TREND ANALYSIS OF MEASLES LABORATORY-CONFIRMED CASES IN TANZANIA FROM THE YEAR 2015 TO 2019 AFTER MEASLES VACCINATION CAMPAIGN

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A Dissertation Submission in (Partial) Fulfilment of the Requirements for the Degree of MSc. in Project Management, Monitoring and Evaluation in Health of Muhimbili University of Health and Allied Sciences

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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for examination by the Muhimbili University of Health and Allied Sciences a dissertation entitled

"Trend analysis of measles laboratory-confirmed cases in Tanzania from the year 2015 to 2019 after measles vaccination campaign"

in partial fulfillment of the requirements for the degree of Masters of Science in Project Management, Monitoring and Evaluation in Health (MSc PMMEH) of Muhimbili University of Health and Allied Sciences.

……………………………………….

Dr. Mughwira Mwangu

(Supervisor)

…………………..

Date

ECLARATION AND COPYRIGHT

I, **ADVENTINA CHUGULU,** declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signure………………………

Date…………………………..

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First and foremost, I would like to thank Almighty God who granted me free breath and the opportunity to pursue this course. In a very special way, I would like to thank my mother and the whole family for their physical and moral support in every step of my study at Muhimbili University of Health and Allied Sciences.

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DEDICATION

I dedicate this work to my beloved husband, Mr. Mura Ngoi for his encouragement and support, my children Isabella and Ian for their patience in the course of pursuing this study. May Almighty God grant them happiness and laughter always.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

CDC	Center for Disease Control and Prevention
CIF	Case Investigation Form
CI	Confidence Interval
EPI	Expanded Program for Immunization
GAVI	Global Alliance for Vaccine and Immunization
IHI	Ifakara Health Institute
IVD	Immunization and Vaccine Development
K	Sampling Interval
LIS	Laboratory Information System
MOHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
MUHAS	Muhimbili University of Health and Allied Sciences
MV2	Measles Vaccine Second dose
M&R	Measles and Rubella
NHLQATC	National Health Laboratory, Quality Assurance and Training Centre
OR	Odds Ratio
RRL	Regional Reference Laboratory
SIAs	Supplementary Immunization Activities
SOP	Standard Operating Procedure
SRS	Sample Referral System
TAT	Turn around Time
VPDs	Vaccine-Preventable Diseases
WHO	World Health Organization

DEFINITION OF KEY TERMS

Confirmed measles case: A suspected case with positive IgM antibody results with ELISA test in the laboratory

Measles vaccination campaigns: An intervention employed to combat a resurgence of measles infection, for this study measles vaccination campaign is an organized course of action that employs the use of measles vaccines to reduce measles cases.

Trend analysis: Is the practice of gathering information and attempting to spot a pattern, for this study trend of laboratory-confirmed measles cases was analyzed from collected information of measles cases that occurred after the rollout of a measles vaccination campaign.

ABSTRACT

Introduction

High coverage of measles vaccines and periodic mass campaigns are the key to reaching measles disease elimination and can prevent the reoccurring of measles outbreaks in the country. This study was designed to establish trends of measles laboratory-confirmed cases as well as determine the socio-demographic factors associated with measles cases in Tanzania.

Objective:

This study sought to establish the trends of measles cases and identifying socio-demographic factors that cause recurring measles outbreaks in the country

Methods:

The analytical cross-sectional study applying a quantitative approach was used to determine the trends of measles laboratory-confirmed cases in Tanzania. Systematic random sampling was deployed to select study samples, data were extracted from surveillance database from National Health Laboratory, Quality Assurance and Training Centre (NHLQATC) for the years 2015-2019. Linear regression was used to establish the association between socio-demographic factors and measles outbreaks, P- value less than 0.005 was considered significant statistically at a 95% confidence interval

The software used for data analysis in this study was the Statistical Package for the Social Sciences (SPSS version 24).

Results: Among 348 samples of suspected cases between 2015 and 2019, laboratory-confirmed cases were 6 (1.7%). The trend of cases was decreasing in the first three years followed by a surge in the last two years. Cases were higher among males 4/192 (2.4%) and children aged 0 to 5 years 6/198 (2.5%). Children without a history of vaccination were more prone to positive cases compared to vaccinated children. The incidence was higher 2857 per 100,000 population. Residency of individual was a predictor of positive measles case, rural residents were 8.4 more likely to have a positive case of measles (OR = 8.4, 95% CI 2.0 – 73.7, p =0.008).

Conclusion: This study observed a resurge of measles cases in 2018 and 2019 with high incidence among young children of 5 years and below. Children who were not previously vaccinated had higher incidences compared with the ones who were previously vaccinated. Children residing from rural residence were found to associate with positive measles unlike the ones from urban residence. This study recommends a prioritization of immunization programs to rural areas and strengthening routine immunization among children.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Measles is a highly contagious viral disease with considerable morbidity and mortality in children and pregnant women; and is still a leading cause of vaccine-preventable deaths in the world (1,2)

It is a highly communicable disease that is a significant cause of mortality and morbidity worldwide. It is transmitted from person to person through air, droplet or by direct contact with the nasal and throat secretions of infected persons. After exposure to the virus, up to 90% of susceptible persons develop measles infection.(3,4)

A safe vaccine against measles has been available and globally recommended since 1974. The World Health Organization established measles elimination as a goal for 2020 but, unfortunately, this objective has not been achieved yet and outbreaks still occur.

Despite achieving and sustaining global measles vaccination coverage of about 80% over the past decade, measles remains the fifth leading cause of mortality among children aged less than 5 years worldwide. It accounts for more than 30 million cases annually and 0.9 million deaths every year, with approximately half of these occurring in Africa(5)

Routine measles vaccination for children, combined with mass immunization campaigns in countries with low routine coverage, are key public health strategies to reduce global measles deaths (WHO, 2019)(6) In 2001, World Health Organization, Africa region launched an initiative aimed at mobilizing resources and provide support to the African Region to reduce measles deaths(7)

The Measles Initiative has supported measles vaccination of over 395 million children in the African Region through measles supplemental immunization activities from 2001 - 2008. To date, 40 countries in the Region have been supported to establish case-based surveillance for measles as a strategy to monitor the impact of vaccination activities and to document the reduction of disease burden. Additionally, a network of 36 national measles laboratories and 4

Regional Reference Laboratories (RRL) has been established for the confirmation of measles cases and outbreaks as well as the isolation of locally circulating measles virus strains (7,8)

In Tanzania, the first measles campaign was done in 2011 targeting children of 9 months to five years of age; the second was conducted in October 2014 targeting children of 9 months to 14 years of age and the third in October 2019 targeting children of 9 to 59 months. Estimates of vaccination coverage among children allow monitoring of vaccination services, guide disease elimination and eradication programs and serve as indicators of health system performance (9). Many countries around the world are experiencing measles outbreaks. As of 5 November 2019, there have been 413,308 confirmed cases reported to WHO through official monthly reporting by 187 Member States in 2019(10)

This study aimed to determine trends in measles cases in the country, to describe cases in terms of person and place, identify gaps in the case-based surveillance data collection system and identify risk factors for measles infection, Determining the trend of cases and analyzing disease patterns and trends will highlight vaccination campaigns efforts that have been put forward in outbreak prevention through the recognizing geographical areas and age groups likely to be affected also highlighting progress towards attaining measles elimination goal in the country.

1.1. Statement of the problem

Despite the availability of a safe and highly effective vaccine, measles remains one of the leading causes of vaccine-preventable deaths in children, 5 years of age worldwide, especially in developing countries, with up to 20% of these deaths occurring in those with less than 1 year (11,12).

According to MOHCDGEC between the years 2016 and 2018, there was a slight increase of confirmed measles among reported cases. In 2018, a total of 91 suspected Measles outbreaks were reported and investigated across 67 councils. However, only two councils had confirmed measles outbreaks in the last quarter of the same year.

The unvaccinated group can be one of the underlying factors for measles outbreak by either having missed the vaccine schedule or due to indigenous culture, these group serves as a hot spot source of the infections.

Determining the performance of immunization campaigns efforts by establishing measles disease trends and the associated factors for re-occurring outbreak will highlight progress towards attaining measles elimination goal in the country, therefore, will help in either coming up with new or modified strategies that can be deployed by the country to reduce the burden of the disease.

1.2. The rationale of the study

This study of analysis of measles laboratory-confirmed cases from 2015 to 2019 after the vaccine campaign will help to make a comparison of the situation before and after the measles campaign and therefore predict the possibility of future measles elimination. Also, the results of this study will add value to recognizing the peak season for measles cases as well as determining what age groups are highly affected and recognizing the strength and weaknesses of the current vaccine-preventable disease surveillance system in accordance with the Global Health Security Agenda

1.3. Research Questions

1.3.1. Main question

What is the trend of measles laboratory-confirmed cases in Tanzania from the year 2015 to 2019 after the measles vaccination campaign?

1.3.2. Specific research questions

1. What is the trend of Laboratory confirmed measles cases in Tanzania?
2. What is the incidence of measles among children who were previously vaccinated against measles?
3. What are the socio-demographic factors associated with positive cases of measles in Tanzania?

1.4. Objectives of the study

1.4.1. Broad objective

To analyze the trend of measles laboratory-confirmed cases in Tanzania from the year 2015 to 2019 after the measles vaccination campaign.

1.5.2 Specific objectives

1. To establish trends of laboratory-confirmed measles cases.
2. To assess the incidence of measles among children who were previously vaccinated against measles.
3. To identify socio-demographic factors associated with positive cases of measles in Tanzania

1.5. Conceptual framework

This conceptual framework explains how the occurrence of the outcome variable (dependent variable) which is the laboratory confirmed cases is associated with different independent variables. In this study, the independent variables are age, gender and immunization history. From the conceptual framework below it is hypothesized that the laboratory-confirmed measles cases is greatly influenced by socioeconomic characteristics, access to health services and demographic characteristics. The factors such as age, gender, location and vaccination history can influence the occurrence of measles or increase the spread of measles which can increase mortality and morbidity.

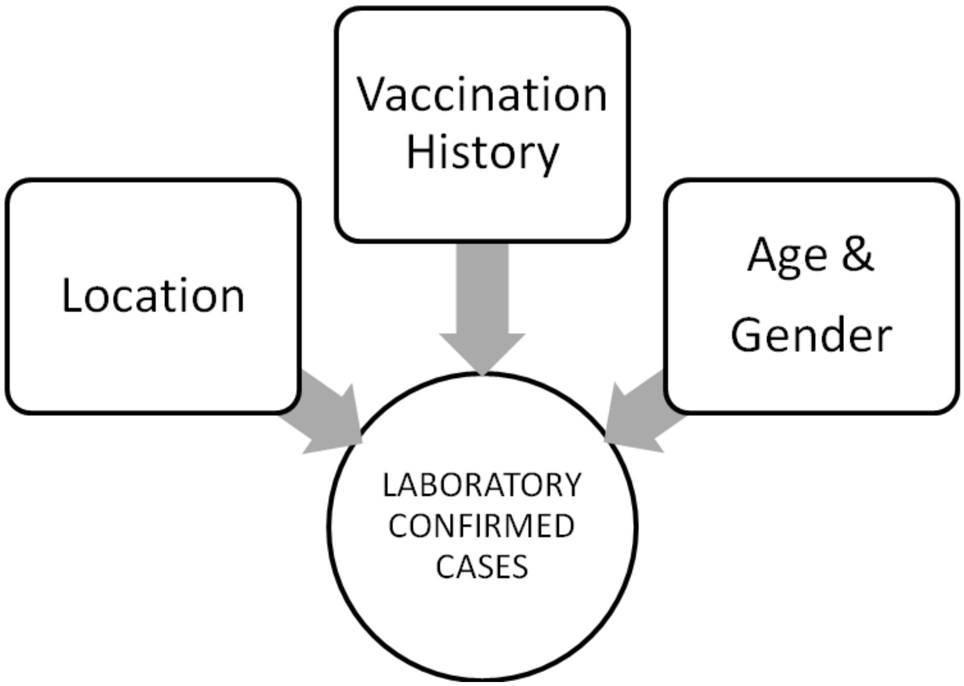

Figure 1: Conceptual framework (Own)

CHAPTER TWO

2.0 LITERATUREREVIEW

2.1 Overview

Measles control activities in World Health Organization (WHO) African Region aim to reduce measles deaths (11) The strategies implemented include improving routine vaccination coverage, providing a second opportunity for measles vaccination through supplementary immunization activities (SIAs), improving measles case management, conducting case-based measles surveillance to enable immunization strategies to be properly adjusted and to document the decline in cases and progress in eliminating the disease, supported by the measles laboratory network(11)

2.2 Trends of laboratory-confirmed measles cases

The introduction of expanded programs for Immunization in Africa leads to the decline of cases of death of under-five children due to measles infections although studies show that there has been a change in epidemiology towards older children and adults. The most affected are the unvaccinated young children, unvaccinated pregnant women and also those who have not been vaccinated or was vaccinated but did not develop immunity are at risk(13)(14)(15)

According to the Global measles and rubella updated report of November 2018, globally the measles cases samples collected for laboratory confirmation were 162,447 but 141,975 samples were tested and among which 39,856 samples only were positive(16).

In WHO Afro region measles cases samples tested were 27,213 and 5376 were positive for 2018 and for the 2017 samples collected for laboratory confirmation were 173,506 but 162,132 samples were tested and among which 44,833 samples only were positive while in the WHO Afro region measles cases samples tested were 35,163 and 4,629 were positive. These data show an increase in cases which poses questions to why the findings(16)

In Nigeria a total of 449 cases of measles were reported between January 2014 and December 2018(5). From 2005 to 2014, a total of 4203 suspected measles cases were reported from ten sub-cities of Addis Ababa. Among the total suspected measles cases, 1154 (27.5%) were laboratory confirmed measles cases, 512 (12.2%) (3) A study done in Sudan revealed 75% of Laboratory measles confirmed cases (17)

According to Tanzania MOHCDGEC Between years 2016 and 2018, there was slight increase of confirmed Measles among reported cases. In 2018, a total of 91 suspected Measles outbreaks were reported and investigated across 67 councils. However only two councils had confirmed measles outbreaks in the last quarter of the same year.

Despite dramatic reductions in global reported incidence and estimated mortality of measles, success have not been uniformly achieved in different countries hence there is a need to analyze trend of laboratory confirmed cases of measles in Tanzania.

2.3 Incidence of measles among children who previously vaccinated against measles

Despite global progress in measles control since 2000, measles remains endemic in many countries. Even in areas where measles is no longer endemic, outbreaks of varying magnitude have occurred although the importance of conducting outbreak response immunization (ORI) in emergency situations has been well recognized and accepted(11)

Many studies worldwide have shown that there a lot of efforts to reduce measles infections strategies have been deployed yet and outbreaks still occur. The resurgence of measles is of serious concern, with extended outbreaks occurring across regions, and particularly in countries that had achieved, or were close to achieving measles elimination. (12) Different countries have been experienced an increased number of measles cases despite of employing effective methods in vaccination

Globally the incidence of measles among children who are already vaccinated varies among different countries.

In Serbia the incidence of measles among children who were previously vaccinated were

65.25 per 1,000,000 per year %(13) in Italy Crude incidence for the was 67.6 per 1,000,000 per year(14) in Burma 73 per 1,000,000 (15) China of 5.2 per million population

In Africa also new cases of measles have been observed in children who were previously vaccinated, in Nigeria 9.80 per 1,000,000 population (16) in Ethiopia 180 per million population (17) in Burkina Faso ⩽25 per 100,000 persons(18)

In Tanzania measles incidence dropped from 5.8 to 1.8 per million population (12). Despite dramatic reductions in global reported incidence and estimated mortality of measles, success have not been uniform in different countries hence there is a need to assess incidence of measles among children who were previously vaccinated against measles in Tanzania.

2.4 Socio-demographic factors associated with positive cases

Globally almost six million children died before the age of five in 2015 and more than half die of vaccine preventable infectious diseases such as measles. However some parents do not vaccinate their children due to a number of reasons such as vaccine refusal or hesitancy based on perception of costs of vaccination, not being sure of whether those vaccines can cause short- or long-term side-effects or are ineffective, religious conflicts, distrust of healthcare systems and governments (19–21)

Globally different factors are associated with measles One factor that must be taken into consideration is the number of vaccine doses administered; many of those who claimed they contracted measles despite vaccination might have received an insufficient dose of the vaccine. A study done in Lebanon revealed that most of laboratory confirmed measles cases are from people received insufficient vaccine (22,23). Some studies also revealed that incidence of measles cases decreased as the age group increase (21,22)

Different factors have been associated with positive cases in different part of sub Saharan Africa, a study done in Ethiopia showed that the incidence of measles cases decreased as the age group increased(17) similar observation was observed in Nigeria and Kenya (24,25) though a study done in Eritrea showed epidemiological shift to older age (26). Furthermore, different studies revealed that insufficient dose of the vaccine is a factor contributing to increase in positive cases of measles (27,28)

This analysis aims to examine the trend of laboratory confirmed measles cases and factors associated with positive cases of measles as it will guide in formulating strategies to be used in combating measles outbreak a way towards measles elimination

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design

This was a retrospective cross-sectional study design to examine change of the outcome over time for five consecutive years (2015-2019) for an outcome evaluation where secondary data of measles surveillance from January 2015 to December 2019 from NHL-QATC in Tanzania was analyzed to determine the trends of laboratory confirmed cases and to establish the association between the socio demographic factors and measles outbreak.

3.2 Study area

This study was done at NHL-QATC constituting cases from both Tanzania Mainland and Zanzibar. Tanzania has been experiencing an outbreak of measles cases in different regions and at different times throughout January 2015 to December 2019. Approximately there were 92 Measles laboratory confirmed cases reported from both Tanzania mainland and Zanzibar.

3.3 Study population

The study population for this study included the entire selected sample by systematic random sampling. The target populations included all measles laboratory confirmed cases from January 2015 to December 2019.

3.4 Inclusion and exclusion criteria

The inclusion criteria was all suspected measles cases from 2015 to 2019 while the exclusion criteria was all samples not tested in the laboratory.

3.5 Sample size and selection

3.5.1 Sample size

The sample size was determined using the assumption that prevalence of measles in Tanzania is estimated to be 50% with standard normal deviate of 1.96 for 95% confidence interval and 5 % marginal of error.

Therefore, minimum sample size was calculated as shown below

$$n = \frac{z2p\,(100 - p)}{\varepsilon^2}$$

Where

z= standard normal deviate=1.96 for 95% confidence level

p = expected prevalence with characteristic of interest

ε = margin of error (precision)

Therefore, minimum sample size will be

Given that

z=1.96

p= 50%

ε=5%

$$n = \frac{1.96^2 * 50\,(100-50)}{5^2}$$

n = 348

Therefore, the minimum samples size required for this study was 348

3.5.2 Sampling technique

This study used the systematic random sampling technique. Laboratory confirmed cases from the Epi Info database from January 2015 to December 2019 were extracted and totalized. The total number of laboratory-confirmed cases was used as sampling frame. This sampling frame together with total number of sample size required was used to calculate systematic sampling interval.

After selecting the first case, consecutive cases were selected based on systematic sampling interval obtained from above explanation.

3.6 Data collection method and tool

Since this study used secondary data, data was extracted from the NHLQATC measles surveillance data base from January 2015 to December 2019. An excel sheet (tool) was prepared which comprised of 348 data and their specific age, sex, Location (Rural/ Urban), Vaccination status (Vaccinated/ Not vaccinated) and Results (Positive/ Negative).

3.7 Pre- testing of data collection instrument

Data collection tool was pretested in NHLQATC. The pretesting process was conducted on ten percent of sample size to check reliability and validity of the tool before actual data collection. The pretested data was not included in the study; the contents of the tool was adjusted based on the pretest results.

3.8. Variables

3.8.1 Dependent variables

Measles outbreak/measles cases

3.8.2 Independent variables

Socio-demographic characteristics of this study are age, gender, and location and immunization history. The association between participant demographic characteristic and trendofmeaslescaseswasperformedusingmultivariatelogisticregression.Pvaluelessthan
0.05 and 95% confidence interval was used to establish association between age, sex, and location and immunization history.

3.9 Data management and analysis

Data from the extraction tool developed which comprised of 348 data and their variables which are specific age, sex, Location (Rural/ Urban), Vaccination status (Vaccinated/ Not vaccinated) and Results (Positive/ Negative) were sorted, extracted and cleaned

Trend of laboratory confirmed measles negative and positive cases were analyzed descriptively therefore frequencies, proportions and percentages were displayed as descriptive information.

Assessment of incidence of measles among children who were previously vaccinated against measles was also analyzed descriptively, therefore incidences of measles cases of children who were previously vaccinated and those who were not vaccinated were calculated and their odds ratio compared.

Association of socio-demographic factors and measles positive cases was analyzed by linear regression so as to establish factors influencing measles outbreak/cases. The analysis was done at 95% confidence intervals (CI) and P-values less than 0.05 was considered statistically significant association.

3.10 Ethical considerations

The research ethical clearance was obtained in writing from the MUHAS Institutional Review Board (IRB) under directorate of research and publications of Muhimbili University of Health and Allied Sciences. The permission to conduct the study was requested from NAHLQAT authorities.

CHAPTER FOUR

4.0 RESULTS

4.1. Socio-demographic characteristics of the participants

This study involved 348 samples of suspected cases from measles surveillance data collected from January 2015 to December 2019 at NHL-QATC in Tanzania. The most frequent age group was children equal and below 5 years of age 56.9% (198/348). More than half of the samples 55.2% (192/348) were male and about 40% of study samples, 138/348 were from rural areas. A total of 218 (62.6%) had history of measles vaccination in their life time (Table 1).

Table 1: Socio-demographic characteristics of the study participants (N = 348)

Variable	Categories	Frequency	Percent
Age (years)	0-5	198	56.9
	≥ 6	150	43.1
Sex	Male	192	55.2
	Female	156	44.8
Residence	Rural	138	40
	Urban	210	60
Vaccination status	Vaccinated	175	50.3
	Not Vaccinated	173	49.7
	Total	348	100.0

4.2. Trends of laboratory confirmed measles cases from 2015 – 2019

Overall trend of laboratory-confirmed measles cases

The overall trend of laboratory confirmed measles cases was decreasing from 5.7% to 3.2% for years 2015 to 2019. The trend was not gradually decreasing whereas no case was reported in 2016 and 2017. (Figure2)

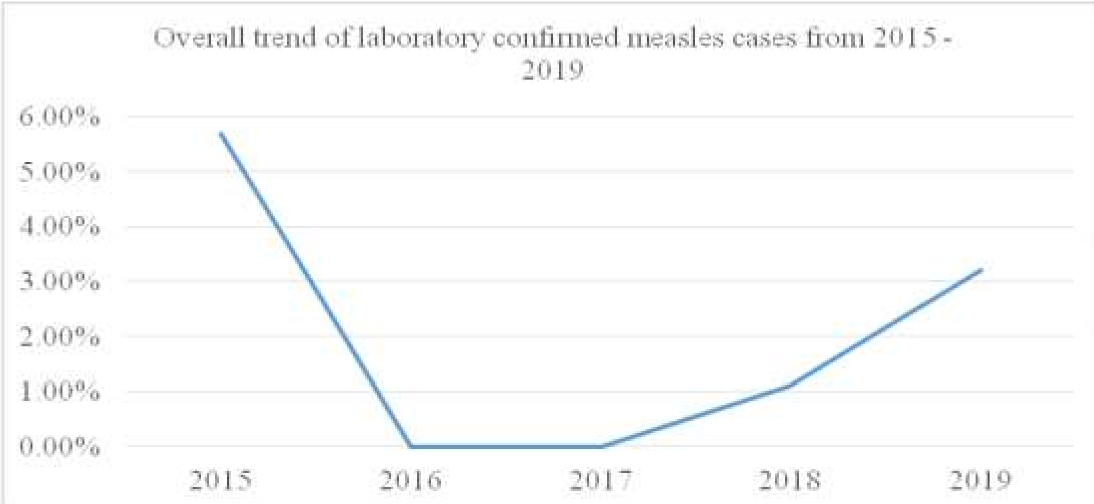

Figure 2: Overall trend of laboratory confirmed measles cases from 2015 – 2019

The trend of laboratory confirmed measles cases by age groups

This study reported a decrease of incidences to zero percent among both young and older children. At this point, the incidence of measles among older children was relatively higher compared to younger ones. In all five years it has shown that the overall incidence among the under-fives to be approximately 2.5% while those above five years of age was about 0.67%. The study observed a rise in incidence of children aged equal and below five years after 2017 unlike for the children above five years of age. (Figure3)

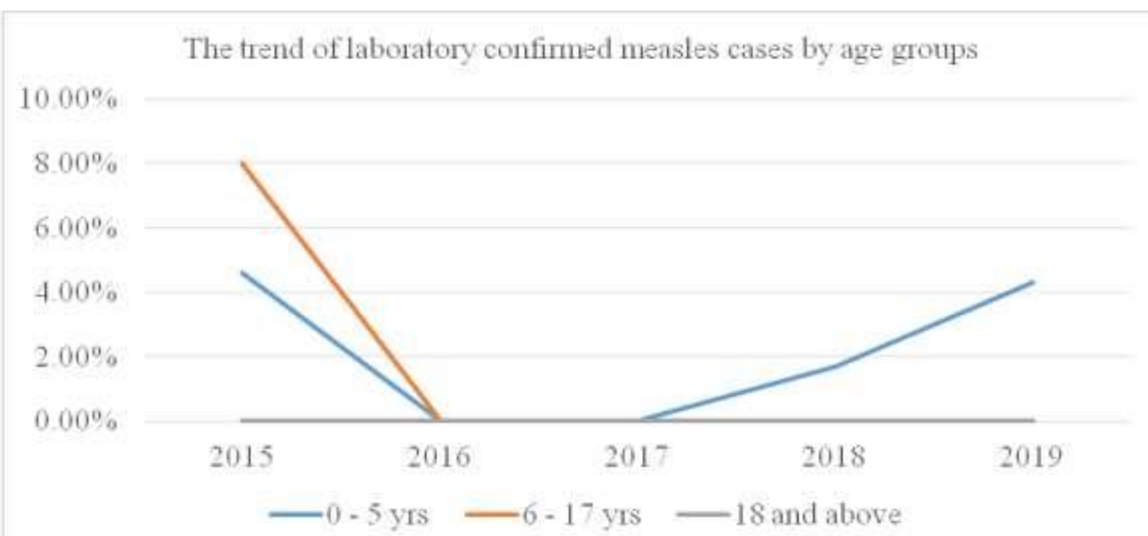

Figure 3: The trend of laboratory confirmed measles cases by age groups

Trend of laboratory confirmed measles cases by gender

Females were found to have a higher incidence than males with slightly similar trend with the overall percentage for all five years being 2.0% and 1.3 % respectively. A sharp decrease to the bottom at 2016 and 2017 followed by a rise in the following years. (Figure 4)

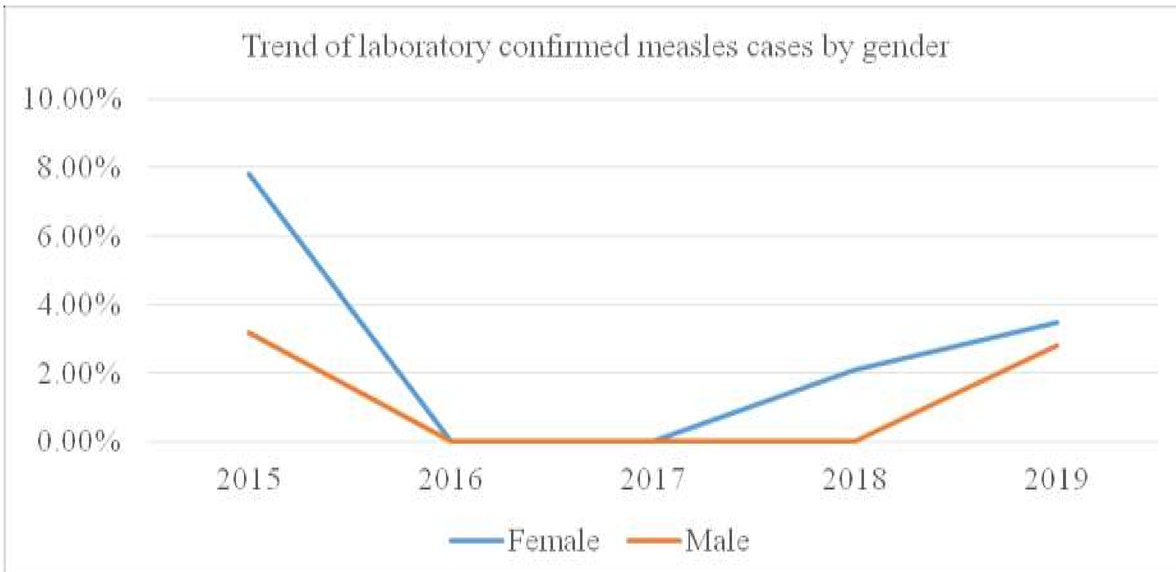

Figure 4: Trend of laboratory confirmed measles cases by gender

Trend of laboratory confirmed measles cases by residence

Individuals living in rural areas were found to have a higher incidence (8%) compared to ones in urban. The incidence of measles among individuals in urban was only once reported in 2016. The incidence in rural observed to rise gradually in two recorded years. (Figure5)

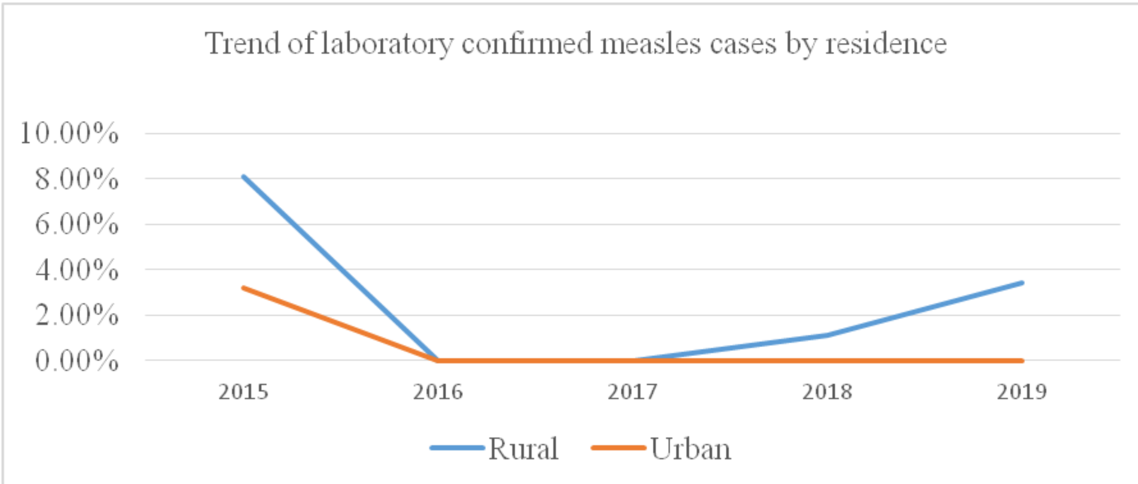

Figure 5: Trend of laboratory confirmed measles cases by residence

4.3. Incidence of measles among children with history of measles vaccination

The incidence of measles among vaccinated children was observed to be 2857 per 100,000 persons between 2015 and 2019. Cases of measles among vaccinated population were lower compared to unvaccinated population of children.

Table 2: Cases of measles from 2015 – 2019 (N = 348)

			Measles IGM results (Positive)	
Variable	**Categories**	**N**	**N (%)**	**p-value**
Age	0-5 years	198	5 (2.5)	0.242
	≥ 6 years	150	1 (0.7)	
Sex	Male	192	4 (2.1)	0.695
	Female	156	2 (1.3)	
Residence	Rural	138	5 (3.6)	0.038
	Urban	210	1 (0.5)	
Vaccination status	Vaccinated	175	1 (0.6)	0.120
	Not vaccinated	173	5 (2.9)	

4.4. Socio-demographic factors associated with laboratory confirmed measles cases in Tanzania

Socio-demographic factors were analyzed on univariate analysis, residence was found significantly associated with positive test of measles. Individuals living in rural areas had increased odds for having measles compared to urban individuals (cOR = 7.9, 95% CI 2.41 – 68, p = 0.006). Other factors including age, sex and vaccination status were not statistically significant associated with measles.

On multivariate analysis, the residence of children was found to have an independent association with measles whereby children in rural areas had 16.8 times increased odds of having measles compared to children at urban (aOR = 8.4, 95% CI 2.0 – 73.7, p = 0.008) (Table 3).

Table 3: Univariate and Multivariate analysis of factors associated with measles (N = 348)

	Measles		Univariate analysis			Multivariate analysis		
Variable	**N**	**n, %**	**cOR**	**95% CI**	**p- value**	**aOR**	**95% CI**	**p-value**
Age (years)								
0 – 5	198	5(2.5)	3.9	0.5 – 33.4	0.22			
≥ 6	150	1(0.7)	Rf					
Sex								
Male	192	4 (2.1)	1.6	0.24 – 9.1	0.572			
Female	156	2 (1.3)	Rf					
Residence								
Rural	138	5 (3.6)	7.9	2.41 – 68.0	0.006	8.4	2.0 – 73.7	0.008
Urban	210	1 (0.5)	Rf					
History of vaccination								
Not Vaccinated	173	5 (2.9)	5.2	0.6 – 44.8	0.135			
Vaccinated	175	1 (0.6)	Rf					

Key: cOR: crude odds ratio, aOR: adjusted odds ratio, Ref: Reference group

CHAPTERFIVE

5.0 DISCUSSION

5.1. The trends of laboratory-confirmed measles cases from 2015 -2019

In this study, the overall trend of laboratory-confirmed measles cases was observed to decrease however not uniformly from 5.7% to 3.2% from 2015 to 2019. The trend is comparable to other previous studies done in different areas of the country following the launch of measles vaccination programs (15,24,26). A rise in cases in 2019 is also reflected in many regions including reports from African, Western Pacific, and Eastern Mediterranean regions (29). Similarly, the increasing trend despite the immunization program has also been reported in Myanmar (15). The WHO has reported the global highest number of cases for the past two decades being in 2019 despite vaccine coverage(30). Interval of years with no cases of measles can be linked with historical epidemiology and natural history of the disease whereby outbreaks were reported to occur after two to three years (31)

Trends by age revealed the absence of new cases among adult individuals in this period. Older children also were reported to have no more cases of measles after 2015. This is not consistent with a study from Eritrea where the epidemiological shift to older age groups was reported (26). This could be explained by time since the launching of the immunization campaign in this country making few younger children susceptible to measles(26,31). Some countries with such a shift started immunization two decades ago. Findings similar to this study have also been reported in Nigeria(5).

In this study, from 2015 cases were reduced to zero in 2016 among urban residents and no more cases were observed afterward during this study. This could be accounted for by the coverage of vaccination in urban areas, areas where interventions targeted the rural areas reported to have high cases in urban (5). A survey involving over 10 countries in Africa reported a decrease in cases in urban from 69% in 2002 to 45% in 2009 which on the other hand is reflected by increased cases in rural areas to up to 67% (31).

Despite the trend by gender being the same, male participants showed a higher number of cases compared to their counterpart, female children. This is similar to many other studies where for several decades the cases among suspected male individuals were higher than in female counterparts (31)(5). This can be accounted for by the fact that boy children are more interactive and are engaged in sports and games increasing the risk to contract the disease.

5.2. Incidence of measles among children with a history of measles vaccination

This study observed a remarkably lower incidence (2857 per 100,000 persons) of laboratory-confirmed measles among vaccinated children from 2015 to 2019. This incidence is incomparable to a documented outbreak among the vaccinated population where over 70% had measles(32–34). Moreover, reports have shown outbreaks in several countries including countries with overall high coverage of vaccination or even where the disease was previously eliminated (35). Although cases have been reported in the vaccinated population, usually these had been considered as reinfection but with low transmission rate and severity (33). The lower incidence can be described by few suspected cases among vaccinated children making the incidence relatively appear high.

5.3. Socio-demographic factors associated with laboratory-confirmed measles cases in Tanzania

This study observed an independent association between laboratory-confirmed measles cases and the place of residence. The rural children had an increased risk (aOR = 16.8, 95% CI 2 – 73.7) for measles similar to other studies in LMIC (36–39). This might be caused by coverage of vaccination programs in the country. Places with low coverage tend to be more affected and the corresponding number of children affected becomes relatively higher. A study done in Nigeria reported a residency in town to be a predictor of measles, this could have been influenced by location priority during mass campaigns and routine immunization (5). In LMIC where there are number of factors hindering vaccination program coverage, rural areas are predisposed to higher incidences of measles.

On the other hand, age and the history of vaccination showed a similar pattern to other previous studies but the results were not statistically significant (5,6,26,32–35). The study demonstratedanincreasedriskformeaslesamongyoungchildrenof5yearsandbelowas compared to young children. Similarly, the study observed an increased risk of measles among the unvaccinated population compared to the counterpart vaccinated children (5).

5.4. Study limitation

This study used secondary data which were collected from different places in the country as a routine activity, sampling may not have been considered and so the likelihood to affects the comparison of the trends. Also, seasonal effects on measles breakout were not documented which could be essential to define the trend. However, the data used in this study was mainly related to the lab-confirmed measles cases giving little emphasis to clinically confirmed cases and epidemiologically linked cases as the details of these were not submitted to the laboratory.

CHAPTER SIX

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

There was a decrease in laboratory-confirmed cases of measles in the early years after the launching of the immunization campaign followed by resurging in recent years 2018 and 2019. Measles cases were higher in children equal and below 5 years of age, men and individuals residing in rural areas. The residence of children was found to be a predictor of measles cases.

6.2. Recommendations

This study recommends the following.

1. Improvement on routine immunization activities is necessary as from the findings it clearly indicates that the under-five children are highly affected by the disease unlike the older children, therefore increasing coverage will speed up the measles disease elimination marathon.
2. Focusing on increasing rural/ hard to reach areas immunization coverage will help in reducing incidences since from the findings show that children from rural residence are prone to getting infections than the ones that are residing in urban areas.
3. The study recommends strengthening of immunization programs in Tanzania as well as the national surveillance system by the country so as to ensure proper investigation, capturing of the cases and documentation of outbreaks and cases at large scale to give a broader picture of the magnitude of measles in our country.

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APPENDICES

Appendix I. Ethical Clearance Certificate

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – POSTGRADUATE STUDIES

In reply quote;
Ref. No. HD/MUH/T.762/2019

27 June, 2021

National Health Laboratory Quality Assurance and
Training Centre,
P.O. Box 9083,
DAR ES SALAAM

Re: INTRODUCTION LETTER

The bearer of this letter is Adventina Chugulu, a student at Muhimbili University of Health and Allied Sciences (MUHAS) pursuing MSc. Project Management Monitoring Evaluation in Health.

As part of her studies she intends to do a study titled: "***Trend Analysis of Meals Laboratory Confirmed Cases in Tanzania from the Year 2015 to 2019 After Meals Vaccination Campaign.***"

The research has been approved by the Chairman of University Senate.

Kindly provide her the necessary assistance to facilitate the conduct of her research.

We thank you for your cooperation.

Ms. Victoria Mwanjilwa
For: DIRECTOR, POSTGRADUATE STUDIES

cc: Dean, School of Public Health and Social Sciences, **MUHAS**
cc: Adventina Chugulu

Received
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Appendix II. Introduction Letter

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR - RESEARCH AND PUBLICATIONS

Ref. No.DA.282/298/01.C/ Date: 24/06/2021

MUHAS-REC-06-2021-714

Adventina Chugulu
MSc - PMMEH, School of Public Health and Social Sciences
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: TREND ANALYSIS OF MEASLES LABORATORY CONFIRMED CASES IN TANZANIA FROM THE YEAR 2015 TO 2019 AFTER MEASLES VACCINATION CAMPAIGN

Reference is made to the above heading.

I am pleased to inform you that the Chairman has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 24/06/2021
EXPIRATION DATE OF APPROVAL: 23/06/2022

STUDY DESCRIPTION:

Purpose:
The purpose of this retrospective cross-sectional study is to assess performance of measles vaccine campaign in Tanzania through measles surveillance data review for years 2015 to 2019.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%20525.pdf and in the MUHAS archives.

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain data transfer agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
8. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
9. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.

Dr. Emmanuel Balandya
Chairman, MUHAS Research and Ethics Committee

Cc: Director of Postgraduate studies,
MUHAS