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Determinants of Measles Recurrent Outbreak in South West Ethiopia: an Obstacle for Implementation of Infectious Disease Eradication in the Country

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Abstract

Background: For long time several diseases combating measures were taken in Ethiopia through integrated diseases surveillance and response strategy. Although these prevention mechanisms had done, still some communicable diseases are seldom occurring in limited parts of Ethiopia. Consequently, we have conducted to assess the measles cases and its determinants in South West Ethiopia.

Methods: A rapid cross sectional study was conducted following epidemics in June 2016 to evaluate factors associated with measles recurrence in South West Ethiopia. Multivariable logistic regression model was used. Variables with p value less than 0.05 claimed as the significant over the dependent variable.

Results: Among total of 192 children 45 (23.3 percent) children were found with manifestations of measles sign and symptoms in South West Ethiopia. About twenty five percent of children were not fully immunized. Although this was high incidence only two variables were significantly associated with measles incidence. These were mothers or family members who had adequate knowledge and fully vaccinated for vaccinated children have less risk of acquiring measles after controlled for wealth quintiles, sex of child, maternal education, occupation, residence, house sanitation and distance from health center.

Conclusion: this study claimed being not fully vaccinated and limited knowledge of mothers and care givers towards diseases exposed children to develop measles. Special focus should be given to improve coverage of full vaccination and creating mass awareness. Consequently, through health education and information are important the way forwards for combating and eliminating measles from country.

Keywords: *Measles; Cases; Children; Control; South West Ethiopia*

Background

Parts of Africa and Asia were usually suffered from More than 20 million measles cases each year. Following either man made or natural disasters measles outbreaks are notably devastating in emergency situations [1].

Measles and some other childhood illness have been main causes of morbidity and mortality in Ethiopia. Following medical development in the twentieth century absolute control of common childhood infectious diseases by the administration of highly effective vaccines was started [2]. A delay in the first dose of measles-containing vaccine may contribute to outbreaks of measles, resulting in a high age-specific incidence in infants less than one year of age [3].

Among these childhood diseases measles is a highly contagious disease that can be effectively prevented through vaccination [4,5]. But it results in a significant public health impact when there are displaced populations, less sanitation and poor nutritional systems due to their characteristic mass population displacement, high population density in camps and low measles vaccination coverage among children. Consequently, the recent increase in vaccination coverage was successful in reducing the mortality globally of the disease [2,6-9]. Some parts of the world have successfully eradicated the disease from their region. But in Africa areas where there is poor personal and self-hygiene, overcrowding, low knowledge and awareness still suffering from measles. Among these areas in South Western, rural and pastoralist regions of Ethiopia are recurrently attacked by measles [10].

Recently measles outbreaks have been occurring in several areas of Ethiopia. Since the start of 2015, a total of 2,190 suspected measles cases have been reported in 61 separate outbreaks in Ethiopia. Of these, 929 have been positively confirmed. The majority of the cases were reported in the woredas (districts) of Nejo and Nole, West Wellega zone in the Oromia Region, the woreda of Kola Tembien, Central Tigray Zone in the Tigray Region and Bench Maji, Keffa and Sheka zone is Southern Peoples Region [6].

Measles outbreak has been linked with morbidity and mortality of affected children [11-14]. The highest probability of measles epidemic occurs in the areas where lower vaccination and poor vaccine handling system. Remarkably, a large number of measles outbreaks could be prevented through timely and proper interventions. The full vaccination of each and every child can significantly reduce the measles outbreak [15].

Many parents make a conscious decision not to have their child immunized with measles, mumps and rubella (MMR) with a substantial proportion opting to use single antigen vaccines. Socioeconomic and cultural patterns in uptake differ for parents choosing the single antigen vaccines and those not immunizing at all Interventions to improve uptake should be designed to meet the needs of different groups [14].

Several studies shown the presence of negative association between measles and residence; those living in urban and closest to health facilities tend to less acquire measles than rural dwellers [7,14,16-18]. Maternal education is also considered as most important factor in determining vaccination care seeking behavior. In addition fear of adverse events following vaccination also has effect on measles. Parental knowledge is also an important factor that affects attitude, intent and behavior. Their knowledge relates to behavior, and behavior produces change towards vaccination. The more knowledge they have about symptoms and signs of measles the more they care for their personal and environmental hygiene [7,9,14,16-21].

Studies conducted to assess the relationship between knowledge and vaccination consistently revealed that, knowledge is strong predictor of vaccination; those having good knowledge about signs of measles are more likely vaccinates their children.

In several studies done in at continental, country or global level, most mothers express their intention to vaccinate their children; in reality, most of them end up either not being vaccinated or fully vaccinated [7-9,13,15,18-20,22].

In 2013 there were 478 measles cases seen from 13 October 2013 to 28 November 2013 with 240 males and 238 females. Of these cases 3 deaths were registered (CFR 0.6%) and the attack rate was 331 per 100,000 populations [23].

In South West Ethiopia, recurrent outbreak of measles is still habitual despite an expanded vaccination routine and campaign approach as well as implementation of the health extension program is being implemented throughout the country. It believed that there are different factors that operate at different level determining the measles outbreak recurrence.

This study was conducted to investigate the determinants of measles outbreak in South Western Ethiopia.

Methods

Study setting and participants

A rapid epidemic assessment was done where there were hotspots of measles. These three zones namely Bench Maji, Keffa and Sheka located in South West Ethiopia. The study area included nine districts that were three districts were selected from each zone. The population of the study area was 2,160,701 and the livelihoods of the zones are agricultures, mixed farming and livestock [24].

There are three general hospitals in three zones provide comprehensive preventive and curative care for catchment population as well as nearby inhabitants. Health extension workers have been applying health extension packages at health posts. In the zones, immunization service utilization (75%) is higher than fully immunization.

Nine districts were purposively selected from three zones. The study participants were all under-five children the included districts. We used both clinical and laboratory confirmed cases of measles. A data from Keffa zone Cheta district and from others were also source of our study participants. Children who were developed signs and symptoms of measles and clinically confirmed by health professionals were considered as incidents of measles.

Even the data collection process was rapid and quick, the research team decided to go ahead the selected data collection approach as planned. During data collection mothers and caregivers of children were explicitly asked. The study team used structured questions comprised of socioeconomic, demographic, facility related, environment related characteristics.

Cases were selected conveniently because of single cases is epidemic in cases of measles. In this case there were 68 cases from three zones were taken as cases. Controls were selected using systematic sampling method, every third control were interviewed until the allotted sample is reached from three zones.

Face to face interview using a pre-tested and structured questionnaire was conducted to collect the data. Questions developed from previous literatures those were focused on measles outbreak. Pretest was done on 40 children who were attending for care in health centers during outbreak time. To check completeness and validity the pretest was used.

Measles outbreak was the dependent variable while characteristics that determine the acquiring measles socio-demographic, economic and facility related factors such as age, number of children, overcrowding, accessibility, vaccination, income, residence, education, knowledge, attitude, residence and quality of care were the independent variables.

Measles was defined as a child has developed signs and symptoms during outbreak as confirmed by health professionals.

Data collectors were nurses and health officers who were selected based on their prior experience in data collection and related field work. Supervisors were University Staffs. Training was given for two days. Data were collected using face-to-face interview using a structured questionnaire with the mothers or close caretaker of the child at home level. Data collectors got training on the objective, confidentiality, beneficence, autonomy and procedures of interview prior to pretest and ideal data collection.

The data was entered into EpiData 3.1. After entry was completed it was exported into SPSS version 20 for further analysis. The descriptive data was summarized using, frequencies, proportions and tables. Composite measures were constructed for knowledge, attitudes and practice variables. Knowledge was assessed using 8 items on signs and symptoms of measles. Mothers who responded 4 and above were considered as "yes" and responded less than 4 correct answers were taken as they had no knowledge on measles. Correct responses were coded as 1 while 0 was given for incorrect answers.

Attitude of mothers was measured using 8 attitude questions. The response of each mother or close taker was given. Then the response was recoded into "1" if the mother or care giver has agreed for the question and "0"otherwise. Then after total score was dichotomized into positive and negative attitude.

Practice of mothers or care givers was also measured based on responses to see whether they had optimum child care practices. That includes full vaccination, feeding system and hygiene of child. Consequently, a score of "1"was given for mothers or caregivers who had

good idea towards practice and"0" point for those who don't meet those criteria. And finally it was categorized in to dichotomous variable as good and poor practice.

Data entering, editing and cleaning were undertaken before analysis. The analysis of both descriptive and inferential statistics was conducted. Descriptive statistics included mean and Standard deviation values for continuous data; percentage and frequency tables for categorical data. Logistic regression was used to identify factors associated with measles onset. Bivariate logistic regression analysis was conducted to see the existence of crude association and select candidate variables (with P-value below 0.25 were considered) to multivariable logistic regression. We checked multicollinearity among selected independent variables via variance inflation factor (VIF) and none was found. P-value 0.05 was considered as a cut point for statistical significance in the final model. Fitness of goodness of the final model was checked by Hosmer and Lemeshow test and was found fit. Data were summarized using odds ratio (OR) and 95% confidence interval.

Ethical approval was get from Institute for Community service and Research Directorate of Mizan Tepi University. Informed verbal consent was obtained from all participants.

Result

Among a total of 174 participants sampled, 52 cases and 156 controls; 45 cases and 147 controls gave response making the response rate of 92.3%.

Socio demographic and economic status

Regarding sociodemographic factors of participants' maternal education (χ^2 = 9.8, p-value = 0.021), children's parental marital status (χ^2 = 6.1, p-value = 0.04) and maternal age (χ^2 = 21.1, p-value < 0.0001) were shown significant difference between cases and controls (Table 1).

Variables	Categories	Cases (45)	Controls (147)	
		Number	Number	X^2, P value
Sex of child	Male	10 (24.4)	31 (21.1)	0.026, 0.51
	Female	35 (75.6)	116 (78.9)	
Mothers educational status	Illiterate	27 (60)	50 (34)	X^2 = 9.8, p-value = 0.021 df = 3
	Primary	12 (26.7)	52 (35.4)	
	Secondary	5 (11.1)	30 (20.4)	
	Tertiary	1 (2.2)	15 (10.2)	
Ethnicity	Bench	18 (6.7)	38 (17.7)	X^2 = 5.7, 0.33 df = 5
	Keffa	15 (40)	48 (25.9)	
	Sheko	2 (33.3)	10 (32.7)	
	Amhara	5 (4.4)	20 (6.8)	
	Oromo	2 (11.1)	5 (13.6)	
	Others	3 (4.4)	26 (3.4)	
Occupation	Farmer	10 (22.2)	18 (12.2)	X^2 = 11, p-value = 0.08 df = 6
	Merchant	10 (22.2)	25	
	Housewife	15 (33.3)	74 (50.3)	
	Student	7 (15.6)	16 (10.9)	
	Governmental employee	2 (4.4)	1 (0.7)	
	Others	1 (2.2)	13 (6.1)	
Family Marital status	Married	12 (26.7)	64 (43.5)	X^2 = 6.1, p-value = 0.04 df = 2
	Widowed	29 (64.4)	64 (43.5)	
	Divorced/ separated	4 (8.9)	19 (12.9)	
Maternal ages	Less than 20 years	3 (6.7)	7 (4.8)	X^2 = 21.1, p-value < 0.0001 df = 3
	20 - 30 years	12 (26.7)	80 (54.4)	
	31 - 40 years	12 (26.7)	43 (29.3)	
	> = 40 years	18 (40)	17 (11.6)	

***Table 1**: Socio-demographic Characteristics of study participants in South West Ethiopia, 2016.*

Knowledge, vaccination history versus measles among cases and controls

Parents knowledge on measles (χ^2 = 144, p-value < 0.0001 df = 1) and full vaccination (χ^2 = 102.6, p-value < 0.0001 df = 1) were signifi-

Variables	Categories	Cases (45)	Controls (147)	
		Number	Number	X^2, P value
Knowledge about measles	Yes	7 (15.6)	145 (98.6)	X^2 = 144, p-value < 0.0001 df = 1
	No	38 (84.4)	2 (1.4)	
Child was fully vaccinated	Yes	8 (17.8)	136 (92.5)	X^2 = 102.6, p-value < 0.0001 df = 1
	No	37 (82.2)	11 (7.5)	
Knowledge of risk age	Children less than 5 years	38 (84.4)	109 (74.1)	X^2 = 2.09, p-value = 0.148 df = 3
	5 - 18 years	3 (6.7)	9 (6.1)	
	Greater than 18 years	1 (2.2)	7 (4.8)	
	I don't know	3 (6.7)	18 (12)	
Vaccination card	Yes	27 (60)	78 (53.1)	X^2 = 0.67 p-value = 0.41 df = 3
	No	18 (40)	69 (46.9)	

Table 2: *Knowledge and vaccination related characteristics in South West Ethiopia.*

cant made difference between cases and controls in our study (Table 2).

Factors independently affecting measles onset between cases and control in South West Ethiopia

After adjusted for confounding factors the following variables were found to be predictors of measles outbreak. Being widower's child is very less likely to acquire measles than divorced or separated (AOR = 0.15, 95% CI: 0.1, 0.43). This means that about 85% of children from widowed mother have probability to acquire measles. This might be related with low socio economic status of widowed woman than others. The unlikelihood of acquiring measles was very low among children with mother's inadequate knowledge towards measles (AOR = 0.02, 95% CI: 0.001, 0.68). This means that about 98% of children from mothers with poor knowledge have probability to acquire

Variables	Categories	Cases N = 45	Controls N = 147	(OR, 95% CI)	
				COR	AOR
Sex of child	Male	10	31	0.9 (0.417, 2.096)	1.4 (0.34, 2.34)
	Female	35	116	1	1
Mothers educational status	Illiterate	27	50	0.1 (0.015, 0.99)	0.8 (0.047, 13.980)
	Primary	12	52	0.3 (0.035. 2.4)	NC
	Secondary	5	30	0.4 (0.43, 3.74)	NC
	Tertiary	1	15	1	
Family Marital status	Married	12	64	1.1 (0.32, 3.9)	0.2 (0.001, 2.7)
	Widowed	29	64	0.5 (0.15, 1.5)	0.02 (0.001, 0.68)
	Divorced/separated	4	19	1	
Maternal ages	Less than 20 years	3	7	2.5 (0.55, 11.1)	NC
	20 - 30 years	12	80	7 (2.87, 17.34)	NC
	31 - 40 years	12	43	3.8 (1.5, 9.5)	1 (0.053, 21.13)
	>= 40 years	18	17	1	
Knowledge about measles	Yes	7	145	1	
	No	38	2	0.003 (0.001, 0.013)	0.001 (001, 0.022)
Child was fully vaccinated	Yes	8	136	1	
	No	37	11	0.017 (0.007, 0.05)	0.01 (0.001, 0.043)
Knowledge of risk age	Children less than 5 years	38	109	1	
	5 - 18 years	3	9	1 (0.27, 4.07)	NC
	Greater than 18 years	4	19	NC	NC
	I don't know	0	10	1.4 (0.373, 5.21)	NC

Table 3: *Multivariate Logistic analysis of factors affecting Measles in South West Ethiopia, 2016.*

measles. And those children fully vaccinated have very less likelihood of acquiring measles than their counterparts (AOR = 0.1, 95% CI: 0.09, 0.17). Unvaccinated children have 90% of probability to acquire measles than others (Table 3).

Discussion

Our study revealed the fundamental determinants those are related to socio demographic factors like low knowledge and awareness for measles; demographic factors such as being in age group of above forty years of mothers, being widowed, having not fully vaccinated. To minimize the recall bias in our study we started our study after 3 months onset of measles outbreak.

The social factors, poor knowledge of mothers about measles signs, symptoms, and severity even its name appeared to be the most important predictor in determining outbreak of measles. Many previous studies conducted in various countries were in line with knowledge level of mothers to be among the most important determinants of onset of measles [2,8,10,20,25]. There are a plenty of justifications that wonder as to why knowledge is a key determinant of measles. For example proper health education should be given to all mothers at village level through IEC (Information, Education and Communication) strategy [19].

Another factor that has also shown an important impact on measles outbreak was parents' marital status. Among parents whom one of either mother or father died were more likely to use measles than married ones. This might be true that displaced, socioeconomically poor and disadvantaged groups have high possibility of acquiring measles [7,10,12,16].

In our study overcrowding or having more number of family members in a house hasn't showed any significant association. This is inconsistent with finding from Pakistan that measles was also more common in households with larger number of members in the family as for every two members increase in a family was associated with measles [3]. This might be due to the difference in study setting culture, family structure and living system.

Having fully vaccinated was strongly associated with measles. Similarly having not fully vaccinated was associated with acquiring measles. This finding demonstrated the fact that full vaccination including measles is a vital for prevention of measles disease [7,10,12,14,16,18,22].

Maternal education level was a determinant in bivariate analysis. This result wasn't engaged in the multivariate analysis. Since all our study participants were from rural area most mothers have similar educational status. This may hide its independent significance on measles. Therefore, still knowledge related information determines measles.

Concerning to other correlates of measles, our finding did not showed any evidence that age, monthly income, distance from health facility, residence, Health extension worker availability and ventilation to show a statistically significant difference between cases and controls. These findings could be related to difference in research methodology, sample size and the difference in other social and demographic factors that might not be considered in this study.

The limitations of this study were being a case control studies since they are not able to establish temporal relationships. So it results in dilemma whether predictors precede the effect or vice versa. Information bias may be expected since cases and control were selected among similar village and mothers may hide the information whether the child was vaccinated or not, this may affect generalizability and internal validity.

Tools used to measure knowledge and attitude were not standardized and tested for their reliability which would affect its comparability.

Inclusion of other variables like perceptions of the existing quality of health extension program implementation, direct and indirect cost of health services and ability of the participants to pay for the service could have their own effect in our findings.

The bold limitations in this study were we used rapid epidemic assessment approach to identify possible causes of measles in area due to epidemics. Following this we collected information from small proportion of the target eligible population. Consequently, the precision is weak and most of variables have no significant association. Although very few variables were found to be significantly associated with measles incidence, they have very wide confidence interval. This shows low precision due to small sample size. The other limitation is we used analytical approach but it is better to triangulate qualitative data with quantitative. Thirdly, we used structured questions to collect data. But to get more and detail it is good if we preferred semi and unstructured question through individual depth interview and focus group discussions.

Conclusion

Less awareness toward the disease and not full immunizing the children were potential causes for measles incidence in South West Ethiopia. It is very important to eradicate measles through absolute community participation. To achieve the childhood illness including measles elimination and eradication, providing pertinent health education and information are the main weapons in the area. In addition, further scientific investigations are strongly encouraged.

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