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Investigation of Measles Outbreak in Mieso District, Oromia Regional State, Eastern Ethiopia, December 2018

Geatchew Abichu

Abstracts

Introduction: Measles is one of the most commonly occurring diseases in different parts of Ethiopia, with various morbidity and mortality rate. After the Oromia Health Bureau received a report from the West Hararghe Zone of Mieso district about an outbreak, an investigation was conducted for confirmation from 20 to 25 December 2018. The investigation identified potential risk factors, and control measures were implemented.

Methods: In a 1:3 unmatched case to control study, 16 patients with clinical signs of fever and maculopapular rash and 48 control participants were investigated from 10 October to 15 December 2018. All the investigated patients were from the Mieso district. Listed data and information from a structured questionnaire were analyzed with excel and Epi Info™ 7.1.0.6 software.

Results: Altogether, 12 suspected and 4 confirmed cases were reported from 10 October to 15 December 2018, out of which 9 (56.25%) were female, with a mean age of 2.6 years (range from 6 months to 8 years). Of the 48 controls, 34 (70.8%) were female, with a mean age of 40.8 years (range from 6 months to 48 years). Of the 4 municipalities (kebeles) where cases were reported, Deneba Hunde Misoma recorded the highest number, with 9 (56.25%) cases. The overall attack rate (AR) was 1.21% per 1000 people with a zero case fatality ratio.

Conclusion: Measles outbreak was reported, and low immunization coverage and malnutrition were identified as potential risk factors. All possible intervention and control measures were implemented.

1. Introduction

Measles is an acute illness caused by the Measles morbillivirus (MeV, *Morbillivirus, Orthoparamyxovirinae, Paramyxoviridae*) and is characterized by a prodromal fever (as high as 105 °F/40.5 °C), malaise, cough, coryza, and conjunctivitis, followed by a maculopapular rash. The rash spreads from the head through the trunk to the lower extremities. Measles is usually a mild or moderately severe illness; however, it can result in complications such as pneumonia, encephalitis, and death. Approximately one case of encephalitis and two to three deaths may occur for every 1,000 reported measles cases (1,2).

Measles is a highly infectious, acute airborne viral disease with an infectious period of four days before to four days after rash onset. It has an incubation period of 10–14 days. Measles can be a serious illness with complications including otitis media, pneumonia and encephalitis (3)

The measles mortality reduction strategy adopted by the African Region includes improving routine measles vaccination coverage, providing a second opportunity for measles vaccination through supplementary immunization activities (SIAs), monitoring the impact of vaccination activities through case-based measles surveillance and improving measles case management (4).

Measles is one of the vaccine-preventable diseases among Ethiopia's leading causes of under-five child mortality. The Expanded Program on Immunization (EPI) was started in Ethiopia in 1980, and in 2021 it aims to administer 11 antigens to the over 3 million babies born in the country each year (5). In Ethiopia, the implementation of the regional measles mortality reduction strategy started in 2002. The first dose of the measles-containing vaccine (MCV1) is given at or shortly after the ninth month of age. Routine vaccination services are delivered through fixed health facilities and outreach sites, and since 2004, in some regions, “Child Health Days”, also referred to as “Enhanced Outreach Services”, are conducted every 6 months to provide routine vaccination services, including measles vaccination, supplemental Vitamin A, deworming tablets and nutritional screening for children (6). Consequently, the measles vaccination coverage has been increasing over the past years in Ethiopia; however, it is influenced by socioeconomic inequality (7). Based on WHO-reported data, the vaccination coverage in 2020 on the first dose of MV vaccine was officially 93%, and for the second dose of MV vaccine was 71%; however, the WHO/UNICEF Estimates of National Immunization Coverage (WUENIC) was significantly lower, 60% and 46%, respectively (8,9)

West Hararghe zonal Public Health Emergency Management (PHEM) officer and Mieso district identified the index case of the measles outbreak on 10 October 2018. The patient was an 8 years old girl attending primary school; she was admitted to Asebot Hospital after observing clinical signs for 3 days. The index case was followed by 15 more cases of patients between 6 months and 7 years of age, with only 3 cases with recorded contact with a measles patient. Most of the cases were diagnosed by observing the clinical signs; from 4 patients, serum samples were collected and sent to Ethiopian Public Health Institute (EPHI) for confirmation by the detection of anti-MV IgM. and confirmed as positive for measles. Four municipalities were affected by the outbreak, and all the cases were treated in Asebot Hospital. The severely malnourished patients received a supplementary balanced diet previously stocked in the hospital for a similar situation. To prevent the spread of the infection, the Oromia Health Bureau organized a mass vaccination campaign, especially for children under 10 years of age in the four affected municipalities. As a result of the intervention, there was no more case reported for consecutive 30 days, and the outbreak investigation team declared that the outbreak ended on 15 December 2018.

The general objective of this paper is to describe the distribution of the outbreak by person, place and time, and identify the potential risk factors associated with the measles outbreak reported between 10 October and 15 December 2018 in the Mieso district of the West Hararghe zone, and recommend preventive measures.

2. Materials and Methods

The study was conducted between 20 and 25 December 2018 in the Mieso district of West Hararghe Zone. Being one of the seventeen districts in the West Hararghe zone, the Mieso district is bordered by the Somali Region on the north, Doba on the east, Chiro on the southeast, Guba Koricha on the south and the Afar Region on the west. Based on the last census, this area in 2007 had a total population of 130,709, of whom 51.18% were men and 48.82 were women (10)

The outbreak was investigated using descriptive epidemiology and an unmatched case-control study between 20 and 25 December 2018. Standard case definition was based on the Public Health Emergency Management (PHEM) guidelines, i.e. a suspected case is any person with fever and maculopapular (non-vesicular) generalized rash and cough, coryza or conjunctivitis (red eyes) or any person in whom a clinician suspects measles, and the confirmed case is a

suspected case with laboratory confirmation (positive IgM antibody) or epidemiological link to confirmed cases in an epidemic (11).

Structured questionnaires were used to collect basic epidemiological information: symptoms, date of onset of disease, age group affected, vaccination history, nutritional status, travel history, and contact history with measles cases before the onset of clinical signs. Data were collected after the infection was confirmed to describe the outbreak by place, patient and time, identify risk factors by observing the medical cards from line lists from Asebot Hospital and review the immunization coverage of the districts. We observed the identified patients and interviewed the parents of the patients regarding immunization status, nutritional status, housing, and the sanitation of the house, including the environmental sanitation, latrine coverage, and waste disposal management. In the health post where the immunization was carried out, the vaccine storage area was checked according to the proper storage requirements and optimal temperature. In the study, the following inclusion and exclusion criteria were determined to create the pool of participants. Any person living in the Mieso district, who had symptoms of measles according to the standard case definition from 10 October to 15 December 2018, and who or whose parents agreed to participate in the study was included as "case". Any person living in the Mieso district who or whose parents were a neighbor to a case and did not develop measles signs and symptoms during the study period of 10 October – 15 December 2018 and agreed to participate were included as "control". Those patients were excluded from the cases who refused to participate or were unconscious. Those who refused to participate and family members from the same household were excluded from the potential controls.

The data were entered and analyzed using Epi-Info7 ^{TM} version 7.1.0.6 (12). Attack rate and case fatality rate were also calculated on SPSS bivariate and multivariate logistic regression. Results were presented in graphs and tables.

3. Results

Altogether 16 suspected measles cases were identified between 10 October and 15 December 2018. After 4 cases were declared "confirmed" by the Ethiopian Public Health Institute (EPHI) based on the detection of anti-MV IgM type antibodies in the serum samples taken from these patients, the basis of the diagnosis in the other 12 cases was the observation of the characteristic clinical signs. Table 1 summarizes the outbreak pattern by the basic information of the cases.

All cases were reported in four municipalities (kebeles) of the Mieso district, West Haraghe zone, Oromia region in the following distribution: 12 cases (75%) in Deneba Hunide Misoma municipality, 2 cases (12.5%) in Asebot town within the Odo Kenen municipality, moreover 1 case (6.25%) in Dire Kora and 1 case (6.25%) in Herqoncha municipalities (Figure 1). All these municipalities are closer to the Asebot Hospital and are adjacent one by one. Of the cases, 9 (56%) were female with a mean age of 2.6 years (range from 6 months to 8 years), and 7 were male with a mean age of 3.2 years (range from 6 months to 7 years). Most of the patients (87.5%) were not vaccinated, while 2 had received 1 dose of the MV vaccination. Based on the child's mid-upper arm circumference, 81.25% of the patients were severely malnourished (Table 2).

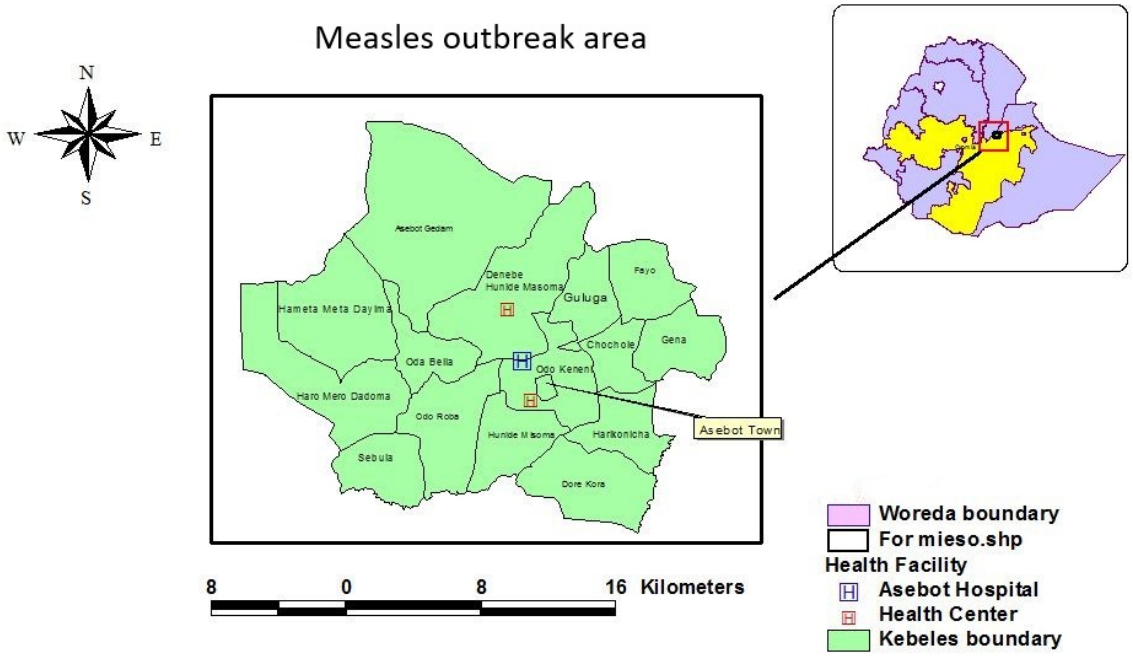

Figure 1. Measles outbreak area Mieso district, West Hararghe Zone, Oromia regional state, 2018

In the case-control study, apart from the 16 measles cases, 48 controls were recruited from the 4 municipalities affected by the outbreak. Data on sex, age, sociodemographic characteristics, and

risk factors, such as vaccination history, nutritional status, travel history starting from 5 days before the index case, contact with measles cases, and living conditions, were collected. The data are summarized in table 3 and table 4.

The result of the statistical analysis on the distribution of the risk factors among the cases and controls is summarized in Table 5.

4. Discussion

This study aimed to describe the distribution of the outbreak by person, place and time, identify the potential risk factors associated with the measles outbreak reported between October and December 2018 in the Mieso district of the West Hararghe zone and recommend preventive measures. From overall the 16 cases (median age: 2 years; IQR: 2; range: 0.6- 8) we recruited 48 controls (median age: 15 years; IQR: 15; range: 0.6-42) for the case-control study. None of the investigated demographic characteristics was associated with the measles outbreak. Our multivariate logistic regression showed that the nourishment status and the vaccination were the most important risk factors. Among those who were severely malnourished, the chances of developing measles were 3.853 times higher than those with normal nutritional status (Adjusted Odds Ratio (AOR): 3.854, 95% CI (2.115-63.84). The odds of developing measles were 3.917 times higher among those who were not vaccinated (Adjusted Odds Ratio (AOR): 3.297, 95% CI (0.97-0.989).

Malnutrition is a critical problem in Ethiopia. According to the (14), the prevalence of stunting is around 40 % (15). Based on UNICEF data, 370,000 children suffered from severe acute malnutrition in 2018, and there are several publications on the analysis of the factors affecting child and maternal malnutrition in Ethiopia (16, 17). The East and West Hararghe zones are identified as areas severely affected by natural disasters, such as the shortage of rain and locust invasions that reduce the efficacy of agricultural production (18). It is also well known that malnutrition leads to increased susceptibility to infectious diseases (19). The results of our study also add evidence to the conclusions already suggested by other authors.

In addition to malnutrition, the lack of vaccination is also a key factor in the incidence of measles. According to surveys, measles vaccination coverage in children under 1 year of age was 78.5% in 2015 (20) In 2020, 86.41% of children in the 12–23 months age group were reported to receive at least 1 dose of measles vaccine (21) Contrary to these data, our study found that 87.5%

of the 0.5-8 years old children affected by the infection were not vaccinated, and even the 2 patients who were immunized received only 1 dose of the MMR vaccine despite the recommendations for a second dose until the 6th year of age (22) In the control group, 67% received 1 dose of the vaccine. Our study revealed a shortage of vaccine supply at the district level: vaccine storage visited by the authors did not have enough stock for the vaccination of children without immunization. However, we also detected that vaccine storage conditions were satisfying as at the health posts, where the vaccinations are conducted, refrigerators were available, the read refrigerator temperatures were optimal, and the power source from the solar system also seemed reliable. Several surveys conducted on measles in Ethiopia suggested that low vaccination coverage results in a higher incidence rate due to the lack of immunity at individual and population levels (23,24) According to previous studies, a seasonal pattern of measles outbreaks has been observed in Ethiopia, with an increased number of cases from December to February (25).Due to the low measles coverage and prevailing poor living and nutritional conditions, measles outbreaks frequently occur in different parts of the country, mostly in Oromia and SNNPR (southern) regions, where the population density is relatively high (26) The number of confirmed measles cases steadily increased from 73 in 2003 to a peak of 3,511 in 2008, following which there was a decline to 1,944 cases in 2009. Even though the measles incidence rate has shown a significant increase since 2010, a dramatic increase has been observed since 2012, with a peak of numbers in several regions in 2015 (27).

The WHO estimates the measles case fatality rate (CFR) to be 3.6% in developing countries (Gutu et al., 2020). Another investigation on a 2018 outbreak with 38 cases in the Oromia region showed a 2.6% CFR (28). In the investigated outbreak, death was not reported.

Despite the lack of vaccination, contact with measles cases did not increase the odds of contracting the disease. Travel history did not affect the chances of infection either. Moreover, although the houses of the study participants were close to each other, crowded with 6-10 family members living together and lacked latrines, the housing conditions, or at least the availability of ventilation, were not a significant factor in the spread of the infection.

To achieve the goal of measles elimination, at least 93-95% of the population must be vaccinated with both doses of the measles vaccine to ensure herd immunity (29). Based on the analysis of the discussed 2018 outbreak, low vaccination coverage and poor nutritional status are the potential risk factors for measles outbreaks. Therefore the conclusion of our study is the following recommendations:

- Mieso district health office should improve the immunization coverage for all children through regular vaccination programs and, if necessary, mop-up vaccination campaigns according to the standard immunization guidelines.
- Efforts and effective programs for eliminating malnutrition, especially among women and children, are necessary in the regions affected by food shortages.

References

1. Gindler J, Tinker S, Markowitz L, Atkinson W, Dales L, Papania MJ. Acute measles mortality in the United States, 1987–2002. J Infect Dis 2004; 189 (Suppl 1):S69–77. doi: 10.1086/378565

2. Walker PJ, Siddell SG, Lefkowitz EJ, Mushegian AR, Adriaenssens EM, Dempsey DM, Dutilh BE, Harrach B, Harrison RL, Hendrickson RC, Junglen S, Knowles NJ, Kropinski AM, Krupovic M, Kuhn JH, Nibert M, Orton RJ, Rubino L, Sabanadzovic S, Simmonds P, Smith DB, Varsani A, Zerbini FM, Davison AJ. Changes to virus taxonomy and the Statutes ratified by the International Committee on Taxonomy of Viruses (2020). ArchVirol. 2020 Nov;165(11):2737-2748. PMID: 32816125.

3. Diau, J., L. Asugeni, M. Puia, J. Maomatekwa, H. Harrington, D. MacLaren, R. Speare and P.D. Massey, 2015. Measles outbreak investigation in a remote area of Solomon Islands. Western Pacific Surveillance and Response Journal, 6: 3; doi: 10.5365/wpsar. 6.2.001.

4. Pan American Health Organization, 2005. Pan American Sanitary Bureau Root WHO. Measles Elimination Field guide, 2nd edition, 2005.

5. Pond, B., Bekele, A., Mounier-Jack, S. et al. Estimation of Ethiopia's immunisation coverage – 20 years of discrepancies. BMC Health Serv Res 21, 587 (2021). https://doi.org/10.1186/s12913-021-06568-0

6. Ethiopian Public Health Institute (EPHI). Ethiopian National Immunization coverage survey 2012 report, Addis Ababa, Ethiopia.

7. Bobo FT, Asante A, Woldie M, Dawson A, Hayen A. Child vaccination in sub-Saharan Africa: Increasing coverage addresses inequalities. Vaccine. 2022 3 January;40(1):141-150. doi: 10.1016/j.vaccine.2021.11.005. Epub 2021 16 November. PMID: 34794824.

8. WHO 2022a: https://immunizationdata.who.int/pages/coverage/MCV.html?CODE=ETH&ANTIGEN=MCV1&YEAR= accessed on 18 April 2022

9. WHO 2022b: https://immunizationdata.who.int/pages/coverage/MCV.html?CODE=ETH&ANTIGEN=MCV2&YEAR= accessed on 18 April 2022

10. Ethiopian Statistics Service: Oromya regional data from the 2007 Population and Housing Census of Ethiopia. https://www.statsethiopia.gov.et/wp-content/uploads/2019/07/Statistical_Oromiya-1.pdf accessed on 18 April 2022

11. The Federal Democratic Republic of Ethiopia, Ethiopian Health and Nutrition Research Institute Public Health Emergency Management Centre (2012): Public Health Emergency Management Guidelines for Ethiopia https://ephi.gov.et/images/guidelines/phem-guideline-final.pdf accessed online: 18 April 2022

12. Dean AG, Arner TG, Sunki GG, Friedman R, Lantinga M, Sangam S, Zubieta JC, Sullivan KM, Brendel KA, Gao Z, Fontaine N, Shu M, Fuller G, Smith DC, Nitschke DA, and Fagan RF. Epi Info™, a database and statistics program for public health professionals. CDC, Atlanta, GA, USA, 2011.

13. Abhina B. and Anitha Chadran C. (2021): Assessment of MUAC, Head and Chest Circumference of Anganwadi Children in Trivandram District, Kerala, IndiaInternational Journal of Arts Humanities and Social Sciences Studies. 6 (3):84-88.

14. Global nutrition report, 2016. From promising to impact ending malnutrition by 2030

15. International Food Policy Research Institute. 2016. Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030. Washington, DC

16 UNICEF Emergency Nutrition Response in Ethiopia, 2018 https://www.unicef.org/ethiopia/media/531/file/UNICEF%20Emergency%20Nutrition%20Response%20in%20Ethiopia%20.pdf accessed on 18 April 2022

17 Geda, N.R. Inequalities in maternal malnutrition in Ethiopia: evidence from a nationally representative data. BMC Women's Health 21, 3 (2021). https://doi.org/10.1186/s12905-020-01154-8 United Nations Office for the Coordination of Humanitarian Affairs (OCHA): Ethiopia Humanitarian Bulletin Issue #8 6– 20 June 2021

18 United Nations Office for the Coordination of Humanitarian Affairs (OCHA): Ethiopia Humanitarian Bulletin Issue #8 6– 20 June 2021

19 Schaible UE, Kaufmann SH. Malnutrition and infection: complex mechanisms and global impacts. PLoS Med. 2007;4(5):e115. doi:10.1371/journal.pmed.0040115

20 Yitbarek K, Tilahun T, Debela T, Abdena D, Girma T. Measles epidemiology and vaccination coverage in Oromia Region, Ethiopia: Evidence from surveillance, 2011-2018. Vaccine. 2021 13 July;39(31):4351-4358. doi: 10.1016/j.vaccine.2021.06.015. Epub 2021 16 June. PMID: 34147294.

21 Worku, A., Alemu, H., Belay, H. et al. Contribution of health information system to child immunization services in Ethiopia: baseline study of 33 woredas. BMC Med Inform Decis Mak 22, 64 (2022). https://doi.org/10.1186/s12911-022-01796-8

22 Bester, J. C. (2016). Measles and Measles Vaccination. JAMA Pediatrics, 170(12), 1209. doi:10.1001/jamapediatrics.2016.1787

23 Desta TK, Lemango ET, Wayess JD, Masresha BG. Measles Epidemiology in Ethiopia from 2006 - 2016: Predictors of High Measles Incidence from Surveillance Data Analysis. J Immunol Sci (2018); S (018): 122-129

24 Yitbarek K, Tilahun T, Debela T, Abdena D, Girma T. Measles epidemiology and vaccination coverage in Oromia Region, Ethiopia: Evidence from surveillance, 2011-2018. Vaccine. 2021 13 July;39(31):4351-4358. doi: 10.1016/j.vaccine.2021.06.015. Epub 2021 16 June. PMID: 34147294.

25 Akalu HB (2015) Review on Measles Situation in Ethiopia; Past and Present. J Trop Dis 4: 193. doi:10.4172/2329-891X.1000193

26 Gutu MA, Bekele A, Seid Y, Woyessa AB. Epidemiology of measles in Oromia region, Ethiopia, 2007-2016. Pan Afr Med J. 2020 20 October;37:171. doi: 10.11604/pamj.2020.37.171.23543. PMID: 33447326; PMCID: PMC7778185.

27 Akalu HB (2015) Review on Measles Situation in Ethiopia; Past and Present. J Trop Dis 4: 193. doi:10.4172/2329-891X.1000193

28 Tariku, M.K., Misikir, S.W. Measles outbreak investigation in Artuma Fursi Woreda, Oromia Zone, Amhara Region, Ethiopia, 2018: a case control study. BMC Res Notes 12, 765 (2019). https://doi.org/10.1186/s13104-019-4806-y

29 Bester, J. C. (2016). Measles and Measles Vaccination. JAMA Pediatrics, 170(12), 1209. doi:10.1001/jamapediatrics.2016.1787

Table 1: Basic information of the cases, date of onset, sex, age distribution and vaccination status.

Case	Date of report (onset) in 2018	Place of living	Sex	Age (years)	Measles vaccination
1	10 October	Deneba Hunide Misoma	F	8	one dose
2.	28 October	Deneba Hunde Misoma	M	3	none
3.	28 October	Deneba Hunide Misoma	F	2	none
4.	28 October	Deneba Hunde Misoma	F	1	none
5.	28 October	Deneba Hunide Misoma	F	0.5	none
6.	9 November	Deneba Hunide Misoma	M	5	none
7.	15 November	Deneba Hunide Misoma	M	4	one dose
8.	21 November	Deneba Hunide Misoma	F	1	none
9.	27 November	Deneba Hunide Misoma	F	5	none
10.	27 November	Deneba Hunide Misoma	M	1	none

11.	3 December	Deneba Hunide Misoma	M	7	none
12.	3 December	Deneba Hunide Misoma	F	1	none
13.	3 December	Herqoncha	M	2	none
14.	3 December	Asebot town	F	1	none
15.	9 December	Asebot town	M	0.5	none
16.	15 December	Dire Kora	F	2	none

Table 1: Child Mid Upper Arm Circumference (MUAC) reading result of measles cases in Mieso District West Hararghe Zone, Oromia region, 2018. (13).

Case ID	Sex	Age (years)	MUAC (mm)	Interpretation
1	F	8	280	normal
2	M	3	104	severe
3	F	2	108	severe
4	F	1	92	severe
5	F	0.5	98	severe
6	M	5	104	severe
7	M	4	102	severe
8	F	1	106	severe
9	F	5	260	normal
10	M	1	98	severe
11	M	7	230	normal
12	F	1	108	severe
13	M	2	104	severe
14	F	1	108	severe
15	M	0.5	100	severe
16	F	2	102	severe

Table 2: Sociodemographic characteristics of measles cases and controls (Univariate Analysis)

Variable	Cases (n=16)	Control (n=48)

	Number (%)	Number (%)
Sex		
Male	7 (44)	16 (33.3)
Female	9 (56)	32 (66.7)
Age Group		
<1 yr.	2 (12.5)	6 (12.5)
1-5yr	12 (75)	8 (16.7)
6-10yr	2 (12)	7 (14.6)
11-15 yr.	0	4 (8.3)
16-20 yr.	0	3 (6.25)
21-25 yr.	0	8 (16.7)
26-30 yr.	0	7 (14.6)
>30 yr.	0	5 (14.4)
Marital status		
Single	16 (100)	27 (56.25)
Married	0	21 (43.75)
Widowed	0	0
Divorced	0	0
Educational level		
None	14 (87.5)	14 (29.2)
Primary 1-8	2 (12.5)	18 (37.5)
Secondary 8-12	0	16 (33.3)

Table 3: Risk Factors Distribution among measles cases and controls (Univariate Analysis)

Variables	Case (n=16)	Control (n=48)
	Number (%)	Number (%)
Travel history 5 days before the onset of the cases		
Yes	4 (25%)	19 (40 %)

No	12 (75%)	29 (60%)
Measles vaccination received		
None	14 (87.5%)	16 (33%)
1 dose	2 (12.5)%	32 (67%)
Nutritional status		
Severely malnourished	13 (81%)	4 (8)
Not malnourished	3 (19%)	44 (92%)
Exposure to measles patient within a week before the onset of the case		
Yes	3 (19%)	16 (33%)
No	13 (81%)	32 (76%)
The living house has windows for enough ventilation		
Yes	6 (38%)	8 (17%)
No	10 (62%)	40 (83%)

Table 4: Comparing the Distribution of Measles Risk Factors among Cases and Controls Using Bivariate and Multivariate Analysis, Mieso District, West Hararghe Zone, Oromia Regional State, October-December, 2018

Variable		**Case n (%)**	**Control n (%)**	**Crude odds ratio(COR)**	**P value**	**Adjusted odds ratio(AOR at 95% CI**
Vaccination status	Yes	2 (12.5)	16 (33)	**7.75***	**0.005**	**3.917 (0.97-0.989)***
	No	14 (87.5)	32 (67)			
Travel history	Yes	4 (25)	19 (40)	1.086	0.297	0.69 (0.218-7.346)
	No	12 (75)	29 (60)			
Ventilation of the house	Yes	6 (38)	8 (17)	1.186	0.27	0 (0)
	No	10 (62)	40 (83)			
Contact with measles case within 5 days before onset of the case	Yes	3 (19)	16 (33)	2.897	0.089	0 (0)
	No	13 (81)	32 (67)			
Nutritional status (malnourished)	Yes	13 (81)	4 (8)	**12.157***	0.000	**3.853 (2.115-63.84)***
	No	3 (19)	44 (92)			

Table *6*: Attack Rate in Percentage of Measles Outbreak West Hararghe Zone Mieso District, Oromia Region from 10 October to 15 December 2018.

Variable	No of cases	Population	AR/1000 population
Age group			
<1yr	2	2345	0.85
1-5yr	12	3589	3.34
6-10 yr.	2	5678	0.35
Sex			
Male	7	6,693	1.04
Female	9	6,444	1.4
Total	16	13,137	1.21
Municipalities (kebeles)			
Deneba Hunde Misoma	12	6,032	2
Harqoncha	1	5,044	0.2
Asebot town	2	13,137	0.2
Dire Kora	1	6383	0.2