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An Examination of Mothers' Socio-Demographic Factors Associated With Incomplete Vaccination Status among Under-five Populations in Malawi

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An Examination of Mothers' Socio-Demographic Factors Associated With

Incomplete Vaccination Status among Under-five Populations in Malawi

By

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Master of Public Health
GEORGIA STATE UNIVERSITY

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List of acronyms

AD: Auto Disable syringes
BCG: Bacille-Calmette- Guerin (Tuberculosis vaccine)
CFR: Case Fatality Rate
CHAM: Christian Health Association of Malawi
DPT: Diphtheria Pertussis Tetanus vaccine
EPI: Expanded Program of Immunization
FAO: Food and Agricultural Organization
GAVI: Global Alliance for Vaccines and Immunization
GDP: Gross Domestic Product
HIV: Human Immunodeficiency Virus
MDG: Millennium Development Goals
MEASURE-DHS: Monitoring and Evaluation to Access and Use Results Demographic and Survey
MOH: Ministry of Health (Malawi)
SES: socio economic status
SPSS: Statistical Package for Social Scientist
SSA: Sub Saharan Africa
VDPV: Vaccine Derived Polio Viruses
VPDs: Vaccine Preventable Diseases
WHO: World Health Organization

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APPROVAL PAGE

An Examination of Mothers' Socio-Demographic Factors Associated With Incomplete
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ABSTRACT

Background: Millions of children still remain unvaccinated despite efforts to eradicate some of the vaccine preventable diseases globally. The African continent harbors the most burdens as and millions of children do not have access to basic immunization services. As Malawi thrives to meet the MDG of reducing the infant mortality rate and decrease the proportion of one year-old children immunized against measles, a considerable proportion of children still remain with incomplete vaccination status.

Objective: The study examined some of the selected mothers' socio demographic factors that are associated with incomplete vaccination status among the under-five populations in Malawi. Socio-demographic factors such as age of the mother; household wealth index; educational level of the mother; region, place of residence and religion were evaluated to assess their associations with vaccine status outcome.

Methodology: The selected demographic factors were analyzed using the SPSS version 20. In this study, the rate of incomplete vaccination was 22% among the study population. Data were obtained from the MEASURE DHS-2010 data base. Frequencies for the selected demographics were created; univariate and multinomial logistic regression analyses were also run to measure the associations between the mother's sociodemographic factors and the vaccination status population under study.

Results: The study revealed statistically significant results between the northern region and vaccination coverage which has higher vaccination coverage as compared to the Central and Southern region in Malawi respectively. The results also revealed a positive association between wealth index of the household specifically the middle level class that had a statistically significant association between vaccination and wealth. Importantly,

factors like education, religion, age of mother, ownership of a radio and a television had statistically insignificant associations.

Conclusion: This study did not find a statistically significant association between education and status of vaccination including factors related to living in rural or the urban set up. More research studies on regional boundaries and health disparities specifically on vaccination coverage among the under-five populations should be taken into consideration.

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Chapter I

INTRODUCTION

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1.1. Background

Over 22.4 million children remain unvaccinated globally (WHO-2012). The African continent harbors the most burdens as it is estimated that 24 million children do not have access to basic immunization services and as such the burden is confined in developing countries especially in the Sub Sahara African bloc. (WHO- 2007).

The epidemiology of vaccine preventable diseases has since shifted in Malawi. A significant part of childhood mortality can be prevented if there is a well-functioning health care system that fosters on delivering vaccines to children during their first year of life. (Abebe et al. 2012).

Malawi being a country embattled with poverty and with a 10.6% prevalence of human immunodeficiency virus (HIV) among adults has approximately 600,000 children orphaned due to HIV/AIDS and thrives to improve and save lives of the under-five populations by scaling up of sustainable and cost effective infant immunization programs. (Ministry of Health, 2012).

Malawi is focused towards achieving the Millennium Development Goal 4 that aims at reducing the infant mortality rate per 1000 live births and decrease the proportion of one year-old children immunized against measles by two thirds from 1990 to 2015.

Presently, there is no study that has explored the associations that exist between vaccination uptake or coverage among children aged 5 years and under and in relation to several mothers or caregiver's socio-demographic variables like maternal age (age of mother), gender, religion, educational attainment, wealth index (household) and region of residence; as well as access to media factors by evaluating factors like radio and television ownership and mode of

transportation (i.e. bicycle). Complete vaccination status shall mean that the child received and completed all the recommended vaccines such as measles, DPT-HepB+Hib, Polio and BCG vaccines to children under one year of the age.

Exploring the associations based on these parameters can substantially assist with determining practical interventions that are efficient and cost-effective in the healthcare delivery system of vaccines in Malawi. The knowledge and data accrued would enable planning of cost-effective and efficient vaccine programs in stopping vaccine preventable diseases like polio, measles, tetanus, pertussis, diphtheria and tuberculosis in the pediatric populations under the age of five in Malawi.

1.2 Purpose of Study

Although several studies have been conducted to demonstrate the association that exists between immunization and mother's socio-demographic factors in other countries, in Malawi only limited studies have been carried out. Because of this gap, it is important to conduct a study to examine the associations between immunization or vaccine uptake and the socio-demographic factors like age, gender, religion, educational attainment, ethnicity, wealth index and region of residence as well as access to media formats such as radio and television along with mode of transportation like bicycles.

1.3 Research Questions

The purpose of this study is to contribute to an existing body of literature on the relationship between immunization and mother's socio-demographic factors that exist. The relationship was investigated by using the following questions:

1. Do immunization (vaccine) status among the under-five populations differ by mother's sociodemographic factors such as age, gender, religion, educational attainment, ethnicity, wealth index and region of residence?

1.4 Hypothesis

From the above mentioned research questions, the following hypothesis was generated:

1. H_0: There are differences between immunization uptake among the under-five populations with respect to mother's sociodemographic factors such as age, gender, religion, educational attainment, ethnicity, wealth index and region of residence.

H_a: There are no differences between immunization uptake among the under-five populations with respect to mother's socio-demographic factors such as age, gender, religion, educational attainment, ethnicity, wealth index and region of residence.

Chapter II

2.1 Review of the Literature

The purpose of the this study was to examine the associations between immunization (vaccination) status in relation to mother's socio-demographic factors such as age, gender, religion, educational attainment, ethnicity, wealth index and region of residence in Malawi.

To justify the rationale for this study, a review of the literature will explore the current global epidemiology of immunizations. The review will also explore how age, sex, gender, religion, educational attainment, ethnicity, wealth index and region of residence impact on immunization coverage and deter vaccine preventable diseases such as polio, measles, pertussis, tetanus, tuberculosis and diphtheria in Malawi.

2.2 Global Immunization Epidemiology

Immunization has great potential to improve the health of people. The inception of public immunization campaigns has contributed in reducing vaccine preventable diseases and deaths globally. Immunization is regarded as one of the most cost-effective public health interventions. It is enshrined as one of the utmost medical accomplishment that has succeeded to save more lives than any other health care intervention in the 20th century. (Wiysonge et al. 2009).

Vaccines offer cost-effective ways to avert numerous preventable diseases and disability, and promote advancement of health and welfare. It is important to note that immunization also protects both an individual and the community by reducing the likelihood of the transmission of infection in the community through herd immunity. (Haber et al. 2007).

Immunization calls for the great potential of campaign and health education to remove misconceptions, mistrust and beliefs that pose as barriers to vaccine acceptance by educating the targeted population for a vaccine to be accepted. (Poole et al.2013).

Immunization averts an estimated 2 to 3 million deaths annually in all age groups from diseases such as diphtheria, tetanus, pertussis (whooping cough), and measles. In 2011, an estimated 83% (107 million) of infants worldwide were vaccinated with three doses of diphtheria-tetanus-pertussis (DTP3) vaccine. Three regions-the Americas, Europe and Western Pacific- maintained over 90% DTP3 immunization coverage. (WHO, 2008).

The global goal, as outlined in the Global Immunization Vision and Strategy, is that by 2010 or earlier, mortality due to measles will have been reduced by 90% in comparison with the estimated 2000 levels. The global mortality due to measles has been reduced by 78%, from an estimated 733 000 deaths in 2000 to an estimated 164 000 deaths in 2008. (WHO, 2009).

In 2008, global routine coverage with the first dose of measles-containing vaccine reached 83%, an increase from 72% in 2000. In 2008, more than 110 million children received measles-containing vaccine through supplementary immunization activities in the 47 priority countries identified as having a high measles mortality burden in 2000. (WHO, 2009).

In 2011, 162 countries compared to 158 in 2010 reached 80% or more in immunization coverage with DTP3 vaccine and the number of countries that reached over 90% DTP3 coverage remained at 130 in 2010 and 2011. This trend emphasizes the commitment of the immunization programs in averting vaccine preventable diseases. (WHO, 2009).

Notably, deaths due to measles worldwide decreased by a remarkable 74% between 2000 and 2007 from 750,000 to 197 000 and it is estimated that during this period, 11 million measles deaths were averted globally as a result of measles control activities.(WHO.2007).

The eradication of poliomyelitis is imminent though there are still some unfolding challenges. Since the launch of the Global Polio Eradication in 1988, the incidence of polio reduced by more than 99% and an estimated five million people are protected from paralysis by the wild poliovirus. Polio is reported to be endemic in only four countries in the world. (WHO, 2009).

Measles deaths worldwide fell by a remarkable 74% between 2000 and 2007 from 750,000 to 197, 000 and it is estimated that during this period, 11 million measles deaths were averted globally as a result of measles control activities. (WHO, 2007).

The campaign towards eradication of polio has been a major immunization undertaking across the world. Although small pox was successfully eradicated twenty-five years, ongoing efforts to eradicate poliomyelitis is reported to have grown into the largest international health initiative ever commenced. (Aylward, et. al.2005).

Oral polio vaccine (OPV) has been the primary tool global efforts to eradicate the polio virus. The vaccine has several advantages, including its simple oral delivery, low cost, and potential to achieve secondary immunization in people who come into close contact with those who have been vaccinated. In poorly immunized communities, however, this last property can, on occasion, lead to the creation of vaccine-derived polioviruses (VDPV) that continue to transmit in populations until they are stopped by increased immunization activities. VDPVs are very similar to the strains found in vaccine but have much greater potential to cause paralytic disease and outbreaks. (NCIRD, 2008).

The adoption of new vaccines in developing countries is crucial for the reduction of childhood mortality and fosters meeting the Millennium Development Goal 4. However, such endeavors have not gone without challenges and have had delays that can be attributed to various

factors such as lack of recognition of the value of a vaccine; factors related to weak health systems and policy considerations. This calls for measures to have strategies that should to address barriers for vaccine adoption. (Hajjek, 2011).

Challenges to immunization have contributed to millions of children to remain unvaccinated. The number of children under one year of age who did not receive DTP3 vaccine worldwide was 22.4 million in 2011 compared to 21.1 million in 2010. (WHO, 2012).

An important aspect to note is that more than seventy percent of these children live in ten countries namely; Afghanistan, Chad, Democratic Republic of the Congo, Ethiopia, India, Indonesia, Nigeria, Pakistan, Philippines and South Africa. This makes these countries to be the hub of these virulent viruses and pose challenges on measures towards eradication.(WHO, 2012). Half of all unvaccinated children live in India, Indonesia and Nigeria. These countries have large child populations and their immunization programs are hampered by occasional problems with vaccine supply and inaccessibility to vulnerable populations. (Haber et al. 2007)

In 2011 there were 158, 000 measles deaths globally and it is estimated that about 430 deaths occurred daily or 18 deaths hourly. More than 95% of measles deaths occurred in low income countries with weak health care infrastructures. (WHO, 2012).

There are also challenges as regards the management of vaccine logistics in Africa where one fifth of the countries are still expected to implement the auto disposal syringes and maintain adequate safety and wastes disposal. (Machingaidze et al 2013).

Still Machingaidze et al. (2013) asserts that the management of cold chain is a challenge in most countries since the vast majority of the population lives in rural places with having no access to electricity at all and there are electric power outages that pose a challenge on cold chain management of vaccines and furthermore much as the children get these

vaccines in most cases this done rather late with inappropriate age timing rendering the children to get suboptimal diseases protection.(Machingaidze et la.2013).

2.3 Sub Saharan Africa (SSA) Immunization Epidemiology

In the Sub-Saharan Africa (SSA) it is estimated that 24 million children do not have access to basic immunization services. (WHO, 2007).

The dynamics of childhood vaccination uptake in developing countries remains unclear. Much as various studies document the relationship between vaccination coverage and access, socio economic and demographic factors, less knowledge about the relationship between vaccination coverage and carers' motivation and willingness to seek childhood vaccinations still need to be explored and studied. (Holte et al.2012).

It is eventually concluded that easy access to vaccination services still fail to explain why demand is high since many carers had to travel long distances to reach vaccination delivery points and some respondents reported waiting and travelling time as long. High level of trust in distributors of information and vaccines may be an essential explanatory factor for why carers seek immunization for their children, even in the presence of considerable costs and Holte et al. continues to point that trust may be an important explanatory factor as it can be seen to generate positive perceived benefits. (Holte et al. 2012).

An increase in vaccine uptake among children living closer to an under five clinic and having a father who has some education and the opposite occurred among children who lived further from the nearest under five clinic or coming from low SES family. (Jahn et al.2008)

The mobile vaccination teams play an important role in improving the vaccination status of under-five populations in hard to reach areas. There have been reports of noncompliance with

vaccination being associated with living in villages that had no access to mobile vaccination teams. (Vaahtera et al.2000).

Much as there are efforts to provide comprehensive immunization programs to under five populations in Malawi, a great deal of children under the age of five remains unvaccinated and this is the case in almost all countries that are in the Sub Saharan African bloc.

2.4 Malawi Immunization Epidemiology

Expanded Program on Immunization (EPI) was initiated in 1976 as a pilot program and was fully operational in 1978. The EPI provides vaccines such as measles, DPT-HepB+Hib, Polio and BCG vaccines to children under one year of the age.

In addition, the program provides vitamin A supplementation to children from the age groups of six months to 59 months at an interval of six months. Despite records of adequate routine childhood immunization in Malawi, there have been challenges to comprehensive vaccination coverage in the country. (Ministry of Health, 2012)

The EPI faces challenges on logistics and supplies of vaccines. For example, there are situations that warrant cancellation of vaccination clinics due to lack of transport and cold chain problems. Childhood deaths from vaccine preventable diseases like measles continue to occur in developing countries like Malawi. For example in 2010, Malawi registered a total of 134,000 cases and 304 deaths with a case fatality rate (CFR) of 0.002%. (Minetti et al.2013).

The EPI program mostly relies on donor funds and this is one of the factors that bring in disparities in terms of services coverage due to finance constraints. (Bonu et al.2004).

EPI logistics and supplies are often overwhelmed such that health facilities that are along the border zones often incur shortages of vaccines and this puts children that are not vaccinated

at risk. In addressing immunization coverage for migratory and mobile populations especially in country boundary, regions might require exploring the cross boundary policies in the interest from the perspectives of global health promotion. This gap in immunization places the lives of unvaccinated children at increased risk of dying from vaccine preventable diseases. For example, in 2010 Malawi registered a total of 134,000 measles cases where 304 children died. (Minetti et al.2013).

The measles outbreak case underscores the importance of having a comprehensive immunization program in Malawi so that losses of lives due to vaccine preventable diseases can be averted. One of the crucial roles of a health system is to guarantee that a larger population of under-five children gets the vaccines as required. Immunization protects children from life threatening infections such as diphtheria; tetanus; pertussis (whooping cough), poliomyelitis (polio); measles; haemophilus influenza type B (hib) and hepatitis B. The dynamics of childhood vaccination uptake in developing countries like Malawi remains unclear and poses a challenge to implement programs that are cost effective.(Minetti et al. 2013).

An effective immunization program requires that service such as vaccine deliveries; the capacity to maintain vaccines at the right temperature (cold chain) and distribute them through the system at the right time; monitoring and surveillance; availability of trained health workers; program planning and management.(WHO,2013).

The Expanded Program on Immunization provides logistics regarding vaccines in the country. In 2010, around 85 % of children aged between 6-59 months received vitamin A supplementation while the proportion of DPT3 immunization coverage in one year old children was at 97% in 2011 and 93% in 2010 respectively. Hepatitis B (Hep B) immunization in 2011 was at 97 % and in 2010 at 93 % respectively. Measles coverage in 2011 was at 96% and 93%

with a total of 118,712 measles cases in 2010. Four cases of neonatal tetanus were reported against neonatal tetanus coverage of 87%. (WHO,2013).

2.5 Attitudes on Immunization

There is less knowledge about the relationship between vaccination coverage and mothers or care givers' motivation and willingness to seek childhood vaccinations. Easy access to vaccination services still fails to explain why demand is high since many mothers or care givers had to travel long distances to reach vaccination delivery points and some studies reported waiting and travelling time as long.(Holte et al. 2012).

High level of trust in distributors of information and vaccines may be an essential explanatory factor as to why mothers or care givers seek immunization for their children, although there may be costs. Trust is deemed to be an important explanatory factor as it seems to produce positive observed benefits. (Holte et al. 2012).

2.6 Health Care Delivery System in Malawi

In 2010, the population of Malawi was at 14.4 million with an annual population growth rate of 3.1% and a crude death rate of 16%. It is important to note that 80% of the population lives in rural areas. (WHO, 2013).

Importantly, the Ministry of Health (MoH) accounts for 52.8% of the facilities in the country on health care delivery system and 26.9% is provided by Christian Hospital Association of Malawi (CHAM),firms account for 6.7% with 4.9% by private institutions and 6.7% by the military institutions. The MoH offers free health care services to the population including

immunization services that are offered for free in all health care facilities including CHAM and all private institutions. (Ministry of Health, 2012).

The Malawian economy is mostly agrarian with tobacco as one of the major exports for the country and the country began exporting tobacco in 1893. Tobacco accounts for 70% of Malawi's foreign earnings and continues to thrive as one of the world's most tobacco-dependent economies. (Wilshaw et al.,1994; World Bank-Malawi, 2006; IMF -Malawi, 2007).

Over 70% of the arable land in Malawi is used to grow tobacco instead of growing nutritious foods and the country continues to register cases of malnutrition in the under-five populations. Malawi has a total workforce of five million people of which close to two million members are directly employed in the tobacco sector which primarily consists of tobacco farming and factory processing jobs. (FAO, 2009).

Much as the world is concerned by the plight of children by providing services like vaccines, Otañez (2006) observes that cigarette manufacturers and global leaf companies continue to fund child labor "corporate social responsibility" projects in Malawi to distract public attention from how they profit from low wages and cheap tobacco.(Otañez et al.2006).

Malawi is one of the poorest countries in the world. Gross Domestic Product (GDP) per capita grew from less than $250 in 2004 to $313 in 2008. Malawi's economy is predominantly agricultural, both in terms of subsistence activity and the formal sector. It is estimated that the GDP will be growing at a low rate of 3% annually. (Otañez et al.2006).

Consequently, Malawi's economic growth is significantly below the 5-6% required to deliver widespread welfare gains to the population. Aggregate growth is declining towards negligible levels; while growth remains is concentrated in urban areas.

The low levels and slow growth of economic activity prevents both individuals and households from lifting themselves out of poverty, and constrains the Malawi government's ability to deliver services that could reduce poverty. The government budget is heavily reliant on donor support. (Ministry of Health, 2012).

2.7 Finances of Immunization Programs

The major challenge to immunization campaign program stems on lack of adequate financial support for sustenance and EPI programs in low income countries. In 2000 reuse of disposable syringes caused 22 million infections. The measles supplemental immunization activities (SIAs) and the Global Alliance for Vaccines and Immunization (GAVI) by provided to improve the situation by replacing the disposable and sterilizable syringes with auto-disable (AD) syringes to improve injection safety in low income countries. (Saxiennian et al. 2011).

Although immunization is regarded as one of the "best buys" in global health, there prevails a notion of inequities in specific countries financing of vaccines. To mitigate this problem, in 2008 GAVI required that countries cover a share of the cost on vaccines by introducing modest co- financing mechanisms. (Saxiennian et al. 2011).

2.8 Region of Residence

The epidemiology and burden of vaccine preventable diseases varies according to country and region due to differences in vaccine uptake. This is particularly true in situations where outbreaks from a different country tend to spread much faster to another bordering country, cross border out, for example Nigeria is the only country to have three types of polio viruses,

and it possess a substantial risk to the global goals because its neighboring countries are vulnerable to the spread of the infection. (WHO, 2012).

Jahn et al. 2008, in their assessment of factors related to recorded vaccine uptake, which may confound the evaluation of vaccine impact, indicated that the ascertainment of vaccination coverage from a cross-sectional population survey poses considerable difficulties due to incomplete records and lack of precise birth dates. The systematic omission of documenting repeat BCG, measles and polio vaccines during campaigns makes it impossible to determine complete vaccine histories. (Jahn et al.2008).

This study also confirms that analyses based on family-held records are likely to result in misclassification of vaccination status if the absence of vaccination records is interpreted as not having been vaccinated. Adherence to vaccination schedule is strongly influenced by socio-economic characteristics and access to health services, which are intrinsic risk factors for child health and survival. Any analysis of vaccination effects must take account of these variables as potential confounders. (Jahn et al.2008).

Of the unvaccinated children, those who miss out on routine vaccination programs live in remote locations, urban slums, and border areas. Disparities are inevitable from populations that reside in hard-to-reach areas, displaced populations, dominance of social barriers, lack of awareness or motivation to be vaccinated, and those among who refuse to be vaccinated. (WHO, 2007).

2.9 Religion and Immunizations

Religious beliefs have been associated with people denying to get vaccinated. Ahmad et al., (2007) states that religious opposition by Muslim fundamentalists is regarded as a major contributing factor in the failure of immunization programs against polio in Nigeria, Pakistan and Afghanistan. Religious conflicts in the tribal areas of Pakistan pose as one of the biggest hindrances to effective polio vaccination. (Ahmad, 2007).

Over the past years, several kidnappings and beatings of vaccinators have been reported. Vaccination campaigns in Nigeria and Afghanistan have also been hampered by Islamic extremists, especially in the Nigerian province of Kano in 2003. (Kapp, 2003).

Religious and philosophical exemptions from vaccinations in the US require proof of vaccination for school entrance and most states permit non-medical exemptions. (Salmon, 2001).

2.10 Education of Mother or Care Giver and Access to Immunization Services

A study in Malawi revealed that children that live close proximity to a clinic and were from educated parents were significantly more likely to have vaccination documentation. (Jahn et al 2008).

The issue of equity was ably dispensed by the GAVI for over a decade as a public private partnership that dealt with fundamental disparities by ensuring that marginalized children in poor parts of the world are not denied access to life saving vaccines because of costs. In this respect, GAVI plays a tremendous role in mobilizing finances and thereby providing vaccine to a great deal of children globally and ensuring that measles vaccines to remain a cost effective public health intervention. (Lob-Levy, 2011).

2.11 Wealth Index and Immunization

Disparities in immunization coverage are compounded by social economic determinants. People are immunized at different ages throughout their lifetime mostly between birth and five years (Health Literacy Manual, 2008).

The dynamics of childhood vaccination uptake in developing countries are unclear. Numerous studies document the relationship between vaccination coverage and access, socio economic and demographic factors. However, there is less knowledge about the relationship between vaccination coverage and carers' motivation and willingness to seek childhood vaccinations. (Holte et al.2012).

Socio-economic inequities within a community may also influence health outputs, resulting in parallel inequities in vaccination coverage rates, unless deliberate efforts are made to reduce the inequities. The health systems in different countries may have different capacities and political will to reach the most disadvantaged children. Hence, wide variations in the impact of polio initiative on changes in social equity in immunization coverage may be expected. (Holte et al.2012)

2. 11 Challenges in Immunizations

Immunization campaign has met several challenges as regards financial and logistics. It is possible to implement an effective immunization program in a multiethnic, cultural and religious country. (Ling et al. 2012).

In Netherlands it was observed that despite high vaccination coverage, cases of measles, mumps, and rubella epidemics were reported and were largely confined to an orthodox protestant minority that objects to vaccination.(Ruijs et. al.2012).

Policymakers and health care professionals can provide an important role in motivating orthodox protestant parents to make a deliberate choice on vaccination. They can manage the consequences of a particular decision by informing vaccinating parents of adverse vaccination effects and by providing non- vaccinating parents a second chance for vaccination. (Ruijs et al., 2012).

With reference to a study that was conducted in Latin America, it clearly shows that show that a common regulatory framework for vaccine approval is needed to accelerate delivery and pool human, technological and scientific resources in the region. This underscores the importance of public-private partnerships between industry, government, academia and non-profit sectors. It could provide new investment to stimulate vaccine development in the region and thereby reducing prices in the long term. These reforms are now crucial, particularly as vaccines for previously neglected, developing-world diseases become available. In essence it is suffice to condone put in place a regionally-coordinated health policy in order to reduce vaccination inequality in Latin America. (Tapia et al., 2013).

The World Health Organization committed itself to eradication programs following the success of vaccination in middle-income and developing countries. (Minor 2012).

The drive to eradicate of some of the vaccine preventable diseases such as polio and measles cannot be possible without having challenges specifically on health policies. Therefore it is important to understand the features of infection, its silent nature and the ability of the live vaccine (OPV) to evolve and change in vaccine recipients and their contacts. (Minor 2012).

Another school of thoughts from Aylward et al. (2005) embrace a combination of task simplification, technological innovations and adaptation of strategies to fit local circumstances and monitor progress in virtually every area of every country, regardless of the health infrastructure, conflict geography and/or culture. This approach calls for political advocacy and mass community mobilization, together with strong management and supervisory processes. Non-monetary incentives, reimbursement of costs and substantial technical assistance have been essential. (Aylward, 2005).

Chapter III

METHODS AND PROCEDURES

3.1 Background

In this study, the independent variables included age, sex, education attainment, ethnicity, place of residence and wealth index. The dependent variables were the type of vaccine that includes BCG, DPT, HepB+Hib, Measles and Polio.

3.2 Data Source

Data for this study were obtained from the Monitoring and Evaluation to Access and Use Results Demographic and Survey (MEASURE-DHS). The MEASURE DHS project has over 25 years of experience since its establishment in 1984.

The project has provided technical assistance to over 260 surveys in over 90 countries. The project stands to advance global understanding of health and populations trends in developing countries. The project is funded by the United States Agency for International Development (USAID).

This study was conducted using the 2010 Malawi Demographic Health Survey. The Malawi Demographic Health survey was conducted by the National Statistical Office (NSO) in 2010 with a nationally representative sample of more than 27,000 households. All eligible women aged 15-49 in these sampled households and all eligible men aged 15-54 in a subsample of one-third of the sampled households were individually interviewed.

The 2010 MDHS was the first demographic health survey to collect data on basic demographic and health indicators at the district level. In this study, the focus was on maternal and child health.

The 2010 MDHS sample included 849 clusters: 158 in urban areas and 691 in rural areas and a nationally representative sample of 27, 345 households were selected.

3.3 Independent variables

Participants in this study were asked questions about age, sex, wealth status, education attainment, religion, ethnicity and place of residence.

3.3.1 Age

Participants age in years were obtained from the question " In what months and years were you born".in this study age was categorized to 15-19,20-24,30-39,and 40-49 age groups based on previous studies among the Malawian population.

3.3.2 Gender

Respondents on gender were coded as "male" or "female".

3.3.3 Religion

Participants were asked "What is your religion" and they indicated which religion they were identified with and responses were recorded as : 'Catholic', 'CCAP', 'Anglican', 'Seventh Day Adventist', Muslims', 'No religion' and 'Other '. The response 'Other' was used due to the small sample size of participants who belong to some religions different from the ones listed above.

Since Christianity is the dominant religion in Malawi, religion was categorized into Christian (by combining the Catholic, Anglican, Seventh Day Adventist), Muslims and No religion whereas other religion comprise of Hinduism, Jehovah's Witness and African Apostolic.

3.3.4 Education attainment

On education attainment, participants were asked questions like: "What is the highest level of school ever attended and what is the highest class level completed that year? Responses were primary, Secondary or Higher education. Educational levels were coded as 'No education', 'Primary', 'Secondary', or 'Higher' and Higher education represented individuals who have completed educational levels above secondary school such as the attainment of tertiary education in colleges and universities.

3.3.5 Ethnicity

Participants were assigned an ethnic group after responding to the question "What is your tribe or ethnic group?" Participants were grouped into nine ethnic groups: "Chewa", "Tumbuka", "Lomwe "," Tonga "," Yao "," Sena "," Nkhonde "," Ngoni and Other." The ninth category of "other" was assigned to participants from ethnic groups that represented small sample sizes.

3.3.6 Wealth Index

The wealth index is used throughout the report as a background characteristic. It serves as a proxy for measuring the long-term standard of living. It is based on data from the household's ownership of consumer goods; dwelling characteristics; type of drinking water source; toilet facilities; and other characteristics that are related to a household's socioeconomic status. Wealth index was determined from the questions: "What have you been doing for most of the time over the last 12 months?" What is your occupation, that is, what kind of work do you mainly do?" "Are you paid or do you earn in cash or kind for this work or are you not paid at all?" and "On average, how much of your household's expenditures do your earnings pay for: almost none, less than half, about half, more than half, or all?". Respondent were assigned "poorer", "poor", "middle", "rich", or "richer" based on answers from the series of questions. Respondents wealth indexes were re-coded into three categories for this study into "poor", "middle" and "richer".

3.3.7 Region of Residence

Respondents' regions of residence were coded as "North", "Central" and "Southern".

3.3.8 Vaccination status

Participants' vaccination status was asked by asking question like Did (NAME) ever receives any vaccinations to prevent him/her from getting diseases, including vaccinations received in a national immunization campaign.

3.4 Dependent variables

The dependent variables were BCG, DPT/Pentavalent, Measles, Polio vaccines.

Specific questions for a particular vaccine were asked. For example on BCG vaccine, a participant was asked the question: Did the child receive a BCG vaccination against tuberculosis, that is, an injection in the arm or shoulder that usually causes a scar?

DPT/Pentavalent: A DPT/Pentavalent (DPT-HepB-Hib) vaccination, that is, an injection given in the thigh or buttocks, sometimes at the same time as polio drops? How many times was a DPT/ Pentavalent (DPT-HepB-Hib) vaccination received?

Measles: A measles injection or an MMR injection - that is, a shot in the thigh at the age of 9 months or older - to prevent him/her from getting measles?

Polio: Polio vaccine, that is, drops in the mouth? Was the first polio vaccine received in the first two weeks after birth or later? How many times was the polio vaccine received?

3.6 Data Analysis

Data management and analyses were done using SPSS version 20.0 (SPSS Inc. 2012). Subjects that were less than one year old were excluded from analysis. Frequency distributions of studied independent variables (gender, education, age, religion, marital status, and wealth status, region of residence, ethnicity, and place of residence and vaccination status) were calculated.

To determine association of the selected independent variables and dependent variables, odds ratio from both univariate and multivariate logistic regression analysis were done. In the multivariate analysis, statistical adjustments were made for confounding variables such as educational attainment and place of residence with complete vaccination status as an outcome.

3.7 Human Subjects Consideration

This study was approved by the Georgia State University Institutional Review Board (IRB) as exempt. This study used publicly available data from the MEASURE-DHS with no identifiable information such as name and national identity number on subjects.

CHAPTER IV

RESULTS

4.1 Characteristics of Study Population

The sample size for this study was 14,593 children aged between one year and five years. Table 1, provides a frequency summary of selected demographic variables and shows that slightly over three quarters (78.2%) of children had complete vaccination status with about one fifth (21.7%) reporting having incomplete vaccination status of their children.

Majority of the children in the study lived in rural areas (90.5%) compared to less than 10.0% from the urban areas. On regional boundaries, majority of the children lived in Southern region (48.0%) and Central region (34.1%) with less than one fifth from the Northern region (17.9%). The Northern region reported the highest vaccination coverage (82.7%) compared to the Southern region (79.5%) and the Central region (73.9%).

On ethnicity, the largest ethnic group is the Chewa clan which reported having 30%, with the Lomwe 11%, Ngoni and Yao were over 10%, Tumbuka 10 % and Sena 6%. Christianity is the main religion with 86.8% of the subjects reported being Christians and 12.3 % belong to the Islamic group. There were findings on those with no religion at all that accounted for 0.7% and those with other religions were 0.2%. The results also showed that majority of the children lived in households headed by men (79.0%).

Attainment of formal education is an important aspect that was analyzed, and the results indicated that 69.1% of the mothers had at attended primary school and 17.2% of the women did not have formal education with 13.1% reported having attended secondary school and a small proportion of 0.5% attained college or university education. According to the wealth index 32.5% were rich with 22.5% of the subjects were in the middle level category and 45% were poor. As regards ownership of a radio, 55.0% of the subjects had a radio and 48.8% owned a bicycle with only 8% of the subjects reported owning a television.

Table 1: Frequencies of selected variables in the study sample

Characteristics	N	%
Complete vaccination status	11422	78.3
Incomplete vaccination status	3164	21.7
Urban	1380	9.5
Rural	13213	90.5
Male	11583	79.4
Female	3010	20.6
15-19 years	589	4
20-24 years	3847	26.4
25-29 years	4294	29.4
30-34 years	2814	19.4
35-39 years	1864	12.8
40-44 years	831	5.7
45-49 years	354	2.4
Radio available	8025	55.0
No radio	6367	43.6

*Note: on radio there were missing numbers and they were calculated as system missing

Table 2: Frequencies of selected variables in the study sample

Characteristics	N	%
With bicycle available	7123	48.8
No bicycle	7263	49.8
With TV	1144	7.8
No TV	13235	90.7
North	2618	17.9
Central	4972	34.1
South	7003	48.0
Chewa	4415	30.3
Tumbuka	1497	10.3
Lomwe	2307	15.8
Tonga	413	2.9
Yao	1621	11.1
Sena	880	6.0
Nkhonde	261	1.8
Ngoni	1849	12.7
Manganja	445	3.0
Lambya	113	0.8

*Note: there were missing numbers for TV and bicycles variables and the numbers were calculated as systematic missing in the model

Table 3: Frequencies of selected variables in the study sample

Characteristics	N	%
College education	75	0.5
Secondary education	1910	13.1
Primary	10091	69.1
No education	2517	17.2
Christianity	12647	86.8
Muslims	1794	12.3
No religion	102	0.7
Other religion	33	0.2
Rich	3812	32.5
Middle	2612	22.5
Poor	4998	45

Table 4: Univariate logistic regression analysis showing associations between selected demographic variables with complete vaccination status

Variable	Odds Ratio	95% CI	p-value
No education (Reference)	**1.0**	**Reference**	**Reference**
45-49 years (Reference)	**1.0**	**Reference**	**Reference**
15-19 years	0.861	0.629-1.178	0.350
20-24 years	0.968	0.750-1.249	0.801
25-29 years	0.849	0.658-1.096	0.209
30-34 years	0.786	0.606-1.021	0.071
35-39 years	0.832	0.636-1.088	0.179
40-44 years	0.983	0.735-1.316	0.910
Christianity (Reference)	**1.0**	**Reference**	**Reference**
Muslim	0.366	0.183-0.731	0.004
No religion	0.424	0.211-0.853	0.016
Other religion	0.593	0.264-1.331	0.205
Urban(Reference)	**1.0**	**Reference**	**Reference**
Rural	1.207	1.061-1.374	0.004

Table 5: Univariate logistic regression analysis showing associations between selected demographic variables with complete vaccination status

Variable	Odds Ratio	95% CI	p-value
Sothern region (Reference)	**1.0**	**Reference**	**Reference**
Central	0.831	0.739-0.934	0.002
Northern	1.401	1.286-1.527	p<0.001
No bicycle (Reference)	**1.0**	**Reference**	**Reference**
with bicycle	1.222	1.129-1.324	p<0.001
No radio (Reference)	**1.0**	**Reference**	**Reference**
Has radio	1.218	1.124-1.319	p<0.001
With television(Reference)	**1.0**	**Reference**	**Reference**
No television	1.062	0.915-1.233	0.431
Sothern region (Reference)	**1.0**	**Reference**	**Reference**
Central	0.831	0.739-0.934	0.002
Northern	1.401	1.286-1.527	p<0.001
No bicycle (Reference)	**1.0**	**Reference**	**Reference**
with bicycle	1.222	1.129-1.324	p<0.001
No radio (Reference)	**1.0**	**Reference**	**Reference**
Has radio	1.218	1.124-1.319	p<0.001
With television(Reference)	**1.0**	**Reference**	**Reference**
No television	1.062	0.915-1.233	0.431

Education

The odds of having full immunization was twice higher among children from parents with

college education compared to those with no education (OR: 2.116 95%, CI: 1.109-4.036

p=0.023). However, the odds of complete immunization status among children from parents with secondary education were slightly higher than those with no education.

Age of mother

Children from mothers aged 45-49 years old had the highest vaccination coverage compared to mothers of other age groups. However, there were no statistically significant differences in the odds of being vaccinated among children from mothers of different age groups.

Religion

On religious inclinations, children from Muslim parents have 0.3 (95% CI: 0.183 – 0.731, p=0.004) odds of having complete vaccination status for their children as compared to children from Christian homes. Also children from parents who practice no religion have 0.4 (95% CI: 0.211 – 0.853, p=0.016) odds of having complete vaccination status. Lastly, children of parents from other religions have 0.5 (95% CI: 0.264 – 1.331, p=0.205) odds of having complete vaccination status.

Wealth Index

Children from the middle level class have 1.2 odds of having complete vaccination status for their children as compared to those that are poor. (OR: 1.285, 95% CI: 1.173 – 1.408, p<0.001).

Residence

The study shows that children from the rural areas have 1.2 (95% CI: 1.061 – 1.374, p=0.004).odds of having complete vaccinations as compared to their counterparts from the urban settings.

Region

Children that live in the northern region have 1.4 (95% CI: 1.286 – 1.527, p<0.001) odds and those from Central region have 0.79 (95% CI: 0.73 – 0.85, p<0.001) odds to have complete vaccination status compared to those that live in the Sothern region.

Bicycle

Availability of bicycle puts the odds of children to have complete vaccination status at 1.2 (95% CI: 124 – 1.324, p<0.001) compared to those that do not have a bicycle.

Radio

Children from households that own a radio have 20% higher odds of having complete vaccination status compared to those that do not have a radio - (OR: 1.218, 95% CI: 1.124 – 1.324, p<0.001).

Television

Children from household that own a television set had 1.1 (95% CI: 0.915 – 1.233, p=431) odds of not having complete vaccinations status as compared to those that do not have televisions in their households.

Table 6: Multivariate logistic regression analysis showing associations between selected demographic variables with complete vaccination status

Variable	Odds ratio	95% CI	*p*-value
No educ. (Reference)	**1.00**	**Reference**	**Reference**
College education	2.80	1.76- 4.45	p <0.001
Secondary	2.03	1.28- 3.21	0.002
Primary	1.17	0.71-1.90	0.533
45-49 (Reference)	**1.00**	**Reference**	**Reference**
15-19	0.901	0.651-1.246	0.528
20-24	0.855	0.656-1.115	0.248
25-29	0.971	0.746-1266	0.830
30-34	1.093	0.835-1.431	0.516
35-39	1.082	0.22-1.424	0.573
40-44	0.962	0.714-1.296	0.800
Rich (Reference)	**1.00**	**Reference**	**Reference**
Middle	0.930	0.821-1.053	0.931
Poor	0.830	0.736-0.936	0.002
Other religion(Reference)	**1.0**	**Reference**	**Reference**
Christianity	2.229	1.105-1.196	0.025
Muslim	1.917	0.933-3.939	0.77
No religion	1.639	0.722-3.721	0.237

Table 7: Multivariate logistic regression analysis showing associations between selected demographic variables with complete vaccination status

Variable	Odds ratio	95% CI	*p*-value
Rural (Reference)	**1.00**	**Reference**	**Reference**
Urban	0.681	0.586-0.791	p<0.001
Southern (Reference)	**1.00**	**Reference**	**Reference**
Northern	0.987	0.787-1.215	0.840
Central	0.661	0.583-0.749	p< 0.001
With bicycle (Reference)	**1.00**	**Reference**	**Reference**
No bicycle	0.911	0.833-0.1997	0.043
With radio(Reference)	**1.00**	**Reference**	**Reference**
No radio	0.964	0.878-1.058	0.438
TV (Reference)	**1.00**	**Reference**	**Reference**
No TV	1.131	0.952-1.344	0.163

Education

As regards educational level of the mothers, those with college educational attainment have 2.8 (95% CI: 1.76-4.45, p<0.001) odds of having complete vaccination status as compared to children that are from parents with no educational attainment and this was statistically. Children from parents with secondary education are 2 times (OR: 2.03, 95% CI: 0.17-1.90, p=0.002) more likely to have their children achieve complete vaccination status as compared to children from the parents that have no education. and parents with primary education had the lowest chances of having their children attain complete vaccination status if compared with all categories.

Age of Mother

Considering the ages of mothers, the findings in all age groups were statistically insignificant.

Religion

Children from Christian families have 2.2 (95% CI: 1.105-1.196, p=0.025) odds of having complete vaccination status compared to those that do not have any religion

Wealth Index

Children from poor families are less likely to have complete vaccination status as compared to those from the middle class as well (OR: 0.930, 95% CI: 0.821-1.05 p=0.931) and the rich (OR: 0.830, 95% CI: 0.736-0.936, p=0.002).

Residence

Those that live in the urban areas are less likely to have children with completes vaccination status compared to those that live in the rural areas (OR: 0.681, 95% CI: 0.586-0.791, p<0.001), and this finding was statistically significant.

Region

Subjects that live in the Northern and Central regions have 0.9 (95% CI: 0.787-1.215, p=0.840) odds and 0.6 (95% CI: 0.583-0.749, p< 0.001) odds respectively of having complete vaccination status compared to those that live in the Southern region.

Radio

Considering the availability of radio, children from those with no radios have 0.9 (95%, CI: 0.87-1.058, p<0.438) odds of having complete vaccination status compared to those with a radio

Bicycle

The odds of having complete vaccination status among the children from those with a bicycle are 0.9 (95% CI: 0.833-0.199, p=0.043) times compared to the people with no bicycles.

Television

Children from those with no television sets have 1.1 (95% CI: 0.952-1.344, p=0.163) odds of having complete vaccination status than those with TV sets in their homes.

DISCUSSIONS AND CONCLUSIONS

5.1 Policy Recommendations

As it is evident that educational level of the mother plays an important role in improving the vaccine status of the children, there arises the need to empower women by improving and motivating them to attain education. There is a unique finding that shows that staying in the urban is not necessarily a guarantee that the health needs of the individual are met, as shown in the study, it is even more advantageous to remain the rural and have the child complete vaccinations. Much as it expected for the urban residents to have more access to medical services, in this particular development, women in the urban are less likely to have their children complete vaccination implying that there is a shift in terms of resource allocation and focus. The issues of urbanization and health disparities need to be explored so as to capture the marginalized societies that live within the urban but lack access of health care services as compared to the rich.

Owing to levels of rurality, the EPI in Malawi thrives to deploy health workers to rural settings and distribute vaccines accordingly despite being constrained financially.
There is also this need to explore the urbanization and health disparities and tailor strategies that should target all under five children and try to introduce mandatory vaccination as a tool for school entry in all primary schools in order to enhance and capture those that that do not have vaccinations.

Importantly, is that the Central region continues to lag behind in its efforts to have complete vaccination among the under-five populations although the Ministry of Health headquarters is within the Central region. This fosters on policy makers to start exploring the root cause and map up working strategies so that the vaccination rates continue to improve.

As Gauvreau et al. 2012 points out that developing countries face critical choices for introducing needed, effective, but expensive new vaccines, especially given the accelerated need to decrease the mortality of children under age five and the increased immunization resources available from international donors.(Gauvreau et al. 2010).

The use of the Disability-Adjusted Life Year (DALY) outcome measure and an alternative generalized cost-effectiveness analysis approach is restricted to developing countries. To alleviate this issue, the use of cost-effectiveness analysis (CEA) tool among decision makers can use for efficiently help to allocate expanding resources. Greater attention to pediatric interventions and donor funding in the conduct of CEA could lead to better policies and thus more worthwhile and good-value programs to benefit children's health in developing countries. (Gauvreau et al. 2010).

5.2 Study Strengths and Limitations

Data sets   that were used for this study were nationally representative and the sample size that was valid enough to generalize the results. In this regard, its generalizability could be limited to the Malawian context only. The source of the data is the MEASURE DHS that produces reliable data from several countries and this tends to be strength in this study.

However, this study had some setbacks as regards the type of data that was used. Data that was used in this study   was derived from cross sectional data implying that there is no causation that could be inferred in the course of the analysis and only associations   could be derived. Cross sectional data tend to limit the ability to track individuals and identify missed.

Secondly, responses from women only were included in this study and no information was derived to seek the opinions of men on vaccines.

Thirdly, this study use secondary data as a source. The initial and prompt questions that could seek therein were not met as there were limitations to explore more questions and come up with results that are consistent with the core driving the research question, however, the could be manipulated to suit such study design and in so doing, some vital information are either deleted or omitted with no further analysis on the subject.

5.3 Implications of Findings

This study brings to the limelight the need to increase awareness among the populations as a means to increase vaccine coverage and continues to reduce the prevalence of vaccine preventable diseases in Malawi. It also points on the issue of urban residents having a lapse in vaccination status that is a concern to the policy makers and the EPI program respectively. However, it is important to point out that the EPI program in Malawi is doing a tremendous job in the immunization of the under-five populations although there is a challenge on the rate of incomplete vaccinations.

5.4 Future Research Studies

It would be important to conduct a comparative research on cost effectiveness analysis on the impact of conducting vaccination outreach clinics by team from the district health offices versus having a static clinic to all hard to reach areas in Malawi.

A study on the knowledge, attitude, practice   and cultural beliefs on vaccine uptake among caregivers in Malawi may also be considered.

5.5 CONCLUSION

Malawi continues to have high immunization coverage despite having incomplete immunization status. Conclusively, the EPI should continue with its developmental strategies that thrive to address social determinants of health to embrace the under-five populations group in order to achieve an equitable distribution of vaccine and coverage.

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Appendices

1. Map of Malawi showing regions and cities