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Social/Cultural Factors in Preschool Immunizations, Mozambique

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Walden University
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Abstract

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Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Public Health

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August 2021

Abstract

Immunizations are scientifically proven, effective global health interventions that prevent infectious diseases and save lives. Yet, in Mozambique at the national level, less than 65% of children are fully immunized, i.e., received all the basic/routine vaccinations. The overall purpose of the doctoral study was to conduct quantitative research examining the sociocultural factors that may impact childhood immunization status in the context of the social ecological model. The study examined the relationship between child's gender, mother's and her husband/partner's educational level, household wealth index, religion, ethnicity/language, urban-rural residency, and province/region with the child's full immunization status in Mozambique. Secondary analysis of the 2011 Mozambique Demographic and Health Survey datasets was done. Of the 8,388 children aged 12-59 months old, 62% had full immunization. Binary logistic regression analysis was performed using SPSS version 27, and the model resulted that child's gender and urban-rural residency were not significant ($p > .05$); however, the independent variables mother's educational level, husband/partner's educational attainment, household wealth index, religion, ethnicity/language, and province/region were found to be significant ($p < .05$). Implications for positive social change include that the study findings may contribute to the knowledge and information that will be used to potentially further inform multifaceted communication and public health interventions that are culturally and ethnolinguistically relevant and appropriate to improve full immunization status and overall child health.

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Dedication

This doctoral study is dedicated to my family; all the children, mothers/parents, and families, especially those in Mozambique; for the non-traditional students and scholars, including working parents, and to the global community for the continued motivation to strive towards positive social change and enhance global health.

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Section 1: Foundation of the Study and Literature Review

Introduction

Immunizations are scientifically proven, effective global health interventions that prevent infectious diseases and save lives (Kroger et al., 2015; Lanaspa et al., 2015; Orenstein & Ahmed, 2017; Plotkin et al., 2018). Yet, in Mozambique, a major public health problem exists in that less than 65% of children are considered fully immunized (World Health Organization [WHO], n.d.a). Specific areas and subpopulations have much lower immunization uptake than others, and this detail is not reflected in the reported immunization coverage at the national level (Brownwright et al., 2017).

There is a gap in the research literature regarding the socioecological levels of intra- and interpersonal, institutional, community-based, and policy-based influences that contribute to the disparities with the uptake of vaccines (Corben & Leask, 2016; Larson et al., 2014). According to Kestenbaum and Feemster (2015), there is a need to examine and better understand the sociocultural factors that influence vaccine delay, hesitancy, and refusal. At a broader but intersecting level, UNICEF has found that there is a lack of understanding of the cultural factors and the role of gender inequality that may contribute to overall child health (UNICEF, 2018). Corben and Leask (2016) argued that vaccine uptake and immunization coverage are partially a reflection of not only the parents' decisions but could also be influenced by the specific context of their community on their decisions and attitudes toward childhood immunizations. To address this gap, I examined the role of certain sociocultural factors that might influence vaccine uptake, i.e., preschool children's immunization status.

Problem Statement

There is a need to further examine inequalities in childhood immunizations. Restrepo-Méndez et al. (2016) reported that even with improvements in immunization rates at the national level in Mozambique, there is a need to uncover and address underlying disparities within the country. This is because, in Mozambique, the immunization coverage at the national level has improved but there remains unequal coverage in poorer socioeconomic areas and subpopulations (Restrepo-Méndez et al., 2016). However, in all economic/wealth quintiles it is possible to get children fully vaccinated. Thus, the lack of vaccinations in some groups indicates that there are other factors the impact immunization status.

It has been reported that a large percentage of children from households with higher income are likely to be fully immunized, and there is also a large percentage of children in poorer households that are reported to be fully immunized as well (Ashish et al., 2017; Restrepo-Méndez et al., 2016). This indicates that economics or wealth alone does not fully explain vaccination decisions and that there are other factors that impact immunization status that should also be considered (Ashish et al., 2017).

Purpose of the Study

The overall purpose of this doctoral study was to conduct quantitative research examining the social/cultural factors that may impact children's immunization status at the provincial/regional level. Mozambique is a socially and culturally diverse nation, with regional differences (Bingham et al., 2012). There is a need to further examine sociocultural factors, such as the role of ethnicity/language, religion, and gender, and

their relationship to a child's immunization status (UNICEF, 2018). My goal was to examine the different factors that might contribute to the disparities with immunization status of children under 5 years old at the provincial/regional level to address the research gap and public health problem.

Research Questions and Hypotheses

The research questions and hypotheses of the study are described below.

Research question 1 (RQ1): What is the relationship between child's gender, parents' educational level, household wealth index, urban-rural residency, and the province/region with preschool children's immunization status in Mozambique?

Null Hypothesis ($H_0$1): There is no relationship between child's gender, parents' educational level, household wealth index, urban-rural residency, and the province/region with preschool children's immunization status in Mozambique.

Alternative Hypothesis (H_a1): There is a relationship between child's gender, parents' educational level, household wealth index, urban-rural residency, and the province/region with preschool children's immunization status in Mozambique.

Research Question 2 (RQ2): What is the relationship between significant sociocultural factors of religion and ethnicity/language/ with childhood immunization status at the provincial/regional level in Mozambique?

Null Hypothesis ($H_0$2): There is no difference or there is no relationship between religion and ethnicity/language with childhood immunization status at the provincial/regional level.

Alternative Hypothesis (H_a2): There is a relationship between religion and ethnicity/language with childhood immunization status at the provincial/regional level.

Theoretical Foundation for the Study

I selected the social ecological model (SEM) as the theoretical foundation for this study. The origin or source of SEM stems from sociology and was used by researchers to better understand human development and interactions that individuals have with different multilevel systems that could influence behavior (Bronfenbrenner, 1977; Bronfenbrenner, 1986; Kilanowski, 2017). In SEM, the individual is at the center of the model and is influenced by the following systems: microsystem, mesosystem, exosystem, macrosystem, and chronosystem (Bronfenbrenner, 1986; Kilanowski, 2017). Throughout the years, the use of the SEM evolved to have practical applications in the field of public health (Kilanowski, 2017). The SEM has been applied to examine multilevel interactions and strategies to address various public health issues including health promotion at the individual, interpersonal, organizational, community, and public policy/enabling environment levels (Kilanowski, 2017; Office of Behavioral & Social Sciences Research, n.d.; Sallis & Owen, 2015). My decision to use SEM also fulfills Walden University's mission for positive social change. It is a practical public health framework with which to study childhood immunization because UNICEF uses SEM for their communication strategy/approach that includes advocacy, social mobilization, and social change components (Salihu et al., 2015; UNICEF, 2018). Additionally, using the SEM model supports research with diverse populations and in various countries, including low resource settings (Salihu et al., 2015). I used the SEM to examine multilevel-related

factors that contribute to the immunization of children in Mozambique, as the framework or foundation of the study.

Varied prevalence of childhood immunizations is a part of is the socioecological system. By using a systems approach, public health issues related to childhood immunizations can be examined at multiple levels and perspectives. Social determinants of health include income, education, housing, and other sociocultural factors that could impact population health and health disparities (Centers for Disease Control and Prevention [CDC], 2021; Larson et al., 2015; WHO, 2010). I used the research questions to specifically examine the role of the child's gender and the sociocultural factors of religion, language, and ethnicity/ethnic group identity on immunization status. Thus, SEM is reflected in the research questions by looking at different variables or contextual factors related at the individual, family/community/social levels that might contribute or influence a child's immunization status (Golden & Earp, 2012). Corben and Leask (2016) described how parents' decisions regarding childhood immunization and support they needed to make these decisions were influenced by not only individual factors, but also a confluence of various factors at the interpersonal, institutional/service delivery, and community levels. According to Frew et al. (2014), "immunization decision-making is informed by a 'chain reaction' series of events driven by an entire ecological system including direct and indirect influencers" (p.1737). With immunizations there are various stakeholders that include the children who receive the vaccines, their parents (or other caregivers/guardians) who are the decision makers, and their community leaders and

governments who may influence the decision regarding immunizations, as well as the accessibility and availability of vaccines (WHO, n.d.b).

There are certain proposition and assumptions to consider (or that have been considered/studied) in global health that make SEM an applicable theory to examine childhood immunizations in different and complex settings. The proposition of SEM is that the social environment influences health and thus, it could either enable or serve as a barrier to disease prevention and health promotion (McLeroy et al.,1988). The SEM provides a framework to address public health issues at multiple levels and look at correlated factors that could contribute to the uptake of childhood immunizations. The SEM is more of an encompassing theory that looks beyond the individual level and is used to examine complex layers of factors that impact childhood immunization. With the application of the SEM, I explored how certain socioecological factors, including some social determinants of health, contribute to preschool children's immunization status in Mozambique.

I chose the SEM to examine different individual, demographic, economic, and cultural factors that influence the adoption of childhood immunizations. Immunization is a complex issue that look beyond the parents or caregivers but also by providing and creating an environment for children to thrive and to support/empower parents to get their children fully vaccinated. In this study, I examined this complicated issue and the interpersonal and other levels to determine influencing or contributing factors. This model provides a systems thinking approach (Adamu et al., 2019; Leischow et al., 2008), and it is in line with the data source and methods using secondary analysis of

demographic health survey data sets. The SEM is used to consider social change implications and applications of the study at multiple levels that could impact overall child health. Another reason that I chose the SEM model for this study is that it has been applied in other immunization studies, health promotion/prevention, diverse populations, and various settings in sub-Saharan Africa (Glanz et al., 2008; Nyambe et al., 2016; Oleribe et al., 2017). Furthermore, for public/child health services, often the interventions could be more effective if they were aimed beyond just focusing on changing parental attitude/behavior/practices and taking into account external factors that could influence their decisions and actions (Corben & Leask, 2016).

The key elements of the SEM include the multifaceted interactions of the individual, interpersonal, organizational, community, and public policy related factors (UNICEF, 2018). From the SEM perspective, these are interconnected micro and macro factors at different levels that could influence and contribute to parents' decision and attitude towards childhood immunizations. I developed the research questions for this doctoral study to examine various socioecological factors that could impact childhood immunization in Mozambique. The SEM relates to the study approach and key research questions by looking at relationships of certain variables of interest that might potentially impact disparity and predictors of immunization status.

Nature of the Study

The doctoral study is a quantitative analysis of secondary data. My primary rationale for this design is that it is a requirement for Walden University's DrPH program. I used accessible data that have been previously collected (retrospective) from

specific time periods and conducted a cross-sectional analysis of the data. In addition, the quantitative approach aligns with the problem statement, which I developed to examine the relevant socioecological factors that interplay at the intra- and inter-personal, institution, community, and policy levels that contribute to the uptake of childhood immunization. The key study variables included childhood immunization status (i.e., full immunization status), as the dependent variable of interest and independent variables are related to child-focused variables (e.g., gender), the parents (e.g., education, wealth/socioeconomic), belonging/identifying to a particular community (e.g., religion, language/ethnicity), urban-rural residency and province/region. The datasets were from demographic and health surveys. I used SPSS version 27 to facilitate the data analysis.

Literature Search Strategy

I conducted the literature review using multiple databases and search engines to find relevant articles, reports, and other published studies. These included PubMed, Scopus, Walden University Library databases (including dissertations), and Google scholar. I also used Google to find pertinent information relevant for this doctoral study. Search terms included *immunization and vaccination, child health and mortality, childhood, under-five, Mozambique, socioecological or SEM, gender, religion, language, ethnic and ethnicity, socio, cultural, social determinants, quantitative,* and *demographic health survey (DHS).* I sought literature that was relevant to the theory/framework, background information, study design, and methodology. Depending on the number of articles that resulted from the search, I did not limit the search to certain years of publication. However, to reduce the numbers of results generated, I narrowed my search

to a more targeted inclusion of current peer-reviewed articles published within the last 5 years. I also included information from books or older publications for background information, particularly related to Mozambique, or seminal work relevant to the doctoral study regardless of the time of publication if relevant and appropriate for the study. Information from websites and publications from reputable organizations or commonly known authority in public health were also included for consideration. These organizations included the U.S. CDC, U.S. National Institutes of Health (NIH), United Nations Human Development (UNDP), UNICEF, and WHO. Furthermore, I also included specific country information from governmental or other relevant organizations (e.g., Ministry of Health) in Mozambique in the literary search strategy.

Literature Review Related to Key Variables and/or Concepts

Background

In Mozambique, there is a large health disparity in the under-five mortality rates reported. The 2011 under-five mortality rates reported ranged from 58.1 deaths per 1000 live births in Inhambane, 80.5 deaths per 1000 live births in the capital city of Maputo, and up to 141.6 per 1000 livebirths in Zambézia province (WHO Global Health Observatory (GHO), 2020). Childhood immunizations are effective public health interventions that contribute to improving under-five mortality rate (which is a health equity monitoring indicator) by protecting children from vaccine-preventable infectious diseases (Orenstein & Ahmed, 2017; WHO GHO, 2020). Parents and other caregivers are the direct decision-makers regarding childhood immunization behavior; however, these decisions could be influenced by complex, external factors at the various socioecological

levels (Bingham et al., 2012; Corben & Leask, 2016). In considering immunization supplemental activities and other programs/interventions, a better understanding of the local context and the relevant sociocultural factors could further enhance existing and future interventions (Brownwright et al., 2017; Corben & Leask, 2016). Shemwell et al. (2017) examined certain factors that influence full immunization status. Though they found no statistical difference between ethnic group, religion, and urban-rural residency in two districts in Zambézia province, understanding or having knowledge of Portuguese (i.e., language) and the educational level of the female head of household were shown to be related with the child's immunization status. However, Shemwell et al. (2017) noted that a limitation in their study was that their findings may not necessarily be generalizable to other areas and provinces in Mozambique. They also did not look into potential gender disparity in immunization between boys and girls. There is currently no published study that systematically looks at key social determinants and cultural factors for all the provinces in Mozambique. Examining other areas could provide insight to enhancing and further developing policies and programs that are appropriate for the specific context of a province or subpopulation. There is a need to continuously communicate, facilitate, and support families to improve vaccination coverage at various stages of life.

Mozambique Context

Mozambique is a diverse, mostly rural nation, with an estimated population of about 31 million people (World Factbook, n.d.). Mozambique is located along the southeastern coast of Africa. The country gained its independence in 1975, after almost 500 years as a Portuguese colony, and endured a prolonged civil war (World Factbook,

n.d.). The nation has 11 provinces/regions that are divided into 144 districts. In the northern part of Mozambique are the provinces of Niassa, Cabo Delgado and Nampula; located in the center are Zambézia, Tete, Manica, and Sofala; and in the South are Inhambane, Gaza, Maputo, and Maputo City (Ministerio da Saude [MISAU], Instituto Nacional de Estatística [INE], & ICF International [ICFI], 2013).

According to the UNDP's Human Development Report, in 2019 Mozambique ranked 181 out of 189 country/territory rankings, with one of the lowest human development levels reported, and considered a least developed country (UNDP, 2020). However, from 1990 to 2019, there have been human development improvement trends reported in terms of life expectancy and years of schooling (UNDP, 2020). Mozambique is also one of the poorest countries in Sub-Saharan Africa with large variation in immunization rates within the country (Restrepo-Méndez et al., 2016). Health sector factors, such as with improved planning at district and national levels, funding, and resources have enhanced immunization service coverage, particularly in the poorest groups/lowest wealth quintile (Restrepo-Méndez et al., 2016). Despite these incremental improvements over time, according to Restrepo-Méndez et al. (2016), there remains a need to look also beyond the health sector (or health system) and examine other factors that further explain the disparity or the inequality in childhood immunization.

Religion

The effect of religion on child health is not always clear, and it may vary depending on the context of the community (Cau et al., 2013; Agadjanian & Jansen, 2018). A mother's religious affiliation has been shown to be a contributing factor to

under-five mortality and positively influence a child's survival in Mozambique (Cau et al., 2013). Cau et al. (2013) argued that religious organizations could influence (e.g., provide support) and could play an integral role on child health and survival at the community level, particularly in developing countries in Sub-Saharan Africa. Other studies conducted in Sub-Saharan Africa, such as Nigeria, have shown the influence/role of religion on childhood immunization and note the importance of looking at this issue in specific contexts (Antai, 2009; Oleribe et al., 2017). According to the Mozambique DHS Final Report (2013), in terms of religion, almost a third of the population is Catholic (28.4%), 17.9% are Muslims, 15.5% are Zionists, and about 18.7% of the country's population does not profess any religion/belief (MISAU, INE, & ICFI, 2013). In this study, I examined the influence of religion specifically on vaccine uptake, i.e., the child's immunization status, in Mozambique to address this research gap in the field.

Ethnolinguistic

Mozambique has 42 recognized languages, including Portuguese as the official language; however, about 85% of the population has the "mother tongue" of the Bantu languages (MISAU, INE, & ICFI, 2013). The most commonly spoken languages used in everyday communication are Emakhuwa (25.4%), Portuguese (12.8%), Xichangana (10.4%), Cisena (7.1%), Elomwe (6.9%), and Cinyanja (5.8%; MISAU, INE, & ICFI, 2013). The spoken communication language of the healthcare worker might be different from the parents, patients, or that of the local community, which could affect vaccine uptake (Shemwell et al., 2017). Therefore, I further examined the ethnolinguistic influence (ethnicity/language) on the child's immunization status.

Education/Literacy

One of the influencing factors on children's health and health behavior is the mother's level of education (MISAU, INE, & ICFI, 2013). According to MISAU, INE, & ICF (2013), in 2011 31% of females and 13% of males between the ages of 15 – 49 were not educated (no schooling); and 60% of females and 30% of males in this age group were illiterate. Only about 1% of females and 2% of males attended higher education (MISAU, INE, & ICFI, 2013). In Zambézia province, 36.0% of women between the ages of 15 – 49 reported having no schooling, about 53.7% did not complete primary school, and about 8% attended secondary school (MISAU, INE, & ICFI, 2013). The literacy rate of women between ages 15 – 49 in Zambézia was only 24.6% (MISAU, INE, & ICFI, 2013).

Preschool or Childhood Immunizations

Vaccination of children leads to the decrease in the incidence of vaccine-preventable diseases and protects not only the children who are immunized, but also their families and communities (Plotkin et al, 2018). Immunization coverage and adoption varies throughout Mozambique; hence, outbreaks of vaccine-preventable diseases, such as measles, continue to occur in the country (WHO, n.d.a). The 2011 DHS data provide insight to the degree of inequities in achievement of the Expanded Program on Immunization (EPI) (MISAU, INE, & ICFI, 2013). In Mozambique, 64% of children by age 1 received all the vaccines (fully immunized), being higher in urban areas at 75% and lowest in rural areas at 60%. At the provincial level, Maputo Province has the highest

immunization coverage rate (88%), while Zambézia has the lowest percentage of children who received all the vaccines (below 50%; MISAU, INE, & ICFI, 2013).

Mozambique EPI

The Mozambique EPI was established in 1979, and the program has been committed to reducing infant mortality and morbidity through the provision of immunization services at all levels. The program has made progress over the years, as demonstrated by the increase of the third dose of the diphtheria-pertussis-tetanus vaccine (DPT3) coverage rate from 47% in 1997 to about 71% in 2011 (MISAU, INE, & ICFI, 2013). The EPI utilizes a two-pronged approach that includes routine immunization services as part of the general primary healthcare and supplementary mass vaccination campaigns (UNICEF Mozambique, 2014). The program involves the improvement of the planning and supervision of immunization activities, including maintaining regular supply of vaccines, training health workers, educating communities, and promoting immunization through local leaders and local media (UNICEF Mozambique, 2014). EPI strategies include Reach Every District (RED), Monthly Health Days, and Child Health Weeks. The RED strategy aims to bring routine immunization to hard to reach and under-served areas by strengthening the capacity of district authorities (UNICEF Mozambique, 2014; Vandelaer et al., 2008). With the Monthly Health Days, a mobile health team visits a rural village or locality and immunizes children, administer vitamin A and deworming medication, conduct health education session and meet with community members. The Child Health Weeks are weeklong campaigns that complement routine child health

services and Monthly Health Days by providing basic services through fixed health units and mobile brigades (UNICEF Mozambique, 2014).

Despite the efforts and EPI activities, many of the districts have yet to achieve 80% coverage in all the antigens in the EPI schedule. There are constraints related to the weak performance of the EPI in Mozambique, including issues with the structural and functional organization of the program at all levels, poor data and vaccine stock management, inadequate cold chain capacity and management, deficient implementation of the RED strategy (e.g., insufficient financial resources, transport), and lack of trained health staff with appropriate supportive supervision at all levels of the health system (UNICEF Mozambique, 2014).

Immunization Studies in Certain Areas of Mozambique

Jani et al. (2008) aimed to identify reasons for nonimmunization and the magnitude for missed opportunities for immunization of children under 2 years old in the rural district of Magude in Maputo Province in southern Mozambique. Jani et al. (2008) conducted a cross-sectional study and surveyed 668 mothers of children under 2 years old from five administrative posts of the district in 2001. The researchers worked with traditional leaders (regulos), who were instrumental in assisting them with the recruitment process and ensuring that majority of families would be home for the survey. The children's Road-to-Health Cards (RHC) were used to obtain their immunization dates, number of vaccine doses, and dates of other health facility visits. Some of the other information collected about the participants included the mothers' knowledge about immunization and the EPI program and accessibility to the nearest health facility. The

findings of the study included the following: Over half of the mothers (52.0%) lived far away from the health facility, with the average walking time to the nearest health facility of 1 hour (range 3 minutes- 4 hours; Jani et al., 2008). There were 142 (21.2%) mothers who had heard about the EPI as a specific program. The major sources of information for this knowledge were reported to be the following: at the health facility (*n* = 67, 47.1%), the radio (*n* = 44, 30.9%), from community workers (*n* = 25, 17.6%) and family and friends (*n* = 14, 9.8%). Immunization was considered important by 642 mothers (96.l%). However, 606 mothers (90.7%) did not know any contraindication for immunization and only 423 (63.3%) knew that the immunization program should be completed by the child's age of 9 months with the measles vaccine. In Jani et al.'s (2008) study, there were 479 (71.7%) children with a complete immunization status (fully immunized). The reasons identified by the respondents for not being able to vaccinate their children were associated with health services delivery (*n* = 71, 38.3%), including long waiting time, no personnel at the health facility, no vaccines available on the day, no information about the day for vaccination and no vaccination given due to the child's sickness. Other reasons reported were forgetting the day of immunization (*n* = 33, 17.8%) and difficulties in accessing the health facility (*n* =29, 15.6%; Jani et al., 2008). Overall, the findings from Jani, et al.'s showed that the community in Magude District utilized the health services; mothers were motivated to understand about the benefits of immunization, and were willing to travel the distance to get health care; although immunizations rates were still less than 80% (2008).

Two qualitative studies in the southern region of Mozambique focused on the perceptions and attitudes of childhood immunization, with the intent to gather information about possible acceptance towards the potential introduction of malaria treatment or vaccine in the near future (Pool et al., 2006; Bingham et al., 2012). In one study conducted by Pool et al. (2006), they described mothers' and community members' attitudes to EPI andtheir responses and perceptions with the introduction of the malaria intermittent preventive treatment in infants (IPTi). The study included an ongoing malaria IPTi clinical trial, alongside routine EPI vaccinations. The anthropological study conducted by Pool and colleagues (2006) included in-depth interviews with 308 mothers/caregivers of infants (266 were also participating in the IPTi trial) and with community members and traditional healers; and participant observation in community and clinic settings at the Manhica Health Research Centre, Manhica District (Maputo Province) in southern Mozambique. The researchers did a convenience sampling by recruiting participants from those attending the clinic (Pool et al., 2006).

The researchers found that women caregivers in their study (recruited during routine EPI vaccinations for their children) were not generally familiar with the term "immunization" in Portuguese (*imunizao*) but understood the concept of immunization by the local term *kuvikela*, broadly meaning "to prevent, to avoid, to protect", and through the traditional treatment given to infants for prevention of diseases called *humba* or *xihlambetwana* (Pool et al., 2006). This finding showed the importance of using local terms to describe and communicate information about immunization. In the study, the researchers reported that the participants in general were aware that immunization

prevented or lessened the severity of diseases. The participants perceived the notion of prevention as generally beneficial for infants (Pool et al., 2006), even if there were side effects mentioned, such as localized swelling and fever after immunization. The researchers reported that perception of EPI immunization and other services (e.g., antenatal care) as compulsory/mandatory reinforced the acceptance by mothers and their relatives (Pool et al., 2006). The women in the study described immunization as "the law of the hospital" or "the law of the government"; and a general sense from the participants that immunizations were part of the "local culture" (Pool et al., 2006). The authors observed routine acceptance of EPI and general trust of the clinic, and adherence (adoption) was further supported by the relative independence of several of the mothers when making health-related decisions (Pool et al., 2006).

The other qualitative study, conducted by Bingham et al. (2012), examined community perceptions of malaria and vaccines in two malaria-endemic districts: 1) the inland Chokwe District in Gaza Province, and 2) the coastal Massinga District in Inhambane Province, both located in the southern region of Mozambique. Their formative research study aimed to collect information that would inform the design of communications strategy for the possible introduction of a malaria vaccine before it became available. The researchers included two districts in the study to capture some of the geographic and cultural diversity of the coastal and inland areas of Mozambique (Bingham et al., 2012). They used a criteria-based sampling and conducted 23 focus group discussions and 26 in-depth interviews in 2010 (Bingham et al., 2012). The study team conducted focus group discussions to explore the knowledge and beliefs of parents

and other caregivers, the "direct" decision-makers of childhood vaccine use. In addition, the study team conducted focus group discussions with community leaders (e.g., traditional healers, traditional leaders, religious leaders), who may influence the direct decision-makers with their decisions (Bingham et al., 2012). They engaged community stakeholders in the implementation of their study. The participants comprised caregivers of children under 2 years old (from urban and rural areas; female and male) and community leaders (e.g., traditional healers, traditional leaders, religious leaders, a community health worker, and a traditional birth attendant). The study included a total of 200 participants with a total of 49 data collection events: 24 (11 focus groups and 13 in-depth interviews) in Chokwe and 25 (12 focus groups and 13 in-depth interviews) in Massinga (Bingham et al., 2012). They did not report the demographic information about the participants and the immunization status of the caregivers' children. Participants responded to questions regarding their perceptions and experiences with vaccination, the health decision-making process in their households, the acceptability of a future malaria vaccine, and their primary communication and information channels (Bingham et al., 2012). For the data analysis, the researchers performed thematic content analysis and, from their interview guide, developed structural content codes. They reviewed the code reports for themes and examined information by subgroup (e.g., caregivers and health providers) and by site, gender, and religious and ethnic groups (Bingham et al., 2012). The findings of their study based on the researchers' central domains of inquiry regarding vaccinations included: perceptions and experiences with childhood vaccination, motivating factors related to childhood immunization, and concerns and constraints

related to childhood immunization (Bingham et al., 2012). In terms of the perceptions, participants in the two focal districts showed varying knowledge about vaccines available. Some of the caregivers named vaccines that do not exist, and only some community leaders named specific vaccines. Overall, most of the participants perceived vaccinations as beneficial (Bingham et al., 2012). Previous experiences by several of the caregivers and traditional and religious leaders with immunization and getting immunized as a child influenced their decision to have their child immunized. The influence of local leadership (e.g., government, community leaders, and health workers) and their directives served as motivating factors related to childhood immunization that encouraged immunizations of children (Bingham et al., 2012). In terms of concerns and constraints, the lack of information or poor messaging, fear of side effects and perceived risks, and taboos related to vaccination were some of the concerns expressed by the participants. Other constraints reported included the lack of understanding of the importance of vaccines and how they work, the quality of the service delivery, and the distance to the vaccination sites and service hours (Bingham et al., 2012). The researchers reported the main messages included the demand for immunization could be improved if caregivers viewed vaccines positively, trusted health workers, obtained educational materials in the local languages (including information about side effects and perceived risks), and confident in who delivered the information to them (e.g., religious leaders and traditional healers as trusted sources of health information in the community) (Bingham, et al., 2012).

The researchers mentioned above conducted studies in specific provinces or limited areas in Mozambique. The sociocultural context varied in different places or regions of Mozambique. With these studies, I gained insights into factors and variables to consider for this doctoral study and look more widely at all the provinces of Mozambique to examine within-country immunization disparities.

Definitions

In this segment, I provided and further explained below the key variables of interest for the doctoral study. These included select indicators from DHS data relevant to the study. The dependent variable of interest was the child's immunization status. Full immunization status was defined to have received all the basic vaccines, which include Bacille-Calmette Guerin (BCG); three doses of diphtheria, pertussis, and tetanus (DPT3); three doses of oral polio vaccine (OPV3), and measles vaccines. Independent categorical variables/factors of interest, related to SEM levels, included the following:

- Individual - Child's gender (female or male)
- Interpersonal - Parent's educational level (e.g., completed secondary and/or higher education, incomplete secondary, complete primary, incomplete primary or no education)
- Organizational - Household wealth index (richest, richer, middle, poorer or poorest)
- Community - Ethnicity/language (ethnolinguistic variable) and religion
- Social/public policy - Residence (urban or rural) and province/region

Assumptions

The developers of the DHS, who conducted the survey to be able to obtain reliable data, made certain assumptions. Hence, in this study I followed or agreed with their assumptions reflected in the survey data, as the data source for this study. One assumption was that the respondents understood each of the questions and responded as honestly or to their best ability. Other assumptions included that the respondents knew the different vaccines in the EPI schedule and did their best to recall the vaccines received or not received when asked during the survey, if they did not have their child's immunization card to verify this information.

Scope and Delimitations

The doctoral study addressed only specific aspects of childhood immunizations among preschool aged children in Mozambique. The study was bound to the population targeted in the DHS. These could pose internal and external validity issues. Because this was a retrospective, cross-sectional study, the intent was not to show a causal relationship but rather to provide a descriptive study. However, the advantage of using DHS data is the potential for the generalizability of the results.

The scope of the doctoral study encompassed a retrospective, quantitative, secondary data analysis of demographic and health survey data, which are nationally and sub-nationally representative data. The delimitation of the study was bound to the confines of the data sources and the variables included in the study and analyzed, i.e., previously collected DHS data, and the population surveyed (including the target population, sample size, and the questions and information included in the survey). This

study and the datasets were limited to the people of Mozambique who voluntarily participated in the survey. Another delimitation with the data sources and variables were limited to the DHS data collected in 2011.

Significance

The hope is that the doctoral study will contribute to public health knowledge and a better understanding of sociocultural factors that may impact childhood immunizations in Mozambique. The findings could further address the sociocultural differences with the uptake of childhood immunizations at the provincial level. Protecting children's health and well-being and minimizing the health disparities due to lack of immunizations is an ongoing public health issue. If children cannot receive available lifesaving vaccines, this is arguably a human rights issue (Hinman, 2004). A commitment to improving child health can also lead to the overall benefit of developing and reducing poverty in Mozambique (UNICEF Mozambique, 2014). The study findings may contribute to knowledge and information used to potentially further develop community-based/engaged communication and educational interventions. These strategies should be culturally and linguistically relevant and appropriate to heterogeneous subpopulations in Mozambique for positive social change to improve overall child health. By addressing the research gap in this area, this study could provide the information needed to guide programs, policies, and other interventions aimed at improving children's immunization status and increasing immunization rates needed to achieve herd immunity and beneficially impact children's well-being, as well as their families and communities (Kestenbaum & Feemster, 2015).

Summary and Conclusions

Childhood immunizations are effective public health interventions that protect children, their families, and communities from vaccine-preventable infectious diseases. In Mozambique, numerous preschool aged children have not received all the basic vaccines and are not fully vaccinated. With a focused scope, this doctoral study aimed to examine the socioecological and cultural factors that contributed to children's immunization status. These factors vary depending on the geographical areas. It is essential to understand the local barriers in a particular context to develop and implement effective immunization programs and inform public health policies (Jani et al., 2008). The implications for social change and interventions aimed not only at parents but also at the community, provincial/regional, and national levels. There continues to be a need to elucidate further ways to improve childhood immunization in Mozambique. The information presented in this section leads to the methods described in Section 2. The next chapter further describes the methodology and more detailed information about the data analysis process.

Section 2: Research Design and Data Collection

Introduction

There are limited childhood immunization studies conducted in Mozambique. Based on the literature search and review, there does not seem to be a comprehensive study that more thoroughly analyzes information at the national level and also include data for all the provinces in Mozambique. My rationale for including and analyzing both national and provincial level data, as mentioned in the previous chapter, is that there are hidden disparities with the national level data that does not fully show the extent of the immunization issues (e.g., differences in uptake/immunization status or inequities) within the country at the various provinces. Another reason is that there is regional diversity in the populations (or diverse populations in the various areas) in Mozambique. By also examining the data for each province/region, my goal was to elucidate sociocultural factors that might contribute to different immunization status.

In this chapter, I will describe my methods for this study. The major sections include the research design, rationale, and detailed methodology (including the target population, sampling procedures, description of the instrument, and the operationalization of the constructs). In other sections, I will focus on the potential threats to validity and the ethical procedures related to secondary data analysis of previously collected demographic health surveys. This chapter concludes with an overall summary.

Research Design and Rationale

The research design that I used for this doctoral study was retrospective and cross-sectional with secondary quantitative data analysis. There are advantages with

using this approach and design. Less time and resources are needed because data have already been collected (no new human subjects involved), and are accessible to the public for educational/research purposes. By using nationally and subnationally representative data, I was able to address the research questions of interest. The study variables included childhood immunization status as the dependent variable, characterized as full immunization status for children aged 12 – 59 months. The independent variables of interest included child's gender, parents' educational level, household wealth index (which took into account household income/assets), religion, ethnicity/language, urban-rural residency, and province/region. I chose this design because of the DrPH's program requirement to use secondary data and a consistent approach with other immunization studies that further advance and lead to new knowledge in public health. Furthermore, with secondary data analysis, this research design minimizes risks and averts potential ethical issues and challenges related with primary data collection involving human subjects (NIH Library, 2018).

Methodology

Population and Sampling

The target population was preschool children aged 12 – 59 months and the characteristics of their parents and households. For this study, I utilized datasets from the 2011 Mozambique DHS. The survey sample size includes 13,919 households, with 13,745 women age 15 to 49 and 4,035 men age 15 to 64 (MISAU, INE, & ICFI, 2013). The fieldwork was conducted from June through November 2011 and the implementing organization was the Instituto Nacional de Estatística (INE). In order to gain access to the

needed datasets, I registered online and obtained any necessary permission required by The DHS Program. To learn more about the select variables and how they were coded, I conducted a thorough review of the data code manual and then did a descriptive analysis.

Sampling and Sampling Procedures Used to Collect Data as Described in Secondary Data Materials

In this section, I provided a description of the developer's sampling and sampling procedures to collect data. The sample strategy included a multistage, probabilistic, and stratified sampling from the general population census by the INE to obtain estimates at various levels, including national, regional, provincial, and urban/rural (MISAU, INE, & ICFI, 2013). The sample only included populations residing in households and excluded those in other types of residency (e.g., hotels, military and student housing, homeless; MISAU, INE, & ICFI, 2013). The multistage sampling strategy included the sampling frame of geographical areas, i.e., "enumeration areas of groups of households from the latest population census available, and then probability of selection based on the unit's population and stratification characteristics" (Corsi et al., 2012, p.1606; ICF International, 2012). Specifically for the Mozambique 2011 DHS, the first stage included 611 primary sampling units (PSU) from the probability of selection based on the size of the number of households in each stratum within each province (MISAU, INE, & ICFI, 2013). Then the second stage included a probability of selection of 20 households in urban PSUs and 25 households in rural PSUs (MISAU, INE, & ICFI, 2013). Then demographic and health data were collected from women age 15–49 and children under 5 years old from the selected households (MISAU, INE, & ICFI, 2013).

Justification for the effect size, the alpha level, and the power level

Statistical power is dependent on both the effect size and sample size (Sullivan & Feinn, 2012). The effect size shows the "magnitude of the difference between groups" being compared in the analysis, which indicates if there is meaningful difference with the effect and not just statistical significance (Laureate Education, 2016; Sullivan & Feinn, 2012, p. 279). Therefore, the study results included the effect size, as well as the alpha level (.05) and the *p*-value to show meaningful difference and statistical significance. The data source used to obtain the sample size came from The DHS Program.

Instrumentation and Operationalization of Constructs

The published instrument was developed by USAID/MEASURE DHS and the publication year was 2013 (The DHS Program, n.d.d). The data were previously collected from June through November 2011 (MISAU, INE, & ICFI, 2013; The DHS Program, n.d.d). The 2020–2021 DHS is currently still ongoing and the survey data are not yet available. However, a future study could apply and potentially replicate the methodology using more current data and/or future datasets. The demographic and health surveys were appropriate for the study because they include targeted information/data to be able to answer the research questions of interest, including childhood immunizations. These surveys have been and are being used to be able to conduct other public health, population-based, evaluation, and other research studies in several lower- and middle-income countries, with publications that further demonstrate the validity and reliability of the DHS survey instrument (Corsi et al., 2012; The DHS Program, n.d.a). To ensure the

reliability of the DHS survey instrument, standard data collection procedures are implemented and multiple interviewer trainings are also conducted (Corsi et al., 2012).

As previously mentioned, I obtained permission from the developer to be able to use their published instrument for this study. A copy of the approval letter was included in the appendix.

Operationalization

This section includes the operational definition of the study variables. Preschool age is less than 5 years old and children should have received their routine (basic) childhood vaccinations by 12 months old. The childhood full immunization status as the dependent variable is defined as the following: a child aged 12–59 months who have received BCG, DPT_3, OPV_3, and measles vaccines. Whereas, incomplete status is if there is any of these vaccines missing; and non-immunization status is if none of these vaccines were reported. The independent variables of interest included child's gender; parents' educational level, household wealth index, religion, ethnicity/language, urban-rural residency, and province/region.

Data Analysis Plan

For the data analysis, I used the software SPSS version 27. I reviewed the DHS questionnaires and recoded variables to conduct the necessary data analysis. The following restates the research questions and hypotheses mentioned in Section1:

RQ1: What is the relationship between child's gender, parents' educational level, household wealth index, urban-rural residency, and the province/region with preschool children's immunization status in Mozambique?

$H_0$1: There is no relationship between child's gender, parents' educational level, household wealth index, urban-rural residency, and the province/region with preschool children's immunization status in Mozambique.

H_a1: There is a relationship between child's gender, parents' educational level, household wealth index, urban-rural residency, and the province/region with preschool children's immunization status in Mozambique.

RQ2: What is the relationship between significant sociocultural factors of religion and ethnicity/language with childhood immunization status at the provincial/regional level in Mozambique?

$H_0$2: There is no difference or there is no relationship between religion and ethnicity/language with childhood immunization status at the provincial level.

H_a2: There is a relationship between religion and ethnicity/language with childhood immunization status at the provincial/regional level.

The secondary data and sources of information include demographic and health surveys available and accessible through The DHS Program (The DHS Program, n.d.a). These are national household survey data for Mozambique (The DHS Program, n.d.d).

The analytical strategies depended on the types of variables of interest are presented in the demographic and health survey data. The dependent variable was dichotomous, and the independent/potential predictor variable of interest were all categorical variables. Therefore, the appropriate test statistic was the binary (or binomial) logistic regression. I further developed the analytic approach and strategies with input

from Walden University's quantitative methodology advisors and doctoral study committee's guidance.

Threats to Validity

As part of the data analysis, I took into account and addressed potential threats to validity. For external validity, there are potential threats to consider about the generalizability of the study. An advantage of using DHS data with a large sample size of nationally represented data, the intent is that the data analyzed will be generalizable to a larger population and the results could be applied to public health practice and policy (Steckler & McLeroy, 2008). However, with the use of secondary data, a limitation is that only selected variables were included by the data collectors. Yet, these still include valuable data of interest.

The other threats to validity relate to internal validity (e.g., history, instrumentation, and statistical regression). In terms of history, the data were previously collected in 2011 and possible external events at that time might affected respondents' responses. However, this study could be potentially replicated to apply to more recently collected data (including 2020–2021 data that might become available in the near future). To address potential issues that might be related to instrumentation, the survey questionnaires have been piloted, the interviewers trained, and multiple levels of quality checks have been put in place to standardize the survey procedures (MISAU, INE, & ICFI, 2013). The potential issue with statistical regression has already been addressed through the multistage sampling strategy used to select respondents, which avoids bias

towards selecting and including only particular individuals (Matthay & Glymour, 2020; Ohlund & Yu, n.d.).

Ethical Procedures

For the doctoral study, I utilized secondary data analysis of DHS dataset. These previously collected data by USAID/MEASURE DHS are anonymous and deidentified (The DHS Program, n.d.a). I analyzed aggregated data (no direct contact with human subjects). Per the requirements of Walden University, I submitted an application for ethical approval by Walden's Institutional Review Board (IRB) before obtaining the data and conducting any analysis. The DHS Program also required that the user register on their website before accessing the data. The data agreement to gain access to secondary DHS dataset and other required documentation and information were included in the IRB application. For the study's ethical procedural requirements, I obtained IRB approval (IRB approval number: 02-19-21-0723447) before conducting the data analysis and had no known conflict of interest.

For the actual DHS survey, it was reviewed and approved by the ICF Institutional Review Board (IRB) and any in-country/local IRB clearances required in Mozambique (The DHS Program, n.d.d). In addition, the ICF IRB required that the survey was compliant with the United States Department of Health and Human Services' protection of human subjects regulations (45 CFR 46; The DHS Program, n.d.e). Participation in the survey was voluntary (i.e., respondents were able to accept or decline participation, decline to answer any questions, or withdraw at any time without consequence) and informed consent was obtained from each respondent before conducting the survey

interview. For ethical considerations and to protect the DHS survey respondents involved, privacy and confidentiality were maintained during the data collection and data processing procedures (The DHS Program, n.d.e).

Summary

In summary, I further described in this chapter the proposed methodology to conduct this retrospective, cross-sectional doctoral study. The information included the rationale for the study design, the target sample, instrument, data used, and potential threats to validity. The ethical procedures were further described. Then in the next section, I will focus on the results of conducting the proposed methods and actual implementation of the study.

Section 3: Presentation of the Results and Findings

Introduction

The purpose of this doctoral study was to conduct quantitative research examining the sociocultural factors that may impact preschool children's immunization status at the provincial level in Mozambique. I examined the different factors that contributed to the disparities with immunization status of preschool children aged 12 months to 59 months. The research questions and the hypotheses are shown below:

RQ1: What is the relationship between child's gender, parents' educational level, household wealth index, urban-rural residency, and the province/region with preschool children's immunization status in Mozambique?

$H_0$1: There is no relationship between child's gender, parents' educational level, household wealth index, urban-rural residency, and the province/region with preschool children's immunization status in Mozambique.

H_a1: There is a relationship between child's gender, parents' educational level, household wealth index, urban-rural residency, and the province/region with preschool children's immunization status in Mozambique.

RQ2: What is the relationship between significant sociocultural factors of religion and ethnicity/language with childhood immunization status at the provincial/regional level in Mozambique?

- $H_0$2: There is no difference or there is no relationship between religion and ethnicity/language with childhood immunization status at the provincial/regional level.

- H_a2: There is a relationship between religion and ethnicity/language with childhood immunization status at the provincial/regional level.

In this section, I f describe the data collection procedures of the secondary data set from DHS, the process and results from the data analysis, and conclude with a brief summary.

Data Collection of Secondary Data Set

Before the secondary data could be accessed and analyzed, Walden University requires doctoral students to comply to ethical standards for conducting research and obtain IRB approval. To be in compliance, I completed the following before proceeding with the doctoral study: Form A, Collaborative Institutional Training Initiative (CITI) training, and then completion and submission of Form B for IRB approval for secondary analyses.

To access DHS data, users are required to register online and provide the purpose and reason for requesting the specific data sets and how they will be used. Then once reviewed and approved by DHS, a letter is sent to the registered user that includes a Data User Agreement. I only requested the Mozambique survey data sets and received approval to be used for the doctoral study.

To understand better the secondary data sets and for data analysis, DHS recommended the use of the following reports/publications: Guide to DHS Statistics (Croft et al., 2018), questionnaires used in the survey (MISAU, INE, & ICFI, 2013), and the DHS Recode Manual (The DHS Program, n.d.c). This manual provides a description, including the rationale for recoding variables, and information and dictionary on the

recoded variables). They also suggested additional resources available on the DHS websites and other helpful links.

The DHS team conducted the fieldwork to collect the data in Mozambique from June through November 2011. The sample design of the survey was probabilistic, stratified multistage cluster to include "populations residing in households" (MISAU, INE, & ICFI, 2013, p. 11). The initial stage was the delineation of the enumeration areas based on Mozambique's general population and housing census data (MISAU, INE, & ICFI, 2013). At the next stage, the household sample was selected from each enumeration area. This design strategy provides a representative sample at the national, residential (e.g., urban, rural), and regional (e.g., provincial) levels (MISAU, INE, & ICFI, 2013; The DHS Program, n.d.b). The sample design resulted in the inclusion of 13,964 households. From the total number of households included in the survey, there were 13,871 women identified to be eligible. Out of this subsample, there was a 99% response rate to include 13,718 women interviewed. Demographic and health data were collected from these women aged 15 – 49 years old and their children under 5 years old in these selected households (MISAU, INE, & ICFI, 2013).

The field staff/interviewers who conducted the primary data collection were trained on the fieldwork procedures by INE and ICF International to ensure consistency. Due to the ethnolinguistic diversity of Mozambique, the field staff were from the provinces where they conducted the survey interviews and collected data and spoke the "prevailing languages in those areas" (MISAU, INE, & ICFI, 2013, p. 11). For standardization, the questionnaires used were based on the sixth phase of the

Demographic and Health Surveys (DHS-VI) with modifications tailored to the needs of Mozambique. The survey instruments were pre-tested in urban and rural locations in Bilene Macia District, Gaza Province (MISAU, INE, & ICFI, 2013). The data collected were entered into a tablet computer using the Computer-Assisted Personal Interview (CAPI) system (MISAU, INE, & ICFI, 2013). The fieldwork conducted was also closely supervised for quality control by INE, MISAU and ICF International staff. (MISAU, INE, & ICFI, 2013, p.12).

For the doctoral study, I used the children's dataset in the DHS Mozambique Kid's Recode (KR) file that contains child health data and indicators, including immunization data, as well as household and mother's information. The KR file includes one record for each child under 5 years old of the women interviewed. Therefore, for the KR file dataset, the unit of analysis (i.e., case) as defined by The DHS Program "is the children of women born in the last 5 years (0 – 59 months)" (Croft et al., 2018). The total number of children in the sample is 11,102 (weighted sample: 11,704). For the doctoral study, the age range of interest is from 12 to 59 months old for a total of 8,388 children. I selected this age range because the target population of interest was preschool aged children. In addition, children under 12 months old were excluded because, following Mozambique's immunization schedule, children should have received all the basic vaccines by 12 months of age (MISAU, INE, & ICFI, 2013).

Present Any Discrepancies in the Use of the Secondary Data Set from the Plan Presented in Section 2

Discrepancies in the use of the secondary data set from the initial proposed plan are presented below. The reason for the discrepancies is due to the data/variables available in the dataset. Because the child health data are linked to the DHS Mozambique Women Questionnaire, the parental data included the information of the mothers who were interviewed. However, the KR file does include the educational attainment of the mother's husband/partner, who is not necessarily identified as the father of the child; yet, this information was also included in the data analysis. Another caveat is that each country can specify certain questions to be included in the DHS questionnaire to meet their needs, and one of them is on ethnicity or language. For the purpose of this study, I captured ethnicity/language as one ethnolinguistic variable.

Description of Representative Sample of the Population of Interest (External Validity)

The intent, aim, and design of the DHS survey were to include data and indicators that are nationally and sub-nationally representative (ICF International, 2012). The geographic coverage of the survey included all the provinces/regions/ in Mozambique, including the urban and rural areas, and the capital city. As mentioned earlier, the DHS developers used a multistage probability sampling to obtain a representative sample randomly selected from the population of interest (ICF International, 2012). They applied and used sampling weights (weighted by cluster) in the data analysis to produce nationally and regionally representative survey results (ICF International, 2012).

Descriptive and Demographic Characteristics of the Sample and Univariate Analyses

The descriptive and demographic characteristics of the sample are described below. The sample includes data relevant to 8,388 children aged 12 – 59 months old. To capture the immunization status data, the sources of information are either from the child's immunization card or according to the mother's recollection of the child receiving all the basic vaccinations (if the child's immunization card was not available). The descriptive statistics and univariate analyses are presented in the tables below. In the sample, about 62% or 5,165 children aged 12 – 59 months old have full immunization status (all basic vaccinations received) as seen in Table 1.

Table 1

Frequency table of full immunization status

All basic vaccinations according to either source

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	3223	38.4	38.4	38.4
	Yes	5165	61.6	61.6	100.0
	Total	8388	100.0	100.0	

Tables 2 – 6 present the cross-tabulation data of child full immunization status by different factors according to the social ecological levels. There were 61.7% of boys and 61.5% of girls in the sample with full immunization status. The children's immunization status was verified by showing the vaccination card were 5,962 and those by mother's

recall were 2,427. These child-specific factors at the individual level are presented in Table 2 below.

Table 2

Full immunization status - Child/Individual level factors

		All basic vaccinations according to either source (%)		
		No	Yes	Number
Sex of child	Male	38.3	61.7	4196
	Female	38.5	61.5	4193
	Total	38.4	61.6	8388
Vaccination card seen	No	86.2	13.8	2427
	Yes	19.0	81.0	5962
	Total	38.4	61.6	8388

Table 3 shows the varying frequencies and percentages of full immunization status according to the mother's age in 5-year groups, their highest educational level, as well as their husband/partner's highest educational attainment, as interpersonal factors.

Table 3

Full immunization status - Parental (mother or husband/partner)/Interpersonal factors

		All basic vaccinations according to either source (%)		
		No	Yes	Number
Mother's Age in 5-year groups	15-19	35.9	64.1	527
	20-24	36.2	63.8	2032
	25-29	39.0	61.0	2084
	30-34	37.7	62.3	1721
	35-39	41.0	59.0	1232
	40-44	40.6	59.4	552
	45-49	45.4	54.6	240
	Total	38.4	61.6	8388
Mother's Highest educational level	No education	44.3	55.7	3129
	Primary	36.1	63.9	4318
	Secondary	29.5	70.5	894
	Higher	30.0	70.0	47
	Total	38.4	61.6	8388
Husband/partner's educational attainment	No education	46.3	53.7	1987
	Incomplete primary	40.7	59.3	3424
	Complete primary	30.0	70.0	803
	Incomplete secondary	27.0	73.0	979
	Complete secondary	34.3	65.7	306
	Higher	34.5	65.5	97
	Don't know	31.8	68.2	484
	Total	38.5	61.5	8081

Table 4 presents the varying frequencies and percentages of full immunization status according to the household wealth index that range from poorest to richest, as an organizational/institutional level factor.

Table 4

Full immunization status - Household/Organizational or institutional level factor

		All basic vaccinations according to either source (%)		
		No	Yes	Number
Wealth index	Poorest	49.1	50.9	1938
	Poorer	44.2	55.8	1851
	Middle	35.5	64.5	1631
	Richer	28.8	71.2	1671
	Richest	30.4	69.6	1296
	Total	38.4	61.6	8388

Table 5 includes the varying frequencies and percentages of full immunization status by religion and ethnicity/language, which could be considered as influencing factors at the community level.

Table 5

Full immunization status - Community level factors

		All basic vaccinations according to either source (%)		
		No	Yes	Number
Religion	Catholic	42.9	57.1	2373
	Islamic	31.9	68.1	1548
	Zion	39.3	60.7	1500
	Evangelical/ Pentecostal	33.6	66.4	1476

	Anglican	31.9	68.1	92
	No religion	42.8	57.2	827
	Protestant	43.9	56.1	422
	Other	37.6	62.4	148
	Total	38.4	61.6	8386
Ethnicity/Language	Emakhuwa	35.3	64.7	2027
	Portuguese	29.3	70.7	406
	Xichangana	24.6	75.4	918
	Cisena	34.6	65.4	959
	Elomwe	71.3	28.7	768
	Echuwabo	51.2	48.8	555
	Shona	34.3	65.7	131
	Cinyungwe	34.9	65.1	300
	Cibalke	47.2	52.8	68
	Bitonga	32.8	67.2	106
	Cicewa	48.6	51.4	731
	Ciyao	23.3	76.7	259
	Cichopi	31.4	68.6	105
	Cindau	26.3	73.7	370
	Shimakonde	21.4	78.6	109
	Chitewe	40.9	59.1	140
	Xitswa	32.0	68.0	309
	Xirhonga	18.7	81.3	25
	Kimwane	37.7	62.3	19
	Coti	54.6	45.4	8
	Outra/Other	53.1	46.9	75
	Missing	100.0	0.0	1
	Total	38.4	61.6	8388

Table 6 presents the varying frequencies and percentages of full immunization status by urban-rural residency and province/region, which could be considered as influencing factors at the social/public policy or enabling environment level.

Table 6

Full immunization status - Social/Public Policy (enabling environmental) level factors

		All basic vaccinations according to either source (%)		
		No	Yes	Number
Type of place of residence	Urban	31.2	68.8	2331
	Rural	41.2	58.8	6057
	Total	38.4	61.6	8388
Region	Niassa	26.9	73.1	499
	Cabo Delgado	33.2	66.8	703
	Nampula	36.2	63.8	1279
	Zambezia	64.8	35.2	1748
	Tete	39.6	60.4	1017
	Manica	39.0	61.0	621
	Sofala	20.1	79.9	831
	Inhambane	33.7	66.3	474
	Gaza	29.0	71.0	442
	Maputo Provincia	13.8	86.2	465
	Maputo City	30.9	69.1	311
	Total	38.4	61.6	8388

Based on the research questions and the following statistical assumptions, I used in this study the binary (or binomial) logistic regression as the appropriate test statistic:

- Assumption 1: The dependent variable is a dichotomous (categorical/nominal) variable.
- Assumption 2: There is at least one or more independent variable of interest included that can be categorical/nominal.
- Assumption 3: There is independence of observations and the dependent variable has “mutually exclusive and exhaustive categories” (Laerd Statistics, n.d.).

The results are described and presented below.

Results/Findings

To investigate if there is a relationship between the independent variables (IVs) and the dependent variable (i.e., if IVs/factors predict child's full immunization status), I conducted a binary logistic regression analysis]. The binary logistic regression analysis I performed using SPSS version 27examined the addition of possible predictor variables in five blocks according to the social ecological levels and sociocultural factors if 1) child's gender, 2) mother's educational level and husband/partner's educational attainment, 3) household wealth index, 4) religion and ethnicity/language, and 5) urban-rural residency and region are factors that predict a child's full immunization. The outcome of interest was child's full immunization status (*No=0, Yes=1*), i.e., all basic vaccinations received. The Hosmer-Lemeshow goodness-of-fit was not significant ($p > .05$), the *-2 Log likelihood* = 9667.395 and the *Nagelkerke R squared* = *.173*. According to Crouch and Dickes (2015), because the Hosmer-Lemeshow goodness-of-fit was not significant, this indicated the logistic model was appropriate and correctly specified. The model resulted that the independent variables child's gender and urban-rural residency were not significant ($p > .05$), however, the independent variables mother's educational level, husband/partner's educational attainment, household wealth index, religion, ethnicity, and province/region were found to be significant ($p < .05$). Controlling for child's gender and urban-rural residency, the predictor variables, mother's educational level, husband/partner's educational attainment, household wealth index, religion, ethnicity, and province/region, in the logistic regression analysis were found to contribute to the

model. Table 7 below presents the results of the binary logistic regression analysis as estimates of coefficients and odds ratio. The following summarizes the results of the significant predictor variables ($p < .05$) and possible interpretations:

- For mother's highest educational level, the reference category is "No education":
    - For Primary education: The unstandardized $B = .280$, $SE = .059$, $Wald = 22.638$, $p < .05$. The estimated odds ratio favored a positive relationship of about 32% [*Exp (B)* = 1.324, 95% CI (1.179, 1.486)] more likely to receive full immunization status with mothers with primary education level compared to having no education, after controlling for the other variables in the model (all other variables being constant).
    - Secondary education: The unstandardized $B = .316$, $SE = .124$, $Wald = 6.545$, $p < .05$. The estimated odds ratio favored a positive relationship of about 37% [*Exp (B)* = 1.372, 95% CI (1.077, 1.748)] more likely to receive full immunization status with mothers with secondary education level compared to having no education, after controlling for the other variables in the model.
- For husband/partner's educational attainment, the reference category is "No education":
    - Incomplete primary: The unstandardized $B = .297$, $SE = .066$, $Wald = 20.366$, $p < .05$. The estimated odds ratio favored a positive relationship of nearly 35% [*Exp (B)* = [1.345], 95% CI (1.183, 1.530)] more likely to receive full immunization status with mothers whose husband/partner

attained incomplete primary education compared to having no education, after controlling for the other variables in the model.

- Complete primary: The unstandardized B = .453, SE = .102, $Wald$ = 19.613, $p < .05$. The estimated odds ratio favored a positive relationship of nearly 60% [*Exp (B)* = 1.573, 95% CI (1.287, 1.922)] more likely to receive full immunization status with mothers whose husband/partner attained complete primary education compared to having no education, after controlling for the other variables in the model.
- Incomplete secondary: The unstandardized B = .466, SE = .107, $Wald$ = 18.817, $p < .05$. The estimated odds ratio favored a positive relationship of nearly 60% [*Exp (B)* = 1.593, 95% CI (1.291, 1.966)] more likely to receive full immunization status with mothers whose husband/partner attained incomplete secondary education compared to having no education, after controlling for the other variables in the model.
- Don't know: The unstandardized B = .259, SE = .116, $Wald$ = 4.983, $p < .05$. The estimated odds ratio favored a positive relationship of nearly 30% [*Exp (B)* = 1.295, 95% CI (1.032, 1.626)] more likely to receive full immunization status with mothers whose husband/partner's highest educational attainment is unknown compared to having no education, after controlling for the other variables in the model.

- For household wealth index, the reference category is "poorest":

- Richest: The unstandardized *B* = -.303, *SE* = [.126], *Wald* = [5.796], *p* < .05. The estimated odds ratio favored an inverse relationship of about 26% [*Exp (B)* = .739, 95% CI (.577, .945)] less likely of receiving full immunization status those in households with richest wealth index compared to those in the poorest wealth index, after controlling for the other variables in the model.

- For religion, the reference category is "Catholic":
  - Islamic: The unstandardized *B* = .463, *SE* = .084, *Wald* = 30.311, *p* < .05. The estimated odds ratio favored a positive relationship of nearly 60% [*Exp (B)* = 1.589, 95% CI (1.348, 1.874)] more likely of receiving full immunization status of Islamic religious affiliation compared to Catholic religious affiliation, after controlling for the other variables in the model.
  - Zion: The unstandardized *B* = -.221, *SE* = .091, *Wald* = 5.958, *p* < .05. The estimated odds ratio favored an inverse relationship of nearly 20% [*Exp (B)* = [.802], 95% CI (.671, .957)] less likely of receiving full immunization status of Zion religious affiliation compared to Catholic religious affiliation, after controlling for the other variables in the model.
  - No religion: The unstandardized *B* = -.303, *SE* = .101, *Wald* = 8.910, *p* < .05. The estimated odds ratio favored an inverse relationship of about 26% [*Exp (B)* = .739, 95% CI (.606, .901)] less likely to receive full immunization status of no religious affiliation compared to Catholic religious affiliation, after controlling for the other variables in the model.

- Protestant: The unstandardized $B = .281$, $SE = .125$, $Wald = 5.099$, $p < .05$. The estimated odds ratio favored a positive relationship of about 33% [*Exp (B)* = 1.325, 95% CI (1.038, 1.691)] more likely of receiving full immunization status of Protestant religious affiliation compared to Catholic religious affiliation, after controlling for the other variables in the model.

- For language/ethnicity, the reference category is "Emakhuwa" (the largest group in the sample):
  - Elomwe: The unstandardized $B = -.578$, $SE = .207$, $Wald = 7.831$, $p < .05$. The estimated odds ratio favored an inverse relationship of nearly 44% [*Exp (B)* = .561, 95% CI (.374, .841)] less likely of receiving full immunization status in the Elomwe group compared to the Emakhuwa group, after controlling for the other variables in the model.
  - Shimakonde: The unstandardized $B = .875$, $SE = .260$, $Wald = 11.330$, $p < .05$. The estimated odds ratio favored a positive relationship of nearly 2.4 times (about 140%) [*Exp (B)* = 2.398, 95% CI (1.441, 3.992)] more likely of receiving full immunization status in the Shimakonde group compared to the Emakhuwa group, after controlling for the other variables in the model.
  - Outra/Other: The unstandardized $B = -.617$, $SE = .299$, $Wald = 4.258$, $p < .05$. The estimated odds ratio favored an inverse relationship of about 46% [*Exp (B)* = 0.539, 95% CI (.300, .970)] less likely of full immunization

status in the “Outra”/other group compared to Emakhuwa group, after controlling for the other variables in the model.

- For province/region, the reference category is Maputo City:
  - Cabo Delgado: The unstandardized *B* = -.655, *SE* = .272, *Wald* = 5.797, *p* < .05. The estimated odds ratio favored an inverse relationship of 48% [*Exp (B)* = .520, 95% CI (.305, .885)] less likely of receiving full immunization status in Cabo Delgado compared to Maputo City, after controlling for the other variables in the model.
  - Nampula: The unstandardized *B* = -.734, *SE* = .262, *Wald* = 7.863, *p* < .05. The estimated odds ratio favored an inverse relationship of 52% [*Exp (B)* = .480, 95% CI (.287, .802)] less likely of receiving full immunization status in Nampula compared to Maputo City, after controlling for the other variables in the model.
  - Zambézia: The unstandardized *B* = -1.511, *SE* = .230, *Wald* = [43.025], *p* < .05. The estimated odds ratio favored an inverse relationship of nearly 78% [*Exp (B)* = .221, 95% CI (.141, .347)] less likely of receiving full immunization status in Zambézia compared to Maputo City, after controlling for the other variables in the model.
  - Manica: The unstandardized *B* = -.627, *SE* = .231, *Wald* = 7.345, *p* < .05. The estimated odds ratio favored an inverse relationship of nearly 47% [*Exp (B)* = .534, 95% CI (.339, .841)] less likely of receiving full

immunization status in Cabo Delgado compared to Maputo City, after controlling for the other variables in the model.

- Maputo province: The unstandardized $B = 1.034$, $SE = .208$, $Wald = 24.797$, $p < .05$. The estimated odds ratio favored a positive relationship of about 2.8 times (181%) [*Exp (B)* = 2.813, 95% CI (1.872, 4.226)] more likely of receiving full immunization status in Maputo province compared to Maputo City, after controlling for the other variables in the model.

Table 7

The estimates of coefficients and odds ratio (OR) of binary logistic regression

Variables in the Equation	B	S.E.	Wald	df	Sig.	Exp(B) (OR)	95% C.I. for EXP(B) Lower	Upper
Sex of child - Female	-0.015	0.049	0.093	1	0.761	0.985	0.894	1.085
Mother's highest educational level			23.617	3	0.000			
Primary	0.280	0.059	22.638	1	0.000	1.324	1.179	1.486
Secondary	0.316	0.124	6.545	1	0.011	1.372	1.077	1.748
Higher	0.614	0.419	2.149	1	0.143	1.848	0.813	4.199
Husband/partner's educational attainment			35.715	6	0.000			
Incomplete primary	0.297	0.066	20.366	1	0.000	1.345	1.183	1.530
Complete primary	0.453	0.102	19.613	1	0.000	1.573	1.287	1.922
Incomplete secondary	0.466	0.107	18.817	1	0.000	1.593	1.291	1.966
Complete secondary	0.215	0.161	1.773	1	0.183	1.239	0.904	1.700
Higher	-0.106	0.281	0.143	1	0.705	0.899	0.518	1.560
Don't know	0.259	0.116	4.983	1	0.026	1.295	1.032	1.626
Wealth index			20.001	4	0.000			
Poorer	-0.033	0.072	0.209	1	0.648	0.968	0.841	1.114
Middle	0.095	0.078	1.462	1	0.227	1.100	0.943	1.282
Richer	0.142	0.090	2.492	1	0.114	1.153	0.966	1.375
Richest	-0.303	0.126	5.796	1	0.016	0.739	0.577	0.945
Religion			62.903	7	0.000			
Islamic	0.463	0.084	30.311	1	0.000	1.589	1.348	1.874
Zion	-0.221	0.091	5.958	1	0.015	0.802	0.671	0.957
Evangelical/ Pentecostal	0.083	0.087	0.908	1	0.341	1.087	0.916	1.290
Anglican	-0.037	0.251	0.022	1	0.883	0.964	0.589	1.576
No religion	-0.303	0.101	8.910	1	0.003	0.739	0.606	0.901
Protestant	0.281	0.125	5.099	1	0.024	1.325	1.038	1.691
Other	0.054	0.201	0.071	1	0.789	1.055	0.711	1.566

Variables in the Equation	B	S.E.	Wald	df	Sig.	Exp(B) (OR)	95% C.I. for EXP(B) Lower	Upper
Ethnicity			69.672	21	0.000			
Portuguese	-0.081	0.218	0.138	1	0.710	0.922	0.601	1.415
Xichangana	-0.064	0.248	0.067	1	0.796	0.938	0.577	1.524
Cisena	0.103	0.203	0.255	1	0.614	1.108	0.744	1.650
Elomwe	-0.578	0.207	7.831	1	0.005	0.561	0.374	0.841
Echuwabo	0.048	0.205	0.054	1	0.816	1.049	0.702	1.568
Shona	0.063	0.280	0.051	1	0.822	1.065	0.615	1.844
Cinyungwe	-0.083	0.234	0.125	1	0.724	0.920	0.581	1.457
Cibalke	-0.408	0.334	1.492	1	0.222	0.665	0.345	1.280
Bitonga	-0.348	0.355	0.965	1	0.326	0.706	0.352	1.414
Cicewa	-0.379	0.203	3.488	1	0.062	0.685	0.460	1.019
Ciyao	0.151	0.215	0.497	1	0.481	1.164	0.764	1.773
Cichopi	-0.191	0.343	0.309	1	0.578	0.826	0.422	1.619
Cindau	0.130	0.240	0.295	1	0.587	1.139	0.712	1.823
Shimakonde	0.875	0.260	11.330	1	0.001	2.398	1.441	3.992
Chitewe	-0.268	0.281	0.911	1	0.340	0.765	0.441	1.327
Xitswa	-0.047	0.322	0.021	1	0.884	0.954	0.507	1.794
Xirhonga	-0.179	0.602	0.089	1	0.766	0.836	0.257	2.721
Kimwane	-0.192	0.505	0.144	1	0.704	0.826	0.307	2.221
Coti	-0.860	0.735	1.369	1	0.242	0.423	0.100	1.787
Outra	-0.617	0.299	4.258	1	0.039	0.539	0.300	0.970
Missing	-21.696	54961.588	0.000	1	1.000	0.000	0.000	
Type of place of residence - Rural	-0.068	0.074	0.838	1	0.360	0.935	0.808	1.080
Region			266.007	10	0.000			
Niassa	-0.365	0.277	1.737	1	0.188	0.694	0.404	1.195
Cabo Delgado	-0.655	0.272	5.797	1	0.016	0.520	0.305	0.885
Nampula	-0.734	0.262	7.863	1	0.005	0.480	0.287	0.802
Zambezia	-1.511	0.230	43.025	1	0.000	0.221	0.141	0.347
Tete	-0.247	0.237	1.085	1	0.298	0.781	0.491	1.243
Manica	-0.627	0.231	7.345	1	0.007	0.534	0.339	0.841
Sofala	0.272	0.233	1.363	1	0.243	1.313	0.831	2.073
Inhambane	-0.231	0.269	0.735	1	0.391	0.794	0.468	1.346
Gaza	-0.031	0.200	0.025	1	0.875	0.969	0.655	1.434
Maputo province	1.034	0.208	24.797	1	0.000	2.813	1.872	4.226
Constant	0.727	0.274	7.041	1	0.008	2.069		

Summary

To summarize this section, I further described the sample, including demographic characteristics and descriptive statistics, and conducted binary logistic regression analysis using SPSS version 27 to answer the doctoral study research questions. Based on the data analysis and results from the logistic regression, the null hypotheses are rejected for both RQ1 and RQ2, that there is no relationship between child's immunization status and the predictor variables of interest. For RQ1, though child's gender and urban-rural residency were not statistically significant, the factors of mother's highest educational level, husband/partner's highest educational attainment, household wealth index, and province/region were significant predictor variables of full immunization status. Preschool children with mothers who have primary or secondary educational levels were >30% more likely to have full immunization status compared with those whose mother had no education. Husband/partner's educational attainment of incomplete primary, complete primary, and incomplete secondary favored a positive relationship that ranged from about 35% and up to nearly 60% more likely to have full immunization status compared with those who had no education. For the household wealth index, those in the richest households were 26% less likely to have full immunization status compared to those in the poorest households. With respect to regional/provincial differences, Cabo Delgado (48% less likely), Nampula (52% less likely), Zambézia (nearly 78% less likely), and Manica (about 47% less likely) had inverse relationships with full immunization status compared to those from Maputo City; whereas, Maputo province

had a positive relationship (about 2.8 times or 181% more likely) with full immunization status compared to those from Maputo City. For RQ2, religion and ethnicity/language were significant predictor variables of full immunization status. Affiliation with certain religions favored a positive relationship with full immunization status, including Islamic (nearly 60%) and Protestant (about 33%), and an inverse relationship with Zion (nearly 20% less likely) and no religion (about 26% less likely) compared to Catholic. For ethnolinguistic factors, Elomwe (nearly 44% less likely) and "other" (about 46% less likely) had inverse relationships with full immunization status compared to Emakhuwa; whereas, Shimakonde favored a positive relationship (nearly 2.4 times or about 140% more likely) with full immunization status compared to Emakhuwa. The final section of the doctoral study focuses on the application of the results and study findings to professional practice and their implications for social change.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

The overall purpose of this doctoral study was to conduct quantitative research examining the sociocultural factors that may impact immunization status. The nature of the doctoral study was a cross-sectional, quantitative analysis of secondary data using the 2011 Mozambique DHS datasets in the context of the SEM framework. I conducted the study to fill a gap in the literature to understand better how to improve childhood immunization status or uptake in Mozambique.

Interpretation of the Findings

The doctoral study results showed that there is a relationship between a child's full immunization status and certain sociocultural factors related to the mother's and her husband/partner's educational level or attainment, household wealth index, religion, ethnicity/language, and province/region. Preschool children with mothers who have primary or secondary educational levels were more than 30% more likely to have full immunization status compared with those whose mothers had no education. The husband/partner's education attainment of incomplete primary, complete primary, and incomplete secondary favored a positive relationship ranging from nearly 35% and up to nearly 60% more likely to have full immunization status compared with those who had no education. For the household wealth index, those in the richest households were 26% less likely to have full immunization status compared to those in the poorest households. Affiliation with certain religions favored a positive relationship with full immunization status, including Islamic and Protestant, and an inverse relationship with Zion and no

religion compared to Catholics. The ethnolinguistic variable of Elomwe and "other" had inverse relationships with full immunization status, whereas Shimakonde favored a positive relationship (about 140% more likely) compared to Emakhuwa. There were also regional/provincial differences with Cabo Delgado, Nampula, Zambézia, and Manica having an inverse relationship with full immunization status. In contrast, Maputo province had a positive relationship (about 2.8 times more likely) compared to Maputo City. Child's gender and urban-rural residency were not significantly associated with full immunization status. There are disparities in the immunization status based on certain sociocultural factors. From the findings, there is a need to consider the specific context and address childhood immunizations from the social ecological perspective and take into account the multifaceted factors that contribute to children's immunization status.

Some of the findings corroborate with other studies, including empirical studies, that looked at the various predictor variables, but either separately or in different ways and may have been conducted in another country or only in specific/targeted areas in Mozambique. For example, as mentioned in Section1, Shemwell et al. (2017) found no statistical difference between ethnic group, religion, and urban-rural residency in two districts in Zambézia province, but understanding or having knowledge of Portuguese (i.e., language) and the education level of the female head of household were shown to be related with the child's immunization status. Interestingly, children in the richest households based on wealth index were less likely to have full immunization compared those in poorest household. This finding is not consistently seen/reported in other studies and is context specific, which further reiterates that economics, income, or wealth alone

does not necessarily tell the whole immunization story. There are also other factors that impact full immunization status that should also be considered (Ashish et al., 2017; Restrepo-Méndez et al., 2016).

Limitations of the Study

Using secondary data, the study was bound to only the available data previously collected for another purpose. The intent of the study was not to show causal link but to identify socio-cultural factors that are associated with child immunization status. The available DHS data was from 2011 and the release of more current data was further delayed and likely affected by the pandemic and other in-country issues. Though there are these limitations with the doctoral study, I utilized representative DHS data and the results are potentially generalizable for broader application (The DHS Program, n.d.a). In terms of the validity and reliability of the secondary dataset, The DHS Program has detailed documentations and standardized procedures to ensure the quality and trustworthiness of their surveys and datasets, which are available and have been used for other studies (Corsi et al., 2012; The DHS Program, n.d.a). In the study, I documented the process and methodology in detail so that it could be replicated for future studies and applied as updated or more current data become available.

Recommendations

From the results of the doctoral study, presented below are recommendations for consideration based and grounded in the study's strengths and limitations and the literature reviewed. As previously mentioned in the literature review, there is a need to conduct immunization studies that are context specific as they relate to certain

populations, sub-populations, and areas. Additional and more targeted studies could be conducted to delve into the specific situation with more depth (e.g., qualitative studies) to further understand the context-specific immunization issues among certain sub-groups (e.g., religious groups) and provinces/region (such as Cabo Delgado, Nampula, Zambézia, and Manica). Given the limitations of this doctoral study, other factors could be further examined and also a comparison study of any changes with newer DHS data that become available and effects of current events/situational changes in Mozambique.

Implications for Professional Practice and Social Change

Professional Practice

From this doctoral study, secondary data analysis of DHS data provided another resource to improve understanding about childhood immunizations that could be applied to future studies in the field of public health. The study could inform potential multilevel strategies that include community engagement to learn about best practices of how certain sub-populations (e.g., religious and ethnic groups) have achieved higher childhood full immunization status. The methodology and results could potentially be broadly applicable and used in academia and in other professional and public health practice.

Positive Social Change

For the doctoral study, I aimed to contribute to the public health knowledge and understanding of the sociocultural factors that may impact childhood immunizations in Mozambique. My hope is that the findings could lead to further addressing the sociocultural disparities with the uptake of childhood immunizations and be used to

potentially inform multifaceted communication and educational interventions that take into account the social ecological perspective. Given the complexities with immunizations, particularly in the midst of a pandemic and in-country strife, the implications for social change and potential interventions are aimed not only at parents, but also consider the socioecological factors related at the community and social/public policy (enabling environment) levels to continue to strive towards improving children's full immunization status in Mozambique.

Conclusion

For the doctoral study, with a focused scope and from a social ecological perspective, I examined sociocultural factors that influence preschool children's immunization status in Mozambique. The secondary data analysis of the 2011 DHS Mozambique datasets that I conducted for this cross-sectional, descriptive, quantitative study showed that there is a relationship between a child's full immunization status and certain sociocultural factors related to the mother's and her husband/partner's educational level or attainment, household wealth index, religion, ethnicity/language, and province/region. Even with the limitations of the study, there is information learned and recommendations offered for possible future studies. The study further reiterates the need to continue to address the complex challenges with childhood immunizations, and the importance of multilevel/multifaceted approaches to improve children's immunization status to go beyond the basic/routine immunizations and continue to get the additional vaccines available and as new vaccines are rolled out for the prevention of diseases (including epidemics and pandemics) that have local public health as well as global

health impact. Though this is just one academic step, the implications for social change include that the study findings may contribute to the knowledge, information, and body of literature on childhood immunizations. These could further lead to ongoing steps toward reducing health disparities and improving children's full immunization status to enhance global health and health equity.

References

Adamu, A. A., Sarki, A. M., Uthman, O. A., Wiyeh, A. B., Gadanya, M. A., & Wiysonge, C. S. (2019). Prevalence and dynamics of missed opportunities for vaccination among children in Africa: Applying systems thinking in a systematic review and meta-analysis of observational studies. *Expert Review of Vaccines*, *18*(5), 547-558. https://doi.org/10.1080/14760584.2019.1588728

Agadjanian, V., & Jansen, N. A. (2018). Historical legacies, social capital, and women's decision-making power: Religion and child nutrition in Mozambique. *Journal of Religion and Health*, *57*(4), 1458-1472. https://doi.org/10.1007/s10943-017-0526-6

Antai, D. (2009). Inequitable childhood immunization uptake in Nigeria: a multilevel analysis of individual and contextual determinants. *BMC Infectious Diseases, 9*(1), 1-10. https://doi.org/10.1186/1471-2334-9-181

Ashish, K. C., Nelin, V., Raaijmakers, H., Kim, H. J., Singh, C., & Målqvist, M. (2017). Increased immunization coverage addresses the equity gap in Nepal. *Bulletin of the World Health Organization, 95*(4), 261. https://doi.org/10.2471/BLT.16.178327

Bingham, A., Gaspar, F., Lancaster, K., Conjera, J., Collymore, Y., & Ba-Nguz, A. (2012). Community perceptions of malaria and vaccines in two districts of Mozambique. *Malaria Journal*, *11*(1), 394. https://doi.org/10.1186/1475-2875-11-394

Bronfenbrenner, U. (1977). Toward an experimental ecology of human

development. *American Psychologist, 32*(7), 513. https://www.semanticscholar.org/paper/Toward-an-experimental-ecology-of-human-Bronfenbrenner/a5f5a4f4a4545519d84c5c57095b4bcc685d7dd9

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology*, *22*(6), 723. https://doi.org/10.1037/0012-1649.22.6.723

Brownwright, T. K., Dodson, Z. M., & van Panhuis, W. G. (2017). Spatial clustering of measles vaccination coverage among children in sub-Saharan Africa. *BMC Public Health*, *17*(1), 957. https://doi.org/10.1186/s12889-017-4961-9

Cau, B. M., Sevoyan, A., & Agadjanian, V. (2013). Religious affiliation and under-five mortality in Mozambique. *Journal of Biosocial Science*, *45*(3), 415-429. https://doi.org/10.1017/S0021932012000454

CDC. (2021). Social determinants of health: Know what affects health. https://www.cdc.gov/socialdeterminants/

Corben, P., & Leask, J. (2016). To close the childhood immunization gap, we need a richer understanding of parents' decision-making. *Human Vaccines & Immunotherapeutics*, *12*(12), 3168–3176. http://doi.org/10.1080/21645515.2016.1221553

Corsi, D. J., Neuman, M., Finlay, J. E., & Subramanian, S. V. (2012). Demographic and health surveys: A profile. *International Journal of Epidemiology*, *41*(6), 1602-1613. https://doi.org/10.1093/ije/dys184

Croft, T. N., Marshall, A. M., Allen, C. K., Arnold, F., Assaf, S., & Balian, S. (2018).

Guide to DHS statistics. ICF. https://dhsprogram.com/data/Guide-to-DHS-Statistics/Organization_of_DHS_Data.htm

Crouch, E., & Dickes, L. A. (2015). A prediction model of childhood immunization rates. *Applied Health Economics and Health Policy*, *13*(2), 243-251.

Frew, P. M., Saint-Victor, D. S., Owens, L. E., & Omer, S. B. (2014). Socioecological and message framing factors influencing maternal influenza immunization among minority women. *Vaccine*, *32*(15), 1736-1744. http://dx.doi.org/10.1016/j.vaccine.2014.01.03

Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). (2008). *Health behavior and health education: theory, research, and practice*. John Wiley & Sons. https://pdfs.semanticscholar.org/885d/139f0065dfaf1075dd9c76f3b87cf105719f.pdf

Golden, S. D., & Earp, J. A. L. (2012). Social ecological approaches to individuals and their contexts: Twenty years of health education & behavior health promotion interventions. *Health Education & Behavior*, *39*(3), 364-372. https://doi.org/10.1177/1090198111418634

Hinman, A. R. (2004). Immunization, equity, and human rights. *American Journal of Preventive Medicine*, *26*(1), 84-88. https://doi.org/10.1016/j.amepre.2003.09.008

ICF International. (2012). Demographic and health survey sampling and household listing manual. MEASURE DHS: ICF International. https://www.dhsprogram.com/publications/publication-dhsm4-dhs-questionnaires-and-manuals.cfm?cssearch=127353_1

Jani, J. V., De Schacht, C., Jani, I. V., & Bjune, G. (2008). Risk factors for incomplete vaccination and missed opportunity for immunization in rural Mozambique. *BMC Public Health, 8*(1), 1-7. https://doi.org/10.1186/1471-2458-8-161

Kestenbaum, L. A., & Feemster, K. A. (2015). Identifying and addressing vaccine hesitancy. *Pediatric Annals*, *44*(4), e71-e75. https://doi.org/10.3928/00904481-20150410-07

Kilanowski, J. F. (2017). Breadth of the socio-ecological model. *Journal of Agromedicine, 22*(4), 295-297. https://doi.org/10.1080/1059924X.2017.1358971

Kroger, A. T., Pickering, L. K., Wharton, M., Mawle, A., Hinman, A. R., & Orenstein, W. A. (2015). Immunization. In *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases* (pp. 3516-3553).

Laerd Statistics. (n.d.). Binomial logistic regression using SPSS statistics. https://statistics.laerd.com/spss-tutorials/binomial-logistic-regression-using-spss-statistics.php

Lanaspa, M., Balcells, R., Sacoor, C., Nhama, A., Aponte, J. J., & Bassat, Q. (2015). The performance of the expanded programme on immunization in a rural area of Mozambique. *Acta Tropica*, *149*, 262-266. https://doi.org/10.1016/j.actatropica.2015.06.007

Larson, H. J., Jarrett, C., Eckersberger, E., Smith, D. M., & Paterson, P. (2014). Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012. *Vaccine*, *32*(19), 2150-2159. https://doi.org/10.1016/j.vaccine.2014.01.081

Larson, H. J., Jarrett, C., Schulz, W. S., Chaudhuri, M., Zhou, Y., Dube, E., ... & Wilson, R. (2015). Measuring vaccine hesitancy: the development of a survey tool. *Vaccine*, *33*(34), 4165-4175. https://doi.org/10.1016/j.vaccine.2015.04.037

Laureate Education (Producer). (2016). *Meaningfulness vs. statistical significance* [Video file]. Baltimore, MD: Author.

Leischow, S. J., Best, A., Trochim, W. M., Clark, P. I., Gallagher, R. S., Marcus, S. E., & Matthews, E. (2008). Systems thinking to improve the public's health. *American Journal of Preventive Medicine, 35*(2 Suppl), S196–S203. https://doi.org/10.1016/j.amepre.2008.05.014

Matthay, E. C., & Glymour, M. M. (2020). A graphical catalog of threats to validity: Linking social science with epidemiology. *Epidemiology (Cambridge, Mass.), 31*(3), 376–384. https://doi.org/10.1097/EDE.0000000000001161

McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly, 15*(4), 351–377. https://doi.org/10.1177/109019818801500401

MISAU, INE e ICFI. (2013). *Moçambique Inquérito Demográfico e de Saúde 2011*. Calverton, Maryland, USA: MISAU, INE e ICFI. https://dhsprogram.com/publications/publication-FR266-DHS-Final-Reports.cfm

NIH Library. (2018). Health data resources: Common data types in public health research. https://www.nihlibrary.nih.gov/resources/subject-guides/health-data-resources/common-data-types-public-health-research

Nyambe, A., Van Hal, G., & Kampen, J. K. (2016). Screening and vaccination as

determined by the Social Ecological Model and the Theory of Triadic Influence: a systematic review. *BMC Public Health, 16*(1), 1166. https://doi.org/10.1186/s12889-016-3802-6

Office of Behavioral & Social Sciences Research. (n.d.). e-Source: Behavioral & social sciences research. https://obssr.od.nih.gov/wp-content/uploads/2016/05/Social-and-Behavioral-Theories.pdf

Ohlund, B., & Yu, C. (n.d.). Threats to validity of research design. https://web.pdx.edu/~stipakb/download/PA555/ResearchDesign.html

Oleribe, O., Kumar, V., Awosika-Olumo, A., & Taylor-Robinson, S. D. (2017). Individual and socioeconomic factors associated with childhood immunization coverage in Nigeria. *The Pan African Medical Journal*, *26*, 220. https://doi.org/10.11604/pamj.2017.26.220.11453

Orenstein, W. A., & Ahmed, R. (2017). Simply put: Vaccination saves lives. *Proceedings of the National Academy of Sciences*, *114*(16), 4031-4033. https://doi.org/10.1073/pnas.1704507114

Plotkin, S.A., Orenstein, W.A., Offit, P.A., & Edwards, K.M. (2018). *Plotkin's vaccines* (7th ed.). Elsevier.

Pool, R., Munguambe, K., Macete, E., Aide, P., Juma, G., Alonso, P., & Menendez, C. (2006). Community response to intermittent preventive treatment delivered to infants (IPTi) through the EPI system in Manhica, Mozambique. *Tropical Medicine & International Health, 11*(11), 1670-1678. https://doi.org/10.1111/j.1365-3156.2006.01725.x

Restrepo-Méndez, M. C., Barros, A. J., Wong, K. L., Johnson, H. L., Pariyo, G., França, G. V., … Victora, C. G. (2016). Inequalities in full immunization coverage: Trends in low- and middle-income countries. *Bulletin of the World Health Organization, 94*(11), 794–805B. https://doi.org/10.2471/BLT.15.162172

Salihu, H. M., Wilson, R. E., King, L. M., Marty, P. J., & Whiteman, V. E. (2015). Socio-ecological model as a framework for overcoming barriers and challenges in randomized control trials in minority and underserved communities. *International Journal of MCH and AIDS, 3*(1), 85–95. https://pubmed.ncbi.nlm.nih.gov/27621990/

Sallis, J. F., & Owen, N. (2015). Ecological models of health behavior. In K. Glanz, B. K. Rimer, & K. "V." Viswanath (Eds.), *Health behavior: Theory, research, and practice* (pp. 43–64). Jossey-Bass/Wiley.Shemwell, S. A., Peratikos, M. B., González-Calvo, L., Renom-Llonch, M., Boon, A., Martinho, S., ... & Moon, T. D. (2017). Determinants of full vaccination status in children aged 12–23 months in Gurùé and Milange districts, Mozambique: Results of a population-based cross-sectional survey. *International Health*, *9*(4), 234-242. https://doi.org/10.1093/inthealth/ihx020

Steckler, A., & McLeroy, K. R. (2008). The importance of external validity. *American Journal of Public Health*, 98(1), 9–10. https://doi.org/10.2105/AJPH.2007.126847

Sullivan, G. M., & Feinn, R. (2012). Using effect size-or why the p value is not enough. *Journal of Graduate Medical Education, 4*(3), 279–282. https://doi.org/10.4300/JGME-D-12-00156.1

The DHS Program. (n.d.a). Data. https://dhsprogram.com/Data/

The DHS Program. (n.d.b) DHS Methodology. https://dhsprogram.com/Methodology/Survey-Types/DHS-Methodology.cfm

The DHS Program. (n.d.c). DHS Recode Manual. https://dhsprogram.com/publications/publication-dhsg4-dhs-questionnaires-and-manuals.cfm

The DHS Program. (n.d.d). Mozambique: Standard DHS, 2011. https://dhsprogram.com/what-we-do/survey/survey-display-362.cfm

The DHS Program. (n.d.e). Protecting the privacy of DHS survey respondents. https://dhsprogram.com/What-We-Do/Protecting-the-Privacy-of-DHS-Survey-Respondents.cfm

UNDP. (2020). Human development report 2020: Mozambique. http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/MOZ.pdf

UNICEF. (2018). UNICEF 2017 report on communication for development (C4D): Global progress and country level highlights across programme areas. https://www.unicef.org/media/47781/file/UNICEF_2017_Report_on_Communication_for_Development_C4D.pdf

UNICEF Mozambique. (2014). Situation analysis of children in Mozambique 2014. https://sitan.unicef.org.mz/english/files/UNICEF%20SitAn%20FULL%2014%20EN_WEB.pdf

Vandelaer, J., Bilous, J., & Nshimirimana, D. (2008). Reaching Every District (RED) approach: a way to improve immunization performance. *Bulletin of the World*

Health Organization, *86*, A-B. https://doi.org/10.2471/blt.07.042127

World Factbook. (n.d.). Mozambique. https://www.cia.gov/the-world-factbook/countries/mozambique/

WHO. (2010). A conceptual framework for action on the social determinants of health. https://www.who.int/sdhconference/resources/ConceptualframeworkforactiononSDH_eng.pdf

WHO. (n.d.a). Countries - Mozambique: Immunization in Mozambique. http://www.who.int/countries/moz/immunization/en/

WHO. (n.d.b). Immunization, vaccines and biologicals: Partners and stakeholders. http://www.who.int/immunization/global_vaccine_action_plan/partners_stakeholders/en/index6.html

WHO Global Health Observatory. (2020). Data repository: Child mortality – Mozambique Data. https://apps.who.int/gho/data/view.main.SUBREGchildmortality-MOZ

Appendix: Letter of Approval for DHS Dataset Access and Use

ICF

Jan 28, 2021

Kristine Bernabe
Walden University
United States
[redacted]
Request Date: 01/28/2021

Dear Kristine Bernabe:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "Preschool Immunizations, Mozambique":

Mozambique

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified.

The DHS Data may be used only for the purpose of statistical reporting and analysis, and only for your registered research. To use the data for another purpose, a new research project must be registered. All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. Please reference the complete terms of use at: https://dhsprogram.com/Data/terms-of-use.cfm.

The data must not be passed on to other researchers without the written consent of DHS. However, if you have coresearchers registered in your account for this research paper, you are authorized to share the data with them. All data users are required to submit an electronic copy (pdf) of any reports/publications resulting from using the DHS data files to: references@dhsprogram.com.

Sincerely,

Bridgette Wellington

Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program

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