

Factors associated with non-vaccination against measles among 12-23 months old children in Yirgachefe district of SNNPR, Ethiopia, 2016

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Abstract

Immunization is an effective and proven tool for controlling and eliminating life-threatening vaccine preventable infectious diseases. In Ethiopia 5% of childhood mortalities are due to measles. In 2015, 85% of children had received 1 dose of measles vaccine by their second birthday. Despite the availability of a safe and effective vaccine, measles outbreaks secondary to non-vaccination are occurring in southern Ethiopia especially in Yirgachefe district. This study was done to assess the risk factors associated with non-vaccination against measles. A Community-based unmatched case control study was conducted in Yirgachefe district from December 1-31, 2016. Cases were defined as children in the age group of 12- 23 months of age who did not take measles vaccination. The study was done in 6 randomly selected kebeles and cases and controls were selected randomly by probability proportional to size sampling. A structured questionnaire was used for data collection and data was analyzed by using Epi info version 7 and SPSS version 20. Statistical significance was interpreted using Odds ratio with 95% confidence interval and P value <0.05. A total of 320 individuals (107 cases and 214 controls) were approached for interview with a response rate of 93.75%. Of the cases, 57% were males and more than half fall in the 12- 18 months age group. Lack of Ante Natal Care follow up (Adjusted Odds Ratio (AOR) =3.57; 95% Confidence Interval (CI): 1.22-10.44), lack of knowledge on the importance of vaccination, who should be vaccinated and if measles is contagious with an AOR and CI of (AOR=6.81; 95% CI: 1.56-29.64), (AOR=4.29; 95% CI: 1.83-10.04) and (AOR=8.97; 95%CI: 3.15-25.58) respectively were independent risk factors. Lack of ANC follow up, lack of knowledge about who should get vaccinated, the importance of vaccination and contagiousness of the disease were identified as risk factors for non-vaccination against measles. Education and awareness about measles and its immunization should be given to the community. Additionally, ANC follow up should also be strengthened.

Background

Immunization is an effective and proven tool for controlling and eliminating life-threatening infectious diseases. It is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine. Vaccines stimulate the body's own immune system to protect the person against subsequent infection or disease. It has clearly defined target groups; it can be delivered effectively through outreach activities(1).

It is estimated that about 2 to 3 million deaths from diphtheria, tetanus, pertussis and measles were averted through immunization every year. However, an additional 1.5 million deaths could be avoided if global vaccination coverage improves. Measles, one of the vaccine preventable diseases, is a highly contagious disease caused by a virus, which usually results in a high fever and rash, and can lead to blindness, encephalitis or death(2).

By 2008, measles immunization coverage was 83% globally among children aged 12–23 months old. The lowest rates were in the WHO South-East Asia (75%) and African (73%) regions(3). By the end of 2015, globally 85% of children had received 1 dose of measles vaccine by their second birthday, and 160

countries had included a second dose as part of routine immunization and 61% of children received 2 doses of measles vaccine according to national immunization schedule. Despite the availability of a safe and effective vaccine, measles remains one of the leading causes of death among young children globally(4).

Under the Global Vaccine Action Plan, measles is targeted for elimination in five WHO Regions by 2020. Effective vaccination against the disease is helpful to achieve the elimination goal. The highly effective, safe and relatively inexpensive measles- containing vaccines protect individuals from infection, and their widespread use can completely stop the spread of the viruses in populations that achieve and maintain high levels of immunity(5).Between 2000 and 2014,measles vaccination resulted in 79% drop in measles deaths worldwide making measles vaccine one of the best buys in public health (6).

Unvaccinated young children are at highest risk of measles and its complications, including death. Unvaccinated pregnant women are also at risk. Any non-immune person (who has not been vaccinated or was vaccinated but did not develop immunity) can become infected with measles(6). Studies showed that children who had not received measles vaccine were 35 times more likely to get infected (7).

According to the 2011 EDHS report, the measles vaccination coverage of Ethiopia and SNNP was 56% and 57.8% respectively. Additionally, in 2014 WHO reported that the measles vaccination status of Ethiopia to be 70%.However Federal Ministry of Health has reported an overall measles vaccination coverage above 90% in 2015/2016(8).Even though there is an improvement in the vaccination coverage, outbreaks still persists and in Ethiopia measles accounts for 5% of childhood mortality. It is probably common among the vaccine preventable diseases that occur repeatedly and mothers recognize it as a self-limited common childhood illness for which no medical care is often sought. Based on the Epidemiology of measles and burden of disease modeling, it is estimated that more than 1.5 million cases of measles and 70,000 deaths would occur in Ethiopia annually. In 2013, measles incidence was 7.2 cases per 100,000 populations and a total of 243 measles outbreaks were confirmed with 192 affected districts(9).

Ethiopia is committed to achieving the elimination of measles by 2020 in line with African region Resolution. Through implementation of the recommended strategies including strengthening routine immunization activities and accelerated measles control since 2002, there was steady progress in reducing morbidity and mortality from measles. Continuing measles outbreaks despite efforts to implement planned strategies are documented especially in SNNP, Amhara and Oromia regions(9).In 2015, SNNPR regional health bureau had reported an outbreak in 2015.

The occurrence of outbreaks despite the improvement in vaccination may be due to ineffective cold chain management or underreporting of the unvaccinated. Non vaccination can be a result of maternal factors, service related factors or factors associated with child characteristics. Therefore the aim of this study is to assess the risk factors associated with non vaccination against measles in Yirgachefe woreda which could contribute in achieving the elimination goal of measles by 2020.

Objectives

To assess factors associated with non vaccination against measles in Yirgachefe District of Gedeo zone, SNNPR, Ethiopia.

Methods And Materials

This study was conducted in Yirgachefe district, one of the districts in SNNPR of Ethiopia. It is 395 Km far from Addis Ababa, capital of the country. It is bordered on the south by Kochere, on the north by Wonago, on the east by Bule, and on the southeast by Gedeb districts(28). It has a total population of 257,489 when projected from the 2007 housing and population census and 50.7% are males. Thirty seven thousand five hundred ninety four (37,594) of the total population segment are children less than five years. The district is divided in to 33 administrative kebeles (small administrative units) of which 2 are urban kebeles. The woreda is 5% Kola and 95% Dega and Woyina Dega. In Yirgachefe woreda, there are 7 health centers and 31 health posts. Moreover, there are 3 private clinics.

A Community-based unmatched case control study design was conducted from December 1-31, 2016. Children in the 12-23 months age group in Yirgachefe District were the source population. Cases were children in the age group of 12- 23 months of age who did not take measles vaccine while Controls were Children in the age group of 12-23 months and who took at least one dose of measles vaccine. Those children of mothers who neither have vaccination card nor remember whether their child has taken measles vaccination or not were excluded from the study.

The sample size was generated using StatCalc in Epi-Info 7 statistical software. As shown in the table below, sample size was calculated for different risk factors from various literatures using 1:2 cases to control ratio, 5% margin of error, 95% confidence interval, 80% power, a non-response rate of 10 % and a design effect of 1.5. Considering the time given for data collection and the resource allocated, assessing 478 households will not be feasible. Therefore the second large sample size was taken. Hence, a total of 320 participants (107 cases and 214 controls) were included in the study (Table 01).

Multi stage sampling technique was used to obtain a representative study sample. There are a total of 31 rural and 2 urban kebeles in the district. In the first stage, 5 rural kebeles and 1 urban kebele was selected by using simple random sampling technique. In each selected kebeles, the list and addresses of a child between the age group of 12-23 months with their measles vaccination status was pulled out from each kebeles health extension workers family folder. Sampling frame was prepared for both cases and controls. By using probability proportional to size sampling, the number of cases and controls to be included in the study for each kebeles was calculated. Finally from the total sampling frame, the calculated number of cases and controls was selected randomly by using lottery method from each kebeles (Fig.1).

Measles Vaccination status of children aged 12-23 months was the dependent variable. Socio demographic characteristics of mothers/caretakers, sex of child, birth order of child, place of residence,

place of delivery, educational status of mother/ care taker and father, Maternal tetanus toxoid immunization status, Knowledge of mothers/caretakers about vaccinations and its importance, family size, Parity, Time of travel to reach the nearest health facility, monthly family income, ANC and PNC follow up of a mother, availability of immunization services, availability of health extension worker, and past EPI experiences were the independent variables.

A structured interviewer administered questionnaire initially developed in English and later translated into the local language (Gedeo) was used for data collection. The questionnaire was adapted from various literature sources. The content of the questionnaire include socio-demographic and economic characteristics, maternal and child factors and health service related factors.

Vaccination status of a child and a mother was recorded from the available immunization card or by asking the mother or care taker if the card is not available. The data collector helped the mother or care taker to remember by telling her the time of administration or the site of injection. For a child with immunization card, the information on the doses and types of vaccines received was recorded from the card. Additionally verbal information from the mother/caretaker about the doses taken was recorded.

The questionnaire was pretested in one kebele of Wonago district to determine its appropriateness on the local context. Diploma nurses and health extension workers from other unselected kebeles were recruited as data collectors and health officers were assigned as supervisors. All the data collectors and the supervisors were trained intensively for about three days about the objective of the study, on how to select households, how to approach each interviewee, how to ask question, regarding ethical issues, data quality and how to collect important information.

During data collection every questionnaire filled by data collectors was checked daily by field supervisors for its completeness. Unfilled questions on the questionnaire were completed by revisiting those households. Data collectors filled information regarding child vaccination history based on vaccination card (if available) and they gave enough time for mothers/caretakers to bring the card. Additionally, the principal investigator checked the filled questionnaire and gave feedback for field supervisors every day prior to data entry.

The data was entered, cleaned and edited using EPI-Info 7 and transferred to SPSS version 20 for further analysis. Frequencies, means and percentages were calculated and differences in proportions were calculated using the Chi-square test with 5% significance level. Associations between factors and non-vaccination status were tested first by the chi-square test. In order to investigate relative importance of the variables in relation to the dependent factor and any confounding between them, they were fitted together in a binary logistic regression model to identify independent factors. Those variables that come significant in the bivariate analysis were fitted to a multivariable analysis followed by a backward stepwise procedure to control confounding. Additionally variables with p value <0.2 were entered to the final model to avoid confounding. Statistical significance was interpreted using Odds ratio with 95% confidence interval and P value <0.05.

Ethical approval was obtained from Saint Paul's Hospital Millennium Medical College institutional review board. A formal letter was also submitted to all the concerned bodies (SNNPR Health Bureau, Gedeo Zone Health Department and Yirgachefe Health office) to obtain their cooperation. Before data collection informed verbal consent was gained from parents or guardians. All respondents were free to withdraw from the study at any time without any consequences. Confidentiality was assured and no personal details were recorded or produced on any documentation related to the study. No one was obliged to participate unless otherwise agreed to take part.

Operational Definitions

Accessibility of vaccination Services: Opportunity to get immunization services within short radius (less than 5 kilometers).

Vaccination: The administration of a vaccine to stimulate a protective immune response that will prevent disease in the vaccinated person if contact with the corresponding infectious agent occurs subsequently.

Vaccinated: A child who received at least one dose of MCV according to information from vaccination cards or from mothers' (care givers') verbal reports. Unvaccinated: A child who did not receive any dose of MCV according to information from vaccination cards or from mothers' (care giver's) verbal reports.

Vaccination Coverage: Proportion of children who took measles vaccination. Non Professional attendant: TBAs and those attendants who didn't take any formal training.

Result

Socio Demographic characteristics

A total of 300 individuals (100 cases and 200 controls) were approached for interview. Children's caretakers were interviewed and the response rate was 93.75%. Protestant is the dominant religion for both caretakers of cases and controls with a percentage of 85% and 93.5% respectively. Additionally almost all of the cases (98%) and controls (98.5%) were Gedeo in ethnicity. Equal percentage (78%) of the cases and controls mothers/caretakers earns ≤ 500 birr monthly. While a small group of cases (5%) and controls (3%) caretakers have a monthly income of ≥ 1000 . The mean and median income of the interviewees was 400 and 300 birr respectively with a Standard Deviation (SD) of 436.04 birr. Among the interviewed caretakers of cases and controls, more than half (68%) and (56.5%) respectively, were housewives and about two third of cases (70%) and controls (62.5%) caretaker's were illiterate. From the total study participants, 55% were males. In addition to this, among the cases, 57% were males. On the other hand, more than half of the cases and controls fall in the 12-18 months age group and the mean and median age was 17.84 months and 18 months respectively with a SD of 3.94. Regarding birth order, 40% of cases and 38% of controls were fourth or above child for their mothers. The mean and median birth order was 3.46 and 3 respectively with SD of 2.47. Fifty-five (55%) percent of the cases and 58% of

the controls had 5 or less family members. The mean family member was 5.41 and the median was 5 with SD of 2.2 (Table 02).

Maternal behavior related characteristics

Maternal behavior related factors regarding measles immunization were also assessed and out of the total caretakers of cases and controls, 72% and 92.5% respectively heard about measles vaccination. Of those cases of mothers/caretakers heard about measles, 86% got the information from health professionals. Only 8% and 4% cases and controls mothers/caretakers respectively got the information from mass media. Participants were also asked if all children should be vaccinated and only 26% of the cases mothers/caretakers answered yes. However 76% of the controls mothers/caretakers knew that all children should be vaccinated against measles. Of the cases mothers/caretakers, only 31% had awareness about the right age of vaccination, while 74% of the controls mothers/caretakers had knowledge that it was at 9 months. Moreover interviewees were also asked if vaccinating a child was important and its benefit. More than two third of the cases and almost all of the controls mothers/caretakers agreed that vaccination is important. However only half of the cases mothers/caretakers knew its benefit is to prevent disease while more than three fourth of the control's mothers/caretakers knew the benefit of measles vaccination. On the other hand, 60% and 92% of cases and controls mothers/caretakers respectively agreed that measles is vaccine preventable and 65% of cases and 91% of controls mothers/caretakers knew that it is contagious (Table 03).

Health service-related factors associated with measles vaccination

The nearest health facility in 84% of the cases and 78% of controls kebele provide routine immunization and health post is the dominant health facility. Health extension workers live in almost all cases and controls kebele. Forty five percent (45%) of the cases mothers/caretakers will walk 15-30 min to reach the nearest health facility while only 24% took more than one hour.

Only around a quarter (23%) of the cases mothers/caretakers had vaccination card. However, vaccination card was available in 79% of the control's household. Majority of the cases and controls didn't face delay in any EPI services. Moreover 25% of cases and 33% of controls experienced delay in other EPI services. Additionally, 45% of the cases mothers/caretakers had Ante Natal Care (ANC) follow up while more than three fourth of the control's mothers/caretakers visited the health facility during their pregnancy. On the other hand, 30% of the cases and 56% of the control's mothers/caretakers had post-natal care follow-up.

Regarding place of delivery, 73% of cases mothers/caretakers gave birth to their last child in their home and 67% were attended by non-professional attendants. However, for the controls, the percentage of home delivery was 49%. Additionally, mothers/caretakers of cases who took tetanus toxoid (TT) vaccine during their pregnancy were 42% while controls were 77.5% (Table 04).

Independent predictors of non-immunization against measles

In Bivariate analysis, 9 variables: religion, availability of vaccination card, if a child was ever vaccinated when they go to health facility for other purposes, ANC follow up, TT vaccine, place of delivery, birth attendant, PNC follow up, heard about measles vaccination, knowledge on right age of vaccination, if measles is vaccine preventable and contagious, importance and benefit of vaccination, were significant.

The variables that showed statistical significant in the bivariate analysis, variables with p value less than 0.2 and variables that were significant in most previous studies were further analyzed in multivariable logistic regression to adjust for potential confounders and to identify independent factors that affect measles vaccination.

Therefore income, availability of vaccination card, if a child was ever vaccinated when they go to health facility for other purposes, ANC follow up, TT vaccine, place of delivery, birth attendant, PNC follow up, heard about measles vaccination, knowledge on right age of vaccination, if measles is vaccine preventable and contagious, importance and benefit of vaccination, mothers/caretakers educational status, source of information about measles immunization, availability of HEWs in the kebele, availability of immunization in the nearest health facility, distance to reach health facility, delay in other EPI services and if there is any child went to health facility but not vaccinated were the variables identified for further analysis.

The multivariable analysis showed that knowing if vaccinating a child is important, having ANC follow up, knowledge if all children should take measles vaccine and if it is contagious were independent risk factors related to child's non vaccination against measles (Table 05).

Knowledge if vaccinating a child is important was a significant variable for child vaccination against measles. According to this study the odds that being unvaccinated against measles was because of mothers/caretaker's lack of knowledge on the importance of vaccination was 6.81 as compared to being vaccinated against measles.

It was also found that the odds are 3.57 times higher given those children born from mothers who don't have ANC follow up will be unvaccinated against measles compared to those born from mothers who had ANC follow up.

Knowing that all children should be vaccinated against measles was also another predictor found to be associated with non-vaccination against measles. Thus; the odds of mothers/caretakers who didn't know that all children should be vaccinated against measles among non-vaccinated children were 4.29 as great as the odds among the vaccinated children.

Furthermore, mothers/caretaker's knowledge if measles was contagious was another independent predictor for child vaccination against measles. According to this study, the odds are 8.97 times greater

given those children of caretakers/mothers who don't know that measles is contagious will be unvaccinated against measles compared to those born from mothers who knew measles is contagious.

Discussion

This study was conducted in Yirgachefe woreda of Gedeo zone to identify risk factors associated with non-immunization against measles in 12-23 months old children. Immunization status of a child was confirmed either by vaccination card or by caretaker's recall. Different risk factors were assessed and ANC follow up, mother's or care taker's knowledge if vaccinating a child is important, if all children should be vaccinated and if measles is contagious were found to be significant predictors of non-vaccination against measles.

The current study revealed that the odds of mother's who had ANC follow up during their pregnancy were 3.57 times greater to vaccinate their child against measles when compared to those who did not have ANC follow up. This finding is consistent with studies done in Ambo, Machakal and Sinana (7,17 and 29).The study in Ambo found that Children of mother who had ANC were 2.1 times more likely to vaccinate their child than those with no follow up (17).Additionally according to a study in Machakal, children who were born from mothers who had no antenatal care visit during pregnancy were 2.5 times more likely to default to complete vaccination compared to infants who were born from mothers who had antenatal care visit during pregnancy(7). Moreover, in Sinana it was also identified that mothers/caretakers who had ANC visit were more likely to vaccinate their children (29). These findings may be due to the increased probability that mothers who had ANC follow up may have the chance to discuss with health professionals and get information about measles vaccination. Additionally, it shows the health seeking behavior of the mother.

In contrary to several studies, having PNC follow up was not significant in the current study. However, knowledge on measles immunization was found to be one of the determinants of vaccination against the disease. This study identified that the odds of mothers/caretakers who didn't know that all children should be vaccinated against measles among non-vaccinated children were 4.29 as great as the odds among the vaccinated children. Similar study from Sinana has also identified that children whose mothers have sufficient knowledge on immunization were twice more likely to be fully vaccinated than whose mother had little knowledge(29).In addition to this, from a study in Wonago, it was found that Knowledge regarding measles vaccine and schedule of polio vaccines were predictors of child immunization completion(30). Moreover, in Kyoto Japan, low levels of knowledge were significantly associated with uncompleted measles vaccination (31). A study from Mecha has also revealed that those mothers who have good knowledge on vaccination were more likely to fully vaccinate their child (20).

Caretakers/mothers knowledge if vaccinating a child is important was another identified risk factor associated with vaccination against measles. According to this study the odds that being unvaccinated against measles was because of mothers/caretaker's lack of knowledge on the importance of vaccination was 6.81 as compared to being vaccinated against measles. In consistence to this, a study in

Arbaminch revealed that mothers with lack of knowledge about immunization benefits are more likely to vaccinate their children (19). This may be due to the fact that mothers who have knowledge about measles vaccination will probably vaccinate their child.

Participants were also asked if they knew that measles was contagious and 35% of the cases have no awareness on it while only 9% of the controls gave the answer no. The odds are 8.97 times greater given those children of caretakers/mothers who don't know that measles is contagious will be unvaccinated against measles compared to those born from mothers who knew measles is contagious. Coherently in Kyoto, those who have low levels of knowledge on measles were less likely to vaccinate their child (31). Caretakers who have knowledge on measles contagiousness may seek health service in case of the disease and are likely to vaccinate their child against it.

None of the socio demographic factors have become significant in this study. Consistently according to the study in Ambo mother's socio demographic characteristics were not significant (17). However maternal education was an important predictor in studies from Arbaminch and Somali (18, 19). Additionally, child age and parity were determinants of vaccination in a study in Machakal (7). Place of delivery were a significant predictor in most studies including Mecha, Machakal and Arbaminch (7, 19, and 20).

Recall bias is one of the major limitations of the study. As information on vaccination status was collected from both vaccination card and mothers/caretaker's information, recall bias is likely to occur and cases and controls could be misclassified. Additionally, the study was not supported by qualitative study to explore reasons of mothers/caretakers for not vaccinating their child.

Conclusions and Recommendations

The result of this study identified that factors associated with non-immunization against measles are mostly related to maternal characteristics. ANC follow up, knowing if vaccination is important and if all should be vaccinated were identified as risk factors for non-vaccination. Additionally, awareness if measles is contagious was another predictor associated with non-immunization of children against measles.

Therefore, education and awareness should be given about measles immunization. Additionally, health professionals should give information for the community on overall measles. Health professionals should give additional information on vaccination for pregnant mothers that come to health facility for pregnancy care. Moreover, more emphasis should be given on ANC utilization of mothers as it has a great role to curb non vaccination against measles.

Acronyms And Abbreviations

ANC

Ante Natal Care

AOR	Adjusted Odds Ratio
BCG	Bacillus Calmette Guerin Vaccine
CI	Confidence Interval
COR	Crude Odds Ratio
EPI	Expanded program on Immunization
FMOH	Federal Ministry of Health
HEWs	Health Extension Workers
HF	Health Facility
MCV	Measles Containing Vaccine
MMR	Measles-Mumps-Rubella
MMRV	Measles-Mumps-Rubella-Varicella
MR	Measles-Rubella
NGOs	Non Governmental Organizations
OPV	Oral Polio Vaccine
PCV	Pneumococcal Conjugate Vaccine
SD	Standard Deviation
SIA	Supplemental Immunization Activities
SNNPR	Southern Nations' Nationalities and People's Region
TT	Tetanus Toxioid

Declarations Section

Ethics approval and consent to participate

Ethical clearance was obtained from Saint Paul's Hospital Millennium Medical College. A letter was written for SNNP regional health bureau in order to obtain approval on the data collection. An informed written consent was obtained from all parents of the study participants. Confidentiality of information was assured and ensured. Participants were treated with respect and willingly participated in the study with no payment or cohesion.

Consent for publication

Not Applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

There is no conflict of interest.

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Authors' contributions

LHD, the corresponding author, was the major contributor in preparing the manuscript. YW supported in the analysis and interpretation of the data and revised the manuscript critically for important intellectual contents. MT contributed a lot in the conception, revision and approval of the final version of the manuscript. All the authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors have approved the final manuscript.

References

1. <http://www.who.int/topics/immunization/en/>. Accessed on August 2016
2. WHO. Immunization coverage fact sheet N°378. 2016
3. CDC: Overview of Measles Diseases. .National Center for Immunization and Respiratory Diseases 2013
4. WHO. Measles Fact sheet N°286, April 2016
5. WHO. Global measles and rRubella Strategic plan. 2012-2020
6. <http://www.who.int/mediacentre/factsheets/fs286/en/>). Accessed on August 2016
7. Yenit MK, Assegid S, Abrha H. Factors Associated With Incomplete Childhood Vaccination among Children 12-23 Months of Age in Machakel Woreda , East Gojjam Zone: A Case Control Study. 2015;2(4):2–7.
8. Health and Health relatd Indicator. Version 1. 2007;1–66.
9. Akalu HB. Journal of Tropical Diseases Review on Measles Situation in Ethiopia; Past and Present. 2015;4(2):2–7.

10. Hu Y, Li Q, Luo S, Lou L, Qi X, Xie S. Timeliness Vaccination of Measles Containing Vaccine and Barriers to Vaccination among Migrant Children in East China. 2013;8(8):1–7.
11. <http://www.who.int/mediacentre/news/releases/2015/measles-vaccination/en/>. Accessed on August 2016
12. Summary E, Plan RS. Proceedings and Draft Recommendations from the Fifth Meeting of the SAGE Working Group on Measles and Rubella 1 . Measles and Rubella Status Report. 2015;(October):1–30.
13. <http://www.who.int/mediacentre/news/releases/2015/measles-vaccination/en/>). Accessed on August 2016
14. Anekwe TD, Newell M, Tanser F, Pillay D. The causal effect of childhood measles vaccination on educational attainment: A mother fixed-effects study in rural South Africa. Vaccine [Internet]. Elsevier Ltd; 2015;33(38):5020–6.
15. Mutua MK, Kimani-murage E, Ettarh RR. Childhood vaccination in informal urban settlements in Nairobi , Kenya : Who gets vaccinated ? BMC Public Health [Internet]. BioMed Central Ltd; 2011;11(1):6.
16. Tagbo BN, Eke CB, Omotowo BI, Onwuasigwe CN, Onyeka EB, Mildred UO. Vaccination Coverage and Its Determinants in Children Aged 11 - 23 Months in an Urban District of Nigeria. 2014; (November):175–83.
17. Etana B, Deressa W. Factors associated with complete immunization coverage in children aged 12 – 23 months in Ambo Woreda , Central Ethiopia [Internet]. BMC Public Health. BMC Public Health; 2012. p. 1.
18. Mohamud AN, Feleke A, Worku W, Kifle M, Sharma HR. Immunization coverage of 12 – 23 months old children and associated factors in Jigjiga District , Somali National Regional State , Ethiopia. 2014;1–9.
19. Animaw W, Taye W, Merdekios B, Tilahun M, Ayele G. Expanded program of immunization coverage and associated factors among children age 12 – 23 months in Arba Minch town and Zuria. 2014;14(1):1–10.
20. Debie A, Taye B. Assessment of fully vaccination coverage and associated factors among children aged 12-23 months in Mecha district , North West Ethiopia : A cross-sectional study. 2014;2(4):342–8.
21. Kassahun MB, Biks GA, Teferra AS. Level of immunization coverage and associated factors among children aged 12 – 23 months in Lay Armachiho District , North Gondar Zone , Northwest Ethiopia : a community based cross sectional study. BMC Res Notes. BioMed Central; 2015;1–10.
22. Roy SG. Risk Factors for Childhood Immunization Incompletion in Ethiopia. 2010;
23. Rahman M, Obaida-nasrin S. Factors affecting acceptance of complete immunization coverage of children under five years in rural Bangladesh. 2010;52(2):134–40.
24. Negussie A, Kassahun W, Assegid S, Hagan AK. Factors associated with incomplete childhood immunization in Arbogona district , southern Ethiopia : a case – control study. BMC Public Health

[Internet]. BMC Public Health; 2016;1–9. Available from: <http://dx.doi.org/10.1186/s12889-015-2678-1>

25. Science MC. Factors affecting compliance with the measles vaccination schedule in a Brazilian city. 2008;126(3):166–71.
26. Bugvi AS, Rahat R, Zakar R, Zakar MZ, Fischer F. Factors associated with non-utilization of child immunization in Pakistan: evidence from the Demographic and Health Survey 2006-07. BMC Public Health [Internet]. BMC Public Health; 2014;14(1):1–7.
27. Funmilayo A. Determinants of full child immunization among 12-23 months old in Nigeria. 2013; (6812-12).
28. [https://en.wikipedia.org/wiki/Yirgachefe_\(woreda\)](https://en.wikipedia.org/wiki/Yirgachefe_(woreda))). Accessed on August 2016
29. Elias L, Worku D. An assessment of child immunization coverage and its determinants in Sinana District, Southeast Ethiopia. *Biomed central*. 2015, 15:31
30. Abyot GA, Digsu NK, et al. Determinants of default to fully completion of immunization among children aged 12 to 23 months in south Ethiopia: unmatched case-control study. 2016;8688:1–8.
31. Takayo M, Takeo N, Shigeru O, Hideko I. Measles vaccination coverage and factors related to uncompleted vaccination among 18 months old and 36 months old children in Kyoto, Japan. *BMC public health*. 2005, 5:59.

Tables

Table 1: Risk factors used for sample size calculation of "risk factors associated with non vaccination against measles in Yirgachefe woreda, Ethiopia, 2016.

Risk Factor	Proportion of cases	Proportion of controls	Odds Ratio	Calculated sample size	References
Knowledge of the mother about child Immunization	11.5%	2.30%	5.51	478	(24)
Mothers negative perception about vaccine side effects	57.3	32.2	2.83	251	(7)
Antenatal care	48.5%	27%	2.55	320	(7)
Post natal care	68%	44%	2.7	277	(29)

Table 2: socio-demographic factors related to non vaccination against measles in Yirgachefe district, Southern Ethiopia, 2017

Variables	Category	Cases	Controls	Crude OR(95% CI)	<i>p</i> value
Religion	Protestant	85(85%)	187(93.5%)	1	
	Other	15(15%)	13(6.5%)	2.54(1.16-5.57)	0.02
Ethnicity	Gedeo	98(98%)	197(98.5%)	1	
	Other	2(2%)	3(1.5%)	1.34(0.22-8.15)	0.75
Family income	≥1000	5(5%)	6(3%)	1	
	500-1000	17(17%)	38(19%)	0.54(0.14-2.00)	0.36
	≤500	78(78%)	156(78%)	0.60(0.18-2.03)	0.41
Mother's/Caretaker's occupation	House wife	68(68%)	113(56.5%)	1	
	Student	2(2%)	10(5%)	0.33(0.71-1.56)	0.16
	Merchant	5(5%)	19(9.5%)	0.44(0.16-1.23)	0.12
	Farmer	23(23%)	54(27%)	0.71(0.40-1.26)	0.24
	Other	2(2%)	4(2%)	0.83(0.15-4.66)	0.83
Mother's/Caretaker's educational status	Literate	30(30%)	75(37.5%)	1	
	Illiterate	70(70%)	125(62.5%)	1.40(0.84-2.34)	0.20
Mother's/Caretaker's marital status	Married	99(99%)	199(99.5%)	1	
	Other	1(1%)	1(0.5%)	2.01(0.12-32.47)	0.62
Sex of the child	Male	57(57%)	109(54.5%)	1	
	Female	43(43%)	91(45.5%)	0.90(0.56-1.47)	0.68
Age of the child	12-18 months	57(57%)	105(52.5%)	1	
	19-23 months	43(43%)	95(47.5%)	0.83(0.51-1.35)	0.46
Birth order	1	25(25%)	55(27.5%)	1	
	2-3	35(35%)	68(34%)	1.13(0.61-2.11)	0.70
	≥4	40(40%)	77(38.5%)	1.14(0.62-2.1)	0.70
Family size	<5	55(55%)	116(58%)	1	
	>5	45(45%)	84(42%)	1.13(0.70-1.83)	0.62

Table 3: Maternal behavior related to non vaccination against measles in Yirgachefe district, Southern Ethiopia, 2017

Variables	Category	Cases No (%)	Controls No (%)	Crude OR(95% CI)	p value
Ever heard about measles vaccination	Yes	72(72%)	185(92.5%)	1	
	No	28(28%)	15(7.5%)	4.80(2.42-9.50)	0.00*
Where did you get the information	Health professionals	62(86.1%)	170(92.9%)	1	
	Mass media	6(8.3%)	8(4.4%)	2.06(0.69-6.16)	0.20
	Other	4(5.6%)	5(2.7%)	2.19(0.57-8.43)	0.25
Should all children be vaccinated	Yes	26(26%)	152(76%)	1	
	No	74(74%)	48(24%)	9.01(5.19-15.66)	0.00*
The right age of vaccination	At 9 months	31(31%)	147(73.5%)	1	
	Didn't know	69(69%)	53(26.5%)	6.17(3.64-10.46)	0.00*
Is vaccinating a child important?	Yes	70(70%)	191(95.5%)	1	
	No	30(30%)	9(4.5%)	9.1(4.11-20.11)	0.00*
Benefit of vaccination	To prevent from disease	48(48%)	154(77%)	1	
	Didn't know	52(52%)	46(23%)	3.63(2.17-6.05)	0.00*
Is measles vaccine preventable?	Yes	60(60%)	184(92%)	1	
	No	40(40%)	16(8%)	7.67(4.01-14.67)	0.00*
Is measles contagious?	Yes	65(65%)	182(91%)	1	
	No	35(35%)	18(9%)	5.44(2.89-10.28)	0.00*

Table 4: Risk factors related to non vaccination against measles in Yirgachefe district, Southern Ethiopia, 2017

Variables	Category	Cases No (%)	Controls No (%)	Crude OR(95% CI)	p value
Nearest HF provide routine immunization service	Yes	168(84%)	78(78%)	1	
	No	32(16%)	22(22%)	1.48(0.81-2.71)	0.20
HEWs living in the kebele	Yes	199(99.5)	96(96%)	1	
	No	1(0.5%)	4(4%)	8.29(0.91-75.19)	0.06
Distance to reach the near HF	15-30 min	33(44.6%)	60(39%)	1	
	30 min-1 hr	23(31.1%)	64(41.6%)	0.65(0.34,1.24)	0.19
	> 1 hr	18(24.3%)	30(19.5%)	1.09(0.53,2.25)	0.81
Availability of vaccination card	Yes	23(23%)	158(79%)	1	
	No	77(77%)	42(21%)	12.59(7.07-22.42)	0.00*
Faced delay in other EPI vaccinations	Yes	25(25%)	65(32.5%)	0.69(0.40-1.19)	0.18
	No	75(75%)	135(67.5%)	1	
Child ever vaccinated when they go to HF for other purposes	Yes	14(14%)	74(37%)	1	
	No	86(86%)	126(63%)	3.61(1.92-6.8)	0.00*
Any child you took to HF but not vaccinated	Yes	17(17%)	22(11%)	1.66(0.84-3.29)	0.15
	No	83(83%)	178(89%)	1	
ANC follow-up	Yes	34(34%)	157(78.5%)	1	
	No	66(66%)	43(21.5%)	7.09(4.16-12.09)	0.00*
Offered TT vaccination	Yes	42(42%)	155(77.5%)	1	
	No	58(58%)	45(22.5%)	4.76(2.84-7.98)	0.00*
Place of Delivery	Health Institution	27(27%)	102(51%)	1	
	Home	73(73%)	98(49%)	2.81(1.67-4.74)	0.00*
Who attended the delivery	Health professional	33(33%)	102(51%)	1	
	Non-professional	67(67%)	98(49%)	2.11(1.28-3.49)	0.003*
	PNC follow-up	Yes	30(30%)	112(56%)	1
	No	70(70%)	88(44%)	2.97(1.78-4.95)	0.00*

Table 5: Independent predictors of non vaccination against measles in Yirgachefe district, Southern Ethiopia, 2017

Variables	Category	Cases	Controls	COR(95% CI)	AOR(95% CI)
Is vaccinating a child important?	Yes	70(70%)	191(95.5%)	1	
	No	30(30%)	9(4.5%)	9.10(4.11-20.11)	6.81(1.56-29.64)
ANC follow up	Yes	34(34%)	157(78.5%)	1	
	No	66(66%)	43(21.5%)	7.09(4.16-12.09)	3.57(1.22-10.44)
Should all children be vaccinated?	Yes	26(26%)	152(76%)	1	
	No	74(74%)	48(24%)	9.01(5.19-15.66)	4.29(1.83-10.04)
Is measles contagious?	Yes	65(65%)	182(91%)	1	
	No	35(35%)	18(9%)	5.44(2.89-10.28)	8.97(3.15-25.58)

Figures

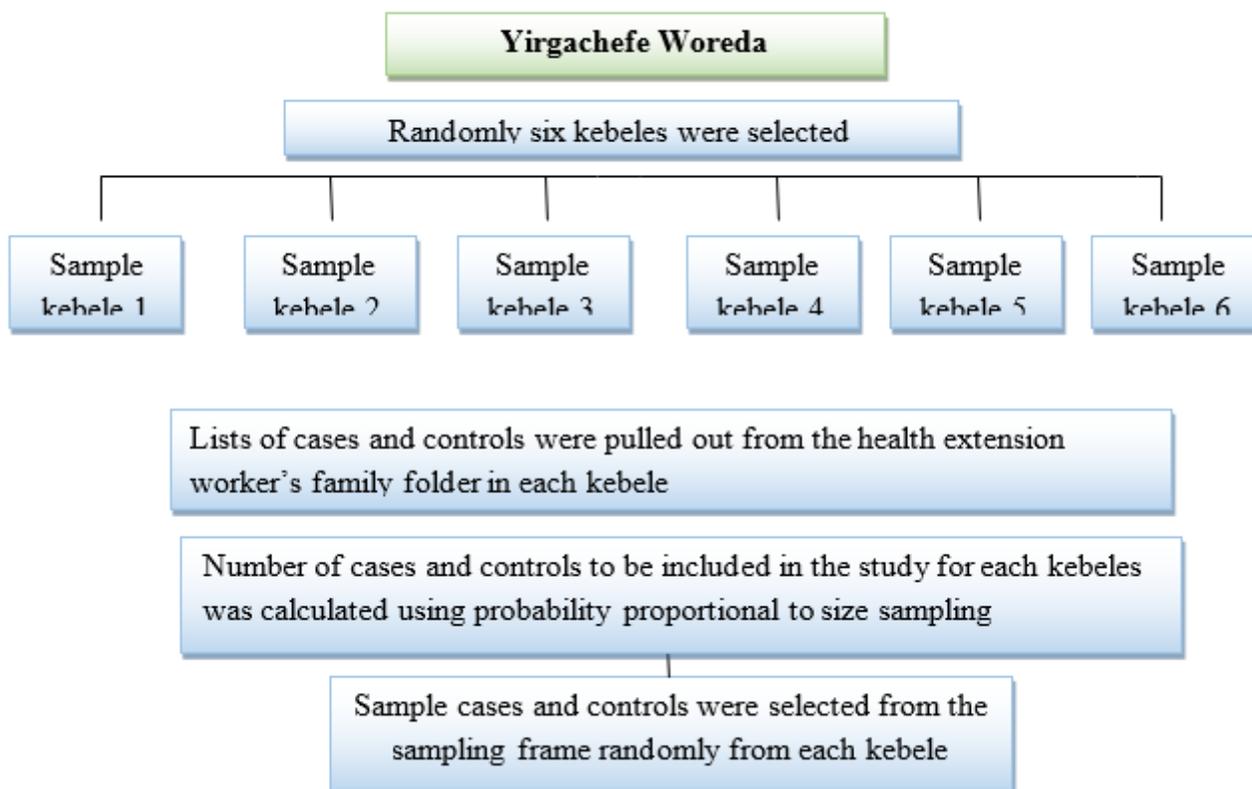


Figure 1

Sampling procedure of cases and controls for factors associated with non vaccination against measles in 12-23 months children, Yirgachefe woreda, 2016.