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Preventive Health Services Provided at Infant and Child Visits at Six Maternal-Child Health Clinics in Western Kenya: A Cross-Sectional Assessment, 2017

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By

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Bachelor of Science
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Thesis Committee Chair: Kate Winskell, PhD

An abstract of
a thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Health
2018

Abstract

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By Andrew Roland Deathe

Despite Kenya making great progress in reducing child mortality and improving child health outcomes in recent decades, the Millennium Development Goals related to child mortality were not reached by 2015 and the country is not on track to achieve the Sustainable Development Goals by 2030. Effective interventions and services are available at Maternal and Child Health (MCH) clinics and have the potential to eliminate preventable child deaths. The purpose of this thesis was to determine what services are provided at six MCH clinics, estimate the coverage of services, and identify factors associated with service coverage.

A cross-sectional study of 78 caregivers and their children from six MCH clinics in Kenya was performed. Child health records were reviewed to determine coverage of immunizations, growth monitoring, vitamin A supplementation, deworming, and developmental screening. Caregivers were administered a questionnaire on their attitudes and practices related to the services provided at their MCH clinic and their child's care and development.

Nearly 70% (69.2) of children were fully vaccinated for their age. We found a significant disparity in full vaccination coverage by gender, as males were 3.5 times more likely to be fully vaccinated than females. Further, full vaccination coverage also differed significantly across MCH clinic sites and ranged from 43.8% to 92.9%. No children in the study had developmental screening provided at any visit and few caregivers reported their clinic provides any child developmental services.

Preventive health service coverage estimated in this study is consistent with national and sub-national findings. However, our study found significant equity gaps in coverage at these six clinics that need to be further investigated to ensure that all children are reached with life-saving interventions and services. Child development is not routinely incorporated into MCH clinic visits, indicating an opportunity to dramatically scale up this component of MCH clinic service delivery and to maximize caregivers' ability to enhance their child's development.

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Acknowledgements

I would like to extend my most sincere gratitude to Dr. Kate Winskell, Dr. Megan McHenry, and Dr. Roger Rochat for taking me under their wing and helping me finish this thesis on such a short timeline. I am beyond thankful for their patience, guidance, and unwavering support on this project. I'd like to acknowledge and thank Dr. Megan McHenry and her colleagues in Kenya for allowing me to use data they worked tirelessly to collect and for giving me the opportunity to investigate and write my thesis on such a critical issue. Additionally, I'd like to thank Carole McAteer for her guidance at the onset of this project.

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Chapter 1: Introduction

Infant and child mortality are high in low- and middle-income countries and poor child health outcomes are all too common. In 2016, nearly six million children under five years of age lost their life [1]. One region alone, sub-Saharan Africa (SSA), accounted for nearly 3.2 million of these deaths [1]. Further, there are six countries in the world with an under-five mortality rate higher than 100 per 1,000 live births, all of which are located in SSA [1]. The under-five mortality rate in SSA is 83 deaths per 1,000 live births; for perspective, the average under-five mortality rate in high-income income countries is 5.3 deaths per 1,000 live births [1, 2]. In Kenya, one in every 26 children do not survive to their first birthday and nearly one in every 19 dies before reaching the age of five [3]. The under-five mortality rate is 52 deaths per 1,000 live births. In the first year of life, 3.9% of infants die and 1.4% of children die between their first and fifth birthdays [3].

The Millennium Development Goals (MDGs), adopted in September 2000, represented a commitment by the United Nation member states to combat poverty and disease among other global concerns [4]. The 8 goals outlined in the MDGs were set to be achieved by December 2015. MDG 4 "Reduce child mortality" aimed to achieve a two-thirds reduction of the under-five mortality rate between 1990 and 2015 [4]. While this goal was not met, significant progress was made to improve child survival. The under-five mortality rate in Kenya decreased by 52%, from 102.3 in 1990 to 49.4 in 2015 [2, 5]. Infant mortality was also reduced but not as rapidly [2]. Despite not meeting the MDG targets for reducing child mortality, significant progress was still made during this era. In fact, SSA had some of the most substantial improvements in under-five mortality during the MDG era [3]. With these achievements, the world was ready to make a new set of goals and priorities to further the health and wellness of the global population [6].

Implemented in 2016, the Sustainable Development Goals (SDGs) created a global agenda to reach, build on, and eventually surpass the goals of the MDGs into the year 2030 [7]. Similar to the MDGs, the SDGs continue to emphasize child health and its importance. SDG Goal 3.2 set to ultimately end preventable deaths of newborns and children under five years of age. Specifically, SDG 3.2 aimed to reduce neonatal and under-five mortality in each country to at least 12 and 25 deaths per 1,000 live births, respectively [7].

The most significant causes of mortality in children under five years of age in Kenya are conditions that could be prevented or diseases that could be effectively treated [8]. Maternal and Child Health clinics provide services to prevent and treat disease such as immunizations, vitamin A supplementation, deworming, growth monitoring, among other services. Inadequate provision of care and of these services throughout the maternal and child health continuum of care from the prenatal, perinatal and early childhood periods contributes to many unnecessary infant and child deaths [2]. According to the World Health Organization and Maternal and Child Epidemiology Estimation Group (MCEE), acute respiratory conditions accounted for 14.4% of all deaths in children under five, while diarrhea (6.9%), malaria (3.9%) and HIV (3.3%) were the other leading causes of death [1]. These conditions are exacerbated by and associated with malnutrition. Nearly half (45%) of all child deaths across the world are partially attributable to malnutrition [9]. Stunting, wasting, and being underweight are common measures of malnutrition. In Kenya, 26% of children under five years of age are stunted, 4% are wasted, and 11% are underweight [3].

Malnutrition is a condition that should be averted to ensure optimal physical, behavioral, motor and cognitive growth and development. In addition to concerns regarding the relationship between malnutrition, disease, and child development, the prevalence of HIV in the western

region of Kenya (16.1%), the highest in Kenya, severely compromises the proper development of children [10]. Approximately 1.6 million HIV-infected children and adults live in Kenya and the country is one of 22 countries that collectively account for over 90% of all HIV-infected pregnant women [11, 12]. This high prevalence of HIV is related to child development by higher rates of neurodevelopment (ND) delays seen in children born to HIV-infected mothers compared to HIV-unexposed children [13]. If children are unable to reach their maximal development potential, there are broad concerns regarding potential impacts on their families and the economy. According to estimates from the Lancet series on child development, children who fail to reach their development potential have a 20% deficit in adult income [14].

If the ambitious targets of the SDGs are to be reached by 2030 in Kenya, high quality preventive healthcare services must be accessible for all children. Inequalities affecting the access, utilization, delivery and subsequent coverage of services provided to children need to be understood and addressed. Further, any gaps in or barriers to the preventive healthcare services provided to children need to be better understood. In addition to improving survival, emphasis must be placed on optimizing children's developmental potential. In fact, early childhood development is an integral part of SDG 4.2 "ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education" [7].

Poor health among children in Kenya has the potential to have numerous downstream effects later in life, even if it doesn't result in mortality. Poor health once a child reaches adulthood, low educational attainment, and eventual intergenerational poverty are all consequences of children not achieving optimal health and development [14].

Problem Statement

Childhood mortality continues to be an urgent concern in Kenya. Progress in reducing mortality has been made, however, addressing the poor developmental outcomes of children, improving their overall health and well-being, and monitoring the coverage of preventive healthcare services are still a priority. Increasing the use and quality of healthcare services among children and their caregivers may reduce morbidity and continue to improve child survival in Kenya. It is unacceptable that children in Kenya die every day from preventable causes and fail to reach their developmental potential while effective interventions and services are available.

Maternal-Child Health (MCH) clinics are the primary source of healthcare for infants and children in Kenya and are the principal location where morbidity and mortality can be reduced. Identifying what services are provided at these MCH clinics, the coverage of said services, and any gaps that may prevent children from receiving the critically important care they need to live healthy and productive lives is a crucial step in moving Kenya forward in the new sustainable development era.

Purpose Statement

This study used cross-sectional data collected at six MCH clinics in western Kenya to assess the coverage of services provided to children under five years of age. The purpose of this study was to describe the current coverage of services and interventions provided to infants and children at six maternal and child health clinics in western Kenya, to identify gaps in the services provided, and to investigate factors that may be associated with coverage. This study also aims to understand caregiver behavior related to taking their child to a MCH clinic, their concerns and practices related to their child's development, and how they perceive child development services.

Significance statement

In order for child mortality in Kenya to be reduced, health and developmental outcomes must be improved. These outcomes can be improved through the delivery of effective services and interventions at MCH clinics. It is critically important to assess what services are offered at MCH clinics and determine which children receive them. If there are gaps or inequities associated with service coverage, these must be understood to ensure all children have equal access.

Research Questions

1. When do caregivers bring their children to an MCH clinic?

Sub-questions

- At what age do caregivers begin taking their children to an MCH clinic?
- What reasons do caregivers give for bringing their child to an MCH clinic?

2. What preventive healthcare services are provided at the six MCH clinics?

Sub-questions

- What is the coverage for each vaccine included in the Kenyan immunization schedule?
- What proportion of children are considered fully vaccinated for their age?
- What is the coverage for vitamin A supplementation and deworming?
- What proportion of children have received all vitamin A supplementation and deworming services for which they are eligible?
- Are there differences in coverage by gender?
- What proportion of children have routine growth monitoring recorded in their Mother and Child Health Booklet?
- What preventive healthcare services do caregivers want their children to receive?

- What factors are associated with children receiving preventive healthcare services?

3. Are there any differences in coverage of preventive healthcare services between MCH clinic sites?

4. How is child development evaluated and documented in Mother and Child Health Booklets?

Sub-questions

- Are child development services provided at the MCH clinics?
- Do caregivers have concerns related to their child's development?

Chapter 2: Literature Review

As presented in Chapter 1, child mortality and morbidity remain critical issues in resource-limited settings such as Kenya. Chapter 2 provides an overview of the relevant literature on child survival, health, and development in resource-limited settings (with an emphasis on SSA and Kenya), the diseases and conditions that are adversely associated with these, the role of MCH clinics in the Kenyan healthcare system, and evidence-based health interventions and services that have the potential to improve child survival, health, and development.

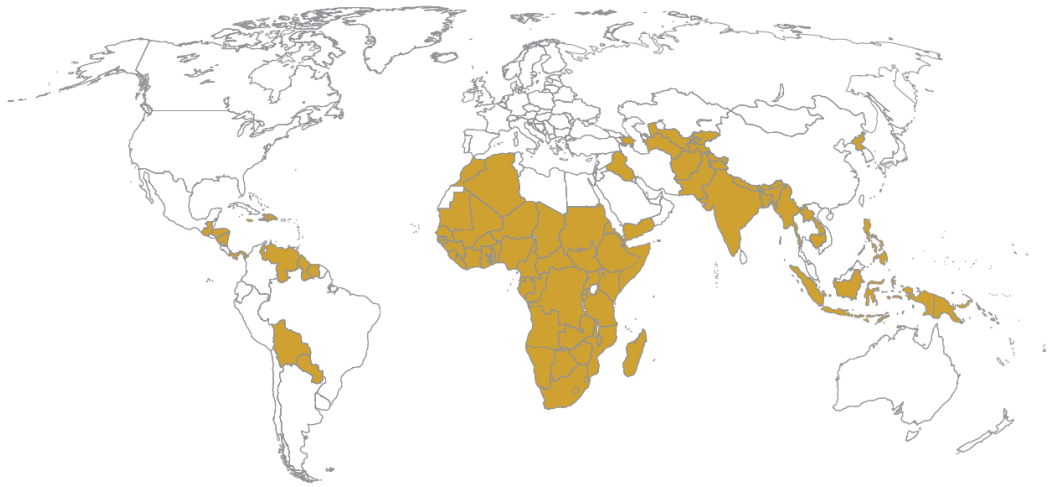
Maternal, infant, and child health are of critical concern to the international health community. Reducing maternal and child mortality was an important focus of the MDGs and is still a global priority in the current SDG agenda [6]. The MDG era, which ended in 2015, was characterized by monumental success in reducing child mortality. From 1990 to 2015, the global under-five mortality rate declined by 55% [1]. In 1990, the global under-five mortality rate was 93 deaths per 1,000 births and by 2015, this rate had been reduced to 42 [1]. Increased health funding, successful implementation of the MDG agenda, and scale-up of effective interventions contributed to this significant decline [5]. While the world as a whole has made substantial progress, huge disparities exist both between and within regions and countries. Two regions, sub-Saharan Africa and Southern Asia, accounted for nearly 80% of the 5.6 million under-five deaths in 2016 [1]. SSA alone shared nearly half of the total burden (49.2%) [1]. The 55% decline in under-five mortality achieved globally from 1990-2015 was matched by SSA, however, the under-five mortality rate in SSA remained a staggering 82 in 2015 [1]. This is the highest under-five mortality rate of all regions in the world. For perspective, this means that 1 in 13 children in SSA die before their fifth birthday, a ratio 15 times higher than that of high-income countries [1].

The most concerning thing about the deaths among children under-five is that the majority are due to preventable causes. Children are most vulnerable in their first 28 days of life, which is known as the neonatal period. Out of all under-five deaths in 2016, 46% occurred during the neonatal period [1]. In 2016, the global rate of neonatal mortality was 19 per 1,000 live births, down from 37 in 1990 [1]. This 49% decline in neonatal mortality from 1990-2016 was a great achievement, however, it occurred at a slower pace than the decline seen among children aged 1-59 months (62%) [1]. SSA and Southern Asia are strikingly similar in their patterns of under-five mortality and also have the highest neonatal mortality rates (28). In 2016, they accounted together for 80% of all neonatal deaths [1].

The foundational role of health and well-being to economic and social development is expressed by the concerted focus of the SDG framework, which has health-related targets affiliated with many of the seventeen global goals set to be achieved by 2030 [7]. Goal 3, "ensure healthy lives and promote well-being for all at all ages" has two targets associated with child health: (3.2) ending preventable deaths in infants and children and (3.8) achieving universal health coverage for reproductive, maternal, newborn and child health services [7]. Key indicators for these targets are under-five mortality rate, neonatal mortality rate, and coverage of essential interventions and health services [7]. The ambitious aims for ending preventable deaths of infants and children consist of reducing under-five mortality to 25 deaths per 1,000 live births and neonatal mortality to 12 per 1,000 live births. The emphasis and inclusion of children throughout the SDG framework highlights the need to reduce inequalities in child health and ensure that all children are reached with high-quality services and interventions [8, 15]. Meeting these needs is a prerequisite to achieving a more sustainable future [16].

The international community has committed to improving child health as evidenced by the MDGs, SDGs, and the launch of many important initiatives. To translate the SDG agenda and provide guidance on how to improve and accelerate progress in women's, children's and adolescents' health, The Global Strategy for Women's, Children's and Adolescents' Health (2016-2030) was developed in 2015 [16]. Aligned with the SDGs, The Global Strategy aims to help countries implement the Sustainable Development agenda and achieve the targets by 2030. Countdown to 2030, originally launched in 2005 as Countdown to 2015 to track progress towards achieving the MDGs, is a similar initiative consisting of a multi-institutional partnership between academia, UN agencies, and civil society aimed towards achieving the SDG target of ending preventable maternal, infant, and child deaths [17]. Countdown to 2030's primary focus is on coverage levels (the proportion of individuals needing a service or intervention who actually receive it) for evidence-based interventions to reduce maternal, newborn, and child mortality and to improve health and nutrition. A key function of Countdown to 2030 is their monitoring and reporting on countries with the highest burden of maternal, neonatal and child mortality. In 2017, Countdown identified 81 priority countries that cumulatively account for 90% of all child deaths and 95% of all maternal deaths [15]. While these 81 countries account for a majority of the global burden of maternal and child mortality, they are home to only 47% of the world's population [15]. The unweighted averages of infant and under-five mortality in these 81 countries in 2015 were 24 and 59, respectively [15]. As seen in Figure 1, nearly the entire continent of Africa is comprised of Countdown countries and SSA is saturated with them.

Figure 1. Map of Countdown Priority Countries



Only 14% of the world's population live in SSA yet the region accounts for nearly half of all global deaths among children under the age of five [1]. According to the Levels and Trends in Child Mortality 2017 Report, the majority of the 52 countries not on track to meet the child mortality targets outlined in the SDGs are located in SSA [1]. Further, the report states that more than 75% of countries in SSA will not meet the targets by 2030 if progress is not accelerated [1]. Along with child mortality, SSA is disproportionately affected by many other pertinent health challenges such as HIV. Among the 36.7 million people living with HIV globally, more than half (52%) live in SSA despite only 12% of the world's population living here [18].

Kenya, a country located in SSA, is situated on the eastern side of the African continent and on the coast of the Indian Ocean. Kenya's neighboring countries are Ethiopia, Somalia, Tanzania, Uganda, and South Sudan [3]. In 2016, the population of Kenya was nearly 48.5 million and 16% were children under five years of age [19]. More than two-thirds of the population live in rural areas [3]. The country is divided into 47 counties; however, the county system wasn't implemented until 2013 and the literature still refers to the provincial structure that was replaced. Before 2013, Kenya was divided into 8 provinces (Figure 2); Western,

Nyanza, Rift Valley, Central, Nairobi, Eastern, North Eastern, and Coast. The present study collected data from sites in the Western and Rift Valley provinces.

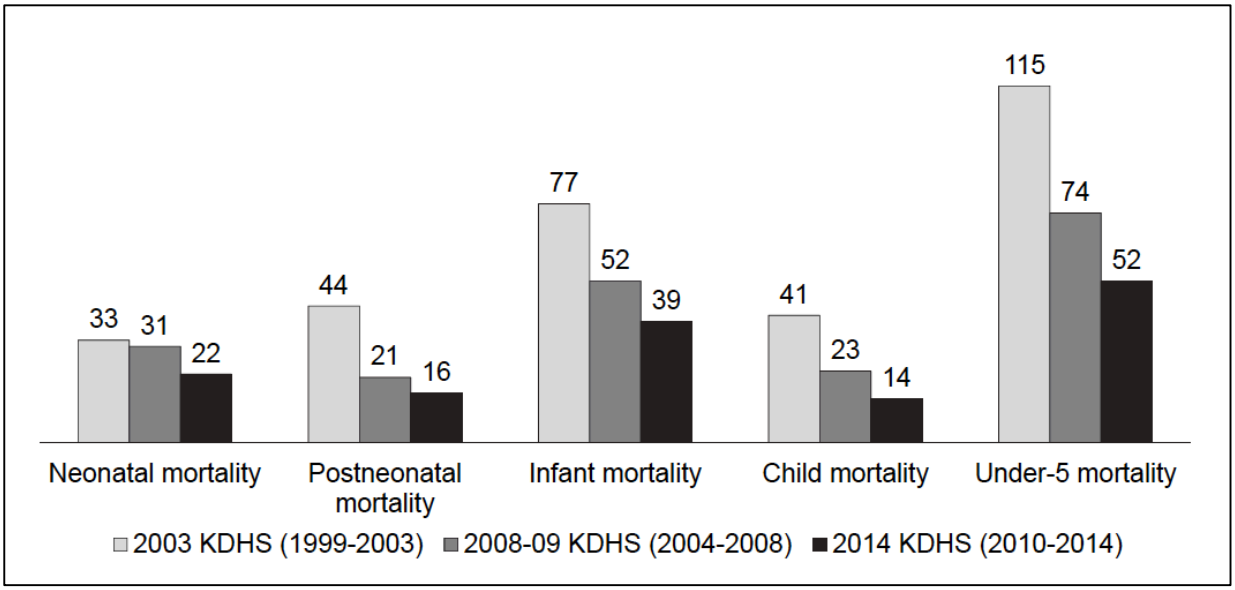
Figure 2. Map of Kenya

Childhood Mortality and Morbidity

Kenya is one of the 81 Countdown priority countries as neonatal and child health outcomes remain suboptimal. Compared to recent global under-five and neonatal mortality rates of 42 and 19, respectively, Kenya has much higher rates [1]. According to the Countdown to 2030 Report, in Kenya the under-five mortality rate was 49 and the neonatal mortality rate was 23 in 2016 [15]. Comparing child mortality data from the three Kenya Demographic and Health Surveys from 2003 [20], 2008-2009 [21], and 2014 [3]; the under-five mortality rates have continued to decrease. In the five-year period preceding the 2004 KDHS, the under-five

mortality was 115 deaths per 1,000 live births [20]. This was reduced to 74 in 2004-2008 and by the 2014 KDHS, the under-five mortality in Kenya was reduced to 52 [3, 21]. From a regional perspective, differentials in under-five mortality are pronounced. Ranging from 42 (Central) to 82 (Nyanza) deaths per 1,000 live births, the Rift Valley region is positioned on the low end with 45 deaths per 1,000 live births [3]. The Western region is higher, with an under-five mortality rate of 64 [3]. The Kenyan under-five mortality in 2016 was estimated at 49, signaling that progress is still being made [5]. Similar reductions were made in neonatal mortality, however, at a slower rate. From the 2003 [20], 2008-2009 [21], and 2014 KDHS reports [3], neonatal mortality declined from 33 to 31 to 22, respectively. Differentials across regions were less pronounced for neonatal mortality, which ranged from a low of 19 in Nyanza and Western regions to a high of 39 in Nairobi [3]. Rift Valley was near the low end at 20 [3]. Despite the substantial progress in reducing childhood mortality, children born in Kenya are still extremely vulnerable. Trends in mortality can be seen in Figure 3.

Figure 3. Trends in childhood mortality (per 1,000 live births) in Kenya, 1999-2014



Future progress in reducing child mortality in Kenya and improving the health of children hinges on ending preventable deaths, which constitute a significant proportion of childhood deaths. Among children ages 1-59 months in Kenya, the leading causes of death in 2017 were pneumonia (21.1%), diarrhea (12.7%), injuries (12.6%), malaria (7.4%), and AIDS (6.1%) [22]. The leading causes of death among newborns (first month of life) in Kenya were intrapartum-related events (29.1%), preterm birth complications (28%), sepsis (16.9%), congenital anomalies (12.5%), and pneumonia (6.7%) [22]. Similar causes of death were seen in the other 80 priority Countdown countries [15]. Further, poverty is an underlying cause of death in many cases as it undermines the health of children by an association with increased risk of illness and undernutrition, insufficient housing and sanitation, and poor access to healthcare services [23]. While undernutrition was not listed explicitly as a cause of death for either group of children, it is a main contributor to mortality and is an underlying cause of nearly 45% of all child deaths [9]. Lack of adequate nutrition in children can cause and exacerbate common illnesses such as diarrhea and pneumonia, two of the leading causes of death in children ages 1-59 months [9]. Further, it also interferes with proper growth and development of the child [9, 24-26]. According to the 2014 KDHS, 26% of children under-five are considered short for their age (stunted) and are chronically malnourished, 4% are considered thin (wasted) and are acutely malnourished, and 11% are underweight and considered chronically and acutely malnourished [3]. Child birth weight and wasting are important variable that can be used to indicate a child's vulnerability by an increased risk of illness and lower chance of survival [3]. Children born weighing less than 2.5 kilograms are considered to be at a higher risk of mortality [3]. In Kenya, 8% of children are born with a weight less than 2.5 kg [3].

Acute respiratory infections, such as pneumonia, and diarrheal disease are among the leading causes of mortality in children age 1-59 months and also cause significant morbidity. These illnesses and many others can be prevented with effective immunization campaigns. Additionally, they can be treated successfully with antibiotics and oral rehydration, respectively. Ensuring that children with these conditions access treatment in a timely manner is crucial to their ability to overcome illness, however, this is dependent on the caregivers' care seeking behavior [27]. Unfortunately, many children succumb to these diseases as a result of not being taken to a health facility or delays in seeking care on the part of the caregiver [27]. According to data from the 2014 KDHS, only 58% of children with diarrhea had caregivers who sought advice or treatment from a health provider, while a larger proportion (67%) with acute respiratory infection had caregivers take the same action [3].

Child Development

Intense focus has been placed on child survival and ensuring that children reach their fifth birthday; however, child development is a crucial aspect that cannot be neglected. Early childhood development is foundationally important and part of the first SDG, "ensure that all human beings can fulfill their potential in dignity and equality" and is taken further with 4.2, "by 2030 ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education" [7, 14]. As more and more children are surviving as a result of the success in reducing childhood mortality, ensuring that these children are able achieve their full developmental potential is an additional priority. Surviving and thriving are both urgent concerns. The same factors that place children at an increased risk of mortality (poverty, chronic illness, malnutrition) adversely impact their development [9, 14]. Due to these factors, an estimated 250 million children under five in low-

and middle-income countries (43%) are at risk of failing to reach their full developmental potential [14, 28]. Further, two-thirds of all children in SSA are at risk of the same fate [29]. According to Shonkoff et al. (2012), "building a strong foundation for healthy development during the early years of life is an important prerequisite for lifelong well-being, successful communities, economic productivity, and harmonious civil societies" [30] (page 461). Therefore, we cannot expect to achieve a world of sustainability and productivity if the future of said world is not reaching their full potential; failing to address child development and the conditions that limit the prospects of young children poses a threat to the progress and achievement of the sustainable development goals. This puts children, as well as the communities where they live, at great risk for underachievement.

Poor nutrition negatively affects the brain development of children and can lead to many negative outcomes in adulthood, such as reduced income-earning potential [15]. The estimated loss in adult annual income was 19.8% [14]. Evidence from many studies suggest that children being exposed to chronic undernutrition (stunting) and poverty are associated with deficient cognitive and social-emotional development and poor educational performance [31]. A recent analysis show that children living in the poorest households have stunting rates twice as high as children living in the richest households [32].

HIV, a disease that affects 1.6 million people in Kenya [12], is also negatively linked to child development. Children who are infected with HIV have worse developmental outcomes than children who are unexposed. Sherr et al. (2018) found that HIV-positive children in South Africa and Malawi had higher rates of stunting and were more likely to be underweight than their uninfected peers [33]. Further, a recent meta-analysis found that children who are exposed to HIV and antiretroviral (ARV) medications but who are not infected themselves have lower

mental and motor scores compared to children who are uninfected and unexposed [13]. This is of particular interest as prevention of mother-to-child transmission of HIV (PMTCT) consists of ARV exposure to the unborn infant. While PMTCT may prevent new HIV infections in newborns, this meta-analysis [13] suggests that these children may face adverse developmental outcomes. The cumulative impact poverty, malnutrition, and chronic illness have on the development of children in Kenya is significant. It is crucial to monitor and evaluate the development of children and provide effective interventions to enhance their development.

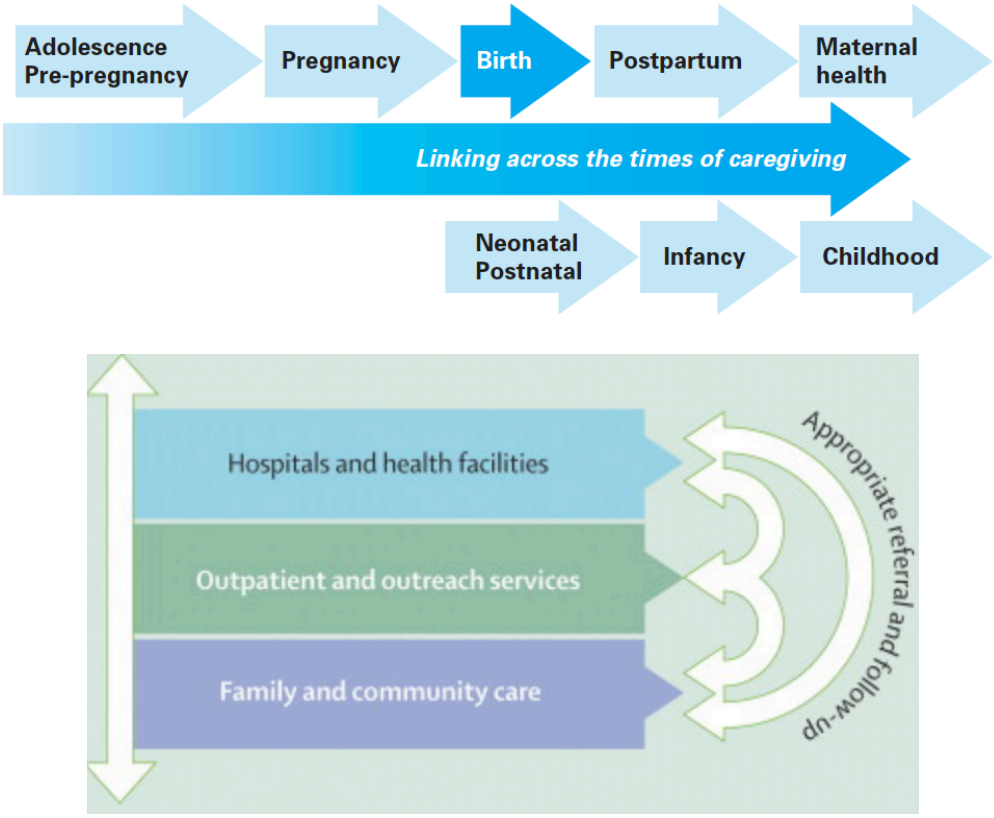
Maternal, Neonatal and Child Health Care in Kenya

Despite the multitude of factors in Kenya that have a negative impact on child survival, health, and development, there is reason for optimism surrounding the achievement of the sustainable goals by 2030. Reason for this optimism can be found in the fact that 24 low- and middle-income countries met the MDG goal of reducing under-five mortality by two-thirds, showing that even in low-resource settings with high burden of child mortality, significant progress can be made [1]. The success to date in reducing childhood mortality in Kenya is associated with concerted effort and scaling up of interventions across the maternal, neonatal, and child healthcare continuum. Working towards achieving universal health coverage and ensuring equitable access to healthcare services are necessary for future success.

The continuum of care concept originates from the 1970s and refers to the promotion of patient care through linkages to people, places, and times to reduce patients being lost to follow-up [34]. The maternal, neonatal, and child health continuum of care, originally coined in the 2005 *World Health Report* [35], expounds on this concept and emphasizes the interconnectedness of the health and well-being of mothers, newborns and children [34]. While the stages of the lifecycle included in the continuum are sequentially related, there are still

distinct transitions in the dimensions of time and place affecting the provision of healthcare services (Figure 4). For the dimension of time, the continuum includes care before and during pregnancy, during childbirth, immediately after childbirth, during infancy and lastly throughout childhood. For the dimension of place, the continuum includes the specific places where care is provided: the home, community, and health facility [34]. The purpose of the care continuum framework is to integrate and link delivery of essential health services across time and place to achieve universal coverage and save millions of lives. The importance of each stage and the successful linkage to the next in the continuum cannot be overlooked as Owili et al. (2016) found that utilization of each level of care determines utilization in each level thereafter [36].

Figure 4. Continuum of Care for Maternal, Neonatal, and Child Health – Through Time & Place



The Kenya Essential Package for Health (KEPH), introduced in the National Health Sector Strategic Plan II [37], reinforces the idea of integrating individual health services and

interventions into packages delivered throughout the lifespan. As stated in the Kenya Service Provision Assessment Survey [38], "The KEPH envisions the provision of comprehensive, integrated curative and preventive health services, available at the first point of contact and accessible to all" (page 15). Essentially, KEPH was established to target essential health services needed to fulfill the country's six policy objectives aimed towards achieving the highest possible health standards. The six policy objectives are to: 1) Eliminate communicable conditions, 2) Halt, and reverse the rising burden of non-communicable conditions, 3) Reduce the burden of violence and injuries, 4) Provide essential health care, 5) Minimize exposure to health risk factors, and 6) Strengthen collaboration with health-related sectors [37]. Two of these objectives explicitly include reproductive, maternal, neonatal, and child health (RMNCH) services and interventions. For the sake of this thesis, only those objectives and their corresponding interventions targeting children age 1-59 months will be included. Table 1 shows the essential services that need to be provided to children age 1-59 months according to the KEPH.

Table 1. Kenya Essential Package for Health (KEPH) Interventions and Services for Children 1-59 Months

Policy Objective: Eliminate communicable conditions	
Service area	Intervention
Immunization	**BCG vaccination** **Oral Polio Vaccination** **Pentavalent vaccination** **Rotavirus vaccination** **PCV – 10 vaccination** **Measles vaccination** Typhoid vaccination Yellow fever vaccination HPV vaccination
Child Health	**Deworming** Management of pneumonia Management of malaria Management of diarrhea

Policy Objective: Provide essential health care	
Service area	Intervention
Integrated MCH / Family planning	**Vitamin A supplementation** Micronutrient supplementation Iron and folic acid supplementation **Weight monitoring** **Height measurement** Mid upper arm circumference measurement Screening for malnutrition

*Interventions/services listed in **bold font** are those on which our study collected data

Immunization

An estimated two million children worldwide die from vaccine-preventable diseases every year [39]. An integral part of preventing these deaths is through immunization. In Kenya, The Expanded Programme on Immunisation (EPI) under the Ministry of Health aims to fully immunize children before they reach one year of age. Universal vaccination coverage for vaccine-preventable diseases among children in Kenya is crucial to achieving optimal infant and child health. Children in Kenya are immunized against tuberculosis, diphtheria, whooping cough (pertussis), tetanus, polio, measles, hepatitis B, *Haemophilus influenza* type b (Hib), *Streptococcus pneumonia*, and rotavirus [3].

Immunization against tuberculosis is achieved through administration of the Bacillus Calmette-Guerin (BCG). Protection against Diphtheria, pertussis, tetanus, hepatitis B, and Hib is provided through the pentavalent vaccine. Immunization against the polio virus is achieved through administration of the Oral Polio Vaccine (OPV) and measles has its own vaccine. Lastly, children are vaccinated against Streptococcus pneumoniae via administration of the pneumococcal conjugate vaccine (PCV) [3]. Children receive these immunizations at varying times. The timing and sequence for each vaccine and series are listed below:

- BCG (1 dose) – at birth or first clinical contact

- Pentavalent (3 doses) – 6, 10, and 14 weeks of age
- OPV (4 doses) – birth, 6, 10, and 14 weeks of age
- Measles (2 doses) – 9 and 18 months of age
- PCV (3 doses) – 6, 10, and 14 weeks of age
- Rotavirus (2 doses) – 6 and 10 weeks of age

According to the WHO, children are considered to have received all basic immunizations once they receive BCG at birth, the full series of Pentavalent and OPV (at 6, 10, and 14 weeks), and measles at 9 months of age. The Kenyan EPI expands upon this and considers children to be fully vaccinated once they receive these basic immunizations in addition to three doses of PCV.

Deworming

Soil-transmitted helminth infections present in children are associated with malnutrition, poor physical growth, and cognitive impairment by increasing malabsorption of nutrients and feeding on host tissues, resulting in a loss of nutrients available for the body [40, 41]. To clear these infections, the World Health Organization recommends children ages 12-59 months receive one dose of either albendazole or mebendazole every 6 months. This strategy has been found to be very cost-effective [3].

Vitamin A Supplementation

Micronutrient deficiency is a key aspect of undernutrition that can contribute to childhood morbidity and mortality. Due to Vitamin A being an essential micronutrient for the immune system, a deficiency of this vitamin can make children more susceptible to infections and even increase their severity [3]. Vitamin A deficiency affects nearly 30% of children in low- and middle-income countries and is linked to child mortality [42]. To prevent vitamin A deficiency, high-dose vitamin A is given once every 6 months as a supplement, beginning at 6

months of age and ending at 59 months of age [3]. High coverage of vitamin A supplementation has been found to decrease mortality in children ages 6-59 months by up to 24% [43].

Coverage of Interventions and Services

While the scaling up of interventions and services is largely responsible for the decline in childhood mortality, monitoring coverage of these interventions and services is critical to determine gaps in coverage [44].

Immunization coverage among children 12-23 months in Kenya has fluctuated a considerable amount since 1993, when 79% of this cohort received all of the basic vaccinations (BCG+OPV+pentavalent+measles) [20]. From 1993-1998, this proportion declined from 79% to 65% and then declined again to 57% in 2003 [20, 21]. By 2008-09, the proportion increased significantly to 77% and increased again slightly to 79% by 2014 [3, 21]. A systematic assessment of RMNCH in Kenya calculated national-level trends in intervention and service coverage along all stages of the maternal, neonatal, and child health continuum [5]. In 2014, this assessment found vaccination coverage in Kenya ranged from 96.7% for BCG, to 90% for OPV, and 85% for measles [5]. Slightly more than three out of four children were fully vaccinated (77.4%) [5]. Further, improvements in full vaccination were found to be related to higher literacy among parents and less poverty, among other variables [5]. According to the Countdown to 2030 report, in 2016 the pentavalent vaccine coverage was highest at 89% [15]. Coverage for measles, rotavirus, and PCV vaccines were 75%, 74%, and 78%, respectively [15]. Compared to median coverage among all 81 Countdown priority countries, pentavalent vaccine coverage was higher in Kenya (89% compared to 87%) as was rotavirus coverage (74% vs 59%) [3, 15]. Measles and PCV coverage were lower in Kenya than the Countdown priority countries as a whole [3, 15]. Due to the multiple doses required for the pentavalent, OPV, and PCV vaccines, some children

did not receive the final dose after receiving the first. This event, termed vaccine dropout, had a rate of 8% for pentavalent and OPV and 9% for PCV [3].

Immunization coverage in Kenya varies by maternal education status, wealth, and region [45, 46]. Only 55% of children whose mothers had no education are fully immunized compared to 75% of those whose mothers had completed primary education [3]. Based on wealth, children in the lowest quintile are less likely to be fully immunized compared to children in the other quintiles (62% and 80%, respectively) [3]. Regional disparities in full immunization rate are quite apparent and range from 51% in North Eastern Kenya to 90% in Central. Rift Valley and Western regions are 68.7% and 77.8%, respectively [3].

The 2014 KDHS evaluated coverage of vitamin A supplementation and deworming. According to this study, 72% of children 12-59 months received vitamin A supplementation in the 6 months preceding the survey while 51% of the same cohort received deworming medication in the same time period [3]. Disparity among deworming coverage were evident, with 48% of rural areas dewormed compared to 57% of urban areas [3]. This disparity was less pronounced in vitamin A supplementation coverage, with 75% covered in urban compared to 70% in rural areas [3].

Summary

Throughout this literature review, child health, survival and development in SSA and Kenya have been discussed. The substantial progress in reducing child mortality has been noted, however, children in SSA and Kenya are still at risk of mortality, poor health, and poor development. The majority of deaths among children under five can be prevented with effective interventions and services that exist along the maternal, infant, and child health continuum. While scaling up services and interventions along the continuum has led to significant progress

in reducing child deaths, it is critically important to monitor and assess coverage of these interventions and address any disparities that may make certain populations more vulnerable. While national coverage in Kenya is high, this can distort and misrepresent coverage at the sub-national level. Further, as more and more children are surviving as a result of the successes through the MDG and now SDG era, early childhood development demands more attention. Little is known about how and to what extent child development services are integrated into routine child health care in low-resource settings despite the substantial proportion of children in this setting at risk of not achieving their full potential. In addition, there is no established way to determine the number of children experiencing developmental delays in these settings. Therefore, it is imperative to assess what, if any, child development services are offered in these clinics and to determine how both caregivers and healthcare workers perceive the provision of these services.

Chapter 3: Methodology

This chapter provides an overview of the study setting and population, procedures involved in data collection, the data collection tools and data sources, and data management and analysis procedures.

The purpose of this cross-sectional descriptive study was to describe the coverage of services and interventions provided to infants and children at six maternal and child health clinics in western Kenya, identify gaps in the services provided, and to identify factors that may be associated with lower coverage.

Population and sample

The Academic Model Providing Access to Healthcare (AMPATH), an institutional partnership between Moi University School of Medicine and Indiana University, aims to improve delivery of healthcare services through research in western Kenya. This existing partnership and their close collaboration with the local MCH clinics throughout the region provided the rationale for the selection of the study setting. This study took place in six MCH clinics located in Bungoma, Nandi, Trans Nzoia, and Uasin Gishu counties located in western Kenya. The clinics were located in the towns of Eldoret, Turbo, Webuye, Mosoriot, Burnt Forest, and Kitale (Figure 5).

Caregivers bringing a child under the age of five years to the MCH clinic were recruited for inclusion in the present study. A member of the research team spent one day at each of the six MCH clinics and actively recruited participants by approaching each caregiver present at the MCH clinic. A total of 78 caregivers consented and agreed to participate in the study. Distribution of caregivers across the six sites can be seen in Table 2. Only 1 caregiver chose not

to participate in the study. For each caregiver, the child they brought to clinic was also included in the study, however, only retrospective data collection was undertaken for the children.

Table 2. Caregiver Recruitment by MCH Site

Site	Caregivers & Children
Eldoret	10
Turbo	17
Webuye	10
Mosoriot	16
Burnt Forest	11
Kitale	14
Total	78

Figure 5. Map of AMPATH Clinic Sites (study sites designated by circle)

Procedures

The data collected from caregivers were obtained through brief oral interviews. Interviews were conducted in either English or Kiswahili, whichever the participant felt most comfortable speaking. One member of the study staff was trained to ask questions on the questionnaire and to categorize the responses into the pre-assigned answer choices. A free text

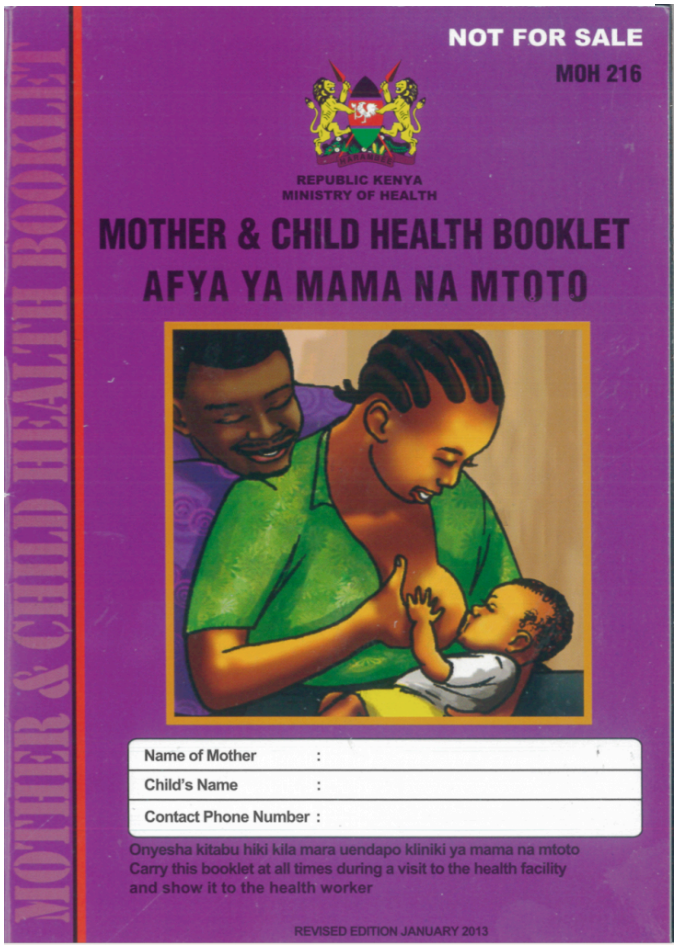
option was used if the study team member found that any categories were not appropriate. As previously mentioned, retrospective data collection was performed to ascertain health services related data for each child. This consisted of a member of the study staff reviewing the contents of the caregiver's Mother and Child Health Booklet.

Instruments

The caregiver questionnaire was designed and used to capture demographic information as well as the knowledge, attitudes, and practices of caregivers bringing a child to the MCH clinic related to services offered at their MCH clinic, their child's development, when they bring their child to the clinic, and what barriers may prevent them from coming to clinic.

Kenya began using The Mother and Child Health Booklet (Figure 6) in 2008 in an attempt to link maternal and child health care and have one comprehensive medical record [47]. The Mother and Child Health Booklet also is intended to be used by the mother for educational purposes to improve her and her child's health. It is to be brought to every visit with a healthcare provider as it is the primary health record for a mother and her child. Healthcare providers are instructed to record services and

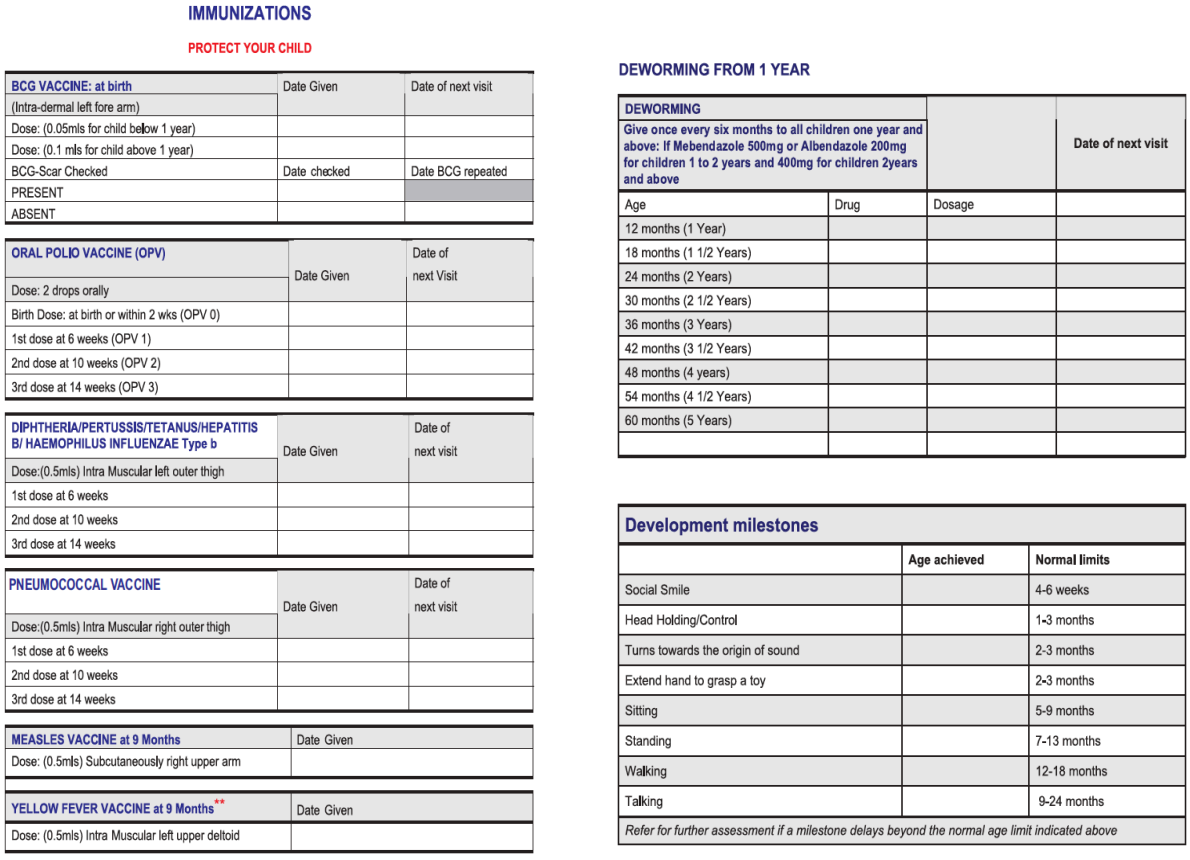
Figure 6. Kenya's Mother and Child Health Booklet



interventions provided at each visit in the booklet.

For the present study, the records marked by healthcare providers in the booklets were reviewed specifically for immunizations, vitamin A supplementation, deworming, growth monitoring, and child development screening. The pages from which data were extracted can be seen in Figure 7. For immunizations, whether the child received each dose in each vaccine series was recorded. For vitamin A supplementation, deworming, and growth monitoring, whether these services were provided at each appropriate time point or visit was recorded. For all health services data, distinction was made between not receiving services due to them not being offered and a child being ineligible due to age (1 = yes, 2 = no, 0 = ineligible/not applicable). Eligibility for health services was verified by referencing the age of the child, presence at MCH clinic, and timing of service delivery.

Figure 7. Sample Pages from Mother and Child Health Booklet



IMMUNIZATIONS

PROTECT YOUR CHILD

BCG VACCINE: at birth	Date Given	Date of next visit
(Intra-dermal left fore arm)		
Dose: (0.05mls for child below 1 year)		
Dose: (0.1 mls for child above 1 year)		
BCG-Scar Checked	Date checked	Date BCG repeated
PRESENT		
ABSENT		

ORAL POLIO VACCINE (OPV)	Date Given	Date of next Visit
Dose: 2 drops orally		
Birth Dose: at birth or within 2 wks (OPV 0)		
1st dose at 6 weeks (OPV 1)		
2nd dose at 10 weeks (OPV 2)		
3rd dose at 14 weeks (OPV 3)		

DIPHTHERIA/PERTUSSIS/TETANUS/HEPATITIS B/ HAEMOPHILUS INFLUENZAE Type b	Date Given	Date of next visit
Dose:(0.5mls) Intra Muscular left outer thigh		
1st dose at 6 weeks		
2nd dose at 10 weeks		
3rd dose at 14 weeks		

PNEUMOCOCCAL VACCINE	Date Given	Date of next visit
Dose:(0.5mls) Intra Muscular right outer thigh		
1st dose at 6 weeks		
2nd dose at 10 weeks		
3rd dose at 14 weeks		

MEASLES VACCINE at 9 Months	Date Given
Dose: (0.5mls) Subcutaneously right upper arm	

YELLOW FEVER VACCINE at 9 Months**	Date Given
Dose: (0.5mls) Intra Muscular left upper deltoid	

DEWORMING FROM 1 YEAR

DEWORMING Give once every six months to all children one year and above: If Mebendazole 500mg or Albendazole 200mg for children 1 to 2 years and 400mg for children 2years and above			Date of next visit
Age	Drug	Dosage	
12 months (1 Year)			
18 months (1 1/2 Years)			
24 months (2 Years)			
30 months (2 1/2 Years)			
36 months (3 Years)			
42 months (3 1/2 Years)			
48 months (4 years)			
54 months (4 1/2 Years)			
60 months (5 Years)			

Development milestones		
	Age achieved	Normal limits
Social Smile		4-6 weeks
Head Holding/Control		1-3 months
Turns towards the origin of sound		2-3 months
Extend hand to grasp a toy		2-3 months
Sitting		5-9 months
Standing		7-13 months
Walking		12-18 months
Talking		9-24 months
Refer for further assessment if a milestone delays beyond the normal age limit indicated above		

Variables

Following the conclusion of data collection, health services records extracted from the Mother and Child Health Booklets and responses from the caregiver questionnaires were entered into a Microsoft Excel file.

For immunizations, variables were created for each vaccine series to determine whether each child was up-to-date for each vaccine. Being up-to-date was defined for each vaccine as the child receiving every dose in the series they were eligible for, based on age. For example, if a child was 12 weeks old and they received the first three doses of OPV (at birth, 6 weeks, and 10 weeks), they were determined to be up-to-date on OPV despite this child not receiving the last dose (given at 14-weeks). An additional variable, (allvax_uptodate), was created and accounted for every vaccine and series in the immunization schedule. If a child had received all vaccines and was up-to-date on all series in the immunization schedule, they were considered up-to-date on all vaccines and fully vaccinated for their age. Similar variables following the same criteria were created for vitamin A supplementation, deworming, and growth monitoring. For Vitamin A, a variable (vita_allrecdoses) was created and determined whether the child received each administration of vitamin A supplementation they were eligible for, based on age. For deworming, a variable (deworm_allrecdoses) was created and determined whether the child received each administration of deworming medicine they were eligible for. For growth monitoring, a variable (weight_allvisits) was created and determined whether a weight measurement was recorded at each visit the child was present. Height was not accounted for in the growth monitoring variable due to so few children having a height measurement recorded.

Table 3. List of Immunization and Vitamin A Supplementation Variables

Variable	Definition
Immunization Variables	
BCG	Proportion of children receiving BCG vaccine at birth
OPV_Birth	Proportion of children receiving the first dose of OPV at birth
OPV_6week	Proportion of children >6 weeks of age receiving the second dose of OPV
OPV_10week	Proportion of children >10 weeks of age receiving the third dose of OPV
OPV_14week	Proportion of children >14 weeks of age receiving the fourth dose of OPV
OPV_uptodate	Proportion of children receiving all OPV doses they were eligible for
Pent_6week	Proportion of children >6 weeks of age receiving the first dose of pentavalent vaccine
Pent_10week	Proportion of children >10 weeks of age receiving the second dose of pentavalent vaccine
Pent_14week	Proportion of children >14 weeks of age receiving the third dose of pentavalent vaccine
Pent_uptodate	Proportion of children receiving all doses of pentavalent vaccine they were eligible for
Pneum_6week	Proportion of children >6 weeks of age receiving the first dose of the pneumococcal conjugate vaccine
Pneum_10week	Proportion of children >10 weeks of age receiving the second dose of the pneumococcal conjugate vaccine
Pneum_14week	Proportion of children >14 weeks of age receiving the third dose of the pneumococcal conjugate vaccine
Pneum_uptodate	Proportion of children receiving all doses of the pneumococcal conjugate vaccine they were eligible for
Rotavirus_6week	Proportion of children >6 weeks of age receiving the first dose of the rotavirus vaccine
Rotavirus_10week	Proportion of children >10 weeks of age receiving the second dose of the rotavirus vaccine
Rotavirus_uptodate	Proportion of children receiving all doses of the rotavirus vaccine they were eligible for
Measles_9month	Proportion of children >9 months of age receiving the first dose of the measles vaccine
Measles_18month	Proportion of children >18 months of age receiving the second dose of the measles vaccine
Measles_uptodate	Proportion of children receiving all doses of the measles vaccine they were eligible for
Allvax_uptodate	Proportion of children receiving every dose in every series they were eligible for
Vitamin A Supplementation Variables	
Vita_6month	Proportion of children >6 months of age receiving vitamin A supplementation at 6 months of age

Vita_12months	Proportion of children >12 months of age receiving vitamin A supplementation at 12 months of age
Vita_18months	Proportion of children >18 months of age receiving vitamin A supplementation at 18 months of age
Vita_24months	Proportion of children >24 months of age receiving vitamin A supplementation at 24 months of age
Vita_allrecdoses	Proportion of children receiving every dose of vitamin A supplementation they were eligible for

*** for redundancy sake, deworming and weight monitoring variables are not listed because they follow the same format as immunization and vitamin A supplementation

Data Analysis

Descriptive statistics were used to analyze the responses from the caregiver questionnaire and the proportion of children who received health services and those up-to-date (having received all services they were eligible for). These health services included immunizations, vitamin A supplementation, deworming, growth monitoring, and child development screening.

Pearson's chi-square test was applied to determine whether there was a significant difference in the proportion of males and females up-to-date on all vaccines, vitamin A supplementation, deworming, and weight measurement.

Multiple variable logistic regression models were applied in order to analyze variables that could be predictive of a child being considered fully vaccinated and up-to-date on all vaccines they were eligible for. The outcome variable (allvax_uptodate) was divided into two categories: yes or no. This outcome variable was used because children included in the sample were so young and using fully-vaccinated among children 12-23 months, which is traditionally used, would not have been effective as only 4 children in the sample were older than 12 months. Independent variables used in in the logistic regression models include the age of the caregiver, presence of other children in the home, type of transportation used to travel to MCH clinic, time it takes to travel to MCH clinic, MCH clinic site, and gender of the child.

Cohen's h was used to compare and describe the difference in the proportion of children up-to-date on all vaccines between MCH clinic sites [48]. Cohen's h calculates an effect size and determines the difference between two proportions. Pair-wise comparisons were made between each MCH site and effect sizes were calculated. Predetermined threshold cut-offs by Cohen were used to describe the differences between MCH sites (h = .2 = small difference, h = .5 = medium difference, and h = .7 = large difference). Only pair-wise comparisons with large differences were reported. All analyses were conducted using SPSS (version 24).

Chapter 4: Results

This chapter presents the findings of the univariate and bivariate analyses. Expected and unexpected results will be discussed.

The background characteristics for both the caregivers and children are presented in Table 4. The majority of caregivers who participated in the study were mothers of the children brought to clinic (98.7%), while one caregiver was identified as household help. Nearly half of all caregivers (46.2%) were between the ages of 25 – 29 years and 61.5% had more than one child. Among the children included in the study, gender was evenly distributed (50%) and the mean age was 22.0 weeks. Only four children in the sample were over the age of 12 months. MCH clinics in Turbo and Mosoriot had the most caregivers in the study (n=17, n=16, respectively) followed by Kitale (n=14), Burnt Forest (n=11), Eldoret (n=10), and Webuye (n=10).

Table 4. Participant Demographics

Variable	N (%)
Caregiver's Relationship to Child	
- Mother	77 (98.7)
- Household Help	1 (1.3)
Caregiver's Age (in years)	
- < 20	1 (1.3)
- 20 – 24	16 (20.5)
- 25 – 29	36 (46.2)
- 30 – 34	17 (21.8)
- 35 – 39	6 (7.7)
- Over 40	2 (2.6)
Other Children in the Home	
- Yes	48 (61.5)
- No	30 (38.5)
Gender of Child	
- Male	39 (50.0)
- Female	39 (50.0)
Age of Child (in months)	
- < 1	13 (16.7)
- 1 – 3	29 (37.2)
- 4 – 6	14 (17.9)
- 7 – 9	8 (10.3)
- 10 – 12	10 (12.8)
- > 12	4 (5.1)
Age of Child (in weeks)	
- Mean: 22.0	

Over eighty-percent (n=64) of caregivers began bringing their child to clinic within the first 28 days of life. Among caregivers, 35.9% had to travel between 30-59 minutes to reach their MCH clinic while slightly less (29.5%) had to travel for more than 1 hour. The remaining

caregivers travelled less than 30 minutes. The most common forms of transportation used to reach clinic were motorbike (38.5%) and walking (37.2%), while the remaining 24.4% of caregivers use a matatu. Matatus are privately owned share taxis. The most common reasons given by caregivers for bringing their child to clinic were weight checks (62.8%), immunizations (53.8%), and routine health monitoring (39.7%). Only 20.5% indicated vitamin A supplementation as a reason and even less, 10.3%, listed seeking treatment for illness. When asked what types of services their MCH clinic offered, most caregivers (98.7%) listed growth monitoring while 48.7% and 37.2% listed immunizations and nutrition, respectively. Only 7.7% listed vitamin A supplementation and just two caregivers (2.3%) said their MCH clinic offered educational health talks and teaching for mothers.

Immunizations

Among the six vaccines included in the routine immunization schedule in Kenya, all but one, BCG, is given in a series of multiple doses. Individual dose coverage for all vaccines in the immunization schedule ranged from 84.4% to 100%. The third dose of OPV had the highest coverage at 100% while the first dose of rotavirus vaccine had the lowest (84.4%). Out of fifteen total doses of vaccine given, only four doses had coverage below 90% (Figure 8 and Table 5).

OPV A larger proportion of children received each of the last three doses of OPV than the first which is given at birth. Birth coverage was 92.3%, while the 6, 10, and 14 week doses were 93.8%, 100%, and 95.3%, respectively.

Pentavalent Nearly all (96.9% and 98%) children received the first and second doses of pentavalent vaccine, respectively. Coverage remained high for the last dose (93.2%). The drop-out rate for the pentavalent vaccine (the proportion of children receiving the first dose in the series but not the third if eligible), a common way to measure access to services, was 6.7%.

PCV Slightly less than ninety-percent (89.1%) of eligible children received the first dose of the PCV vaccine given at six weeks. A larger proportion of children received the second (94%) and third (90.9%) doses.

Rotavirus Both the 6 and 10 week doses of rotavirus vaccine had coverage below 90% (84.4% and 89.8%, respectively).

Measles Sixteen of the eighteen or 88.9% of children eligible for the measles vaccine given at nine months received it. All six children eligible for the second (18 month) dose received it.

Among vaccines incorporating a 10-week dose in their full series (OPV, pentavalent, PCV, and rotavirus), the dose with the highest coverage was the 10-week for all regardless of whether it was the second (pentavalent, PCV, rotavirus) or third (OPV) dose in the series.

Figure 8. Individual Dose Coverage for Each Vaccine Series

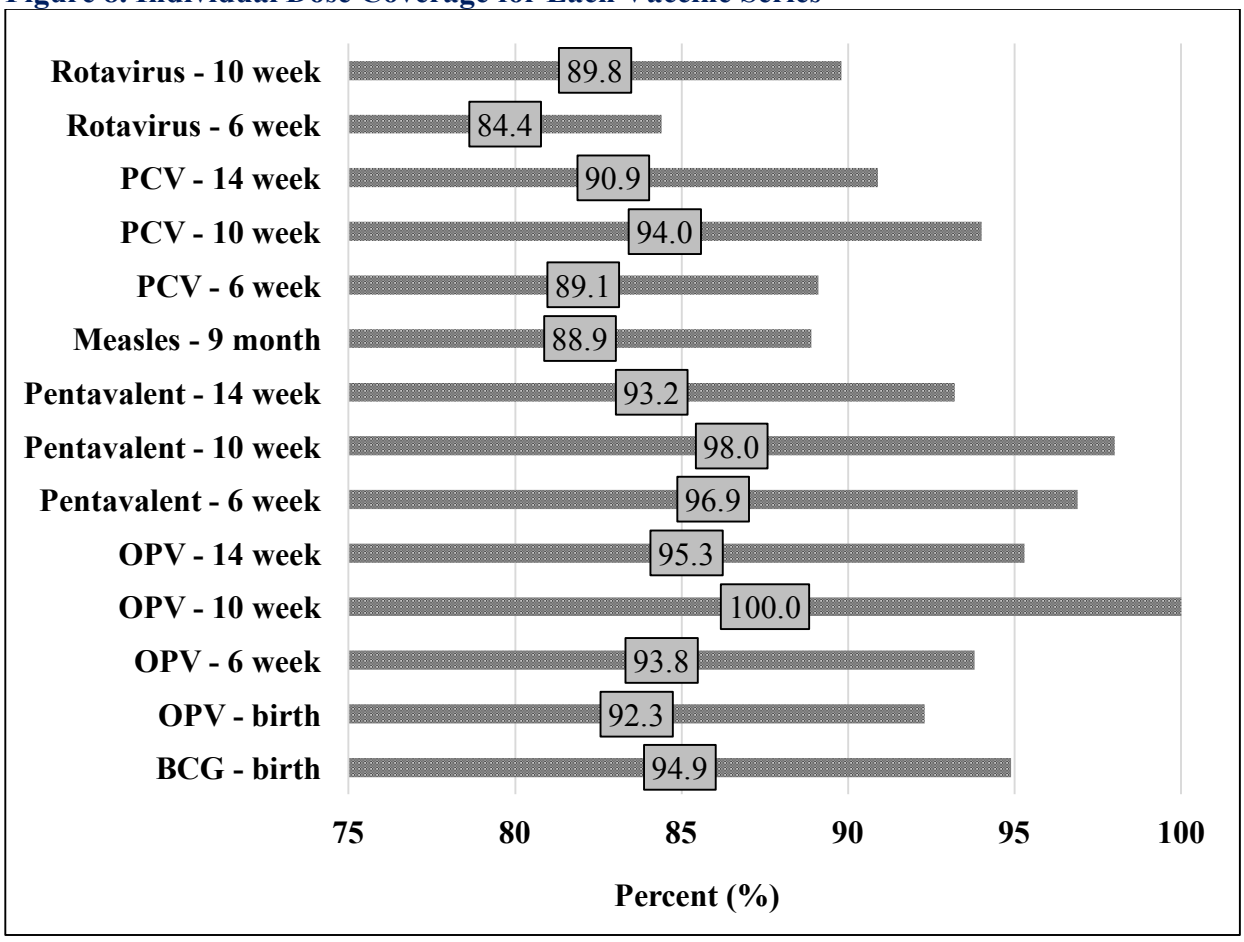


Table 5. Number and Percentage of Eligible Children Receiving Specific Vaccinations by Background Characteristics

	BCG	OPV				Pentavalent			Measles	PCV			Rotavirus	
	n (%)	n (%)				n (%)			n (%)	n (%)			n (%)	
	0[a]	0[a]	1[b]	2[c]	3[d]	1[b]	2[c]	3[d]	1[e]	1[b]	2[c]	3[d]	1[c]	2[d]
Sex														
Male	37 (94.9)	37 (94.9)	31 (93.9)	26 (100)	22 (100)	33 (100)	26 (100)	22 (100)	8 (88.9)	31 (93.9)	26 (100)	22 (100)	29 (87.9)	22 (88)
Female	37 (94.9)	35 (89.7)	29 (93.5)	24 (100)	19 (90.5)	29 (93.5)	23 (95.8)	19 (86.4)	8 (88.9)	26 (83.4)	21 (87.5)	18 (81.8)	25 (80.6)	22 (91.7)
MCH site														
Eldoret	10 (100)	9 (90)	10 (100)	7 (100)	6 (100)	10 (100)	7 (100)	6 (100)	1 (100)	10 (100)	7 (100)	5 (83.3)	9 (90)	5 (83.3)
Turbo	14 (82.4)	16 (94.1)	13 (100)	11 (100)	9 (90)	13 (100)	11 (100)	10 (90.9)	8 (100)	13 (100)	10 (90.9)	10 (90.9)	11 (84.6)	10 (90.9)
Webuye	10 (100)	10 (100)	5 (100)	10 (100)	4 (100)	5 (100)	5 (100)	4 (100)	0 (0)	5 (100)	5 (100)	4 (100)	5 (100)	5 (100)
Mosoriot	15 (93.8)	13 (81.3)	12 (80)	16 (100)	9 (100)	14 (93.3)	11 (100)	9 (100)	2 (100)	10 (66.7)	10 (90.9)	9 (100)	10 (66.7)	10 (90.9)
Burnt Forest	11 (100)	10 (90.9)	10 (90.9)	9 (100)	9 (100)	10 (90.9)	8 (88.9)	8 (88.9)	5 (100)	9 (81.8)	8 (88.9)	8 (88.9)	10 (90.9)	9 (100)
Kitale	14 (100)	14 (100)	10 (100)	7 (100)	4 (80)	10 (100)	7 (100)	4 (80)	0 (0)	10 (100)	7 (100)	4 (80)	9 (90)	5 (71.4)
Total	74 (94.9)	72 (92.3)	60 (93.8)	50 (100)	41 (95.3)	62 (96.9)	49 (98)	41 (93.2)	16 (88.9)	57 (89.1)	47 (94)	40 (90.9)	54 (84.4)	44 (89.8)

a = dose given at birth, b = dose given at 6 weeks of age, c = dose given at 10 weeks of age, d = dose given at 14 weeks of age, e = dose given at 9 months of age

After accounting for varying child age and eligibility for vaccines, the proportion of children up-to-date on each vaccine was calculated (Table 6 and Figure 9). BCG vaccine given at birth had the highest coverage of all vaccines (94.9%) while PCV and rotavirus had the lowest (each 82.8%). The proportion of children up-to-date on pentavalent, OPV, and measles was 92.2%, 85.9%, and 88.9%, respectively. A lesser proportion of females were up-to-date on all vaccines, with the exception of BCG and measles which had the same coverage as males. Across all MCH sites, Mosoriot was the only site where coverage fell below 80% for any

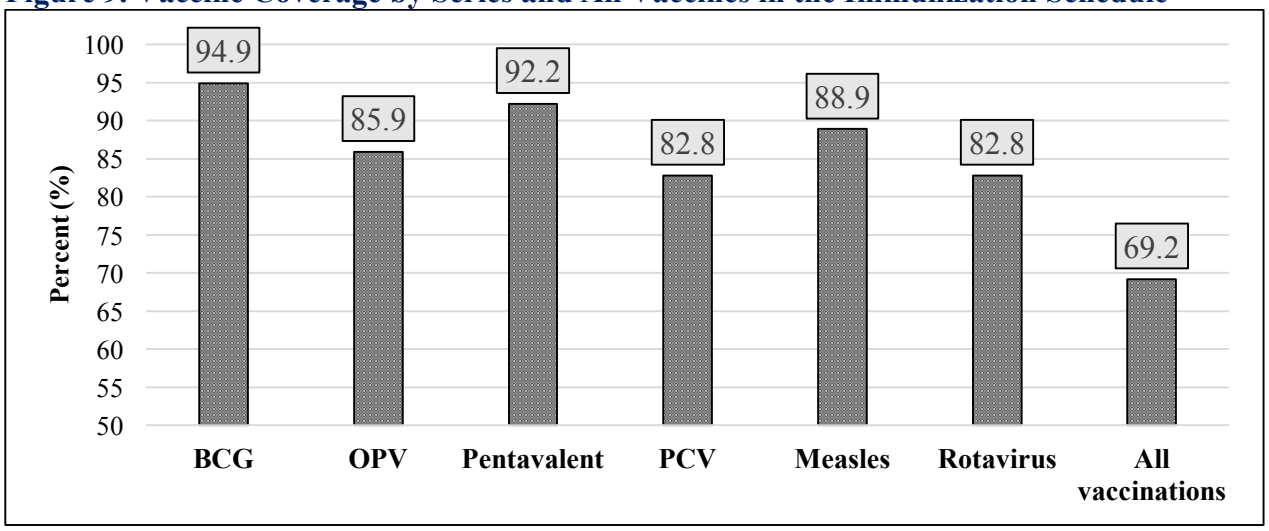
single vaccine. Here, less than 80% of children were up-to-date on OPV (68.8%), PCV (66.7%), and rotavirus (66.7%).

Slightly less than seventy percent (69.2%) of children were up-to-date on all vaccines and fully vaccinated for their age. Gender was found to be significantly associated with being up-to-date on all vaccines ($p = .017$) as males were 3.5 times more likely to be up-to-date for all vaccines than females [95% CI 1.256, 9.936]. More than 8 out of every 10 males in the sample (82.1%) were up-to-date on all vaccines compared to just 56.4% of females. Further analysis revealed there was a significant difference in the proportion of children up-to-date on all vaccines between MCH sites. Among all MCH sites, Kitale had the highest proportion of children up-to-date on all vaccines and fully vaccinated for their age (92.9%).

Table 6. Number and Percent of Children Up-to-Date on Vaccines by Sex and MCH Site

	BCG n (%)	OPV n (%)	Pentavalent n (%)	PCV n (%)	Measles n (%)	Rotavirus n (%)	Fully Vaccinated n (%)
Sex							
Male	37 (94.9)	36 (92.3)	33 (100)	31 (93.9)	8 (88.9)	28 (84.8)	**32 (82.1)**
Female	37 (94.9)	31 (79.5)	26 (83.9)	22 (71)	8 (88.9)	25 (80.6)	**22 (56.4)**
MCH Site							
Eldoret	10 (100)	9 (90)	10 (100)	9 (90)	1 (100)	9 (90)	**8 (80)**
Turbo	14 (82.4)	15 (88.2)	12 (92.3)	11 (84.6)	8 (100)	11 (84.6)	**11 (64.7)**
Webuye	10 (100)	10 (100)	5 (100)	5 (100)	0 (0)	5 (100)	**8 (80)**
Mosoriot	15 (93.8)	11 (68.8)	14 (93.3)	10 (66.7)	2 (100)	10 (66.7)	**7 (43.8)**
Burnt Forest	11 (100)	9 (81.8)	9 (81.8)	9 (81.8)	5 (100)	10 (90.9)	**7 (63.6)**
Kitale	14 (100)	13 (92.9)	9 (90)	9 (90)	0 (0)	8 (80)	**13 (92.9)**
Total	**74 (94.9)**	**67 (85.9)**	**59 (92.2)**	**53 (82.8)**	**16 (88.9)**	**53 (82.8)**	**54 (69.2)**

Figure 9. Vaccine Coverage by Series and All Vaccines in the Immunization Schedule



Limited by small sample size at each site, Cohen's h was calculated comparing each MCH clinic site proportion of children up-to-date on all vaccines to each of the other clinics. There was found to be a significant difference between Mosoriot (43.8%) and Kitale (92.9%), with an effect size of (h = 1.2). In Eldoret and Webuye, 80% of children were up-to-date on all vaccines, while less than two-thirds were in Turbo (64.7%) and Burnt Forest (63.6%). Except for the previously mentioned gender of the child, logistic regression did not reveal any other variables associated with a child being up-to-date on all vaccines (Table 7).

Table 7. Variables Included in Logistic Regression Model with Up-to-Date on All Vaccines

Independent Variable	***Up-to-date on all vaccines***	
	Odds Ratio (95% CI)	p-value
Caregiver age	.656 (.382, 1.126)	1.126
Other children in the home	.943 (.350, 2.540)	.907
Type of transportation taken to MCH	.866 (.597, 1.314)	.546
MCH clinic site	.933 (.700, 1.244)	.637
Travel time to MCH	1.039 (.551, 1.959)	.907
Child gender	3.532 (1.256, 9.936)	**.017**[a]

[a] - bolded values met statistical significance, with an α set at 0.05

Vitamin A and Deworming

Only 35.9% (n=28) of children in the sample were old enough to be eligible for vitamin A supplementation (VAS). Of these, over seventy-five percent (78.6%) received VAS at 6 months of age, while 50% received it at 12 months of age. All children received VAS at 18 and 24 months of age (n = 3, n = 1, respectively). Twenty-two (78.6%) of children received every dose of VAS for which they were eligible (Table 8). VAS coverage was nearly the same for males (80%) and females (77%). Turbo and Burnt Forest were the only MCH sites where a child did not receive VAS. Only 3/7 of children received VAS in Turbo compared to 3/5 in Burnt Forest. However, VAS was not significantly associated with MCH site (p = .054).

Of the 6 children eligible to receive deworming medicine at 12 months of age, just 2 (33.3%) received it (Table 8). At 12 months, none of the 4 females eligible received deworming while both males did. At 18 months of age, none of the 3 children eligible received deworming. One child was eligible for deworming at 24 months and they received the medicine.

Table 8. Number and Percentage of Children Receiving Individual and All Eligible Doses of Vitamin A Supplementation and Deworming Medicine

Vitamin A					Deworming			
6 months n (%)	12 months n (%)	18 months n (%)	24 months n (%)	All eligible doses n (%)	12 months n (%)	18 months n (%)	24 months n (%)	All eligible doses n (%)
22 (78.6)	3 (50)	3 (100)	1 (100)	22 (78.6)	2 (33.3)	0 (0)	1 (100)	2 (33.3)

Growth Monitoring

Only one-third (n=26) of children had a birthweight recorded. The proportion of children having a weight measurement recorded at their first MCH clinic visit, at six weeks of age, was 83.1%. The majority of children had a weight measurement recorded at all MCH visits and the proportion dropped below 70% for one visit interval throughout the 24-month period (Table 9).

Among all children in the sample, 61.5% had weight recorded at every MCH visit. Two-thirds of males (66.7%) had weight recorded at every visit compared to 56.3% of females, however, the association between presence of a recorded weight measurement and gender was not significant (p = .658). Across MCH sites, Eldoret and Kitale had the highest proportions of weight recording, 100% and 90%, respectively, while Burnt Forest (22.2%) and Turbo (30.8%) had the lowest. Only 30.8% (n = 24) of children had a height measurement recorded at one or more MCH clinic visits. None had a height measurement recorded at every MCH visit.

Table 9. Number and Percentage of Children with Weight Recorded at Each Visit

	6 weeks	10 weeks	14 weeks	4 months	5 months	6 months	7 months	8 months	9 months	10 months	11 months	12 months	18 months	24 months	Every Visit
Sex															
Male	27 (81.8)	27 (100)	21 (91.3)	18 (94.7)	15 (100)	15 (93.8)	11 (84.6)	10 (76.9)	9 (90)	4 (66.7)	2 (66.7)	3 (100)	0 (0)	0 (0)	**22 (66.7)**
Female	27 (84.4)	23 (88.5)	21 (88)	14 (73.7)	12 (85.7)	12 (92.3)	6 (66.7)	6 (66.7)	6 (66.7)	6 (75)	3 (50)	2 (50)	3 (75)	1 (100)	**18 (56.3)**
MCH Site															
Eldoret	10 (100)	7 (100)	7 (100)	3 (100)	2 (100)	2 (100)	1 (100)	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	**10 (100)**
Turbo	9 (69.2)	11 (91.7)	10 (90.9)	9 (81.8)	8 (100)	7 (88)	5 (63)	4 (50)	6 (75)	2 (40)	3 (75)	3 (75)	1 (50)	1 (100)	**4 (30.8)**
Webuye	6 (100)	5 (100)	5 (100)	3 (75)	2 (66.7)	3 (75)	2 (66.7)	2 (66.7)	3 (100)	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	**5 (83.3)**
Mosoriot	13 (86.7)	12 (92.3)	8 (80)	8 (88.9)	9 (100)	8 (100)	4 (100)	4 (100)	1 (50)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	**10 (66.7)**
Burnt Forest	6 (54.5)	8 (88.9)	7 (77.8)	7 (88)	4 (80)	5 (100)	4 (80)	4 (80)	4 (80)	4 (80)	2 (40)	2 (66.7)	2 (100)	0 (0)	**2 (22.2)**
Kitale	10 (100)	7 (100)	5 (100)	2 (66.7)	2 (100)	2 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**9 (90)**
Total	**54 (83.1)**	**50 (94.3)**	**42 (89.4)**	**32 (84.2)**	**27 (93.1)**	**27 (93.1)**	**17 (77.3)**	**16 (72.7)**	**15 (78.9)**	**10 (71.4)**	**5 (55.6)**	**5 (71.4)**	**3 (75)**	**1 (100)**	**40 (61.5)**

Child Development

Only two caregivers stated that their MCH clinic provided services related to child development and screening, however, no children in the sample had any developmental screening recorded within the allotted space in the Mother and Child Health Booklet. Four caregivers (5.1%), all from the MCH clinic in Turbo, had concerns related to their child's development. Despite the small number of caregivers having concerns related to their child's development, 79.5% of all caregivers reported that they would very much like having child development screening incorporated into their MCH clinic visits. When asked how they can help their child to develop, 60.7% and 34.4% of caregivers stated breastfeeding and good feeding practices, respectively. Keeping the child clean (16.4%), ensuring the child is taken care of and brought to clinic (11.5%), providing a clean environment and home (8.2%), and helping them to exercise and walk (6.6%) were other responses given. Based on the play and communication activities present in the Mother and Child Health Booklet, only 21.8% of caregivers correctly identified at least one activity in which they can help their child to develop.

Chapter 5: Discussion

This study looks at the levels of coverage of health services and interventions provided to children aged <1–24 months at six MCH clinics located in rural western Kenya. Additionally, this study assessed caregivers' knowledge, attitudes, and practices regarding their child's development and the services provided at their MCH clinic. In this small cross-sectional study of six MCH clinics, we found that coverage rates within our study were consistent with regional data in Kenya's national surveys. However, these rates are still below the necessary coverage rates for adequate herd immunity. Furthermore, disparity of coverage between various clinic locations was present, although this did not meet statistical significance. Additionally, we found that barriers to accessing care at MCH clinics and longer travel duration to arrive at clinic did not affect vaccination coverage. Males were found to have higher coverage for vaccination and for nearly all other services included in the study than females. In this study, we also found that MCH clinics lacked developmental screening services and no children had developmental screening completed in their booklet. Furthermore, caregivers were unable to differentiate between physical growth and child development, and lastly, caregivers showed a lack of knowledge on how to enhance their child's development.

The estimated 69.2% of children up-to-date on all vaccines and fully vaccinated for their age in the six MCH clinics included in this study is comparable to national estimates in Kenya based off of the most recent 2014 KDHS [3]. According to this KDHS, 74.9% of children are fully vaccinated in Kenya. Individual vaccine coverage is also comparable, as the difference in coverage does not exceed 5% for any single vaccination [3]. Pentavalent (92.2%) and measles (88.9%) vaccines are the only vaccines with higher coverage in the present study. Subnational vaccine coverage estimates are consistent with the findings of the present study. The proportion

of fully vaccinated children in the Rift Valley region of Kenya (68.7%) [3], where the present took place, is nearly identical to the findings of the present study (69.2%). In addition, individual vaccine coverage estimated in this study more closely resembles the Rift Valley regions than national estimates. Measles coverage at the national (87.1%), subnational (Rift Valley) (83.1%), and in this study are all well below the 95% threshold for achieving herd immunity [49].

Common immunization indicators used by the Countdown to 2030 group are pentavalent, measles, PCV, and rotavirus vaccine coverage [15]. Compared to the median coverage among the 81 Countdown countries, the estimated coverage for each of these vaccines in the present study is higher [15]. The drop-out between the first and third pentavalent vaccine coverage for all MCH clinics was 6.7%, indicating good performance. This drop-out rate is similar to other studies in Kenya [50]. These comparisons to national, subnational, and Countdown priority country coverage suggest that the six MCH clinics studied here deliver effective immunization services as a whole. However, many of the other studies discussed used population-based sampling rather than clinic-based, used here. Recruiting caregivers and their children at the clinic, meaning they are already able to access services, could explain the higher vaccination coverage found in this study. The vaccination coverage rates for the six MCH clinics combined distort the poor coverage in individual clinics as the results of the study showing that vaccination coverage varied significantly from site to site. In Mosoriot, only 43.8% of children were considered fully vaccinated for their age. Further investigation on why certain MCH clinics had poorer vaccination coverage is needed. Other studies in similar settings have found wealth [39, 51, 52], caregiver knowledge of immunization services [39], fewer children in the household [53], skilled birth attendance [52, 54], high health worker performance [39], literacy [39], and parental education [53] to be associated with higher vaccination coverage. It is not currently

known what role these factors play in determining coverage among the MCH clinics surveyed in this study.

The finding that males in our study were more likely to be fully vaccinated than females is not consistent with recent DHS reports and other studies which show no difference in the coverage rates for males and females [3, 51, 55]. These studies were done at the national level [3], in an urban setting [55], and in rural western Kenya [51]. In our study, we found that males were over 3.5 times more likely to be fully vaccinated for their age compared to females. While our small sample size may skew this finding, it is still concerning. A recent study conducted in Nairobi, Kenya, in support of the presence of an immunization gender gap found that only 65.2% of females were fully vaccinated compared to 73.2% of their male counterparts [46]. Similar to the gender disparity found in vaccination coverage, a lesser proportion of females received vitamin A supplementation and growth monitoring. While these differences were not as significant as the one found for vaccination coverage, they still raise concern and could indicate that female children do not have the same access to preventive health service as male children. There is a need for additional research to ascertain whether caregivers are seeking the same care regardless of the gender of their child and to determine whether strategies to improve vaccination coverage in this region of Kenya should target female children with a view to achieving equitable coverage.

Interestingly, we found that children whose caregivers indicated they had barriers in accessing an MCH clinic had higher rates of being fully vaccinated for their age than children whose caregivers did not indicate any barriers. No literature was found to support this finding; however, we hypothesize that caregivers who reported barriers may have been more engaged in their children's care and therefore more likely to report a barrier. It is also feasible that the

barriers reported do not actually affect caregivers' care-seeking behavior for their children, they just make it more difficult. We also found that a larger proportion of children whose caregivers had to travel longer than one hour to arrive to clinic were fully vaccinated for their age than children who had to travel less than one hour. Distance to a health facility has been found to be a significant factor associated with vaccination coverage [39]. While we don't know the distances caregivers had to travel in this study, we do know an approximation of their travel duration. One possible explanation for this finding is caregivers who had to travel longer than one hour had a superior mode of transportation, making it physically easier for them to access the MCH clinic despite the longer time to travel.

In this study, we found no children had the child development screening portion of their Mother and Child Health Booklet completed. Further, caregivers indicated that child development services are rarely incorporated into their routine visits, despite the majority of them wanting these (i.e. child development services) to be offered to them and their child. This is concerning considering the global interest and commitment towards ensuring children reach their full developmental potential. While it is possible that child development screening was provided and just not indicated in the Mother and Child Health Booklet, monitoring these services facilitates accountability. It is encouraging that child development is included in the Mother and Child Health Booklet, but without the ability to monitor the activities we lack evidence that the services are being implemented. Caregivers displayed an inability to differentiate between physical growth and child development in the study. When asked how they can help their child develop, most listed breastfeeding and better feeding practices, but only slightly more than one-fifth of caregivers were able to list an appropriate way to enhance their child's development. These findings demonstrate that caregivers are unable to differentiate between growth and

development, which is supported by other literature. In one study, when asked what development meant to them, caregivers emphasized feeding practices and physical growth [56]. While feeding practices and subsequent adequate nutrition is associated with child development and thriving later in life, it is important that caregivers understand and don't neglect the role of nurturing play and communication caregiving activities [57]. It is encouraging that caregivers demonstrated their knowledge on the importance of adequate nutrition for their child, but future strategies should address the knowledge gap present in the difference between cognitive and physical growth.

Vitamin A supplementation coverage among the children in the study was higher than findings from the most recent KDHS [3]. According to this KDHS, 67.9% of children ages 6-8 months received vitamin A supplementation compared to 78.6% of children receiving vitamin A supplementation at the first 6-month interval of eligibility. Vitamin A supplementation coverage was similar among males and females within the KDHS as well [3]. Deworming coverage was lower in the sample than national estimates. Only one-third of children in the present study received deworming medicines in the last twelve months compared to 51% estimated in the most recent KDHS [3].

Limitations

This study was subject to sampling bias as participants were recruited at the MCH clinic. Only caregivers and children who were already present in the MCH clinic were eligible for inclusion in the study. Recruiting participants at the clinic excludes caregivers and children who do not have access to or encounter barriers in accessing preventive health services. Doing this could potentially lead to an overestimation of service coverage because we were unable to account for these children. Another potential source of overestimating service coverage pertained

to the sampling strategy; because it was difficult to determine whether the caregiver was just arriving or just leaving the clinic at the time of recruitment, when reviewing the Mother and Child Health Booklet it was assumed that all services were provided on the visit they were there for. There was also chance for systematic bias as the study relied on accurate recording of health services in the Mother and Child Health Booklet by the healthcare provider. It was assumed that a service was not provided if it was not recorded in the booklet, despite the possibility that the provider forgot to complete the record. This could potentially lead to underestimating service coverage. Other limitations that could lead to inaccurate coverage estimates include the age of the children in the sample and the sampling strategy. Due to the majority of the children in the sample being so young, it was not possible to determine vaccination coverage in terms of the number of children receiving all required doses. Few children were old enough to have even been eligible to receive all vaccines, so coverage was defined by them receiving the vaccines they were eligible for. This could lead to overestimating vaccine coverage because we were unable to account for potential future missed doses. Finally, the small sample size used in this study restricts the representativeness and generalizability of the results.

Chapter 6: Recommendations

Monitoring sub-national coverage of preventive health services for children is a critical component of achieving the SDGs for improving child health outcomes, survival, and development. We recommend that a robust service coverage monitoring system be implemented in the network of MCH clinics studied. The results of this study suggest that there are inequities, disparities and knowledge gaps present affecting the MCH clinics, caregivers, and children. Implementing a routine monitoring system in this setting will systematically track these disparities and allow for informed strategies to be put in place. The gender gap found in this study needs further investigation to elucidate what factors are associated with females having significantly lower vaccination coverage than males. Further, the disparity in vaccination coverage between MCH sites needs to be analyzed. Conducting these studies will inform strategies to ensure that health services are accessible to all children. We recommend that future researchers undertaking these tasks have a strong sampling strategy and have a large sample to make their findings more representative of the region and generalizable.

Before an effective monitoring system is to be put in place, the data collection tools and strategies need to be optimized. The caregiver questionnaire should be expanded to include questions about maternal education, household income, and other important sociodemographic variables that could be determining factors of service coverage. Further, the caregiver questionnaire should be revised and validated before being employed in routine monitoring. This process should include a series of important steps that will ensure the capture of high quality data. These include: a review of the literature to identify similar surveys, re-development of survey items in accordance with current survey design methods, expert validation, cognitive interviewing with caregivers to ensure the questions are interpreted correctly, and lastly, the

revised questionnaire should be pilot tested to ensure validity and reliability [58]. This will improve the data quality and enable more effective analyses and the output of high quality results. Regarding the Mother and Child Health Booklets, a robust training curriculum for the healthcare providers in the MCH clinics who record what services were provided in the booklets should be developed. As previously discussed in the limitations of this study, it was impossible to differentiate between a service not being provided and not being recorded properly in the booklet. This training curriculum will ensure comprehensive and accurate service records are maintained. Accurate estimates of service coverage are dependent on reliable and accurate health service records.

Future research is needed to determine caregiver knowledge on child development to inform strategies to address the disparity between growth and development found in this study. We recommend that strategies emphasizing ways caregivers can help support their child's development be incorporated into routine visits at MCH clinics. Further, a comprehensive evaluation of what child development services are actually offered at MCH clinics is needed. No children had developmental screening provided to them in this study. An evaluation of child development services offered will provide more in-depth knowledge on how and to what extent these services are delivered, independent of reviewing the Mother and Child Health Booklet.

In conclusion, service coverage among children at the six MCH clinics included in this study is comparable to recent national and sub-national estimates. We found a significant gender disparity in vaccination coverage as females in our study were not as fully immunized as males. Further, females in our study were also found to have lower coverage of vitamin A supplementation and growth monitoring. Child development is not routinely incorporated into

MCH clinic visits, indicating an opportunity to dramatically scale up this component of MCH clinic service delivery.

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