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Maternal Characteristics and Childhood Immunization Series Completion Rates Among Children 2-Years-Old

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Walden University
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Abstract

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Dissertation Submitted in Partial Fulfillment

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Abstract

Delays in childhood immunization may have adverse health implications. In the United States, childhood immunization among children who are below 3 years of age continues to be below Healthy People 2020 targets for some vaccines such as DTaP, PCV, HIB, Hep A, Rotavirus, and Hep B birth dose. The purpose of this study was to examine the association between maternal characteristics and childhood immunization series completion rates among children 2 years of age. The social learning theory and self-efficacy theory provided the theoretical foundation for the study. Data from the Florida Department of Health Immunization Surveys were used. ANOVA and multinomial statistical tests were used to analyze the data. According to the study results, maternal factors such as age, marital status, and educational level were significant predictors of childhood immunization completion rates. The findings from the study could lead to positive social change initiatives through education and inclusion of mothers' concerns during interventions to increase immunization rates in children. Increase in immunization completion rates can reduce communicable disease in the population. Insights from this study could assist health care providers, parents, and care givers in their responsibilities relative to childhood immunization practices.

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Dedication

This study is dedicated to my family, John, Garcia, Jhannel, and Jon who has truly supported me on this very long and arduous journey. My husband who supported me in so many ways; spending so many late nights and committing to numerous chores, which was difficult for me to complete. My children, I hope I have inspired you to succeed in your pursuit and for you to realize that life is what you make of it. This document is dedicated also to my dad who passed away September 2014 and never had the opportunity to celebrate this achievement. I cannot end without dedicating this study to the “Almighty” who gave me the strength and the courage to endure to this time. It is with gratitude, love, and perseverance that I can say Thank you, Thank you!

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Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Introduction

Immunization behaviors are influenced by parental knowledge level and attitude; a lack of parental knowledge about communicable diseases and the importance of vaccines are associated with low immunization completion rates (Whyte, Whyte, & Eccles, 2011). Parents must take responsibility for immunizing their child. Immunization programs worldwide require funding for vaccine purchasing, vaccine maintenance, and sufficient staffing; however, the health care system ultimately saves money when a child is properly vaccinated because child death and illness are prevented (Andre et al., 2008). High vaccination coverage helps to control and eliminate vaccine-preventable diseases. Although the Expanded Program of Immunization in Turkey had aimed for 95% immunization coverage, the vaccine targets for children 1 year of age and all vaccine coverage increasing within the last 10 years were unmet. The reasons for the incomplete and lack of up-to-date immunization are not understood (Ozkaya, Eker, Aycan, & Samamci, 2010). A mother's mental state may determine how well she is able to perform preventive measures, such as immunization (Ozkaya et al. 2010). Ozkaya et al. study to determine the association between a mother's anxiety state and whether she sought immunization coverage for a child less than 3 years of age found that mothers with high anxiety scores were more at risk for an incomplete vaccination status of her child. There were no indications as to whether socio- economic variables were associated with mothers with high anxiety scores, compared to those mothers with low anxiety scores (Ozkaya et al. 2010). Cox et al. (2008) study found that younger mothers tended to have

more emotional disturbances, loneliness, isolation, and depression compared to adolescent parents. The adolescent mothers were also less mentally developed. Cox et al. revealed that 53.6 % of the adolescent mothers had depressive symptoms in their first postpartum year; the adolescents also had higher occurrences of prior mental health issues (63%). According to Cox et al., depressed adolescents were less likely to have the ability to care for their children; therefore, it is important to design vaccine intervention programs that consider depression, social support, and parenting qualities.

The purpose of this study was to determine if there was an association between maternal characteristics and childhood immunization series completion rates among children 2 years of age. I explored the importance of immunization education and immunization conformity for all mothers who had children under their care regardless of ages (<20 years, 20-24 years, 25-29 years, and =>30 years) and other demographic factors. I examined the implications of incomplete or no immunization of the recommended vaccine series completion, which could lead to re-emerging communicable diseases (such as the recent outbreak of some vaccine-preventable diseases like the measles and mumps). The outbreak of measles in December 2014 in California was due to unvaccinated individuals (Center for Disease Control & Prevention, 2015a). This multistage outbreak was linked to the Disneyland Amusement Park in California. In August 24, 2015, 24 states had reported 188 measles cases (Center for Disease Control & Prevention, 2015a). Of the 188 reported cases, 117 cases were attributed to the Disneyland outbreak (Center for Disease Control & Prevention, 2015a). One hundred and ten measles cases were in California residents (Center for Disease Control & Prevention,

2015a). Forty five percent were unvaccinated, 5% had only one dose of a measles vaccine, 43% of the children had an unknown or undocumented immunization status, and the remaining 7% had two or more measles vaccine (Center for Disease Control & Prevention, 2015b). The United States declared measles elimination in 2000; however, countries where measles is endemic have been associated with outbreaks in parts of the country, as well as unvaccinated persons (Clemmons, Gastanaduy, Fiebelkorn, Reddi, & Wallace, 2015). Between January 4 and April 2, 2015, there were 159 measles cases, of which over 80% were attributed to unvaccinated individuals or individuals whose immunization status was unknown (Clemmons et al., 2015). Therefore, it is imperative to emphasize the importance for sustained immunization coverage across the United States (Clemmons et al., 2015).

Background

In the United States, the leading cause of hospitalization and outpatient visits in children are from respiratory diseases, such as pneumonia and influenza (Office of Disease Prevention & Health Promotion [ODPHP], 2013); these are vaccine-preventable diseases. Vaccine-preventable diseases illness or diseases are preventable when vaccinations are completed timely as recommended by Advisory Committee on Immunization Practices (ACIP). Gust et al. (2004) stated that parental attitudes, behaviors, and beliefs are ascribed to14.8% of children who not completely immunized. Luthy, Beckstrand, and Peterson (2009) claimed that parents delay immunizing their children because of confusion with the schedule and not understanding when to return. Childhood up- to-date immunizations is a quality measurement for child health care.

Inadequate immunization increases the chance for the child to acquire an infectious disease (Nguyen, Klusaritz, & Cronholm, 2014). Vaccines are the most cost-effective method to prevent children from contracting vaccine-preventable diseases (Kitamura, Komada, Xeuatvongsa, & Hachiya, 2013).

Scholars have attempted to explain the differences in immunization coverage among various ethnic groups and maternal characteristics, such as attitudes, beliefs, and behaviors (Adorador, McNulty, Hart, & Fitzpatrick, 2011; Luthy, Beckstrand, & Callister, 2010). The immunization series completion rate in 2013 for ≥ 4 doses of diphtheria, tetanus, and pertussis vaccine was the following: full series of haemophilus influenza Type B; vaccine ≥ 2 doses of Hepatitis A vaccine; Hepatitis B birth dose vaccine; and ≥ 4 doses of pneumococcal conjugate vaccine (Center for Disease Control & Prevention, 2014). Measles, mumps, and rubella were also below the Healthy People, 2020 target in 17 states (Center for Disease Control & Prevention, 2014). Therefore, it is imperative to maintain high coverage vaccine rates across all states and all groups to prevent the re-emerging of vaccine-preventable diseases (Center for Disease Control & Prevention, 2014).

Teen mothers may have little or no knowledge of vaccine-preventable diseases. Teen mothers and their children are at risk of poor or no vaccination due to the many challenges associated with teen motherhood. In this study, I sought to determine the association between maternal characteristics and childhood immunization series completion rates among children 2 years of age.

Problem Statement

Childhood vaccination is a basic public health policy as well as a health intervention (Buelow & Van Hook, 2008; Choi & Manning, 2010). The re-emergence of some childhood vaccine-preventable diseases warranted the need to examine maternal characteristics that could lead to the upsurge of these infectious diseases. The Healthy People 2020 immunization objective is to decrease, eradicate, or maintain the eradication of vaccine-preventable diseases (ODPHP, 2014). In the United States, vaccines are given at no cost to children under age 18 years who are enrolled with public and private providers, thereby helping to ensure that all children receive the recommended vaccine on schedule (Smith, Hinman, & Pickering, 2014). Seventeen vaccine-preventable diseases in infants, children, and adults have been recommended as routine vaccinations (Kroger, Sumaya, Pickering, & Atkinson, 2011). Vaccines are cost-effective measures for preventing diseases and improving the health of a country (Kitamura et al., 2013). According to Feemster, Spain, Eberhart, Pati, and Watson (2009), immunization delay predicts subsequent immunization status. Children whose immunizations are delayed are at risk for underimmunization. When immunizations are initiated late, it might be an indicator for inadequate receipt of general preventive health care. In the United States, immunization coverage varies by selected demographics and by state (Center for Disease Control & Prevention, 2014). Children of African Americans are more likely to be below the federal poverty level and have low coverage (Center for Disease Control & Prevention, 2014). Although there has been worldwide progress to control the spread of communicable diseases with the use of vaccines, some countries are struggling to uphold

immunization coverage due to regional and local disparities (World Health Organization, 2015a).

Access to health care and health insurance play a role in reducing vaccine-preventable diseases. In the United States, the Affordable Care Act provides parents the opportunity to receive preventive services, such as vaccines for their children. Some scholars have attributed low immunization rates to disadvantaged groups (Adorador et al., 2011; Henderson, Millet, & Thorogood, 2008). Some teen mothers have little or no knowledge of vaccine-preventable diseases. This limited knowledge could increase their difficulty in maintaining increased immunization coverage (Hilton, Patterson, Smith, Bedford, & Hunt, 2013). Low immunization may be due to attitudes, beliefs, and behaviors. More research is needed to identify the barriers to childhood immunization; once identified, intervention programs can be designed to reduce or eliminate those barriers (Niederhauser & Markowitz, 2007). The purpose of this study was to determine if there was an association between maternal characteristics and childhood immunization series completion rates among children 2 years of age.

Purpose Statement

The purpose of this study was to determine if there was an association between maternal characteristics and childhood immunization series completion rates among children 2 years of age. The examination of the demographic characteristics of the participants was vital in this study as the intent was to determine associations that could contribute to childhood immunization series completion rates. The Florida Department of Health Immunization Survey was chosen as the study site. I chose Florida because I

wished to have a better understanding of the challenges related to childhood immunization practices in that particular state. Secondary data from the Florida Department of Health Immunization Survey was used to gather demographic characteristics and childhood immunization series completion rates. Data from this source included maternal age groups: mothers below 20 years of age, mothers 20-24 years of age, mothers 25-29 years of age, and mother 30 years of age and over; and mothers' educational level, marital status, race and ethnicity, trimester of prenatal care, and childhood immunization series completion rate. Insights from this study could assist policy makers, health care providers, parents, and other caregivers of the role of maternal characteristics that might predict suboptimization of immunization coverage and therein guide future intervention strategies. Understanding the maternal characteristics that contribute to incomplete immunization or no immunization among children age 2 years and providing education and supporting to mothers in immunization practices could decrease vaccine-preventable diseases, thus supporting a healthier community and nation.

Research Questions and Null Hypotheses

RQ1: Is there a statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

Immunization series completion was defined by age 24 months in which there are four vaccinations for diphtheria, tetanus, and acellular pertussis (DTaP), three polio, one measles, mumps and rubella (MMR), three Haemophilus influenza Type B (Hib), three

hepatitis B, and one varicella. The statistical test for this research question was analysis of variance.

$H_0$1: There is no statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_1$1: There is statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

RQ2: Is there a statistically significant association between mothers' educational level and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

The statistical test for this research question was the analysis of variance test to determine if maternal characteristic predicted childhood immunization series completion rates among children 2 years of age.

$H_0$2: There is no statistically significant association between mothers' educational level and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_1$2: There is a statistically significant association between mothers' educational level and childhood immunization series completion 4:3:1: 3: 3:1 rate among children 2 years of age.

RQ3: Is there a statistically significant association between mothers' racial ethnicity and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

$H_0$3: There is no statistically significant association between mothers' racial ethnicity and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_1$3: There is a statistically significant association between mothers' racial ethnicity and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

RQ4: Is there a statistically significant association between mothers' marital status and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

$H_0$4: There is no statistically significant association between mothers' marital status and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_1$4: There is a statistically significant association between mothers' marital status and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

RQ5: Is there a statistically significant association between initiation of prenatal care and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

$H_0$5: There is no statistically significant association between initiation of prenatal care and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_1$5: There is a statistically significant association between initiation of prenatal care and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

RQ6: Is the mothers' age associated with the mothers' level of education, marital status, ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 (the last four in the series refer to four pneumococcal conjugate vaccines) rate among children 2 years of age?

The statistical test for this research question was a multiple logistic regression.

$H_0$6: The mothers' age is not associated with the mothers' level of education, marital status, ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 rate among children 2 years of age.

$H_1$6: The mothers' age is associated with the mothers' level of education, marital status, ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 rate among children 2 years of age.

Descriptive statistical tests were conducted in the study. Such statistics are used to describe the characteristic of the sample. In comparing the groups, the mean, median,

mode, range, standard deviation, and variability were used to describe and summarize personal and clinical data. Frequencies and percentages were computed to describe continuous and categorical demographics.

Theoretical Framework

The theoretical framework for this study was the social learning theory (SLT) and self-efficacy (SE). The SLT has been in use since the 1950s; however, it was later redefined by Bandura (1977) in addressing SE. The SLT theory deals with the cognitive, emotional, and behavioral aspects for understanding change in behavior. The SLT is also pertinent to changing human behavior and human development. The SLT centers on individuals learning from one another. People can learn new information and behaviors by observing other people (Chavis, 2012). The SLT was chosen because an individual's action is revealed in his/her cognitive activities, which are centered on human development. The SLT and SE theories can be used to examine children's health, maternal characteristics, and understanding of health care practices and how maternal developmental stages influences immunization practices. The ability to adhere to maternal responsibilities such, as completing childhood immunization series on time, can lead to increased childhood immunization rates. These concepts are important in the SLT and SE practices. Mothers should be educated on the importance of timely completion of childhood immunization series and be provided with information based on their individual needs.

Nature of the Study

The Florida Department of Health Immunization Survey (a quantitative, nonexperimental, cross sectional survey among 2-year-old children) was used in this study. Secondary data obtained from the Florida Immunization Survey among 2-year-olds in 2014 were used to test variables and characteristics to determine if there was an association between maternal characteristics of mothers and childhood immunization series completion rates among children 2 years of age. Inferential statistical tests were used to analyze the data. ANOVA and logistic regression analyses statistical tests were performed to provide answers to the research questions.

Operational Definitions

4:3:1:3:3 series: Four doses of DTaP, three doses of polio, one dose of MMR, three doses of Hib, and three doses of Hepatitis B.

4:3:1:3 series: Four doses of DTaP, three doses of polio, one dose of MMR, and three doses of Hepatitis B.

Adolescence: MacKay and Duran (2008) stated that the years vary and the period of life is debatable, especially by health professionals. Puberty for some children begins at age 10 years, and by age 19 years, most children have completed their teenage years and are moving into the young adult world. In this study, multiple ages for parents were used, and teens were reflected as under 20 years.

Childhood immunization: Vaccinations given to children known as vaccines for children (VFC) up to age 18 years as recommended by the Center for Disease, Control and Prevention and the Advisory Committee on Immunization Practices (Strikas, 2015).

Childhood immunization series completion rates: Vaccines that a child must complete by 2 years of age 4:3:1:3:3:1- four DTaP, three polio, one MMR, three Hib, three Hepatitis B, and one varicella; 4:3:1:3:3:1:4- four DTaP, three polio, one MMR, three Hib, three Hepatitis B, one varicella, and four pneumococcal conjugate (PCV).

Efficient decision-making: The choice of doing the right thing (Nura & Osman, 2012).

Immunization status: A child's up-to-date or not up-to-date required and/or recommended vaccines (Adorador et al., 2011).

Low-level literacy: Documents, brochures, and pamphlets exceeding the individual's reading skills (Wilson, Baker, Nordstrom, & Legwand, 2008).

Maternal literacy: The cognitive and social skills that determine the mothers' ability to access information and to understand and use that information to produce positive health outcome for her children (Wilson et al., 2008).

Self-efficacy: The ability of adolescents/ teens to carry out responsibilities and tasks, make decisions, and manage transitions. Low self-efficacy is associated with indecision about the future and behavioral problems (Nota, Soresi, Ferrari, & Wehmeyer, 2011).

Subpopulation: Socially situated groups (Henderson et al., 2008).

Teen parents: Parents aged 19 years and younger (Beers & Hollo, 2009); Patel and Sen (2012) used the age 18 years or less to define teens, and Jutte et al. (2010) considered mothers less than 20 years as adolescent.

Assumptions

The assumptions made for this study were the following:

1. The instrument used in the Florida Department of Health Immunization Survey was a reliable and standardized instrument.
2. The data collected by the Florida Department of Health were in accordance with ethical standard used for human subject research.
3. The sample chosen was representative of the state of Florida and included mothers of multiple age groups.

Data from the Florida Department of Health Immunization Survey were analyzed. The variables such as maternal age, mother's education, marital status, trimester initiation of prenatal care, ethnicity, and children immunization status were variables examined in the quantitative study. These variables further are explained in Chapter 3.

Scope

Numerous studies on childhood immunization have been conducted; however, few scholars have examined an association between maternal characteristics of mothers and childhood immunization series' (4:3:1:3:3:1 & 4: 3:1:3:3:1:4) completion rates among children 2 years of age. Buelow and Vanhook (2008) examined timely immunization and focused on 4:3:1:3:3 series. Other researchers looked at some single vaccines such as influenza (Santibanez, Santoli, Bridges, & Euler, 2006; Uwemedimo, Findley, Andres, Irigoyen, & Stockwell, 2012); varicella (Papaloukas, Giannouli, & Papaevangelou, 2014); and measles, mumps, and rubella (Avis, Tan, Anderson, Tan, & Muhajarine, 2007; Pearce, Law, Elliman, Cole, & Bedford, 2008). Some studies were

older than 10 years when the immunization series 4:3:1:3:3:1& 4:3:1:3:3:1:4 that is now studied was not in existence. Florida Department of Health (FDOH) has a history of monitoring and publishing immunization coverage of children, there were no studies of this nature conducted in Florida. In this study, I intended to fill the gap in knowledge of the role of maternal characteristics that could predict suboptimization of immunization coverage, therein guiding future intervention strategies.

In this study, I sought to accept or reject the hypotheses in the study and to make reliable inferences from empirical observations. Once inferences are observed, intervention programs can be designed to reduce the elements that influence childhood immunization series completion rates. The target population selected was mothers of multiple ages: mothers aged < 20 years, mothers aged 20-24 years, mothers age 25 to 29years, and mothers aged = >30years with children 2 years of age. Multiple age groups were selected to control for bias. Although secondary data obtained from FDOH were used to gather quantitative data, the results of the study are not limited to the state of Florida or other parts of the United States. There are similarities that are common among states and countries of parental attitudes, behavior, and childhood immunization practices. Secondary data were chosen to complete the study due to the cost it would incur to collect primary data. All ethical steps and principles were followed as would have been employed with primary data collection. Secondary data sharing increases the speed of scientific discovery and augments the value of public investment in research (Brakewood &Poldrack, 2013). A complete assessment of maternal factors such as age, maternal education, and initiation of prenatal care were reviewed. The correct number of

cases, the correct number of variables, and the original statistics were verified. The overarching goal of the study was to impart the information nationally and internationally as immunization plays a role in abating infectious diseases across all nations. Historical trend of Florida immunization series 4:3:1:3:3:1 are shown in the Table 1 below:

Table 1

Immunization Series 4:3:1:3:3:1 Levels in 2 -Year Old Children-Historical Trend, 2010-2014

	2010	2011	2012	2013	2014
Survey Participants	1,712	1,780	1,755	1,752	1,740
Complete %	81.1	86.1	83.0	86.7	85.6
Partial %	18.1	12.8	15.5	11.9	12.4
No Shots %	0.7	1.1	1.6	1.4	1.9
Private Provider %	65.9	70.9	76.7	73.7	75.1
CHD %	9.6	10	6.0	7.0	4.7
CHC %	5.4	4.8	4.7	4.6	5.9
No Source %	19.1	14.3	12.5	14.7	14.3
≥ 4 DTaP %	88.0	89.4	87.8	89.3	88.2
≥ 3 Polio %	94.2	95.2	95.5	96.2	95.5
MMR %	93.3	93.6	92.5	93.3	94.4
3 Hib %	91.3	94	96.7	95.8	96.1
3 Hep B %	93	94.6	92.3	95.0	94.1
VZV %	93.9	94.9	93.3	94.0	95.2
State Total	86%	94%	95%	93%	89%

Note. Adapted from "Survey of immunization levels in Two- year old children" by Florida Department of Health, 2013, from http://www.floridahealth.gov/prevention-safety-and-wellness/immunization/resources/surveys/_documents/2yo2013.pdf

The historical data immunization levels for the years 2010-2014 in 2-year-old children in Florida justified examining the role of maternal characteristics that might predict suboptimization of immunization coverage, guiding future intervention strategies. The involvement of private providers, community leaders, and policy makers is critical in vaccine intervention strategies.

Delimitations

The delimitations of fathers in the studies are displayed; the mother is the main figure in child survival programs, especially in developing countries, and is expected to initiate preventive services such as immunization and breastfeeding (Ozkaya et al., 2010). In addition, the mother is mainly the child's primary parent. Therefore, her destiny and the child's are closely connected (Mollborn & Blalock, 2012). Although fathers play a role in immunizations, especially when costs are incurred, women are in charge of taking their children for immunization (Babirye et al., 2011). Mothers involved in a stable relationship or living with a significant other were not defined as the data identified marital status as married or not married. Although many of the studies reviewed referred to parental factors, I addressed maternal characteristics because mothers are the main persons who seek health care for their child.

Limitations

The availability of secondary data in the state of Florida used to gather information on immunization series completion rates of 2- year-old children could pose a limitation; therefore, the findings from the study cannot be generalized beyond the study population as the data were only from the State of Florida. The data, however, could also

provide statistical information on teen pregnancy in the state of Florida. Teen pregnancy impacts children's health outcomes; therefore, it could be used to examine parents who give birth in their teen years and link this information to children who could be at risk for poor health status because of inadequate immunization. No data for fathers were collected, except their educational level; therefore, fathers were excluded from the study. With the use of secondary data, I had no control over the data. In using secondary data, I was aware that the original investigator could be seeking to estimate only the kind of data needed to test hypotheses. According to the Belmont Principle, secondary data should also follow the same human principle as that of primary data: respect for persons, justice, and beneficence (Brakewood & Poldrack, 2013). Secondary data allows the researcher to gather data from groups that he or she may not have access to, thereby enhancing the generalizability of the study and ensuring the likelihood that social justice is applied (Brakewood & Poldrack, 2013).

Using the FDOH Immunization Survey increases data errors and limits data interpretation due to the inaccessibility of aspects of the study to the public. Requesting unpublished areas of the survey was important. The FDOH had repeated consultations with vital statistics on birth records; using birth records 2 years prior to the immunization survey reduced the risk of reporting errors. There were no published data on quality control for the document for the public; however, the FDOH had its own internal data quality control staff who managed such functions. The Immunization Survey quality control documents were for internal use only. It should, however, be emphasized that government institutions do strive to have quality data.

Another concern was the survey design. Gaining access to the methodology was challenging; in addition, the process to gain permission was lengthy. Stratified sampling methodology was used where 20 of the largest counties and all other counties represented a stratum. A limitation with stratified sampling is that a complete list of the population must be available, and the list be portrayed in each stratum. The FDOH documented that the birth records were categorized based on vital statistics and county of residence at birth. A possible confounding variable was race. Race was defined as White and non-White. Because ethnicity included more groups than just White and non-White, both ethnicity and race was accounted for in the analysis. The study was limited to 2-year-old children with a Florida birth certification number.

Significance of the Study

The purpose of the study was to examine if there was an association between maternal characteristics and childhood immunization series completion rates among children 2 years of age. The risk to children who are born to young parents is now clearer; however, there still remains uncertainty as to whether the risks are associated with maternal age and other pre-existing factors (Beers & Hollo, 2009). Although teen pregnancy and teen parenting continue to be significant public health issues that merit ongoing attention (Beers & Hollo, 2009), Niederhauser and Markowitz (2007) highlighted the need for more research to identify the barriers to childhood immunization to design intervention programs to reduce the barriers. This study was centered on mothers of all ages. Understanding low childhood immunization completion rates could lead to the implementation of education and intervention programs that are tailored to

parents' needs to decrease vaccine-preventable diseases. In this study, I focused on maternal characteristics of mothers and childhood immunization series completion rates among children 2 years of age, which had not been previously studied in Florida. I attempted to fill the gap in research on the role of maternal characteristics predicting suboptimization of immunization coverage, thereby guiding future intervention strategies. The intent was to share pertinent findings of the study with immunization providers, immunization support groups, and policy makers to assist them with implementing strategies to augment immunization coverage, especially among this population. The insight gained from this study could also help inform health care practitioners in communicating to parents, especially those parents who have not seen the infectious diseases that are now re-emerging. Childhood immunization education is vital in order for parents to have a better understanding of the benefits and the risks of not having their child completely immunized.

This study contributes to positive social change by supporting the goals of Healthy People 2020 to increase immunization completion rates and to reduce vaccine-preventable diseases (Office of Disease Prevention & Health Promotion, 2013), thus helping the nation to remain healthier. The results of this study could provide evidence of the importance of childhood immunization education and childhood up to-date immunization conformity, thereby reducing communicable diseases. The study was applicable not only to a particular group of mothers, but also to all mothers who have children under their care with incomplete immunization or no immunization of vaccine series for children. Policy makers could have a better understanding as to the various

barriers that affect immunization completion rates of children concerning maternal factors. The results of study can be used to inform targeted education campaigns, public health actions for vaccine-preventable disease investigations, and future policies and immunization programs for all parents to increase the immunization rates of children less than 3 years of age.

Summary

This chapter was an introduction to the concerns of childhood immunization completion series rates noted in the United States and in some other countries, especially those children less than 3 years of age. Exploring the association between the maternal characteristics of mothers and childhood immunization series completion rates among children 2 years of age could be significant in childhood immunization completion series rates to address the ongoing issues of low childhood immunization series completion rates.

Chapter 2 contains the literature review on childhood immunization status, parental issues, and behaviors. The chapter review also includes health outcomes of children born to young parents, childhood vaccines, immunizations beliefs, perceptions and practices, barriers to immunization, benefits of education and immunization, immunization intervention programs and public health intervention applications, SLT, and SE.

Chapter 2: Literature Review

Introduction

Childhood immunization programs offer an investment return. Despite the advancement in immunization, nearly 300 children in the United States die each year from vaccine-preventable diseases. The Office of Disease Prevention & Health Promotion (2014) showed that 33, 000 lives have been saved, 14 million cases of diseases have been prevented, direct health care cost have been reduced by $9.9 billion, and $33.4 billion have been saved in indirect cost for children who followed the routine immunization schedule. Although many children receive the recommended schedule vaccines, many children continue to lag behind (Niederhauser & Markowitz, 2007; Whyte et al., 2011). Coverage rates may differ by race, geography, and ethnicity (Al-Sahab et al., 2012; Ransom, Schaff, & Kan, 2012), and few scholars have examined maternal factors as contributing factors to vaccination rates of children. According to Ransom et al. (2012), these differences in childhood immunization coverage rates have been noted for approximately 2 decades; however, the reasons for a lack of childhood immunizations are poorly understood. State laws require children to be fully immunized before entering school to make certain that children are protected; however, even those fully immunized by school entry may have been underimmunized during their first 4 years of life, at which age they are most vulnerable to severe morbidity and mortality from childhood diseases (Ransom et al., 2012). The purpose of this study was to examine if there was an association between maternal characteristics and childhood immunization series completion rates among children 2 years of age.

The use of secondary data was important for me to minimize the time it would take to complete a study. In addition, using primary data is costly. In support of the Belmont principle, researchers must practice autonomy by acting intentionally after providing sufficient information and time, allowing the participant to understand the information; doing no harm to the participants, supporting nonmaleficence; providing well-being to the participant and community; considering beneficence; and practicing justice by distributing social benefits equitably (U.S. Department of Health & Human Services, 1979). The FDOH immunization data are public data that were used only for research purposes.

The FDOH Immunization Survey was conducted under strict and confidential procedures, adhering to the principles mentioned above. Informed consents were obtained from the parents to participate in the FDOH Immunization Survey and to get permission to contact the children's immunization provider. The representation of proper sampling was evident in the Immunization Survey. Kemp and Drummond (2013) argued that the recruitment of a representative sample is crucial to research, and the study sample must represent the central characteristics of the population, as it will allow for meaningful generalization of the population. The Florida Department of Health Immunization Survey (FDHIS) database contained all Florida birth records and provided vital statistics. These birth records consisted of all 2-year-old children born 2 years prior to 2014 from the Vital Statistics Resident Live birth for the month of January 2012.

The sample size was calculated using an online sample size calculator. The population used in the calculator was the total number of births in January for the county

(population), divided by an integer (1, 2, 3…), which was the number of 2-year-old children in the immunization registry to obtain the sample. I used record frequency to establish the integer to obtain the sample for each county; the n^{th} record was pulled and was included in the sample for the county. The sample file was created and submitted to the Bureau of Immunization. The data were further cleaned, with the inclusion of vital statistics after which the sample was ready for survey. The researchers created the survey output, displaying the immunization coverage rate as the number of children who completed the immunization series divided by the survey participants for the county. The survey participants equaled the sample size, minus the number of children who I was unable to locate.

Numerous scholars have looked at the immunization coverage status of children and the health of children born of teen parents (Brunson, 2013; Jutte et al., 2010; Luthy et al., 2009; Mollborn & Dennis, 2012; Whyte et al., 2011). The goal of the Global Immunization Vision and Strategy (GIVS) was to reduce vaccine-preventable diseases by two thirds by 2015 as recommended by the World Health Organization and the United Nations Children Fund (Wolfson et al., 2008). There are the numerous factors that affect a child's immunization status. Some of the factors are attributed to children whose parents are considered to be in high risk groups and parents who are in minority groups, multiethnic groups, rural populations, and home-schooled children (Adorador et al., 2011; Henderson et al., 2008; Luthy et al., 2010; Niederhauser & Markowitz, 2007). Luthy et al. (2010) provided information on the reasons why parents do not adhere to childhood immunization, and they found that the majority of parents in Utah who had

underimmunized their children had waved their decision in immunizing their child due to a fear of vaccine side effects, safety concerns, and their belief that the child did not need so many vaccines at one time. The demographics of the participants were mainly non-Hispanic Whites (70.4), Hispanics (23.9%), Hawaiian or Pacific Islander, and other (5.6%); some college education and college graduates made up 78.2% of the sample; high school education was over 14 %; did not graduated from high school was 7.2%; and mean income was U.S. $30,000-$45,000 (Luthy et al., 2010). Participants' religion or religious beliefs were unaccounted for (Luthy et al., 2010). Twenty-four percent of the parents were concerned about the safety of vaccines and feared mercury-based preservatives in vaccines called thimerosal, which they believed caused autism (Luthy et al., 2010). Thimerosal is a well-known preservative used in vaccines, and there is no evidence to support that the quantity used in vaccine causes autism (World Health Organization, 2015b). Some parents felt that some of the vaccines were unnecessary and or should be given one at a time or when they felt it was necessary (Luthy et al., 2010). Luthy et al. found that some participants believed that they should not be rushed or pressured into completing the vaccines for the provider's sake because of insurance purposes and making the clinic look well. Luthy et al. pointed to two main themes in parental hesitation in vaccinating their child: vaccine safety (84.4%) and the belief that so many vaccines were unnecessary (15.6%). The participants reported safety concerns were overload of the child's immune system and serious vaccine reactions, the perception that there were too many vaccines, and the vaccine schedule (Luthy et al., 2010).

Freed, Clark, Butchart, Singer, and Davis (2010) stated that safety concerns regarding vaccines in the United States have been in existence since the first small pox campaign in the 18th century. Feed et al. argued that safety concerns affect immunization completion rates in immunization completion rates. According to the World Health Organization (2015a), vaccine-preventable diseases can be prevented. Children who are not immunized are vulnerable to vaccine-preventable diseases. Giving several vaccines at any one time to a child produces no harmful effects, as children come in contact daily with many antigens that trigger the immune system, and these antigens far outnumber vaccines. Vaccines do not cause diseases; however, having a disease is risky as natural immunity can pose lead to complications including cancers and death.

Chapter 2 contains the literature review on childhood immunization status, parental issues, and behaviors. The chapter review also includes health outcomes of children born to young parents, childhood vaccines, immunizations beliefs, perceptions and practices, barriers to immunization, benefits of education and immunization, immunization intervention programs and public health intervention applications, SLT, and SE.

Organization of the Literature Review

A review of the literature was conducted to provide an experiential foundation for this study. Various databases such as CINAHL, Medline, PUBMED, Academic Search Premier, Psychinfo, and ProQuest were used to gather literature for the study. Immunization guidelines and recommendations on childhood immunizations were also reviewed from the CDC and the ACIP websites. Search terms were used and explored

such as *teen mother*, *teenage mother*, *teen parents*, *adolescent health*, *adolescent mothers*, *childhood immunization*, *immunization*, *SLT*, and *SE* to determine if these key terms would identify primary sources relevant for the study.

Immunization Intervention Programs

Many interventions in the United States have been developed to increase childhood immunization completion rates. These programs include Electronic Immunization Registry, Reminder/Recall system, Vaccine for Children, Standing Orders, Family Incentive Rewards, Home Visits, Catch up Immunization Schedule, Educational Intervention programs, and others. Most of these programs have been successful in increasing the immunization status of children living in the United States; however, failure to adhere to the schedule immunization, not just the first shot, may result in resurgence of disease (Guerra, 2007). Research is needed to determine the factors that contribute to some parents adhering to the childhood immunization schedule and others not adhering to the childhood immunization schedule. Underimmunization is a main cause of community immunity reduction to vaccine-preventable diseases, thereby increasing the risk for disease outbreak (Luthy et al., 2009).

The VFC program was initiated in 1994 with the goal of providing all eligible children with the recommended vaccines free of charge. These vaccines, purchased by the Center for Disease Control and Prevention (CDC), are allocated to state and local health departments that distribute the vaccines to clinics and physician offices. All children 18 years and below are eligible for the VFC. Although VFC rates have shown improvement in the United States, ongoing attention to vaccination rates is vital to ensure

that the program tackles the challenges to vaccinations and incorporates these factors to enhance delivery (Whitney, Zhou, Singleton, & Schuchat (2014). Some successful intervention programs are

- School registry/school records. Many states have criteria and school laws that require children to receive a certain number of vaccines prior to admission to school.
- Reminder/recall. The reminder system tracks future appointments for the client while the recall system tracks missed appointments in which the client would have had the immunization given. This program has shown to improve the immunization completion rates in all types of medical settings (The Community Guide, 2014; Vann & Szilagyi, 2005).
- Immunization schedule. The U.S. childhood immunization schedule is determined by the CDC as recommended by the ACIP (a committee consisting of medical and public health experts, the American Academic of Pediatrics, and the American Academy of Family Physicians). The purpose of the schedule is to provide immunity to children, especially in early life prior to them being exposed to life threatening diseases. Children less than 2 years of age are protected from approximately 14 serious vaccine-preventable diseases (ACIP, 2013).
- Immunization Information System (IIS). These electronic databases consolidate all immunizations given by all participating providers. The system facilitates immunization programs to discover vaccine-preventable

disease high risks areas and to implement efficient programs to protect those children who are located in high risk areas. IIS consolidates records, is private and confidential, provides reminders to family of immunizations due and those missed, offers clinical decision support, and serves as data exchange (Groom et al., 2014).

Despite all of these intervention programs and the success of vaccines in preventing many children from infectious diseases, there are still children under the age of 35 months in the United States who are not up-to-date with childhood immunization (Fagnan et al., 2011). Robison, Kurosky, Young, Gallia, and Arbor (2010) articulated that a challenge to increasing childhood immunization at the state or local level is the restricted standard summary measures of up-to-date rates. Robison et al. recommended a milestone approach to evaluate early childhood immunizations in which the patterns by which children fall behind at each milestone period are more evident.

Other interventions considered to help promote better health outcomes are the public health intervention model, which helps to explain the scope of practice and work of public health disciplines at the community and system level. Three components of this intervention model are

- Basis for all public health intervention
- Three levels of public health practices: community, systems, and individual/families
- Seventeen public health interventions: surveillance, disease and health treat investigation, outreach, screening, case finding, follow up and

referral, case management, delegated functions, health teaching, counseling, consultation, collaboration, coalition building, community organizing, advocacy, social marketing, policy development, and enforcement (Minnesota Department of Health, 2001).

Figure 1 below shows a diagram of the intervention components:

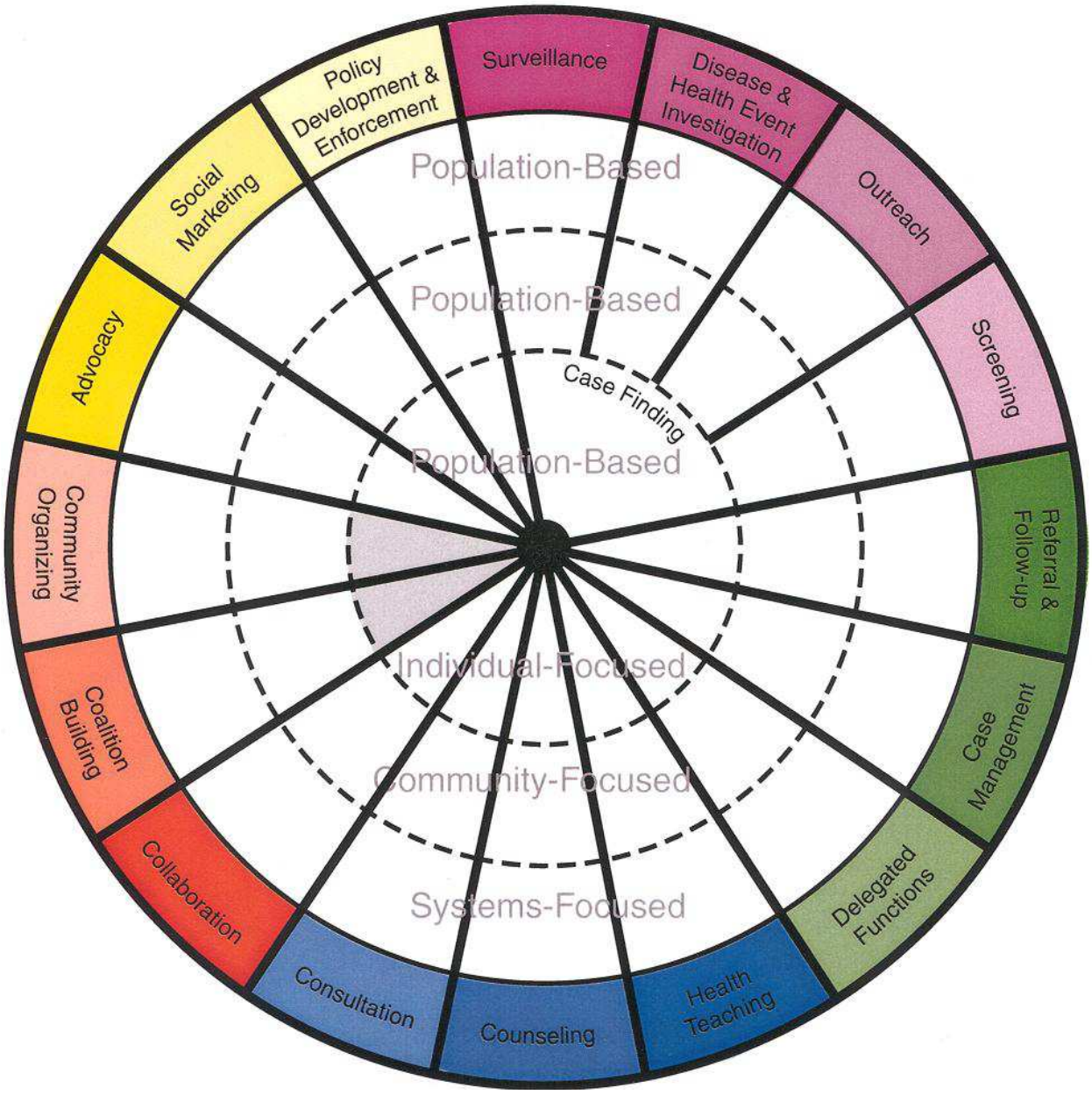

Figure1. Applications for public health nursing practice. Adapted from the Minnesota Department of Health, 2001, from www.health.state.mn.us/divs/opi/cd/phn/docs/0301wheel_manual.pdf

According to Whyte et al. (2011), if the factors that influence parental decision-making related to childhood immunization were better understood, immunization interventions would be better developed and tested to strengthen the relationship between parents and the community to enhance the health outcomes for children.

Health Outcomes of Children Born to Young Parents

In the United States alone, more than one in six female teens is expected to give birth before the age of 20 (Mollborn & Blalock, 2012). As a result, an important policy in the United States is to improve the health outcomes of teen parents and their children (Mollborn & Blalock, 2012). In 2010, the United States' teenage birth rate was 34.3 births per 1,000 females, ages 15-19 years of age (Martinez, Daniels, & Chandra, 2012). This was a 44 % decline from the peak rate observed in 1991 (Martinez et al., 2012). Teen pregnancy rates in the United States, although declining, are significantly higher than those of other Western countries (Martinez et al., 2012). Martinez et al. (2012) declared that teen childbearing is associated with social disadvantage and adverse child developmental outcomes. Young maternal age has been shown to negatively influence behavioral outcomes (Mollborn & Dennis, 2012). Young mothers tend to display lower-quality parenting practices. Mollborn and Dennis (2012) found that children of the youngest mothers have more negative outcomes. Teens are less positive in their parenting skills and have more unrealistic expectations (Beers & Hollo, 2009).

Teen births continue to afflict the United States. Patel and Sen (2012) stated that each year, about 750,000 women aged 15-19 years get pregnant; the majority of these pregnancies result in live births. About 10% of U.S. births in 2006 were linked to

adolescents (Patel & Sen, 2012). Teen childbearing has been linked to adverse health and well-being of children (Aujoulat, Libion, Berrewaerts, Noirhomme-Renard, & Deccahe, 2010; Jutte et al., 2010; Mollborn & Dennis, 2012; Patel & Sen, 2012).

Teen mothers' beliefs, perceptions, and knowledge of health and available medical services might be hampered by social and psychological factors (Beers & Hollo, 2009; Mollborn & Dennis, 2012; Patel & Sen, 2012; Sadler et al., 2007; SmithBattle, 2008). Kroger et al. (2011) stated that teen parents are incapable of providing self-care or dependent care. Younger mothers possess lower quality parenting practices and their parenting is limited compared to adult mothers, especially in relation to behavior patterns, appropriateness, vocal responsiveness, cognitive preparation, parenting role, levels of stress, and adaptive parenting styles (Mollborn & Dennis, 2012). Children born to teen mothers are at risk for developmental problems (Beers & Hollo, 2009). Barnett (2008) found that teen mothers were only associated with compromised parenting with the presence of psychological distress. Teen mothers are still teenagers who have their own developmental needs and who must attend to complex maternal tasks (Sadler et al., 2007).

Stiles (2010) stated that teen mothers have less healthy relationship skills in relating to their children compared to adult mothers and supported the premise that teen mothers cannot visualize that their actions, feelings, or attitudes affect their infants. Teen mothers may not realize that they have to dismiss their own needs and feelings in order to focus and respond timely to their infants (Stiles, 2010). They need support to help care for themselves and their children, and support should include teaching them how to care

for their infants. Stiles argued that adolescents caring for their children might not have accomplished the stage of formal operational thought; they are unable to see that their actions, feelings, or attitudes directly affect their children (Stiles, 2010). Depression, parenting stress, and social support are noted in some teen mothers (Stiles, 2010). These affect both the health of the infant and the teen mother. Stiles concluded that the components of maternal sensitivity that the single teen mother expresses are a representation of all adolescent mothers.

Sriyasak, Akerlind, and Akhaven (2013) implied that teenage mothers globally are a public health concern, as both pregnancy and birth are problems. Teenage mothers have two roles to complete: teenage roles and their parenting roles. Teen mothers often struggle to cope with the developmental tasks of motherhood and the tasks of a teenager. Time and energy for childcare tasks and responsibilities becomes complicated for teen mothers. Sriyasak et al. claimed that teen mothers lack of self-confidence in caring for their children and in breastfeeding. Sriyasak et al. recommended that health care providers must provide childcare experiences in both ante-partum and postpartum periods through teaching and demonstration. Focusing more on the needs of teenage mothers in relation to their growth and development in health care practices would afford better health care decisions for teen mothers' children.

Patel and Sen (2012) implied that teen motherhood is associated with adverse outcomes; however, there is uncertainty as to whether it is experiencing teen motherhood that leads to these adverse outcomes or if it is the factors that cause teen motherhood that leads to poor outcomes (Patel & Sen, 2012). Although Patel and Sen showed that teen

motherhood did lead to poorer physical health, especially as mothers aged, Patel and Sen hypothesizes that it could be the economic constraints of teen motherhood and the issues of early childrearing that caused the young mothers to be incapable of caring for their own physical health. Teen mothers' beliefs, perceptions, and knowledge of health and available medical services might be hampered by social and psychological factors (Beers & Hollo, 2009; Mollborn & Dennis, 2012; Patel & Sen, 2012; Sadler et al., 2007). Teen motherhood leads to poor physical health; therefore, a mother's poor physical health could be detrimental to the health of her infant/child.

Mollborn and Dennis (2012) examined the relationship between parenting teens and child outcomes. Mollborn and Dennis questioned whether maternal age was related to pre-existing social disadvantage, ongoing resource disadvantage, and parenting practices. Mollborn and Dennis argued that even before the birth of the child, teenage mothers who become pregnant are disadvantaged socioeconomically and educationally and that pre-existing social disadvantage accounts for the maldevelopment noted among teen mothers' children. Mollborn and Dennis claimed that a lack of material and social resources was evident and that few resources were available for teen parents. Mollborn and Dennis also stated that the social isolation and or stigmatization that teen parents faced resulted in a lack of resources. Mollborn and Dennis provided several explanations for the different ways in which some teen parents care for their children: teen development, which explained the immaturity and inexperience that teens display in adult roles and family stress. Families who are undergoing economic hardship are faced with psychological distress (Mollborn & Dennis, 2012). Most teenage parents face such

adversity. Developmental differences such as cognitive, attachment, physical growth, health, and learning between teenage mothers' children and those children of older mothers were observed by the start of schooling and as the child got older (Mollborn & Dennis, 2012). Differences in parenting practices between young mothers and older mothers affect children's development, and early child bearing affects children's development (Mollborn & Dennis, 2012).

Jutte et al. (2010) found that teen mothers are more likely to have infant deaths, school-aged deaths, and adolescent deaths. In children of teen mothers, hospitalization rates in the first year of life were more than doubled for who mothers who had never been a teen mother; the relative risk was 2.11, with a 95% confidence interval (Jutte et al., 2010). For children ages 1-5 years, hospitalization was higher for teen mothers (Jutte et al., 2010). Jutte et al. showed that although only 16.5 % of the children were born to teen mothers and prior teen mothers, it accounted for 27% of the children hospitalized during the first year of life. Thirty four percent of these children died, 30% failed to graduate high school, 51% were in foster care, 44% were on welfare as young adults, and 56% of the children would be teen mothers for the next generation (Jutte et al., 2010). Expanded services should be implemented to improve the medical and social needs for children of teens.

Aujoulat et al. (2010) explored the views of young mothers on their personal experience of teenage pregnancy and motherhood, as well as the health and education needs of young parents and parents-to-be. Aujoulat et al. found that health education, psychosocial and health needs, health needs at delivery time, and health needs after the

birth of the baby were concerns for young mothers and mothers-to-be. The needs of teen mothers must not be limited to counseling about termination, continuing the pregnancy, or contraception, but also the need for continuous professional support.

Sriyasak et al. (2013) claimed that becoming a mother generates emotional responsibility in the maternal role and leads to affection towards babies; however, teen mothers need support from their families and health care providers. Assistance with infant care builds self-confidence in the teens' maternal role and in childcare. Children of adolescent mothers are more at risk for adverse health problems compared to older mothers; however, not all adverse health outcomes are directly associated with maternal age (Pinzon & Jones, 2012). The outcome of children born to younger mothers versus older mothers needs to be explored to determine if there is any health difference in these children, especially in the childhood immunization completion series.

Childhood Vaccines

Maintaining high levels of childhood vaccinations is important, and continued success involves acceptable coverage. Parents need to be committed to vaccination to prevent their children from contracting vaccine-preventable diseases (Bond & Nolan, 2011). Parents may be overwhelmed by the complicated immunization schedule, making immunization commitment difficult. Some parents may also question vaccine safety (Bond & Nolan, 2011).

The earliest record of vaccination began in the 18th century when Lady Wortley Montagu learnt of variolation in Constantinople; a process where the dried scabs of small pox was blown into Asians' and Africans' noses (in 1717) causing them to develop a

mild form of the disease (U.S. National Library of Congress, 2015). Lady Montagu's influence, along with the Prince of Wales, allowed small pox (in 1721) to be injected underneath the skin of prisoners and abandoned children (U.S. National Library of Congress, 2015). Months later, those inoculated were exposed to small pox; however, they did not contract the diseases. Due to the trial, the Royal family was inoculated. The procedure later extended to Europe (U.S. National Library of Congress, 2015). By the end of the 19th century, several vaccines for humans were developed, including small pox, rabies, plague, cholera, and typhoid vaccines. Some pioneers in vaccine development are Edward Jenner for small pox, Jonas Salk and Albert Sabin for polio, Pasteur for the rabies vaccine, and Hilleman for the rubella vaccine now used in the MMR series.

Vaccine development and testing in the United States follows a standard set of steps. They are tested more rigorously than nonvaccine drugs due to the number of human subjects who are in vaccine clinical trials, which are usually greater than in nonvaccine trials (The College of Physicians of Philadelphia, 2015). The federal government, mandated by the US Public Service Act (1944), issues licenses for biological products, such as vaccines. The center that is responsible for vaccine safety and regulation is the Center for Biologics Evaluation and Research (The College of Physicians of Philadelphia, 2015).

In 1921, there were 206,000 cases of diphtheria in the United States, which resulted in 15, 520 deaths (The College of Physicians of Philadelphia, 2015). The death rates ranged approximately 20% for individuals under 5 years and over 40 years (The

College of Physicians of Philadelphia, 2015). Diphtheria was known to be the third leading cause of death in England and Wales in 1930 (The College of Physicians of Philadelphia, 2015). The diphtheria vaccine was cultivated in 1921; however, it was not extensively used until the 1930s, and in the 1940s, it was combined with tetanus and pertussis to form the DPT vaccine (The College of Physicians of Philadelphia, 2015). During 2004-2008, there were no reported cases of diphtheria in the United States, which was likely due to effective immunization and the advent of several immunization intervention programs. In 2007, 4,190 cases were reported globally (The College of Physicians of Philadelphia, 2015).

According to the National Immunization Survey (NIS, 2014), the national coverage for all recommended vaccines in 2010 remained stable compared to 2009. The NIS showed variations according to race, poverty, and state. The CDC (2011) stated that the present childhood immunization schedule prevents nearly 42,000 deaths and 20 million cases of disease: a profit of nearly $14 billion direct costs and $69 billion societal costs. Cases of whooping cough (pertussis) and measles in children below 5 years of age continue to be seen in the United States despite the increase in coverage rates; therefore, the continuous monitoring of subpopulations is critical to ensure that all children are adequately protected (NIS, 2014). According to Whitney et al. (2014), 4 million children are born in the United States per year and are susceptible to vaccine-preventable infections, which continue to spread. This is a public health challenge for public health professionals due to the importation of diseases, such as measles, from countries where

these conditions are endemic. It is, therefore, important to monitor immunization coverage continuously.

Vaccines series 4:3:1:3:3:1 refers to four or more doses of diphtheria, tetanus toxoids, and pertussis; three or more doses of polio; one or more dose of MMR, three or more doses of HiB, three doses of Hepatitis B vaccine; and one dose of varicella; 4:3:1:3:3:1:4 refers to four or more doses of diphtheria, tetanus toxoids, and pertussis; three or more doses of polio; one or more dose of MMR; three or more doses of HiB; three doses of Hepatitis B vaccine; one dose of varicella; and four or more doses of pneumococcal conjugate (FDOH, n. d). Table 2 shows the recommended childhood immunization series for 2-year-old children.

Table 2

The Recommended Childhood Immunization Schedule: Age and Shot

AGE	**SHOT**
Birth	Hep B
2 months	DTaP, Hep B, Hib, IPV, PCV, Rotavirus
4 months	DtaP, Hib, IPV, PCV, Rotavirus
6 months	DtaP, Hib, PCV, Rotavirus*, Yearly Influenza
6-18 months	Hep B, IPV, Yearly Influenza
12-15 months	MMR, Varicella, PCV, Hib, Yearly Influenza
15-18 months	DtaP, Yearly Influenza
12-23 months	Hep A (2 doses), Yearly Influenza

Note. Adapted from "Policy statement: Recommended childhood and adolescent immunization schedule- United States, 2014," by American Academy of Pediatrics, 2014, *Pediatrics, 133*(2), p. 357-363. doi: 10.1542/peds.2013-3965

The lower rates of childhood immunization have been found in communities considered disadvantaged and in some minority communities where preventive health programs have been low (Henderson et al., 2008). Henderson et al. (2008) investigated whether religious or ethnic reasons were factors for the low immunization for the Jewish community. Henderson et al. showed that only one parent/mother had fully immunized all of her four children. The other mothers had indicated that vaccines were unnecessary and they were undecided about some vaccines due to advice given (Henderson et al., 2008). The mothers claimed that they were unlikely to immunize their younger children as they did for the older children (Henderson et al., 2008). Henderson et al. stated that the low immunization completion rates in the community were mainly from the community perceptions of vaccination harm, vaccination anxieties, and religious beliefs (Henderson et al., 2008). Henderson et al. identified the need to investigate how different social groups receive and process health information to determine how mothers of different populations understand the implications of childhood vaccines.

In a Utah community, Luthy et al. (2010) looked to establish the reasons why parents hesitated to immunize their children. The main concerns described by the parents were immunization safety and the lack of need for immunization (Luthy et al., 2010). One third of the parents who had their children immunized late had expressed concerns about reactions to vaccines (Luthy et al., 2010). Some parents listed vaccines as unnecessary, and some felt that individualized plans of care for their children were more important than a time schedule (Luthy et al., 2010). Luthy et al. confirmed that the most common reason that the majority of parents provided for late immunization for their child

was their confusion with the immunization schedule. The most hesitant parents were observed to be White mothers, 30-years-old, who had higher education levels (Luthy et al., 2010). Luthy et al. found that having more than three children in a family was related to immunization noncompliance. Luthy et al. declared that understanding the demographic profile of the target population is valuable in planning interventions to increase childhood immunization completion rates; identifying population specifics prior to intervention is important, as the national demographics of parents who hesitate to immunize their child may be different from those local community parents who hesitate to immunize their child.

Buelow and Van Hook (2008) examined the timely immunization series completion rates of children of immigrant parents. Buelow and Van Hook found that the children of foreign-born mothers were more likely not to complete an immunizations series on time. Maternal nativity, citizenship, and residential duration are factors to be considered when evaluating childhood immunization status or rates. Buelow and Van Hook voiced that attention is required for vaccination rates of children of newly arrived to the United States and noncitizen immigrants. The secondary data used from the FDOH in this study did not include information on maternal nativity; however, all 2-year-old children included in the survey were born in the state of Florida; therefore, portions of these young children would have some similar maternal characteristics as indicated in the Buelow and Van Hook study. In 2013, 13 U.S. states met the Healthy People 2020 goal by achieving a vaccination coverage rate of 80 % or more in the 4:3:1:3 (four DTaP,

three polio, one MMR, and three Hep B series) among children aged 19-35 months (Child Trends Data Bank, 2014).

In another childhood immunization study, Vikram, Vannerman, and Desai (2012) argued that an association between maternal education and childhood vaccination existed, and they posited that educated women are given higher status in most social arenas and medical practitioners show more respect to them. Guerra (2007) focused on the implications of delays in immunization, which can have potential serious health effects. Guerra stated that although some scholars inferred that the unavailability to health care is not a reason for the delay in immunization, it still factored into maternal decision for vaccination. Both practitioners and parents have a responsibility to adhere to the recommended childhood immunization schedule and improvement in adhering to the recommended childhood immunization schedule would be a success in protecting children from diseases (Guerra, 2007).

Babirye et al. (2011) determined the influences on immunization practices by using the attitude social self-efficacy model. Babirye et al. argued that there are three main factors that contribute to a parent's decision to vaccinate his or her child: individual attitude towards childhood immunization, social influence and support from significant persons in the child's life, and self-efficacy, which directly influences behavior. Babirye et al. stated that previous behavior or attempting to carry out the behavior created a feedback mechanism that influenced parental social self-efficacy. Recommendations for health promotional activities to improve immunization uptake were suggested; however, because socioeconomic and demographic factors are not easy to change, identifying those

factors are crucial to plan for improving immunization completion rates (Babirye et al., 2011). Immunization programs should empower women economically and help men recognize the role of female decision-making for their child's health

Miller, Verhoef, and Cardwell (2008) explored rural parents' perspectives about information on childhood immunization. Miller et al. found that although immunization information played a part in their decisions regarding childhood immunization, there were other factors that influenced a parent's decision to vaccinate his or her child, such as personal experiences, beliefs, perceived risks, their parental rights to make decisions, and relationships with their child health provider. Miller et al. concluded that t parents should immunize their children for the benefit of the community; however, some parents may see the risk as being unnecessary. The nurses had a better understanding of maternal concerns and recognized the need to present the benefits and risks in a manner to support immunization (Miller et al., 2008). Miller et al. recommended for further inquiry on a larger and more diverse population to determine if there are differences between rural and urban maternal perspectives to assist health care professionals who are front liners in childhood immunization practices.

In Hong Kong, the immunization coverage rates for childhood vaccines are 100%; however, the uptake rates of optional vaccines in Hong Kong remain suboptimal (Wang, Lam, Wu, Liao, & Fielding, 2014). Wang et al. (2014) conducted a study to determine how a group of mothers made decisions for their children's vaccines and found that institutional factors, insufficient vaccine knowledge, advice impact on motivation, vaccination barriers, and social influences impacted parent's decisions to vaccinate his or

her child. Institutional factors that influenced parents' vaccination decision were the health care system, which included policies and vaccination schedules (Wang et al., 2014). The insufficient vaccination knowledge and advice included insufficient knowledge and misconceptions, awareness of vaccine availability, key sources of vaccination information, a lack of vaccination advice from health care providers, and low trust from health care professionals in optional vaccines (Wang et al., 2014). Wang et al. found that the provision of free mandatory vaccines under the CIP prompted parents to vaccinate their children. Despite the program, social influence was crucial in maternal vaccination decisions for the mothers in the study (Wang et al., 2014). Wang et al. justified the need to include mothers, as mothers are the main informants to assess their child's need for a vaccination.

Immunization and Home Schooled Children

Although home schooled children were not assessed in the study, this population constitutes approximately 2 million children in the United States (Choi & Manning, 2010). There is uncertainty whether these children are adequately immunized (Choi & Manning, 2010). Some states have different immunization guidelines for home schooled children, and others do not require registration for home schooled children, making the immunization status of these children difficult to trace. Many home schooled children may not receive adequate vaccinations due to the lack of immunization laws that are in place to monitor childhood immunization in home schooled children. Unvaccinated home schooled children could pose a threat to themselves and other individuals (Choi & Manning, 2010). In this study, I assessed the immunization series completion rate of 2-

year-old children who were born in Florida. Home schooled children who attend medical facilities and who were vaccinated in the geographical locations were unidentified. These children made up the study population and were factored in the secondary data.

Barriers to Immunization

Leask et al. (2012) implied that poor communication can affect immunization compliance. A factor in determining maternal acceptance to childhood immunization is the mother's interaction with the health care provider. In effective interactions, the health care providers address the concerns that mothers have and may motivate those mothers who are hesitant in immunizing their child to adhere to immunization (Leask et al., 2012). On the other hand, poor communication may lead to vaccine refusal. Health care providers may assume that the refusal of vaccine is a result of maternal ignorance, contributing it to poor communication (Leask et al., 2012). The provider may attempt to correct the situation by persuading the mother or providing more information to the mother. That approach is ineffective as there are multitudes of reasons associated with immunization refusal, and many parents decide on immunizing their child based on the how the information is presented according to their experience and the social context (Leask et al., 2012). Trust in the person who supplied the information is more significant than the information itself. Leask et al. stated that communication strategies in immunization remain ineffective, and good communication is a core measure for immunization uptake. There is a need for evidence-based vaccine interventions that take into account the importance of mother-provider interaction.

Luthy et al. (2009) developed a questionnaire to determine the reasons that parents hesitated to immunize their child and found that the most common reason provided for the delay in immunization was confusion about the schedule and the uncertainty of when to return. These concerns may affect timely immunization series completion. In addition, these parents may have similar characteristics of the study population.

Freed et al. (2010) examined if vaccine refusal and vaccine safety concerns were more common in specific population groups and found that women were more likely to be concerned about safety issues. Hispanic parents, compared to White and Black parents, were more likely to believe that vaccines cause autism in healthy children (Freed et al., 2010). Black parents were more likely to refuse recommended vaccines by their child health care provider (Freed et al., 2010). Childhood vaccines, such as varicella, meningococcal conjugate, and MMR were the most commonly refused vaccine (Freed et al., 2010). Freed et al. claimed that although the majority of children in the United States received immunization, if informational programs do not address the safety concerns of target populations, more parents will continue to refuse vaccines. DeStefano, Price, and Weintraub (2012) evaluated immunization and autism spectrum disorder and found that the amount of antigens in the vaccines in a given day or during the first 2 years of a child's life had no relationship to autism. Price et al. (2010) conducted a study on vaccine safety related to exposure to thimerosal. Thimerosal is a preservative used in some vaccines that contains mercury, ethlymercury, and thiosalicylate (Price et al., 2010). Price et al. found no evidence that increasing ethlymercury exposure from thimerosal-

containing vaccines related to any risk of autism or autism disorder. Due to the many concerns regarding thimerosal in vaccines, the U.S. Food and Drug Administration (2014) removed or reduced thimerosal to trace amounts in all vaccines that are recommended for children 6 years of age and younger. The inactivated influenza vaccine is an exception as it still contains thimerosal. A preservative-free inactivated influenza vaccine is given to infants, children, and pregnant women (U.S. Food and Drug Administration, 2014). This preservative-free inactivated influenza consists of trace amounts such as 1 microgram or less of mercury per dose (U.S. Food and Drug Administration, 2014). The American Academy of Pediatrics (2010) implicated that some organizations and websites have represented themselves as credible resources on vaccine information; however, the information they offered is flawed and biased, which has stimulated public concern regarding the safety of vaccine. As a result, there has been an increased rate of immunization refusal or hindrance to timely childhood immunization.

Exploring the experiences and the perceptions of the severity of disease and susceptibility of 45 Australian parents, Bond and Nolan (2011) found different interpretations among parents classified as immunizers (35.5%), incomplete immunizers (27%), partial immunizers (15.5%), and nonimmunizers (22%) regarding the severity and susceptibility to diseases and vaccine risk. The immunizers feared unfamiliar diseases while the nonimmunizers feared unknown, long-term side effects of vaccines (Bond & Nolan, 2011). The participants believed that the risk and complications of diseases are not equally spread in the community; it is not the number of individuals who have the disease, but rather the familiarity or the unfamiliarity of the disease and the

characteristics of persons with the disease that forces them to act (Bond & Nolan, 2011). The majority of the participants felt that they were not at risk to contract disease, but believed it was not worth to take risk with their children's health (Bond & Nolan, 2011). Familiar disease may play a role in delaying immunization or not immunizing, as these diseases to parents are not considered severe (Pineda & Myers, 2011). Many parents do not understand the risk and severity of vaccine-preventable diseases, and they are unaware that they are uninformed. Most parents want a trusting health care relationship, they want more information, and they value guidance and want someone to validate the information they discover (Pineda & Myers, 2011). Communication that entails listening and acknowledging individuals concerns is appreciated (Bond &Nolan, 2011).

Wilson et al. (2008) assessed maternal health literacy and mothers' aptitude in comprehending and communicating information regarding childhood immunization among low-income mothers. Wilson et al. showed that literacy level had a relationship with the benefits and risks of polio and pneumonia vaccines. Mothers with one child correctly identified benefits of the pneumonia vaccine 70% of the time, while mothers with more than one child identified the benefits of pneumonia vaccines 100% of the time (Wilson et al., 2008). Wilson et al. found that age was not significantly associated with the benefits or safety of pneumonia or polio vaccine. Some relationship was evident with the correct responses with the risk of pneumonia vaccine and age. Younger mothers' responses to risk of pneumonia vaccination were more correct (Wilson et al., 2008). Overall, there were inconsistencies of the mothers' ability to communicate crucial vaccine immunization information (Wilson, et al., 2008). Wilson et al. suggested that

accurate information is necessary to alleviate fears and barriers to immunizing children. Promoting self-care performances as a normal growth and developmental process should be encouraged; nurses should also involve prevention, controlling and curing diseases, and the prevention of disability.

Most of the studies reviewed excluded the association between maternal factors and childhood immunization completion series rates. The few studies on the association between maternal age and immunization focused on teenagers attitudes towards their own vaccines (Hilton et al., 2013; Lehmann & Benson, 2009; Sakou et al., 2011). Studies on childhood immunization with a wide range of parental age did not examine the association between childhood immunization completion series rates and maternal age (Brunson, 2013; Buelow &Van Hook, 2008; Henderson et al., 2008; Luthy et al., 2009). Lehmann and Benson (2009) supported the call for increasing vaccine awareness among parents of adolescents. In Lehmann and Benson's study, the ages of the parents of these adolescents were not determined, and the study was not linked to some of the childhood vaccines that are recommended and required for children below age 3. This knowledge may enhance the implementation of strategies that would be useful in increasing vaccine awareness. Luthy et al. (2009) found that low immunization rates were associated with parents being hesitant to immunize their child for reasons such as confusion about the schedule and not being sure when to return. Luthy et al. showed that the most common response for the child being overdue for his or her vaccines was being confused with the immunization schedule. The most common concern the parents had regarding childhood immunization was the child's cry, anxiety, and pain (Luthy et al., 2009). The parents also

saw their child primary care provider as the vaccine information source (Luthy et al., 2009).

Williams et al. (2013) addressed an intervention program designed to increase parents' acceptance of childhood vaccines. Williams et al. concluded that educational intervention, even as minimal as an 8-minute video, as well as information customized to vaccine-hesitant parents could improve their attitudes towards childhood immunization. Gust et al. (2008) explored mothers' attitudes and beliefs about vaccines and their relationship with their child's primary care provider. The majority of the mothers' concerns were about vaccine safety (particularly autism), mercury in vaccines, and the number of vaccines that a child received that could be too much for the child's immune system (Gust et al., 2008). Most mothers were aware of the requirements of the state exemption from childhood vaccines (Gust et al., 2008). The majority of the mothers were curious as to when their child should not get a vaccine, the long-term effects of vaccines, the effects of not receiving the vaccine, and if there was any natural immunity rather than vaccines (Gust et al., 2008). In regards to the information provided by their child's primary care provider, the mothers felt that they were the most respected source of immunization information; however, the mothers did not take their concerns seriously (Gust et al., 2008). Some other topic suggestions were the names of the vaccines, testing of vaccines and vaccine risk, not judging parents, and presenting the facts to parents Gust et al., 2008). In Phase 2 of Gust et al.'s study, educational materials were modified based on the recommendations of the mothers. The mothers favored the revised educational materials, and most commented that the brochures were more trustworthy and made them

feel better informed and safe (Gust et al., 2008). Gust et al.'s was applicable to my study because mothers are forefront decision makers in immunization practices. In order to increase childhood immunization series completion rates, ongoing immunization education is a key component.

The studies in the literature reflected the importance of childhood immunization. Scholars reviewed the attitudes and beliefs among parents toward childhood immunization, the health of teen mothers' children, vaccine adherence in adolescents, the barriers to immunization in certain ethnic groups, and parental education and its relation to childhood immunization (Adorador et al., 2011; Gust et al. 2005; Henderson et al., 2008; Lehmann & Benson, 2009). Parental practices that influence a child's health and the factors that contribute to poor child health, such as maternal education, culture, belief system, parental attitude, parental economic status, and social support were also factors linked to childhood immunization history. These researchers, however, did not explore the association between maternal characteristics and childhood immunization series completion rates among 2-year-old children. Understanding this association could enhance strategies that could be useful in increasing vaccine series completion rates.

Other immunization barriers noted are children sick at time of the visit, transportation issues (Adorador et al., 2011), provider communication issues, and vaccine safety (Dorell, Yankee, Kennedy, & Stokley, 2012). Parents with a history of substance abuse, parental motivation issues, work schedule, a lack of parental support complex, parental knowledge, parental beliefs, parental fears, organizational barriers, transportation, financial, childcare, and child illness issues (Niederhauser & Markowitz,

2007) are also barriers to children receiving vaccines. In most of the studies, parental lack of knowledge seemed to be a common theme. There are significant barriers in the immunization delivery process. Incomplete immunizations are reasons for the incidence of diseases, and the recent outbreaks of vaccine-preventable diseases are associated with incomplete immunizations (Gore et al., 1999).

Benefits of Education and Childhood Immunization

Vikram et al. (2012) explored the benefits of education and childhood immunization and they highlighted four benefits: educated mothers have a better understanding of medical practices that they referred to as the human capital advantage of education; education offers a range of contacts for mothers allowing them more accessibility to medical services, termed social capital path to better health care; education awards general skills that are socially valued, placing these mothers in higher statuses that raised their self-confidence and improved social interaction, called cultural path to medical care; and education may allow women to participate in a more dynamic, self-confident role in their homes and in public that allow them to claim better health care for their children. Vikram et al. showed that socioeconomic status and residence had an impact on maternal education and childhood immunization. Parents with higher education levels had children who were more likely to be fully immunized with the recommended vaccines (Vikram et al., 2012. Effective communication between the medical system and the mother is just as important as the individual characteristics of the mother (Vikram et al., 2012). However, maternal education is not the only factor that is associated with childhood immunization completion rates.

The VFC estimated that children who receive vaccines born between 1994 and 2003 will prevent 322 million illnesses, 21 million hospitalizations, and 732,000 deaths over the children's lifetimes. The estimated number of illnesses, hospitalization, and deaths prevented by routine childhood immunization for selected vaccine-preventable diseases among children born during the VFC era (1994-2013) in the United States (Whitney et al., 2014) is shown in Table 2 below:

Table 3

VFC Illnesses, Hospitalizations, and Death Estimations for1994-2013 (Cases Prevented in Thousands)

Vaccine Preventable Disease	Illnesses	Hospitalizations	Deaths
Diphtheria	5,073	5073	507.3
Tetanus	3	3	0.5
Pertussis	54,406	2,697	20.3
HIB	361	334	13.7
Polio	1,244	530	14.8
Measles	70,748	8,877	57.3
Mumps	42,704	1,361	0.2
Rubella	36,540	134	0.3
Congenital rubella syndrome	12	17	1.3
Hepatitis B	4,007	623	59.7
Varicella	68,445	176	1.2
Pneumoccous	26,578	903	55.0
Rotavirus	11,968	327	0.1
Total	322,089	21,055	731.7

Social Learning Theory

The SLT centers on learning, supporting the concept that people learn from one another by observing other individuals (Chavis, 2012). Bandura (1977) provided a theoretical framework for the SLT by investigating human thought and behavior. Bandura claimed that theories must reveal predictive power to discover the determinants of human behavior and the intervening mechanisms that are answerable for the changes.

A theory of behavior ought to clarify how patterns of behavior are obtained, how expression is controlled by the interactions of a person, and external sources of influence. Bandura implied that people learn by response consequences and that response consequences have three main functions: imparting information, serving as motivators, and strengthening responses automatically (reinforcing). In the informative responses, Bandura declared that individuals not only execute responses, but also are aware of the effects they produce in the course of learning. The information acquired serves as a guide for future action, which may present successful performances or ineffective performances. The motivational function enables an individual to be motivated when there is anticipatory capacities (ie., past experiences) that will result in expectations that certain deeds will produce benefits while others will not bring beneficial results. The third function is the reinforcing function; reinforcement offers a means of regulating behaviors that have been learned but have not been effective in creating the behaviors.

Learning through modeling by observing human behavior serves as a guide for action. By observing others, new behaviors are performed. Individuals practice model activities, which aids as their guides for suitable performances. Bandura (1977) named four components that govern observational learning: attention processes, retention processes, motor reproduction processes, and motivational processes. For observational processes, people do not learn by observing; they must become attentive to expose them to what can be obtained from the experiences. Retention processes deals with remembrance; people must remember the modeled behavior and retain the activities. Changing symbolic images into suitable actions is the motor reproduction processes.

Organizing a person's responses spatially and temporally with the modeled patterns produces behavioral reproduction. The responses chosen are based on cognitive skills, and the unavailability of such skills will allow for faulty behavioral responses. Motivational processes involve adapting to modeled behavior if the outcomes are valued.

Cognitive events such as imagery events, experiences in symbolic forms, and thought processes are associated with most external influences, which do affect behavior. A motivator of behavior is cognitive representation (Bandura, 1977). Many actions are rooted in cognitive activities. Other cognitive sources of motivation are goal setting and self-regulated reinforcement (Bandura, 1977). Goal setting is a criterion for self-evaluation. Clear goals provide information on the type and the amount of effort that is necessary and offer self-satisfaction by supplying signs of personal achievement (Bandura, 1977). Goals that are unrealistically high result in disappointing performances, while moderately difficult goals are considered more motivating and more satisfying (Bandura, 1977). Self-motivation through self-reactive influences is important in the motivational experience and informative feedback (Bandura, 1977).

People are agents of experiences. Individuals use the nervous system, such as the sensory, motor, and cerebral systems to achieve the tasks and goals that are important in the course in their lives (Bandura, 1977). The SLT can be applied to this study by merging or associating the concepts with developmental stages, behavior, attitude, and actions regarding health care practices of parents for their children. Younger mothers have lower cognitive scores than their counterparts and are more immature with beliefs about permanency of relationships (Patel & Sen, 2012). Parenting interventions founded

on the SLT are effective in managing social interactional family issues. One such intervention is self-regulation, in which parents acquire skills and learn to change their parenting practices by solving their own problem and controlling their child's fate (Sanders & Burke, 2014). The SLT is effective in changing human behavior across several environmental settings for all groups of mothers and families, and understanding the theory and the force of behavior on human development are interventions in social and behavioral science (Chavis, 2012). The SLT was used in this study to test the hypotheses in the context of maternal age. The SLT was also used in Research Question 6 for this study.

Self- Efficacy

The theory of self-efficacy created by Bandura (1977) relates to humans beliefs in their ability to accomplish given attainments. Perceived efficacy plays a role in human functioning. It does not only directly affect behavior, but it does impact goals and aspirations, outcome expectations, emotional tendencies, and perception of impediments and opportunities in the social environment (Bandura, 1977). Self-efficacy is the essence of emotional wellbeing. Self- efficacy is important during adolescence as it is critical in an individual's ability to master the various task demands, risks, and challenges successfully as a person moves from adolescence to adulthood. Griffin (1998) implied that self-devaluation and low self-esteem issues have been associated with adolescent parenting. Griffin also posited that individuals with low self-efficacy, regardless of their ability, tend to blame their failures on personal ability deficits. The poor performances may be a result of their skill deficit or from the limitations that low self -efficacy may

enforce on skill use. Teen mothers may be suffering from these effects even before becoming pregnant. Bandura (1989) argued that individuals' beliefs about their capabilities to apply control over events that affect their lives are fundamental; self - efficacy is a determinant of human motivation, affect, and action. According to Bandura (1989), efficacy beliefs involve a multifaceted process of self-persuasion and include performance mastery experiences, vivid experiences, verbal persuasion, and physiological states that determine a person's capabilities, strength, and vulnerability. Zullig and Teoli (2011) stated that self-efficacy plays a role in the decisions an individual has to make daily, even if the decision is simple. Avoiding a particular activity because the effort and the outcome expected to complete the activity is greater than the benefit to accept and participate in the task is acting according to a person's own self–efficacy. Bandura (1982) declared that people who possess the skills and confidence in their coping efficacy muster the effort required to succeed in risky situations. Mothers with successful observational experiences can increase their efficacy expectations. Performance-based activities have shown to be the most successful for effecting psychological changes; however, Bandura (1977) implied that different methods derived from a common cognitive mechanism could bring about changes, and the more trustworthy the observed sources, the better the changes in perceived self-efficacy. According to Babirye et al. (2011), self-efficacy is an individual ability to cope with the barriers that may hinder obedience to recommended immunization schedules. In Research Question 6, I measured self-efficacy. This question included the demographic variables needed to identify if maternal age was associated with the capability to execute

performances to immunize their children at the recommended schedule. According to Clifton (2011), efficiency is a productivity decision-making measurement of how fast something is accomplished. This concept of self-efficacy involves a mother being efficient in carrying out her maternal tasks, which influences outcome expectations.

Summary

According to the literature review, there was a need to explore the factors that mothers experience in complying with childhood immunization schedules. The health outcomes of children born to young mothers are consistent; however, because learning and support (as proposed by the SLT) determines how these parental patterns of behavior are controlled, the need for in-depth study on immunization barriers is justified. SLT and SE play a role in human health care decisions, functions, and maintenance. Some young parents have little or no knowledge of infectious diseases, such as poliomyelitis; diphtheria, tetanus, and pertussis and may be reluctant to immunize their child. There is a lack of awareness among mothers, including adolescent mothers, of the risk and the seriousness of infectious diseases and the importance of immunization.

The barriers must be attended to in order to augment adolescent vaccine adherence, and parental education is the main issue that must be dealt with to increase immunization coverage not only for adolescents but also for those children born to adolescent mothers. Although maternal education plays a role in health care adherence and acceptance, the root of the problem needs to be identified for compliancy. Intervention models that address all intervention levels (displayed in Figure 2) may allow

parents to value and follow through the governmental guidelines and policies that highlight the importance of children receiving timely recommended schedule vaccines.

In this chapter, I highlighted the need for further study to be conducted to determine the association between maternal characteristics of mothers and childhood immunization series completion rate among 2-year-old children. There is a need to identify unique childhood immunization barriers specific to particular populations/groups and to find solutions for who children underimmunized. Knowledge of the issues and challenges faced by parents to protect their children from vaccine-preventable diseases is critical in assisting parents who are unaware of the possible dangers of not adhering to vaccine schedules. With the advent of many state and national immunization intervention programs, there are still groups of children who are underimmunized and are not up-to-date with the recommended immunization. The Florida Department of Health continues to monitor and publish immunization coverage levels. This study intends to fill the gap of the role of maternal factors that might predict suboptimization of immunization coverage, thereby guiding future intervention strategies. Identifying those unique barriers to age groups, such as teen mothers, with consideration of the SLT and self- efficacy will provide understanding of the issues surrounding maternal adherence to childhood immunization.

In Chapter 3, I address the research design and the methods used in this study to determine the association between maternal characteristics of mothers and childhood immunization completion series among children 2 years of age.

Chapter 3: Research Method

Introduction

The purpose of this study was to examine if there was an association between maternal characteristics and childhood immunization series completion rates among children 2 years of age. This chapter provides a description of the methods used to implement the study. Also addressed in this chapter is a discussion of the design, sample, and participants' eligibility criteria for inclusion; justification of the sample size; and instruments, procedure, and data analysis. I used a quantitative approach to gain a clearer understanding of the problems associated with childhood immunization.

The study was a quantitative, cross sectional study using secondary data obtained from the FDOH Annual Immunization Survey conducted in 2014. A quantitative method approach was used to assess the association among the variables using statistical tests to determine the outcome. Secondary data collected from the FDOH Annual Immunization Survey were used as they offered ease in collecting the data by saving both time and resources. The secondary data were from a study sample of 1,740 2-year old children; 2,001 children were used to assess childhood immunization completion rates from the state (see Figure 2).

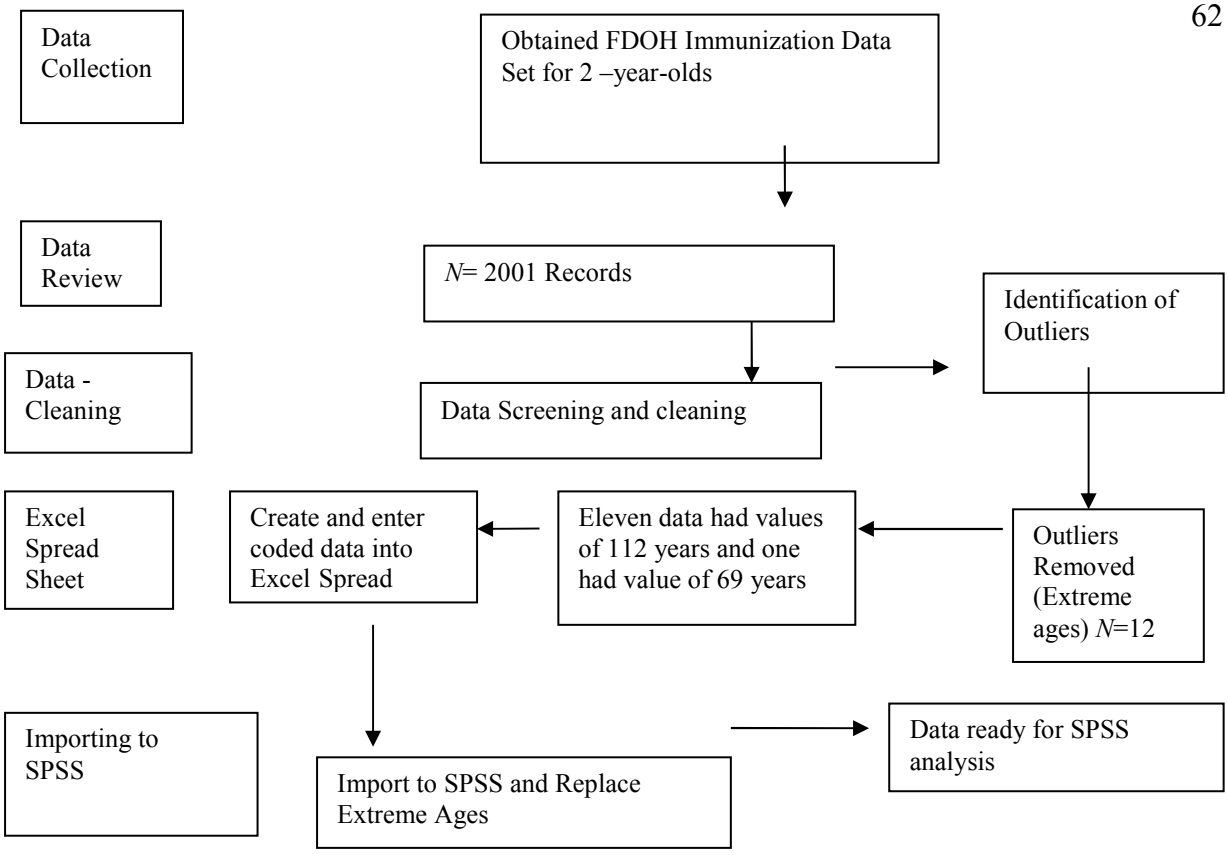

Figure 2. Flow diagram of sample selection process for study participants.

The sample covered all geographical areas of Florida where county health departments were located. The goal of the FDOH Immunization Survey was to identify areas where additional focus could improve immunization coverage for 2-year- old children, thus meeting the national coverage goal of 90% (FDOH, n. d)].

Six research questions were posed:

RQ1: Is there a statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

$H_0$1: There is no statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_0$1: There is a statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

RQ2: Is there a statistically significant association between mothers' educational level and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

$H_0$2: There is no statistically significant association between mothers' educational level and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_1$2: There is a statistically significant association between mothers' educational level and childhood immunization series completion 4:3:1: 3: 3:1 rate among children 2 years of age.

RQ3: Is there a statistically significant association between mothers' racial ethnicity and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

$H_0$3: There is no statistically significant association between mothers' racial ethnicity and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_1$3: There is a statistically significant association between mothers' racial ethnicity and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

RQ4: Is there a statistically significant association between mothers' marital status and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

$H_0$4: There is no statistically significant association between mothers' marital status and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_1$4: There is a statistically significant association between mothers' marital status and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

RQ5: Is there a statistically significant association between initiation of prenatal care and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age?

$H_0$5: There is no statistically significant association between initiation of prenatal care and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

$H_1$5: There is a statistically significant association between initiation of prenatal care and childhood immunization series completion 4:3:1:3:3:1 rate among children 2 years of age.

RQ6: Is the mothers' age associated with the mothers' level of education, marital status, ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 (the last four in the series refer to four pneumococcal conjugate vaccines) rate among children 2 years of age?

*H*o6: The mothers' age is not associated with the mothers' level of education, marital status, ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 rate among children 2 years of age.

$H_1$6: The mothers' age is associated with the mothers' level of education, marital status, ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 rate among children 2 years of age.

Setting and Sample

The FDOH 2014 Annual Immunization Survey of 2-year-old children born in Florida was used to answer the research questions. The immunization survey supplied the quantitative data. The Immunization Survey is an annual survey used to estimate the immunization levels for 1- and 2-year-old children receiving immunization in the 67 county's health department (CHD). The CHD administers thousands of vaccine doses to children whose parents use the CHD for their child immunization home. The state uses an online tracking system, the Florida State Health Online Tracking System (SHOT; Florida Department of Health, n. d.) for its data collection. The state annual survey results were

used to improve immunization coverage to support the national coverage goal, which was 90%. Table 1 provides the recommended vaccine series.

In October 2014, field staff conducted the survey with the help of the county health department staff, private physicians, and parents. Over 2,000 2-year-old participants were initially surveyed; however, 1,740 remained in the study after the exclusion for adoption, death, refusal of parents to participate, and those parents who could not be located.

The series of vaccine reviewed are 4:3:1:3:3:1and the 4:3:1:3:3:1:4 (FDOH, n. d.). Annually, the Bureau of Immunizations of the FDOH conducts survey to estimate the immunization coverage rates of 2-year-old children in the State of Florida. For the 2014-year survey, the SHOT, the instrument in the survey, generated the sample for the survey. The instrument developed allowed health care providers to share electronic immunization information in order to enable surveillance that would support efforts to increase and preserve childhood immunization levels and to eradicate vaccine-preventable diseases (FDOH, n. d.). The survey enabled the researchers to record the data collected. The Florida Immunization Survey sample was chosen because county-level immunization coverage rates are important, as public health issues usually start in small geographical areas and public health action are most effective at a local level (Smith & Singleton, 2011). Also, the methodology was standardized to enable aggregation to produce a national profile. The independent variables assessed were from the FDOH Immunization Survey, 2014. These variables shown in Table 4 below:

Table 4

Independent Variables and Variability Indicators

Mothers Education Level	**<12**	**12**	**>12**	**UNK**	**Frequency Count, Percentage CI (95%)**
Age of Mother	<20	20-24	25-29	30+	Frequency Count, Percentage CI (95%)
Marital Status	Yes	No			Frequency count, Percentage, CI (95%)
Trimester Initiation of Pre-N Care	3rd	2nd	1st	UNK	Frequency count, Percentage, CI (95%)
Race/Ethnicity	White	Black	Hispanic	Other	Frequency count, Percentage CI (95%)

Note. Unk=Unknown; Pre-N care= Prenatal care

Research Design and Rationale

In this study, I used a quantitative, cross sectional study. The data were obtained from the FDOH SHOTS database. The database receives birth data from vital statistics and contains all Florida birth records, with the exception of adoptions/sealed records. The

patient record, when added to the system, is assigned a state immunization identifier (a 10-digit numeric created in sequential numbering when a record is added to the system). The children were added to the system based on the sequence in which the records were presented and processed from vital statistic birth records. The records were categorized based on the vital stat county of residence at birth. Stratified sampling was performed where one stratum was for each of the 20 largest counties, and the remaining 47 Florida counties were grouped together into a single stratum.

I sought to examine the association between maternal characteristics and childhood immunization series completion rates among children 2 years of age. The dependent variables were the immunization series completion rates for the following two immunization series: 4:3:1:3:3:1; 4:3:1:3:3:1:4 (series of vaccines coded as shown in Table 5); the independent variables were maternal age, maternal education, marital status, trimester of initiation of prenatal care, race, and ethnicity to determine levels of association with the dependent variables. I input data into SPSS 21.0 windows. To determine if there was an association between maternal characteristics and childhood immunization series completion rates among children 2 years of age, ANOVA and logistic regression were the statistical tests performed to provide answers to the research questions.

Role of the Researcher

The research involved use of deidentified secondary data, provided by the FDOH. The study involved a vulnerable population (teenage mothers and children); however, the secondary data were deidentified; therefore, participants were not at risk. Providing

accurate interpretation of the data is an important ethical issue in data collection and data analysis. I used unbiased words and language in the study. My intent was to share the findings accurately with health professionals, community leaders, policy makers, and stakeholders. The study findings will also be shared in professional conferences, at local and work-related groups, and in public health journals. The Institutional Review Board of Walden University reviewed the proposal to ensure protection was provided against human rights infringements. In addition to reviewing the proposal, I agreed not to begin implementation of the research until Walden gave me IRB approval to begin.

Quantitative Data Collection

The participants' demographics, clinical data, and immunization variables were needed to conduct the study (see Table 4). The deidentified data are public data, accessible from the FDOH, and can be used for research and educational purposes. All ethical practices were adhered to when accessing and using the FDHIS data.

Study Measures

The demographic characteristics of the mothers in the Florida Immunization Survey for 2014 included their level of education. The levels ranged from less than 12 years, to more than 12 years of education, and with some unknown. Maternal age, another characteristic, ranged from less than 20 years to more than 30 years with some unknown. The remaining demographic characteristics were marital status defined as married and not married and with some unknown and trimester initiation of prenatal care ranging from first to third trimester with some unknown. Race and ethnicity were also recorded (FDOH, n. d.).

Methods

A quantitative, cross sectional, observational study was used to address the research questions and hypotheses posed in this study. Secondary data from the Florida Immunization Survey for 2014 were used. The database was developed to be representative of Florida's population, as it consisted of 2-year-old children born to mothers of varying age groups, education, marital status, race and ethnicity, and initiation of prenatal trimester care. The immunization survey provided immunization levels of 2-year-olds in the state of Florida. Stratified sampling methodology was used in the original study where each of the 20 largest counties made up 20 of the strata (that is one stratum per county), and the remaining 47 Florida counties were grouped together into a single stratum, yielding 21 strata.

Preanalysis Data Screening

Only those subjects who had all of the variables required for the study were requested. The data were collected, reviewed, and organized. Prior to data analysis for the study, the data were also screened to ensure that all of the variables for the study were present, properly defined, and complete and that all variables to be tested were included. Descriptive statistics such as the mean, median, mode, and standard deviation were computed to determine if the responses were within the expected ranges and that there were no outliers, which may skew findings.

Data Analysis Plan

Analyses of the FDOH 2014 Immunization Survey were conducted using SPSS Statistics 21.0 for Windows. Descriptive statistical tests were used to describe and

summarize personal and clinical data. Computation of central tendency was done in descriptive statistics. Frequency tables showed the frequency of the responses, missing, or unknown responses. The percentages of the variable values provided a summary of the data. Measures of variability quantified the spread of the observations. Table 4 shows the variable values of maternal age, education, marital status, race and ethnicity, and trimester of initiation of prenatal care. Table 5 shows the immunization status of children with the series of vaccine: 4:3:1:3:3:1, 4:3:1:3:3:1:4. The appropriate scales measured the values as indicated in Table 5 below:

Table 5

Dependent Variables and Variability Indicators

Variables	**RQ**	**Type of Data**	**Response Range**	**Variability Indicator**
Immz. Status	1& 5	CAT	4:3:1:3:3:1;	Frequency, relative frequency
	3	CAT	4:3:1:3:3:1:4	
			4 Series Vaccine	
			4 doses =Fully immunized (coded 4), 3doses = Almost fully immunized (coded 3), 2 doses= Somewhat immunized (coded 2), 1 dose=A little immunized(coded1)	
			0 doses = Not immunized (coded 0)	
			Three Series Vaccine	
			3 doses= Fully immunized(coded 3) 2 doses= Almost fully immunized (coded 2)	
			1dose= Somewhat immunized (coded 1)	
			0 dose= Not immunized (coded 0).	
			1 Series	
			1dose= Fully immunized (coded 1)	
			0 dose= Not immunized (coded 0)	

Numerical codes were used for maternal characteristics to conduct statistical analyses. Maternal ages were coded as < 20 (1), 20-24 (2), 25-29 (3), and ≥ 30 (4); educational levels were coded as < Grade 12 (1), Grade 12 (2), and > Grade 12 (3); racial/ethnicity was coded as White (1), African American/Black (2), Asians (3), other non-White (4), and unknown (5); initiation of prenatal care (0-9 months) and marital status were coded as unmarried (1) and married (2).

This study included six research questions. The statistical tests for RQ1-RQ5 were analysis of variance. The question provided the degree of completion or incompletion of the vaccine series. The test included the extent to which there was an association between the independent variables and childhood immunization series completion rates to predict if there was a relationship. The odds ratio and associated 95% confidence intervals were calculated. The X^2 statistic provided the model significance. The predicted probability of the association between maternal characteristics and childhood immunization series completion rates was used with a beta (β) value of 0.20 and alpha (α) value of 0.05 to determine statistical significance. The hull hypothesis ($H_0$1) stated that there was no statistically significant association between mothers' level of education, ethnicity, maternal age, and childhood immunization series completion 4:3 1:3:3:1 rates among children 2 years of age.

Prior to analysis, the assumptions were tested to determine if the populations were normally distributed, the population variances were all equal, and there were independence of observations. All the scores for the maternal characteristics were normally distributed. To assess this assumption, a histogram was used to check normality

of the data by displaying a normal distribution, a bell curve, as well as the visual inspection of a quantile-quantile plot (QQ plot), which is similar to a probability-probability plot (P-P plot). The Q-Q plot plots the quantiles of the data set and not the individual score in the data as the P-P plot. With the Q-Q plot, it is easier to understand, especially with large sample sizes (Ghasemi & Zahedias, 2012). Statistical tests, such as the chi square goodness of fit test, were also used to assess normal distribution. Data transformation could be performed either by log transformation of the data by taking the log of each observation and using a base log or conducting the square root transformation, where the square root of each observation could be taken; however, this was not done in this study. Independent of observations were assessed by the test of independence, goodness of fit test, where the data were organized into a contingency table, showing the row and column variables to be independent of each other. To assess homogeneity, the Levene's test was used to assess the equality of variances for the maternal characteristics listed above. If the *p*-value is greater than 0.05, the H_o cannot be rejected, and the conclusion can be made that there is no significant difference between the group variances (there is equality of variances). If the *p*-value is below 0.5, the H_o is rejected and there is no equality of variance. The one way ANOVA is vigorous against the normality assumption and puts up with violations to its normality assumption well. If the data failed the assumption, a Welch ANOVA was conducted. The amount of variability between the groups was compared (there were only two groups: married and unmarried) to the amount of variability within the group that is due to chance. If the ratio is 1, then the amount of variability due to within marital status differences is equal to the

amount of variability due to between group differences. Any differences between groups would not be significant. If the average differences between groups get larger, and the numerator of the ratio increases, the *F*-value increases also. If the *F*-value increases, this becomes more extreme and is more likely not due to chance but something else.

The formula for computing the *F*-value is $F = \frac{MS_{between}}{MS_{within}}$

The null hypothesis ($H_0 2$) states that the mothers' marital status does not predict childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

The statistical test to answer Research Question 6 was multinomial logistic regression. This logistic regression was chosen because of its multiequation model to understand whether maternal characteristics predicted immunization completion rates of the 4:3:1:3:3:1:4 series. Education, age, marital status, ethnicity, and trimester initiation of prenatal care were the predictor variables. The criterion variable or the outcome variable was childhood pneumococcal immunization completion rates of the 4:3:1:3:3:1:4 series (see degree of immunization listed in Table 5). The odds of the degree of immunization on the predictor variables were assessed. The model significance was used to examine the effect of the independent variables, presented with X^2 statistic, which predicted the probability of the outcome as determined by the standardized beta value. An alpha value of 0.05 was used to determine statistical significance. Below is the model:

Full Model (Age<20) = education + marital status + ethnicity + prenatal +→immunize.

Full Model (20-24) = education + marital status + ethnicity + prenatal + → immunize.

Full Model (25-29) = education + marital status + ethnicity + prenatal + → immunize.

Full Model (30+) = education + marital status + ethnicity + prenatal + → immunize

The null hypothesis (*H*o3) states that the mothers' age is not associated with the mothers' level of education, marital status, ethnicity, or trimester initiation of prenatal care relative to the ability to predict childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 among children 2 years of age.

Logistic regression assumptions are the following: the true conditional probabilities are a logistic function of the independent variables with no important variables omitted, no extraneous variables are included, the independent variables are measured without error, the observations are independent, and the independent variables are not linear combinations of each other. To test for violations of these assumptions, the link test can be used to ensure that the model is properly specified. The link test, as suggested by Pregibon (1980), is used to detect specification error. If the model is properly fit with no additional predictors, statistically significance should be found except by chance. The goodness of fit test was used to assess if the model fits the data, if collinearity was present, and a new variable was created. To assess for observations that may have significant influence on the model such as data entry errors and incorrect data points, Pearson residual was applied to measure the deviations between the observed and the fitted values. The categorical variables in the study included age, education, marital status, race/ethnicity, and prenatal trimester care, and the dependent variable denoted the degree of completion of the pneumococcal immunization series 4:3:1:3:3:1:4 by use of the scale as indicated in Table 5.

Power and Sample Size Justification

To test the hypotheses, the study included analyses of variances and logistic regression statistical tests. Because it is imperative to maintain sample size requirements, sample size calculation was completed using G Power version 3.1.9.2. An a priori analysis is an effective way of controlling statistical power prior to conducting a study (Faul, Erdfelder, Lang, & Buchner 2007). The *F* test was the test the family used, and the statistical test used was the ANOVA: fixed effects, special, main effects, and interactions. The ANOVA statistical test was used to answer five of the six research questions. To determine adequate sample size, a medium effect size (0.25) was assumed, with an acceptable power of 0.80 and α error probability 0.05 to determine significance. To ensure empirical validity in this study, the calculated sample was the G power version using the parameters above and reflected 180 participants per group. The sample size of 1,740 used in the FDOH 2014 Immunization Survey was, therefore, adequate to detect significant differences at the 0.25 effect level if such significant differences existed. In testing the null hypotheses, the criteria were based on the *P*-value, α was chosen to be 0.05. If the *P*-value < α, the H_0 is rejected; if the *P*-value ≥ α, the H_0 is not rejected. Type 1 error occurs when the researcher rejects a true H_0; there is no difference and conclusion made that the groups are different. Beta (β) was chosen to be 0.20, allowing power for 0.80. The probability of making a Type II error was no more than 20%. Type II errorr occur when the researcher retains a false H_0; there is a difference and conclusion made that the groups are not different. Sample size calculations are important in reducing the likelihood of these types of errors.

Threats to Validity

In this study, I conducted a literature review and referred to credible and reliable information. Primary sources were used as first-hand sources. The authors' credential, the date the sources were published, and the Internet sources were some strategies employed to enhance credibility. The sampling process used for the 2014 Immunization Survey was the application of Florida SHOTS to define the survey and to generate the sample (FDOH, n. d.). The immunization survey staff of the FDOH recorded the data gathered, and data accuracy was completed with further cleaning and consultation with vital statistics. The FDHIS developed a user guide that provided systematic instruction for the immunization field staff. The Department of Health immunization field staff also followed written protocols. The instrument used in the survey was a standardized instrument used annually since 2010 in the 2-year-old immunization survey (FDOH, n. d.); with such a record, it should be considered reliable. The study included a participation rate of 86.8 %. Also important to me was the external validity in that I hoped that the findings of the study are useful to other similar populations. Statements about the associations of variables based on valid statistical tests were included in the study, supporting statistical validity. In addressing the six research questions, inferential statistics were used to predict and draw accurate conclusions. The statistical results of hypothesis testing addressing the research questions were answered and reported; confidence intervals and effect size were also reported upon completion of data analysis to provide statistical validity. The statistical findings are included in Chapter 4.

Summary

Chapter 3 provided information on the research methodology that was used in this quantitative study. The FDOH Immunization Survey 2014 provided the data set. In this study, the independent and the dependent variables were defined. The statistical software SPSS was used to determine if there was an association between maternal characteristics and childhood immunization series completion rates among children 2 years of age. Sample size determination, testing of assumptions, credibility, reliability, and validity were addressed in this section. Chapter 4 provide the statistical analysis and the results of the study.

Chapter 4: Results

Introduction

The purpose of the study was to examine if there was an association between maternal characteristics and childhood immunization series completion rates among children 2 years of age. In this chapter, I present the data collection process, describe the characteristics of the sample, discuss the statistical tests used in the study, provide the statistical analysis used in this study, and report the results of the study. Tables and figures are also included in this chapter to illustrate the results. A summary of the chapter concludes the chapter.

The six research questions in this study were as follows:

RQ1: Is there a statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age?

$H_0$1: There is no statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

$H_0$1: There is a statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

RQ2: Is there a statistically significant association between mothers' educational level and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age?

$H_0$2: There is no statistically significant association between mothers' educational level and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

$H_1$2: There is a statistically significant association between mothers' educational level and childhood immunization series completion 4:3:1: 3: 3:1 rates among children 2 years of age.

RQ3: Is there a statistically significant association between mothers' racial ethnicity and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age?

$H_0$3: There is no statistically significant association between mothers' racial ethnicity and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

$H_1$3: There is a statistically significant association between mothers' racial ethnicity and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age?

RQ4: Is there a statistically significant association between mothers' marital status and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age?

$H_0$4: There is no statistically significant association between mothers' marital status and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

$H_1$4: There is a statistically significant association between mothers' marital status and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

RQ5: Is there a statistically significant association between initiation of prenatal care and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age?

$H_0$5: There is no statistically significant association between initiation of prenatal care and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

$H_1$5: There is a statistically significant association between initiation of prenatal care and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

RQ6: Is the mothers' age associated with the mothers' level of education, marital status, ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 (the last four in the series refer to four pneumococcal conjugate vaccines) rates among children 2 years of age?

$H_0$6: The mothers' age is not associated with the mothers' level of education, marital status, ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 rates among children 2 years of age.

$H_1$6: The mothers' age is associated with the mothers' level of education, marital status, ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization series completion 4:3:1:3:3:1:4 rates among children 2 years of age.

Data Collection

Upon IRB approval, data collection ensued. The period for data collection was approximately 2 months. Figure 2 illustrates a flow diagram of the sample selection process. The variable number of siblings originally included in the proposal was removed as the secondary data collected from the Department of Health did not include the number of siblings. The data were entered into an Excel spreadsheet prior to importing into SPSS. The data were then further cleaned by removing outliers of some extreme ages. Twelve ages were extreme in the data set, 11 showed mothers with 112 years, and one showed a mother with 69 years. The data were also formatted, the variables were labeled and coded, and new variables were created and added to the existing variables. The participants' demographic, clinical data, and immunization variables were used to analyze and report the findings of the study. Table 6 below describes the maternal characteristics of the sample.

Table 6

Maternal Characteristics: Age, Race/ Ethnicity, Educational Level, Marital Status, & Prenatal Care Distribution

Independent Variables	Groups	Responses	Percentage
Maternal Age	< 20	98	4.9%
	20-24	459	22.9%
	25-29	584	29.2%
	≥30	860	43%
Total		2001	100%
Race &Ethnicity	White	1189	59.4%
	Black/African American	399	19.9%
	Asians	57	2.8%
	Other Non-White	229	11.4%
	Unknown	127	6.3%
Total		2001	100%
Marital Status	Married	1087	54.3%
	Not Married	914	45.7%
Total		2001	100%
Maternal Educational Level	<Grade 12	284	14.2%
	Grade 12-13	997	49.8%
	Grade ≥14	720	36.0%
Total		2001	100%
Trimester Prenatal Care	1st Trimester	1458	72.9%
	2nd trimester	394	19.7%
	3rd Trimester	75	3.7%
	unknown	74	3.7%
Total		2001	100%

Tables 7-Table 11shows the maternal and clinical characteristics of the study population (Florida's general population of adult women). Table 7 shows the age distribution with the largest age group ≥ 30years and the smallest age group < 20 years. Table 8 shows the educational levels. The most common response was ≥ 12^{th} grade educational level, and the lowest educational attainment was < 12^{th} grade. Table 9 shows race/ethnicity with four groups and an unknown category. Table 10 shows marital status defined as unmarried and married with more mothers identified as married. Tables 7-11 show the initiation of prenatal care. Most mothers initiated prenatal care in the second month of pregnancy, and fewer mothers initiated prenatal care in the 9th month of their pregnancy. Initiation ranged from 1th to 9th month of pregnancy. The initiation of prenatal care is displayed in trimester as commonly used in health intervention planning programs.

Table 7

Maternal Age Group of Study Population & Female Age Group of Florida's General Population

Age Groups	Study Responses	Study Percent	Florida's Population Percent
Under 20	98	4.9	15.4
20-24	459	22.9	16.9
25-29	584	29.2	17.7
≥30	860	43.0	49.9
Total	2001	100	100

Note. Florida female population for listed age groups: ages < 20= 575,780; 20-24=633,236; 25-29=661,872 & ≥30= 1869,329 (United States Census Bureau, 2016). Percentages for the age groups are calculated using the age groups as depicted in the table with the total population =3,740, 217 (United States Census Bureau, 2016).

Table 8

Maternal Educational Level of Study Population and Educational Level of Florida's General Population

Educational Level	Study Responses	Study Percent	Florida's Population Percent
<12	284	14.2	12.8
12	997	49.8	30
>12	720	36.0	57.2
Total	2001	100	100

Table 8 described the maternal educational level of Floridians: the study population and the general population. The United States Census Bureau (2016) showed that, in 2015, in Florida 12. 8 % had obtained < high school education; 30 % attained high school education; and the remaining 57% had some college education, an associate, or a bachelor's education (United States Census Bureau, 2016). The table also shows that 49.8% of the study population had received a high school education, and 36 % of the study population had some college or a college education.

Table 9

Maternal Race/Ethnicity of Study Population and Female Race/Ethnicity of Florida's General Population

Race & Ethnicity	Study Responses	Study Population Percent	Florida's Population Percent
White	1189	59.4	77.7
Black/AA	399	19.9	16.8
Asians	57	2.8	2.8
Other non-White	229	11.4	
American Indians &Alaska Native			0.5
Unknown	127	6.3	
Native Hawaiian &Pacific Islander			0.1
Two or more Races			2.0
Total	2001	100	100

Note. Hispanic female population reported as 24 % (United States Census Bureau, 2016). The highest racial group in the general population of female in Florida was White (77.7%); African American (16 .8%); Asians 2.8 %, and other races such as American Indians, Hawaiians, and other mixed groups (United States Census Bureau, 2016). Please note that the other non-White Florida population percentage was a compilation of American Indians and Alaska Natives, Native Hawaiian and Pacific Islander, and multiracial as reported by the United States Census Bureau (2016). However, the study population had fewer White participants and more other non-White participants as compared to the Florida maternal population.

Table 10

Maternal Marital Status of Study Population & Female Marital Status of Florida's General Population

Marital Status	Study Responses	Study Percent	Florida's Population Percent
Unmarried	914	45.7	52.6
Married	1087	54.3	47.4
Total	2001	100	100

Note. Table 10 described unmarried and married women in the study population and Florida population. In 2014, the Census Bureau (2016) classified marital status for Florida as never married 27.4 %, widowed 10.8 %, and divorced 14.4% (aggregated and classified as unmarried = 52.6%). Now married 44.5% and separated 2.9 % (aggregated and classified as married=47.4%).

Table 11

Initiation of Prenatal Care of Study Population & Initiation of Prenatal Care Florida's General Population

Initiation Prenatal Care	Study Responses	Study Percent	Florida's Population Percent
1st trimester (1-3mths)	1458	75.7	79.5
2nd Trimester(4-6mths)	394	20.4	15.3
3rd Trimester (7-9mths)	75	3.9	3.7
No Prenatal Care			1.5
Total	1927	100	100

Note. Seventy four of the 2001 study responses for initiation of prenatal care (PNC) were unknown (these were subtracted from the 2001 responses) leaving 1,927 responses as displayed in the table. In 2015, first trimester prenatal care for Florida's general population was 79.5%, second trimester prenatal care was 15.3%, third trimester was 3.7%, and no prenatal care was 1.5%. The denominator for known trimester initiation of prenatal care was 605,660. The count for first trimester PNC =481,709, second trimester PNC =92,496, and third trimester PNC =22, 594. No trimester PNC count was 8,861(FDOH: Division of Public Health Statistics and Performance Management, 2016).

Results

Research Question 1

ANOVA was conducted to investigate if there was a statistically significant association between maternal age and childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age. The outcome variable of interest was the completion of the 4:3:1:3:3:1 vaccine series, and the possible predictor variable was maternal age.

DTAP: In assessing maternal age and DTAP vaccine, an ANOVA test was conducted. The outcome of interest was completion of DTAP vaccine series. The possible predictor variable was maternal age. The assumption of homogeneity of variances was violated, as assessed by the Levene's test of equality for variances, p=0 .005. The Welch correction was used. Analysis result: F (3, 452.669) =1.585, p>.05 (p=0.192). Therefore, no statistically significant association was found between maternal age and completion of the DTAP vaccine series among children 2 years of age.

Polio: In assessing maternal age and polio vaccine, an ANOVA was conducted. The outcome of interest was completion of polio vaccine series. The possible predictor variable was maternal age. The assumption of homogeneity of variances was violated, as assessed by the Levene's test of equality for variances, p< 0.001. Welch correction was used. Analysis result: F (3, 471.054) = 3.894, p <0.05 (p=0.009). There was a statistically significant association between maternal age and completion of the polio vaccine series among children 2 years of age. This association needed to be explored; hence, the Games-Howell post hoc test was necessary to determine which of four age groups

differed significantly from the childhood immunization series completion of the polio vaccine. Using a priori alpha level of 0.05 mean difference between the <20 (0.118) and the ≥ 30 age group (0.184), *p*= 0.005, 95% *CI* (0.04 to 0.32). There was a statistically significant association between maternal age and completion of polio vaccine series among children 2 years of age. The difference was observed between children of mothers <20 and ≥30 years with a mean difference of 0.066. Mothers' age ≥30 children had better immunization completion rates than children of mothers who were <20 years.

Hepatitis B: In assessing maternal age and Hep B vaccine, an ANOVA was conducted. The outcome of interest was completion of the Hepatitis B vaccine series. The possible predictor variable was maternal age. The assumption of homogeneity of variances was violated, as assessed by the Levene's test of equality for variances, $p <$ 0.001. Welch correction was used. Analysis result: F (3,478.815) = 7.274, $p<.05$ (p <0.001). There was a statistically significant association between maternal age and completion of the Hepatitis B vaccine series among children 2 years of age. The ANOVA test was not able to show the differences. The differences needed to be explored; hence, the Games-Howell post hoc test was necessary to determine which of the four age groups differed significantly from the completion of the Hepatitis B vaccine series. Using priori alpha level of.0.05, the under 20 and 25-29 age group (mean difference=0.174), *p*= 0.011, 95% *CI* (0.03 to 0.32); < 20 and ≥ 30 age group (mean difference = 0.243), *p*= <0.001, 95 % *CI* (0.10 to 0.38); 20-24 and ≥ 30 group (mean difference=0.119), *p*=0.030, 95% *CI* (0.01 to 0.23). There was statistically significant association between maternal age and completion of the Hepatitis B vaccine series among children 2 years of age. These

observed differences were between the < 20 and 25-29, <20 and ≥30, 20-24, and ≥30. There were better immunization completion rates with an increase in maternal age. Mothers older than 20 years' children had better immunization completion rates with the Hepatitis B vaccine series.

HIB: In assessing maternal age and HIB vaccine, an ANOVA was conducted. The outcome of interest was completion of the HIB vaccine series. The possible predictor variable was maternal age. The assumption of homogeneity of variances was violated, as assessed by the Levene's test of equality for variances, $p< 0.001$. Welch correction was used. Analysis result: F (3 467.729) =3.041, p=0.029. There was a statistically significant association between maternal and completion of the HIB vaccine series among children 2 years of age. An ANOVA test was not able to show the differences. The differences needed to be explored. The Games Howell post hoc test was necessary to determine which of the four groups differed significantly. Using priori alpha level of 0.05, the under 20 and ≥ 30 age group (mean difference= 0.163) was significant, p= 0.015, 95% *CI* (0.02 to 0.30). There was a statistically significant association between maternal age and completion of HIB vaccine series among children two years of age. Better immunization completion rates were observed among mothers ≥ 30 compared to mothers <20 years.

Varicella: In assessing maternal age and Varicella, an ANOVA was conducted. The outcome of interest was completion of the Varicella vaccine series. The possible predictor variable was maternal age. The assumption of homogeneity of variances was met, as assessed by the Levene's test of equality for variances, $p >.05$ (p=0.111), the ANOVA analysis proceeded. Analysis result: F (3, 1997) = .487, $p> .05$ (p=0.691).

There was no statistically significant association between maternal age and completion of the Varicella vaccine series among children 2 years of age.

MMR: In assessing maternal age and MMR vaccine, an ANOVA was conducted. The outcome of interest was completion of the MMR vaccine series. The possible predictor variable was maternal age. The assumption of homogeneity of variances was violated, as assessed by the Levene's test of equality for variances, p=0.008. Welch correction was used. Analysis result: F (3,432.846) = 1.056, p> 0.05 (p= 0.368). There was no statistically significant association between maternal age and completion of the MMR vaccine series among children 2 years of age. Table 12 provides the results for Research Question 1.

Table 12

ANOVA Results for Research Question 1: Vaccines and Maternal Age

Vaccines	Test	Statistics	df1	df2	Sig.
DTAP	Welch	1.585[a]	3	452.669	.192
Polio	Welch	3.894[a]	3	471.054	.009
Hep B	Welch	7.274[a]	3	478.815	<0.001
HIB	Welch	3.041[a]	3	467.729	.029
Varicella	ANOVA	.487	3	1997	.691
MMR	Welch	1.056[a]	3	432.846	.368

Note. Asymptotically F distributed. ANOVA F statistics for Varicella. polio, Hep B, & HIB vaccines showed statistically significance (p<0.05).

Research Question 2

Analysis of variance was conducted to determine if mothers' educational level was significantly associated with childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

DTAP: In assessing educational level and DTAP vaccine, an ANOVA was conducted. The outcome of interest was completion of the DTAP vaccine series. The possible predictor variable was educational level. The assumption of homogeneity of variances was assumed. Levene's test of equality for variances, $p > 0.05$ ($p = 0.166$). Equality of variances was assumed. An ANOVA test proceeded. Analysis result: F (2, 1998) = 0.237, $p > 0.05$ ($p = 0.789$). There was no statistically significant association between educational level and completion of the DTAP vaccine series among children 2 years of age.

Polio: In assessing educational level and polio vaccine, an ANOVA was conducted. The outcome of interest was completion of the polio vaccine series. The possible predictor variable was educational level. The assumption of homogeneity of variances was not met, Levene's test of equality for variances, $p < 0.05$ ($p = 0.009$). Welch correction was used. Analysis result: F (2,791.334) = 1.254, $p > 0.05$, ($p = 0.286$). There was no statistically significant association between educational level and completion of the polio vaccine series among children 2 years of age.

Hepatitis B: In assessing educational level and the Hepatitis B vaccine, an ANOVA was conducted. The outcome of interest was completion of the Hepatitis B vaccine series. The possible predictor variable was educational level. The assumption of homogeneity of variances was not met. Welch correction was used. Analysis result F (2, 807.518) = 5.804, $p = 0.006$. A Games Howell post hoc test conducted. Analysis result: education level < 12^{th} grade and ≥ 14^{th} frade (college level) showed a mean difference of 0.144 and was statistically significance with a p-value 0.013, 95% CI (0.02 to 0.26) with

the Hepatitis B vaccine series among children 2 years of age. A difference between 12th grade and 14th grade was also observed, showing a mean difference of 0.106, and was statistically significant with a *p*-value of 0.020, 95% *CI* (0.01 to 0.20) with the Hepatitis B vaccine series among children 2 years of age. Mothers with higher educational levels (higher than 12th grade) had better immunization completion rates.

HIB: In assessing educational level and the HIB vaccine, an ANOVA was conducted. The outcome of interest was completion of the HIB vaccine series. The possible predictor variable was educational level. The assumption of homogeneity of variances was assumed. Levene's test of equality of variances, $p > 0.05$ ($p = 0.830$). The ANOVA test proceeded. Analysis result: F (3, 1997) = 1.405, $p > 0.05$ ($p = 0.240$). There was no statistically significant association between educational level and completion of HIB vaccine series among children 2 years of age.

Varicella: In assessing educational level and the varicella vaccine, an ANOVA was conducted. The outcome of interest was completion of the varicella vaccine series. The possible predictor variable was educational level. The assumption of homogeneity of variances was not assumed. Levene's test of equality of variances, $p < 0.05$ ($p = 0.024$). A Welch correction was used. Analysis result: F (1, 322.141) = 0.176, $p > .05$ ($p = 0.675$). There was no statistically significant association between educational level and completion of varicella vaccine series among children 2 years of age.

MMR: In assessing educational level and the MMR vaccine, an ANOVA was conducted. The outcome of interest was completion of the MMR vaccine series. The possible predictor variable was educational level. The assumption of homogeneity of

variances was assumed. Levene's test of equality of variances, $p > 0.05$ ($p = .073$). The ANOVA test proceeded. Analysis result: F (1, 1999) = 2.732, $p > 0.05$ ($p = .098$). There was no statistically significant association between educational level and completion of MMR vaccine series among children 2 years of age. Table 13 provides the results for Research Question 2.

Table 13

ANOVA Results for Research Question 2: Vaccines and Educational Level

Vaccines	Test	Statistics	df1	df2	Sig.
DTAP	ANOVA	0.237	2	1998	.789
Polio	Welch	1.254[a]	2	791.334	.286
Hep B	Welch	5.084	2	807.518	.006
HIB	ANOVA	1.405	3	1997	.240
Varicella	Welch	.176[a]	1	322.141	.675
MMR	ANOVA	2.732	1	1999	.098

Note. Asymptotically F distributed. ANOVA F statistics results for DTAP, HIB & MMR. Statistically significance showed for Hep B vaccine ($p<0.05$).

Research Question 3

An analysis of variance was conducted to determine if marital status was significantly associated with childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

DTAP: In assessing marital status and the DTAP vaccine, an ANOVA was conducted. The outcome of interest was completion of the DTAP vaccine series. The possible predictor variable was marital status. The assumption of homogeneity of variance was not assumed. Levene's test of equality of variances, $p < .05$ ($p = <0.001$). A Welch correction was used. Analysis result: F (1, 1983.446) = 9.543, $p < .05$ ($p = 0.002$). There was a statistically significant association between marital status and completion of

DTAP vaccine series among children 2 years of age. A post hoc test was not performed for marital status and completion of DTAP vaccine series because there were fewer than three groups. Mothers whose marital status was married (54.3%) had better immunization completion rates of the DAP vaccine series.

Polio: In assessing marital status and the polio vaccine, an ANOVA was conducted. The outcome of interest was completion of the polio vaccine series. The possible predictor variable was marital status. The assumption of homogeneity of variances was not assumed. Levene's test of equality of variances, $p < .05$ ($p = <0.001$). A Welch correction was used. Analysis result: F (1, 1949.998) = 20.076, $p < .05$ ($p = <0.001$). There was a statistically significant association between marital status and completion of the polio vaccine series among children 2 years of age. A post hoc test was not performed for marital status and completion of the polio vaccine series because there were fewer than three groups.

Hepatitis B: In assessing marital status and the Hepatitis B vaccine, an ANOVA was conducted. The outcome of interest was completion of the hepatitis B vaccine series. The possible predictor variable was the assumption of homogeneity of variances not assumed. Levene's test of equality of variances, $p < .05$ ($p = <0.001$). A Welch correction was used. Analysis result: F (1, 1935.484) = 30.124, $p < .05$ ($p = <0.001$). There was a statistically significant association between marital status and completion of the Hepatitis B vaccine series among children 2 years of age. Mothers whose marital status was married (54.3%) had better immunization completion rates. A post hoc test was not

performed for marital status and completion of the Hepatitis B vaccine series because there were fewer than three groups.

HIB: In assessing marital status and the HIB vaccine, an ANOVA was conducted. The outcome of interest was completion of the HIB. The possible predictor variable was marital status. The assumption of homogeneity of variances was not assumed. Levene's test of equality of variances, $p < .05$ (p=<0.001). A Welch correction was used. Analysis result: F (1, 1946.957) = 17.630, $p < .05$ (p = < 0.001). There was a statistically significant association between marital status and completion of the HIB vaccine series among children 2 years of age. Mothers whose marital status was married (54.3%) had better immunization completion rates. A post hoc test was not performed for marital status and completion of the HIB vaccine series because there are fewer than three groups.

Varicella: In assessing marital status and the varicella vaccine, an ANOVA was conducted. The outcome of interest was completion of the varicella vaccine series. The possible predictor variable was marital status. The assumption of homogeneity of variances was not assumed. Levene's test of equality of variances, $p < .05$ (p = <0.001). A Welch correction was used. Analysis result: F (1, 1998.812) = 10.308, $p < .05$ (p = 0.001).There was a statistically significant association between marital status and completion of varicella vaccine series among children 2 years of age. Mothers whose marital status was married (54.3%) had better immunization completion rates. A post hoc test was not performed for marital status and the completion of varicella vaccine series because there were fewer than three groups.

MMR: In assessing marital status and the MMR vaccine, an ANOVA was conducted. The outcome of interest was completion of the MMR vaccine series. The possible predictor variable was marital status. The assumption of homogeneity of variances was not assumed. Levene's test of equality of variances, $p < .05$ ($p = <0.001$). A Welch correction was used. Analysis result: F (1, 1998.982) =13.395, $p < .05$ ($p <0.001$). There was a statistically significant association between marital status and the completion of MMR vaccine series among children 2 years of age. Mothers whose marital status was married (54.3%) had better immunization completion rates. A post hoc test was not performed for marital status and completion of the MMR vaccine series because there were fewer than three groups. Table 14 provides the results for Research Question 3.

Table 14

ANOVA Results of Research Question 3: Vaccines and Marital Status

Vaccines	Test	Statistics	df1	df2	Sig.
DTAP	Welch	9.543[a]	1	1983.446	0.002
Polio	Welch	20.076[a]	1	1948.998	<0.001
Hep B	Welch	30.124[a]	1	1935.484	<0.001
HIB	Welch	17.630[a]	1	1946.957	<0.001
Varicella	Welch	10.308[a]	1	1998.812	0.001
MMR	Welch	13.395[a]	1	1998.982	<0.001

Note. Asymptotically F distributed. Statistically significance observed with all vaccines & marital status.

Research Question 4

An analysis of variance was conducted to determine if race and ethnicity was significantly associated with childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

DTAP: In assessing race and ethnicity and the DTAP vaccine, an ANOVA was conducted. The outcome of interest was completion of the DTAP vaccine series. The possible predictor variable was race and ethnicity. The assumption of homogeneity of variances was not assumed. Levene's test of equality of variances, $p < .05$ ($p = <0.001$). A Welch correction was used. Analysis result: F (4, 278.021) = 3.021, $p < .05$ ($p = .018$). There was a statistically significant association between race and ethnicity and completion of the DTAP vaccine series among children 2 years of age. An ANOVA alone could not provide which group was significantly different. A Games-Howell post hoc test was performed to determine the mean differences between the groups. The mean differences between the groups were not statistically significantly different for the completion of the DTAP vaccine series among children 2 years of age. The mean score

for the completion of the DTAP vaccine series in the Asians group was lower than all other groups (mean score = 3.37), multiple comparisons between groups' p value >0.05; therefore, there were no statistically significant differences between the groups.

Polio: In assessing race and ethnicity and the polio vaccine, an ANOVA was conducted. The outcome of interest was completion of the polio vaccine series. The possible predictor variable was race and ethnicity. The assumption of homogeneity of variances was not assumed. Levene's test of equality of variances, $p<.05$ ($p= <0.001$). A Welch correction was used. Analysis result: F (4, 278. 659) = 2.618, $p<.05$ ($p= .035$). There was a statistically significant association between race and ethnicity and the completion of the polio vaccine series among children 2 years of age; however, ANOVA alone could not provide which group was significantly different. A Games-Howell post hoc test was performed to determine the mean differences between the groups. The mean differences between the groups were not statistically significantly different for the completion of the polio vaccine series among children 2 years of age. The mean score for the completion of the polio vaccine series in the Asians group was lower than all other groups (mean score = 2.63), multiple comparisons between groups showed a p value > 0.05; therefore, there were no statistically significant differences between the groups.

Hepatitis B: In assessing race and ethnicity and the Hepatitis B vaccine, an ANOVA was conducted. The outcome of interest was the Hepatitis B vaccine. The possible predictor variable was race and ethnicity. The assumption of homogeneity of variances was assumed. Levene's test of equality of variances, $p >.05$ ($p = 0.066$). The ANOVA test proceeded. Analysis result: F (3, 1997) = 1.193, $p >0.05$ ($p = 0.311$). There

was no statistically significant association between race and ethnicity and completion of the Hepatitis B vaccine series among children 2 years of age.

HIB: In assessing race and ethnicity and the HIB vaccine, an ANOVA was conducted. The outcome of interest was HIB. The possible predictor variable was race and ethnicity. The assumption of homogeneity of variances was assumed. Levene's test of equality of variances, $p > .05$ ($p = 0.709$). The ANOVA test proceeded. Analysis result: F (3, 1997) = 0.397, $p > 0.05$ ($p = 0.755$). There was no statistically significant association between race and ethnicity and completion of the HIB vaccine series among children 2 years of age.

Varicella: In assessing race and ethnicity and the varicella vaccine, an ANOVA was conducted. The outcome of interest was completion of the varicella vaccine series. The possible predictor variable was race and ethnicity. The assumption of homogeneity of variances was assumed. The Levene's test of equality of variances, $p > .05$ ($p = 0 .641$). The ANOVA test proceeded. Analysis result: F (1, 1999) =0 .592, $p > .05$ ($p = 0 .442$). There was no statistically significant association between race and ethnicity and the completion of varicella vaccine series among children 2 years of age.

MMR: In assessing race and ethnicity and the MMR vaccine, an ANOVA was conducted. The outcome of interest was MMR. The possible predictor variable was race and ethnicity. The assumption of homogeneity of variances was assumed. Levene's test of equality of variances, $p > 0.05$ ($p = 0.511$). The ANOVA test proceeded. Analysis result: F (1, 1999) = 1.205, $p = >0.05$ ($p = 0 .273$). There was no statistically significant

association between race and ethnicity and the completion of the MMR vaccine series among children 2 years of age. Table 15 provides the results for Research Question 4.

Table 15

ANOVA Results for Research Question 4: Vaccines, Race, and Ethnicity

Vaccines	Test	Statistics	df1	df2	Sig.
DTAP	Welch	3.021[a]	4	278.021	.018
Polio	Welch	2.618[a]	4	278.659	.035
Hep B	ANOVA	1.193	3	1997	.311
HIB	ANOVA	.397	3	1997	.755
Varicella	ANOVA	.592	1	1999	.442
MMR	ANOVA	1.205	1	1999	.273

Note. Asymptotically F distributed. ANOVA F statistics results for Hep B, HIB, varicella, & MMR. Statistically significance showed for DTAP& polio.

Research Question 5

An analysis of variance was conducted to determine if initiation of prenatal care was significantly associated with childhood immunization series completion 4:3:1:3:3:1 rates among children 2 years of age.

DTAP: In assessing initiation of prenatal care and the DTAP vaccine, an ANOVA was conducted. The outcome of interest was completion of the DTAP vaccine series. The possible predictor variable was initiation of prenatal care. The assumption of homogeneity of variances was assumed. The Levene's test of equality of variances, $p > .05$ ($p = .174$). The ANOVA test proceeded. Analysis result: F (4, 1996) = 1.991, $p > .05$ ($p = .093$). There was no statistically significant association between initiation of prenatal care and completion of the DTAP vaccine series among children 2 years of age.

Polio: In assessing initiation of prenatal care and the polio vaccine, an ANOVA was conducted. The outcome of interest was completion of the polio vaccine series. The

possible predictor variable was initiation of prenatal care. The assumption of homogeneity of variances was not assumed. The Levene's test of equality of variances, $p < .05$ ($p = .029$). A Welch correction was used. Analysis result: F (3, 107.448) = 1.317, $p > .05$ ($p = .273$). There was no significant association between initiation of prenatal care and completion of the polio vaccine series among children 2 years of age.

Hepatitis B: In assessing the initiation of prenatal care and the Hepatitis B vaccine, an ANOVA was conducted. The outcome of interest was Hepatitis B. The possible predictor variable was the initiation of prenatal care. The assumption of homogeneity of variances was not assumed. The Levene's test of equality of variances, $p > .05$ ($p = .026$). A Welch correction was used. Analysis result: F (3, 145.154) = 1.051, $p > .05$ ($p = .372$). There was no statistically significant association between the initiation of prenatal care and the completion of Hepatitis B vaccine series among children 2 years of age.

HIB: In assessing the initiation of prenatal care and the HIB vaccine, an ANOVA was conducted. The outcome of interest was the HIB. The possible predictor variable was the initiation of prenatal care. The assumption of homogeneity of variances was not assumed. The Levene's test of equality of variances, $p <0 .05$ ($p = 0.001$). A Welch correction was used. Analysis result: F (3, 109.856) = 2.191, $p >0 .05$ ($p = 0.093$). There was no statistically significant association between the initiation of prenatal completion of the HIB vaccine series among children 2 years of age.

Varicella: In assessing the initiation of prenatal care and the varicella vaccine, an ANOVA was conducted. The outcome of interest was completion of the varicella vaccine

series. The possible predictor variable was the initiation of prenatal care. The assumption of homogeneity of variances was not assumed. The Levene's test of equality of variances, $p < .05$ ($p = .03$). A Welch correction was used. Analysis result: F (1, 321. 943) = 2.533, $p > .05$ ($p = 0.112$). There was no statistically significant association between the initiation of prenatal care and the completion of varicella vaccine series among children 2 years of age.

MMR: In assessing the initiation of prenatal care and the MMR vaccine, an ANOVA was conducted. The outcome of interest was completion of the MMR vaccine series. The possible predictor variable was the initiation of prenatal care. The assumption of homogeneity of variances was assumed. The Levene's test of equality of variances, p >0 .05 (p =0 .266). The ANOVA proceeded. Analysis result: F (1, 1999) =0 .463, p >0 .05 (p =0 .496). There was no statistically significant association between the initiation of prenatal care and the completion of MMR vaccine series among children 2 years of age. . Table 16 provides the results for Research Question 5.

Table 16

ANOVA Results for Research Question 5: Vaccines and Initiation of Prenatal Care

Vaccines	Test	Statistics	df1	df2	Sig.
DTAP	ANOVA	1.991	4	1996	.093
Polio	Welch	1.317[a]	3	107.448	.273
Hep B	Welch	1.051[a]	3	145.154	.372
HIB	Welch	2.191[a]	3	109.856	.093
Varicella	Welch	2.533[a]	1	321.943	.112
MMR	ANOVA	.463	1	1999	.496

Note. Asymptotically F distributed. ANOVA F statistics results for DTAP & MMR.

Research Question 6

A multinomial logistic regression was conducted to investigate if mothers' age was associated with mothers' level of education, marital status, race and ethnicity, and trimester initiation of prenatal care relative to the ability to predict the childhood pneumococcal immunization completion series (4 series). A predictive analysis was necessary to explain the relationship between the dependent nominal variable (the vaccine series-pneumococcal) known as the outcome variable and the independent variables (maternal age, marital status, education, race and ethnicity classified as the predictor/ factor variables, and prenatal care classified as the predictor/covariates). The goodness of fit was significant (p >.05), indicating that the model fits the data well. Additionally, the [-2 log Likelihood=1683.348] and the [Nagelkerke R squared=.041]. Marital status was significant predictor for children 2-years-old receiving the pneumococcal vaccine series (p<.05), p=.009. The full model statistically predicts the dependent variable (pneumococcal vaccine series) better than the intercept-only model alone. The unstandardized B = [-.664], SE = [.231], $Wald$ = [8.241], p < .005.Married women were more likely to receive the pneumococcal vaccine series for their children than unmarried women. Educational level was statistically significant p <0.05 (p= 0.017). Women with higher educational levels (> high school) were more likely to receive the pneumococcal vaccine series for their children than those women who had lower educational levels (< high school). Table 17 below provides the statistical results for Research Question 6.

Table 17

Multinomial Logistic Regression (Likelihood Ratio Tests) of Pneumococcal Vaccine and Maternal Factors

	Model Fitting Criteria	*Likelihood Ratio Tests*		
Effect	-2 Log Likelihood of Reduced Model	Chi Square	df	Sig.
Intercept	1683.348[a]	.000	0	
Prenatal Care	1688.255	4.907	4	.297
Age Group	1692.397	9.049	12	.699
Marital Stat	1696.773	13.429	4	.009
Race Ethnic	1690.389	7.041	16	.972
Education_Lev	1702.040	18.693	8	.017

Note. Statistically significance observed with marital status (0.009) and educational level (0.017) of the pneumococcal vaccine. The reduced model is similar to the final model because omitting the effect does not increase the degree of freedom.

Table 18 below provides additional statistical information and includes odds ratio.

Table 18

Pneumococcal Vaccine Series with Parameter Estimates Including Odds Ratio

Parameter Estimates

Pneumococcal[a]		B	Std. Error	Wald	df	Sig.	Exp(B) (Odds Ratio)	95% Confidence Interval for Exp(B) Lower Bound	Upper Bound
Not Immunized (0 dose)	Intercept	-2.618	.464	31.780	1	.000			
	PNCare	.060	.044	1.849	1	.174	1.062	.974	1.158
	[AgeGroup =1]	-.851	.754	1.273	1	.259	.427	.097	1.872
	[AgeGroup =2]	-.204	.279	.534	1	.465	.815	.472	1.409
	[AgeGroup =3]	-.068	.210	.103	1	.748	.935	.619	1.412
	[AgeGroup =4]	0[b]	.	.	0	.	.	.	.
	[MaritalStat =1]	-.664	.231	8.241	1	.004	**.515**	.327	.810
	[MaritalStat =2]	0[b]	.	.	0	.	.	.	.
	[RaceEthnic=1]	.416	.439	.897	1	.343	1.516	.641	3.584
	[RaceEthnic=2]	.022	.494	.002	1	.965	1.022	.388	2.689
	[RaceEthnic=3]	.915	.579	2.496	1	.114	2.497	.802	7.772
	[RaceEthnic=4]	.344	.502	.469	1	.493	1.411	.527	3.776
	[RaceEthnic=5]	0[b]	.	.	0	.	.	.	.
	[Education_Lev=1]	-.079	.356	.049	1	.824	.924	.460	1.856
	[Education_Lev=2]	.128	.207	.381	1	.537	1.137	.757	1.706
	[Education_Lev=3]	0[b]	.	.	0	.	.	.	.
Little Immunized (1 dose)	Intercept	-3.392	.590	33.084	1	.000			
	PNCare	.041	.071	.337	1	.562	1.042	.907	1.196
	[AgeGroup =1]	-1.434	1.063	1.819	1	.177	.238	.030	1.916
	[AgeGroup =2]	-.149	.401	.138	1	.710	.862	.393	1.890
	[AgeGroup =3]	-.347	.384	.817	1	.366	.707	.333	1.500
	[AgeGroup =4]	0[b]	.	.	0	.	.	.	.
	[MaritalStat =1]	.005	.351	.000	1	.989	1.005	.505	1.999
	[MaritalStat =2]	0[b]	.	.	0	.	.	.	.
	[RaceEthnic=1]	-.449	.510	.775	1	.379	.638	.235	1.735
	[RaceEthnic=2]	-.494	.577	.733	1	.392	.610	.197	1.892
	[RaceEthnic=3]	-.515	1.126	.210	1	.647	.597	.066	5.423
	[RaceEthnic=4]	-.421	.624	.456	1	.500	.656	.193	2.228
	[RaceEthnic=5]	0[b]	.	.	0	.	.	.	*.Table Contin*

Pneumococcal[a]		B	Std. Error	Wald	df	Sig.	Exp(B) (Odds Ratio)	95% Confidence Interval for Exp(B) Lower Bound	Upper Bound
	[Education_Lev=1]	1.126	.474	5.656	1	.017	3.084	1.219	7.803
	[Education_Lev=2]	.377	.398	.897	1	.344	1.457	.669	3.176
	[Education_Lev=3]	0[b]	.	.	0	.	.	.	.
Somewhat Immunized (2 doses)	Intercept	-3.499	.583	35.995	1	.000			
	PNCare	.102	.054	3.563	1	.059	1.107	.996	1.231
	[AgeGroup=1]	.880	.536	2.701	1	.100	2.411	.844	6.887
	[AgeGroup=2]	.262	.368	.508	1	.476	1.300	.632	2.673
	[AgeGroup=3]	.161	.311	.268	1	.604	1.175	.639	2.161
	[AgeGroup=4]	0[b]	.	.	0	.	.	.	.
	[MaritalStat=1]	.115	.305	.142	1	.707	1.122	.617	2.041
	[MaritalStat=2]	0[b]	.	.	0	.	.	.	.
	[RaceEthnic=1]	.162	.541	.090	1	.765	1.176	.407	3.393
	[RaceEthnic=2]	.139	.579	.058	1	.810	1.150	.369	3.578
	[RaceEthnic=3]	.211	.898	.055	1	.815	1.234	.212	7.171
	[RaceEthnic=4]	.176	.628	.079	1	.779	1.193	.349	4.083
	[RaceEthnic=5]	0[b]	.	.	0	.	.	.	.
	[Education_Lev=1]	-.671	.470	2.040	1	.153	.511	.203	1.284
	[Education_Lev=2]	-.366	.304	1.453	1	.228	.693	.382	1.258
	[Education_Lev=3]	0[b]	.	.	0	.	.	.	.
Not Fully Immunized (3 doses)	Intercept	-2.270	.314	52.220	1	.000			
	PNCare	.009	.032	.078	1	.780	1.009	.948	1.074
	[AgeGroup=1]	-.074	.300	.061	1	.804	.928	.515	1.673
	[AgeGroup=2]	-.176	.185	.914	1	.339	.838	.584	1.204
	[AgeGroup=3]	.034	.158	.046	1	.830	1.034	.759	1.409
	[AgeGroup=4]	0[b]	.	.	0	.	.	.	.
	[MaritalStat=1]	.272	.153	3.172	1	.075	1.313	.973	1.771
	[MaritalStat=2]	0[b]	.	.	0	.	.	.	.
	[RaceEthnic=1]	.315	.286	1.210	1	.271	1.370	.782	2.399
	[RaceEthnic=2]	.222	.306	.527	1	.468	1.249	.685	2.275
	[RaceEthnic=3]	.179	.521	.119	1	.731	1.197	.431	3.325
	[RaceEthnic=4]	.179	.331	.290	1	.590	1.196	.624	2.28

Table Contin

Pneumococcal[a]		B	Std. Error	Wald	df	Sig.	Exp(B) **(Odds Ratio)**	95% Confidence Interval for Exp(B) Lower Bound	Upper Bound
	[RaceEthnic=5]	0[b]	.	.	0	.	.	.	.
	[Education_Lev=1]	.673	.218	9.525	1	.002	1.961	1.279	3.007
	[Education_Lev=2]	.344	.165	4.320	1	.038	1.410	1.020	1.950
	[Education_Lev=3]	0[b]	.	.	0	.	.	.	.

Note. The reference category is Fully Immunized (4 doses). This parameter is set to zero because it is redundant.

Codes for independent and dependent variables were defined in Chapter 3.

Table 19 below summarizes the immunization status of the vaccine series (4:3:1:3:3:1:4) among 2-year-olds.

Table 19

Two-Year Old Fully Immunization Status of Vaccine Series 4:3:1:3:3:1:4

Vaccines	Immunized Status	Percentage
DTAP	Fully Immunized (4 doses)	77.6
Polio	Fully Immunized (3 doses)	88.6
Hep B	Fully Immunized (3 doses)	86.5
HIB	Fully Immunized (3 doses)	89.1
MMR	Fully Immunized (1 dose)	72.6
Varicella	Fully Immunized (1 dose)	85.7
Pneumococcal	Fully Immunized (4 doses)	87.2

Note. Research Question1-5 addresses the first six vaccines series. Research Question 6 addresses pneumococcal vaccine series. Fully immunized refers to the required vaccine series for 2-year-olds.

Summary

Maternal characteristics were associated as a predictor of childhood immunization series completion rates among children 2 years of age. Maternal age was associated with polio, Hepatitis B, and HIB vaccines: *p*-value for polio, Hepatitis B, and HIB were < .05. Children of older mothers had better immunization completion rates than children of younger mothers. Maternal educational level and completion of the Hepatitis B vaccine series were also statistically significantly associated, $p <$ than 0.05 (p=0.006). Children of mothers who had higher educational levels had better immunization completion rates for the Hepatitis B vaccine series than children of mothers who had lower educational levels. Mothers' marital status was significantly associated with completion of the childhood vaccines, $p <$0.05 for DTAP, polio, Hep B, HIB, varicella, and MMR. Mothers who were married had better immunization completion rates of the vaccine series (4:3:1:3:3:1) than unmarried mothers. Some racial/ethnic groups had poorer DTAP and polio vaccine series completion rates among children 2 years of age. This was observed between the Asian and the racial/ethnicity unknown group of mothers in the study. Initiation of prenatal care had no association with the completion of any of the vaccine series among children 2 years of age. Investigating maternal characteristic and the pneumococcal vaccine series, the multinomial regression results indicated that unmarried mothers had an odds ratio of 0.515 relative to not having their 2-year-olds immunized with the pneumococcal vaccine when compared to married mothers. Mothers whose educational level was less than high school were 3 times more likely (3.804 odds ratio) of not having their 2-year-olds fully immunized with the pneumococcal vaccine (see Table 18). There was a statistically

significant association between marital status, education, and pneumococcal vaccine series completion rates among children 2 years of age. The study has shown statistically significant association between maternal characteristics and childhood immunization series (4:3:1:3:3:1 and the 4:3:1:3:3:1:4) completion rates among children 2 years of age. Married women and educated women who had higher than high school education were more likely to complete the pneumococcal vaccine series than unmarried women and women who had less than high school education.

Table 20 below provides summary statistics of vaccines and maternal characteristics.

Table 20

Summary of Statistical Significance of Vaccines and Maternal Characteristics

Vaccines	**Maternal Characteristics**							
	Age		**Education**		**Marital Status**		**Race/Ethnicity**	
	Test	Sig	Test	Sig	Test	Sig	Test	Sig
DTAP					Welch	0.002	Welch	0.0180
Polio	Welch	0.009			Welch	<0.001	Welch	0.035
Hep B	Welch	<0.001	Welch	0.006	Welch	<0.001		
HIB	Welch	0.029			Welch	<0.001		
VZV					Welch	<0.001		
MMR					Welch	0.001		
Pneumococcal			Multinomial Regression	0.017	Multinomial Regression	0.009		

Note. Vaccine series (4:3:1:3:3:1:4) statistically significance results. Sig (=Significance) denoting p-value < 0.05. Welch (Anova/Welch test).

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

In this chapter, I address the discussion; interpretation of the findings; social implications for the study; recommendations for health care professionals, stakeholders, and community groups; limitations of the study; and the need for future research. A quantitative, cross sectional study was conducted to examine the association between maternal characteristics and childhood immunization series completion rates among children 2 years of age in Florida. The FDOH conducts yearly immunization survey on 2-year-old children to evaluate immunization coverage levels among children for the state. The report for the 2015 immunization coverage levels in 2-year-old children showed a coverage rate for the 4:3:1:3:3:1 vaccine series to be 85.54%. This did not meet the national coverage goal of 90%. The state continues to not meet the 90% goal due to the number of 2-year-olds who do not receive the DTaP by age 2 years (Florida Health, 2016). Outbreaks of vaccine-preventable diseases continue to occur and increase significantly in the United States. Underimmunization of subpopulation contributed to this phenomenon (Rudefer & Krilov, 2015).

Summary of Findings

In the six research questions, I examined the maternal characteristics and childhood immunization series completion rates among 2-year-old children. According to the study findings, maternal age, educational level, racial/ethnicity, and marital status were predictors for completion of the pneumococcal vaccine series. Maternal age, educational level, racial/ethnicity, and marital status were statistically significantly

associated with completion of the vaccine series (Tables 12-17). The initiation of prenatal care was not significantly associated nor was it found to be a predictor of childhood immunization series completion rates. Marital status was the most consistent association and predictor of completion of all the vaccine series (4:3:1:3:3:1:4). Children whose mothers were married had better immunization completion rates than children of unmarried mothers (unmarried mothers Odds Ratio= 0.515).

Interpretation of Findings

In this study, I found an association between maternal characteristics and childhood immunization series completion rates. These associations are consistent with the findings from the literature. For example, Sabnis and Conway (2015) stated that racial/ethnic and economically disadvantaged groups have shown significant disparities in childhood immunization rates. Immunization completion rates continue to be below the 90 % goal for Healthy People 2020 (Sabnis & Conway, 2015). Crouch and Dickes (2015) indicated that demographic and socioeconomic characteristics of mothers are predictors of childhood immunization, and the age of the mother and education correlates with some childhood immunization series completion. Socioeconomic and demographic characteristics, such as mothers' age, educational level, and race/ethnicity were highly significant at 5 % level with the likelihood of a preschool child in the United States being fully immunized (Crouch & Dickes, 2015). Age, education, and marital status were associated with some vaccines such as Hepatitis B, MMR, polio, and Hib (Crouch & Dickes, 2015). In the present study, all seven primary vaccines for the 2-year-old population were found to be below the Healthy People 2020 goal for 2-year-olds in

Florida during the 2014-2016 study period. The highest percent completion rate (89.1%) was attributed to the Hib vaccine, while the lowest was the MMR vaccine followed by the DTAP (77.6%). Table 19 shows the proportion of study population (2-year-olds) fully immunized with the seven primary vaccine series. Crouch and Dickes's findings were consistent with the findings of this study, which revealed that the maternal characteristics were significant predictors of childhood immunization completion rates. I found that children of older mothers aged > 25-29 and ≥ 30 years were more likely to have better immunization completion rates. In addition, children of married women had better immunization completion rates than children of unmarried women. Children of mothers who had education equal to high school or greater than high school had better immunization completion rates than children of mothers who had lower than a high school education. Race and ethnicity influenced childhood immunization completion rates as was evident in the Asian and the race/ethnicity unknown group in this study.

Maternal Age and Vaccines Series 4:3:1:3:3:1

In this study, I identified vaccines that were of statistical significance. Polio, Hepatitis B, and Hib completion were found to be associated with maternal age (older mothers). Such knowledge may aid the choice of vaccines for their children. The CDC (2014) reported that between the 1990s and 2013, some vaccines exceeded the 90 % national goal. Those that exceeded the 90 % goals were the Polio, Hep B, MMR, and the varicella vaccine. DTAP, pneumococcal, and the HIB vaccines were below the 90% goal (83% to 82%).

Educational Level and Vaccine Series 4:3:1:3:3:1

In this study, I found the Hepatitis B vaccine series completion and education to be of statistical significance. Hepatitis B vaccines' statistical significance was evident, $p = 0.035$. Differences in immunization completion rates were also observed with the pneumococcal vaccine in mothers who completed high school or had some college level education. The odds ratio (3.804) was three times more likely for mothers with less than a high school education to have poorer immunization completion rates, especially the pneumococcal vaccine series (Table 18). Mothers may choose vaccines they consider more beneficial to their children. Vaccine education and knowledge is critical.

Marital Status and Vaccine Series 4: 3:1:3:3:1

The vaccines series completion rates and marital status were statistically significantly associated in this study. The DTaP vaccine series completion was statistically significant: $p < 0.05$ ($p = 0.002$). The polio vaccine series completion was statistically significant, ($p < 0.001$). The Hepatitis B vaccine series completion was statistically significant, $p < 0.05$ ($p < 0.001$). The Hib vaccine series was statistically significant, $p < 0.001$. The varicella vaccine series completion was statistically significant, $p < 0.05$ ($p = 0.001$). The MMR vaccine series completion was statistically significant, $p < 0.05$. Studies in the United States were limited on marital status. In this study, I did not define married women as living separately or living with their partners. Florida consists of parents from various ethnicities, and some Floridian mothers have immigrated to the United States. The requirements for completion of the vaccine series in the United States for 2-year-olds may be different from other developing countries. A

statistically significant association with marital status and childhood vaccines series completion of the 4:3:1:3:31 was revealed in this study (see Tables 14 and 17). In all vaccines analyzed, I found a statistically significant association with marital status. Married women may, therefore, have some support from their spouse aiding their decision regarding childhood immunization compared to unmarried women who may rely on their own understanding and, therefore, are making their own decision.

Race and Ethnicity and Vaccine Series 4:3:1:3:3:1

In this study, statistically significant findings were observed among racial and ethnic groups. The DTAP vaccine series completion rates among children 2 years of age showed statistically significance with $p< 0.05$ ($p = 0.018$), and the polio vaccine series completion rate was statistically significant ($p < 0.05$ ($p = 0.035$). This association was noted with the race/ethnicity unknown and Asians groups. Walker, Smith, and Kolasa (2014) argued that racial/ethnic disparities with the four doses of DTAP vaccine series were almost nonexistent or are decreasing among some minority groups since 2007 while Sabnis and Conway (2015) claimed that considerable disparities in immunization rates between children of different racial/ethnic groups are inherent. Various racial and ethnic groups reside in Florida. In this study, I observed that the non-White and racial/ethnicity unknown group comprised 17.7 % of the study population. The statistically significant differences observed with the vaccines DTAP and polio among racial and ethnic groups may indicate that some racial and ethnic groups may consider some childhood vaccines to be important over others; but, this was not assessed in this study.

Initiation of Prenatal Care and Vaccine Series 4:3:1:3:3:1

In this study, I examined a sample of 2,001 women who initiated prenatal care in any month of their pregnancy or during their trimester of pregnancy. DTaP, polio, Hepatitis B, HIB, varicella, and MMR all had a *p*-value > 0.05. Therefore, no significant association was identified in this study between the initiation of prenatal care and the completion of childhood immunization among 2-year-olds in Florida. Feemster et al. (2009) addressed prenatal care and childhood immunization, and they reported that mothers who had fewer prenatal visits for their infants were late starters for first the immunization. Feemster et al. indicated that the highest proportion of late starters were among infants who were born to young mothers, mothers with less than a high school education, and mothers who had no prenatal care visits. In my study, I did not identify any association with the initiation of prenatal care and the immunization completion rates among children 2-year-olds; however, younger mothers' children had poorer immunization completion rates compared to children of older mothers. Wiecha and Gann (1994) found that maternal care predicted infant immunization delay. Missing more than 25% of scheduled prenatal visits was linked to delay in infant immunization (Wiecha & Gann, 1994). In this study, I found no association between the initiation of prenatal care and the immunization completion rates among children 2-years-old. Many private and governmental public health facilities have vaccine educational programs in their prenatal services. These programs are aimed to sensitize mothers early on in immunization practices, as well as to provide maternal immunization to mothers.

Maternal Factors and Pneumococcal Vaccine

Pneumococcal vaccine series completion rates among 2-year-old children in Florida were statistically significant with the independent variables, marital status, and education level. Statistical significance was $p = 0.009$ and 0.017 respectively between marital status, education, and the pneumococcal vaccine (Table 17). Mothers who were married compared to mothers who were unmarried were more likely to have their children immunized with the pneumococcal vaccine. Mothers who had attained a high school educational level or higher (some college level) compared to mothers who had education lower than high school were also more likely to complete the pneumococcal vaccine series.

Interpretation in Relation to the Theories

The outcome of this study supports Bandura's (1977) statement that people must discover the determinants of human behavior. The findings of this study on maternal age, marital status, and educational level support human functions, which are pivotal roles in health-related behaviors. I revealed that 98(4.9%) of the mothers were under the age of 20 years. Although 4.9 % seems not significant, I showed that older mothers completed polio, Hep B, and HIB vaccine series more often than younger mothers did. It is important to consider younger mothers when designing immunization educational and other health care programs. The SLT is, therefore, applicable to not just one age group but to all age groups as individuals can learn new skills. Mothers with higher educational attainment compared to mothers with lower levels of educational attainment were better with completing the Hep B vaccine series. Health education and health information offer

learning opportunities for all people of all ages, all educational levels, and other maternal characteristics. The information gathered from this study will serve as a guide for younger mothers, mothers whose educational levels are below high school, and mothers of racial/ethnic groups with poorer immunization completion rates. Although I did not assess educational self-efficacy or parental self-efficacy, these two concepts are related to the SLT. Artino (2012) implied that self-efficacy has used to predict an array of human functioning while Glatz and Buchanan (2015) described parental self-efficacy as it parental competency in their parenting role, the ability to manage developmental issues, and the capability to influence their child that fosters positive development and adjustment. Glatz and Buchanan acknowledged unmarried parents and single parents as maternal characteristics that will heighten the challenges of parenting and interfere with parenting self-efficacy. SLT is applicable in this study. I found that older mothers are more likely to complete childhood vaccine series (polio, Hep B, and HIB) than younger mothers. Mothers with higher educational level are more likely to complete childhood vaccine series such as Hep B and pneumococcal vaccine series than mothers with lower educational level. Married mothers are more likely to complete childhood vaccine series (4:3:1:3:3:1:4) than unmarried mothers. These findings are critical to share with all parents and caregivers.

Limitations of the Study

The data for this study were secondary data originally used by the FDOH in the Annual Immunization Survey for Two-Year-Old Children, 2014. Secondary data can pose limitations to a study, as the original data collected were not for the generated

hypotheses in this study. Data cleaning was ensued, and outliers were removed to ensure that all of the variables were appropriate and the data suited the hypotheses (see Figure 2). As the data included only the immunization records of children born in Florida, a limitation is possible. In addition, for children born outside of the United States, their immunization documents may become challenging to the immunization worker who has to interpret such vaccines, especially if they are of a different language. In many public health settings, an immunization interpretation chart for immunizations given in other countries is available. Using the immunization records of the children born in the Florida/United States may provide much accurate interpretation of the vaccines. The data included mainly maternal characteristics with only the educational characteristics of the father. I only addressed the maternal characteristics.

I did not verify the validity of the immunization received by the children, due to the use of secondary data; however, Florida vital statistics housed all birth records, which are entered into the Florida SHOTS database. The patient birth record was assigned an immunization identifier. The Florida SHOTS system enhances data quality. The data for the various groups had unequal sample sizes, and statistical analysis was conducted with the given sample sizes to protect data originality; also, robust statistically measures were used once homogeneity of variances were not assumed. Despite these limitations, maternal characteristics associated with some vaccines were acknowledged. The study provided a better understanding of the predictors of childhood immunization completion.

Recommendations for Further Study

I found that maternal characteristics were significantly associated with childhood immunization series completion, which warrants the need for future studies. Other researchers should investigate why some childhood vaccines are directly associated with some maternal characteristics. The need for more studies on those vaccines and maternal factors, which might influence childhood immunization series completion rates, is imperative. Qualitative studies might provide more insight to validate or discount this study's outcomes. I also revealed that initiation of prenatal care does not influence childhood immunization completion series rates. Further studies are recommended, especially during the mothers' early postpartum period.

Implications of the Study

The outcome of this cross sectional, quantitative study plays a role in educating parents, health care professionals, community partners, and stakeholders of the maternal characteristics that influence completion of childhood immunization series among 2-year-olds. I revealed that maternal age, education, and race/ethnicity was associated with childhood immunization series completion rates. Vaccines prevent morbidity and mortality. Florida, like many other states in the United States, continues to lag behind in meeting the 90 % target goal for Healthy People 2020. As outbreaks of vaccine-preventable diseases continue to plague communities, the need for increased knowledge and awareness to all parents and, those of diverse populations, cultures, and beliefs, is a priority. The findings of the study have implication for age- and educational-appropriate parental education. It also has implication for educating racial/ethnic groups who may

have concerns regarding DTAP and polio vaccines. Some parents choose some vaccines over others. This finding has implication for suboptimal immunization completion in children who are less than 5 years and who are susceptible to many pathogens that might cause severe disability and death. Childhood immunization completion rates are one of the principal health indicators used to measure the health of the nation (American Academy of Pediatrics, 2010). Because the 2015 Survey of Immunization Levels in 2-Year-Old Children showed a continued decline of the 90% goal, the call should not be ignored for more education to parents, health care providers, and community groups (FDOH, 2016). Strategic immunization information, immunization education, and immunization support should be geared towards younger mothers, less educated mothers, unmarried mothers, and some racial and ethnic group of mothers. Such immunization information, immunization education, and immunization supporting strategies are needed to improve childhood immunization completion rates in Florida and in other populations that have similar findings.

Implication for Positive Social Change

The findings from the study have implications for positive social change. I revealed that children of older mothers have better immunization completion rates than children of younger mothers. Children of mothers with education higher than a high school level have better immunization completion rates than children of mothers who have education lower than high school. Children whose parents are married have better immunization completion rates than children of unmarried mothers. Some racial/ethnic groups, such as Asians and race/ethnicity unknown group, in the study had poorer

immunization completion rates. Policy makers should consider the association between maternal characteristics and childhood immunization completion as elements of a vaccine policy. I also support the importance of timely immunization completion series as recommended by the ACIP that more stringent measures and policies are required for vaccine-preventable diseases in order to contain the many outbreaks of diseases that are associated with suboptimal childhood immunization completion.

Health care providers and community leaders should create more awareness based on this knowledge and influence those parents on the importance of vaccine benefits. Many younger parents have not experienced the effects and/or complications of these vaccine-preventable diseases. There is a need for immunization policy changes to protect vulnerable populations. Maternal age, marital status, and education are associated with some vaccine-preventable diseases including HIB; this disease can bring lifelong disability such as brain damage, hearing loss, and death in children less than 5 years of age.

Conclusion

I found maternal characteristics to be significant predictors of childhood immunization series completion rates. Maternal age, educational level, marital status, and race/ethnicity had statistically significant associations with childhood immunization series completion rates among children 2 years of age. Maternal age and vaccines such as polio, Hepatitis B, and HIB were predictors of childhood immunization completion rates. Older mothers' children had better immunization completion rates than younger mothers. Mothers' educational level was also a predictor for immunization completion rates.

Children whose mothers' educational level was greater than high school or had college or some college education had better immunization completion rates with the Hepatitis B vaccine series than children of mothers who had lower educational attainment. Marital status was a predictor of immunization completion rates for DTAP, polio, Hepatitis B, HIB, varicella, and MMR vaccines.

Mothers who were married had better immunization completion rates than children of mothers who were unmarried. Race/ethnicity was associated with DTAP and polio vaccine among Asians and the race/ethnicity unknown group in the study. Children from these racial groups (Asians and race/ethnicity unknown group) had poorer immunization completion rates for the DTAP and the polio vaccine. Trimester initiation of prenatal care was not associated with immunization completion rates among children 2 years of age. Salmon, Dudley, Glanz, and Omer (2015) claimed that many children in the United States are still not up-to-date with the required vaccines for age-appropriate schedule due to many parental factors. The underimmunized child or the suboptimal of childhood immunization poses a threat for disease outbreaks in populations across the United States (Salmon et al., 2015). Vaccines prevent morbidity and mortality. Florida continues to decline in meeting the 90% goal due to the number of children who have not received their vaccines by 2 years of age. Maternal factors are significant predictors in immunization completion rates as indicated in the Florida Immunization Survey (FDOH, n. d.). Continuous monitoring of these maternal characteristics relative to childhood immunization completion rates is necessary. More research is needed to investigate the maternal factors that influence immunization completion rates. The outcomes of this

study may offer awareness and interest for health care professionals, community partners, and policy makers in improving and implementing programs to address younger mothers, mothers with educational levels lower than high school, unmarried mothers, and some racial/ethnicity groups in Florida to increase childhood immunization completion rates. The need for immunization information, immunization education, and immunization support to these mothers, especially in the prenatal and early postnatal health care setting, is vital.

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