, the highest number of measles cases are reported during June 1344(31.6%), may 934(22%) and July 545(12%) season of the year and low number of cases were reported in October November and September 85(2%),41(0.97%) and 98(2.3%) of cases respectively. Cases reach peak level in June .This finding is contrary with the finding of study conducted in Ethiopia, there was a trend of increment of cases in January, February and March(21) . This is due to about 60% of the zone climate were characterized by long persistent dry season (kola).

Limitation of the study

The study does not include the analysis of sample collected for laboratory by place and time, because the line list and case based was not complete. Vitamin A Supplemented for case patients was not included. Because death in the community was not reported case fatality was underestimated. Time lines and completeness was not included because of incomplete data

Strength of the study

The studies try to address all measles cases data type and all variables. Include 2019 data because five districts of the zone were attacked by outbreak. To analyze all related variables of the study, use measles case-based report and line list.

Conclusion

Totally, 4241 measles cases reported with a crude case fatality of 3.07/1000 which is very high. The highest percentage of cases are males 2197(50.6%) with female to male ratio **of** 1:1.04**.** Despite the presence of effective vaccination, under 4 years age are most affected covering 1682(39.4%) of the total cases. Mean age of case patients are 7.13 and standard deviation is 8.09. The highest number of cases reported from Ginir and Gololcha while G/dhamole and Gasara reported low number of cases. From 993 (24%) sample examined for measles IgM 248(24.9%) were measles IgM positive. Concerning Vaccination status 890(21%) were not vaccinated which indicates a significant number of susceptible people are in the community. The highest number (73.3%) of unvaccinated status reported in 2019. Only 582 (13.2%) measles cases were admitted and 3659 (86.2%) suspected measles cases were treated as an outpatient. The cyclic pattern shows increase of cases in April to June**.**

1. **Recommendation**

Surveillance system should strengthen to notify and identify cases early in the community. Health facilities and health offices of the districts in the zone should investigated and report measles death in the community. Samples collected for Laboratory confirmation should be improved in terms of quality and quantity by facilities. Routine immunization program should be strengthened by health posts and facilities in the zone. The zone should strengthen early preparedness and supplementary immunization activities before April to overcome changes in seasonal patterns of measles cases. The possible cause of measles in Ginir district should be further investigated.

Declarations

Competing of interest: - No conflict of interest

Funding: -None

Contribution

GT conceptualized the study and methodology, collected all data, performed data analysis and wrote the original draft and the manuscript. YG contributed to the conceptualization of the study and methodology reviewed and edited the manuscript. GG and NA contributed reviewed and edited the manuscript. All authors read and approved the final manuscript.

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Figures

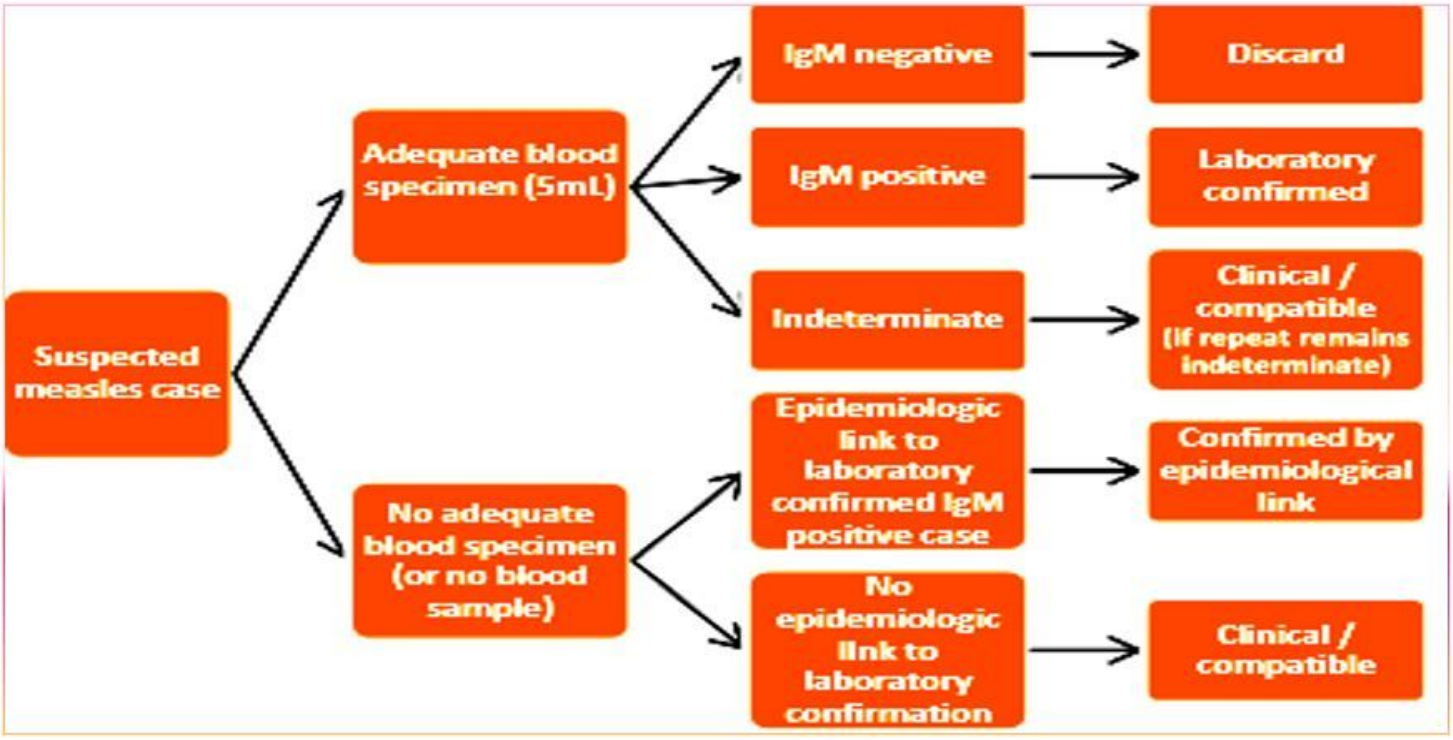

Figure 1

laboratory testing algorithm of serum for measles Igm

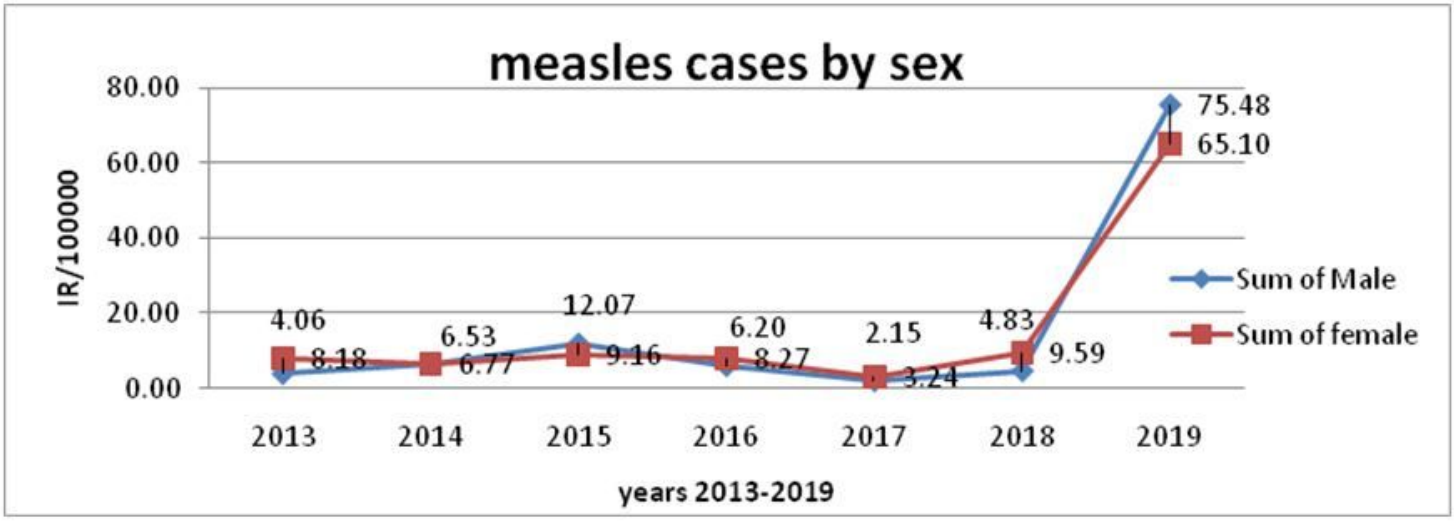

Figure 2

Graph showing measles case trained by sex in 2013-2019 in Bale zone 2019

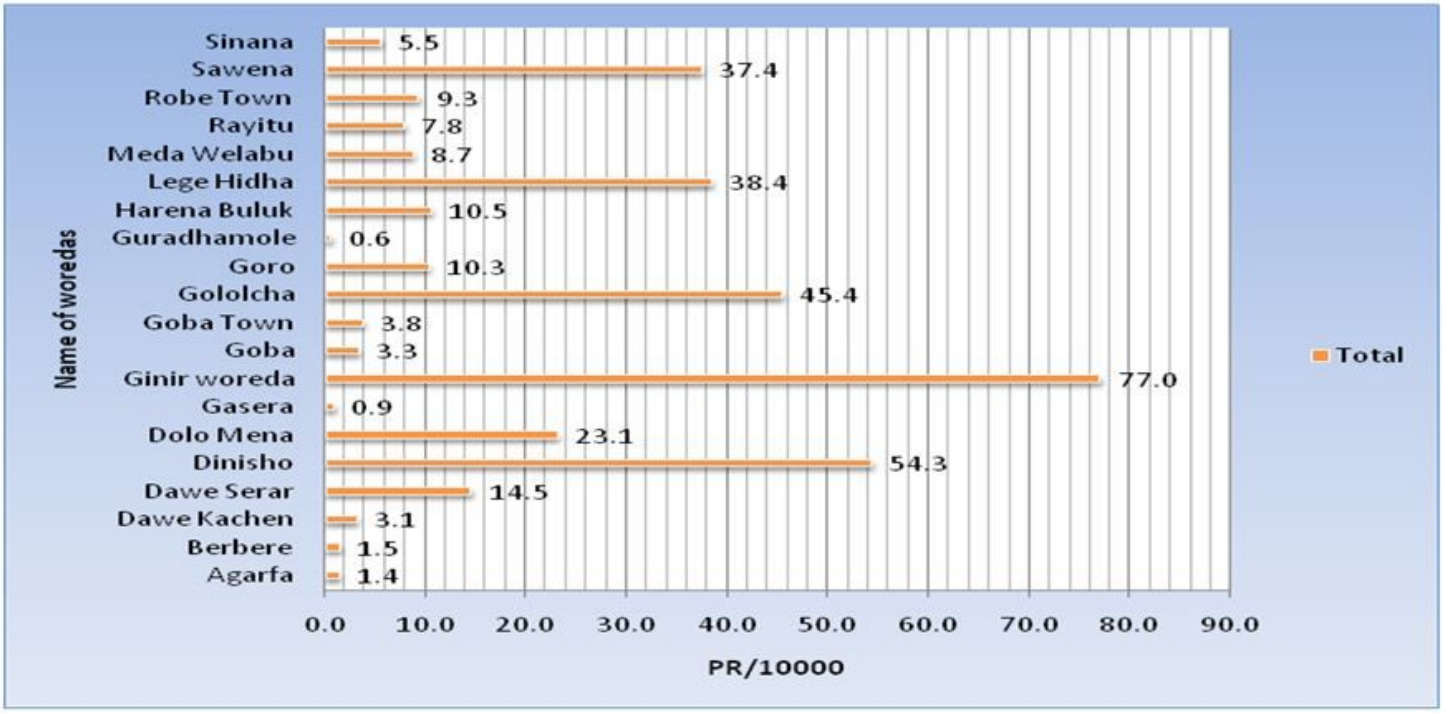

Figure 3

Graph showing measles case distribution by prevalence rate per 10000 place 2013-2019 Bale zone 2019

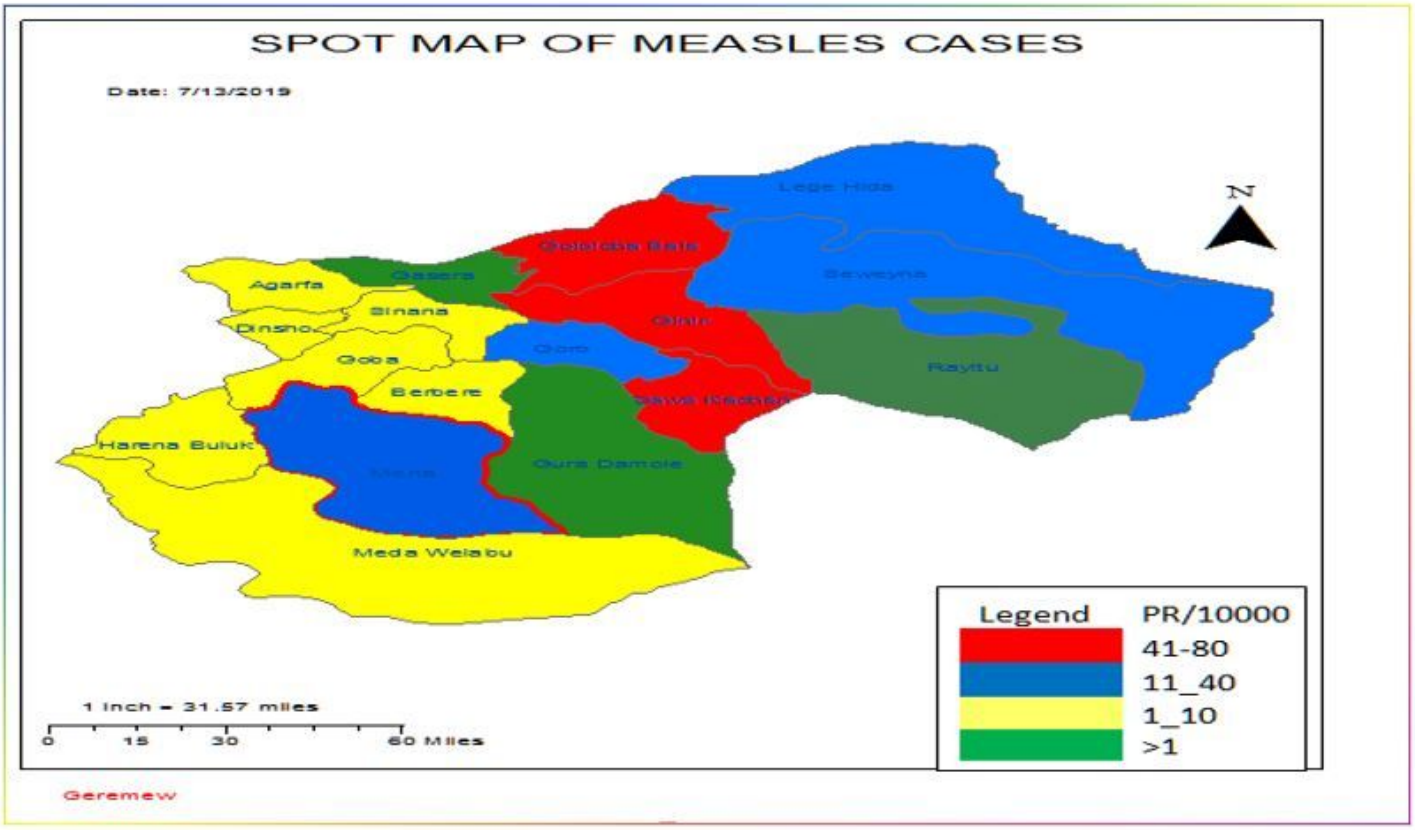

Figure 4

Spot map showing Distribution of measles cases by prevalence rate per 10000 population in 2013-2019 in districts of Bale zone 2019

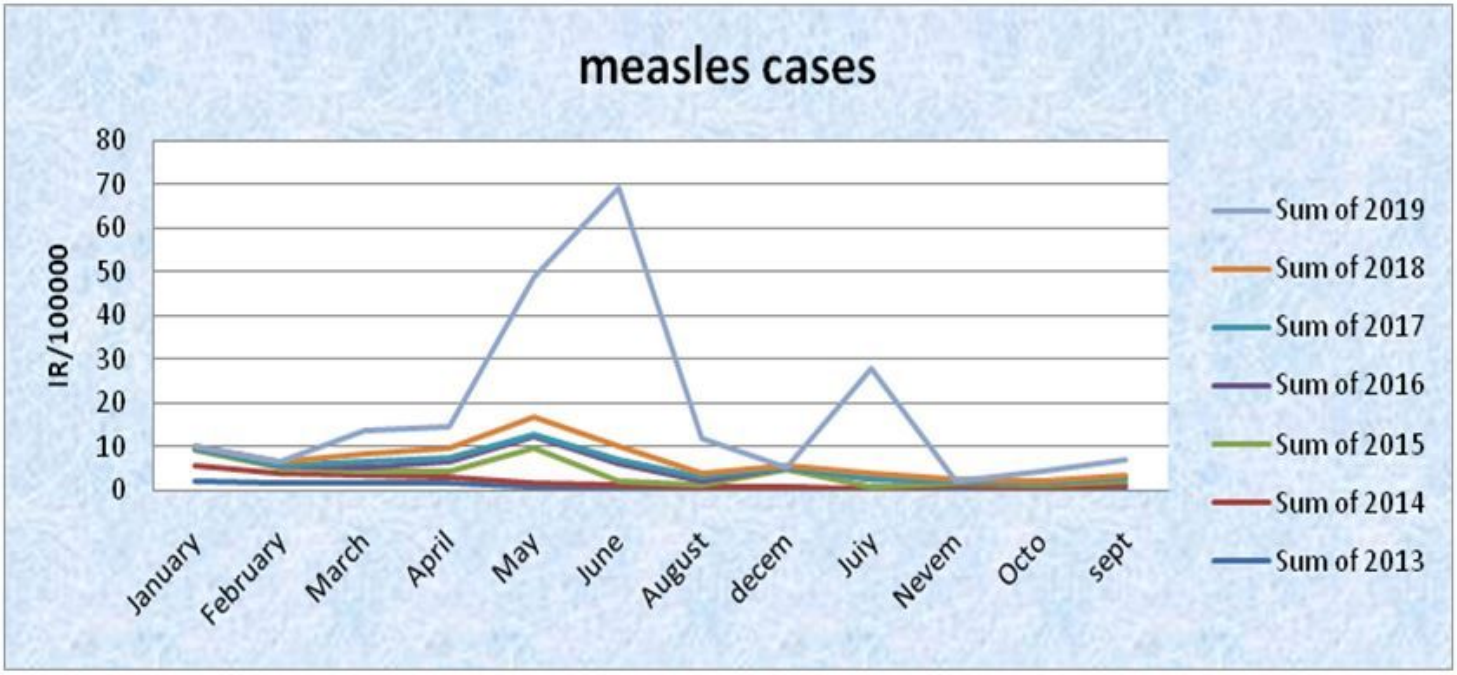

Figure 5

Graph showing cyclic patterns of measles cases 2013-2019 Bale zone 2019

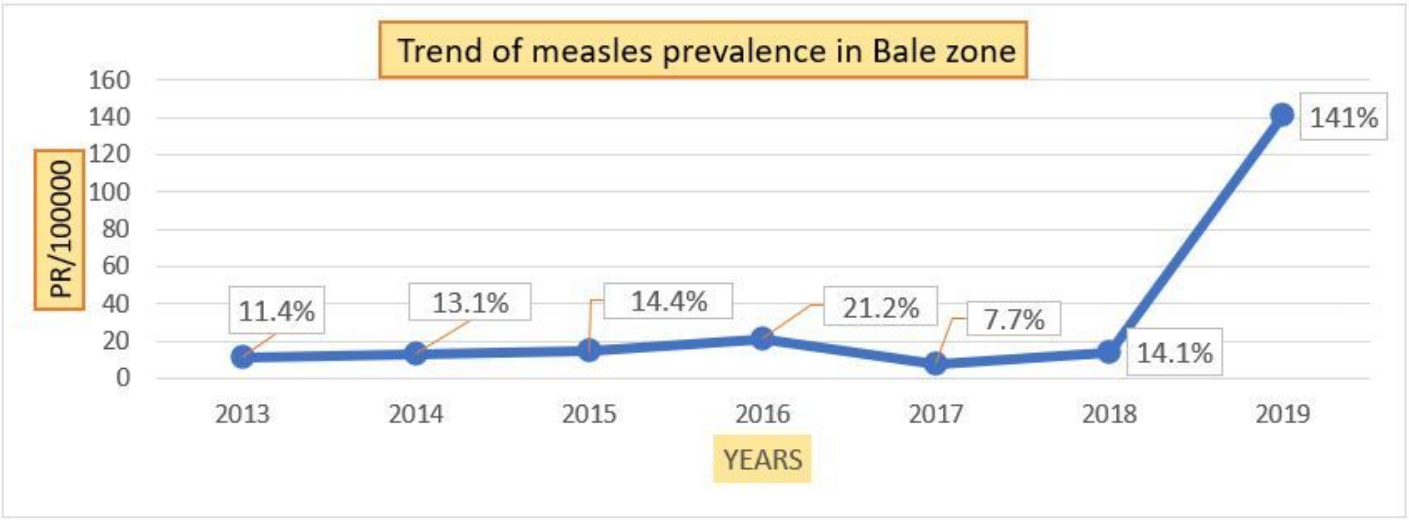

Figure 6

Graph showing trend of measles prevalence by year from 2013-2019 Bale zone 2019

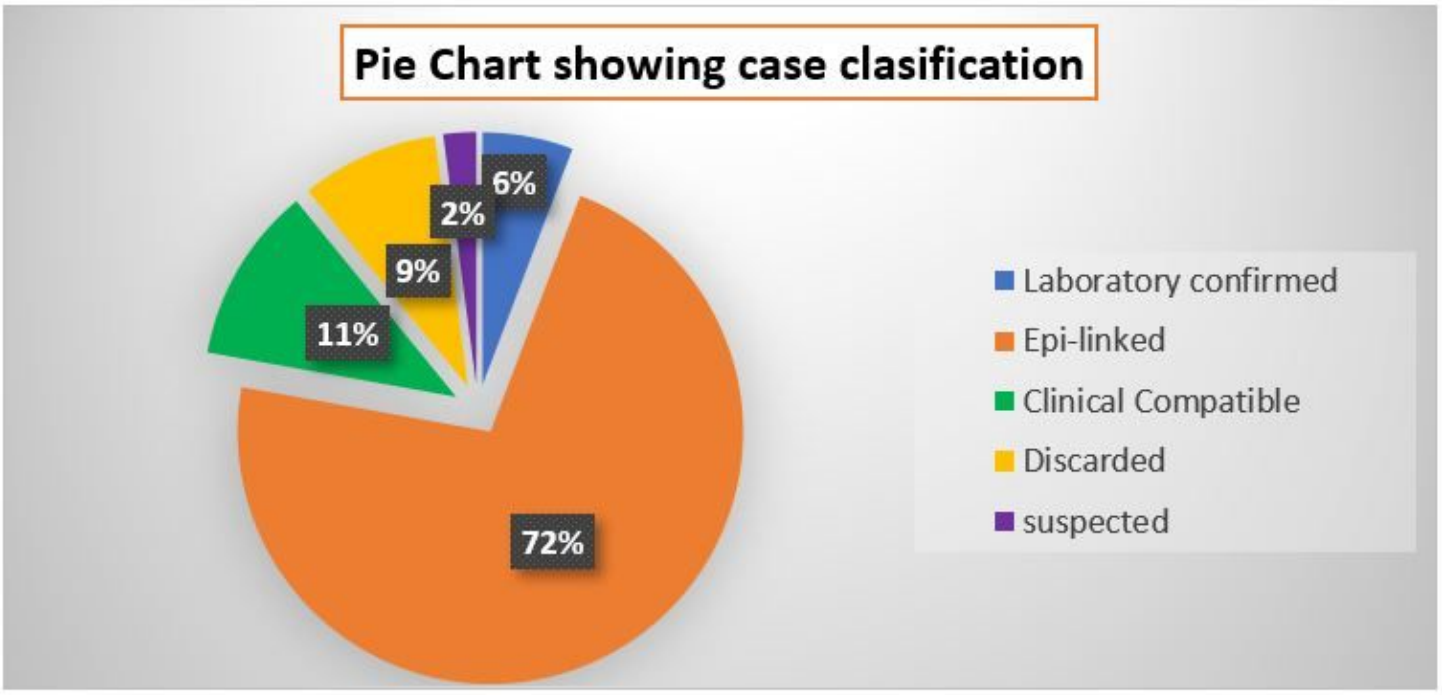

Figure 7

Pie chart showing final case classification of measles case 2013-2019 in Bale Zone 2019

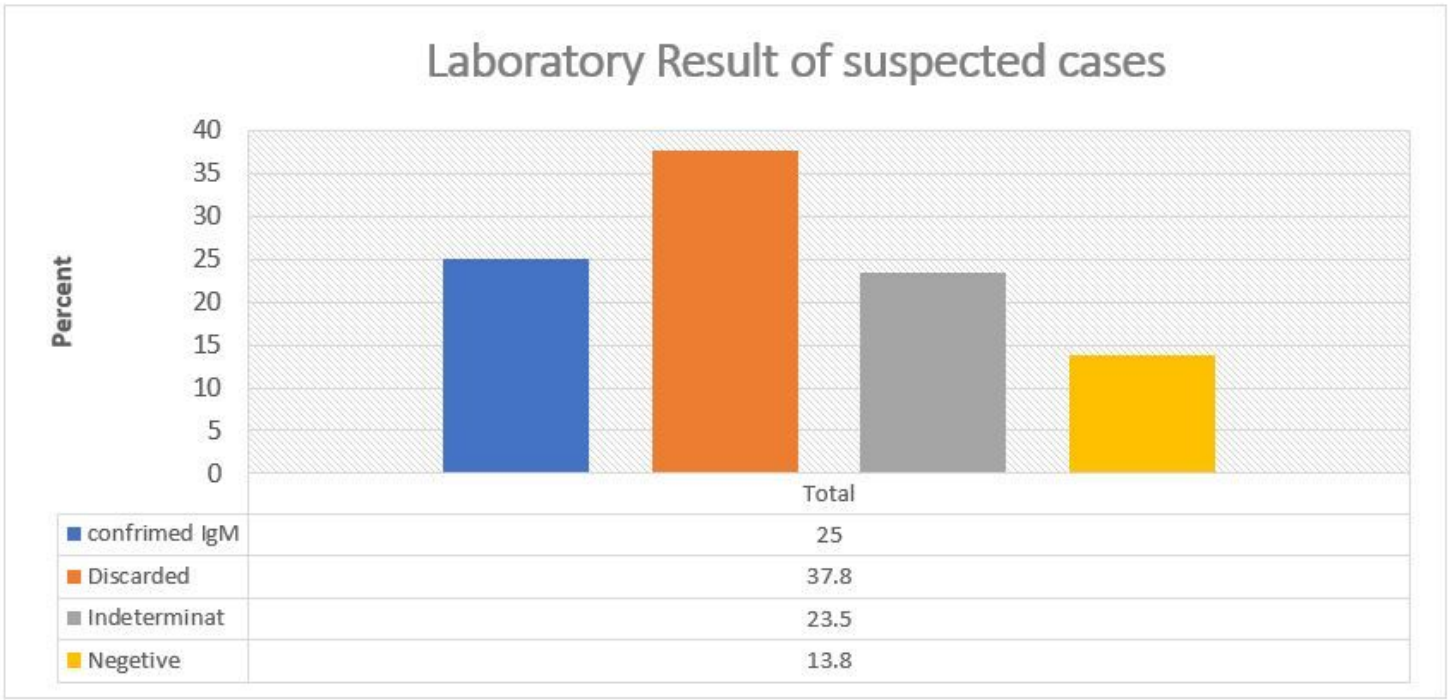

Figure 8

Graph showing percentage samples tested and laboratory result 2013-2019 Bale zone 2019

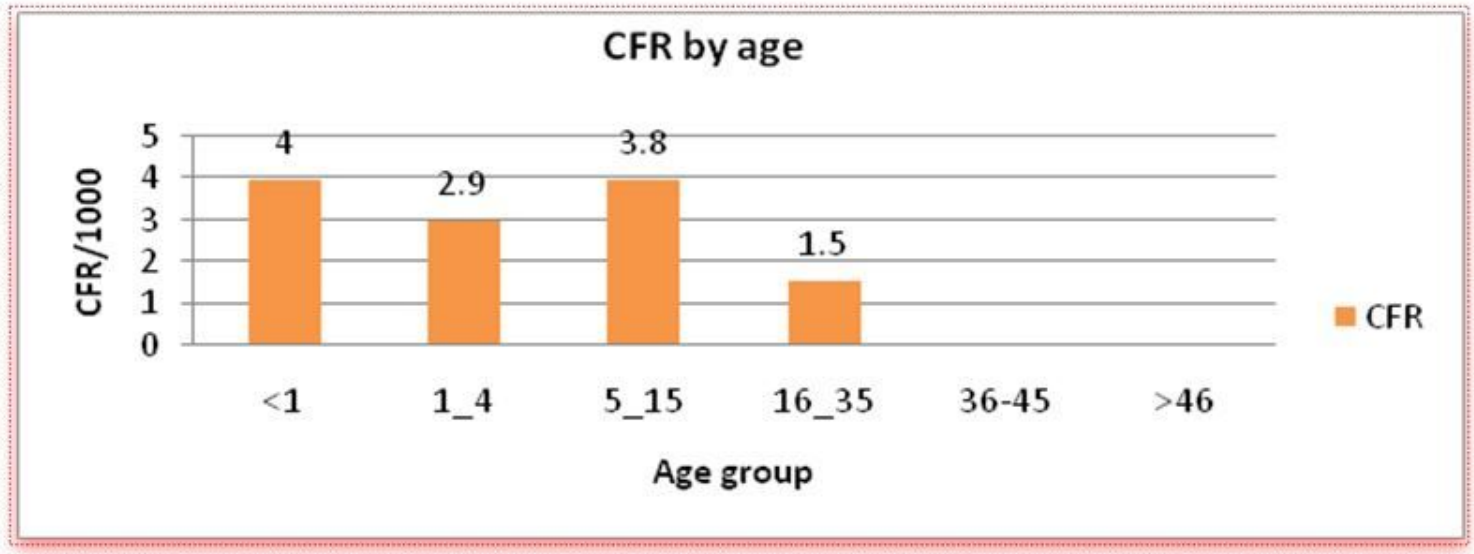

Figure 9

graph showing measles case fatality by group 2019-2013 Bale zone 2019

Figure 10

Graph showing measles trend measles case fatality from2013-2019 in Bale zone 2019

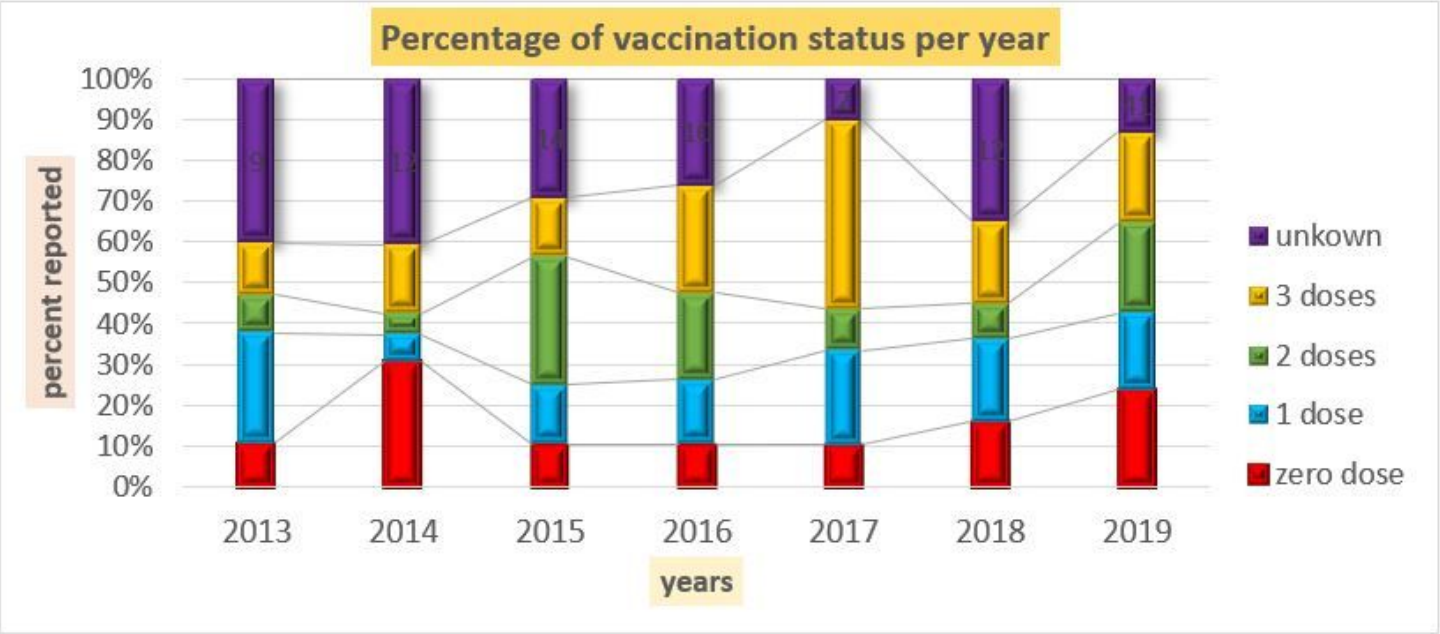

Figure 11

Graph showing trend of vaccination status among reported cases 2013-2019 Bale zone 2019