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The Impact of Teach-Back as a Patient Education Tool in Women with Inadequate Maternal Health Literacy Seeking Immunizations for their Children

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The Impact of Teach-Back as a Patient Education Tool in Women with Inadequate Maternal

Health Literacy Seeking Immunizations for their Children

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A dissertation

presented to

the faculty of the College of Nursing

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Doctor of Philosophy in Nursing

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by

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May 2017

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Keywords: Health literacy, Immunization knowledge, Teach-Back

ABSTRACT

The Impact of Teach-Back as a Patient Education Tool in Women with Inadequate Maternal

Health Literacy Seeking Immunizations for their Children

by

Barbara Jared

Health literacy is recognized as a contributor to health outcomes and maternal health literacy is

important to the health and wellbeing of children and families. Of particular interest are mothers

seeking immunization services for their children. The complexity of the recommended

immunization schedule and the care management of children receiving immunizations have the

potential to create negative health outcomes in the low health literate population. Assessment of

maternal health literacy and provision of effective patient education adapted to the health literacy

level of the individual is important for information transfer. The Teach-Back provides an

opportunity to both assess understanding and reinforce teaching.

This study used an experimental design to study two groups of women for a total of 90

participants in a public health department setting. The control group received the usual

immunization patient education using Vaccination Information Sheets. The intervention group

also received patient education in this manner plus use of the Teach-Back. Immunization

knowledge was assessed prior to and after patient education. Immunization currency was

assessed as well.

The Newest Vital Sign was used to assess the maternal health literacy for 90 mothers bringing

their children for immunizations. A demographic survey addressing both individual

characteristics and social determinants of health variables was also administered.

Most of the participants were low health literate (84%) and low health literacy was related to lower immunization knowledge and poor immunization currency. Social determinants of health variables were related to maternal health literacy, immunization knowledge and immunization currency. The results demonstrated an improvement of immunization knowledge scores with the use of the Teach-Back method of patient education.

Additional research is needed in the area of patient education interventions specific to the low health literate population. The development of instruments to measure interactive and critical health literacy are needed and interventions to promote growth in health literacy are also needed. Clinically, improved patient education interventions for low health literate mothers has the potential to improve health outcomes and decrease health care costs of these women, their children and their families.

DEDICATION

I would like to dedicate this work to my family, the people who encourage and support my efforts. To my husband, Max, for his support and steadfastness that provided a rock of stability in this endeavor, To my daughters, Julie and Hannah, you are the inspiration that motivates me to go one step further. To my parents, J.C. and Betty Slatten, who have led by example with their strong work ethic and conviction that their children would succeed. To my mom who instilled in me the great value in education and the opportunity it brings. While education and practice have taught me the science of nursing, my mother taught me the art of nursing with her selfless service to our family and beyond during times of illness, suffering and death.

Any true success I realize must be attributed to my Father, God the Creator of all. This journey has reinforced over and over again the truth of His Holy Word:

"The steadfast love of the LORD never ceases; His mercies never come to an end; they are new every morning; great is Your faithfulness." Lamentations 3:22-23

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CHAPTER 1

INTRODUCTION

Inadequate health literacy has been identified as a detriment to health and those with low health literacy are at a disadvantage when accessing a complex health care system. Health care providers must consider mothers of particular interest as their ability to access health care impacts not only themselves, but the health of their children as well. Eighty percent of mothers bear the responsibility for making health care decisions for their children (Wyn & Ojeda, 2001) and 59% of women indicate difficulty navigating the health care system (Harris, 2008).

Distinguishing the difference between literacy and health literacy is important. While definitely related, literacy does not fully address the multiple aspects of health literacy. Literacy is specific to both content and context. Persons who are literate in reading ability and comprehension may exhibit low literacy skills in the context of accessing health care and health care information. Maternal health literacy is defined as "the cognitive and social skills that determine the motivation and ability of women to gain access to, understand, and use information in ways that promote and maintain their health and that of their children" (Renkert & Nutbeam, 2001, pg. 382). This definition addresses not only literacy but accessing, understanding and implementing health care information for the benefit of both themselves and their children.

A plethora of information is available in a multitude of formats to assist mothers in gaining a better understanding of the health maintenance needs of their children. This information may be in the form of patient-provider communication, written patient education materials, television, websites, or family and community communication. Mayer & Villaire

(2004) recommend a 3rd to 5th grade reading level for written health education materials. However, most health related education materials are written at a level higher than the reading capacity of many individuals (Gannon & Hildebrandt, 2002).

Of particular interest in this study are the Vaccination Information Sheets (VIS) commonly used as teaching tools for recipients of immunizations (CDC, 2012). The VIS provides information such as type and purpose of immunization, identification and management of common side effects, and identification of adverse reactions requiring medical assistance. However, the VIS are written at the 10th grade reading level (CDC, 2012) increasing the likelihood of mothers with inadequate health literacy to misunderstand the instructions. Potentially, the higher reading level of the VIS may discourage mothers from attempting to read the patient education material. The ability of women with inadequate health literacy to access, understand and effectively use this information varies and identification of the types of information best suited for women of all health literacy levels is needed.

Safe administration of childhood vaccinations requires mothers to provide an accurate health history of the child including any adverse reactions from previous immunizations. Complications of and adverse reactions to immunizations range from mild symptoms such as fussiness, local reactions with redness and swelling, loss of appetite, and low-grade fever to more severe symptoms in the form of seizures and/or high fever (>105 F). A mother's ability to assess for adverse reactions and initiate appropriate interventions is critical. Mothers must be able to administer antipyretics at the appropriate time and in the correct dosage, as well as ascertain the appropriate time to seek medical attention for adverse reactions.

Renkert and Nutbeam's (2001) definition of maternal health literacy places the burden of health literacy on the ability, capacity, and motivation of the mother while neglecting to consider

the impact of the health care environment/system on health literacy. Health literacy is dynamic and requires interaction among the individual, health care providers, and the health care system as a whole. Accessing the health care system may require a mother to make appointments using complex phone or internet scheduling systems, maneuver healthcare facilities by comprehending signage labeled with medical terminology, complete wordy and complex health history forms, and communicate with health care providers who use confusing medical jargon. Mothers with poor or inadequate health literacy are at a distinct disadvantage when trying to access and navigate a complex health care system for their children.

The ability of low health literate mothers to access and manage recommended immunizations for their children is a concern considering the complexity of the health care system and the frequency of appointments for immunizations. The current childhood immunization schedule for the United States recommends children receive more than 20 immunizations providing protection from 14 different diseases in the first 12 months of life at five different points in time (CDC, 2012). The immunization schedule is confusing for mothers regardless of their health literacy status. In addition, best protection by immunization requires following a sequential schedule of immunizations and boosters.

These immunization recommendations require mothers to understand the schedule and navigate the health care system. Mothers are required to access the health care provider for scheduling at least five different times in the first 12 months. These visits require the mother to complete a comprehensive prenatal, birth, and child health history. Additional paperwork must be navigated such as informed consent documents and health insurance information. In addition, mothers are expected to process health teaching and read, comprehend, and implement written health education materials. While these expectations are common for mothers of children

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receiving immunizations, it is uncommon for providers to routinely assess health literacy levels to guide them in the way information is presented to mothers. When providers do assess health literacy there is a paucity of resources available to assist them in supporting the low health literate, and none of the available resources are evidence based (White, Chin, & Atchison, 2008)

Problem Statement

The problem addressed in this study was maternal health literacy and its relationship to maternal knowledge related to childhood immunizations. A lack of maternal understanding related to immunizations may limit a mother's ability to adequately provide critical health information to the providers, assess for adverse reactions, and/or fail to appropriately intervene to protect the health of her children. A mother may misinterpret adverse reactions and seek health care in the form of an unnecessary emergency room visit, inadvertently increasing health care costs. To compound this issue mothers must sort through mixed media messages on the safety of immunizations. For any mother these mixed media messages may contribute to a sense of fear of disease if the child is unvaccinated and a simultaneous fear of disabling complications if the child is vaccinated. This confusion is compounded in the low health literate mother as she will be less likely to read current reports related to immunization, less likely to access credible internet resources, and less likely to know how to verbalize her confusion to her health care provider increasing her inability to make an informed decision (Shieh, Mays, McDaniel & Yu, 2009).

The Upper Cumberland Region of Middle Tennessee is composed of 14 rural counties with a population of approximately 300,000 and 40,000 children under the age of 18. Only 84% of this population has earned a high school diploma and 25.2% are living in poverty. Approximately 8% of the Upper Cumberland population is unemployed. The teenage pregnancy

rate is 54 per1000 and the infant mortality rate is 7 per 1000 for the teenage population (TDOH, 2011).

In the 14 rural counties of the Upper Cumberland Region (UCR) of Tennessee only 74.6% of the children have completed their recommended immunization schedule at 24 months. Those immunizations lagging below the 90% completion rate in the Upper Cumberland are Diphtheria, Tetanus, and Pertussis (86.2%), Pneumococcal (84.7%), Rotavirus (66.1%) and Influenza (55.2%) (Table 1).

Table 1: *Immunization Rates*

Immunization	Upper Cumberland Region	Tennessee
DTP	86.2%	83.8%
MMR	93.1%	90.2%
Pneumococcal	84.7%	83.9%
Rotavirus	66.1%	75.3%
Influenza	55.2%	51.4%
HiB	79.3%	83%
Hep A 1 dose	86.2%	89.9%
Hep B Complete	94.8%	94.2%
IPV	94.0%	93.0%
Varicella	93.1%	91%
Overall	74.6%	75.7%

TIP TDOH, 2015

The vaccination rate for children covered under Tennessee's Medicaid program (Tenn Care) is slightly less than those children who are not enrolled.   In addition, Tennessee children receiving immunizations in the private sector have a 75.3% completion rate as compared to those in the public sector with only a 69.3% immunization completion rate (TIP, 2013). Targeting the public sector for the purpose of improving vaccination rates requires consideration of factors contributing to failure to immunize. Maternal health literacy is one of those contributing factors to be considered as mothers with inadequate health literacy are less likely to grasp the purpose or importance of childhood vaccination (Baker, Wilson, Nordstrom & Legwand, 2007).

Purpose

The three purposes of this study were to 1) determine the impact of maternal health literacy on knowledge of childhood immunizations, 2) currency with the recommended immunization schedule and 3) to test an intervention to improve mothers' knowledge related to childhood immunizations in a population of low health literate mothers in a rural, public health department setting.

Research Questions

1.   What is the level of maternal health literacy as assessed by the Newest Vital Sign (Weiss et al., 2005) in mother's of children receiving immunizations in a public health department?

2.   What is the effectiveness of the Teach-Back (Picker Institute, n.d.) method of patient education versus the traditional VIS (CDC, 2012) patient education in improving immunization knowledge in mothers seeking immunizations for their children?

3.   What is the relationship between maternal health literacy and adherence to recommended childhood immunization schedule in a population of mother's in a public health department setting?

4.   What is the level of immunization knowledge as measured by the Immunization Knowledge Questionnaire?

5.   What factors predict adherence to the recommended immunization schedule (transportation, maternal age, education level, number of children, Immunization Knowledge Scores)?

6.   What factors predict maternal immunization knowledge (health literacy, educational level, number of children, maternal age)?

7.   What factors predict the use of social services and/or programs in qualified mothers/children?

Hypothesis

1.   Higher levels of health literacy as measured with the NVS will be associated with higher immunization knowledge scores regardless of teaching method in mothers seeking immunizations for their children in a public health department setting.

2.   Use of Teach-Back method of patient education will be associated with higher immunization knowledge scores than the standard VIS method in mothers with low health literacy.

Aims

The specific aims for this study were to compare two patient education methods for mothers with inadequate health literacy and to add to the body of literature related to maternal health literacy and patient education materials specific to childhood immunizations.

In a sample of mothers receiving immunizations for their child(ren) in a rural public health department in Middle Tennessee this intervention study will:

1. Describe maternal health literacy, currency with the immunization schedule, and maternal knowledge related to childhood immunizations.

2. Analyze relationships among maternal health literacy, knowledge of childhood immunizations, and methods of patient education.

Conceptual Framework

Health literacy is vital to the successful functioning of individuals in the health care environment. Most of the literature points to the individual as bearing the burden for health literacy as they navigate the complexities of the health care system. However, health literacy is dynamic requiring interaction between the health care system and the individual. The success of this interaction cannot solely be dependent on the individual, but must include characteristics of both the health care system and the individual. Certainly improving health literacy skills of the individual is important, but other areas to consider that may hinder the acquisition or building of health literacy are the characteristics of the health care system such as location, environment, attitudes and communication styles of providers and sensitivity to individual culture, language and values.

The Institute of Medicine (2004) published the first conceptual model of health literacy and this model is referenced in all subsequent models. Literacy skills provide the foundation for the IOM model and health literacy mediates between the individual and the health care system. This linear model set the stage for a broader elaboration of the concepts of health literacy.

Nutbeam's (2000) proposed a conceptual model of health literacy as a continuum. This model encompasses a broad range of capabilities related to engagement in the health care environment. These activities range from basic reading and understanding health information and participation in health care decision making to understanding public policy and the impact of community and cultural influences on health. Nutbeam's (2000) model presents a hierarchical view of health literacy progressing from functional to interactive with the ultimate goal of progression to critical health literacy.

Don Nutbeam has an academic background in history and health education. His professional career has included health education, public health and higher education administration. This model was developed out of the discipline of health education as a desire to promote health education and communication as related to health promotion. Initially health literacy was viewed as an outcome of health promotion (Nutbeam, 2000). Nutbeam holds that health literacy is dependent on health education. However, he also views health literacy as an influence on how we conduct health education.

Nutbeam (2000) proposes health literacy to be more than the ability to understand and apply health related information. Health literacy evolves as a continuum with progression from functional health literacy to interactive health literacy and culminating with critical health literacy. The idea is progression from basic functioning in everyday situations to meaningful interactions with the health care environment. Along the continuum toward critical health

literacy, the use of health literacy skills in conjunction with social skills leads to personal control of health and life situations. The goal is progression toward autonomy and personal empowerment.

The initial model proposed by Nutbeam (2000) was heavily linked with health education and contributed to the concepts of functional, interactive and critical health literacy. Nutbeam's (2008) later work expanded these concepts to view health literacy from the lens of health risks and health assets. Implied in both the model of health literacy as a risk and health literacy as an asset are the three concepts of functional, interactive and critical health literacy.

Extensive study has been conducted related to functional health literacy across multiple disciplines and with various populations. Functional health literacy is defined as "sufficient basic skills in reading and writing to be able to function effectively in everyday situations" (Nutbeam, 2006, pg. 263). The definitions of health literacy most closely related to functional health literacy are "the constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the health care environment," including "the ability to read and comprehend prescription bottles, appointment slips, and other essential health-related materials" (The American Medical Association, 1999), and "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions"(Ratzan, 2001). The AMA definition is narrow in scope in that it only addresses reading and numeracy comprehension. Communication and understanding related to health care matters is more than reading and calculating numbers. This definition does not account for health care accessibility issues, nor does it consider individuals with visual and/or hearing impairment.

Functional health literacy has been operationalized with the development of reliable and valid tools for its measurement. These tools include the Test of Functional Health Literacy in Adults (TOFHLA), the Rapid Estimate of Adult Literacy in Medicine (REALM), Shortened REALM , and the REALM-R, the Medical Achievement Reading Test (MART), and the Newest Vital Sign (NVS) (Parker et al., 1995, Davis, 1991, Hanson-Divers, 1997 & Weiss et al, 2005).

Functional health literacy is defined as "sufficient basic skills in reading and writing to be able to function effectively in everyday situations" (Nutbeam, 2006, pg. 263). The definitions of health literacy most closely related to functional health literacy are "the constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the health care environment," including "the ability to read and comprehend prescription bottles, appointment slips, and other essential health-related materials" (The American Medical Association, 1999), and "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions"(Ratzan, 2001). The AMA definition is narrow in scope in that it only addresses reading and numeracy comprehension. Communication and understanding related to health care matters is more than reading and calculating numbers. This definition does not account for health care accessibility issues, nor does it consider individuals with visual and/or hearing impairment.

Functional health literacy has been studied in relation to pregnancy preparedness (Endres, Sharp, Haney, & Dooley, 2004), mammography behaviors (Guerra, Krumholz & Shea, 2005), perceived cancer risk (Kelly, Shedlosky-Shoemaker, Porter, DeSimone & Andrykowski, 2011), sexual activity and contraceptive use (Rutherford et al., 2006), health information knowledge and health information seeking (Shieh & Halstead, 2009), and immunization knowledge and use (Wilson, Baker, Nordstrom & Legwand, 2008). The established measurement tools and use of

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functional health literacy across multiple disciplines and numerous population groups speaks to its maturity as a concept

The Institutes of Medicine (IOM, 2004) and Healthy People (2000, 2010) also employ Ratzan's definition of functional health literacy. This definition is broader than the AMA definition in that it addresses decision-making skills and does not limit the context of health literacy. This definition expands on the reading, writing and numeracy skills of health literacy to include speaking and listening skills and capabilities of cultural and conceptual knowledge, (IOM, 2004). These skills align more closely with Nutbeam's (2000) interactive health literacy.

Interactive health literacy addresses the individuals' ability to participate in health care activities and to understand health education in both the written and spoken context. Those with adequate interactive health literacy are also able to transfer information learned in one context and apply it to a similar situation (Nutbeam, 2006). For example, a mother with adequate interactive health literacy who is taught and receives written instructions on how to care for a red and swollen post-immunization injection site would take that knowledge and apply it to a child who later has a red and swollen bee sting.

The definition of critical health literacy is a progression in cognitive skills coupled with social skills whose application allow for critical analysis of information and the ability to utilize this information to garner greater personal control (Nutbeam, 2000). The World Health Organization (1998) provides the definition most closely associated with interactive and critical health literacy as "the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health" (p.10). This definition speaks to not only the ability to comprehend and use health information, but also addresses access to health information. In addition, the WHO

definition addresses both the cognitive piece of ability and the social issues that may impact motivation.

Further studies are needed to define and operationalize both interactive and critical health literacy. Oral literacy and social skills are variables impacting the acquisition of both interactive and critical health literacy. Development and refinement of measurement tools to address these variables in relation to health literacy has begun. The Swedish Communicative and Critical Health Literacy Scale was translated from the original Japanese tool and demonstrated reliability and validity in a small sample of 35 participants (Wangdahl & Mfartensson, 2014). The Dutch version of this instrument supported the concept of three levels of health literacy, but was unable to distinguish between low and high health literacy (van der Vaart et al., 2012). Heijmans, Waverijn, Rademakers, van der Vaart & Rijken (2015) used the Dutch version to assess the relationship between health literacy and self-management of chronic disease. Interactive and critical health literacy were more strongly correlated with self-management than functional health literacy. However, a noteworthy aspect of this study was the high number of participants (80%) who had a high functional health literacy. This may have contributed to the strong correlation between self-management and interactive and critical health literacy.

Health literacy viewed as a risk is derived from multiple sources expounds on Nutbeam's earlier health literacy continuum (2000), Baker's work related to health literacy meaning (2006), and a logic model relating health literacy to health outcomes (Paasche-Orlow & Wolf, 2007). The following relational statements are evident: low health literacy levels are related to declining use of available health information and services, health literacy is dependent on individual communication capacity, health literacy is related to access to health care, interaction between

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individuals and health care providers, self-care, and health literacy is related to improved compliance.

Health literacy viewed as an asset also expounds on Nutbeam's health literacy continuum (2000) and requires adequate interactive and critical health literacy skills to support patient empowerment. Relational statements implied are: health literacy is related to greater personal control of determinants of health, health literacy can be built, health literacy is an outcome to health education and communication, and improved health literacy is related to improved health outcomes.

Renkert and Nutbeam (2001) utilized health literacy as a continuum in studying prenatal education content and outcomes. The health educators in the study supported a need for more than information transfer (functional health literacy) and identified a need for opportunity to build confidence in parenting and labor. The health educators realized the time limits of teaching "everything" and recognized the importance of adequate health literacy enabling women to seek information independently (interactive and critical health literacy). Porr, Drummond & Richter (2006) employed Nutbeam's continuum of health literacy with a group of low-income mothers and found functional health literacy to build on traditional education and interactive health literacy to be related to self-efficacy beliefs in these low-income mothers. Critical health literacy was associated with both personal and community confidence and empowerment leading to both social change and social capital.

The definition of maternal health literacy in this study aligns with critical health literacy to include not only reading ability, but also the ability to access health care resources and the capability to properly utilize health care information and resources. Assessment of health literacy level utilizing the NVS will provide an assessment of functional health literacy. The chart

review will address immunization currency and appropriate access to immunizations for their children. The knowledge questionnaire will address knowledge of immunizations, benefits of immunizations, risks, how to treat common reactions, and when to seek medical assistance.

Strengths and Weaknesses of the Model

Nutbeam (2008) does not put forth a different definition but rather proposes new ideas around health literacy. He supports the use of levels of health literacy to represent a progression in health literacy skills with the end goal of individual empowerment. He identifies health literacy as more than a set of skills and the ability to be health literate but to also allow individuals to gain an increasing amount of personal control over their lives.

Functional health literacy has been well studied and could be considered generalizable as it has been studied across disciplines and with multiple population groups with differing characteristics. The concept of functional health literacy holds meaning with the model of health literacy as a continuum and the relationships between the three concepts of functional, interactive, and critical health literacy are easily understood. The model has been useful in clinical practice with women, men, elderly, pregnancy, and to a lesser group adolescents.

Limited study of the application of the concepts of interactive and critical literacy are a definite weakness to the model. In addition, a there are a lack of tools to measure these specific concepts. Another weakness is the lack of attention to the impact of the health care environment (provider, facilities, etc.) on health literacy or those with low health literacy.

The two previous studies (Porr et al.; 2006Renkert & Nutbeam, 2001) utilized health literacy as a continuum to underpin their studies and the model was an appropriate fit for these populations and topic of inquiry. Gray, Klein, Noyce, Sesselbert & Cantrill (2005) studied internet use of adolescents in relation to health literacy. Functional, interactive and critical

health literacy were studied, but were viewed individually rather than as a continuum. Certainly studying health literacy in an adolescent population with a different medium (internet) is beneficial, but the focus on the individual concepts of health literacy without consideration of their interaction or relationships varies from the intent of the continuum model of health literacy. Mitchell and Begoray (2010) took a different approach in using this model by assessing the level of health literacy with a goal of matching patient health literacy to appropriate resources. While they employed the definitions of the concepts and recognized health literacy as a continuum, their aim was not to improve health literacy but to identify and address the patient at their current level of literacy.

Realizing health literacy encompasses a range of skills and is impacted by social, cultural, and support systems the health care environment needs a means to address the needs of individuals at all levels of health literacy. Addressing only functional health literacy oversimplifies the scope of health literacy. As Nutbeam's (2000) model demonstrates, health literacy is a continuum exceeding mere reading, writing and numeracy skills. Health literacy must address the social and cultural aspects of communication as well as the ability to access and use resources. Additionally, interaction and negotiation skills with providers and by providers must be addressed. While this model of health literacy begins to address these complex issues, limited study in this area has prevented the realization of the aims of the model.

Operational Definitions

1. Maternal health literacy is defined as "the cognitive and social skills that determine the motivation and ability of women to gain access to, understand, and use information in ways that promote and maintain their health and that of their children" (Nutbeam and Renkert, 2001,

pg. 382). Maternal health literacy will be measured using the Newest Vital Sign (NVS). Any score lower than 4 on the NVS will be considered inadequate or low health literacy.

2. Immunization knowledge is defined as understanding of childhood immunization schedules, benefits of immunization, immunization adverse reactions, and management of adverse reactions. Immunization knowledge is measured using 6 questions related to immunization type, reactions, interventions, and follow up. The range of possible scores is 0-12.

3. Vaccine Information Sheets (VIS) are standard immunization sheets aimed to provide vaccine information and possible adverse reactions to patients. These information sheets are written and maintained by the Centers for Disease Control (2012).

4. Teach-Back is a patient teaching method promoting adherence, quality and patient safety by insuring health care providers provide clear patient education information and assessing patient understanding by asking patients to explain or "teach-back" what they understand (Picker Institute, n.d.). The ten elements of competency for Teach-Back will be utilized (Schillinger, 2003). Teach-Back not only assesses patient comprehension of health information, but also provides an opportunity for re-teaching and reassessment of comprehension of health information.

5. Childhood immunization schedule is a standard protocol for timing of administration of all childhood immunizations developed and maintained by the Centers for Disease Control.

6. Services are defined as those social services and/or programs available to qualified mothers and their children. Use of these services will be assessed by self-report of the participants.

CHAPTER 2

LITERATURE REVIEW

A woman's ability to navigate the health care system prenatally and for her children requires numerous skills. The mother is expected to complete multiple health history and insurance forms, manage health care appointments, follow written and oral instructions, and manage medication administration. Women with inadequate health literacy demonstrate difficulty meeting these tasks. Barriers are erected limiting her access to health care and hindering management of her health and the health of her children (Ferguson, 2008). These barriers may be individual characteristics or one or more social determinants of health.

Social Determinants of Health

Social determinants of health (SDOH) are the "structural determinants and conditions into which people are born, grow, live, work and age" (CSDH, 2008). These determinants of health are categorized as economic, environmental, educational, food, context (community and social), and the health care system. Social determinants of health are believed to contribute to 20% of a person's health and well-being and these determinants of health impact a person's ability and/or willingness to engage with the health care system (Schroeder, 2007). Healthy People 2020 (2010) recognizes social determinants of health impact health disparities and realize these social, environmental and economic variables must be considered when addressing the health of individuals, families and communities. Social determinants of health are believed to impact overall health outcomes such as morbidity and mortality, access to health care, self-care management, health status, and cost of health care (Heiman & Artiga, 2015). The social determinants of health considered in this study are household income, education level, living

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arrangement/housing, transportation, and health coverage. In addition, some believe health literacy to be a social determinant of health (CHCS, 2010; Kamble & Boyd).

Health Disparities

Health disparities are differences in the incidence, prevalence, and mortality of a disease and the related adverse health conditions that exist among specific population groups. Disparities affect many populations, including racial and ethnic minorities, residents of rural areas, women, children and adolescents, the elderly, and people with disabilities (CDC, 2010). Healthy People 2020 (HP, 2010) define health disparity as "a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic group; religion; socioeconomic status; gender; age; mental health; cognitive, sensory, or physical disability; sexual orientation or gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion."

Social determinants of health are factors influencing health disparities. When social determinants of health are negatively impacted, the individual and family are at risk for health disparity placing obstacles in the path of those seeking health care and maintenance of health care. The rural women and children in this study are at higher risk for health disparity based on their gender and location.

Women and Health Literacy

Addressing the learning needs of women is important when considering the need to alter patient education methods and improve health outcomes for these women and their families. Consideration of learning needs based on gender are needed and appropriate assessment and

interventions related to patient education as it relates to women is dependent on the understanding of differing learning styles and needs from a gender perspective. Wehrwein, Lujan & diCarolo (2007) found women to be more likely to choose a single method of learning as compared to men. Women were more likely to prefer learning via kinesthetic methods. Personal relevance was also key for learning in the female population studied by Wehrwein et al. (2007).

Patient centered communication is also a critical aspect of learning in low health literate women. Specifically, use of clear communication, evaluating understanding after communication and reassessment and reinforcement of critical learning concepts (Sudore & Schillinger, 2009). It is important to note women with inadequate health literacy are less likely to retain verbal instruction (McCarthy, Waite, Curtis, Engel, Baker & Wolf, 2012). This points to the need for alternatives to traditional, verbal patient teaching such as pictures, video, printed materials, and enhanced verbal communication techniques such as Teach-Back.

Motivation and self-management of care is also important to consider in this population as these characteristics impact the family as a whole. Low health literate women are more likely to employ passive decision-making techniques than the health literate woman. This indicates low health literate women are more likely to depend on someone else, such as the health care provider, to make care decisions rather than embracing self-management of care (Lillie, Brewer, O'Neill, Morrill, Dees, Carey & Rimer, 2007).

Defining Maternal Health Literacy

Health literacy was initially described in the 1970's in the context of health education situated in the public school system (Simonds, 1974). Additional work related to health literacy and its impact on both individual and societal health did not occur until the 1990's. The definitions of health literacy are similar in addressing the ability, capacity, and motivation of

individuals. However, they vary in scope and context. The American Medical Association

(1999) definition is limited in that it only addresses reading and numeracy comprehension in

health care communication. This narrow scope fails to consider populations with limited access

to health care. Ratzan (2001) presents a broader definition of health literacy addressing decision

making skills and allowing for a set of individual capabilities including conceptual knowledge,

speaking and listening skills, writing and reading skills and numeracy.

Measurement of Health Literacy

The literature is replete with measurement tools utilized for the purpose of assessing

health literacy skills and the published tools have been used across a variety of populations in an

attempt to operationalize the concept of health literacy. Davis, Crouch & Long (1991) developed

the first instrument for measuring health literacy over twenty years ago. Since that time multiple

instruments have been developed and tested in various contexts but are limited to either English

or Spanish (Table 2). However, the measurement tools have been found to measure different

aspects of literacy and health literacy. In addition, the measurement tools vary in their ability to

address the multiple components found in the health literacy definitions.

For example, both the Rapid Estimate of Adult Literacy in Medicine (REALM) (Davis et

al., 1991) and the Medical Achievement Reading Test (MART) (Hanson-Divers, 1997) assess

reading level using medical terminology by requiring the individual to read aloud. The Test of

Functional Health Literacy in Adults (TOFHLA) (Parker et al., 1995) is also commonly used in

the assessment of health literacy and expands on the REALM by also assessing numeracy

abilities. However, the TOFHLA requires training for the administrators and demands the

greatest length of time to complete (up to 30 minutes). For this reason the S-TOFHOA (short)

instrument was developed but its value is weakened as it fails to address numeracy skills (Baker,

Willimas, Parker, Gazmararian & Nurss, 1999). The TOFHLA, REALM, and MART are limited in their focus and fail to consider the many mental, developmental, and social skills required to access and successfully navigate the health care environment. They also fail to consider other aspects of health literacy such as oral and on-line communication and media and cultural influences.

The newly developed All Aspects of Health Literacy Scale (AAHLS) is a brief screening tool that attempts to measure literacy beyond the functional level (Chinn & McCarthy, 2013). Nutbeam's (2000) conceptual model for health literacy provides the frame for this instrument as the AAHLS attempts to capture the evolution of individual health literacy skills. However, this instrument has only been tested in one setting with a small sample limiting applicability at this point in time.

The Health Literacy Screening Questionnaire scored satisfactorily when compared with the TOFHLA and is quickly administered. This brief tool consisting of three questions negates the necessity for purchase of a formal instrument (Chew, Bradley & Boyko, 2004). However, this instrument has been employed limited times in the literature. The Newest Vital Sign (NVS) also has the advantage of being quick to administer (2.9 minutes) and is broader in scope as it provides information related to reading, comprehension, abstract reasoning, and numeracy skills (Weiss, 2005).

The NVS provides the broadest look at individual health literacy when compared to the other instruments and has the advantage of being free, easily accessible, and quick to administer. Use of a nutrition label to assess health literacy provides a format familiar to most individuals. While the NVS has been studied in multiple contexts, numerous populations, and with various disease entities, it has not been studied to the extent of the REALM and TOFHLA. This study

will contribute to the diversity of populations with which the instrument has been employed to measure health literacy and will provide an additional context in the public health setting assessing the health literacy of an individual who is making health care decisions about a minor child.

Table 2: *Health Literacy Measurement Tools*

Title/Author	Description	Parametrics
REALM "Rapid Estimate of Adult Literacy in Medicine" Davis et al. (1991)	Reading ability 125 words in 4 columns; Score: reading by grade level	Test-retest reliability=0.98 Content reliability: yes Face reliability: yes Criterion Validity SORT:r=0.95; PIAT-R:r=0.998
REALM Shortened Davis et al., (1993)	Reading ability; 66 words in 3 columns; Score: reading by grade level	Test-retest reliability = 0.99 Content: yes Face: yes Criterion Validity SORT: r=0.96; PIAT-r=0.97; WRAT-R: r=0.88
REALM-R "REALM Revised" Bass, Wilson & Griffity (2003)	Reading ability; 8 words; Score: <6 = poor health literacy	Cronbach's α = 0.91 Criterion Validity WRAT-R: r=0.64
TOFHLA "Test of Functional Health Literacy in Adults" Parker et al. (1995)	50 items, reading comprehension from patient education materials, Medicaid application, standard informed consent; 17 item numerical ability test with prescriptions, blood glucose monitoring, and appointments; Score: <60 = inadequate health literacy	Cronbach's α = .98 Criterion validity REALM: r-0.84; WRAT-R: r=0.74 Content Validity: yes

TOFHLA-S "TOFHLA Spanish" Parker et al. (1995)	Spanish version of TOFHLA	Cronbach's α = 0.98 No criterion Content validity: yes
S-TOFHLA(Short) Baker et al. (1999)	36 item reading comprehension from patient education materials and Medicaid application; Score: <17 = inadequate health literacy	Cronbach's α = 0.97 Criterion validity: REALM: r = 0.81 Content Validity: yes
MART "Medical Achievement Reading Test" Hanson-Divers (1997)	Medical word recognition; 42 health care related words from prescription bottles and patient education materials; Score: by grade level	Cronbach's α = 0.98 Content validity: established Criterion: no
"Health Literacy Screening Questionnaire" Chew, Bradley & Boyko (2004)	3 item tool Rapid health literacy screening	AUROC = 0.87, 0.80, 0.76 respectively with STOFHLA
NVS "Newest Vital Sign" Weiss et al. (2005)	6 questions are verbally asked from a nutrition label; Score: <4 = inadequate health literacy Assesses: reading, comprehension, abstract reasoning, numeracy	Cronbach's α = 0.76 (English) Cronbach's α = 0.69 (Spanish) Criterion validity: TOFHLA: r =0.59 (English) TOFHLA: r =0.49 (Spanish)
AAHLS "All Aspect of Health Literacy Scale" Chinn & McCarthy (2013)	14 item self-report scale	Pilot Study N=146 Cronbach's α = 0.74

Characteristics of Low Health Literacy

The literature over the past 15 years has provided a picture of the low health literate population to assist health care providers in identifying those who may need additional assistance navigating the health care system. Gazmararian et al. (1999) and Baker, Gazmararian, Sudano & Patterson (2000) found a positive relationship between number of years of school attended and higher health literacy scores. They also found race (African American) to have a negative impact on health literacy. These studies also found older age (85 years or older) to have a negative impact on health literacy scores. In another study lower health literacy, specifically comprehension and numeracy, were found in an older adult population (Benson & Forman, 2002).

Health Literacy as a Risk

Numerous studies address the relationship of negative health outcomes and low health literacy skills. Endres et al. (2004) identified the lack of pre-conceptual counseling, an increased rate of unplanned pregnancy, and larger babies in diabetic women with low health literacy. Both Endres et al. (2004) and Shieh, Mays, McDaniel & Yu (2009) documented less pregnancy preparedness or self-care knowledge related to pregnancy in women with low health literacy. Two studies found health literacy in women to have an impact on the health outcomes of their children when women with low literacy were less likely to access available resources for their children (Pati, Mohamad, Cnaan, Kavanagh & Shea 2010) and women with low health literacy had less knowledge about vaccinations for their children (Wilson, 2008). Other negative health outcomes associated with low health literacy skills were incorrect self-administration of prescription medications (O'Callaghan & Quine, 2007) and low treatment-seeking in women with bulemia nervosa (Mond, Hay, Rodgers & Owen, 2008). A study of the elderly in Memphis

and Pittsburgh found the elderly with low health literacy to have a two-fold increase in mortality (Sudore et al., 2006). Kazley, Hund, Simpson, Chavin & Baliga (2015) found low health literate individuals to be less likely to be placed on a kidney transplant list and less likely to receive a kidney transplant. From the viewpoint of positive health outcomes, Yajima, Takano, Nakamura & Watanabe (2001) found those with higher health literacy to be less likely to smoke and more likely to quit smoking, more likely to exercise and more likely to relate nutrition to health.

Financial Impact of Inadequate Health Literacy

Another parameter to address when considering inadequate health literacy is the potential for inappropriate use of health care resources. Individuals with inadequate health literacy are more likely to pay an additional $993 in health care costs as compared to their health literate counterpart (Howard, Gazmararian, & Parker, 2005).   Poor health literacy is estimated to increase health care spending by $32-58 million per year (Friedland as cited in Vernon, Trujilio, Rosenbaum & DeBuono 2007). Those with low health literacy are more likely to take medications incorrectly and are less likely to engage in preventive health measures leading to a later entry into the health care system (Cua & Kripalani, 2008; White, Chen & Atchison, 2008). Late entry for health care increases the use of emergency care and repeated inpatient hospitalizations leading to increased health care costs (Sanderson & Dixon, 2000). Programs focusing on improving patient education and targeted discharge teaching in multiple modalities to address all levels of literacy and understanding have demonstrated as much as a 30% decrease in hospital readmissions directly impacting the cost of delivering health care (Jack et al., 2009). In a large study of U.S. veterans, inadequate health literacy was an independent indicator for higher health care costs with higher utilization of health services and higher pharmacy costs. A

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three-year estimate of health care costs was $143 million greater for those with low health literacy as compared to their counterparts with adequate health literacy (Haun et al., 2015).

Health Literacy and Health Care Providers

Health literacy is impacted by health care provider communication and behavior. Visually impaired women linked provider interactions such as provider assumptions, knowledge and communication skills as an influence in their ability or inability to build health literacy (Harrison et al., 2010). Somali women found communication skills and gender of health care providers were beneficial in promoting health literacy (Carroll et al., d2006). Other health care provider characteristics found to influence health literacy are the capability of the provider related to health care training and experience (Ohnishi, Nakamura & Takano, 2005). Vietnamese women with limited health literacy demonstrated fear of disapproval from health care providers and were influenced by the provider's communication skills, sensitivity, and judgmental/non-judgmental behavior toward the women (O'Callaghan & Quine, 2006). Health care providers were also found to perceive higher health literacy in their low literacy adult patients with HIV (Ohl et al., 2009). While not the purpose of the research many studies discussed the impact of health care provider communication skills on health and health literacy (Endres et al., 2004; Guerra et al., 2005; Needham, Wiemann, Tortolero & Chacko, 2010).

Health Literacy and Access to Health Care and Other Resources

Access to health care services considers the availability of health care resources to maintain or improve health (Gulliford et al., 2002). However, individual ability to gain access to available resources is a different matter. Multiple studies address the impact of health literacy on access and use of health care services, but few studies extend this to maternal health literacy and health resources for children. One of these resources is health insurance coverage, and of the

uninsured children in the United States, more than fifty percent of these children qualify for health insurance (The Kaiser Family Foundation, 2010). The health care environment and the care recipient impacts enrollment in available insurance programs. Navigation of the application process may be a hindrance to enrollment in insurance programs. Applications for the State Child Health Insurance Programs (sCHIP) in both English and Spanish had an average 11th-12th grade reading level hindering access to most of the low health literate population as their average reading level is between the 7th and 8th grade (Wallace, DeVoe & Hanson, 2011). Children of mothers with low health literacy are at greater risk of being uninsured limiting their access to many health care benefits (Yin et al., 2009).

Multiple resources are available to families with children who meet the requisite parameters. These resources include nutrition programs such as Women, Infant, Children (WIC) targeting pregnant women and young children and Supplemental Nutrition Assistance Program (SNAP) targeting certain income and household characteristics. In addition, programs like Temporary Assistance for Needy Families provide temporary financial assistance. Other assistance includes housing subsidies for low-income families and health insurance for children in the form of TennCare and children's health insurance program (CHIP). All of these resources have been found to help offset the impact of poverty and to make health care resources available to families with children (Lee, & Mackey-Bilaver, 2007; McKernan & Ratcliffe, 2006). The aforementioned resources are available in every state, but each resource requires parents make application for the resource(s). Many families never take advantage of the resources or are unable to maintain enrollment in the programs over time (UDHHS, 2013). Application for these resources require parents access multiple sites/locations and to complete several different applications.

Low health literate mothers access the nutrition program for Women, Infants, and Children (WIC), food stamps, and housing assistance at a rate similar to women with adequate health literacy. However, mothers with high health literacy are twice as likely to access Temporary Assistance of Needy Families program (Pati et al., 2010).

Low health literate individuals struggle to negotiate the complex health care system. They are more likely to lack the capacity to access resources, process application requirements, and have difficulty understanding basic health information needed to make decisions related to health care. Low health literate parents are more likely to have difficulty accessing and completing program applications leading to lower enrollment in these social services that could influence their poverty level and improve health outcomes of their children (Yin et al., 2009).

Health literacy was found to affect the willingness/ability to access health care or participate in preventive behaviors. Low health literacy was associated with a decreased frequency of receiving mammography screenings in both a decreased frequency of screening (Guerra et al. 2005) and length of time since last screening (LaHouse, 2010). Endres et al. (2004) found women with low health literacy to be less likely to engage in preventive health behaviors in pregnancy. Low health literacy was also found to negatively affect preventive behavior secondary to difficulties navigating the health care system and poor self-advocacy skills (Shieh & Halstead, 2009).

Maternal Health Literacy and Child Health

Low health literate parents are less likely to have adequate knowledge of their child's health with their children more likely to experience poor health outcomes (DeWalt & Hink, 2007). The studies that follow document the negative impact of low parental health literacy on the health of the children.

Prevention of oral disease is another aspect of child health managed by mothers. Mothers of low health literacy, while demonstrating adequate dental health knowledge, are more likely to have children with a poorer dental health status (Miller, Lee, DeWalt & Vann, 2010).

Maternal health literacy must also be considered when discussing management of chronic illness in children. Mothers with low health literacy are more likely to have children with poorly managed asthma symptoms such as a higher incidence of asthma symptoms, greater use of inhalers for symptom management, less asthma knowledge, higher incidence of school absences related to asthma, greater use of the emergency room and greater likelihood of asthma related hospitalizations (DeWalt, Dilling, Rosenthal & Pignone, 2007). Maternal self-efficacy is also positively related to health literacy and management of asthma in children. The higher the maternal health literacy the greater level of maternal self-efficacy contributing to a more positive health outcome for children with asthma such as fewer missed school days and fewer hospitalizations. (Wood, Price, Dake, Telljohann & Khuder, 2010).

Mental health services are important to family health. Inadequate health literacy is considered a barrier to mental health care for women in the childbearing age group (Feinberg et al., 2006). Low health literacy combined with maternal depression increases the risk of poor child development outcomes (Zaslow, Hair, Dion, Ahluwalia & Sargent, 2001). Normal childhood development is another important aspect of child health and can be adversely impacted by maternal mental illness. Maternal depression negatively affects childhood development, language skills, emotional attachment, and are at their highest during a woman's childbearing years (Epperson, 1999).

Identifying methods to assist mothers in managing the healthcare of their children is important. Technology is increasingly offered to the public as a means of providing health

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information and promoting use of health care services. Gazmararian, Yang, Elon, Graham & Parker (2012) found pregnant women and mothers of all health literacy categories attempted to use technology to manage their health care. However, mothers with limited health literacy are less likely to be successful in their attempts to enroll in programs offering technological access to health information (Gazmararian et al., 2012).

Maternal Health Literacy and Medication Administration

Parents bear the primary responsibility for administering medication to their children. Incorrect medication administration contributes to most of the pediatric adverse medication events (Zandieh et al., 2008). Limited studies consider the impact of maternal health literacy on pediatric medication administration. Low health literate mothers demonstrate less knowledge related to weight based medication dosing than mothers of adequate health literacy resulting in a higher incidence of administering incorrect medication dosages (Wallace, Keenum, DeVoe, Bolon & Hansen, 2012; Yin et al., 2008). Mothers with inadequate health literacy are also more likely to use nonstandard dosing instruments for medication administration increasing the likelihood of dosing error (Yin, Dreyer, Foltin, van Schaick & Mendelsohn, 2007). Of mothers with inadequate health literacy who successfully demonstrate correct medication administration, less than half were able to describe correct medication administration (Wallace et al., 2012). In an attempt to improve health care self-management and decrease medication errors, attention is being given to the readability of health care information and medication labeling. However, types of medication labeling have not been associated with a change in the safety of maternal medication administration. (Wallace, Keenum & DeVoe, 2010).

Maternal Health Literacy and Children's Immunizations

Preventive health care is also an important aspect of child health and is impacted by maternal health literacy. Childhood immunization is a national focus for prevention of disease and children are expected to complete more than twenty immunizations prior to their second birthday. Accessing these immunizations requires the mother manage multiple appointments on a scheduled regimen and to be knowledgeable regarding the potential side effects of immunizations. Mothers with inadequate health literacy are less likely to know names of the immunization their child is receiving and less likely to know the purpose of the immunizations than mother's with adequate health literacy (Baker et al., 2007). Factors impacting maternal adherence to childhood immunization schedules have not been clearly identified. However, maternal health literacy does not affect children receiving immunizations on the standard schedule (Pati et al., 2011).

Financial Impact of Immunizations

The financial consequences of inadequate immunization rates are tremendous when the use of personnel hours and health care dollars are considered. In the 2011 measles outbreak 107 cases of measles were confirmed in 16 separate outbreaks. The estimated use of health care resources for this outbreak was up to 82,000 personnel hours and the cost was estimated between $2.7 and $5.3 million dollars (Ortega-Sanchez, Vijayraghavan, Barskey & Wallace, 2014). A conservative estimate of health care cost expended per case was $10,000-$20,000 with a single case with complications related to this measles outbreak costing over $142,000 (Ortega-Sanchez et al., 2014). In 2011 (Pour & Allensworth) the estimated cost of addressing a pertussis outbreak in a Nebraska school was over $50,000 in addition to the reallocation of manpower that caused

other projects to be neglected. Hospital costs alone for five children with pertussis and the resulting infection of health care providers cost the facility over $97,000 (Yasmin et al., 2013).

Healthy People 2020 (Healthypeople.gov, 2010) estimates immunization according to the CDC recommendations would reduce direct health care costs by $9.9 billion and $33.4 billion in indirect costs worldwide. When comparing the cost of immunization in the U.S with the cost of treatment for disease preventable by immunization the net savings is $295 billion in direct care costs and $1.38 trillion in societal costs (Whitney, Fangjun, Singleton & Schuchat, 2014).

Interventions Addressing Maternal Health Literacy

Maternal health literacy affects many aspects of prenatal, infant, and child health. Measurement tools have been developed to assist in the identification of individuals with inadequate health literacy skills, but this information is of limited use if reliable interventions are not identified and employed to address the needs of women with low health literacy.

The majority of intervention studies addressing maternal health literacy are related to types of health information materials. When exploring different modalities for health education mothers scored higher on nutrition health literacy when using a nutrition website as compared to print media or game based modalities (Silk et al., 2008). Non-traditional health information tools also improve health outcomes in the low health literate population. Use of a plain language pictogram increases the accuracy of pediatric medication administration, increases knowledge of medication dosage frequencies and increases correct medication preparation across all health literacy levels as compared to a group receiving traditional medication administration education (Yin et al., 2008). Graphics-based health education tools also result in higher knowledge scores related to preeclampsia than standard pamphlets across all health literacy levels (You, Wolk, Bailey & Grobman, 2011). Also, health education materials written at a literacy level targeted

toward women with low health literacy is beneficial in improving knowledge (Corraino, Freda & Barbara, 1995; Silk, Horodynski, Rienzo, Mercer & Olson, 2010).

Only 20% of the maternal health literacy studies were related to health literacy interventions, and only three were experimental studies. Additional study is needed to identify and implement strategies to both improve health literacy and to address the needs of those with inadequate health literacy skills. While most providers are aware of health literacy issues and interventions, eighty-one percent of providers deviate from the use of plain language in communicating with patients (Castro, Wilson, Want & Schillinger, 2007) and less than 15% of providers use methods such as teach-back to insure understanding with the low health literate population (Schillinger et al., 2003).

Teach-Back

Teach-Back is an approach implemented by health care providers requesting patients to repeat in their own words what they understand about their diagnosis, treatment, and/or plan of care. The goal of using the teach-back method is to decrease the risk of misunderstanding of health care information in the clinical setting (Abrams et al., 2007). Teach-back has the advantage of being both a means of teaching and means of evaluating patient understanding improving the likelihood of patients leaving the clinical setting with a clearer understanding related to their plan of care. Utilization of the teach-back method in clinical practice provides an opportunity for health care providers to accurately assess patient understanding and identify those needing additional or alternative health education strategies.

Schillinger et al. (2003) describes the teach-back method as a means of "closing the loop" with health care recipients. The health care provider presents the information and assesses patient understanding by asking for patient recall of the information in the patient's own words. If

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correct information is recalled no further action is needed. However, if the recall is incorrect or incomplete the provider clarifies the information and may alter the information into a more understandable format. This instruction is followed by assessing patient recall once again. This process may be repeated several times until the provider is assured the patient has a correct understanding of the information. However, continued re-instruction may require use of additional resources to assist with the teaching-learning process. Teach-back as a means of patient education requires approximately five minutes making it especially appealing for the clinical setting (Kripalani, Bengtzen, Henderson & Jacobson, 2008). Schillinger et al. (2003) found diabetic patients whose physicians used this method of patient education and assessment of understanding had lower Hemoglobin A1C levels than those who did not receive this type of education and assessment.

Several competencies have been identified to assist the provider in implementing the teach-back method in the clinical setting. Providers are to demonstrate comfortable body language and to make frequent eye contact while using a caring tone of voice and attitude. Using open-ended questions and a shame-free tone is also important for best results. Fostering a shame-free environment includes putting the responsibility for clear explanations on the provider and not the patient. Plain language and terminology is also critical to improve patient understanding of the material. If the patient is unable to teach-back correctly, rephrase the information and reassess. Use of easy-to-read print materials with few words and many pictures and diagrams also improves the teaching process. Lastly, documentation of patient response to the teach-back process is important for future evaluation of patient understanding (Teachbacktraining.org, n.d.).

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Chapter 2 Summary

Health care for children is greatly influenced by both the health and health literacy capabilities of the mother. These studies address a broad array of child health topics and the role of maternal influence. However, the studies fall short in that they only address maternal health literacy at the functional or basic level. The implementation strategies in these studies address health literacy at the interactive level creating a mismatch between assessment and implementation. Viewing these studies conceptually sheds light on the need for both health literacy assessment tools and health literacy implementation strategies at all three levels of health literacy.

CHAPTER 3

METHODS

The purpose of this study was to test an intervention to improve the knowledge scores related to childhood immunizations in a population of low health literate mothers in a rural, public health department setting and to determine the impact of maternal health literacy on the knowledge of childhood immunizations and currency to the recommended immunization schedule. This chapter explains the methods employed to conduct this study.

Study Design

This experimental study consists of two groups of mothers in a public health department for the purpose of immunizations for their children. A convenience sample selection of mothers, randomly assigned to groups, received either standard treatment (VIS alone) or the intervention treatment (VIS plus Teach-Back). The independent variables are the type of immunization education received by the mothers (VIS or Teach-Back) and health literacy level. The dependent variables are knowledge of childhood immunizations and immunization currency according to the CDC immunization schedule.

Sampling Plan

The sample consists of 90 mothers in a rural, public health department for immunization of their child (ren). The sample size was derived using Stevens (2002) recommendation that use of multiple regression requires a sample of 15 participants per predictor variable. The predictor variables are teaching method, maternal health literacy, immunization knowledge, education level, maternal age, and number of children.

Participants were recruited from the waiting room of the public health department using two methods. A flyer was posted in the waiting room (Appendix A) providing participation parameters and the researcher approached potential participants in the waiting room requesting participation. Participants agreeing to participate were provided both verbal and written informed consent and an informed consent was signed (Appendix B).

Inclusion Criteria

All participants meeting the following inclusion criteria were eligible for participation in the study:

1.   Participants were mothers with at least one child receiving immunizations.

2.   Participants were English speaking

3.   Participant's child received immunization(s) on the day of participation

The following exclusion criteria disqualified participants from the study:

1.   Immunizations not received the day of the study.

2.   Parent or guardian other than the mother brings the child for immunizations.

Participants received a $10 Wal-mart gift card for participation.

Data Collection Methods and Procedures

Potential participants were recruited in two methods:

1. All mothers visited the public health department for the purpose of
   immunization of a child received a flyer at the check-in station. Once the
   potential participant moved to the waiting room the researcher approached the
   potential participant and inquired as to interest in participation.

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2. Mothers of children receiving other services such as WIC, physical exams, etc. identified as needing immunizations were referred by the nurse.

If the participant indicated interest, the researcher escorted her to the designated clinic room and informed consent was provided. At that point, the participant was assigned to either the control or experimental group. Participants were numbered beginning with the number 101 in order of agreement to participate. All odd numbered participants were assigned to the control group and all even numbered participants were assigned to the intervention group. Health department staff were unaware of the group to which the mothers were assigned.

The health literacy of both groups was assessed using the NVS and all participants received the oral immunization knowledge pre-test of six questions administered by the researcher. In addition, the participants completed the demographic survey. All participants received the standard patient education information from the clinic registered nurses using the VIS during the immunization visit. Once the child's immunizations were completed, they are routinely asked to wait in the waiting room for 15 minutes to insure no immediate adverse reaction to the immunization(s) occur. During this waiting time, the researcher met with the individual participants in the control group in a private clinic room and administered the oral immunization knowledge post-test that required approximately10 minutes. Those participants in the intervention group received education using the Teach-Back. Following the Teach-Back, the researcher left the room for 5 minutes and then returned with information for the mother regarding anticipated guidance for normal growth and development. At this time, the researcher administered the oral knowledge post-test that required approximately 3-5 minutes.

Data collection consisted of a self-report demographic survey (Appendix C) followed by an assessment of health literacy using the Newest Vital Sign (NVS) (Appendix D) administered

by the researcher. All participants received an oral immunization knowledge pre and post-test (Appendix E and F). Both groups received the usual patient education information via the VIS. In addition, the intervention group received patient education information using the Teach-Back. If participants indicated incorrect information related to the immunizations the researcher provided additional teaching to insure the participant left with the appropriate information. Once data collection with the participant was complete, the researcher conducted a brief chart review to ascertain currency with the immunization schedule (Appendix G).

Table 3: *Procedure Summary*

Activity	Location and Participants	Estimated Time
Recruitment	Flyer at front desk Approached by researcher in waiting OR referred by nurse	2 minutes
Informed Consent Assigned to intervention or control group	Private clinic room: Participant and researcher	5 minutes
NVS Health Literacy Test	Private clinic room: Participant and researcher	3 minutes
Immunization Knowledge Survey: Pre-test	Private clinic room: Participant and researcher	5 minutes
Demographic Survey	Private clinic room: Participant and researcher	5 minutes
Immunization visit and Patient Education with VIS	Private clinic room: Participant and Registered Nurse	Unknown

Immunization Knowledge Survey: Post-test Control group only	Private clinic room: Participant and researcher	5 minutes
Teach-Back Patient Education & Immunization Knowledge Survey: Post-test Intervention group only	Private clinic room: Participant and researcher	5 minutes
Chart review of child's record for all participants	Nurses station: Researcher	3 minutes

A thirty-minute information session was provided for all registered nurses working the immunization clinics prior to the initiation of data collection. The purpose of the session was to apprise the nurses of the general purpose of the study and to answer all questions. They were asked to continue with their usual method of immunization administration and patient education. The researcher stressed the purpose of the study was to assess the most effective method of patient education and that the nurses teaching effectiveness would not be assessed.

Human Participants and Ethics

IRB approval was obtained from both the researchers' university and the Tennessee Department of Health. Informed consent was provided and a signed consent form was obtained from each participant and her confidentiality assured. Each participant was also given a copy of the informed consent. All instruments were coded with the assigned participant number to prevent identification of individuals. All survey results were kept under double lock until the study was completed and were then stored in a locked cabinet for five years.

The brief chart review was for the sole purpose of accessing the immunization record located at the front of the child health section of the public health record. The researcher

maintained a form with the coded number such as 101, 102, 103, etc. and the corresponding

chart number on an encrypted portable storage device. At the end of each data collection week

the researcher used an encrypted computer to send the encrypted file via encrypted email to the

chair of the research committee. The researcher destroyed the information on the encrypted

portable storage device after emailing the secured information. No names or other identifying

data was on this record.

If a participant in the control group had incorrect immunization information as assessed

by the knowledge post-test the researcher provided appropriate education to the participant

before she left the clinic. Incentives, in the form of $10 Wal-Mart gift cards, were offered to each

participant prior to their leaving the clinic.

Instrumentation

Instruments for this study include a health literacy-screening tool, an immunization

knowledge survey (pre and post-test), a chart review, a demographic survey, and two patient

teaching methods. All instruments were introduced and administered by the researcher (Table

4).

Newest Vital Sign

The Newest Vital Sign (NVS) is the health literacy screening tool utilized. The NVS is a

well-validated instrument used to measure word, numeracy, and document literacy (Weiss et al.,

2005). The NVS can be downloaded from the internet and is a free instrument. This instrument

consists of an ice cream nutrition label given to the participant and six questions asked by the

researcher related to the nutrition label. Participants are instructed to take as much time as

necessary, but the usual time for administration is 3 minutes. Participants are categorized into

one of three categories: high likelihood of limited health literacy, possible limited health literacy, and adequate health literacy. Scoring for this instrument is located in Appendix D. A score of less than four is considered low or inadequate health literacy.

The NVS requires the participant to remember numbers and do basic mathematical calculations, identify potentially harmful ingredients, and make decisions about the information presented to them. This information is similar to many health care actions and decisions families make on a daily basis as they take medications, monitor diet, and manage preparations for health care procedures.

The NVS demonstrated reliability with a Cronbach α 0.76 and highly correlated with the longer Test of Functional Literacy in Adults (TOFHLA). The NVS also indicates good sensitivity (72%) and specificity (87%) in determining health literacy with a ROC of 0.88 (Weiss et al., 2005).

Table 4: *Instruments*

Instrument	Administration
Newest Vital Sign (NVS)	All participants, administered by researcher
Immunization Knowledge Survey (IKS)	All participants, administered by researcher Pre- and Post-test
Demographic Survey	All participants, administered by researcher
Chart Review	All participant children records reviewed by researcher
VIS Patient Education	All participants standard teaching presented by clinic Registered Nurse
Teach-Back Patient Education	Intervention group participants, administered by researcher

Immunization Knowledge Survey (IKS)

An Immunization Knowledge Survey (IKS) was developed by the researcher and consists of six questions. The survey was developed utilizing the content from the CDC Vaccination Information Sheets and includes maternal knowledge of immunization schedules, names and purpose of immunizations, common adverse reactions and emergency reactions, and management of adverse reactions. Specific questions can be found in Appendix D and E. The survey was administered orally by the researcher as both a pre and post-test. Scoring was done as "correct" (2 points), "partially correct" (1 point), and "incorrect" (0 points) with possible scores overall scores ranging from 0-12.

Content face validity was conducted with three immunization experts. The immunization experts reviewed the survey and were all Registered Nurses who routinely administer or monitor immunizations to the pediatric population and routinely provide patient education based on the CDC Vaccination Immunization Sheets. All three experts confirmed the IKS covered all pertinent aspects of immunization education parents need to care for their children.

Demographic Survey

A demographic survey (Appendix C) developed by the researcher was administered to obtain pertinent individual characteristic and social determinants of health information to assist in describing the sample. This information consisted of maternal and child age, maternal education, housing and household income, prenatal information, utilization of social services, health insurance coverage, health care provider information, and number and ages of children.

Chart Review: Immunization Currency

The chart review was completed to attain one item: currency with the immunization schedule. This information was obtained from the one page, immunization record found at the beginning of the "child health" section of the health record. The researcher compared the documented age of the child at immunization administration to the CDC Recommended Immunization Schedule (Appendix G and H). Currency with the immunization schedule was scored as "yes" or "no". The chart review form may be found in Appendix F.

Patient Education

Two methods of patient education was compared in this study, Vaccination Information Sheets (VIS) and the Teach-Back. The VIS are developed, updated, and maintained by the Centers for Disease Control and are available on-line. The public health department provides every patient/parent with a VIS every time a vaccination is administered. The VIS provides the name(s) of the immunizations, their purpose(s), possible adverse reactions, common interventions to alleviate adverse reactions, and when to seek medical assistance. Participants in both groups received the VIS from the nurse to take home.

The Teach-Back is a method of patient education that allows for evaluation of patient comprehension of the health teaching. This method also allows for re-teaching when incorrect information is identified. The researcher provided oral immunization information using plain language in 3-5 main points; name and purpose of the immunization, common adverse reactions, management of adverse reactions, when to seek medical assistance and the timing of the next scheduled immunization. Consistent with the Teach-Back method the participant will be asked; "Please tell me what you understand about the immunizations your child received today". If any information provided by the participant is incorrect the researcher will clarify and reassess.

The demographic variables were described using frequencies and percentages. The variables were classified as either social determinants of health variables or individual characteristic variables. Pearson product-moment correlation or the Spearman Rho was utilized to assess relationship between variables.

Limitations and Challenges

This study was limited by the inclusion of only English speaking patients in the public health setting, thus limiting the diversity of the sample. Another limitation was the inclusion of participants from only one site, a public health department. An extraneous variable to consider is the impact of the pre-test for immunization knowledge on the number and types of questions the mother may ask the registered nurse during the immunization visit. However, this study uses both a control and experimental group with both groups receiving the same pre-test and post-test. Both groups have the same opportunity to ask questions of the nurses related to immunizations. In addition, the researcher evaluated the effectiveness of the randomization process by reviewing the pre-test scores on all participants in both groups.

CHAPTER 4

ANALYSIS

In a population of low health literate mothers in a rural, public health department setting the purpose of this study was to determine:

1. The impact of maternal health literacy on knowledge of childhood immunizations

2. Currency with the recommended immunization schedule

3. Test an intervention to improve mothers' knowledge related to childhood immunizations

The aims of the study were:

1. Compare two patient education methods for mothers with inadequate health literacy

    i. Research Question 2: What is the effectiveness of the Teach-Back method of patient education versus the traditional VIS patient education in improving immunization knowledge in mothers seeking immunizations for their children?

    [H2] Use of Teach-Back method of patient education will be associated with higher immunization knowledge scores than the standard VIS method in mothers with low health literacy.

2. Add to the body of literature related to maternal health literacy and patient education materials specific to childhood immunizations

i. Research Question 1: What is the level of maternal health literacy as assessed by the Newest Vital Sign (NVS) in mothers of children receiving immunizations in a public health department?

ii. Research Question 7: What factors predict the use of services in qualified mothers/children?

b. Describe maternal health literacy, currency with the immunization schedule, and maternal knowledge related to childhood immunization.

i. Research Question 5: What factors predict currency with the recommended immunization schedule?

ii. Research Question 4: What is the level of knowledge as measured by the Immunization Knowledge Questionnaire?

c. Analyze relationships among maternal health literacy, knowledge of childhood immunization, and methods of patient education.

i. Research Question 6: What factors predict maternal immunization knowledge?

[H1] What is the relationship between maternal health literacy and currency with recommended childhood immunization schedule in a population of mothers in a public health department setting?

The study took place in the summer of 2016 in a rural Middle Tennessee county. Ninety participants took part in this study.

Data Analysis Overview

Data analysis was conducted using Statistical Package for the Social Science (SPSS) Window version 23.0. After data cleaning preliminary data analysis was conducted to describe the sample. This analysis included demographic information, health literacy scores, and immunization knowledge. Further analysis was completed to answer the research questions. Table 5 provides relevant information related to statistical analysis by research question and variable.

Table 5: *Data Management and Analysis*

Research Question	Independent Variable	Dependent Variable	Statistical Tests
1. What is the level of maternal health literacy as assessed by the Newest Vital Signs in mothers of children receiving immunizations in a public health department?			Descriptive Statistics (Non-Parametric)
2. What is the effectiveness of the Teach-Back method of patient education versus the traditional VIS patient education in improving immunization knowledge in mothers seeking immunizations for their children?	Patient Education Method	Immunization Knowledge	Descriptive Statistics (Non-Parametric) t-test (Parametric)
3. What is the relationship between maternal health literacy and currency with recommended	Maternal Health Literacy	Immunization Currency	Point-biserial Correlation (Parametric)

childhood immunization schedule in a population of mothers in a public health department setting?			
4. What is the level of knowledge as measured by the Immunization Knowledge Questionnaire?			Descriptive Statistics (Non-Parametric)
5. What variables predict currency with the recommended immunization schedule (transportation, maternal age, education level, number of children, Immunization Knowledge Scores)?	Transportation Maternal Age Education Level Number of children Immunization Knowledge	Immunization Currency	Logistic Regression (Parametric)
6. What variables predict maternal immunization knowledge (health literacy, educational level, number of children, maternal age)?	Health Literacy Education Level Number of Children Maternal age	Immunization Knowledge	Descriptive Statistics (Non-Parametric) Multiple Regression (Parametric)
7. What variables predict the use of services in qualified mothers/children	Health Literacy Education Number of Children Maternal Age	Use of services	Descriptive Statistics (Non-Parametric) Multiple Regression (Parametric)

Sample Demographics

The research study included 90 mothers whose children received one or more immunizations the day of the clinic visit. All mothers were age 18 or older, English speaking and volunteered to participate in the study. Approximately 57% of the participants were 30 years of age or older with an age range of 18 to over 30 (Table 6). One third of the participants completed a high school education (35.6%), approximately 9% obtained a GED and 11% completed a college degree.

Table 6: *Maternal Age*

Age	Frequency	Percent
18	1	1.1
19-21	9	10
22-25	8	8.9
26-30	21	23.3
Over 30	51	56.7

N=90

Prenatal information related to the participant's child was collected in the demographic survey. All 90 (100%) mothers received prenatal care during their pregnancy and 73% initiated prenatal care during the first trimester. Twenty-seven percent were late to prenatal care and initiated care in either the second (21%) or third (6%) trimester. In addition, 83% of the pregnancies resulted in a full term delivery. The remaining 17% of children were delivered prematurely ranging from 34-37.5 weeks gestational age.

Transportation and housing information can be found in Table 7. Transportation was assessed as independent (drove personal car) or dependent (depending on someone else to provide transportation). The majority of the participants (84%) indicated having independent transportation. All of the participants reported having a place of residence with 80% indicating they had their own residence (27% owned home and 53% renting) an 20% lived with someone else.

Table 7: *Transportation and Housing*

Transportation	Frequency	Percent
Independent	76	84.4
Dependent	14	15.6
Housing		
Own home	24	26.7
Rent	48	53.3
Live with others	18	20

Note. N=90

Over half (54.4%) of the participants reported an annual household income of less than $20,000 and 75% of the participants reported an annual household income less than $30,000. Less than half the participants (45.6%) were married and the average number of household members was 4.6 and the mean number of children per participant was 3.1 ranging from 1-8. Household income information was summarized in Table 8.

Table 8: *Household Income*

HH Income	Frequency	Percent
<$10,000	25	27.8
$10,000-19,999	24	26.7
$20,000-29,999	18	20
$30,000-39,999	6	6.7
$40,000-49,999	6	6.7
$50,000-74,999	5	5.6
$75.000-100,000	5	5.6
>$100,000	1	1.1

Note. N=90

The majority of participants reported having personal health insurance (81.1%), however only 63.4% of their children were covered by health insurance. Approximately two thirds of the participants (59%) reported a regular health care provider for their children.

Relationship among Variables

Variables were categorized as either individual characteristic (IC) variables or social determinants of health (SDOH) variables. Statistical analysis was completed to assess relationships between these variables (IC and SDOH) and three dependent variables (maternal health literacy, immunization knowledge, and immunization currency). The Pearson product-moment correlation was used to assess these relationships when both variables were continuous or the dependent variable was continuous and the intervention variable dichotomous. The

Spearman Rho was utilized when the above restrictions were not met. Table 9 outlines the IC and SDOH variables.

Table 9: *IC and SDOH Variables*

Individual Characteristic	Social Determinants of Health
Maternal Age	Household Income
Child Age	Education Level
Birth Weight	Living Arrangement
Prenatal Visit	Transportation
Gestational Age	Health Insurance Coverage
Relationship Status	
Number of Children	
Use of Social Services	
Pediatric/Primary Care Providers	

Maternal Health Literacy

A significant relationship was found between one IC variable and three SDOH variables and maternal health literacy (NVS). The Spearman Rho was employed to assess the relationship between the continuous variable health literacy (NVS) and the categorical SDOH variables household income, education level and living arrangements. A weak, positive relationship was found between health literacy and household income r=.277, p= .008 and a medium relationship between health literacy and education level r=.419, p < .005. In addition, a weak relationship

was demonstrated between health literacy and living arrangements (Table 10). A Pearson R found a medium, positive relationship between the continuous variables health literacy and the IC variable age of the child r=.299, p = .004 (Table 10).

Table 10: *NVS and SDOH Variables*

Spearman's Rho	r	Sig. (2-tailed)
NVS	1.00	
HH Income	.277	.008
Education Level	.419	.000
Living Arr.	-.252	.016
	.299	.004
Child Age (IC)		

p<.05, N=90 (IC) indicates individual characteristics

Immunization Currency

Significant relationships were found between immunization currency and two IC variables (age and number of children) and one SDOH variable (living arrangements). The Spearman Rho found a weak, negative relationship between the dichotomous variable immunization currency and the categorical variable living arrangements, r=-.208, p = .05 (Table 11). The Spearman Rho demonstrated a medium, positive relationship between the dichotomous variable of immunization currency and the continuous variable of the child's age r=.303, p = .004. A weak, negative relationship was demonstrated between the dichotomous variable immunization currency and the continuous variable number of children r=-.299, p < .005 (Table 11).

Table 11: *Immunization Currency with SDOH and IC Variables*

Spearman's Rho	r	Sig. (2-tailed)
I. Currency	1.00	
# Children (IC)	.299	.005
Child's Age (IC)	-.303	.004
Living Arr.	-.208	.05

p<.05, N=90 (IC) indicates individual characteristics

Immunization Knowledge

Significant relationships were found between the continuous variable immunization knowledge, the IC categorical variable maternal age, and the continuous variable the age of the child. Spearman's Rho demonstrated a positive, weak relationship between knowledge and maternal age r= .264, p < .05, and Pearson correlation demonstrated a medium, positive relationship between knowledge and the age of the child r=.34, p = .001. The Spearman's Rho was utilized to assess the relationship between the continuous variable immunization knowledge and the three categorical, SDOH variables education level, household income and living arrangements. A medium, positive relationship was found between knowledge and education level (r=.335, p = .001) and knowledge and household income (r=.381, p<.005). A negative, medium relationship was demonstrated between knowledge and living arrangements, r=.355, p<.005 (Table 12).

Table 12: Immunization Knowledge with IC and SDOH Variables

	Immunization Knowledge	Child age (IC)
Pearson Correlation	1.00	.34
Sig. (2-tailed)		.001

Spearman's Rho	r	Sig. (2-tailed)
Knowledge	1.00	
HH Income	.381	.000
Education Level	.335	.001
Living Arr.	-.355	.000
	.264	.012
Maternal Age(IC)		

p<.05, N=90

Immunization Knowledge Survey

The Immunization Knowledge Survey (IKS) consists of six questions with possible scores ranging from 0-12. Each item on the survey is scored as incorrect (0 points), partially correct (1 point) and correct (2 points). The researcher categorized the Immunization Knowledge Survey into three categories to clearly identify specific areas of knowledge. Table 13 provides the questionnaire categories.

Table 13: *Immunization Knowledge Survey: Categories*

Q#	Question	Category
1	What are the vaccines your child is receiving/ or received today?	General Knowledge
2	What are the benefits of each vaccine?	General Knowledge
3	What are the risks of receiving the vaccine?	General Knowledge
4	When should you seek additional medical attention?	Safety
5	How will you treat fever?	Safety
6	When is the next immunization date?	Follow-up

The participants scored higher on the pre-test on the safety questions related to seeking medical attention (Q#4) with 57.8% answering correctly and 73.3% answered correctly on the safety question relating to treating fever (Q#5) with means of 1.7556 and 1.8556 respectively. The greatest gain in knowledge was found in the follow-up question (Q#6) with a mean gain of 1.3034. See Tables 14 & 15 for detailed information.

Table 14: *Immunization Knowledge Survey: Descriptive Statistics per Survey Item*

Q#	Question	Pre-T(mean)	Post-T(mean)	Gain(mean)
1	General Knowledge	.8778	1.5111	.6333
2	General Knowledge	.7000	1.1333	.4333
3	General Knowledge	.8667	1.3333	.4667
4	Safety	1.5333	1.7556	.2222
5	Safety	1.7000	1.8556	.1461
6	Follow-up	.2889	1.6000	1.3034

Table 15: *Frequency & Percentages: Immunization Knowledge Survey Pre and Post-Test*

Q#	Category	Pre-T %Correct (Frequency)	Post-T %Correct (Frequency)
1	General Knowledge	31.1% (28)	55.6% (50)
2	General Knowledge	14.4% (13)	30% (27)
3	General Knowledge	8.9% (8)	42.2% (38)

4	Safety	57.8%	77.8%
		(52)	(70)
5	Safety	73.3%	85.6%
		(66)	(77)
6	Follow-up	8.9%	70%
		(8)	(63)

The means for knowledge gain were assessed for both the control and intervention group. The mean knowledge gain scores were higher in the intervention group than the control group with the exception of question 1, which addresses the specific immunizations that were given in the clinic visit. A comparison of means on the specific items on the continuous independent variable (Immunization Knowledge Survey) and the categorical, dependent variables (control and intervention group) was evaluated using the independent samples t-test. A significant difference was found in the mean knowledge gain scores between the control and intervention group for 5 of the 6 survey items with a $P=<.05$. No significant difference was found between the groups for question 1 of the survey with a t-score of .163 and sig. .871 ($P<.05$). (Table 16)

Table 16: *Immunization Knowledge Gain Between Groups by Survey Item*

	Levene's Test		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Q#1	.018	.894	.163	88	.871	.02222	.13649

Q#2	14.491	.0000	-3.828	78.188	-.42222	.11030
Q#3	3.307	.072	-3.574	88	-.40000	.11192
Q#4	32.135	.000	-2.971	81.065	-.26667	.08977
Q#5	30.970	.000	-2.524	60.383	-.19889	.07885
Q#6	2.2222	.014	-3.388	87	-.55505	.16384

Note. P=.05

Analysis by Research Question

Research Question 1

What is the level of maternal health literacy as assessed by the Newest Vital Sign (NVS) in mothers of children receiving immunizations in a public health department? The health literacy of each participant was assessed using the NVS. This instrument consists of six questions relating to an ice cream box food label. The responses were scored as correct or incorrect for each item with a possible score of zero to six. A score of less than four indicates inadequate health literacy. The mean NVS score was 2.74 with 84% scoring less than four indicating inadequate health literacy (Table 17).

Table 17: *Health Literacy (NVS)*

N	Mean	Std. Deviation	Minimum	Maximum
90	2.744	1.186	1	6

A comparison of the means on the continuous independent variable (NVS) and the categorical, dependent variables (control and intervention group) was evaluated using the

independent samples t-test. The assumption of equal variance was not violated as reflected by a Levene test of .844. As shown in Table 18, no significant difference was found in the mean scores of the NVS between the control and the intervention group with a t-score of .798 and sig. .427 (p < .05).

Table 18: Comparison of Group Means: NVS

	Levene's Test		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
NVS	.039	.844	.798	88	.427	.20000	.25048

Note. p=.05 N=90

A one-way between-groups ANOVA with post hoc analysis was completed to evaluate the impact of age on health literacy as measured by the NVS (Table 19). Only one participant was found in the age group "18" and that case was collapsed into the 19-21 age group. Groups were divided as follows 1: Age 19-21, 2: Age 22-25, 3: Age 26-30 and 4: Age over 30. Levene statistic was .362 indicating no violation of the assumption of homogeneity of variance. However, the ANOVA between and within groups was not significant at p < .05 (.377).

Table 19: *ANOVA: Maternal Age and Health Literacy*

	SS	Df	MS	F	Sig.
Between Groups	4.399	3	1.466	.925	.432
Within Groups	120.723	86	1.404		
Total	125.122	89			

N=90

A one-way between-groups ANOVA with post-hoc analysis was conducted to explore the impact of education level on health literacy as measured by the NVS (Table 20). The category "Education" was collapsed into three categories: less than high school graduate, high school graduate and college attendance/college graduation. The researcher was interested in finding the impact of a higher education level on health literacy. There was a statistically significant difference at the p<.05 for the three educational levels (F=5.816, p=.004) with a .076 effect size. The Tukey post-hoc analysis indicated the high school graduates mean score was significantly different than the other two groups (p< .03).

Table 20: *ANOVA: Maternal Education and Health Education*

	SS	Df	MS	F	Sig.
Between Groups	14.756	2	7.378	5.816	.004
Within Groups	110.366	87			
Total	125.122	89			

N=90 p < .05

Multiple regression analysis was conducted to assess the predictive value of the IC and SDOH independent variables as displayed in Table 10 on the dependent variable health literacy. The assumption of linearity is met as less than 3 cases fell outside the analysis of residuals. Assumptions for multicollinearity were not violated as the Tolerance scores were .558 or greater and the VIF scores were low (all less than 2). Outliers were assessed by using Mahalanobis distances. The critical value for this model was 18.47 and the maximum Mahalanobis distance was 13.687 indicating no issue with outliers. The Model Summary indicates 25.7% (R^2=.257) health literacy can be explained by the aforementioned predictor variables with a p<.001. Both

household income and education level moderately correlate with health literacy with r=.319 and

r=.427. respectively (p < .001). Education level makes the strongest unique contribution in

describing variance in health literacy (B=.372, p < .001). Age of child, income, and living

arrangements did not significantly contribute to variance in health literacy (Table 21).

Table 21: *Multiple Regression: NVS and IC and SDOH Variables*

Predictor	B	r	Sig.	95% Confidence Intervals
Education	.372	.427	.000	.093, .318
Age of Child(IC)	.199	.299	.068	-.004, .099
HH Income	.033	.319	.792	-.139, .182
Liv. Arr.	.097	-.285	.424	-.586, .249

Note. p<.001

Research Question 2

What is the effectiveness of the Teach-Back method of patient education versus the

traditional VIS patient education in improving immunization knowledge in mothers seeking

immunizations for their children? All participants were randomly assigned to either the control

(N=45) or the intervention group (N=45). The control group received the usual patient education

provided by a registered nurse using the CDC Vaccination Immunization Sheets (VIS). The

intervention group received the CDC VIS patient education by a registered nurse plus the Teach-

Back method by the researcher. Immunization knowledge was assessed pre and post education in

both groups using the Immunization Knowledge Survey consisting of six questions scored as

correct, partially correct or incorrect. Each item had a possible score of 0-2 and a possible total

score of 0-12.

A t-test for two independent samples was used to determine the significance of the difference in the mean knowledge gain scores. The categorical independent variable was the teaching method and the continuous dependent variable was knowledge gain. The intervention group who received the Teach-Back method of education demonstrated higher knowledge gain scores (M=3.98, SE=.22) than the control group who received only the standard teaching using the VIS education materials (M=2.33, SE=.16). While both groups improved their knowledge scores on the post-test, the differences in knowledge gain were significant with t=-6.077, p<.05 with a large effect size r=.85 (Tables 22 and 23). The Levene's test (F=3.633, Sig. .060) indicates equality of variances between the groups.

Table 22: *Immunization Knowledge Gain*

1=Control 2=Intervention	N	Mean	Std. Deviation	Std. Error Mean
1.00	45	2.333	1.066	.1589
2.00	45	3.978	1.469	.2190

Table 23: *Immunization Knowledge Gain Between Groups*

	Levene's Test		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
K Gain	3.633	.060	-6.077	88	.000	-1.6444	.27059

Note. P=.05

Research Question 3

What is the relationship between maternal health literacy and currency with recommended childhood immunization schedule in a population of mothers in a public health department setting? Health literacy was evaluated for all participants using the NVS and the children were identified as current or non-current based on the CDC immunization schedule. The Point-biserial correlation coefficient was used to assess the relationship between the continuous, independent variable maternal health literacy (NVS) and the dichotomous, dependent variable immunization currency. A positive, moderately weak correlation exists between health literacy and immunization currency (r=.25, n=90, p=<.05) as reported in Table 24. The coefficient of determination (r^2=.065) indicates only 6.5% of the variance between the two variables is shared. Therefore, health literacy helps explain 6.5% of the variance in the immunization currency.

Table 24: *Correlation: Health Literacy and Immunization Currency*

	NVS	I. Currency
Pearson Correlation	1.00	.255
Sig. (2-tailed)		.015
N		90

Note. p<.05

Research Question 4

What is the level of knowledge as measured by the Immunization Knowledge Questionnaire? The participants completed an oral immunization knowledge pre and post-test

consisting of six questions. The pre-test was administered prior to the immunization administration and the post-test was administered after the administration of the immunization(s) and after the patient education was completed. The post-test was administered to 45 of the participants after the patient education using the VIS and to 45 participants after the VIS and Teach-Back.

The mean pre-test score for all participants (N=90) was 5.98 with similar means between the groups (Group 1, M=6.0, N=45; Group 2, M=5.96, N=45) as displayed in Table 25.

Table 25: *Immunization Knowledge Survey*

	N	Mean	SE	Minimum	Maximum	Std.Deviation
Pre-Test	90	5.978	.229	0	11	2.177
Pre-Test Group 1	45	6				2.143
Pre-Test Group 2	45	5.956				2.236
Post-Test	90	9.144	.215	3	12	2.037
Post-Test Group 1	45	8.33				2.089
Post-Test Group 2	45	9.956				1.637

A comparison of the means on the continuous independent variable (Immunization Knowledge Pre-test) and the categorical, dependent variables (control and intervention group)

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was evaluated using the independent samples t-test. The assumption of equal variance was not violated as reflected by a Levene test of .740. As shown in Table 26, no significant difference was found in the mean scores of the IKS Pre-test between the control and the intervention group with a t-score of .096 and p=.924.

Table 26: *Comparison of Group Means: IKS Pre-test*

	Levene's Test		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
NVS	.111	.740	.096	88	.924	.04444	.46161

Note. p=.05 N=90

Research Question 5

What variables predict currency with the recommended immunization schedule? A logistic regression model was conducted to explore the predictive value of the independent variables (transportation, maternal age, education level, number of children, immunization knowledge) on the dependent variable immunization currency. The odds ratios indicated a lack of significant predictive value of any of the independent variables (Table 27).

Table 27: *Logistical Regression: Immunization Currency with IC and SDOH Variables & Immunization Knowledge*

Predictor	B	S.E.	Wald X^2	Df	Sig.	Odds Ratio
Constant	0.549	1.269	.187	1	.665	.577
Trans.	-.167	.658	.065	1	.799	.846

M. Age	.099	.224	.195	1	.659	1.104
Ed. <12			4.275	6	.640	
Ed. HS G	.007	.718	.000	1	.992	1.007
Ed. GED	.168	.977	.030	1	.863	1.183
Ed. VT	-.595	1.341	.197	1	.657	.552
Ed. VT G	.925	1.1385	.446	1	.504	2.522
Ed. < Coll	.096	.766	.016	1	.900	1.101
Ed. Coll G	1.637	1.036	2.497	1	.114	5.141
No. Child	-.216	.161	1.802	1	.179	.806
K. Gain	.132	.149	.783	1	3.76	1.141

Test			X^2	Df	p	
Goodness of Fit Test						
Hosmer & Limeshow			8.639	8	.374	

Additional analysis was needed to assess the predictive value of three variables

demonstrating a significant relationship with immunization currency as displayed in Table 11.

A logistic regression was performed to assess the impact of these variables on immunization

currency. The model contained three independent variables (age of child, number of children and

living arrangements). The model containing all of the predictors was statistically significant

$x^2(4, N=90) = 13.63$, $p < .05$. indicating the model was able to distinguish between those

reporting and not reporting currency with immunizations. The model explained 14% (Cox and

Snell R square) and 18.8% (Nagelkerke R squared) of the variance in currency of immunizations and correctly classified 64.4% of the cases. Only two of the independent variables made a unique, statistically significant contribution to the model (age of child and number of children). This can be viewed in Table 28. The strongest predictor of immunization currency was age of the child with an odds ratio of 1.15. The odds ratio indicates the older the child the more likely they were to have immunization currency. The odds ratio of .72 for number of children was less than one, indicating that for every additional child the participants were .72 times less likely to report immunization currency.

Table 28: *Logistical Regression: Immunization Currency, IC and SDOH Variables*

Predictor	B	S.E.	Wald X^2	Df	Sig.	Odds Ratio
# Children	-.334	.170	3.879	1	.049	.716
Child Age	.138	.054	6.549	1	.010	1.148
Home			.344	2	.842	
Home(1)	-.321	.561	.326	1	.568	.726
Home(2)	-.170	.773	.048	1	.826	.844
Constant	.122	.723	.029	1	.866	1.130
Test			X^2	Df	p	
Goodness of Fit Test						
Hosmer & Limeshow			7.198	8	.515	

Research Question 6

What variables predict maternal immunization knowledge?   The predictive value of the independent variables health literacy, maternal educational level, number of children and maternal age on the dependent variable immunization knowledge was assessed using multiple regression. Descriptive statistics for all variables is provided in Table 29. The assumption of linearity is met as only three cases fell outside the analysis of residuals, which indicates 96.67% standard residual. Assumptions for multicollinearity were not violated as the Tolerance scores were .77 or greater and the VIF scores were low (all less than 2). Outliers were assessed by using Mahalanobis distances. The critical value for this model was 18.47 and the maximum Mahalanobis distance was 12.230 indicating no issue with outliers. The Model Summary indicates 18.6% (R^2=.186) maternal immunization knowledge can be explained by the aforementioned predictor variables with a p<.001. Both health literacy (NVS) and education level moderately correlate with maternal immunization knowledge with r=.346 and r=.326 respectively (p < .001). NVS makes the strongest unique contribution in describing variance in immunization knowledge (B=.447, p=.027). Number of children and maternal age did not significantly contribute to variance in immunization knowledge (Table 30).

Table 29: *Descriptive Statistics*

	Mean	Std. Deviation	N
Knowledge (Pre-T)	5.9778	2.1774	90
NVS	2.7444	1.1857	90
Education	5.6333	2.1435	90
# Children	3.0778	1.5595	90

Maternal Age	4.2444	1.0527	90	

Table 30: *Multiple Regression: Immunization Knowledge with IC and SDOH Variables*

Predictor	B	r	Sig.	95% Confidence Intervals
NVS	.447	.346	.027	.051, .844
Education	.176	.326	.124	-.049, .401
# Children	-.055	-.056	.689	-.328, .218
Maternal Age	.353	.252	.098	-.067, .773

Note. p<.05

Research Question 7

What factors predict the use of services in qualified mothers/children? The services

considered for these participants were Supplemental Nutrition Assistance Program (SNAP),

Temporary Assistance for Needy Families (TANF), and Women, Infants and Children (WIC).

Each participant self-reported her use of these programs on the demographic survey. Federal

poverty level information was used to determine eligibility for the SNAP, TANF, and WIC

programs.   Seventy-one percent of the participants (N=64) were eligible for one or more of the

aforementioned services. Of the eligible group 56% participated in the services. The descriptive

statistics are displayed in Table 31.

A logistic regression analysis was used to evaluate the variables predicting the use of the

above services (Table 32). The predictor variables NVS, education, number of children and

maternal age were analyzed for their predictive value on the use of services (dependent variable).

The Hosmer and Limeshow Test for Goodness of Fit indicates a good fit with $X^2(4,$

N=64)=4.842. p>.05 (.774). This indicates the model was able to distinguish between participants who reported and did not report use of services. The model explained between 13.8% and 18.5% of variance in use of services. The model correctly classified 71.9% of the cases. As indicated in Table 32 only 1 of the variables made a unique statistically significant contribution to the model (number of children). The odds ratio for number of children was 1.711. This indicates participants with greater number of children had 1.711 times the likelihood to access social services than those participants with fewer children.

Table 31: *Descriptive Statistics*

	Mean	Std. Deviation	N
NVS	2.7444	1.1857	
Education	5.6333	2.1435	90
# Children	3.0778	1.5595	90
Maternal Age	4.2444	1.0527	90

Table 32: *Logistic Regression: Use of Services with IC and SDOH Variables*

Predictor	B	S.E.	Wald X^2	Df	Sig.	Odds Ratio
NVS	-.123	.300	.167	1	.682	1.131
EDU		.054	3.820	2	.148	
EDU1	-2.121	1.101	3.710	1	.054	.120
EDU2	-.955	.845	1.278	1	.258	.385

Mage			.169	3	.982	
Mage1	-.168	1.050	.026	1	.873	.845
Mage2	.072	.935	.006	1	.939	1.075
Mage3	-.202	.780	.067	1	.796	.817
NoC	.537	.226	5.671	1	.017	1.711
Test			X^2	Df	p	
Goodness of Fit Test						
Hosmer & Limeshow			4.842	8	.774	

Summary

In this chapter, the analysis of the data was presented. A description of the sample was provided with multiple socio-demographic descriptions. Each of the aims of the study were examined in the context of the research questions. These results, along with study limitations and recommendations will be provided in the next chapter.

CHAPTER 5

DISCUSSION, IMPLICATIONS, RECOMMENDATIONS

Discussion of Findings

The three purposes of this study were 1) determine the impact of maternal health literacy on knowledge of childhood immunizations, 2) currency with the recommended immunization schedule and 3) test an intervention to improve mothers' knowledge related to childhood immunizations in a population of low health literate mothers in a rural, public health department.

Background

This study was conducted in a county of the Upper Cumberland region of Tennessee. The region is defined as a rural area by the U.S. Census Bureau (2010), the Office of Management and Budget (USDA, 2010) Economic Research Service Rural-Urban Areas codes 4-10 (USDA, 2010) and the USDA Business and Industry Ineligible Locations (2010), Office of Management and Budget (USDA, 2010), Economic Research Service Rural-Urban Areas codes 4-10 (USDA 2010), the USDA Business and Industry Ineligible Locations (2010) and the U.S. Census Bureau (2010). The population of the Upper Cumberland Region is 326,228 with 168,345 of these being women. The county of study is identified as a rural area by eight of the nine definitions of rural. The U.S. Census Bureau "rural based on census places" (2010) considers the city of the current study urban with a city census of 32,000. The population of the county of study is approximately 75,000 with over 31,000 of those being women over the age of 18 (U.S. Census Bureau, 2015).

The educational, economical, environmental and health care social determinants of health were considered when assessing the community of study. The Upper Cumberland Region is rural, medically underserved, lacks adequate public transportation, and realizes a higher poverty

rate than the state average. While the location of the study is in the "hub" of the Upper Cumberland Region, it reflects the characteristics of the region. It is also important to realize smaller, surrounding counties travel to this county to seek health care and many other services. These social determinants of health put the region and county of study at risk for negative health outcomes and higher mortality and morbidity related to lack of access to health care and poorer self-care management (Heiman & Artiga, 2015).

All 14 counties of the Upper Cumberland region are classified as health professional shortage areas in primary care services, dental care and mental health care and 11 of the 14 counties are classified as medically underserved (TN Dept. of Health, 2016). The county of study is classified as partially medically underserved (TN Dept. of Health, 2016). The PCP:Person ratio for the county of study is 1390:1 and is similar to the state rate (1380:1). The county of study has a regional medical center and 36 specialties of health care. However, it is important to realize many outlying counties in the region must seek primary and specialty care in the county of study.

The county population commutes an average 23 minutes to reach their places of employment and health care provider. Of the 14 counties in the Upper Cumberland region, only 10 have hospitals increasing the load on these hospitals and extending the drive time for hospital services for residents of the other 4 counties. Only 6 of the counties include pediatric specialists (pediatrician or pediatric nurse practitioner) and only 5 of the counties provide prenatal services and childbirth facilities in their counties. For the remaining 9 counties the drive time for prenatal care services is extended to greater than 30 minutes. The length of time and distance required to access health care, specifically pediatric and prenatal care, increases the likelihood individuals

and families will not access needed health care services in a timely manner. Table 33 displays

the health care resources by county.

Table 33: *Upper Cumberland Region Health Care Resources*

County	Hospital	Pediatrician	Prenatal Care	Person:Primary Care Provider(PCP)
1	Y	N	N	3440:1
2	N	N	N	3890:1
3	Y	Y	Y	1340:1
4	Y	Y	N	2130:1
5	Y	N	N	1990:1
6	N	N	N	5760:1
7	Y	Y	N	5680:1
8	Y	N	Y	2760:1
9	N	N	N	5090:1
10**	Y	Y	Y	1390:1
11	Y	Y	Y	1910:1
12	N	N	N	5583:0
13	Y	Y	Y	1900:1
14	Y	N	N	3280:1

**County of research study; County Rankings and Roadmaps (2016)*

The graduation rate for the county of study was 92% and is higher than both the state (86%) and the nation (83%) (County Health Rankings, 2016). However, only 83.9% of the residents over the age of 25 in the county of study hold a high school diploma which is slightly lower than the state average of 85.5% (U.S. Census Bureau, 2015). In addition, participants have a lower rate of college graduation (23%) than both Tennessee (24.9%) and the nation (30%) (U.S. Census Bureau, 2015). The state and federal initiatives over the past 10 years have pushed programs such as credit recovery and on-line high school in an attempt to increase graduation rates. Sixty-three percent of the population in the county of study is over the age of 18 and one third of the population is over the age of 50 impacting the overall rate of high school graduates. The age group counted in the "high school diploma" category is made up of age 25 and older whom did not benefit from the more recent initiatives targeting increased graduation rates.

The median household income is roughly $35,000 as compared to the state average of $45,219. The overall poverty rate in the county of study is 25.2 % as compared to Tennessee (18.3%) and the nation at 13.5%. Children younger than 18 years of age have a state poverty rate of 18.3% while the county of study has a much higher child poverty rate of 26 %. Fifteen percent of the county is uninsured as compared to the state rate of 12% (U.S. Census Bureau, 2015).

An estimated 33,000 households are located in the county of study with approximately 65% homeowners and 35% renters. The average household size of the county of study is 2.53 persons (U.S. Census Bureau, 2015). Of the households in the county of study, 57% were married, 19% single, and the remaining classified as separated or divorced (U.S. Census Bureau, 2015). Public transportation in the Upper Cumberland region is limited and only one percent of the residents in the county of study use public transportation (Towncharts.com, 2016). The

sources of public transportation in the county consists of taxi, limited bus service, and UCARTS for rural residents who are elderly, disabled, or economically disadvantaged and is managed by the Upper Cumberland Human Resource Agency.

The lower education level, higher poverty level, and limited accessible health care may be considered social determinants of health and contribute to the risk of health disparities in the study county and region. These factors are important to consider in this study, as they may be factors influencing access of and engagement with the appropriate health care services.

The public health department participating in this research study provides services to approximately 200 individuals per day. They are staffed with 4 part-time physicians (none of which are primary care physicians), one OBGYN who sees patients twice monthly, 6 Advance Practice Nurses (5 FNP's, 1 WHNP), 8 Registered Nurses, 2 Licensed Practical Nurses, one dentist and one dental assistant. In addition, 2 social workers, 2 child visitation staff, one environmentalist, one Registered Dietician, 2 dietician assistants, 4 medically certified Spanish interpreters, one health educator and 9 clerks provide care in this facility. The clinic is open to the public Monday-Friday 7:30 a.m. to 4:30 p.m. One late clinic per week is available extending the hours to 6:30 p.m. However, no child health or immunizations are provided during those extended hours. The health department offers primary care services, limited prenatal care, child health, home visitation, immunizations across the lifespan, sexually transmitted infection screening, treatment and tracking, women's health and family planning services, dental services, nutrition counseling and WIC, tuberculosis screening, treatment and tracking and community education initiatives.

Study Demographic Findings

Ninety women participated in the research study and all ninety participants received immunization services for their child at the clinic visit. A slightly higher percentage of participants had graduated high school (86.7%) as compared to the county and state percentages. However, the percentage of participants graduating from college (11%) was less than half the average for both local and state college graduation rates. Three fourths of the participants reported household incomes that fell below the average household income in the county and 81% fell below the average household income of the state.

The average household size of the participants was 4.6 which is almost twice the household size of the county of study and the state of Tennessee. The participants who reported owning their own home (26.7%) is less than half of the percentage owning their home in the county of study. A third (35.6%) of the participants reported their relationship status as single, a number almost double the rate of the county of study (19%), and only 45.6% of the participants reported their relationship status as married. Eighty-four percent of the participants reported using personal transportation and is approximately 10% less than the county of study data.

More than 80% of the participants reported having health insurance, but the reported rate of their children having insurance was 63% and is considerably less than the child insurance rate in the county of 96%. Based on household income and household size 71% of the participants were eligible for some or all of the following services: WIC, SNAP and/or TANF. However, only 53% of those eligible participated in these services.

The average age of the 90 children receiving immunization services in the research study was 6.5 years. Of the children receiving immunizations, only 7.8% were born prematurely (less than 37 weeks gestation) which was lower than the state rate of 10.8% (March of Dimes

Foundation, 2016) and the national rate of 9.57% (Hamilton, Martin, Osterman, Curtin & Matthews, 2015).

Low birth weight is defined as a birth weight less than 2500 grams and is considered an indicator of both newborn and national health. Those born with a low birth weight have a higher mortality rate regardless of their gestational age. Only 5.6% of the children in this research study were identified as low birth weight, which is lower than the Upper Cumberland region (11.1%), the state (8.9%) and the nation (8%) (TDOH, 2015).

In summary, the participants in this study were less educated than the county and state. In addition, the participants had a lower average household income, larger percentage of single mothers and larger family size than the surrounding community. These characteristics most likely contributed to the lower number of homeowners and fewer participants with independent transportation than the community at large. Even though the area is considered to be medically underserved, many travel more than 20 minutes for health care, and prenatal care is not readily available to many areas of the region the incidence of preterm birth and low birth weight were lower in this sample as compared to both the county and state population.

Discussion of Specific Aims

Specific Aim 1: Compare two patient education methods for mothers with inadequate health literacy

Hypothesis 2: Use of Teach-Back method of patient education will be associated with higher immunization knowledge scores than the standard VIS method in mothers with low health literacy.

Patient education: Teach-Back vs. vaccination information sheets. Research question 2 addressed the introduction of the patient teaching methods for this study and the results were supportive of the hypothesis. The Teach-Back method was utilized with the intervention group in this study (N=45) and compared to the control group (N=45) who received the standard immunization education using the CDC Vaccination Information Sheet. Participant immunization knowledge was assessed using a 6-item survey. This survey was administered to all 90 participants prior to the administration of immunizations for their child. After the immunization visit was complete and the nurses had provided the standard patient education, using the VIS the researcher administered a post-test of the same immunization knowledge survey to the control group. The intervention group received patient education using the VIS and the Teach-Back method. Pre-test and Post-test scores were obtained and knowledge gain scores were calculated for all 90 participants.

Pre-test knowledge scores were similar for both the intervention and control group with no significant difference between the means of the two groups on the knowledge pre-test. However, there was a significant difference in mean scores on knowledge gain between groups with the intervention group scoring significantly higher on the post-test than the control group.

One of the goals of patient education is to decrease the risk of misunderstanding of health care information in the clinical setting (Abrams et al., 2007). This requires providers to be astute in both the delivery of information and the assessment of understanding of that information. The Teach-Back has the potential to be a powerful tool in assessing patient learning needs and evaluation of understanding of the information taught. The literature supports the use of Teach-Back for the improvement of self-care leading to improved health outcomes related to diabetes (Negarandeh, Hassan, Hayedah, Heshmat & Shakibazadeh, 2013; Schillinger et al., 2003) and

decreased hospital readmissions and increased self-management related to cardiac care (Haney & Shepherd, 2014). Teach-Back was also found to be more effective for diabetes self-management than traditional, written methods of patient education (Negarandeh et al., 2013).

The current study found mothers who received the Teach-Back as a method of patient education related to child immunizations to be more effective than the traditional patient education using the Vaccination Information Sheets. These findings are similar to those of Wilson et al. (2008) and Wilson, Mayeta-Peart, Parada-Webster & Nordstrom (2012) who identified low health literate mothers with incorrect immunization knowledge using the Teach-Back. In addition, they noted increased immunization knowledge of mother's after the use of Teach-Back as a method of patient education.

Teach-Back uses communication interventions identified by McCarthy et al. (2012). These interventions were believed to be effective in improving health care communication in a low health literate female population. The principles associated with McCarthy et al. (2012) study were assessment of patient current understanding of health information, reinforcement of teaching, and re-teaching when necessary. The Teach-Back utilizes these skills and are beneficial in assisting the provider in constructing pertinent and focused health care teaching.

Specific Aim 2: Add to the body of the literature related to maternal health literacy and patient education materials specific to childhood immunizations.

Maternal health literacy. Maternal health literacy is defined as "the cognitive and social skills that determine the motivation and ability of women to gain access to, understand, and use information in ways that promote and maintain their health and that of their children" (Renkert & Nutbeam, 2001, pg. 382). In this study, the researcher assessed maternal health literacy in a population of mothers who accessed the public health department to seek immunizations for their child.

The first research question addressed the health literacy of 90 mothers who brought their children to the health department for immunization services. Their health literacy was assessed using the Newest Vital Sign (NVS) consisting of six questions using an ice cream food label. This instrument is free and requires approximately three minutes to administer. This instrument addresses word, numeracy and document literacy. A score of 3 or less on the NVS indicates limited or inadequate health literacy.

Eighty-four percent of the participants scored less than 4 on the NVS indicating inadequate health literacy with a mean score of 2.74 (Table 8). No significant difference was found in the health literacy scores between the control and intervention groups (Table 9).

In this study, the individual characteristic variable of age of child and the social determinants of health variables education, household income and living arrangements were significantly related to health literacy. Both higher household income and higher education level correlated with health literacy. Education level made the strongest contribution in describing the variance in health literacy. Increasing age of child and living arrangements were significantly related to increased health literacy, but they did not significantly contribute to the variance in health literacy.

Education level has been found to positively correlate with health literacy (Heinrich, 2012). Specifically, completion of high school was correlated with higher health literacy scores (Apolinario, Mansur, Carthery-Goulart, Brucki & Nitrini, 2015; Paasche-Orlow, Parker, Gasmararian, Nielsen-Bohlman & Rudd, 2005). The higher number of years of school attended has been related to higher health literacy scores (Gazmararian et al., 1999).

Participants of the study were found to have less education than the community as a whole with a lower than average number of high school and college graduates. In addition, the median household income of the participants in the study was lower than the median household income of the state and the poverty rate in the county of study was greater when compared to the state poverty level. These factors may contribute to the high percentage of low health literate participants in this study (84%).

Use of social services. Research question 7 explored factors affecting a mother's access to and use of social services. Multiple services are available to families with children and most are based on household income, age of child and other factors specific to each program. The specific social programs considered in this study were Supplemental Nutrition Assistance Program (SNAP), Temporary Assistance for Needy Families (TANF), and Women, Infants, and Children (WIC). Federal poverty level information, age of child, and program guidelines were used to determine eligibility for these services.

On a national level, 92% of families with children access SNAP resources as compared to those households without children (72%). Rate of eligible participation in Tennessee is in the top quarter at a rate of 82% (USDA, 2012). The national rate for eligible participation in WIC for ages 1-4 is 49.8% and Tennessee is similar with a participation rate of 50-59%. Households with an infant have the highest participation rate of 84.4% and the participation rate for WIC

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decreases with the child's age with the lowest participation (32.9%) rate at age 4. The participation in TANF has dropped consistently over the past 10 years and currently only 40% of those eligible are receiving TANF (UDHHS, 2012).

In the current study, a total of 64 children were eligible for one or more of these services, but only 56% received services. The researcher considered the predictor variables maternal health literacy, maternal education level, number of children, and maternal age to assess their predictive value on the use of eligible social services. There was a lack of significant predictive value of any of the aforementioned variables.

Women with low health literacy were also noted to have difficulty navigating the health care system and difficulty advocating for self (Shieh & Halstead, 2009). Low health literate mothers access child-care subsidies less often than those with adequate health literacy (Pati et al., 2010). However, no significant relationship was found between maternal health literacy and participation in TANF, SNAP or WIC. Decreasing participation was found in all programs as the age of the child increased (Pati et al., 2010).

Specific Aim 2a: Describe maternal health literacy, currency with the immunization schedule, and maternal knowledge related to childhood immunization.

Immunization currency. Remaining current with the CDC recommended schedule of immunizations for children requires frequent access to and interaction with the health care system. Multiple skills are required including scheduling of visits using an automated phone system, ability to provide adequate health history and health information for the child. This includes prenatal and birth information, childhood illnesses, previous immunizations received, allergies, adverse reactions, and management of child health care post immunization. The CDC's recommendation for initiation and spacing of 11 different immunizations, 28 doses, and at least 5 visits within the first two years of life provides the optimal protection from preventable diseases.

In this study less than half (45.6%) were current with CDC recommended childhood immunizations. This number is significantly lower than the region (74.6%), the state (75.4%) and the nation (75.4%) at age 24 months. Immunization currency is lowest in the public sector when compared to the private sector, and the participant's children in this study had even lower immunization currency rates (69%) than the local public sector.

Research question 5 explored the predictive value of transportation, maternal age, maternal education, number of children and immunization knowledge on immunization currency. Considering age of child and living arrangements were also significantly related to currency they were added to the model assessing predictive value. Only two of the variables were found to be significantly predictive of immunization currency (age of child and number of children).

The age of the child was the strongest predictor of immunization currency indicating the older the child of the participant the more likely they were to be current with immunizations. These findings were not supported by previous research. Age of child failed to be a predictor of

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immunization currency in a study of an inner-city cohort of mothers and a drop in immunization currency occurred after 7 months (Pati et al., 2011). A large study conducted by Pfizer (2015) noted a 67% decrease in return to health care providers for well visits, including immunizations after the first 12 months of life.

As was cited by Pati et al. (2010), the current study found a decrease in the rate of immunization currency with an increasing number of children in the household. Specifically, Pati et al. (2011) found mothers with 3 or more children to be less likely to be current with immunizations. This could be attributed to the need for increased resources and increased health care management with a greater number of children in the household. This could be compounded with the high percentage of single mothers in this study (35.6%). While this study did not find a significant relationship between relationship status and immunization currency, Pati et al. (2011) did find married couples were more likely to have children who were current with immunizations.

Maternal immunization knowledge. Maternal immunization knowledge was assessed at two points in time during the study by way of a pre and post-test. Pre-test and post-test scores were evaluated in addition to knowledge gain scores derived from the differences between the pre and post-test scores. No significant difference was found between the control and intervention group's pre-test scores indicating the groups were similar in immunization knowledge prior to the intervention.

Looking more closely at the immunization knowledge scores the researcher categorized the 6 survey items into 3 categories: general knowledge (question 1, 2 & 3), safety (question 4 & 5) and follow-up (question 6). Participants in both groups scored higher on the pre-test in the area of the safety questions related to "when to seek medical treatment" and "how to treat fever".

The greatest gain in knowledge was related to the follow-up question "when next immunization is due". The mean knowledge gain scores were studied for each survey item and the intervention group scored higher than the control group on every item except the general knowledge item (question 1) "vaccine name". The gain on question 1 was similar for both the intervention and the control group.

Wilson et al. (2008) found mothers with higher health literacy to verbalize greater knowledge related to immunization indications as compared to mothers with low health literacy. In the same study, those mothers were more likely to respond correctly to questions related to immunization risks and benefits and were more likely to respond incorrectly to questions related to immunization safety. While Wilson et al.'s (2008) study found responses related immunization knowledge differing from the current study it is important to realize their study was small (N-30) and conducted in an urban, inner-city clinic.

Specific Aim 2b: Relationship among maternal health literacy, immunization knowledge and methods of patient education

Hypothesis 1: Higher levels of health literacy as measured with the NVS will be associated with higher immunization knowledge scores regardless of teaching method in mothers seeking immunizations for their children in a public health department setting

Maternal health literacy and immunization knowledge. Research Question 6
evaluated several factors for their predictive value of immunization knowledge in mothers. The
predictor variables of interest were health literacy, maternal education level, number of children
and maternal age. In this study, 18.6% (R^2=.186) of maternal immunization knowledge was
explained by these predictor variables ($p < .001$). Health literacy (r=.346) and maternal education
level (r=.326) moderately correlated with maternal immunization knowledge with health literacy
making the greatest contribution to the variance in immunization knowledge (B=.447, p=.027).
Number of children and maternal age did not significantly contribute to the variance in
immunization knowledge (Table 30) Wilson et al. (2007) was also unable to realize a
relationship between maternal age, number of children and immunization knowledge.

The literature supports the above findings related to health literacy and immunization
knowledge. Mothers with inadequate health literacy are more likely to have inadequate or
incorrect knowledge related to childhood immunizations (Wilson et al., 2008). Specifically, they
are less likely to know the immunizations their child (ren) receive(s) and less likely to know the
indications for those immunizations (Baker et al., 2007).

A significant relationship was found between 3 variables and immunization knowledge.
Both child's age and household income had a moderately positive relationship with
immunization knowledge and living arrangements had a moderately negative impact. However,
these variables were not significantly predictive of immunization knowledge

Maternal health literacy and immunization currency. Research question 3 explored the relationship between maternal health literacy and immunization currency. A moderately weak relationship was found between health literacy and immunization currency. Health literacy explains 6.5% of the variance in immunization currency. Multiple studies have linked health literacy and immunization currency finding a relationship between low health literacy and lack of immunization currency (Lupattelli, Picinardi, Einarson & Nordeng, 2014; Tordorova, 2014). While studies specific to mothers and childhood immunizations are limited, multiple studies have provided information related to health literacy and immunization currency in the general population. Bennett, Chen, Soroui & White (2009), Scott, Stockwell, Williams & Baker (2002), and Sudore et al. (2006) found participants with a low health literacy to also have a lower rate of immunization currency.

Conceptual Framework

Nutbeam's framework was utilized in this study and recognizes health literacy as a continuum progressing from the most basic skills of reading and numeracy (functional) to the most advanced level allowing individuals to interact successfully with the health care environment (interactive) and adequately manage their health care (critical). This model incorporates the dynamic nature of health literacy and encompasses a broad range of skills related to interaction and engagement with the health care system (2000, 2008).

This model of health literacy must be supported by health education implying a need for individuals to interact with the health care environment and recognizes the crucial role health care providers play in providing health care education appropriate to the health literacy needs of their clients. This model supports the idea of individuals progressing from functional health literacy to interactive health literacy and eventually to critical health literacy.

Functional health literacy is an outcome of traditional education and requires reading and numeracy skills and implies the ability to function in everyday situations. Health literacy at this level is viewed as a risk and inadequate health literacy becomes a factor needing intervention to improve health outcomes. This view has the health care provider "doing to" the individual. The individual with low health literacy is impacted by the provider and the health care environment (Nutbeam, 2008).

Interactive and critical health literacy is viewed as a health asset to be strengthened and grown and is an outcome of both communication and health education. Health literacy, as an asset, builds health-care decision-making skills by improving individual capabilities such as speaking and listening skills, self-efficacy and independence in personal health care. As an asset, health literacy equips the individual to become part of the health care team as a decision maker and to gain autonomy in the management of personal/family health care.

Multiple factors mitigate health literacy growth. Health literacy is dependent on cognitive ability and is impacted by both traditional education and exposure to health care content and environments. Individual communication capacity is also a factor influencing health literacy. Access to health care and patient-health care provider interactions also influence health literacy (Nutbeam, 2000)

While the figure below is not part of Nutbeam's model it does represent the idea of health literacy as a continuum. This model depicts the movement or growth in health literacy from the functional level associated with health risk to considering health literacy as an asset. Communication, cognitive ability and context are mitigating factors necessary for a growth in health literacy leading to increased autonomy and decision-making. These skills improve the ability for self-care management.
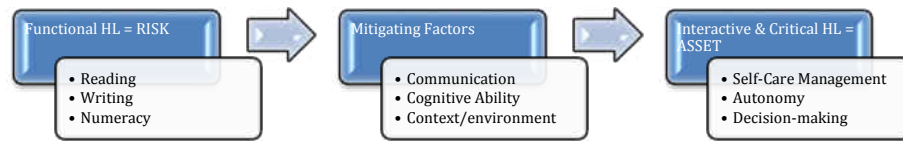
Figure 1. Health Literacy as a Continuum using Nutbeam's Concepts

In this study, functional health literacy was measured using the Newest Vital Sign. Inadequate maternal health literacy in this study was predictive of lower immunization knowledge scores and lower rates of immunization currency. Both of these variables have the potential to negatively influence the health of the child receiving the immunizations.

Based on Nutbeam's (2008) model the goal would be to move from the risk factor of inadequate health literacy and its negative impact to health literacy as an asset. Improvement or growth in maternal health literacy would promote greater ease with self-care management of their child's immunization status. In this study, the Teach-Back was used to assess maternal knowledge and to reinforce correct immunization knowledge. The control group demonstrated a significant increase in immunization knowledge with use of the Teach-Back. Specifically, the Teach-Back increased knowledge related to general immunization information and safety.

After Teach-Back, the participants increased their knowledge scores with correct verbalization of the benefits and risks of the immunizations their child received. They demonstrated an increase in knowledge related to safety factors in correct verbalization of

when to seek medical attention for adverse reactions and how to correctly treat fever in their child.

This model postulates that communication techniques required for the Teach-Back increases immunization knowledge. The knowledge gained provides opportunity to increase decision-making related to immunization safety and self-management of care after immunizations. This depicts a move from functional health literacy (reading, writing, numeracy) to interactive and critical health literacy. It is important to note other factors outside of communication contribute to health literacy growth. Cognitive ability is impacted by education, prior health related experiences and ability to learn and is an important factor to consider. Context is also critical, requiring health care providers to evaluate the obstacles in the health care environment preventing navigation and access to quality care. Provider-patient communication is also a contextual aspect impacting the desire and ability to access and utilize the health care system.
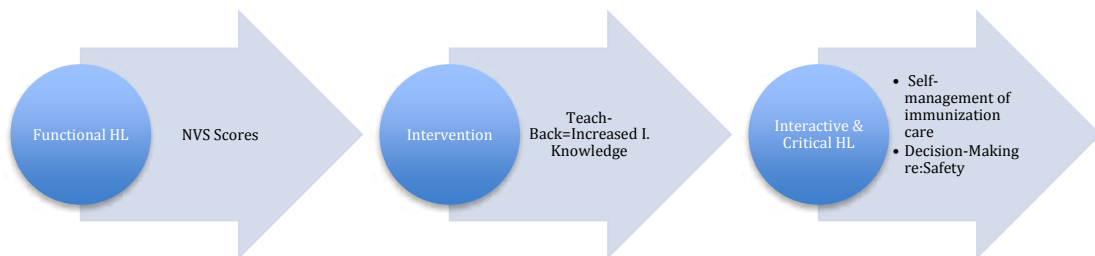
Figure 2. Depiction of Teach-Back as a Health Literacy Intervention

Functional health literacy has been well operationalized and its impact on health outcomes and health care economics has been well studied. There is a scarcity of literature on measurement of interactive and critical literacy and the studies pursuing this objective have

failed to clearly distinguish between the levels of health literacy (Heijmans et al., 2015; van der Vaart et al., 2012). Quality studies providing interventions for the improvement and growth of health literacy are few. While this current study has added to the body of literature of health literacy and expounded on a patient education method (Teach-Back) there is a lack of evidence to support the measurement of interactive and critical health literacy.

Strengths and Limitations

Strengths

The current study adds to the body of literature related to maternal health literacy, immunization knowledge and patient education methods. There is a preponderance of maternal health literacy studies set in urban areas. This study will aid in addressing the differing maternal health literacy needs of women in rural settings. This research study targeted a public health care facility anticipating a different demographic make-up. Gutierrez, Kindratt & Pagels (2014) found a higher incidence of low health literacy in public clinics as opposed to patients receiving care in private clinics. While this study did not compare public and private clinics, the participants seeking care in this public clinic were overwhelmingly low health literate (84%).

Limitations

This study was limited to mothers over the age of 18 and the field of maternal health literacy and immunization knowledge would benefit from studies that incorporate teenage mothers. On the other end of the spectrum, it is well documented that older adults have a higher rate of low health literacy and including older grandparent and foster mothers would broaden our knowledge as to the health literacy needs of that population.

A possible limitation of this study was related to the timing of the post-test assessment. An additional assessment may have been warranted immediately following the usual VIS patient teaching and prior to the Teach-Back in the intervention group. Failing to do this assessment prevented the researcher from ascertaining if knowledge gain was totally related to the Teach-Back intervention or reflective of the additive gain of Teach-Back in addition to VIS. However, based on a lack of a significant difference in means in the pre-test scores between the control and intervention groups the groups should be similar on knowledge scores immediately after the VIS teaching.

The researcher wrote the Immunization Knowledge Survey based on information from the Vaccination Information Sheets. Additional study is needed to ascertain validity beyond content validity. Additional study and a collection of a large number of questions are needed prior to factor analysis to determine construct validity. Additional study is also needed to allow for test/re-test to evaluate reliability and stability over time.

The public health department participating in this study provided a broad range of services to meet the needs of the community. However, the region is lacking in adequate maternal health care services and pediatric services requiring many to travel to access specialty services in a region with inadequate public transportation. These factors may contribute to the poor rate of immunization currency in this study.

Additional Findings

The Affordable Care Act expanded availability for health insurance coverage. In addition, Medicaid programs and Child Health Insurance Programs (CHiP's) increase the accessibility of health insurance for children and pregnant women. Eighty percent of the mothers in this study reported enrollment in either private or public health insurance. It was surprisingly

that only 63% of the children in this study were covered with health insurance. Enrollment in health insurance for the children in this study failed to show any significant relationship with any of the study variables. However, Yin et al. (2009) found a relationship between low parental health literacy and higher uninsured child rate.

Access to health care is another factor related to health outcomes. Only 60% of the children in this study reported having a regular health care provider. The only variable that correlated with regular health care provider was immunization knowledge and it was a weak correlation (p< .036). The Upper Cumberland Region is medically underserved with several counties without pediatric specialists and limited numbers of primary care providers. To compound this concern, available public transportation is limited to assist with accessing the health care environment. Lack of primary providers increases the risk of late entry into care, or as in this study a lack of sufficient immunization coverage which increases the health care costs in an already cost burdened system (Sanderson & Dixon, 2000).

Implications and Recommendations

Clinical Practice Implications

The clinical setting can be a stressful environment for patients and their families. This is compounded in the clinic setting where children are receiving immunizations. Mothers may be distracted by the distress of the child who had received immunizations decreasing her ability to pay attention to important health care information relayed by the provider. This increases the stakes for providers to be effective in the delivery of this information and to be skilled in their ability to assess patient/family understanding of the information.

Health care professionals are the primary source of health care information in low health literate women (Gutierrez et al., 2014). However, health care providers are more likely to over estimate a patient's health literacy skills (Ohl et al., 2009). Failure to employ best practices in health care communication with the low health literate creates barriers to health care (Martinez-Donate et al., 2013). It is crucial for providers to develop skills in measuring health literacy in the clinic setting and to regularly employ strategies to verify patient understanding of their health care with tools like Teach-Back.

Addressing health literacy deficiencies in a busy clinic setting requires providers to meet the patient/family where they are with a goal of providing quality care and to assess and reinforce patient learning to insure understanding. This requires the provider to be adept at reading their audience and determining their needs. When considering low health literate women it is important to incorporate best practices in the communication process. Preferences for learning based on female gender include utilization of only one mode of education at a time and the preferred style is kinesthetic to allow for the use of all senses (Wehrwein et al., 2007). In addition, Mazor et al. (2014) found listening health literacy to be a greater indicator for currency with pap screening than reading literacy. Another study found low health literate women preferred oral information followed up with written information (Sleath et al., 2006). The implications for practice are great and providers need increased educational preparation for health literacy measurement and adaptation of teaching methods in the clinic setting.

Provision of evidence based health care and evidence based patient education information is ineffective if the population served does not understand the message. The health care environment is stressful and many times individuals/families are receiving difficult and life-changing news. Taking the time to evaluate understanding is critical if patients are to progress to

self-care management. Many times patients/families do not understand enough about the information to ask questions and if providers fail to assess and verify a patient leaves the health care environment with adequate knowledge and skill to manage their care or the care of their families.

Recommendations for Future Research

The measurement of functional health literacy and the impact of inadequate health literacy have been well studied in multiple populations and contexts. It is well established that inadequate health literacy negatively affects health outcomes in preventive health and chronic illness management. There is a lack of experimental studies assessing interventions for low health literate populations that promote improved self-care and health management. A prospective follow-up study to assess immunization currency and long term immunization knowledge would provide valuable information related to the long-term effectiveness of the Teach-Back.

Studies addressing curriculum development related to health literacy assessment and quality interventions are needed for each professional health care discipline. Nurse practitioners', while having a knowledge deficit related to health literacy measurement and interventions indicated a strong intention to incorporate health literacy into their clinical practice (Cafiero, 2013). Health literacy training in Family Medicine residents demonstrated an increase in their knowledge and awareness of health literacy. However, increased knowledge and awareness did not translate into their willingness to incorporate health literacy information into their clinical practice (Szwajer, MacDonald & Kvern, 2014). Studies are needed to ascertain the best methods of teaching with health care providers as the recipients. Patient education is a primary

responsibility of registered nurses and quality nursing curriculum promoting health literacy assessment skills and interventions are needed.

Multiple studies have addressed the impact of patient-provider communication on the health outcomes of the patient (Carroll et al., 2006; Endres et al., 2004; Guerra et al., 2005; Harrison et al., 2010; Needham et al., 2009; O'Callaghan & Quine, 2006). Limited use of best practices in communication was considered a barrier to care in a population of cancer patients (Martinez-Donate et al., 2013). In a study of low health literate women listening skills demonstrated a stronger correlation with cervical cancer screening than reading skills (Mazor et al., 2014). Future research addressing best practices in patient-provider communication in the low health literate population is needed.

As previously discussed, additional research is needed to clearly operationalize each level of health literacy. In addition, interventions and strategies for the building of health literacy will need to be studied. Mobley et al. (2014) has begun this work with maternal health literacy using a case management model to provide in-home, follow-up with new mothers. A progression of maternal health literacy was noted, but the lack of clarity in distinguishing the level of health literacy may hinder its usefulness. Renkert and Nutbeam (2001) realized health care providers are unable to teach "everything" and that more than a transfer of knowledge is needed. Adequate health literacy is needed if women are to independently seek health care information and demonstrate active decision-making. This requires a consideration of provider communication skills, interactive patient education methods to increase knowledge, and how we manipulate the health care environment to insure a safe and shame-free environment.

Health literacy is dynamic and dependent on several factors. Functional health literacy requires a foundation of traditional education. For health literacy to improve, exposure to the

health care environment and health care information is needed. Improved health care knowledge is needed and requires methods such as the Teach-Back to insure patient understanding. In addition, promotion of skills leading to self-management of care is critical. Porr et al. (2006) studied a group of mothers and found a relationship between self-efficacy beliefs and interactive health literacy and those progressing to critical health literacy demonstrated self-confidence. Additional study of characteristics of each level of health literacy will provide valuable insight.

The research in this field has yielded quality information related to the measurement of health literacy components such as prose literacy, document literacy and quantitative literacy (numeracy). However, additional study is needed to better qualify and quantify other health literacy components such as oral literacy (Mazor et al., 2014), previous health care language exposure (Mancuso, 2008 & Speros, 2005) and navigation of the health care system.

The majority of health care and self-management occurs in the home in the community where individuals and families live. Studies set in the community are needed to address the self-care needs of individuals and families. Additional maternal health literacy studies are needed in the rural area as the literature is lacking in rural, maternal health literacy. Large studies incorporating both rural and urban practices and both public and private sectors are needed to clearly delineate the needs of each population.

Qualitative research studies would also provide pertinent information to frame the concept of health literacy. In the context of health literacy and immunization knowledge and currency, qualitative studies exploring knowledge acquisition and health resource use would provide depth to the broad body of literature related to health literacy. A clearer understanding as to the individuals' experience with the health care system would grant providers clarity in their approach to health literacy assessment and patient education.

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Conclusions

Teach-Back was found to have a positive impact on immunization knowledge in a population of low health literate mothers. Expanding our knowledge of quality teaching tools geared toward the low health literate population has the potential to improve patient outcomes. Health literacy was a mitigating factor in immunization currency and a predictor of immunization knowledge. Health literacy was not related to enrollment in social programs. Continued work in the field of maternal health literacy is warranted and the initiation of other teaching tools in different contexts is needed.

Schillinger's et al. (2003) model was applicable in this study as Teach-Back prompted an assessment of new concepts or reinforcement of previously taught information related to immunizations. Teach-Back allowed for the researcher to clarify any incorrect information and to reassess understanding when the participant verbalized what she understood. This process leads to comprehension. All that is left to "closing the loop" is follow-up over time to ascertain adherence to the recommendations and ongoing currency with immunizations.

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APPENDICES

YOU ARE INVITED TO PARTICIPATE

IN A

RESEARCH STUDY

A nursing student in the College of Nursing's PhD program at East Tennessee State University is conducting a research **study** related to health literacy and immunization knowledge. The purpose of this study is to identify the most effective methods of patient education related to immunizations.

Participation will occur during todays' health department visit. Confidentiality will be strictly maintained and your name will not be connected to the study results. There will be no medications or medical treatment administered in this study.

A **$10 Walmart© card** will be provided for participants and will be given at the end of todays visit.

If you are a mother receiving immunizations/vaccinations for your child in the health department today, are 18 years or older and speak English as your first language you may participate in this study. Please let the clerk know if you are interested.

APPENDIX B: Informed Consent

Informed Consent

This Informed Consent will explain about being a participant and letting your child's records be used in a research study. It is important that you read this material carefully and then decide if you wish to be a volunteer.

PURPOSE: We are trying to learn if we can do a better job teaching mothers about their children's

vaccines.

DURATION:

If you agree to be in this study, your part will last for about 15-20 minutes before and 15-20 minutes after

your child gets his/her shots.   We think that about 90 mothers will take part in this study

PROCEDURES:

The procedures, which will involve you as a research subject, include:

1. Answer some general questions about you and your child

2.   Answer some questions about a food label that we will ask you to read

3.   Answer some questions about the shots that your child will receive today. We will ask you these

    questions before and after your child gets the shots.

4. About half of the moms in this study will also get the information about their child's shots in a
    new way. The other half of the moms in this study will get the information in the usual way. This
    will help us learn which way works better.

5. We will look at your child's records and write down your child's shot records for our research
    study.

ALTERNATIVE PROCEDURES/TREATMENTS: You will receive the same care for immunizations

and teaching as everyone else in the clinic even if you decide you do not want to volunteer.

POSSIBLE RISKS/DISCOMFORTS: This study will require some of your time to finish. Also, there is a small chance information in your child's record could be seen by someone else. We will keep this information in a locked cabinet and in a locked room.

POSSIBLE BENEFITS: This study may help you learn more about how to care for your child who is getting immunizations today.

FINANCIAL COSTS: This study will not cost you anything to volunteer.

COMPENSATION IN THE FORM OF PAYMENTS TO RESEARCH PARTICIPANTS

You will receive a $10 Walmart gift card at the end of your visit today when the surveys are finished.

VOLUNTARY PARTICIPATION: It is your choice to volunteer and you may stop at any time. If you decide not to volunteer or decide to stop before we are finished you will still receive the same care. If you decide to stop after you leave the clinic you may call   Barbara Jared at 931-235-7200.

CONTACT FOR QUESTIONS: If you have any questions, problems or research-related medical problems at any time, you may call (Barbara) at (931-235-7200). You may call the Chairman of the Institutional Review Board at 423/439-6054 for any questions you may have about your rights as a research volunteer. If you have any questions or concerns about the research and want to talk to someone separate from the research team or you can't reach the study staff, you may call an IRB Coordinator at 423/439-6055 or 423/439/6002.

CONFIDENTIALITY: We will do our best to keep your information private. A copy of the records from this study will be stored in a locked cabinet behind a locked door for at least 5 years after the end of this study. The results of this study may be written about or talked about at meetings without using your name or the name of your child. Although your rights and privacy will be maintained, the Secretary of the Department of Health and Human Services and the ETSU/VA IRB have access to the study records. Your child's (medical) records will be kept completely confidential according to current legal requirements. They will not be shared unless required by law, or as noted above.

You will be provided with a copy of this signed authorization form.

HIPAA Authorization

Authorization for Disclosure of Protected Health Information for Research

A. **Purpose**: The purpose of this authorization form is to authorize Barbara Jared and her research team to collect, use and disclose your childs protected health information to conduct the research study listed above. This authorization will inform you what information about you may be collected in this study as well as who might see or use your information East Tennessee State University has rules that require the research team to protect your health information. There are also federal and state laws that protect the privacy of your health information. Generally, only people on the research team will know that you are in the research study and will see your protected health information. However, there are a few exceptions that are listed in Section C of this form.

By signing this authorization form, you authorize the research team to collect, use and disclose your health information as described in this form. ***You do not have to sign this form***. Your decision not to sign this authorization will not affect your treatment, healthcare, enrollment in health plans or eligibility for benefits. However, your decision not to sign this form will result in your not being allowed to participate in this research study.

B. **Protected Health Information to be Used/Disclosed:** Protected health information is the information in your medical or other healthcare records. This includes all information in your records that can identify you including your name, address, phone number, birth date, and account numbers.

    1. By signing this form you authorize the following healthcare providers, health plans, or other organizations or individuals to disclose your childs protected health information to the research team:

        ▪ Putnam County Health Department

    2. By signing this form you authorize the individuals or organizations listed above to disclose the following types of protected health information to the research team:

        ▪ Immunization History

3. By signing this form you authorize the research team to collect, use and disclose your childs protected health information as listed above, in relation to health care provided to you during the following time period: Birth-Present

C. **How your protected health information will be used:** Barbara Jared and her research team will collect, use and disclose the protected health information described in this form for the purpose of conducting the research study listed on this form. Generally, only Barbara Jared and those individuals on the research team will see your protected health information. However, in certain circumstances the following individuals or organizations may have access to your protected health information:

1. The Department of Health and Human Services

2. The ETSU Institutional Review Board

3. The ETSU Human Research Protection Program

4. The ETSU HIPAA Compliance Office

5. Other representatives of ETSU as reasonably required to carry out the research study

6. Other Individuals/Organizations as required by law

D. **Redisclosure of your protected health information:** Once your childs protected health information is disclosed to anyone outside this research study, the information may no longer be protected by the federal privacy standards and may be redisclosed without obtaining your authorization. Barbara Jared and her research team will only collect, use and disclose your childs protected health information as described in this form or as otherwise permitted or required by law.

E. **Right to revoke this authorization**: If you sign this authorization form, you may change your mind at any time. If you change your mind, the research team may still keep and use your childs protected health information that they already have. The research team will not obtain any more protected health information about your child for this research unless permitted or required by law after you change your mind.

In order to change your mind and revoke this authorization, you must send a written letter to:

Barbara Jared

P.O. Box 5001

Cookeville, TN 38505

If you change your mind you will no longer be able to participate in this research study.

F. **Expiration of authorization:** This authorization will expire at the end of the research study.

G. **Questions about Privacy:** If you have any questions or concerns about your privacy rights you may contact the East Tennessee State University HIPAA Compliance Office via telephone 423.439.8533 or mail P.O. Box 70285, Johnson City, TN 37614.

By signing below, you agree that you have read or had this paper read to you. You are agreeing to volunteer and you are agreeing to allow the researcher to look at your child's medical record. You will be given a signed copy of this informed consent document. You have been given the chance to ask questions

and to talk about your participation with the researcher. You freely and voluntarily choose to be in this research project.

By signing below, I confirm that I have read and understand both the Informed Consent and HIPAA Authorization sections of this form and that I had the opportunity to have them explained to me verbally. You will be given a signed copy of this informed consent document. I confirm that I have had the opportunity to ask questions and that all my questions have been answered. By signing below, I confirm that I freely and voluntarily choose to take part in this research study, and that I authorize Barbara Jared and her research team to collect, use and disclose my childs protected health information as described in this form.

_____   _____

Signature of Participant   Date

_____   _____

Printed Name of Participant   Date

.

_____   _____

Signature of Principal Investigator   Date

_____   _____

Signature of Witness   Date

Demographic Survey

Participant #_____

What is your age?

- o   Less than 16

- o   16-18 years

- o   19-21 years

- o   22-25 years

- o   25-30 years

- o   over 30 years

What is the age of the child or children you brought to clinic for immunizations today?

_____

What was the birth weight of the child you brought for immunization today?_____

When did you have your first prenatal visit?

- o   1-12 weeks of pregnancy

- o   13-26 weeks or pregnancy

- o   27-40 weeks of pregnancy

At what gestational age was your baby born?_____

Is English your primary language?

- o Yes

- o No

Please identify your relationship status:

- o Single

- o Married

- o Separated

- o Divorced

- o Living with partner

What is the highest education completed?

- o Less than 8th grade

- o Completed 8th grade

- o Some high school

- o Graduated high school

- o GED

- o Some vocational school

- o Completed vocational school

- o Some college

- o Completed college

How many people live in your household? _____

What is your annual household income?

- o Less than $10,00

- o $10,000-19,999

- o $20,000-29,999

- o $30,000-39,999

- o $40,000-49,999

- o $50,000-74,999

- o $75,000-99,999

- o $100,000 or greater

- o would rather not say

Do you have insurance?

- o No

- o Yes

    - o Private

    - o TennCare

    - o Other

Please provide information related to your resources:

Transportation

- o Own car

- o Get rides with someone else

- o Use UCARTS or CATS

- o Use Taxi

Home

- o Own home

- o Rent

- o Live in someone else's home

- o Homeless

Television

- o Yes

- o No

Cable or Satellite Television

- o Yes

- o No

Internet

- o In your home

- o In someone else's home

- o At the library

- o At school

- o Do not use the internet

Are you enrolled or do you receive services from any of the following. Mark all that apply:

- o WIC

- o SNAP

- o TennCare

- o Other health insurance

- o Families First

How many children do you have: _____

What are their ages? _____

Do you have a pediatrician?

- o Yes

- o N0

Do you have a Primary Care Provider?

- o Yes

- o No

APPENDIX D: Immunization Knowledge Survey Pre-Test

Pre-Test Immunization Knowledge Survey

Participant #_____

Participant Score____

1.What vaccines will your child receive today?____

2.What are the benefits of each vaccine?____

3.What are the risks of receiving the vaccine?____

4.When should you seek additional medical attention?____

5.How will you treat fever? ____

6.When is the next immunization due?____

Each question will be scored as follows for a total score of 0-12.

2-Correct

1-Partially Correct

0-Incorrect

Post-Test Immunization Knowledge Survey

Participant #_____

Participant Score____

1.What vaccines did your child receive today?____

2.What are the benefits of each vaccine?____

3.What are the risks of receiving the vaccine?____

4.When should you seek additional medical attention?____

5.How will you treat fever? ____

6.When is the next immunization due?____

Each question will be scored as follows for a total score of 0-12.

2-Correct

1-Partially Correct

0-Incorrect

APPENDIX F: Chart Review

Chart Review Form

Participant number:_____

1. Immunizations:

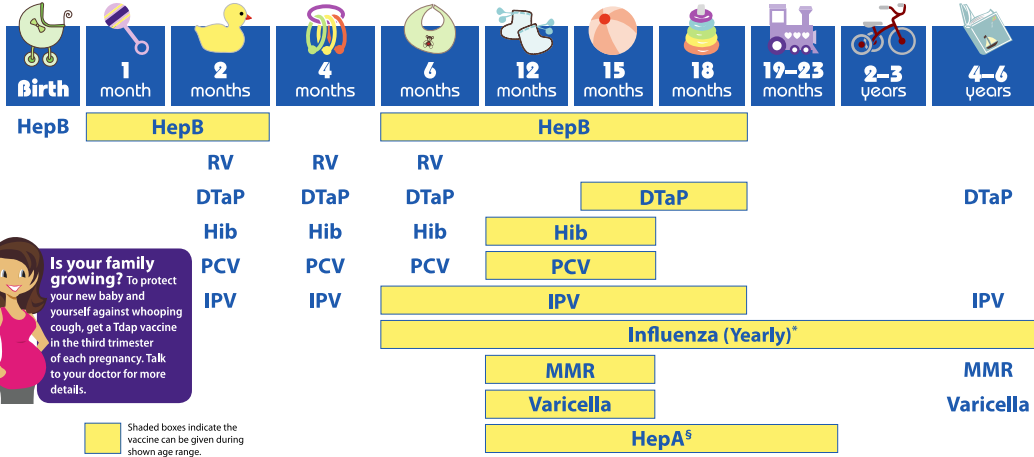| Immunizations received today	Were immunizations received today given within CDC timeframe (Y or N)	If immunizations are late by how many months?	Based on documentation in immunization sheets how many immunizations have been given late in the past?

Immunization currency will be defined using the CDC guidelines.

2015 Recommended Immunizations for Children from Birth Through 6 Years Old

Birth	1 month	2 months	4 months	6 months	12 months	15 months	18 months	19–23 months	2–3 years	4–6 years
HepB	HepB			HepB						
		RV	RV	RV						
		DTaP	DTaP	DTaP		DTaP				DTaP
		Hib	Hib	Hib	Hib					
		PCV	PCV	PCV	PCV					
		IPV	IPV	IPV						IPV
				Influenza (Yearly)*						
					MMR					MMR
					Varicella					Varicella
					HepA§					

Is your family growing? To protect your new baby and yourself against whooping cough, get a Tdap vaccine in the third trimester of each pregnancy. Talk to your doctor for more details.

Shaded boxes indicate the vaccine can be given during shown age range.

NOTE: If your child misses a shot, you don't need to start over, just go back to your child's doctor for the next shot. Talk with your child's doctor if you have questions about vaccines.

FOOTNOTES: * Two doses given at least four weeks apart are recommended for children aged 6 months through 8 years of age who are getting a flu vaccine for the first time and for some other children in this age group.

§ Two doses of HepA vaccine are needed for lasting protection. The first dose of HepA vaccine should be given between 12 months and 23 months of age. The second dose should be given 6 to 18 months later. HepA vaccination may be given to any child 12 months and older to protect against HepA. Children and adolescents who did not receive the HepA vaccine and are at high-risk, should be vaccinated against HepA.

If your child has any medical conditions that put him at risk for infection or is traveling outside the United States, talk to your child's doctor about additional vaccines that he may need.

SEE BACK PAGE FOR MORE INFORMATION ON VACCINE-PREVENTABLE DISEASES AND THE VACCINES THAT PREVENT THEM.

For more information, call toll free
1-800-CDC-INFO (1-800-232-4636)
or visit
http://www.cdc.gov/vaccines

CDC

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

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APPENDIX H: Recommended Immunization Schedule age 7-18 years

2015 Recommended Immunizations for Children from 7 Through 18 Years Old

7-10 YEARS	11-12 YEARS	13-18 YEARS
Tdap [1]	Tetanus, Diphtheria, Pertussis (Tdap) Vaccine	Tdap
	Human Papillomavirus (HPV) Vaccine (3 Doses) [2]	HPV
MCV4	Meningococcal Conjugate Vaccine (MCV4) Dose 1 [3]	MCV4 Dose 1 [3] / Booster at age 16 years
Influenza (Yearly) [4]		
Pneumococcal Vaccine [5]		
Hepatitis A (HepA) Vaccine Series [6]		
Hepatitis B (HepB) Vaccine Series		
Inactivated Polio Vaccine (IPV) Series		
Measles, Mumps, Rubella (MMR) Vaccine Series		
Varicella Vaccine Series		

These shaded boxes indicate when the vaccine is recommended for all children unless your doctor tells you that your child cannot safely receive the vaccine.

These shaded boxes indicate the vaccine should be given if a child is catching-up on missed vaccines.

These shaded boxes indicate the vaccine is recommended for children with certain health conditions that put them at high risk for serious diseases. Note that healthy children **can** get the HepA series [6]. See vaccine-specific recommendations at www.cdc.gov/vaccines/pubs/ACIP-list.htm.

FOOTNOTES

[1] Tdap vaccine is recommended at age 11 or 12 to protect against tetanus, diphtheria and pertussis. If your child has not received any or all of the DTaP vaccine series, or if you don't know if your child has received these shots, your child needs a single dose of Tdap when they are 7-10 years old. Talk to your child's health care provider to find out if they need additional catch-up vaccines.

[2] All 11 or 12 year olds – both girls and boys – should receive 3 doses of HPV vaccine to protect against HPV-related disease. The full HPV vaccine series should be given as recommended for best protection.

[3] Meningococcal conjugate vaccine (MCV) is recommended at age 11 or 12. A booster shot is recommended at age 16. Teens who received MCV for the first time at age 13 through 15 years will need a one-time booster dose between the ages of 16 and 18 years. If your teenager missed getting the vaccine altogether, ask their health care provider about getting it now, especially if your teenager is about to move into a college dorm or military barracks.

[4] Everyone 6 months of age and older—including preteens and teens—should get a flu vaccine every year. Children under the age of 9 years may require more than one dose. Talk to your child's health care provider to find out if they need more than one dose.

[5] Pneumococcal Conjugate Vaccine (PCV13) and Pneumococcal Polysaccharide Vaccine (PPSV23) are recommended for some children 6 through 18 years old with certain medical conditions that place them at high risk. Talk to your healthcare provider about pneumococcal vaccines and what factors may place your child at high risk for pneumococcal disease.

[6] Hepatitis A vaccination is recommended for older children with certain medical conditions that place them at high risk. HepA vaccine is licensed, safe, and effective for all children of all ages. Even if your child is not at high risk, you may decide you want your child protected against HepA. Talk to your healthcare provider about HepA vaccine and what factors may place your child at high risk for HepA.

For more information, call toll free 1-800-CDC-INFO (1-800-232-4636) or visit http://www.cdc.gov/vaccines/teens
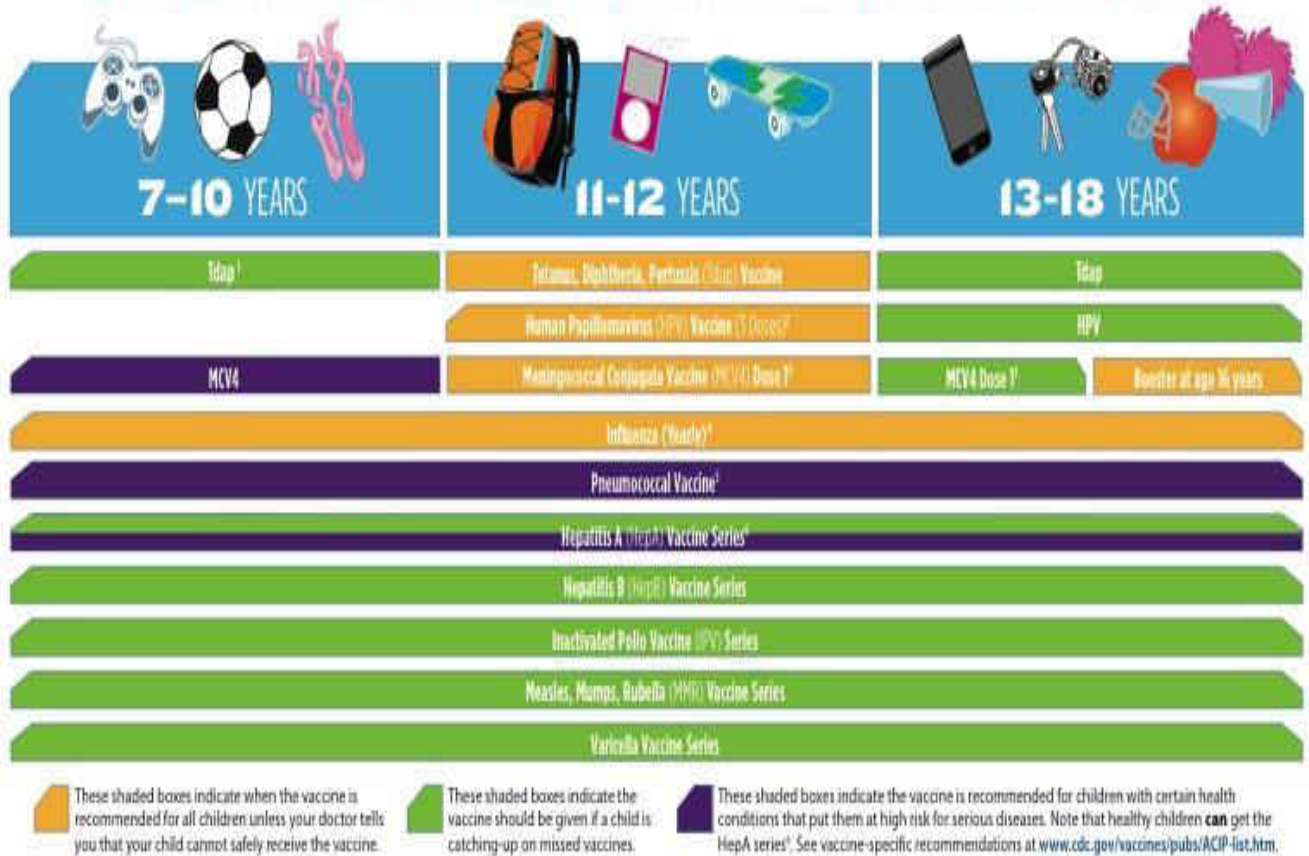
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