2015

# The Association of Maternal Health Literacy Levels and Preterm Birth

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Walden University
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Abstract

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MSED, University of Kansas, 1999

BS, Emory University, 1994

Dissertation Submitted in Partial Fulfillment

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## Abstract

According to the CDC, each year approximately 0.06 % of the world's population dies in infancy. The March of Dimes indicated that the leading causes of infant mortality include birth defects, preterm birth, low birth weight, sudden infant death syndrome, maternal complications of pregnancy, and respiratory distress syndrome, most of which are considered preventable with access to adequate prenatal care by mothers. The goal of this study was to examine the association between maternal health literacy levels and preterm birth. This research was based on the theoretical framework of the Interaction Model of Client Health Behavior. The hypothesis for this study was that reproductive-age women with low levels of maternal health literacy would be more likely to experience a preterm birth. In this case control study, cases were defined as women delivering before 37 weeks gestation. The REALM health literacy assessment tool was used in a sample of 169 women meeting the criteria; 56 fit the case criteria and 113 fit the control criteria. The data were analyzed in SPSS using logistic regression, with preterm birth as the dependent variable, and health literacy levels as the independent variable. When comparing mothers who delivered preterm to mothers that delivered term, there was no significance difference ($p = 0.112$) with respect to maternal health literacy. There was no association between low maternal health literacy levels, as assessed by the REALM instrument, and preterm birth for English-speaking women between the ages of 18 and 35 within the metropolitan Atlanta area. This study reinforces the need to reengage health practitioners to achieve a modest understanding of the principals of health literacy and the health literacy levels of their patients to assist in maternal health improvements. A focus on the development and implementation of educational competencies for clinicians on maternal health literacy would attribute to a positive social change.

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# Dedication and Acknowledgement

My dissertation work is dedicated to my late father, Robert Henry Foppe. His humbleness, humility, and humor successfully guided me in the fulfillment of my life to this point.

I extend my thanks to Dr. Diane Neal for being my initial chair and mentor. She set a strong foundation for me to succeed. I appreciate her being there towards the end of this journey when you had no reason to stick it out on my behalf. I extend my thanks to Dr. Talmage Holmes for stepping up to be my chair and supporting me through this amazing process. His words of guidance were encouraging and his comments for my future endeavors were appreciated. My thanks to Dr. Jessica Arluck for giving me the time during work to collect the necessary data.

I extend my thanks and appreciation to my husband, Jeff for supporting this effort and being there to pick of the slack during my long hours of reading and writing. I am grateful to my Mom, Elaine and in-laws, Jim and Elaine for expressing their pride and showing their support of my efforts and dedication. Finally to my children, Chase and Brooke – I hope my effort has instilled three themes: 1) take care of yourself and take time for yourself – listen to your body, mind and heart; 2) you can have it all – friends, family, love and a career, but take time to nurture them equally; 3) be charitable – give back to yourself, your family, your friends and the community as the reward to you is everlasting. Finally, always know you can accomplish anything that you desire and know those who support you are the foundation to your success! This journey has been amazing and I look forward to my future career prospects.

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# Chapter 1: Introduction to the Study

## Introduction

Infant mortality rate (IRM) is considered an important measure of health in a population (CDC, 2004). Each year approximately 0.06 % of the world's population dies in infancy. The Centers for Disease Control and Prevention's National Center of Health Statistics suggest that infant mortality rates have not experienced a significant change since 2001. The rates have remained in the 6.0 to 7.0 per 1,000 birth range since 2001 (6.8 per 1,000 live births in 2001; 6.78 per 1,000 births in 2004; 6.75 per 1,000 births in 2007; and 6.14 per 1,000 births in 2010) in the United States alone (National Center for Health Statistics, 2012a).

The leading causes of infant mortality include birth defects, preterm birth, low birth weight, sudden infant death syndrome, maternal complications of pregnancy, and respiratory distress syndrome, most of which are considered preventable with access to adequate prenatal care by mothers (March of Dimes, 2011). Research of infant mortality rates consistently measure community health, economic efficiency, and individual well-being (Brosco, 1999). The March of Dimes Peristats (2012b) states the infant mortality rate in 2007 for the state of Georgia was 8.0 per 1,000 live births. Within Georgia's rate of 8.0 per 1,000 live births, the infant mortality rate in Atlanta was 9.3 per 1,000 live births. Statistics from 1996 through 2007 reveal that Atlanta's infant mortality rate has decreased from 12.1 to 9.3. Atlanta continues to follow the state of Georgia with its infant mortality rate, and both still lag behind the national average (March of Dimes, 2012b).

Contributing factors used to assess infant mortality include low birth weight, preterm delivery and early entry into prenatal care. These indicators are significant public

health concerns. Preterm delivery is defined as delivery prior to 37 completed weeks of gestation (CDC, 2011b). The proportion of all infants defined as preterm has risen 20% since 1990 (NCHS, 2009). A small overall increase in preterm deliveries of singleton infants has been observed from 1995 (9.8%) to 2008 (10.6%; CDC, 2011b). It is unclear if the increase is due to an increase in risk factors for preterm delivery or be due to a reflection of better prenatal management that is resulting in a decrease in miscarriages and intra-uterine deaths and allowing more women to actually deliver viable preterm babies. The determinants of preterm births are not fully known (environmental contaminants are starting to be studied) and the identified causes are often multi-factorial, including maternal health-risk conditions, environmental contaminants, socioeconomic status, smoking, and alcohol consumption.

One potential reason for the continuing problem of preterm birth is miscommunication between provider and expectant mother during prenatal care. This miscommunication could be the result of low maternal health literacy levels. Despite evidence of persistent socioeconomic and racial disparity in pregnancy outcomes, there has been little focus on improving the health literacy levels associated with these disparities (Anderson, 2006; Sword, 2003). Identifying maternal health literacy levels could contribute to improving the health outcomes for mothers and their newborn babies. The purpose of this quantitative study was to identify the maternal health literacy levels of postpartum women and determine if there was a relationship between low maternal health literacy levels and adverse pregnancy outcomes, specifically preterm birth. Maternal health literacy and the adverse pregnancy outcomes, including preterm birth, will be discussed more fully in Chapter 2. An identification of an association between

maternal health literacy and preterm birth could lead to increased efforts to improve interactions between health care providers and pregnant women. This identification could, in turn, result in positive social change due to decreased rates of all adverse pregnancy outcomes.

## Background

### Pregnancy Outcomes and Associated Factors

Prenatal care, and adequate communication between provider and pregnant women during that care, may influence several birth outcomes. Preterm birth and the related issue of low birth weight represent the leading causes of infant morbidity and mortality (Arias et al., 2003). The World Health Organization and United Nations Children's Fund (UNICEF/WHO, 2004) defines preterm birth as delivery at less than 37 weeks gestation and low birth weight as weight at birth of less than 2,500 grams (5.5 pounds). A summary report by Arias et al. (2003) reviews the existing research associating various factors that affect pregnancy outcomes. Several factors, including race/ethnicity, smoking, maternal age, parity, and prenatal infection, have been consistently associated with adverse birth outcomes (Arias et al., 2003; Buescher et al.; NCHS, 2000). The Institute of Medicine (1985) has worked to group these risk factors into categories. Table 1 shows the multifactorial risks associated with preterm births and low birth weights.

Table 1

*Maternal Risk Factors for Delivering Preterm and LBW Infants*

| Type of Maternal Risks | Maternal Factors |
|---|---|
| Demographic Risks | • Age (<17; >34)<br>• Race (black)<br>• Low socioeconomic status<br>• Unmarried<br>• Low level of education |
| Medical risk predating pregnancy | • Parity (0; >4)<br>• Low weight for height<br>• Genitourinary anomalies/surgery<br>• Chronic medical conditions: (Diabetes, chronic hypertension, renal disease)<br>• Nonimmune status for selected infections, such as rebella<br>• Poor obstetric history, including previous low birthweight infants, multiple spontaneous abortions |
| Medical risks in current pregnancy | • Multiple pregnancy<br>• Poor weight gain<br>• Short interpregnancy interval<br>• Hypotension<br>• Hypertension/preeclampsia/toxemia<br>• Infections: urinary tract infections, cytomegalovirus, rubella, chorioamnionitis, mycoplasma, bacterial vaginosis, chlamydia trachomatis<br>• First or second trimester bleeding<br>• Placental problems, such as placenta previa and placenta abruption<br>• Hyperesis<br>• Oligohydramnios/polyhydramnios<br>• Isoimmnization<br>• Uterine irritability<br>• Fetal anomalies<br>• Incompetent cervix<br>• Spontaneous premature rupture of membranes |
| Behavioral and environmental risks | • Smoking<br>• Poor nutritional status<br>• Environmental exposures: drugs and occupational hazards<br>• Stress, physical and psychosocial |
| Health care risks | • Absent or inadequate prenatal care<br>• Iatrogenic prematurity |

*Note*. Adapted from Institute of Medicine. (2007). *Preterm birth: Causes, consequences, and prevention.* National Academy Press, Washington, D.C. Published and unpublished analyses. Retrieved from www.marchofdimes.com/peristats.

The American College of Obstetrics and Gynecology and the Academy of Pediatrics define term pregnancy as completing 37 weeks of gestation and delivering after the first day of the 38th week of pregnancy. Those delivered before these periods are defined as preterm births. This group has been highly researched given the US Healthy People objective to achieve a preterm birth rate of no more than 7.6%. Within the broad category of preterm infants, those delivered between the gestational ages of 34 to 36 weeks have been identified as a cohort at increased risk for mortality and morbidity as compared to those born after 36 weeks (Davidoff & Todd, 2006).

**Prenatal Care**

Prenatal care may be the most interaction a woman has with health providers during her reproductive life. Moos (2003) created a framework model suggesting preventive health care for many women generally begins with pregnancy, intensifying throughout the pregnancy with a rapid decline in care after delivery. This loss or gap in clinical interaction may be particularly troublesome for women who have low maternal health literacy levels. Despite evidence of persistent socioeconomic and racial disparity in prenatal service utilization and pregnancy outcomes, there has been little focus on improving health literacy levels (Anderson, 2006; Sword, 2003). Lu and Prentice (2002) discuss that prenatal care serves as an opportunity to provide further health care and education to women but this assumes adequate health literacy.

The Centers for Disease Control and Prevention (2007) recently reviewed Pregnant Risk Assessment Monitoring System (PRAMS) data to learn more about preconception and interconception maternal health status. Prenatal care is a factor in pregnancy, as those women who receive earlier care tend to have less adverse birth

outcomes. Given the increased prevalence in chronic illnesses (such as obesity, diabetes, and hypertension) in the general population, the reproductive age woman is likely to be affected as well. Moos (2003) presented evidence of the increasing need for pre-conceptional counseling and prenatal care. According to HRSA, the percentage of women beginning prenatal care in the third trimester or going without prenatal care remained steady in 2005 at 3.5% (HRSA, 2010).

**Health Literacy**

Within the past 20 years, health consumer's level of health literacy has risen as a public health concern in the United States as awareness of the detrimental impact low health literacy can have on the overall health of individuals has increased (Safeer & Keenan, 2005). According to the Institute of Medicine "health literacy is the degree to which individuals have the capability to obtain, process, understand, and communicate basic health information and services needed to make appropriate health decisions" (IOM, 2004, p.31) . Healthy People 2010 was one of the main documents guiding health literacy at the federal level with Objective 11-2 calling for improved consumer health literacy (US DHHS, 2000). Healthy People 2020 continue to focus on improving health literacy with Objective HC/HIT-1 calling for improved developmental health literacy (US DHHS, 2012).

An individual's health care and quality of life can be directly affected by their health literacy skills (American Medical Association, 1999). Low health literacy has a negative effect on individuals regardless of their age, race, education or income. The National Assessment of Adult Literacy (NAAL) identified relationships between health literacy and these factors; race with white respondents scoring better than other racial

groups and adults living below the poverty line had a lower average health literacy and (Kutner et al., 2006). Health literacy skills are needed for communication with clinicians, reading and understanding health information, medical compliance, and making decisions about treatment options.

Nielson-Bohlman et al. (2004) stated that health literacy deficits are a significant barrier to health care. Ratzan and Parker (2000) defined health literacy as the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decision. Without the ability to understand healthcare information, an individual cannot make informed decisions regarding their healthcare options.

An American Medical Association report (1999) which stated that poor health literacy is a stronger predictor of health than age, income, employment status, education level, and race, focused attention on health literacy as a public health issue. Research has shown direct links between health literacy and health outcomes. Nielson-Bohlman et al. (2004) found that individuals identified with limited health literacy also showed poorer health status and were less likely to use preventive care. Baker et al. (1998; 2002) and Schillinger et al. (2002) found that individuals with low levels of health literacy were more likely to require hospitalization and to experience negative disease outcomes. Within a Medicare managed care setting, researchers found that, after controlling for relevant factors, lower health literacy scores were associated with higher mortality rates (Baker et al., 2007). Wiess (1999) found that adults with low health literacy are less likely to comply with prescribed treatment and self-care regimens, more likely to commit medication or treatment errors, and less able to navigate the healthcare system. This

evidence from past health literacy research suggests that literacy is an independent factor in health outcomes. Individuals with adequate health literacy skills are able to take health information they receive and use it to aid in the improvement of their health outcomes. Health literacy skills are needed for communication with health providers, reading and understanding health information, medication compliance, using medical devices and making decisions about treatment options (Nielsen-Bohlman, Panzer, & Kindig, 2004).

The National Center for Education Statistics (2003) determined that 50% of the U.S. adult population (90 million people) had poor to inadequate health literacy skills. As well, healthcare providers are typically not aware of the health literacy levels of their patients. This topic was examined and reported on by the Institute of Medicine in 2004. Their report titled *Health Literacy: A Prescription to End Confusion* (Nielson-Bohlman, Panzer, & Kindig, 2004) was the first multidisciplinary approach to address the origins, consequences, and potential solutions of this health literacy discrepancy. The ultimate result of this report was an acknowledgement of the importance of health literacy assessment of all health care consumers. Adequate health literacy will enable them to be active participants in their health care to improve health outcomes.

**Health Literacy, Prenatal Care, and Pregnancy Outcomes**

An individual's relationship with the healthcare system is unique to each person. Early in life, their introduction to the healthcare system is via their parents through annual check-ups and school physicals. Additional interaction with the healthcare system is dependent upon healthcare needs (Neilsen-Bohlman, Panzer, & Kindig, 2004). For some women of reproductive age, a pregnancy is the first contact with a healthcare system (Ferguson, 2008). Health literacy has a direct impact on many health outcomes,

including pregnancy. How a pregnant woman obtains, processes, and understands basic health information about her pregnancy can depend upon her level of health literacy (Bennett et al., 2006; Endres et al., 2004). Her level of health literacy may directly influence her healthcare decisions, ultimately affecting her pregnancy outcomes. Failure to assess a mother's health literacy level may result in misunderstandings of noncompliance for adequate prenatal care, that is, failed communication may result in inadequate care and this in turn may lead to adverse birth outcomes. Bennett et al. (2006) identified an association between low health literacy and poor prenatal care utilization. Endres et al. (2004) determined that health literacy levels of pregnant women with diabetes influenced poor birth outcomes (miscarriage, still-birth, preterm birth, or congenital anomaly). To have a positive pregnancy outcome, health literacy levels need to be assessed and accommodated for during prenatal care.

**Assessment of Health Literacy**

There have been numerous research studies that assessed individual health literacy levels (Agency for Healthcare Research and Quality, 2004; American Medical Association, 1999). There are many characteristics to consider during a health literacy assessment including, but not limited to, cognitive reading and reasoning ability, language, religion, culture, access to medical care, and income. Also, patient printed educational materials are often not written at the appropriate reading level for ease of understanding. Assessments of patient literacy have been in existence since the early 1990s. Some of the most widely used assessments for health literacy research include the National Assessment of Adult Literacy (NAAL), Test of Functional Health Literacy in Adults (TOFHLA), and the Rapid Estimate of Adult Literacy in Medicine (REALM). A

health literacy component was incorporated with the 2003 NAAL and is considered the first large scale national assessment of health literacy conducted in the United States (National Center for Education Statistics, 2003). Because the NAAL is a national assessment, it is not appropriate for use in smaller scale research. The TOFHLA is a health literacy assessment that determines an individual's ability to read health-related materials (Parker et al., 1995). The TOFHLA typically takes 22 minutes to administer.

One of the primary assessments is the Rapid Estimate of Adult Health Literacy (REALM) developed in 1991 (Davis et al., 1991). The REALM assesses literacy levels by measuring word recognition and pronunciation. The REALM has been used as an assessment tool for health literacy in many areas of medicine including access to care, depression, hypertension, and diabetes mellitus among various populations.

## Problem Statement

New mothers face a host of health issues and challenges during their pregnancy and following the birth of their baby (Anderson, 2006). The assessment of maternal-child health is one of the key measuring tools for determining the well-being of any community. Indicators such as infant mortality, gestational age, low birth weight, and early entry into prenatal care have been identified and used throughout the nation to assess maternal-child health (March of Dimes, 2011). The prevalence of infant mortality has not changed significantly since 2000. Rates of low birth weight and preterm birth have also held steady over that same period. Entry into prenatal care is not occurring as early in a pregnancy as is recommended. Prenatal care, specifically designed to aid in the reduction of infant mortality, has not had the desired effect. There are many factors (environmental, behavioral, economic, psychosocial) that have been researched as

reducing the effectiveness of prenatal care in influencing pregnancy outcomes, including the timing of the care and the effectiveness of the interactions between the provider and the client.

One factor, related to the effectiveness of prenatal care, that has had limited focus is maternal health literacy. Limited functional maternal health literacy could affect young, low-income, pregnant women who have a high need for health information and resources to insure a healthy birth outcome. While attention continues to be focused on the health of women during pregnancy, there is a need to understand the maternal health literacy levels of these women. Researchers do not know if maternal health literacy levels of recently delivered women affect their delivery outcomes. The maternal health literacy level may affect how a person proceeds through pregnancy. Adequate maternal health literacy facilitates an understanding of resources needed during pregnancy.

## Purpose of Study

Renkert and Nutbeam (2001, p. 382) defined maternal health literacy as "the cognitive and social skills which 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". The specific aim of this quantitative study was to identify the maternal health literacy levels among postpartum women between the ages of 18 and 35 within the metropolitan Atlanta area and compare their maternal health literacy levels (independent variable) to their pregnancy outcomes (dependent variable), specifically preterm birth as defined by gestational age. To achieve this, I obtained the gestational age of infants born to a cohort of nulliparous women that presented for a singleton delivery at a teaching hospital in Atlanta, Georgia and to identify cases and matched controls based

on that information. I assessed the functional maternal health literacy of these postpartum women.

## Research Question and Hypotheses

For this study, the research question was: Is there an association between the maternal health literacy levels of recently delivered women and the preterm birth of their infants?

*Null Hypothesis*: There is no association between low maternal health literacy levels, as assessed by the REALM instrument, and preterm birth for English-speaking women between the ages of 18 and 35 within the metropolitan Atlanta area.

*Alternative Hypothesis*: There is an association between low maternal health literacy levels, as assessed by the REALM instrument, and preterm birth for English-speaking women between the ages of 18 and 35 within the metropolitan Atlanta area.

## Theoretical Framework

The epidemiologic triangle consists of three essential characteristics: host, agent, and environment (Mausner & Bahn, 1974). In this study, I used analytical epidemiology to test a hypothesis about maternal health literacy as an inherent characteristic of women as a cause of adverse birth outcomes. I based this research and the theoretical framework on the Interaction Model of Client Health Behavior (IMHCB). IMHCB is a nursing model developed by Cox (1982) based on the prescriptive theory for health behavior. The model, however, is applicable to multiple types of health care settings (Matthews, 2008).

IMHCB addresses the demographic makeup of individuals along the client-health practitioner interaction. The IMCHB model was created to address research and practice in a framework that would recognize the client's individuality and uniqueness towards

their health behavior, guiding client-health professional interactions thus allowing for therapies to be individually tailored regarding health needs (Cox, 1982). The IMCHB model provides a clear theoretical framework for guiding research in maternal health. This theory assists in identifying, defining and measuring variables pertaining to maternal health.

## Nature of the Study

This study was a quantitative, case control design. I used a convenience sample of a cohort of recently delivered women to explore the relationship between the pregnancy outcome of preterm birth based on gestational age and the maternal health literacy levels of recently delivered women. I used the Rapid Estimate of Adult Literacy (REALM) instrument to assess the patient's ability to read basic health related terminology. REALM is a word recognition/pronunciation test that assesses an adult's ability to read common medical words for body parts and illness (Murphy et al., 1993). The REALM instrument is one of the most widely used health literacy measures and focuses on print literacy (Davis, 1993). Numerous studies have demonstrated the reliability and validity of the REALM (Davis et al., 1993; Davis et al., 1991; Ibrahim et al., 2008; Shea et al., 2004).

I developed and implemented a simple data collection tool (Appendix A) based upon questions available from the Behavioral Risk Factor Surveillance System (BRFSS) survey tool (CDC, 2011) to collect demographic information through patient interviews. I also conducted a chart review to collect information on pregnancy outcomes and prenatal history. The demographic information included mother's age at delivery, race/ethnicity, educational attainment, health insurance coverage, and income.

Information extracted from the medical record included by the number of prenatal care visits, the delivery method (vaginal delivery or cesarean delivery), gestational age of newborn, APGAR score of newborn and birth weight of the newborn.

The source of the research population was a cohort of women between the ages of 18 and 35, within the metropolitan Atlanta area. This population typically includes Caucasian, African American, and Hispanic women. The target population was English speaking and reading women, between the ages of 18 and 35, who delivered at a teaching hospital in the Atlanta Metro Area. I provide more specific details pertaining to the nature of this study in Chapter 3.

## Definition of Terms

*Health literacy* – Health literacy is 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 & Parker, 2000).

*Maternal health literacy* – Renkert and Nutbeam (2001, p. 381) defines maternal health literacy as "the cognitive and social skills (that) determine the motivation and ability of women to gain access to, understand, and use information to ensure positive health outcomes for them and their children". For this study, the term will be used as a modifier to identify the population being studied and therefore comparable with the term "health literacy".

*Health outcome* – Health outcome is consequence or result of an action or intervention. These outcomes may be positive, as in a healthy mother and baby after delivery, or negative, as in fetal demise.

*Prenatal care* – Adequate prenatal care is the number and percent of pregnant women who received early prenatal care (care in the first thirteen weeks of pregnancy) and regular prenatal care (10 or more prenatal care visits; March of Dimes, 2008).

*Prenatal care visits* – Medical care that is given to the pregnant woman by a clinician before delivery.

*Birth weight* categories as defined by March of Dimes (2011):

- high weight (HBW) more than 4500 g
- normal weight (NBW) 2500 g- 4500 g
- low weight (LBW) less than 2500 g
- very low weight (VLBW) less than 1500 g

*Gestational age* – Gestational age is the calculated the number of weeks since the first day of an expecting mother's last menstrual period.

*Parity* - The number of times a woman has given birth to a baby after 24 weeks.

*Term birth* – A birth that occurred between 37 and 41 completed weeks of gestation.

*Preterm birth* – A birth that occurred before 37 completed weeks of gestation.

*Very preterm birth* – A birth that occurred between 34 and36 completed weeks of gestation.

*Postpartum women* – Women who delivered a singleton at least 24 hours prior to being asked to participate in this study.

## Assumptions

The study is based on the following assumptions:

- I assumed that health literacy was measurable. Haun et al. (2009) published the measurement variations of the commonly used health literacy tools. The REALM instrument provides a performance-based measure of one's health literacy level.
- I assumed that the REALM instrument will be correctly administered based upon the user manual provided with the survey cards and collection sheets.
- Health literacy was assumed to be highly individual. I assumed that the participants will answer the questions honestly. I assumed health literacy level is not highly unstable prior to or following birth.
- I assumed that Health literacy, measured after delivery, was highly correlated to Health literacy during the duration of the pregnancy.
- The medial records were assumed to be accurate and the chart data is thought to correctly describe the reality of care for the women as it is accepted policy that if something was not recorded in the chart it was not done or did not occur.

## Scope and Delimitations

The results of this study are not generalizable to the United States reproductive age female population for various reasons; the Spanish speaking populations was underrepresented in the sample population; the sample population was collected from one hospital setting in the community; the sample population was only between the ages of 18-35.

Delimitations of this study were as follows:

- The population of reproductive age women, 18 – 35 years of age at the time of the study, were selected from a large urban city/county teaching hospital in Atlanta, Georgia.

- Postpartum women included in the study were documented as English speaking and reading.
- Only nulliparous, postpartum women with a singleton delivery were included in this study.
- Only postpartum women that self-reported as non-smokers and non-alcoholic drinkers were included in this study.
- Lastly, Spanish speaking postpartum women were excluded from the sample population because the REALM instrument chosen is in English.

## Limitations

The components of this study allowed for the assessment of maternal health literacy and pregnancy outcomes. The design of the data collection allowed for the analysis of the stated hypotheses; however, there were limitations to the study based on the collection methods. The following were limitations to validity and generalizability of the study results:

- All of the study participants were identified at an Atlanta metro area teaching hospital; therefore, the results of the study do not be reflective of those who live in a rural area, other areas of the city, or other regional/national areas.
- The data were collected during a single interaction (or visit) therefore, the data do not reflect maternal health literacy over time.
- The case-control nature of the study prohibited the identification of a causal relationship. I was only able to identify an association between maternal health literacy and birth outcomes.

- Participants who enrolled in the study were not randomly selected, raising the possibility of selection bias.
- The use of a convenience sample limited the representativeness of the sample and introduces the potential for self-selection bias.

## Significance of Study

Researchers have determined health literacy deficits are a significant barrier to health care (e.g., Nielson-Bohlman, Panzer, & Kindig, 2004). An individual can struggle with making an informed decision about their health care if they do not have the ability to understand healthcare information. Low health literacy attributes to economic inefficiency within the health care system. A report on the National Assessment of Adult Literacy Survey (Vernon et al., 2007) estimated the cost of inadequate health literacy at $106 - $238 billion annually.

Researchers have also identified an association between low health literacy and poorer health status, diminished use of preventive care, increased hospitalization, and decreased compliance with treatment and medication use (Nielson-Bohlman, Panzer, & Kindig, 2004; Weiss, 1999, Baker et al., 1998). Minimal research has been conducted on maternal health literacy as a factor of pregnancy outcomes. While the health of women during pregnancy continues to be a focus, there is a need to understand the maternal health literacy levels of these new mothers.

The health of a mother and her infant are dependent on many aspects of the women's life, but the direct social influences on maternal and child health can be loosely categorized as stemming from a few key concepts (Headley & Harrigan, 2009):

- pregnancy and child care knowledge

- behavior or a lack of positive behavior influences
- social isolation or a lack of childcare and pregnancy support and
- economic disadvantage or a lack of financial support.

With research continuing to focus on the health of women during pregnancy, there is a need to understand the maternal health literacy levels of these new mothers. Identifying the maternal health literacy level of recently delivered women could assist in creating/establishing educational techniques for pregnant women to become actively involved in their health and the health of their unborn baby to improve their pregnancy outcomes.

Awareness of a patient's health literacy through increased focus on the issue and accurate measurements may result in their increased understanding of their health and healthcare needs. This could ultimately increase their autonomy and empowerment in their self-care. These efforts would engender positive social change. The REALM is a fast, simple means of ascertaining health literacy levels in patients and could be incorporated into prenatal care.

Clinicians, who become aware of a patient's health literacy needs through the increased focus on this issue and the identification of the consequences of low health literacy on birth outcomes, may seek opportunities for education and training on ways to increase health literacy among the population they serve. I anticipated that the results of this study could be used as a framework for the development of an educational model and/or printed educational materials for prenatal and labor/delivery wards to improve maternal health literacy levels among pregnant women, thereby improving pregnancy outcomes.

## Summary

This chapter included the relevant components of this study. Researchers have identified various factors that are associated with the adverse pregnancy outcome of preterm birth. A potential factor with limited research is whether maternal health literacy levels of delivered mothers are associated with this and other related pregnancy outcomes. The rates of preterm delivery and related low birth weight remain steady. Pregnancy and childbearing in the last quarter of the twentieth century is generally thought to be a healthy and happy choice made by many families. Awareness of the potential of improved maternal health literacy to promote healthier lifestyles for women of childbearing age is a step to improving pregnancy outcomes. Puchner (1995) recognized the importance of women as a focus on improving health literacy, as they are critically important for promoting the health of their children and families. Health care providers can implement maternal health literacy awareness efforts for families and work cooperatively with other agencies and health care providers to promote maternal health literacy.

In Chapter 2, I provided an exploration of the available literature relevant to the dependent variable of this study, gestational age. I also presented literature related to the theoretical foundation and the methodology for this study. Additionally, I reviewed the literature related to the independent variable of this study to include an overview of health literacy, effects of health literacy on health outcomes, and more specifically effects of health literacy on women's health outcomes. Finally, I identified areas where research is still needed and demonstrate how my research will contribute to the existing body of knowledge.

In Chapter 3, I presented the rationale and concept of the study design. I explained the case control study design approach involving women presenting for delivery at a metro-area teaching hospital in Atlanta, Georgia. Further, I provided the specific plans for data collection and analysis, as well as how I ensured patient confidentiality. In Chapter 4, I presented the results of the study including the univariate analysis, bivariate analysis, and multivariate statistics. In Chapter 5, I presented the discussion and interpretation of the findings of the study.

# Chapter 2: Literature Review

## Introduction

Despite evidence of persistent socioeconomic and racial disparity in prenatal service utilization and pregnancy outcomes, there has been little focus on improving health literacy levels, which have been theorized as contributing to this disparity (Anderson, 2006; Sword, 2003). Identifying and improving maternal health literacy levels could contribute to improving the health outcomes for mothers and their newborn babies. In this study, I explored whether an association existed between the maternal health literacy levels of recently delivered mothers and birth outcomes, specifically preterm birth.

In this chapter, I first present my search strategies. Next, multiple theories of health and health behaviors were examined to explain the hypothesized relationship between maternal health literacy and birth outcomes. I reviewed literature related to this theoretical framework to explicate the concepts that shape my hypothesis. This review continued with literature related to pregnancy outcomes, specifically preterm delivery rates and birth weight rates, as well as some of the contributing factors associated with these outcomes. I also reviewed the literature on the association of health literacy levels to health outcomes, in general, and then more specifically in the health outcomes of women.

In addition, I explored the survey instruments used to determine health literacy levels in order to rationalize the choice of survey instrument for this study. Finally, I reviewed studies using the methodology explained for this research. Examining maternal health literacy levels and comparing these levels to pregnancy outcomes could identify

the need for changes in patient/physician communication during prenatal care that could ultimately improve birth outcomes.

## Search Strategy

I conducted a systematic search and review of recent literature to examine study results relevant to my study. This search encompassed behavioral science, epidemiological, medical, and nursing literature. Identification of relevant literature consisted of a focused MEDLINE and CINAHL Plus, Cochrane Library, and PROQUEST database search for the period 1990 through 2010. I searched these databases using a variety of key terms, limited to English studies. Key word searches included: *health literacy, literacy, maternal health literacy, literacy assessment tools, birth weight, low birth weight, gestational age, preterm delivery, prenatal care, gestational age,* and *pregnancy outcomes*. I placed specific focus on research studies conducted in the United States on health literacy and health outcomes. I also obtained several books on health literacy to achieve a thorough understanding of health literacy as it pertains to public health and medicine. The purpose of this literature review was to summarize what is known about pregnancy outcomes specific to birth weight and gestational age, the association between health literacy and general health outcomes, and health literacy and maternal health outcomes.

## Theoretical Framework

The epidemiologic triangle consists of three essential characteristics: host, agent, and environment (Mausner & Bahn, 1974). Host factors can be personal traits, behaviors, genetic predisposition, and immunologic factors that influence the chance for disease or its severity. The agents can be biological, physical, or chemical and are necessary for

disease to occur. The environment consists of external conditions of the physical, biologic, or social. The environment contributes to the disease process.

The theoretical framework that I used in this study was based on analytical epidemiology. It informs my hypothesis that maternal health literacy is an inherent characteristic of women and low maternal health literacy may be related to adverse birth outcomes. Analytic epidemiology is built around the analysis of a relationship between two items: exposures and effects (Merrill, R., & Timmreck, T., 2006). Health literacy level would be the exposure or inherent characteristic of the host that can affect vulnerability to other exposures. In this study, I identified the pregnancy outcomes (specifically gestational age) of their infants, the maternal health literacy level of postpartum mothers, and what association existed between these variables.

Paasche-Orlow and Wolf (2007) created a causal pathway explaining the established associations between health literacy and health outcomes. Figure 1 includes a visual of the causal pathways incorporating both individual and system-level factors that take the component-cause approach typically taken in epidemiological research.

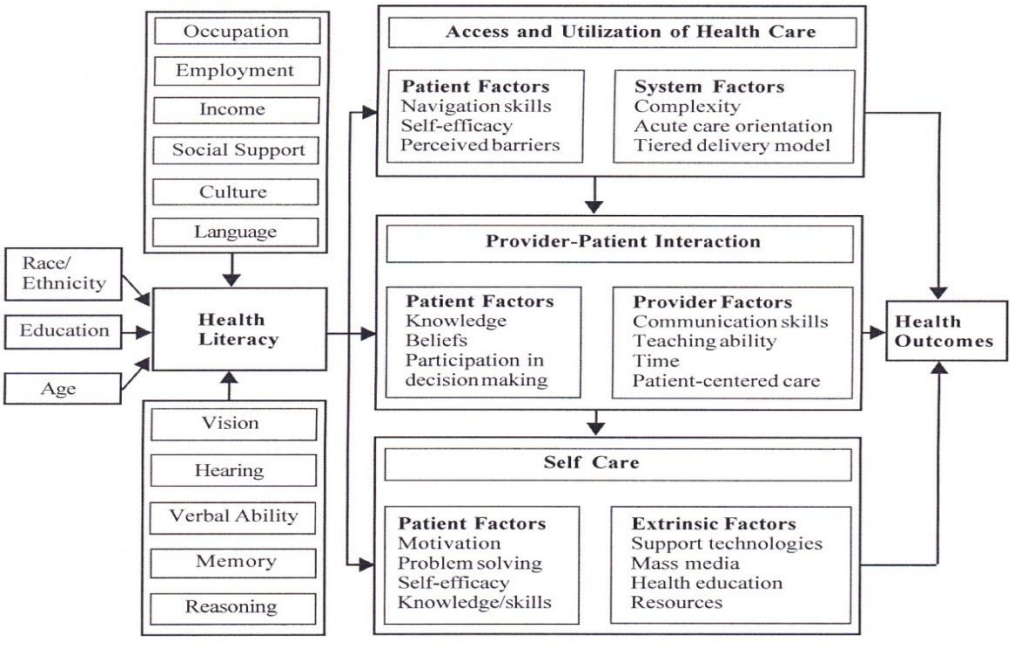


*Figure 1*. Causal pathways between limited health literacy and health outcomes as depicted by Paasch-Orlow & Wolf (2007). Adapted from Paasche-Orlow, M.K., & Wolf, M.S. (2007). The causal pathways linking health literacy to health outcomes. *American Journal of Health Behavior, 31*, 19-26.

This model represents the direct pathways between health literacy and health outcomes and identifies various factors that are associated or thought to influence health literacy. In addition, the model presented by Paasche-Orlow and Wolf (2007) proposes health literacy as a fixed characteristic, not subject to change over time. For the purposes of this study, health literacy was studied as a fixed characteristic as well.

The epidemiologic homeostasis of this study incorporated the Health Belief Model (HBM; Glanz, 1997) and Interaction Model of Client Health Behavior (IMCHB; Cox, 1982). The Health Belief Model is a widely known and accepted theory that attempts to explain and predict health behaviors as they relate to maternal health. These theories propose that decision-making behaviors depend upon social cognitive characteristics and interrelationships of pregnant women. With maternal health, it is

imperative to propose theories that explicate those factors that affect the expectant mothers' decision-making while engaging in prenatal care.

Health promotion models, such as the Health Belief Model can be used to assist health care providers in developing a plan of care for women with low maternal health literacy. The Health Belief Model concept was derived in the 1950s by a group of social psychologists at the U.S. Public Health Service (Glanz, 1997). The Health Belief Model is based upon intrapersonal factors meaning those which occur within the person (i.e. their attitudes and beliefs). HBM is based on the understanding that a person will take a health-related action only if they possess some level of relevant knowledge and motivation (perceived susceptibility), perceive the condition as threatening (perceived severity), have a positive expectation that by taking a recommended action (perceived benefits), he or she will avoid a negative health condition (perceived barriers) and believe that he or she can successfully take a recommended health action (cue to action and self-efficacy; Becker, 1974). These six constructs are beneficial for designing behavior change strategies associated with maternal health. Figure 2 outlines a concept of one's maternal health literacy level to guide the constructs of the HBM on the maternal outcomes of birth weight and gestational age.

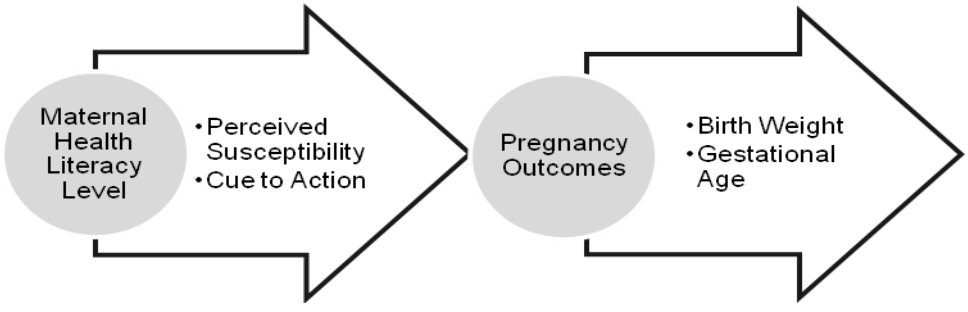


*Figure 2*. Concept of maternal health literacy to guide the health belief model adjusted from Becker's (1974) model to address maternal outcomes. Adapted from Renkert and Nutbeam (2001).

By using the concept of one's health literacy to guide the HBM, attention can focus on the development of skills to make choices that improve a health outcome. Renkert and Nutbeam (2001, p. 381) define this as maternal health literacy where "the cognitive and social skills determine the motivation and ability of women to gain access to, understand, and use information to ensure positive health outcomes for them and their children." Pregnancy for a woman is a time when she may perceive risk in her health or the health of her baby. If a pregnant woman believes her health or the health of her baby will benefit by accessing adequate prenatal care, she will be motivated to do so. An individual's level of health literacy can influence their perceived susceptibility. Specifically within the HBM, perceived susceptibility (level of relevant knowledge) can be applied to maternal health literacy, assuming a pregnant woman will become more concerned about her health when she perceives there is a risk (Janz, Champion, & Strecher, 2002).

More specific to this study was the incorporation of the theoretical framework of Interaction Model of Client Health Behavior (IMHCB). The variables of the IMHCB

were consistent with the predictors of the HBM (Carter & Kulbok, 1995). IMHCB is a nursing model developed by Cox (1982) based on the prescriptive theory for health behavior. The model, however, is applicable to multiple types of health care settings (Matthews, 2008). Carter and Kulbok (1995) conducted a systematic review identifying of the IMHBC model as a valuable theoretical framework for research and practice. They suggested integrating the IMHCB model into other healthcare disciplines to determine its translatability. The IMHCB theoretical model is depicted in Figure 3. As in the adaptation of this model by McLaughlin (2008), the health literacy outcome will be incorporated.

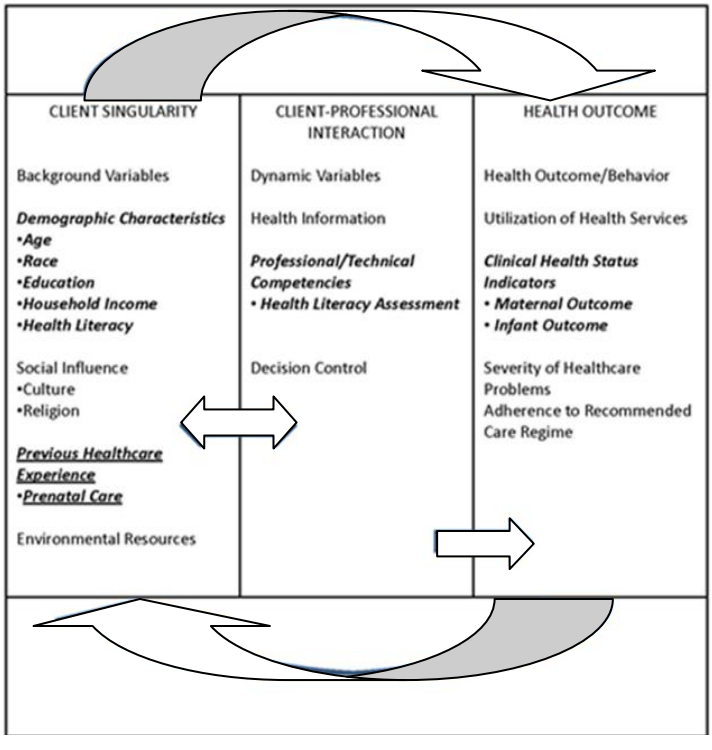


*Figure 3*.Adaptation for this study of Cox's interactive model of client health behavior via McLaughlin (2008) depicted in italics. Underlined components are new to this study. Bold indicates our study elements. Adapted from Cox, C.L., An Interaction Model of Client Health Behavior. Theoretical prescription for nursing. *Advances in Nursing Science, 1982. 5*: p. 41-56.

IMHCB addresses the demographic makeup of individuals along the client-health practitioner interaction. The IMCHB model was created to address research and practice in a framework that would "recognize the client's individuality and uniqueness" towards their health behavior, “guiding client-health professional interactions” thus allowing for therapies to be "individually tailored” regarding health needs (Cox, 1982). Client health behavior is influenced by the healthcare provider through the provision of health information, emotional support, and assistance in decision-making that would include maternal health literacy.

There are three main components of the IMHCB model: client singularity, client-professional interaction, and health outcome (Cox, 1982). Client singularity addresses what the client brings to the interaction. This component consists of a wide range of client background variables (demographics, social influences, previous healthcare experiences, culture, religion, socioeconomic status and environmental resources). A specific health behavior can be identified based upon the interaction of these background variables. This study included the demographic variables of age, race, education, prenatal care, and household income to describe the sample.

The client-professional interaction component focuses on the needs of a client from the healthcare provider perspective. These variables focus on what the healthcare provider offers, including emotional support, health information, decisional control, and professional/technical competencies. The model recognizes the interaction of these variables with the background variables from the individual. This study focused on the technical competency piece and used a health literacy assessment (i.e., REALM) to identify the outcome variable of the level of maternal health literacy of the sample. In this

study, I examined elements of client singularity, which may or may not affect maternal health literacy levels (the interaction component), which in turn may or may not affect the studied birth outcomes (the health outcomes component).

The health outcomes component addresses the goals and results of the interaction that the client has with the healthcare system. The IMHCB model identifies the need for at least one health outcome. This study was concerned with the infant health outcomes post pregnancy to ascertain any association between levels of maternal health literacy and pregnancy outcomes. The significance of assessing the maternal health literacy of postpartum women could result in interventions tailored to a level of understanding to change health behaviors and ultimately health outcomes during pregnancy.

## Pregnancy Outcomes

One of the key measuring tools for determining the well-being of any community is the assessment of maternal-child health. Indicators used to assess maternal-child health include infant mortality, preterm birth, low birth weight and early entry into prenatal care. These indicators are significant public health concerns.

### Infant Mortality

Infant mortality is an important indicator of a nation's, a state's, or a community's health. The infant mortality rate is defined as the number of infants who die between birth and one year of age per 1,000 live births. The U.S. infant mortality rate is higher than the rate in most developed countries (NVSS, 2011). There has been minimal change in the recent trend in infant mortality rates in the United States.

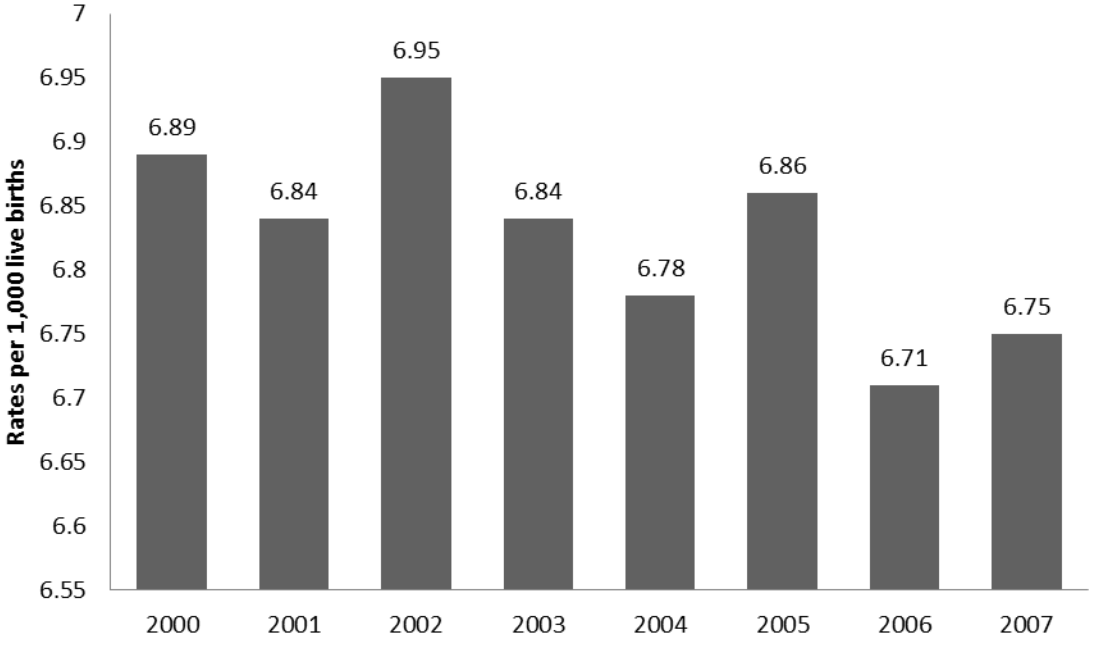


Figure 4: Infant Mortality Rate: United States, 2000-2007. Source: NVSS, Vol. 59, June, 2011

Figure 4 above depicts the recent infant mortality rates in the United States from (NVSS, 2011). Georgia's infant mortality rate stands higher at 8.1 in comparison to the national rate of 6.75 per 1,000 live births (Kaiser Family Foundation, 2011). To understand the factors in infant mortality rates, Byrd et al. (2007) researched the Wisconsin Interactive Statistics. They identified racial disparities in infant mortality and increasing maternal education attainment would improve infant mortality rates but not correct the black/white disparity in infant mortality. Preterm birth and low birth weight represent the leading causes of infant morbidity and mortality (Arias et al., 2003). Despite recent advances in medical technology, preterm birth and low birth weight continue to increase, reaching 12.0% and 7.8% of births respectively (Arias et al., 2003). Research is still identifying the causes of these adverse reproductive outcomes, and our ability to

predict and prevent these occurrences remain weak (Goldenberg & Rouse, 1998; Johnston, Williams, Hogue, & Mattison, 2001). Several factors including racial status, smoking, maternal age, parity, and prenatal infection have been consistently associated with adverse birth outcomes (Arias et al., 2003; Buescher et al., 1998; NCHS, 2000). Yet these factors do not fully account for the incidence of preterm birth and low birth weight.

**Preterm Birth**

Preterm birth is another marker of poor pregnancy outcome. Preterm birth is defined as delivery less than thirty-seven weeks gestation. Martin et al. (2009) reported a 20% increase in preterm birth rates from 1990 to 2006. The main data source for preterm birth rates is the National Center for Health Statistics (NCHS). The 2006 data from NCHS shows the rate of preterm births rising since 1990, from 6.8 to 8.1 % (Martin et al., 2009). Healthy People 2010 recommended that the rate of preterm birth be no higher than 7.6% of all live births (Department of Health and Human Services, 2007). That goal was not met in 2010. This calls for researchers to take a fresh look at what is driving this epidemic. This study will focus on maternal health literacy and the role it may have.

Preterm birth has been associated with minority racial status (Ahern et al., 2003; Rosenberg, Palmer, Wise, Horton, & Corwin, 2002; Demissie et al., 2001). As well, preterm birth has been associated with low socioeconomic status (Nagahawatte & Goldenberg, 2008; Davitz et al., 2004; Ahen et al., 2003; Kramer et al., 2001). MacDorman and Mathews (2008) contribute the increasing preterm birth from 2000 (1.93%) to 2005 (2.03%) as accounting for much of the lack of decline in the United States infant mortality rate.

There were 4,247,694 births in the United States and 146,603 Georgia in 2008 (March of Dimes, 2011). Preterm births (<37 weeks of completed gestation) in the United States accounted for 452,275 (11.6%) births in 1998 and 523,033 (12.3%) births in 2008. According to recent trends, the preterm birth rate has risen by more than 20 % (from 6.8 to 8.1 %) in the United States between the years of 1990-2006 per the National Center for Health Statistics (Martin et al., 2009).

In Georgia, the preterm birth rate has risen by more than 15 % between the years 1998-2008 (March of Dimes, 2011). Infants delivered at 34-36 weeks made up 74% of total preterm births while the rate of those that are very preterm (<32 weeks) has stayed the same. During this period, births at 34 weeks in the United States increased from 1.3 to 1.4 %, births at 35 weeks from 2.1 to 2.3 % and births delivered at 36 weeks from 3.4 to 4.4 % (Martin et al., 2009). This study focuses on births at an urban teaching hospital in metro Atlanta. The preterm birth rate in Atlanta was 14% in 1996 and 16.3% in 2007, which is slightly higher than Georgia. Table 2 depicts the continuous increase of preterm birth rates in Georgia and Atlanta from 1998 -2008.

Table 2

*Preterm Rates: Georgia and Atlanta, 1996-2008*

| Year | Georgia (%) | Georgia (no.) | Atlanta (%) | Atlanta (no.) |
|---|---|---|---|---|
| 1996 | 11.4 | 13003 | 14.0 | 1134 |
| 1997 | 11.6 | 13653 | 13.3 | 1115 |
| 1998 | 11.6 | 14165 | 14.0 | 1215 |
| 1999 | 12.0 | 15135 | 12.0 | 1069 |
| 2000 | 12.0 | 15819 | 12.8 | 1213 |
| 2001 | 12.6 | 16788 | 13.3 | 1241 |
| 2002 | 12.6 | 16794 | 13.2 | 1190 |
| 2003 | 13.1 | 17762 | 14.7 | 1365 |
| 2004 | 12.8 | 17703 | 15.2 | 1386 |

| | | | | |
|---|---|---|---|---|
| 2005 | 13.6 | 19324 | 15.1 | 1436 |
| 2006 | 14.1 | 20977 | 16.5 | 1605 |
| 2007 | 13.9 | 20933 | 16.3 | 1436 |

*Note:* From National Center for Health Statistics, final natality data. Retrieved from www.marchofdimes.com/peristats.

These birth outcomes have risen among mothers of all ages with the largest increases occurring in groups less than 20 and greater than 40 years of age. In addition, current vital statistics suggest that between the years 1990-2006, preterm births were highest for women ages 40 and older (16.8%), followed by women under the age 20 (14.7%), ages 30-39 (12.7%) and ages 20-29 (12.1%) (Engel, 2006). Table 3 depicts the average preterm percentages by maternal age for the United States and Georgia for 2006-2008 (March of Dimes, 2011). In regards to race, non-Hispanic black mothers had more than a 50 % likelihood of having a late preterm delivery as compared to non-Hispanic white mothers and one-third more likely than Hispanic mothers (Martin et al., 2009; Joseph et al., 2002).

Table 3

*Preterm Birth Percentages by Maternal Age: US and Georgia, 2006-2008 Average*

| Age | US (%) | Georgia (%) |
|---|---|---|
| <20 | 14.5 | 15.2 |
| 20-29 | 12.0 | 13.4 |
| 30-39 | 12.6 | 13.7 |
| >=40 | 17.1 | 18.3 |
| Total | 12.6 | 13.8 |

*Note:* From National Center for Health Statistics, final natality data. Retrieved from www.marchofdimes.com/peristats.

At least 12.8 % of births in the United States are classified as preterm (Engel, 2006). The 2006-2008 data on preterm birth rates in the United States as well as Georgia were highest for black infants (18.1%) when compared to other racial/ethnic groups, 12.1% for Hispanics and 11.6% for whites (March of Dimes, 2011). Additionally, the risk for preterm birth significantly varies in African American and white women by poverty level and attained educational (Savitz et al., 2004). Table 4 depicts the average preterm birth percentages by race for the United States and Georgia for 2006-2008 (March of Dimes, 2011).

Table 4

*Preterm Birth Percentages by race: US and Georgia, 2006-2008 Average*

| Race | US (%) | Georgia (%) |
|---|---|---|
| White | 11.7 | 11.8 |
| Black | 17.8 | 17.7 |
| Native American | 13.9 | 13.1 |
| Asian | 10.9 | 10.4 |
| Total | 12.6 | 13.8 |

*Note:* From National Center for Health Statistics, final natality data. Retrieved from www.marchofdimes.com/peristats.

Late preterm birth is defined as the period from 34 to 36 full weeks of pregnancy (Engel & Kominiarek, 2008). Within Georgia, late preterm birth rates increased by 16%, from 7.9 in 1999 to 10.1 in 2007 (March of Dimes, 2011). Table 5 depicts the increase of late preterm birth rates in Georgia and Atlanta from 1998 -2008.

Table 5

*Late Preterm Birth Rates: Georgia and Atlanta, 1996-2008*

| Year | Georgia (%) | Georgia (no.) | Atlanta (%) | Atlanta (no.) |
|---|---|---|---|---|
| 1996 | 7.9 | 8958 | 9.3 | 756 |
| 1997 | 8.2 | 9662 | 8.9 | 748 |
| 1998 | 8.3 | 10120 | 9.3 | 808 |
| 1999 | 8.7 | 10944 | 8.1 | 723 |
| 2000 | 8.5 | 11262 | 8.4 | 795 |
| 2001 | 9.2 | 12250 | 9.2 | 861 |
| 2002 | 9.1 | 12151 | 9.2 | 827 |
| 2003 | 9.4 | 12792 | 10.5 | 975 |
| 2004 | 9.2 | 12764 | 10.7 | 980 |
| 2005 | 10.0 | 14142 | 11.1 | 1052 |
| 2006 | 10.4 | 15467 | 11.5 | 1115 |
| 2007 | 10.1 | 15182 | 11.7 | 1036 |

*Note:* From National Center for Health Statistics, final natality data. Retrieved from www.marchofdimes.com/peristats.

Martin et al. (2009) reported that more than 900 late preterm births occur every day in the United States. The importance of research in this growing susceptible group of preterm birth is one of the most important determinants of mortality and morbidity in infancy and can place a monetary burden on society. Those infants born between the gestational ages of 34-36 weeks have a four-fold higher mortality rate than term births (Joseph et al., 2002).

In 2005, the annual societal economic cost (medical, educational, and lost productivity) associated with preterm birth in the United States was at least $26.2 billion

(Institute of Medicine, 2007). Relative to full term infants, infants born preterm have significantly more inpatient hospital admissions in the first five year of life, which in turn is associated with a much higher cost of health care (Petrou et al., 2003). In addition, infants born preterm and low birth weight infants are at greater risk of a variety of negative short- and long-term outcomes such as Attention Deficit Hyperactivity Disorder, poor growth attainment, and other health issues including respiratory infections and ear infections (Hack, Klein, & Glover, 1995).

**Low Birth Weight**

Infants born weighing less than 2,500 grams (5 ½ pounds) regardless of the length of pregnancy are considered to be low birth weight (LBW) (UNICEF, 2004). These infants have a higher mortality rate. Low birth weight occurs for two reasons: premature birth (accounting for 67%) and fetal growth restriction (March of Dimes, 2011). This study will focus on preterm birth, but as that birth outcome is often associated with low birth weight, birth weight is also considered in this discussion. Factors associated with increased risk for delivering a low birth weight infant include low level of education, late entry into prenatal care, low level of education, and low socioeconomic status but significantly differ among racial/ethnic groups (Sparks, 2009). African-American women significantly demonstrate higher LBW than Caucasian or Hispanic women, 13.6%, 7.2%, and 6.9% respectively (MacDorman & Mathews 2008). As depicted in Table 6 below, National Vital Statistics Reports (2010) show this trend since 1990.

Table 6

*Percentage of very low and low birth weight, by race and Hispanic origin of mother: United States*

| Year | Very Low Birth Weight (%) | Low Birth Weight (%) |
|---|---|---|
| All races | | |
| 2008 | 1.11 | 6.40 |
| 2007 | 1.14 | 6.45 |
| 2006 | 1.14 | 6.49 |
| 2005 | 1.14 | 6.41 |
| 1990 | 1.05 | 5.90 |
| Non-Hispanic White | | |
| 2008 | 0.82 | 5.26 |
| 2007 | 0.83 | 5.32 |
| 2006 | 0.85 | 5.37 |
| 2005 | 0.84 | 5.32 |
| 1990 | 0.73 | 4.56 |
| Non-Hispanic Black | | |
| 2008 | 2.49 | 11.60 |
| 2007 | 2.65 | 11.78 |
| 2006 | 2.61 | 11.85 |
| 2005 | 2.71 | 11.90 |
| 1990 | 2.54 | 11.92 |
| Hispanic | | |
| 2008 | 0.96 | 5.74 |
| 2007 | 0.97 | 5.74 |
| 2006 | 0.98 | 5.79 |
| 2005 | 0.97 | 5.69 |
| 1990 | 0.87 | 5.23 |

*Note:* From Martin JA, Hamilton BE, Sutton PD, et al. Births: Final data for 2008. National vital statistics reports; vol 59 no 1. Hyattsville, MD: National Center for Health Statistics. 2010.

Birth weight has also varied by maternal age. USDHHS (2011) reported, "the rate of low birth weight in 2008 was highest among babies born to women younger than 15 years of age (12.4 %), followed by babies born to women aged 40–54 years (11.8 %). The lowest rates occurred among babies born to mothers aged 25–29 years and 30–34 years (7.4 and 7.6 %, respectively)".

The incidence of low birth weight (< 2,500 grams) has also increased, from 6.2% of births in 1994, to 8.2% in 2008. (Martinet al., 2006; NCHS, 2010). Low birth weight and premature births are significant public health concerns and major contributors to infant morbidity and mortality (Arias et al., 2003; Mathews et al., 2003). The U.S. infant mortality rate was 6.8 deaths per 1,000 live births in 2009, down from 8.0 in 2004, but the rate of decrease has slowed over the last decade. Southern states are also experiencing challenges in the incidence of these indicators of poor birth outcomes. Georgia's low birth weight rate was 9.6% in 2008, higher than the U.S. Georgia's prematurity rate was 13.4% in 2008, receiving a failing grade in comparison to the Health People 2010 goal of 7.6% (March of Dimes, 2010).

## Health Literacy

The U.S. Department of Health and Human Services within the Healthy People 2010 and more recently Healthy People 2020 (DHHS, 2007 and DHHS, 2012) has identified inadequate health literacy as a priority. In 2003, the United States Department of Education conducted the National Assessment of Adult Literacy (NAAL) survey and found that 93 million Americans (36% of respondents) had below basic (14%) or basic (22%) health literacy skills and only 12% had proficient health literacy skills (Kutner et al., 2006). The NAAL survey also determined that individuals with no health insurance or

covered by Medicare or Medicaid were more likely to have basic or below basic health literacy skills (Vernon et al., 2007). With the complexity and volume of health information available today, this level of health literacy is insufficient for making informed decisions about health. White, Chen, & Atchison (2008) took the NAAL survey nationally representative sample of 18,100 adults and explored relationships between health literacy levels and preventive health practices. They conducted a regression analysis controlling for various demographic factors and determined an association of low literacy with a decreased likelihood of using most preventive health measures for adults 65 and older (White, Chen, & Atchison, 2008).

An economic impact report by Vernon, Trujillo, Rosenbaum, & DeBuono, D. (2007) summarized ethnic minority groups as disproportionately affected by low health literacy, but the majority of individuals with low literacy skills in the U.S. are white, native-born Americans. Specific to women, the NAAL survey identified women with low health literacy as less likely to have a high school education and more likely to be low-income or of racial/ethnic minority (Kutner et al., 2006). Additional research from the NAAL survey determined grade level completion did not correlate to actual reading level (Kirsch et al., 2002). Wilson et al. (2006) determined from the NAAL survey data that mothers had reading levels four to five grades lower than their actual school grade completion. This can contribute to low health literacy women having a greater difficulty reading and understanding health information.

For many women, pregnancy is the entry point into the health care system (Gold, 2011). Yet few programs are in existence for pregnant women to improve their health literacy prior to the birth of their child (Institute of Medicine, 2010). As well, there are

physical barriers such as lack of transportation and facilities for health care access (Nielsen-Bohlman et al, 2004). Even when there are adequate facilities, the hours of operation can prove a daunting barrier for low health literacy women. Shi and Singh (2008) noted that most clinics are open during normal business hours and low health literacy women are more likely to be a lower-paying job requiring unpaid leave to obtain health care. The choice of time off without leave is typically an unacceptable one for these women.

When a visit does come to fruition with a clinician, the barrier of understanding health care information and describing their health care needs comes into play. In a study by Zarcadoolas et al. (2006), women identified with low health literacy were not able to judge the suitability and appropriateness of health information compared to women identified with adequate literacy. There have been studies reporting participants with low health literacy were more likely to inaccurately identify and provide information about their own medications (Williams et al., 1995). Lillie et al. (2007) interviewed one hundred sixty-three women with stage I or II breast cancer to assess their health literacy and knowledge and attitudes toward a genomic test for breast cancer. They determined those women with lower health literacy recalled less of the health information regarding the genomic test and those women with higher health literacy wanted a more active role in the decisions about their health.

As well, there are physician barriers to health literacy. Kelly and Haidet (2007) recruited 12 non-academic physicians and 100 patients to study physician estimation of patient health literacy. They incorporated the REALM assessment tool and found that physicians overestimated the health literacy for 54% of African Americans, 11% of white

non-Hispanics, and 36% of other race/ethnicities concluding that physicians commonly overestimate their patient's health literacy.

**Consequences of Low Literacy Levels**

Health literacy is the ability of people to use their literacy skills, such as reading and comprehension, to obtain, process, and understand basic health information and services so to make appropriate health decisions (Kutner, Greenberg, Jun, & Paulsen, 2006). The Institute of Medicine (2004) has associated low health literacy with poor understanding and utilization of health information. U.S. Department of Health and Human Services (2010) presented the impact of limited health literacy as affecting people of all ages, races, incomes and education levels, and disproportionately affecting lower socioeconomic and minority groups. Nielson-Bohlman, Panzer, and Kindig (2004) reported poorer health status and less use of preventive care among individuals with limited health literacy. Maniaci, Heckman, and Dawson (2008) conducted a study looking at patient knowledge about newly prescribed medication after hospital discharge. Within their study population, they determined a positive association between poor functional health literacy and lack of knowledge regarding newly prescribed medication. Ishikawa and Yano, (2008) conducted a literature review determining inadequate health literacy levels directly affects preventive behaviors, self-care, health management and medical costs. As well, limited health literacy has been associated with worse health outcomes and higher health care costs (AHRQ, 2004).

**Health Consequences**

The concept of health literacy as a factor related to health outcomes is recent compared to other health related factors. Vernon et al. (2007) conducted an impact report

identifying health literacy, in conjunction with other factors such as education, income, and gender affects health outcomes. Macabasco-O'Connell et al. (2011) conducted a randomized control study examining the relationship between health literacy and heart failure quality of life and determined an association between low health literacy and health knowledge, and self-care behaviors. Paasche-Orlow and Wolf (2007) determined a direct negative correlation between the levels of health literacy an individual possesses and associated morbidity and mortality rates.

Research has shown that health literacy may influence information seeking, thereby affecting health knowledge and behavior. Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd (2004) conducted a systematic review of 84 health literacy studies concluding low health literacy is most prevalent in people over 50 years old, ethnic minorities, people who have not completed high school, and people living in the United States but speaking a language other than English. As well, Kutner et al. (2006) identified an association between low health literacy and living below the poverty level. Baker et al. (2004) conducted a cohort study on 3,260 Medicare managed care enrollees age 65 or older and determined an impact where inadequate and marginal health literacy levels of patients seeking primary cares services were more likely to have an emergency department visit than those with adequate health literacy.

Adverse outcomes have also been associated with low literacy levels. HIV-infected individuals with low literacy had poorer knowledge of their HIV-related status and were non-adherent to their antiviral regimen (Wolf et al., 2007). Miller et al. (2007) determined that patients identified with low health literacy were 44% less likely to be knowledgeable about colorectal cancer screening and more likely to have an advanced

stage of prostate cancer than patients with high health literacy levels. Dewalt, Boone & Pignone (2007) conducted a cross-sectional survey and chart review looking to identify a relationship between health literacy and trust, self-efficacy, and participation in medical decision making for adults with diabetes. Their study of two hundred sixty-eight patients with diabetes determined that low health literacy was associated with less desire to participate in their medical decisions only but was not associated with their diabetes outcome.

Cross-sectional design research conducted at two urban public hospitals has also identified a significant association between low health literacy and a higher number of emergency room visits and increased likelihood to report fair or poor health (Baker et al., 2004; Baker, Parker, Williams, & Clark, 1998). This research entailed participation of 2,669 patients entering emergency care centers in the TOFLA comprehension assessment of health literacy. Gazmararian et al. (1999) found similar results in studying Medicare enrollees and determined their low health literacy levels were twice as likely to be associated with their self-identified health rating of fair/poor.

Cho et al. (2008) studied whether the intermediate factors of greater disease knowledge, healthier behaviors, greater use of preventive care and higher degree of medication compliance had a significant effect on health literacy and health outcomes. Through their face-to-face interview of 489 elderly Medicare patients, they determined these specific intermediate factors did not significantly affect the health outcomes, but that health literacy levels had a direct effect on their health outcomes. Health knowledge was also the research focus through a prospective study to determine the association of health literacy and acceptance of HIV testing. Barragan et al. (2005) surveyed patients

routinely offered an HIV test upon presentation at an urgent care clinic and found that of the 372 surveyed there was a significant difference showing low health literacy as a predictor of HIV test acceptance.

DeWalt et al. (2007) conducted a retrospective cohort study in a pediatric clinic to understand whether the health literacy level of a parent relates to emergency room visits, hospitalizations and school days missed for their asthmatic children. The results established an association between low health literacy via the REALM assessment and more severe asthma symptoms resulting in more hospital visits and missed school days.

**Economic Consequences**

Research has identified an economic impact of low health literacy levels and adverse health outcomes. Hohn (1998) presented annual health care costs of individuals with low health literacy levels as four times higher than those with higher health literacy levels. The National Academy on an Aging Society (1998) determined that individuals with low health literacy levels use more health care services than those with higher health literacy levels. The study determined that low health literacy levels resulted in estimated additional health care costs of about $73 billion health care dollars. Friedland (2002) estimated healthcare spending in 2001 to be an additional $32 to $58 billion dollars because of low functional literacy. Phillips et al. (2004) determined higher incurred hospital costs for patients with chronic heart failure and low health literacy levels. Howard (2005) identified patients with limited health literacy as spending approximately $993 more for inpatient care.

**Maternal Health Literacy**

Maternal health literacy was derived from the concept of general health literacy with a focus on defining the outcomes of maternal and child health education. Renkert and Nutbeam (2001, p.381) defined maternal health literacy as "the cognitive and social skills which 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". Adequate maternal health literacy levels are critical for both the mother and her infant. For some women, pregnancy may be their initial encounter with the health care system (Zarcadoolas, Plesant, & Greer, 2006). Vezeau (2005) identified that low-literacy women experience more difficulty navigating health care systems, including problems with learning new information and following directions. There has been limited research on the association of maternal health literacy to pregnancy outcomes. Bennett et al., (2007) determined an association between low literacy in Spanish speaking pregnant women and depressive symptomatology.

Studies have been conducted in terms of low health literacy in reproductive age women and the effects on a women's pregnancy understanding. Previous research has shown women with low health literacy were relatively less likely to have knowledge about prenatal screening tests for birth defects (Cho et al., 2007).

**Effects of Low Literacy on Women's Health Outcomes**

According to the Institute of Medicine, nearly half of all American adults (90 million) have limited functional health literacy. Low literacy is associated with poorer health status, low rates of compliance with complicated medical regimens, high hospitalization rates, over use of emergency services, and under use of preventive health services. Women with low health literacy face more barriers when accessing health care

(Shi & Singh, 2008). This limited functional health literacy can affect young, low-income, pregnancy women who have a high need for health information and resources for a healthy birth outcome.

There have been studies identified specific to women's health and their level of health literacy. Gazmararian et al. (1999) determined that one in ten Medicaid-enrolled women with low literacy skills had worse family planning knowledge and practices. The REALM assessment was implemented for a study of 400 oral contraceptive pill (OCP) users presenting at family planning clinic. Patient demographics, knowledge and self-reported OCP adherence were compared to the REALM results and Davis et al. (2006, p. 713) determined that "patients of all literacy levels had limited understanding of OCP side effects and what to do about multiple missed pills". Lindau, Basu, & Leitsch (2006) did a prospective clinical study to determine whether health literacy predicts patient adherence to follow-up recommendations after an abnormal Pap smear. They assessed health literacy with the REALM assessment tool of sixty-eight women and compared those levels to the outcome measures of on time and 1-year follow up and duration of time to follow-up after an abnormal Pap smear. The results showed women identified with low health literacy were significantly more likely to fail to present for follow-up care. Torres and Marks (2009, p.46) studied 106 postmenopausal women to examine the "relationships among health literacy, knowledge about hormone therapy, self-efficacy, and behavioral intent concerning hormone therapy". They determined through the Pearson correlation test a positive correlation between their health literacy score and both knowledge and self-efficacy.

Previous studies determined low health literacy levels in women correlated to decreased knowledge about prenatal screening for birth defects, effects on smoking, or the time of month when they are most likely to get pregnant (Arnold et al., 2001; Cho, Plunkett, Wolf, Simon, & Grobman, 2007; Gazmararian, Parker, & Baker, 1999). Endres, Sharp, Haney, & Dooley (2004) focused their research on pregnant women with pregestational diabetes. They studied 74 women and classified 16 (22%) as having low functional health literacy and this group was significantly more likely to have an unplanned pregnancy, not have taken folic acid, and not to have consulted with a clinician before pregnancy. This study "suggests low functional health literacy among women with pregestational diabetes is associated with several factors that may adversely impact birth outcomes" (Endres et al., 2004, p, 331).

Health literacy levels and depressive symptoms in pregnant Latino women have also been studied. Bennett, Culhane, & Elo (2007) found pregnant Latino women with low health literacy to be more than twice as likely to have depressive symptoms as pregnant Latinos with high literacy. Postpartum women with low health literacy as determined by the REALM assessment tool were shown in one study as less likely to breastfeed their babies exclusively during the first 2 months after birth, compared with the postpartum women with high health literacy (Kaufman, Skipper, Small, Terry, & McGrew, 2001).

As with many health topics, there is extensive information regarding the cycle of pregnancy including prenatal and postpartum care. This can lead to a greater demand to read and understand health information during pregnancy. Shieh, Broome, and Stump (2010, p 426) "examin(ed) the relationships between health literacy, self-efficacy, and

fetal health locus of control to health information-seeking in low-income pregnant women". Their cross-sectional study of 143 pregnant women did not determine a significant correlation between health literacy and health-information seeking.

An evaluation study of obstetric and gynecologic pamphlets found that women with low health literacy became easily frustrated when the pamphlets were more difficult to comprehend (Freda, Damus, & Merkatz, 1999). Gazmararian et al. (1999) determined women identified as having low health literacy did not understand when they were more likely to become pregnant. A longitudinal study conducted by the March of Dimes (2011) found that women between the ages of 18 and 24 who did not attend college were less likely to know the importance of folic acid prior to and during pregnancy as compared with their college-educated counterparts.

The National Healthcare Disparities Report conducted by AHRQ (2005) identified low health literacy women as less likely to obtain prenatal care. Complex health information can negatively affect the health-seeking habits of women with less years of education (Cho et al., 2007). The low health literacy level and low grade level attainment of mothers can adversely contribute to the health of an infant/child. The Centers for Disease Control (2004), after reviewing infant mortality data from 41 states, reported mothers who completed fewer than 12 years of school had a 49 % higher rate of infant mortality than mothers who completed 16 or more years of education.

There is limited research examining whether a relationship between health literacy and birth outcomes exists. A pregnant woman understanding her health and the health of her unborn baby is an important component of successful pregnancy outcomes. Health literacy has a direct impact on pregnancy for both the mother and her child. A

woman's health literacy level may affect how successfully she navigates the health care system. Low health literacy has been associated with poor prenatal care utilization (Bennett et al., 2006). Janicke et al. (2001) reports that a mother's health literacy level affects how appropriate health decisions for her and her child are made and will directly influence her future response in seeking health care for herself and family. The Centers for Disease Control and Prevention (CDC) reported that the infant mortality rate of mothers who completed fewer than 12 years of school were 49% higher (Mathews & MacDorman, 2007).

**Assessment of Health Literacy**

The concept of health literacy became prominent in the 1990's due to published research in the developing world on the link between reading skill and health related outcomes. In 1993, (Kirsch, Jungeblut, Jenkins, & Kolstad, 1993) initiated this specific research in the United States which eventually lead to the lead to the administration of the National Assessment of Adult Literacy (NAAL) survey. The 2003 National Assessment of Adult Literacy (NAAL) was "the first large-scale national literacy assessment to contain a component designed specifically to measure health literacy among American adults" (White, 2008, p. 7). The results of the NAAL survey found that 93 million Americans (36% of respondents) had below basic (14%) or basic (22%) health literacy skills and only 12% had proficient health literacy skills (Kutner et al., 2006). This research lead to the inclusion of health literacy as a focused objective within Healthy People 2010 (US DHHS, 2000) with continued focus in Healthy People 2020 (US DHHS, 2012). Assessments were needed in order to identify a link between health literacy levels and health related outcomes. Over the years, several assessments have

been developed that prove both reliable and valid. Two types of standardized literacy assessment tools were developed specifically to measure patients' health literacy skills. Davis et al. (1993) developed the valid and reliable Rapid Assessment of Adult Literacy in Medicine (REALM), which is a word recognition test. The word recognition test deals with the ability to decode the words. Decoding is the process of transforming the letters into words and being able to pronounce them correctly. This is an essential step in reading. Parker et al. (1995) developed the valid and reliable Test for Functional Health Literacy in Adults (TOFHLA) assessment, which is a reading comprehension test. The comprehension skill test deals with how much the patient understand from reading.

Davis et al. (2003) assessed the correlation of the three most common standardized reading assessments for health literacy: the REALM, the Slosson Oral Reading Test – Rapid (SORT-R), PIAT-R Recognition, and the Wide Range Achievement Test – Rapid (WRA-R) and the comprehensive version of health literacy assessment, the TOFHLA. All assessments had a p-value of <.0001. Review of previous research has shown that the REALM assessment is best suited for the clinical setting (Davis et al., 2003) due to the ease and limited time needed for implementation.

## Methodology

I reviewed literature related to the use of differing methodologies to investigate the outcomes of interest for this study. Both qualitative and quantitative studies have addressed health literacy and health outcomes. Quantitative methodology is more common due to the incorporation of health literacy instruments used to determine health literacy levels (Vernon et al., 2007). Berkman et al. (AHRQ, 2004) conducted a systematic review of analyzed relationships of health literacy on various health outcomes.

Of the 684 articles reviewed, 44 were quantitative in nature. Additionally, documentation of methodological studies for birth outcomes has more often been quantitative. The quantitative methodology was the focus of this study with some review of qualitative studies for thoroughness of the subject. For this study, I implemented an observational, case-control design with correlation statistics as the majority of studies reviewed used quantitative statistics such as chi-square, t-test, and regression analysis.

## Summary

The current state of the literature suggests that the rates of morbidity and mortality associated with preterm birth are not improving. Despite recent advances in medical technology, preterm birth, as well as the related problem of low birth weight continues to increase (Arias et al., 2003). Unfortunately, we still struggle with understanding the causes of such reproductive outcomes, and our ability to predict and prevent their occurrence remains poor (Goldenberg & Rouse, 1998; Johnston, et al., 2001). Several factors including minority racial status, smoking, maternal age, parity, and prenatal care have been consistently associated with adverse birth outcomes (Arias et al., 2003; NCHS, 2000). Yet, these factors do not fully account for the incidence of preterm birth and low birth weight.

Maternal health literacy levels, as measured by postpartum women, are unknown concerning birth outcomes. Few studies, if any, have addressed the assessment of maternal health literacy levels of postpartum women and the potential impact on birth outcomes. The primary purpose of this study was to examine the association between maternal health literacy levels of postpartum women and the birth outcome of preterm birth as measured by gestational age. The assessment of maternal health literacy levels

and the potential impact on preterm birth was a logical next step in the fight to promote and maintain the health of mothers and their children. In conducting this study, I expected that study findings could have important implications for how the field conceptualizes maternal health literacy. Pregnant women with adequate maternal health literacy skills are able to take health information they receive and use to aid in the improvement of their pregnancy health outcomes. I hope that clinicians can use these study results to assist in identifying women at high risk for preterm birth. Ultimately, early intervention may lessen the impact of adverse birth outcomes. Moreover, at a conceptual level, support for the outlined hypothesis may help to answer questions regarding the nature of maternal health literacy, particularly in a portion of the population where these constructs influence not only the well-being of reproductive age women, but also their infants.

An observational research design was employed in this study to investigate the hypothesis that maternal health literacy levels contribute to pregnancy outcomes. The literature review identified limited research on maternal health literacy among postpartum women. The observational research design is a more natural design process (Mausner & Bahn, 1974) and fit better with the recruiting on women postpartum day one to participate. The observational study design was a case control. Cases and controls were determined based upon birth outcomes from a cohort of women that have delivered at a teaching hospital in the Atlanta metro area during a 12-week period, the exposure of interest is their maternal health literacy levels one day after the delivery. In Chapter 3, I discuss the methodology of this study.

# Chapter 3: Research Methods

## Introduction

In the previous chapters, I described factors that contribute to preterm birth. Despite efforts to explore and address the various social, biological, environmental, and behavioral factors contributing to it, adverse pregnancy outcomes remain constant (Goldenberg & Rouse, 1998; Johnston et al., 2001). One factor that has not been extensively researched is the impact of low literacy levels on the effectiveness of prenatal care interactions.

The specific aim of this study was to identify maternal health literacy levels among postpartum women between the ages of 18 and 35 within the metropolitan Atlanta area and investigate the association between their maternal health literacy levels and their pregnancy outcomes. To achieve this, I investigated using a cohort of nulliparous, postpartum women whose delivery resulted in a singleton birth. Through a case-control research design, I examined the association between the dependent variable, pregnancy outcome, specifically preterm birth as measured by gestational age, and the independent variable, maternal health literacy.

The first of the two-step process was to obtain the pregnancy outcomes of previously nulliparous women who had a singleton delivery at a teaching hospital in Atlanta, Georgia. I requested an IRB to allow access to the teaching hospital delivery logs to determine the pregnancy outcomes of nulliparous women that delivered the previous day. The cases were identified as those with outcome preterm birth and the controls were identified as those deliveries which occurred at term.

The second step was to assess the functional health literacy of cases and controls after enrolling them in the study. During a 12-week period, postpartum day 1 nulliparous women with a singleton delivery were recruited to participate in the study. Matching on the cofounders of age and race were conducted at a 2:1 ratio. Demographic data was collected through direct interview using questions obtained from the BRFSS survey. I conducted a medical chart review to obtain information on prenatal care and medical history. Health literacy was assessed through the implementation of the REALM survey.

In this chapter, I explain the quantitative design, sampling, and instrumentation for understanding the relationship between adverse birth outcomes and maternal health literacy. In addition, in this chapter, I provide an explanation of the data collection process and the data analysis, and address ethical concerns. This study was guided by the question: Is there an association between the health literacy levels, as measured by the REALM instrument, of recently delivered English-speaking women and the preterm birth of their infants?

## Research Design

The specific aim of this study was to identify the maternal health literacy levels among postpartum day 1 women between the ages of 18 and 35 within the metropolitan Atlanta area and compare their maternal health literacy levels to their pregnancy outcomes. Because this study was focused on identification and association, and there is limited research on maternal health literacy among postpartum women, the observational design was an appropriate choice. Berkman et al. (2004) conducted a systematic review to analyze the relationship between health literacy and various health outcomes. In their review of 684 articles, 44 articles fit their key question of looking at a relationship

between health literacy and health outcomes. All 44 articles were quantitative in nature. I chose the quantitative design because it allowed for data collection within a specified timeframe, provided anonymity for the participants, and allowed for use of limited resources, in terms of both time and money.

Furthermore, there was no need for follow up because this design utilized a particular timeframe, and observational bias was limited (Merrill & Timmreck, 2006). This design allowed me to identify and correlate relationships among the variables (Timmreck, 1994). If I did identify an association, then a feasible next step would be a quasi-experimental or true experimental design. Research could be implemented that could introduce a treatment, for example an educational component that would look at improving maternal health literacy.

## Setting and Sample

Recruitment and data collection took place during a 12-week period, at a teaching hospital in the Atlanta metro area. The teaching hospital and their clinics provided services primarily to populations from the adjacent urban communities. The hospital was affiliated with a private university and serves as a teaching facility for medical, nursing, and allied health students.

The hospital performs approximately 3,200 deliveries per year. I selected the labor and delivery and postpartum floors of the hospital as the study site for feasibility and ease of recruitment. Rounding on postpartum patients at the hospital typically occurred in the early morning hours of 5am to 7pm. To limit interference with this process, introduction to the study and data collection took place between the hours of 7:30am and 11:30am at the hospital.

**Population**

For this study, the target population was women between the ages of 18 and 35 within the metropolitan Atlanta area that have delivered a live singleton that was defined as preterm gestational age or normal gestational age at a teaching hospital in Atlanta, Georgia. This population typically includes Caucasian, African American and Hispanic women. The Emory University Gynecology and Obstetrics (GYN/OB) program represents a practice within this teaching hospital that utilize professionals with diverse educational backgrounds to provide care. Providers in the practice are Emory GYN/OB residents who study under the faculty providers and represent the next generation of providers. The practice at the teaching hospital provides the opportunity to examine a group of reproductive age women defined as a bounded target group. I sampled from the patients who are seen primarily by the GYN/OB residents and faculty that provide services at the teaching hospital.

A case-control study requires recruitment of both cases and controls from the sample population. Defining cases and controls for this study involved establishing eligibility criteria for the selection of the participants. In addition, the cases were identified based upon the established objective criteria of an adverse pregnancy outcome (specifically preterm birth). The control group was comparable to the case group except that the women in the control group had a normal pregnancy outcome (term birth). Matching was used for the cases and controls to address the issue of confounding as well as provide an increase in the precision of estimates. Controls were matched to cases on the attributes of age and race.

**Participants**

I adopted a convenience sampling method for this study. This was necessary, as not all women may consent to participate. The cohort was all postpartum day 1 nulliparous women between the ages of 18 and 35, able to speak and read English, having delivered a singleton at the teaching hospital during a selected 12 - week period, and willing to be a study participant Exclusion criteria included age less than 18 years or greater than 35 years, native language other than English, use of magnesium during delivery, self-reported as a smoker, self-reported as a drinker, greater than parity 1 and too ill to participate (i.e., on IV medication, previous diagnosis of eclampsia, previous seizure disorders). These exclusion criteria were applied to limit the number of spurious associations between maternal health literacy and adverse pregnancy outcomes.

A case control design allowed for the assignment of cases and controls from within this single cohort. I drew from this cohort based on the gestational age of the infant at the time of the delivery and their willingness to participate. I then selected controls in a ratio of 2 controls to 1 case after matching on age and race. Additional information about the participants was not collected until after completing an informed consent.

**Sample Size**

The teaching hospital averages 3200 births (~61 births weekly). On average 50% of the births are to nulliparous women with a singleton delivery parity one (~30 births weekly). The study was conducted for a 12-week period. The sample size was based on convenience sampling as it was dependent on the number of women who met the criteria for eligibility presenting for delivery at the teaching hospital over a twelve-week period.

Creswell (2009) discussed this sampling as not as strong because of the lack of probability. Convenience sampling was the logical option with the chosen sample population and shortened recruitment window.

Frankfort-Nachmias and Nachmias (2008, p.165) indicated that the population included in a study may be defined as "finite or infinite." Finite population signifies a countable number of individuals to be included in an investigation and infinite population mean unlimited number of samples. The population for my research study was classified as finite because it is estimated that 267 births occur per month, of which 133 fit the criteria of this study.

The estimated sample size for this study was determined using Cohen's d (Burkholder, 2010). Burkholder (2010, p.2) indicated that, in order to estimate the sample size for a study, a researcher needs to determine three elements: "statistical power, alpha, and effect size.¨ The statistical power refers to the sample being large enough to "ensure a reasonable likelihood of detecting a difference or relationship within the studied population¨ (Burkholder, 2010, p. 2). The statistical power provides evidence that a study was able to produce a change in the variables or detect a relationship within the variables (Burkholder, 2010). Higher statistical power helps to provide evidence that research results are true and not a matter of chance (Burkholder, 2010). In this study, I set the statistical power at .80, as recommended by Burkholder (2010) and Creswell (2009).

According to Burkholder (2010) alpha value is predetermined by the researcher and has two conventional values .05 or .01. The alpha value for the research was a conventional value of .05, which signified that there was a 5% chance of arriving at the wrong conclusions (Burkholder, 2010; Creswell, 2009, p. 157). The third element, the

effect size, was based on estimates of the anticipated and clinically significant effect of an intervention or relationship between the variables. Creswell (2009, p.157) recommended setting it at .50.

Based on national estimates (NCHS, 2012), 10.44% of singleton births are defined as *preterm*. I incorporated a binominal definition of gestational age with preterm birth being less than 37 weeks gestation and normal birth being equal to or greater than 37 weeks gestation at delivery. For calculating sample size, I assumed, based on national estimates (Paasche-Orlow & Wolf, 2007) that about 20% of the population will have limited health literacy skills (i.e., REALM score < 6th grade).

With the results defined in the research reviewed it was reasonable to assume 15% of controls and 40% of cases to be defined as having low health literacy. Using these assumptions, I calculated the sample size. Based upon the table for matched pair control studies, table 6, with an 80% power and 95% confidence, recruited 56 cases and 112 controls. With the estimation that ~31 deliveries per week would be eligible for this study (372 deliveries), I anticipated that the total sample population of 168 was feasible within the 12-week time period.

Table 7

*Sample Size Table for Matched Pair Control Studies with 80% Power and Alpha of 0.05*

| Pi | 0.05 | 0.10 | 0.15 | 0.20 | 0.25 | 0.30 | 0.35 | 0.40 | 0.45 | 0.50 | 0.55 | 0.60 | 0.65 | 0.70 | 0.75 | 0.80 | 0.85 | 0.90 | 0.95 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pc | | | | | | | | | | | | | | | | | | | |
| 0.05 | | 295 | 100 | 56 | 39 | 29 | 24 | 20 | 17 | 15 | 14 | 13 | 12 | 11 | 10 | 10 | 9 | 9 | 8 |
| 0.10 | 295 | | 529 | 163 | 86 | 57 | 42 | 33 | 27 | 23 | 20 | 18 | 16 | 15 | 14 | 13 | 12 | 11 | 11 |
| 0.15 | 99 | 523 | | 791 | 233 | 120 | 77 | **56** | 43 | 35 | 30 | 26 | 23 | 20 | 18 | 17 | 16 | 15 | 14 |
| 0.20 | 54 | 157 | 776 | | 1085 | 312 | 158 | 100 | 71 | 55 | 44 | 37 | 32 | 28 | 25 | 22 | 21 | 19 | 18 |
| 0.25 | 36 | 84 | 223 | 1061 | | 1419 | 402 | 201 | 126 | 89 | 68 | 54 | 45 | 39 | 34 | 30 | 27 | 25 | 23 |
| 0.30 | 26 | 52 | 112 | 298 | 1388 | | 1800 | 505 | 249 | 155 | 109 | 83 | 66 | 55 | 47 | 41 | 36 | 32 | 29 |
| 0.35 | 20 | 37 | 70 | 147 | 385 | 1764 | | 2240 | 623 | 306 | 189 | 132 | 100 | 79 | 66 | 56 | 48 | 43 | 38 |
| 0.40 | 16 | 28 | 49 | 91 | 188 | 486 | 2203 | | 2753 | 761 | 372 | 229 | 159 | 120 | 95 | 78 | 66 | 58 | 51 |
| 0.45 | 14 | 22 | 37 | 64 | 116 | 327 | 606 | 2723 | | 3360 | 924 | 449 | 275 | 191 | 143 | 114 | 93 | 79 | 68 |
| 0.50 | 11 | 19 | 30 | 48 | 81 | 146 | 296 | 749 | 3346 | | 4087 | 1120 | 543 | 332 | 230 | 172 | 136 | 111 | 94 |
| 0.55 | 10 | 16 | 25 | 39 | 62 | 102 | 183 | 367 | 924 | 4107 | | 4977 | 1359 | 657 | 400 | 276 | 207 | 163 | 133 |
| 0.60 | 9 | 14 | 21 | 32 | 50 | 78 | 129 | 229 | 456 | 1143 | 5059 | | 6089 | 1658 | 799 | 486 | 335 | 250 | 197 |
| 0.65 | 8 | 12 | 18 | 28 | 42 | 64 | 100 | 163 | 287 | 571 | 1425 | 6283 | | 7519 | 2043 | 983 | 596 | 411 | 306 |
| 0.70 | 7 | 11 | 17 | 25 | 37 | 55 | 83 | 128 | 209 | 366 | 724 | 1800 | 7914 | | 9425 | 2555 | 1227 | 744 | 511 |
| 0.75 | 6 | 10 | 16 | 23 | 34 | 49 | 73 | 109 | 168 | 273 | 476 | 938 | 2326 | 10198 | | 12093 | 3273 | 1569 | 950 |
| 0.80 | 6 | 10 | 15 | 22 | 33 | 47 | 68 | 100 | 149 | 229 | 369 | 641 | 1259 | 3114 | 13625 | | 16096 | 4350 | 2083 |
| 0.85 | 6 | 10 | 16 | 23 | 34 | 49 | 70 | 100 | 145 | 215 | 329 | 528 | 916 | 1794 | 4428 | 19336 | | 22767 | 6144 |
| 0.90 | 6 | 11 | 18 | 27 | 40 | 57 | 81 | 114 | 163 | 235 | 347 | 529 | 848 | 1465 | 2865 | 7056 | 30757 | | 36101 |
| 0.95 | 8 | 16 | 27 | 42 | 62 | 89 | 125 | 176 | 248 | 351 | 505 | 743 | 1130 | 1806 | 3114 | 6077 | 14940 | 65021 | |

**Research Model**

This observational study design was a case control model. A case-control study was conducted within a defined cohort in whom exposure data and population characteristics are available to some extent, often from the time of enrollment into the cohort. Cases were determined based upon the defined cohort. The defined cohort for this study was the women, meeting the selection criteria, having delivered during a defined 12-week period at an Atlanta metro-area teaching hospital. Because I drew both the cases and controls from the same predetermined population selection, bias was limited and variability was reduced (Biesheuvel et al., 2008).

Matching was used for the identification of the cases and controls, thereby providing for an increase in the precision of the estimates. Matching of cases and controls is frequently employed to control the effects of known potential confounding variables, which in the case of this study is age and race. Matching of cases and control

occurred on age (+/- 2 years) and on race (e.g., White, Black, Hispanic). Matching allowed for the control of these confounding variables to the anticipated smaller sample size. By matching, I was able to assess the relationship to the exposure (maternal health literacy) having already taken two of the confounding variables into account, thereby not needing to adjust for these variables in the analysis.

Table 8

*Confounding Variables*

| Potential confounder | Adjustment per study design |
|---|---|
| Age, +/- 2 years | Matching |
| Race, White/Black/Hispanic | Matching |
| Prenatal care utilization, $\geq$ 10 prenatal visits | Logistic Regression Analysis |
| Smoking | Excluded |
| Weight gain | Not Adjusted |
| Socioeconomic status | Logistic Regression Analysis |
| Level of education | Logistic Regression Analysis |
| Chronic medical conditions | Excluded |
| Alcohol use | Excluded |

Using a case-control study design is advantageous when the outcome is rare, as was the case with preterm birth. While the exposure is also uncommon with about 20% of the population exhibiting poor health literacy (Paasche-Orlow & Wolf, 2007), the outcome is even less common as preterm birth is 11-12 % among this population (Paasche-Orlow & Wolf, 2007).Case control studies also provide efficiencies in costs and time. Figure 5 displays the case control design.

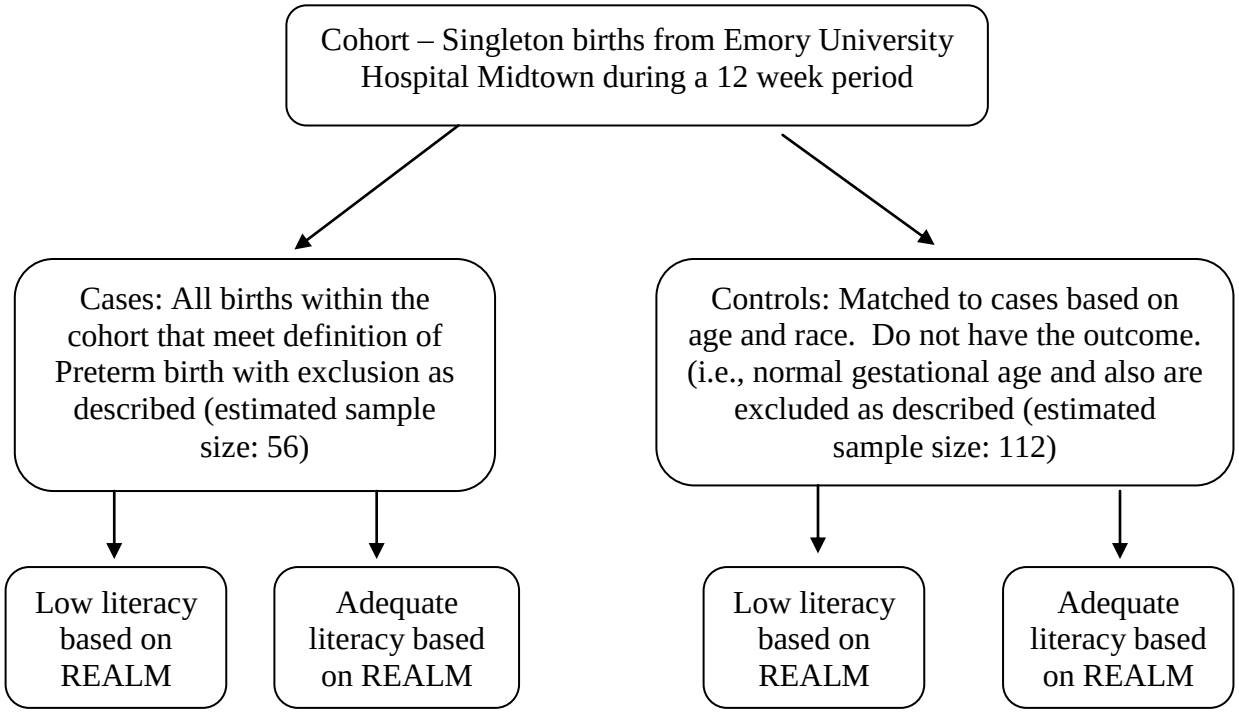


*Figure 5.* Case-control design.

**Health Literacy Instrument**

There have been several methods developed for assessing health literacy. Policy efforts on assessing health literacy have recently been implemented due to the mounting research indicating the impact of low health literacy on individual health (Vernon et al., 2007). This aided in identifying multiple instruments for use in determining basic health literacy skills.

I chose the Rapid Estimate of Adult Literacy in Medicine or REALM as the health literacy assessment tool for this research study. The REALM screens an adult's ability to read common medical words focusing on word recognition and enunciation instead of comprehension (Davis et al., 1996). The tool was designed to be administered by a health professional that scores each word as the patient reads it aloud.

The participants read aloud from a list of 66 health words that increase in difficulty. If they got to a word that they did not know or could not pronounce, they were instructed to proceed to the next word. The time recommended to conduct the REALM for assessment of basic health literacy was 2 to 3 minutes. Use of the REALM assessment tool was a major advantage for virtually any clinical setting. The results of the REALM were in a number format that identifies the health literacy level of the patient. This number result can be efficiently recorded and charted for data analysis. A score of 0 to 18 represents a reading level of third grade or less. The score is determined by placing a plus by each correct response, a check by an incorrect response, and a minus by any word not attempted (Murphy et al., 1993). Raw scores are determined by adding the number of correctly pronounced words. These scores are then converted to grade range estimates (third grade and below, fourth to sixth grade, seventh to eighth, and high school. Fourth to sixth grade reading level is determined by a score of 19 to 44 and scores 45 to 60 represents a seventh to eighth grade reading level. The highest score range is 61 to 66 indicating a high school reading level. A REALM score of less than 61 is considered as inadequate health literacy status for an adult. For this study, the independent variable was identified as either inadequate or adequate as defined by the REALM assessment.

Table 9

*REALM Instrument Grade Equivalent*

| Raw score | Grade range | Health literacy status |
|---|---|---|
| 0 – 18 | 3rd Grade and below | Inadequate |
| 19 -44 | $4^{th}$ to $6^{th}$ Grade | Inadequate |
| 45 – 60 | $7^{th}$ to $8^{th}$ Grade | Inadequate |
| 61-66 | Highschool | Adequate |

The REALM has been used as an assessment tool for health literacy in many areas of medical research including access to care, depression, hypertension, and diabetes mellitus among various populations. The validity and reliability have been established with comparison to another commonly used health literacy assessment tool, the Test of Functional Health Literacy in Adults (TOFHLA; Davis, Crouch, Long, & Green, 2003). TOFHLA is an assessment of comprehension along with basic health literacy. A significant limitation and reason for not using that tool in this research is that the TOFHLA is the administration averages 12 to 22 minutes (Tkacz et al., 2008). The reliability and validity of the REALM has been demonstrated and used in many studies (Davis et al, 1993; Davis et al., 1991; Ibrahim et al., 2008; Shea et al., 2004). The REALM has significant correlations (0.88 to 0.97) with other general reading tests (Davis et al., 1993). Pignone et al. (2005) conducted a systematic review on the implementation of interventions to improve health outcomes of individuals identified with low health literacy skills and identified that the REALM was the most commonly used screening tool between 1980 and 2003. Baker (2006) has called it the "gold standard" for measuring health literacy.

The Rapid Estimate of Adult Literacy in Medicine (REALM) was chosen for this study due to the high degree of validity and reliability associated with the use of the instrument, as well as the ease with which it can be administered. Davis et al. (2003) validated the REALM tool by assessing the correlation with three other standardized reading tests: the SORT-R, PIAT-R Recognition, and the WRA-R. Each had a p-value of $< .0001$. Concurrent validity with the comprehensive version of health literacy assessment, the Test of Functional Health Literacy in Adults (TOFHLA) has also been

established with a p-value of < .001. (Davis et al., 2003). A part of public domain, permission to use the REALM tool is unnecessary. The time needed to administer the REALM and collect the demographic data should be no more than 10 minutes. This allowed for convenience as it did not interrupt the clinic's day to day operation.

**Research Plan**

For a designated 12-week period, I presented every morning at Labor and Delivery in the identified teaching hospital to recruit participants that had a singleton, parity one delivery on the previous day (postpartum day 1). Through the IRB process, I requested waiver approval to obtain pregnancy outcome information prior to enrollment of potential study participants so that I could determine my cases and controls. With the IRB approval, I identified from the faculty or resident through the daily delivery logs, potential cases and controls that meet the study criteria. Each day, for every case identified I identified two controls after matching for age (+/- 2 years) and race (White, Black, and Hispanic). I inquired if potential participants were interested in participating in a short survey studying health literacy and pregnancy outcomes. If the participant accepted, I further explained the study in some detail, presented, reviewed with them the informed consent, and obtained their signature. I anticipated very few potential participants that declined participation in the study as this study was conducted at a teaching hospital, and the majority of the participants were familiar with recruitment into studies early on in their medical care.

**Data Collection**

Demographic data, as well as any characteristic factors such as a risk factor or a protection factor for a disease, was obtained using a data collection form (Appendix A).

The data collection form was designed using questions from the Behavioral Risk Factor Surveillance Survey (CDC, 2011). Participants were be asked to provide information about themselves on several socio-demographic variables previously found to be associated with low birth weight and preterm delivery (e.g. ethnicity, age, household income, and education). Patient medical records were also be reviewed after signed consent to ascertain the number of prenatal care visits, the delivery method (vaginal delivery or cesarean delivery), birth weight (grams) and gestational age (weeks) at delivery. According to March of Dimes (2008), adequate prenatal care is at least 10 prenatal visits during a pregnancy.

**Instrumentation**

**Rapid estimate of adult health literacy (REALM**). After consent and collection of demographic information, the Rapid Estimate of Adult Health Literacy in Medicine (REALM) instrument (Appendix B) was administered to the participant. The REALM Health Literacy Instrument has been copyrighted; however it is in the public domain. No permission requests were needed. The instrument was introduced to patients by using the template provided with the REALM instrument materials. The REALM instrument (Davis et al., 1991) (50 examiner record forms that may be photocopied) and instructional booklet were ordered from the Prevention and Patient Education Project, LSU Health Sciences Center in Shreveport, Louisiana. The instrument was printed on a laminated purple paper and had large type set with widely spaced columns providing a friendly, not-threatening appearance (Murphy et al., 1993). The participant as asked to read aloud the words on the REALM and a score as calculated and recorded. According to the instruction booklet, participants start by reading the first word on List 1 and

continue until all lists are completed. Five seconds was allowed for pronunciation of each word before the participant is asked to go to the next word. After reaching a point where no additional words can be read, participants were asked to look over the remaining words to determining if they recognized any of them. The REALM instrument survey was stopped when the participant was unable to pronounce any additional words correctly.

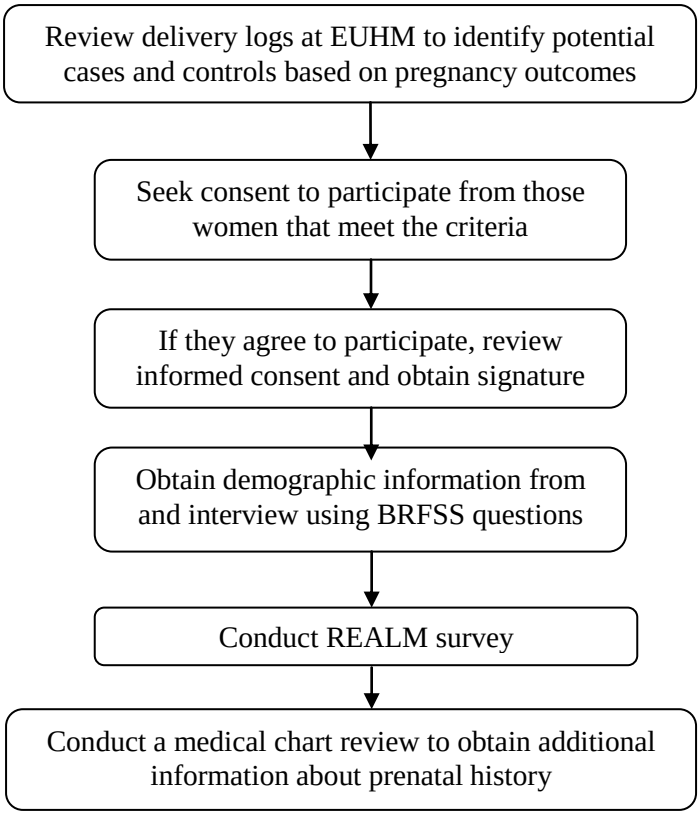


*Figure 6.* Activity that occurred during the12-week data collection period.

***Levels of measurement***. Creswell (2009) describes a quantitative design study as one that works to understand the factors or variables that influence an outcome. For this study, I assessed multiple levels of measurement. Franfort-Nachmias (2008) presents the four levels of measurement as nominal, ordinal, interval and ratio. In table 8, I outlined the dependent and independent variables and potential confounders. The confounders of

medical risk predating pregnancy, medical risk in current pregnancy, behavioral and environmental risks, and health care risks were excluded from this study. Including too many variables in the analysis itself risks having to increase the sample size to accommodate them. For feasibility of this study due to time and cost, I excluded these variables.

Table 10

*Independent and Dependent Variables and Cofounders*

| Variable | Type | Level of Measurement | Potential Responses | Origin |
|---|---|---|---|---|
| Preterm Birth | Dependent Variable | Binomial | Term<br>Preterm | Categorized using gestational age from chart review |
| Maternal Health Literacy Score | Independent Variable | Binomial | Adequate<br>Inadequate | REALM Survey |
| Age | Matching | Continuous | 18-35, matched within +/- 2 years | Data Collection Tool |
| Race | Matching | Nominal | Black<br>White<br>Hispanic<br>Other | Data Collection Tool |
| Education Level | Confounder | Ordinal | Less than 3rd grade<br>Fourth-eighth grade<br>Grades 9-11<br>High school or GED<br>Do not know/Refused<br>Some college<br>College Graduate | Data Collection Tool |
| Income Level | Confounder | Ordinal | <$20,000<br>$20,000 - $39,000<br>$40,000+ | Data Collection Tool |
| Prenatal Care | Confounder | Binomial | <10 visits<br>≥ 10 visits | Categorized using gestational age from chart review |

**Reliability and Validity**

This retrospective case control study was based upon a 12-week convenience sample of pregnant women presenting for delivery at Emory University Hospital Midtown. The study was limited to English speaking participants. Once a potential participant was identified, they were introduced to the study. Those who agreed to participate were given a detailed explanation of the study and the consent form. As this was a retrospective study, the variables were collected in an organized manner to ensure that the data are complete and accurate.

McKenzie et al. (2009) explains reliability as a consistency of a measurement whereby the same results are obtained each time a measurement is used. Validity in a measurement pertains to the extent with which an instrument measures what it is intended to measure (McKenzie et al., 2009). Gilbert (1996) explains that the onus is always on the researcher to demonstrate to the readers that the data were abstracted reliably and in an unbiased manner. To reduce the potential threat of internal validity and maintain reliability the data obtained from the form were compared to the patient's medical chart.

As stated, the health literacy data collection was in the form of the REALM (Appendix B). The REALM is a screening tool designed to assess health literacy through work pronunciation from a 3$^{rd}$ through 12$^{th}$ grade level (Davis et al., 1993). The REALM consists of 66 medical words arranged in three columns, each containing 22 words arranged by number of syllables and difficult and printed in 18 fonts for easy readability. The tool is designed to be administered by a health professional that scores each word as

the patient reads it aloud. It typically takes three-five minutes to perform. The reliability and validity of the REALM has been demonstrated and used in many studies (Davis et al., 1993; Davis et al., 1991; Ibrahim et al., 2008; Shea et al., 2004). Baker (2006) has called it the "gold standard" for measure health literacy. The time needed to administer the REALM and collect the demographic data should be no more than 10 minutes. This was convenient as it did not interrupt the prenatal clinic's day to day operation.

**Appropriate Measurement Scales and Instruments for the Study**

Franfort-Nachmias (2008, p.415) explain that the use of scales "enables researchers to represent several variables by a single score, a quality that reduce the difficulties of dealing with complex data". The developed demographic collection tool was appropriate for the collection of variable items that can be used as indicators for the study. As well, the implementation of the REALM instrument was appropriate for this study based upon its established validity and reliability from previous peer-reviewed studies.

**Data Analysis Plan**

According to Frankfort-Nachmias & and Nachimas (2008, p.329), "observations tend to cluster around a central value". This provides the ability for a description of the data based on averages. Using measures of central tendency make it easier to compare different distributions. Data analysis was initiated by examining frequency distributions for nominal and ordinal level data and measures of central tendency for interval/ratio level data.

Collected data was entered into an excel spreadsheet. The data was uploaded into SPSS for analysis. I analyzed the data using SPSS 20.0. Data analysis to determine a

conclusion regarding my hypothesis required the calculation of the descriptive statistics, inferential statistic (Chi-square and t-test), determination of the probability (p value), and then based on p value, acceptance or rejection of my hypothesis. These steps lead to the conclusion that will be discussed in Chapter 5. Descriptive statistics including percentages, means, standard deviations, frequencies, and measures of central tendency were calculated on the demographic variables and the maternal health literacy levels of the recently delivered women.

Table 11

*Example Demographic: Age*

| Age | Mean +SD | Range |
|---|---|---|
| Cases | | |
| Controls | | |

Table 12

*Example Demographic: Race*

| Race | Number of Participants | Percentage | Cumulative Frequency | Cumulative Percentage |
|---|---|---|---|---|
| White | | | | |
| Black | | | | |
| Hispanic | | | | |

Table 13

*Example Demographic: Income*

| Income Range | Number of Participants | Percentage | Cumulative Frequency | Cumulative Percentage |
|---|---|---|---|---|
| <$20,000 | | | | |
| $20,000 - $39,000 | | | | |
| $40,000+ | | | | |

Table 14

*Example Demographic: Highest Level of Education Attained*

| Grade Levels | Number of Participants | Percentage | Cumulative Frequency | Cumulative Percentage |
|---|---|---|---|---|
| Less than 3rd grade | | | | |
| Fourth-eighth grade | | | | |
| Grades 9-11 | | | | |
| Highschool or GED | | | | |
| Some College | | | | |
| College Graduate | | | | |
| Do Not Know/Refused | | | | |

Table 15

*Example Demographics: Prenatal Utilization*

| Prenatal Visit | Number of Participants | Percentage | Cumulative Frequency |
|---|---|---|---|
| <14 | | | |
| ≥ 14 | | | |

In addition to descriptive statistics, I conducted inferential statistics. The use of inferential statistics allowed me to make comparisons between two characteristics to see if they were linked or related to each other (Frankfort-Nachmias & Nachmias 2008). One way to do this is to work out what we would expect to find if there was no relationship between them (the usual null hypothesis) and what we actually observe. The test used to measure the differences between what is observed and what is expected according to an assumed hypothesis is called the chi-square test (Frankfort-Nachmias & Nachmias 2008). Bivariate analysis, specifically Chi Square were used to examine differences in demographic and obstetric characteristics between recently delivered women with adequate and inadequate maternal health literacy, as well as differences between women with and without adverse birth outcomes.

Table 16

*Example Chi Square Analysis of Participants Stratified by Maternal Health Literacy Level*

| Variable | Chi Square Test Statistic | 95% CI | *p* |
|---|---|---|---|
| Education | | | |
| Income | | | |

| |
|---|
| Prenatal Care visits |

Table 17

*Example Chi Square Analysis of Participants Stratified by Preterm Birth*

| Variable | Chi Square Test Statistic | 95% CI | *p* |
|---|---|---|---|
| Education | | | |
| Income | | | |
| Prenatal Care visits | | | |

To address the research question: Is there an association between the maternal health literacy levels of recently delivered women and the pregnancy outcomes of their infants, I determined any bivariate relationships between maternal health literacy and adverse birth outcomes using the Chi Square test of association. A 2x2 table of the bivariate relationship was included in the results.

Table 18

*Example 2 x 2 of Relationship of Outcome to Exposure*

| EXPOSURE | OUTCOME | |
|---|---|---|
| | Adverse | Normal |
| Low maternal health literacy | | |
| Normal maternal health literacy | | |

Multivariate analysis using logistic regression was conducted to calculate the odds of preterm birth associated with low maternal health literacy levels after controlling for factors whose bivariate analyses suggest they may confound that relationship. By conducting this data analysis, I was able to examine the likelihood of the exposure, maternal health literacy level, in relation to the binominal outcome of preterm birth. Low health literacy is defined as a REALM raw score of 60 or less and normal health literacy is defined as a REALM raw score of $\geq$ to 61.

In a review of the IMCHB model as a theoretical framework for research, Carter and Kulbok (1995) identified logistic regression analysis as one of the most commonly used statistical analysis. It is appropriate given the dependent variable was binomial. It also worked well for this study because the independent variable (level of maternal health literacy) was established as a categorical variable; either low (inadequate) maternal health literacy or normal (adequate) maternal health literacy. This resulted in specific odds ratios for preterm birth related to the two levels of health literacy. To determine the contribution of health literacy to birth outcomes across the entire range of REALM scores, I analyzed health literacy as an ordinal variable. Logistic regression analysis was used to measure the association between REALM scores and preterm birth while controlling for the confounding variables of age and race with matching. I used a logistic regression model to assess the independent effect of maternal health literacy level on gestational age (normal age, >37 weeks). The relationships would be charted as follows:

X – Mother's maternal health literacy level (low coded as "1", and normal coded as "2")

$Y_1$ – gestational age of the infant (in weeks) at the time of birth

The confounders were education level, income level, and prenatal care. A backward elimination process was used with the logistic regression model. This involved starting with all variables, including the independent variable and the confounders previously tested using bivariate analysis. In SPSS, backwards stepwise regression uses a .10 level of significance as the threshold for retention in the model. The elimination of extraneous variables continues until no further improvement to the model is possible (Draper & Smith, 1981). The outcome of the final model was evaluated in terms of odds ratios, their associated p values and 95% confidence intervals. While I focused on the odds ratio of preterm birth associated with inadequate health literacy, I also reported on odds ratios for variables included in the final model.

Table 19

Example Outcome of Logistic Regression Analysis

| Variable | *OR* | 95% CI | *p* |
|---|---|---|---|
| Health Literacy | | | |
| Education | | | |
| Income | | | |
| Prenatal Care | | | |

**Limitations**

The components of this study allowed for the assessment of maternal health literacy and its relationship to pregnancy outcomes. The data collected provided a basis to answer the

stated research question and either reject or fail to reject the null hypothesis and make informed recommendations. However, there were limitations to the study. The use of a case-control design prevented the identification of causal relationships between maternal health literacy and pregnancy outcomes. The study was somewhat exploratory and was limited in explaining the relationships of low maternal health literacy and other covariates to pregnancy outcomes. I only included participants that could read or speak English; therefore, the study was not generalizable to all postpartum women. In terms of the data collection tools, there was some interpretation bias that would need to be addressed as the REALM tool was introduced by the researcher to the study participant.

**Ethical Concerns**

For this study, the ethical issues related to the project will follow the Walden University IRB process and the Emory University IRB process. This process was based upon the HHS Regulations for the Protection of Human Subjects, identified as 45 CFR 46. As such there were several ethical concerns that needed to be dealt including informed consent, confidentiality, protection of health information and protection of study participants.

To be in compliance, informed consent from potential participants was required. As with the majority of informed consent, the following were addressed:

- all potential ethical issues were addressed.
- The benefits/risks were disclosed. For this project there were no perceived benefits/risks.

- The potential participant was informed of their right to withdraw from the research at any time without any consequences as well as their right to obtain conclusions regarding the research.
- That the research findings may be disseminated to improve upon clinical care and teaching of residents regarding post-partum health care.
- Participant names were not reported, as all publications and presentations will reflect only aggregate data.

Finally, there was a need to instill measures to protect the participant's privacy information. This includes access to the information. Precautions to protect the data gathered from participants and kept confidential were taken by providing all participants with a unique identifier, ensuring their privacy. Unique identifiers were established based on the day the participant was included in the study (for example 1:3 would mean day one, third participant). Access to data was password protected to abide by the Health Insurance Portability and Accountability Act (HIPAA) ensuring the confidentiality of health information gathered from participants.

## Summary

The purpose of this study was to explore the possibility that maternal health literacy levels may be a risk factor for adverse pregnancy outcomes. The null hypothesis was that maternal health literacy levels are not a risk factor for adverse pregnancy outcomes. The study design was a case-control study conducted on a sampling of cases and controls drawn from a cohort of women presenting at two teaching hospitals in Atlanta, Georgia. Cases and controls were identified during a 12-week period that

coincides with two GYN/OB residency rotations. Controls were matched to cases based age and race. The data was entered into SPSS for analysis. Frequency tables, 2x2 contingency tables, and logistic regression were used to determine the odds ratios for each variable, and level of significance was determined using the chi-square statistic.

This study filled a gap in the literature on the maternal health literacy as a risk factor of adverse pregnancy outcomes. The positive social change implications of this study included developing and implementing new educational competencies of maternal health literacy that may influence pregnancy outcomes. The outcome of this study could be useful for practicing obstetrical clinicians, academic faculty that provide education and oversight to gynecology and obstetrics residency programs and medical students, as well as obstetrical societies and associations that establish matrix for successful pregnancy outcomes.

# Chapter 4: Results

## Introduction

The specific aim of this quantitative study was to identify the maternal health literacy levels among postpartum women between the ages of 18 and 35 within the metropolitan Atlanta area and compare their maternal health literacy levels (independent variable) to their pregnancy outcomes (dependent variable), specifically preterm birth as defined by gestational age. Permission to collect, access, and analyze all data was contingent upon approvals by the Walden (# 03-21-13-0131271) and Emory University (IRB00064450) IRBs. Data for all study variables (age, race, marital status, educational level, household income level, type of insurance, delivery type, physician type, # of prenatal visits, and gestational age) were obtained as described.

Data collection was initiated the first week of May, 2013 and lasted 18.5 weeks, concluding the first week of September, 2013 for the controls and the last week of November, 2013 for the cases. I estimated the initial data collection plan to be completed within 12 weeks, with me presenting every morning on Labor and Delivery to review the previous 24-hour delivery logs. Due to work constraints, a family vacation, and a few sick days, I was not able to present every day. The Emory IRB approval was for either my principal investigator or I to review labor logs, request and obtain consent, and collect data.

I had arranged for my principal investigator to cover my review during my week of vacation, but she was unable to execute due to her work schedule on the Labor and Delivery floor. In addition to these time constraints, the opportunity to identify cases (preterm singleton birth) was more challenging than estimated as maternal criteria for

eligibility was a greater factor than anticipated, particularly the use of magnesium sulfate during delivery. Magnesium sulfate is sometimes used as a tocolytic medicine to slow uterine contractions or to help protect the baby's brain during preterm labor. I included the use of this as an exclusion criterion because it can have a side effect of confusion, headaches and weakness. This was suitable for the implementation of the REALM assessment tool. It was necessary to continue the case collection through the end of November 2013 to achieve the minimum number of cases as determined through the sample size calculation for this study. These factors pushed the data collection time period from the estimated 12 weeks to 18.5 weeks for the controls and 30 weeks for the cases.

Daily, between the hours of 8am and 10am, I presented on the Labor and Delivery floor of the teaching hospital to review the previous day deliveries. Singleton deliveries from nulliparous women were identified and documented on the data collection form for this study. Women that met the inclusion criteria for both cases and controls were then greeted and informed of the study via the Emory IRB protocol. During the 30-week time period, extended to complete the case recruitment, 2,168 women presented for delivery, 846 women met the cohort criteria of presenting for singleton birth as Gravida 1. Of the 846 women meeting the criteria, 84 fit the case criteria and 563 fit the control criteria. Of the 84 deliveries that fit the case criteria, 10 women declined to participate and 18 did not fit the inclusion criteria due to various reasons (too ill to participate, medical indication preventing inclusion, stillborn, twin delivery, etc.). This left 56 women meeting the inclusion criteria and agreeing to participate.

The control recruitment occurred during the first 18.5 of the 30 weeks as more controls were available for inclusion in the study. During that 18.5 week period, 350 controls met the criteria of the study. Of those 350 controls, 87 declined to participate. With the goal to match on age and race, controls that were collected were matched to the 56 cases at a two to one ratio, leaving 113 controls for this study.

The research question and associated null hypothesis for this study were: Is there an association between the maternal health literacy levels of recently delivered women and the preterm birth of their infants?

*Null Hypothesis*: There is no association between low maternal health literacy levels, as assessed by the REALM instrument, and preterm birth for English-speaking women between the ages of 18 and 35 within the metropolitan Atlanta area.

*Alternative Hypothesis*: There is an association between low maternal health literacy levels, as assessed by the REALM instrument, and preterm birth for English-speaking women between the ages of 18 and 35 within the metropolitan Atlanta area.

The hypothesis was tested using primary data from a case-control study conducted on a sampling of cases and controls drawn from a cohort of women presenting for nulliparous delivery. The associations between maternal health literacy levels and pregnancy outcomes with and without the covariates of number of prenatal visits, education level, income level, marital status, and employment status, were analyzed using binary logistic regression. Due to the constraints of sample size, I matched cases and controls on age (+/- 2 years) and race (White, Black, Other), thereby providing for an increase in the power of the study. Statistical analyses were conducted using SPSS 20.

This chapter provided the results of my analyses. I described the time frame for data collection and presented discrepancies in actual data collection as compared to the plan presented in Chapter 3. I reported descriptive and demographic characteristics. I provided results of univariate analyses that justify the inclusion of covariates in the multivariable logistic regression model. I reported, tabulated, and summarized all statistical analysis findings in relation to my stated alternative hypothesis that there was an association between low maternal health literacy levels, as assessed by the REALM instrument, and preterm birth for English-speaking women between the ages of 18 and 35 within the metropolitan Atlanta area.

## Univariate Analysis

The total cohort was comprised of 856 women presenting for delivery between the periods on May 1, 2013 and November 30, 2013. Of the 856 participants in the total cohort, 647 fit the criteria of the study. Of the 647 women that met the criteria of the study, 169 agreed to participate. Figure 7 displays the data collection process and period.

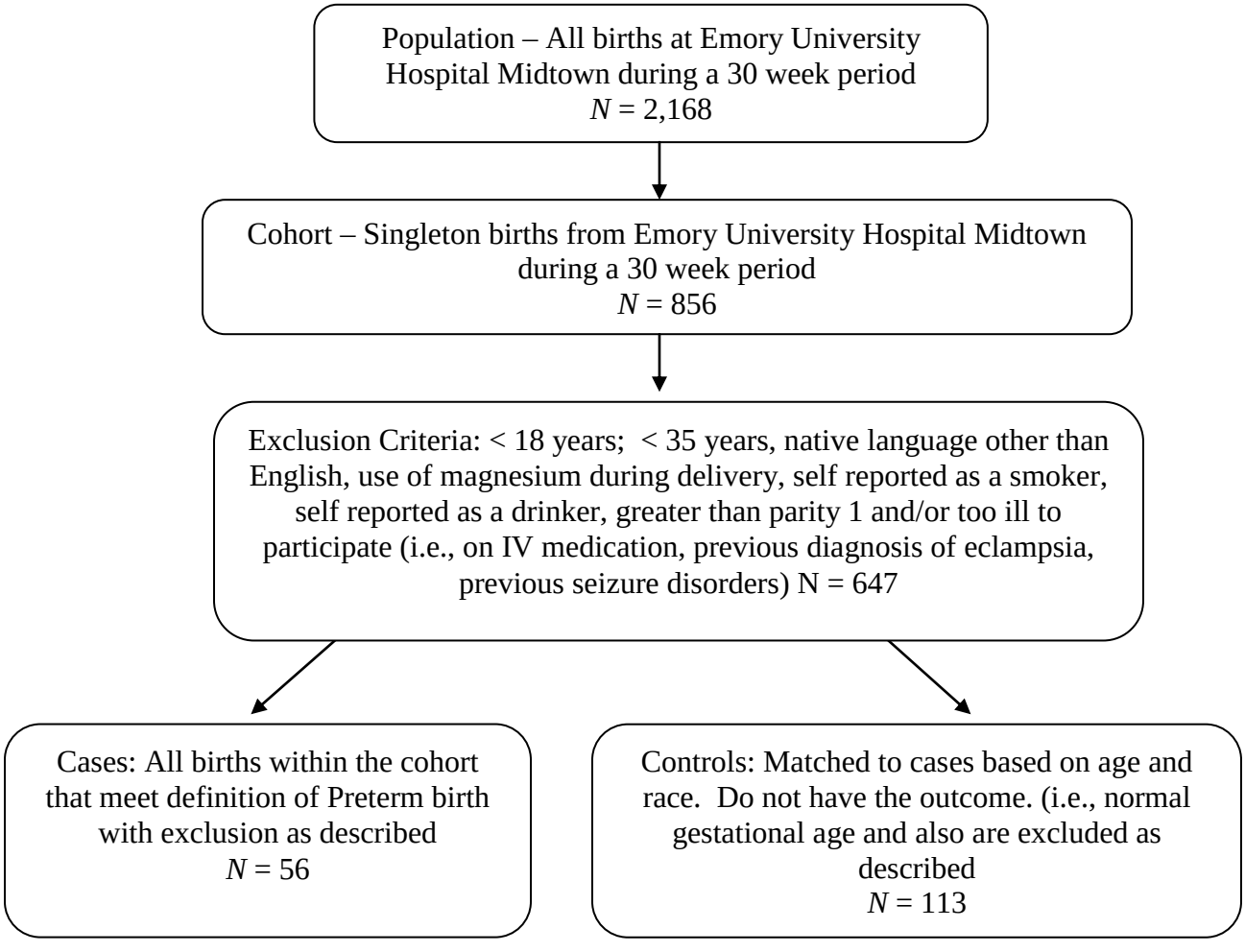


*Figure 7.* Results of data collection period.

The cases and controls were matched on age and race. The mothers of the infants in this study ranged in age from 18-35 for both the case and control groups (Tables 20 and 21). Analysis confirmed accuracy of matching with the mean age equivalent for the two groups: 25 years old in the case group and 25 years old in the control group (see Table 20).

Table 20

*Cohort Demographic: Age in Years*

| Age | Cases | Controls |
|---|---|---|
| Mean +SD | 25.86 +5.55 | 24.86 +5.99 |
| Range | 18-35 | 18-35 |

Additionally, analysis confirmed accuracy of matching on race for the two groups based upon the percentages noted in Table 21. This cohort demographic reflects the obstetrical patient population at the hospital during the same time period in which the study was conducted with 75.5% Black, 17.2% White, and 3.5% Other.

Table 21

*Cohort Demographic: Race*

| | Cases ($n$ = 56) | Controls ($n$ = 113) |
|---|---|---|
| White | 9 (16.1%) | 18 (15.9%) |
| Black | 46 (82.1%) | 94 (83.2%) |
| Other | 1 (1.8%) | 1 (0.9%) |

Infant birth weights in the overall sample ranged from 500 to 4320 grams; the mean birth weights were 2105.95 grams in the case group, and 3237 grams in the control group (see Table 22). This variation between the case and control group accounted for

the preterm delivery status of all cases in this study. This is in line with the averages within the United States of term births at 3389 grams (Donahue, 2010).

Table 22

*Cohort Demographic: Infant Birth Weight in Grams*

| Infant Birth Weight | Mean +SD | Range |
|---|---|---|
| Cases | 2105.95 +708 | 500 – 3355 |
| Controls | 3237.93 +420 | 2155 – 4320 |

The gestational age in the overall sample ranged 23 to 41.1 weeks; 23 – 36.6 weeks in the case group and 37 – 41.1 in the control group (Table 23). The mean gestation ages were 33.8 weeks in the case group and 39.1 weeks in the control group.

Table 23

*Cohort Demographic: Gestational Age in Weeks*

| Gestational Age | Mean +SD | Range |
|---|---|---|
| Cases | 33.8 +3.1 | 23 – 36.6 |
| Controls | 39.1 +1.02 | 37 – 41.1 |

The total number of prenatal visits in the overall sample ranged from 1 to 14; 2 – 12 in the case group and 1 – 14 in the control group (Table 24). The median for the number of prenatal visits was 7 visits in the case group and nine visits in the control group.

Table 24

*Cohort Demographic: Number of Prenatal Visits*

| Prenatal Visits | Median +SD | Range |
|---|---|---|
| Cases | 7.00 +2.00 | 2 – 12 |
| Controls | 9.00 +3.00 | 1 – 14 |

Of note I expected to see lower prenatal visits in the cases as their pregnancy did not last as long. But it was interesting to identify that for the controls (term births) their median did not meet the adequate prenatal care guidelines of at least 10 prenatal visits during a pregnancy, (March of Dimes, 2008).

## Bivariate analysis

### Pregnancy Outcome

Chi-square statistical tests were used to examine the relationships between variables associated with preterm delivery. This information provides further descriptions of the population under study as well as information needed for later statistical analysis (i.e. logistical regression). Table 25 depicts the frequencies and percentage distributions of each variable in the study when compared to the presence or absence of a preterm birth. Crosstabs were used to describe the frequency and percentage of variables. In addition, a chi square statistical test was used to determine if there were significant relationships between these same variable. Statistical significance as it is associated with preterm delivery was shown for the variables of education level, insurance type and delivery type. Statistical significance is highlighted in bold and underlined in Table 25.

Table 25

*Demographic Characteristics of Delivered Mothers by Pregnancy Outcome – Preterm Birth*

| | Cases (*n*=56) | Controls (*n*=113) | Test of Significance ( *p*) |
|---|---|---|---|
| Education (*n*, %) | | | **0.05** |
| < Highschool | 12(21.4%) | 9(8.0%) | |
| Highschool Degree | 17(30.4%) | 40(35.4%) | |
| Some College | 17(30.4%) | 31(27.4%) | |
| College Degree | 10(17.8%) | 33(29.2%) | |
| Employment Status (*n*, %) | | | 0.43 |
| Employed | 24 (42.9%) | 81 (47.9%) | |
| Self-employed | 0 (0%) | 3 (10.8%) | |
| Unemployed | 19 (33.9%) | 47 (27.8%) | |
| Student | 7 (12.5%) | 24 (14.2%) | |
| Homemaker | 6 (10.7%) | 14 (8.3%) | |
| Household Income (*n*, %) | | | 0.08 |
| Less than $20K | 32 (1.8%) | 44 (2.4%) | |
| Greater than $20 and Less than $50K | 19 (35.7%) | 54 (22.5%) | |
| Greater than $50K | 5 (19.6%) | 15 (20.1%) | |
| Type of Insurance (*n*, %) | | | **0.02** |
| None | 4 (7.1%) | 4 (2.4%) | |
| Private | 22 (39.3%) | 74 (43.8%) | |
| Pubic | 30 (53.6%) | 91 (53.8%) | |
| Marital Status (*n*, %) | | | 0.70 |
| Married | 20 (35.7%) | 57 (33.7%) | |
| Never Married | 36 (64.3%) | 112 (66.3%) | |
| Prenatal Care Visits (*n*, %) | | | 0.79 |
| Adequate | 54 (96.4%) | 108 (95.6%) | |
| Inadequate | 2 (3.6%) | 5 (4.4%) | |
| Type of Delivery (*n*, %) | | | **0.04** |
| Vaginal | 37 (66.0%) | 91 (80.5%) | |
| C-Section | 19 (34.0%) | 22 (19.5%) | |
| Type of Physician (*n*, %) | | | 0.60 |
| Academic | 16 (28.6%) | 28 (24.8%) | |
| Private | 40 (71.4%) | 85 (75.2%) | |
| Maternal Health Literacy (*n*, %) | | | 0.11 |
| Adequate | 21 (37.5%) | 57 (50.4%) | |
| Inadequate | 35 (62.5%) | 56 (49.6%) | |

**Education**. The case group showed a higher percentage (21.4%) of mother's having less than a high school education as compared to the control group (8.0%). Additionally, the demographic data shows that the control group had a higher education level than that of the cohort in general and the case group. From the data collected, when comparing mothers that delivered preterm to mothers that delivered term, there was significance (p-value = 0.05) with respected to education and birth outcome, thereby rejecting the null hypothesis showing level of education and birth outcome are slightly related.

**Employment Status.** Employment status was evenly distributed among the case and control group for all employment status levels. There were no significant differences between the case group and control group with respect to employment status of the mother. From the data collected on employment status, the p-value (0.43) was greater than 0.05, accepting the null hypothesis showing that employment status and birth outcome is independent.

**Household Income**. There was not a significant difference between the case group and control group. From the data collected, the mothers of the infants in both groups have a p-value of 0.08 which will accept the null hypothesis and says that household and birth outcome are independent.

**Type of Insurance**. Type of insurance was evenly distributed among the case and control group with the case group have 46% private and 54% public insurance and the control group have 43.8% private and 53.8% public insurance. There was a significant difference between the case group and control group. From the data collected, the

mothers of the infants in both groups have a p-value of 0.02 which will reject the null hypothesis and says that type of insurance and birth outcome are related.

**Marital Status**. The marital status of the case and control groups was evenly matched with 32.8% of the case group being married and 33.77% of the control group being married. There was no significant difference between the case group and control group. From the data collected, the mothers of the infants in both groups have a p-value of 0.7 which will accept the null hypothesis and says that marital status and birth outcome are independent.

**Prenatal Care Visits**. American College of Obstetrics and Gynecologists recommends 14 visits to be considered adequate during a 40 week pregnancy (ACOG, 2005). The collected data for each sample was identified as either adequate ($\geq$14 visits) or inadequate (<14 visits). The adequacy of prenatal care visit for the case group was 96.4% (n = 54) and for the control group was 95.6% (n = 108). 4.2% (n = 7) of all mothers attained an inadequate amount of prenatal care visits. The inadequacy of prenatal care visit for the case group was 3.6% (n = 2) and for the control group was 4.4% (n =5). There was not a significant difference between the mothers in the case group and those in the control group.

**Type of Delivery**. For both the case and the control group, vaginal delivery was reported more often than c-section (66% of cases and 80.5% of controls). There was a significant difference between the case group and control group. From the data collected, the p-value was 0.04 which will reject the null hypothesis and tell us that type of delivery and birth outcome are related.

**Type of Physician**. The deliveries that took place at this hospital were conducted by two specific groups; doctors that were part of the academic institution and physicians that were in private practice. Both sets of doctors had access and were provided the exact same hospital services. The majority of deliveries were performed by private physicians in both groups (cases = 71.4% and controls = 75.2%). There was no significant difference between the case group and control group. From the data collected, the mothers of the infants in both groups have a p-value of 0.60 which will accept the null hypothesis and says that type of physician and birth outcome are independent.

**Maternal Health Literacy** The main focus of this study was to determine if there was an association between maternal health literacy level and preterm birth. From the data collected, when comparing mothers that delivered preterm to mothers that delivered term, there was not significance (p-value = 0.11) with respect to maternal health literacy. Therefore, we accept the null hypothesis of this study that there is no association between low maternal health literacy levels, as assessed by the REALM instrument, and preterm birth for English-speaking women between the ages of 18 and 35 within the metropolitan Atlanta area. Mean health literacy scores of study participants are presented in Table 26. Total health literacy scores were reported in two different ways. Upon examination of health literacy, the Rapid Estimate of Adult Health Literacy (REALM) scores had a mean score for the case group of 44.00+10 and a mean score for the control group of 62.00+3. A health literacy score of 0-60 represents an inadequate health literacy status. A raw score of 44 represents a $4^{th}$ to $6^{th}$ grade reading level. Conversely, a health literacy score of 62 represents an adequate health literacy status indicating a high school reading level.

Table 26

*Maternal Health Literacy Scores of Study Participants*

| Maternal Health Literacy | Mean +SD | Range |
|---|---|---|
| Cases | 44.00 +10.00 | 19-60 |
| Controls | 62.00 +3.00 | 61-66 |

In Table 27 they are reported as continuous variables in literacy categories and categorized as inadequate and adequate literacy.

Table 27

*Maternal Health Literacy Scores of Study Participants*

| Maternal Health Literacy | Cases (%) | Controls (%) |
|---|---|---|
| Inadequate | 35 (21%) | 58 (34%) |
| 0-18 | 0 (0%) | 0(0%) |
| 19-44 | 15 (9%) | 19(11%) |
| 45-60 | 20 (12%) | 39(23%) |
| Adequate | 21 (12%) | 55(33%) |
| 61-66 | 21 (12%) | 55(33%) |

## Multivariate Statistics

Based on my research question, "Is there an association between the maternal health literacy levels of recently delivered women and the preterm birth of their infants?", I used conditional binary logistic regression analysis, a multivariate approach, to determine the adjusted odds of preterm birth in the presence of potential confounders. For the results of the logistic regression analysis to be valid, I had to check that the assumptions of the statistical test were met.

**Assumptions**

The first assumption required by logistic regression was that the dependent variable be binomial or binary. Preterm birth uses the gestational age of the infant and that is a highly skewed continuous variable. I determined it would be better to categorize preterm birth. I created a binomial variable with preterm birth was coded as 0 and not preterm birth coded as 1.

The other assumption required is that the independent variables not be highly correlated, or that there is no multicollinearity. Multiple highly correlated variables can obscure the true relationships of the independent variables to preterm birth. I again used the Chi Square test of association to test the significance of the relationships among the variables I planned to include in the model based on my bivariate analysis. So when we incorporated multicolinearity, all variables were highly correlated with the strongest variable being education level. This will aid in maintaining a stronger power. Therefore, highest grade level was chosen for the final logistic regression analysis because this variable canceled the other variables out and was highly correlated to health literacy levels.

Level of education was identified as the strongest confounder with the strongest association with preterm birth. Level of education can be presumed to be highly related to maternal healthy literacy. The results of multiple logistic regression analysis are presented in Table 28. The results suggest that women that have some high school education are 5.23 times more likely to have a preterm birth than those with completed highschool or earned a GED and 1.49 and 1.86 times more likely than those with some college or a college degree, respectively. Additionally, women that delivered by C-section were 2.44 times more likely to have a preterm birth. Backward logistic regression

enabled the identification of the utilization of variables of significance while simultaneously adjusting for the effect of other variables. I present the results of those tests in Table 28.

Table 28

*Outcome of Backward Step Binary Logistic Regression Analysis*

| Variable | *OR* | 95% CI | *p* |
|---|---|---|---|
| Education graduated (highschool or GED) | 5.23 | .061 - .601 | .005 |
| Education (some college) | 1.49 | .266 – 1.689 | .396 |
| Education (college degree) | 1.86 | .209 – 1.372 | .194 |
| Delivery Type | 2.44 | .193 - .866 | .020 |

Based on the results of the Chi Square tests, I determined that education level, employment status and household income were correlated. I chose to include education to represent marital status and income to avoid issues with multicollinearity, based on the extant literature.

**The Model**

I used the results of the bivariate analyses of the relationships of the independent variables to preterm birth, maternal health literacy, and each other to determine which of the variables collected should be included in the model of the principle relationship of maternal health literacy and preterm birth. The variables included in the initial model were: level of education, type of health insurance, and type of delivery. To create the

most parsimonious model to conserve power given the restricted sample size, I used SPSS backwards logistic regression. The parameters were set at p=.05 for entry and p=.10 for removal into the model. The final model included level of education and delivery type. The OR and significance of each of the variables in the final model are in Table 29.

Since maternal health literacy was not included in the initial model using this approach and it is the independent variable of interest to this study, I conducted an additional model using the enter approach. For that model I used only the variables found significant using the backwards approach and maternal health literacy to compute an adjusted odds ratio for that primary relationship.

Table 29

*Outcome of Backward Step Binary Logistic Regression Analysis*

| | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| Model | | B | Std. Error | Beta | *t* | Sig. |
| 1 | (Constant) | .615 | .049 | | 12.491 | .000 |
| | Adequate literacy level | .115 | .073 | .122 | 1.591 | .113 |
| 2 | (Constant) | .669 | .036 | | 18.412 | .000 |

a. Dependent variable: Preterm Labor

This showed that the relationship between preterm labor and maternal health literacy was negative (.113) and based on the t-value (1.591) and the p-value (.113). I concluded this relationship as not being statistically significant. After adjusting for confounding variables, the results of the multiple logistic regression analysis showed that maternal health literacy and preterm birth were not significantly associated with each other.

## Summary of Findings

I focused this study on determining if an association existed between maternal health literacy levels may be a risk factor for adverse pregnancy outcomes, specifically preterm birth. There were no signification associations between cases and controls with respect to age and race because this study matched for those variables. In this study, the main focus was to determine if there was an association between maternal health literacy level and preterm birth. From the data collected, when comparing mothers that delivered preterm to mothers that delivered term, there was no significance (p-value = 0.112) with respect to maternal health literacy. Therefore, I accept the null hypothesis of this study that there was no association between low maternal health literacy levels, as assessed by the REALM instrument, and preterm birth for English-speaking women between the ages of 18 and 35 within the metropolitan Atlanta area. The other risk factors of type of insurance, type of delivery and level of education, were found to have significant influence on the birth outcome. Further discussion and interpretation of these finding will be found in Chapter 5.

# Chapter 5: Discussion, Conclusions and Recommendations

The purpose of the study was informative in nature with a goal to identify the maternal health literacy levels among postpartum women between the ages of 18 and 35 within the metropolitan Atlanta area and compare their maternal health literacy levels (independent variable) to their pregnancy outcomes (dependent variable), specifically preterm birth as defined by gestational age. The study was designed to address whether there was an association with pregnancy outcome when looking at maternal health literacy levels of recently delivered women.

Analyzing this primary data provided an opportunity to explore the relationship between pregnancy outcomes and maternal health literacy levels. The overall purpose of this dissertation was to address the null hypothesis that there was no association between low maternal health literacy levels, as assessed by the REALM instrument, and preterm birth for English-speaking women between the ages of 18 and 35 within the metropolitan Atlanta area. It is important to remember that the data collected was cross-sectional and cannot be used for cause and effect relationships. Likewise, I matched the groups in this study matched on age and race. Therefore, I cannot establish whether low health literacy levels of new mothers contribute to a woman's risk for preterm delivery.

## Interpretation of Findings

Through the use of binary logistic regression model I was able to determine that educational level was a significant contributory factor associated with preterm birth.

## Preterm Birth

**Association to age and race.** Previous research identified an association between preterm birth and race, specifically non-Hispanic black mothers (March of Dimes, 2011). An association had also been identified between preterm birth and age of mother. There are many studies that have identified young maternal age as an important risk factor for preterm birth (Amini et al., 1996; Branum and Schoendorf, 2005; Fraser et al., 1995). I acknowledge this fact in this study, but do not need to address it as my study only included women over the age of 18.

Women ages 35 and over are also at increased risk for preterm delivery (Astolfi and Zonta, 2002; Cnattingius et al., 1992). Astolfi and Zonta (2002) found a 64% increase in the odds of preterm delivery among mothers 35 years of age or older compared with that among mother less than 35 years of age when education, birth order, and fetal gender were controlled for. Of interest to this study is the Astolfi and Zonta (2002) study which found the risk was particularly remarkable among mothers over 35 years of age who had a nulliparous delivery. The reasons for the increased risk for preterm delivery among older women are not known. Pooled data for the 1998 to 2000 U.S. birth cohorts from the National Center for Health Statistics (IOM, 2007) identified a U-shaped curve that characterizes the relationship between maternal age and preterm delivery (Figure 8). I acknowledge this fact in this study, but do not need to address it as I matched for age.

Race is obviously an important issue with both preterm birth and maternal health literacy, and that were it not controlled for in the study design would be an important

factor, but, my study is not on racial disparity as preterm birth and maternal literacy cut across all ethnicities and races.

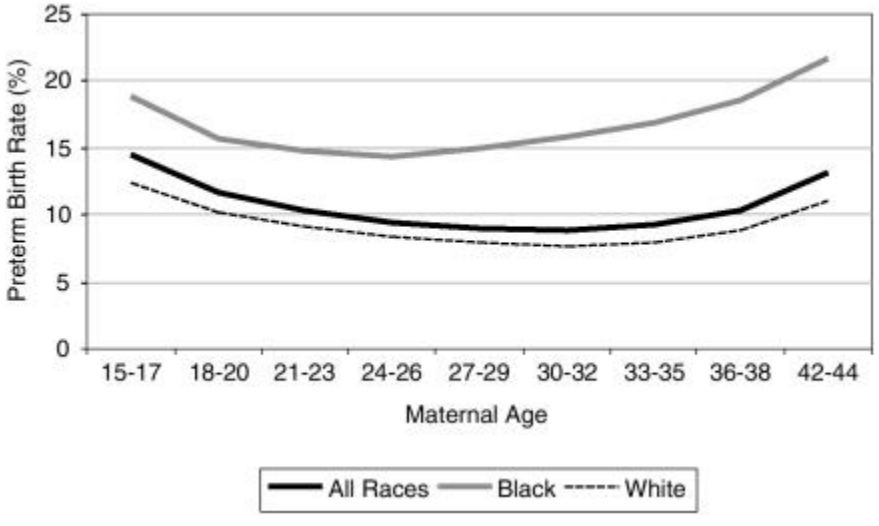


*Figure 8.* Relationship between maternal age and preterm birth, by race, 1998 to 2000, U.S. birth cohorts. Adapted from: NCHS (unpublished data). Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK11388/

**Association to marital status.** In this study, I did not find a significant association between preterm birth and marital status. Past researchers have identified an association in unmarried women and higher risk of preterm birth (e.g., Luo et al., 2004; Raatikainen et al., 2005; Zeitlin et al., 2002). Review of NCHS data for the 1998 to 2000 U.S. birth cohorts so preterm birth rates higher for unmarried women than for married women across all racial ethic and age groups (IOM, 2007). In this study, I did not find an association between preterm birth and marital status. My matching on age and race within the case and control group could have caused the lack of significance. Of note, I asked marital status as *married* or *never married*. It did not question relationships that were cohabitational in nature. The CDC (2000) estimated that 40% of births that occur outside of marriage are within a cohabitating couple.

**Association to quantity of prenatal care visits.** This study did not find a significant association between preterm birth and quantity of prenatal visits. This conflicts with past research that has demonstrated that lack of prenatal care is associated with higher risk of preterm births. Vintzileos et al. (2002) determined that absence of prenatal care increased the relative risk for preterm birth 2.8 fold in both African American and Caucasian women. Low health literacy has been associated with poor prenatal care utilization (Bennett et al., 2006). Janicke et al. Granted, in my study I compared adequate ($\geq$ 10 prenatal visits) versus inadequate prenatal care as defined by the March of Dimes (2011). The lack of significance may be due to our matching of cases and controls on age and race as those variables are included in past research on this area and I controlled for them.

**Association to type of physician.** I did not find a significant association between preterm birth and type of physician. I thought it would be of interest to determine if a significant association existed between the type of physician caring for the pregnancy of the mother and pregnancy outcome. Two types of physicians practiced at the urban hospital in which this study was conducted. One type was identified as a community physician – those typically going into private practice upon successful completion of their residency. The other type was identified as an academic physician- those that have a practice within an academic setting in addition to education and training medical students and gynecology and obstetrics residents. I thought it would be interesting to see if the type of practice played any role in the delivery outcome because academic physicians are more current with up to date peer-reviewed information as it is part of their requirement in educating and training medical students and residents.

**Association to employment status.** I did not find a significant association between preterm birth and employment status. This coincides with research conducted by Saurel-Cubizolles et al. (2004) and a meta-analysis conducted by Mozurkewich et al. (2000) that determined employed women did not have an excess risk of preterm birth, but determined it was the specific types of working conditions that affected the risk of preterm birth. I acknowledge that conducting a chi-square analysis with multiple categories, as it is in this case, causes a stronger likelihood of a Type 1 error in this study choose to keep the categories as they are so to be consistent with the Behavior Risk Factor Surveillance System questionnaire that was used for this study.

**Association to maternal health literacy.** I did not find a significant association with regards to preterm birth and maternal health literacy level. At the time of the inception of this study idea, there was limited previous research that studied this association. Evidence was noted in a study by Mojoyinola (2011) that did not determined a significant relationship between maternal health literacy and pregnancy outcomes but there was a positive relationship between the two variables. The study did not clarify the pregnancy outcomes that were factored. The Mojoyinola study does support the findings of the Ohnishi et al (2005) showing that mothers identified with suitable maternal health literacy have higher birth weight and less premature deliveries. Similarly, Kohan et al. (2007) determined through their descriptive study of women that delivered at an Iranian hospital that good health literacy among pregnant women was associated with good pregnancy outcome.

Of note, these studies were conducted outside of the United States so it is difficult to generalize the results of these studies to this study. Even so, there was a statistically

significant association found with preterm birth and the social factor of education level. We can show through past research that educational level is directly associated with level of health literacy, with lower educational levels in adults to be directly associated with lower health literacy levels. Specific to women, the NAAL survey identified women with low health literacy as less likely to have a high school education and more likely to be low-income or of racial/ethnic minority (Kutner et al., 2006). Additional research from the NAAL survey determined grade level completion did not correlate to actual reading level (Kirsch et al., 2002). Wilson et al. (2006) determined from the NAAL survey data that mothers had reading levels four to five grades lower than their actual school grade completion. This can contribute to low health literacy women having a greater difficulty reading and understanding health information.

**Association to educational level.** I did identify a statistically significance association with preterm birth and the social factor of education level ($p=0.051$). Past research has identified an association in lower levels of maternal education women and higher risk of preterm birth (Miranda et al., 2009, Luo et al., 2004, Roberts, 1997, & Schoendorf et al., 1992). This coincides with a study conducted by Messer et al. (2005) that found Caucasian women with the lowest level of education had an odds ratio of preterm birth 1.47 times than that for Caucasian women with the highest level of education. This leads to the interpretation that educational levels of pregnant women are independent indicators for the adverse birth outcome of preterm delivery.

**Association to type of insurance.** I did identify a statistically significant association with preterm birth and type of insurance ($p=0.015$). It was necessary to determine if an association existed because publicly insured women usually have a

different demographic background to privately insured women, which is related to poor neonatal outcomes after birth. The results of our analysis correlates to a large four year study that reviewed 25,104 hospitalizations for preterm labor concluding that among other factors, types of insurance had a significant association with preterm labor (Nicolson et al., 2000). Conversely, Whitehead (2012) determined that lower income and Medicaid-paid cases were independently associated with an increased risk of preterm contractions but not preterm delivery. Again, conducting a chi-square analysis with multiple categories, as it is in this case, I am unable to state what category produced this statistical significance as there is a difference between no insurance and private insurance. I can state that there is an association between type of insurance and preterm birth but I cannot say whether that is due to the fact that they have no insurance compared to private insurance or public insurance. The analysis showed that private insurance is more likely among the control group. The U.S. Department of Education's 2003 National Assessment of Adult Literacy was able to show that "compared to privately insured adults, both publicly insured and uninsured adults had lower health literacy skills" (Kutner, M., Greenberg, E., Jin, Y., & Paulsen, C., 2006).

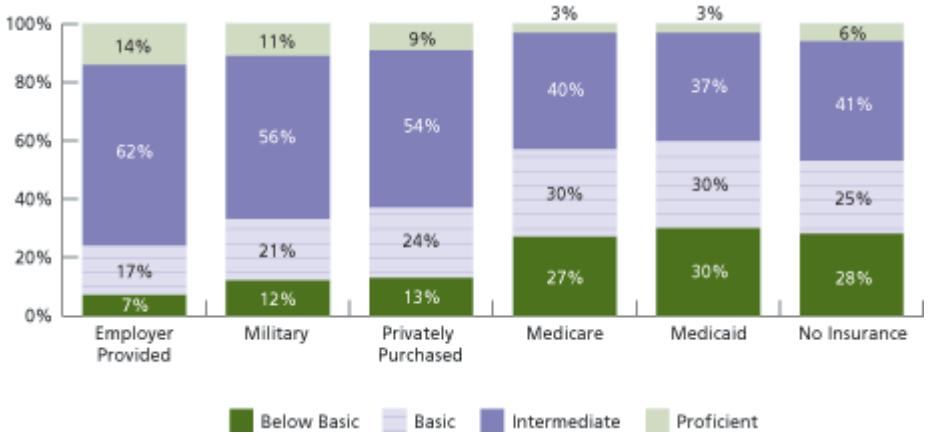


*Figure 9:* Adults' Health Literacy, By Type of Health Insurance. 2003 U.S. Department of Education, Institute of Education Sciences. Adapted from Kutner, M., Greenberg, E., Jin, Y., & Paulsen, C.(2006). *The health literacy of American adults: Results from the 2003 National Assessment of Adult Literacy*. U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Future research on stratification and comparison to a referent group on this study topic would be beneficial to make a more meaningful conclusion.

**Association to type of delivery -** I did identify a statistically significant association with preterm birth and type of delivery (p=0.039). I would expect a significant association between type of delivery and birth outcome because the outcome of preterm birth is a lower birth weight and easier for a vaginal delivery.

**Maternal Health Literacy**

The REALM tool was used to identify the health literacy levels of the recently delivered women. Validating research of the REALM tool has determined individuals with a REALM score identified as an inadequate level and are associated with significantly reduced skill levels. These individuals would have much difficulty in reading printed materials for low-literacy individual or within the medical realm have

much difficulty understanding basic appointment and prescription information. Thirty-five women in the case group and 56 women in the control group fell into the inadequate category. With a REALM score identified as an adequate level, these individuals are equivocal to those with a high school education, college work or college degree. Twenty-one women in the case group and 57 women in the control group fell into the adequate category. For those participants with an adequate REALM, the prediction is they will be able to read most patient education materials. They majority of participants in this study (both cases and controls), 53.8 % (n = 91), fell into the inadequate category which is equivalent to a high school education. In the 2003 National Assessment of Health Literacy, a higher percentage of individuals who had not attended or completed high school had inadequate health literacy.

I identified a small but significant association between maternal health literacy and level of education (<p=0.001), household income (<p=0.001), type of insurance (<p=0.001), race (<p=0.001), type of physician (<p=0.001) and marital status (<p=0.001). This statistical significance correlates with past studies that looked at health literacy level and these factors. These findings are similar to the results of the 2003 National Assessment of Adult Literacy which indicated individuals who had at least some college education or graduated from graduated from college had a higher health literacy levels when compared to individuals who had less than a high school education (Kunter et al., 2006). The2003 NAAL survey also determined individuals with public health insurance were more likely to have basic or below basic literacy skills (Vernon et al., 2007). Olney, Warner, Reyna, Wood, & Siegel (2007) support the idea that the degree of education attained is directly correlated with health literacy. Individuals with lower

income and less education have been found to be at increased risk for marginal or inadequate health literacy, putting them in dander of the negative health outcomes associated with limited literacy (Cutillie, 2007). My study reinforces past research as it pertains to these factors.

**Association to type of delivery.** There was a stronger statistical significance in the association with maternal health literacy and type of delivery (p=0.039). Past research has not looked at this factor as it relates to health literacy. The significance may be in part due to a lack of education as it pertains to the risk factors associated with delivery type. All of the mothers were assessed within 24 to 48 hours of delivery. This result may be a reflection of the mother's status after a C-section and could be a reflection of their lack of understanding of the REALM survey. The study did attempt to control for this factor as mothers were excluded from the study if they too ill to participate, medical indication preventing inclusion or were given magnesium sulfate prior to delivery.

**Health literacy and preterm birth.** I did not find a significant association between health literacy and preterm birth. This maybe in part related to our small sample size. But one could argue that with the findings of a significant association between education level and preterm birth and the fact that education level and health literacy level are strongly correlated that indirectly health literacy level could be an attributing factor to preterm birth.

## Social Change Implication

Today, many of the health issues that are complicated by health literacy are of complex origin. The boundaries between what is medical and what is social, what is

biological and what is behavioral, what is genetic and what is environmental, are all beginning to blur as more is learned about the complexity of problems ranging from cancer and heart disease to teenage pregnancy and drug and alcohol abuse. Throw one's health literacy level in this mix and it is not only blurred but muddy.

Thus, public health's sense of purpose as it pertains to health literacy and more specifically maternal health literacy needs refashioning. Public health's predicament surrounding health literacy is not lack of interest. Rather, it is lack of sustained interest. We need to reengage health practitioners to achieve a modest understanding of the principals of health literacy, not to mention appreciation of the work being done to the extent of more focused implementation. The challenge I realized over these years is that we need to engage and maintain the health practitioner's interest long enough to build the understanding and support that is essential to good health literacy practice. I strive for maintaining their interest which would hopefully lead to improvements in maternal health. To make this goal more attainable, I plan to focus my next area of interest on developing health literacy curriculum that could potentially be implemented in medical school training and/or residency training.

## Limitations of Study

There were several limitations to this study. The biggest limitation for this study was the small sample size which was under powered to detect difference in the sample which also decreases the generalizability of the findings. While there were over 2000 births during the time period of this study, and 657 births that fit the inclusion criteria, there were only 169 that agreed to participate in the study. This reinforced the concept of the convenience sample as those participants that agreed to participate did so out of

convenience. This limits the representativeness of the sample and introduced the potential for self-selection bias. Secondly, the low participation level added to the amount of time that was estimated to collect the data. The study was extended to allow more opportunity to collect the desired sample size.

The condition of preterm birth is more uncommon than term birth making this logical for a case-control study design. With a case-control study design, fewer subjects are required but the flexibility of the variables chosen to be studied comes at the expense of the restricted outcomes studied. The only outcome was the presence or absence of the criteria chosen; in this case maternal health literacy level. This added another limitation of confounding variables and bias. This study had confounding variables that were associated with both the exposure and outcome of interest, not being the variable studied. Another limitation identified in this study was the use of the health literacy measurement, the REALM survey. This tool is available in both English and Spanish, but I do not speak Spanish and therefore could only administer the consent, demographic questions and survey tool to English speaking participants. The components of this study allowed for the assessment of maternal health literacy and pregnancy outcomes. The design of the data collection allowed for the analysis of the stated hypotheses; however, there may have been limitations to the study based on the collection methods.

Another limitation identified was the level of gestation may have influenced the maternal health literacy levels because some mothers may have and more prenatal visits due to the fact that their pregnancy went longer in gestation.

Lastly, I conducted this study in only one urban location in the southeastern United States. This may not be reflective of the experience of recently delivered mothers who live in rural settings or in a different area of the United States.

## Implications

The theoretical framework for this study was based on Cox's model of The Interaction of Client Health Behavior because health literacy involves behaviors from the patient and the clinician (Cox, 1982). This model could serve as a framework for continued research into health literacy as it allows for factors that influence the patient and clinician to be reviewed notwithstanding the health outcomes. Clear, understandable communication is needed by the patient and clinician to affect a positive health outcome in the mother and infant. Health literacy needs to be considered an outcome variable that changes with increased health information (Bennett, 2006). The role of the health provider is diverse and multi-dimensional. The expectation of the modern provider is now somebody who strives for a comprehensive collaborative relationship between health care provider and their patients. For women with their first pregnancy, the GYN/OB provider is often the first provided involved in the overall success of a delivery. Documenting the importance of low health literacy in pregnant women and understanding how to mitigate its effects would contribute greatly to the field of obstetrical training and education. Continued analysis of maternal health literacy levels may help to understand how health system changes can positively affect literacy-related barriers.

Change and Kelly (2007) discuss the positive role patient education and increased literacy levels had on the health provider in general. It would benefit the GYN/OB

profession to administer more emphasis on the importance of patient knowledge and education in clinical practice. Ideal opportunities exist in the clinical training received in GYN/OB residency. Incorporation of health literacy in this curriculum could aid in providers learning their patient's health literacy levels and adjust their prenatal care to aid in a successfully pregnancy outcome.

## Recommendations for Further Research

As which has been identified in previous studies, low health literacy leads to increased risk of hospitalization, more barriers to receiving necessary health services. Additionally, patients are less likely to understand medical advice that can affect their health and are more vulnerable to receiving poor-quality care and to being exposed to medical errors because of communication barriers. Implementation of the ACOG Committee Opinion in gynecology and obstetrics practice would be an ideal start for the improvement of maternal health literacy. The majority of health literacy research has involved the elderly and limited English speaking populations. Reproductive age women have been less studied and this study provided an opportunity to delve into the area. Since the inception of this study, the American College of Obstetrics and Gynecologists (ACOG) has published a Committee Opinion (No. 585) addressing all entities within the health care profession are responsible for recognizing and addressing the problem of low health literacy. There should be a systematic approach in offices, hospitals, clinics, national organization, local health organizations, advocacy organizations, medical schools, residency training programs and CME program. Additionally, nurses are often the ones to identify the level of health literacy of a patient, so it is important that they be educated on how to help patients. Some of the guidelines that ACOG supports are to

tailor speaking and listening skills to individual patients. Ask open ended questions using the works "what" and "how" to start the sentence. Use medically trained interpreters when necessary. Check for comprehension by having the patient restate what you have told them in their own words. Encourage staff and colleagues to use plain language that is culturally sensitive.

In this study, I matched for race and age. Research has shown that race is an important risk factor for preterm birth, future studies of consideration may be to incorporate treating race as a risk factor when comparing to maternal health literacy. Further research into the area of health literacy in the GYN/OB community is essential if the growth is expected in regards to positive patient outcomes. The economic strains placed on modern medicine encourage the role of the autonomous patient. For this particular study I would recommend working with a larger sample size as the estimated time frame based upon previous research conducted was inaccurate. A larger sample size would allow for a greater power in this type of study. Furthermore, additional research on this topic may be warranted as this study only looked at multiparous births and not multiparities. Learning that education is a significant factor associated with preterm births, it would be interesting to look at this factor with multiparities as well. Also, it would be interesting to consider research looking at comorbidities and education and preterm birth.

## Conclusion

Health literacy may be the instrumental to improving our statistical rates of poor pregnancy outcomes. A successful pregnancy outcome needs to be managed as a team between the patient and the clinician. Because individuals have control over what they

will actually do to take care of themselves, the clinician can offer the medical necessities such as health information and medical care to help improve health literacy. This will lead to clearer communication and improved health outcomes. Assessment and intervention concerning an individuals' health literacy level is a pathway to that clear communication. Understanding how to have a healthy pregnancy and how to care for oneself during their pregnancy can empower an individual to make positive health behavior changes. A better understanding of health literacy and its role in maintaining health, specifically in relation to the health of pregnant women, may improve birth outcomes.

With national attention placed on this construct of health literacy, increasing health literacy levels is being recognized as one of the key factors to positively influence patient outcomes and needs to be addressed by every healthcare professional in America. With the patient, clinician, and healthcare system all working together to improve communication between the recipient and provider of health care, reduction in consequences of poor pregnancy outcomes and increased quality of life can surely be the outcome.

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# Appendix A: Data Collection Tool

*Demographics: Information gathered from medical record*

Number:_____ Maternal Age at delivery:_____ Initial Prenatal Care sought: _____weeks
# of prenatal visits ___

*Ethnicity*
__Black
__White
__Hispanic
__Other

*Years of school completed:*
Less than 3rd grade: ___
Fourth-eighth grade: ___
Grades 9-11: ___
High school or GED: ___
Some college: ___
College Graduate: ____

*Income:*
<$20,000____
$20,000 - $39,000 ____
$40,000+____
Do not know/Refused____

*Literacy Assessment: (From the Mother)*
Rapid Estimate of Adult Health Literacy in Medicine (REALM):
Score: 0-18___ 19-44___ 45-60___ 61-66___

*Pregnancy Outcomes:*
Preterm labor: Yes or No
Cesarean section: Yes or No
Vaginal Delivery: Yes or No
Spontaneous labor at term: Yes or No

*Infant Outcome:*
Fetal Demise (stillbirth): Yes or No
Birth Weight: ___
Gestational Age: ___

BRFSS Questions

Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare or Indian Health Services?

1 Yes
2 No
3 Don‘t know / Not sure

What is your age? _ _ Code age in years 0 7 Don‘t know / Not sure 0 9 Refused
Are you Hispanic or Latino? 1 Yes 2 No 7 Don‘t know / Not sure

Which one or more of the following would you say is your race? **(Check all that apply)** 1 White 2 Black or African American 3 Asian 4 Native Hawaiian or Other Pacific Islander 5 American Indian or Alaska Native **Or** 6 Other [specify]_____

**Do not read:**
8 No additional choices
7 Don‘t know / Not sure
9 Refused
**Note: If more than one response to previous; continue to next question. Otherwise, go to question after next.**

Which one of these groups would you say best represents your race?
**Please read:**
1 White
2 Black or African American
3 Asian
4 Native Hawaiian or Other Pacific Islander
5 American Indian or Alaska Native
Or
6 Other [specify]_____

Do not read:
7 Don‘t know / Not sure
9 Refused

Are you…?
(
**Please read:**
1 Married
2 Divorced
3 Widowed
4 Separated
5 Never married
**Or**
6 A member of an unmarried couple

What is the highest grade or year of school you completed?

1 Never attended school or only attended kindergarten
2 Grades 1 through 8 (Elementary)
3 Grades 9 through 11 (Some high school)
4 Grade 12 or GED (High school graduate)
5 College 1 year to 3 years (Some college or technical school)
6 College 4 years or more (College graduate)

Are you currently…?
**Please read:**
1 Employed for wages
2 Self-employed
3 Out of work for more than 1 year
4 Out of work for less than 1 year
5 A Homemaker

6 A Student
7 Retired
**Or**
8 Unable to work
**Do not read:**
9 Refused

Is your annual household income from all sources—

**If respondent refuses at ANY income level, code „99" (Refused)**
**Read only if necessary:**
01 Less than $10,000 If "no," code 02
02 Less than $15,000 If "no," code 03; if "yes," ask 01
($10,000 to less than $15,000)
03 Less than $20,000 If "no," code 04; if "yes," ask 02
($15,000 to less than $20,000)
04 Less than $25,000 If "no," ask 05; if "yes," ask 03
($20,000 to less than $25,000)
05 Less than $35,000 If "no," ask 06
($25,000 to less than $35,000)
06 Less than $50,000 If "no," ask 07
($35,000 to less than $50,000)
07 Less than $75,000 If "no," code 08
($50,000 to less than $75,000)
08 $75,000 or more

# Appendix B: REALM Assessment Tool

## Rapid Estimate of Adult Literacy in Medicine

Patient name _____ Date of birth _____ Reading level _____

Date _____ Clinic _____ Examiner _____ Grade completed _____

| List 1 | | List 2 | | List 3 | |
|---|---|---|---|---|---|
| Fat | ❑ | Fatigue | ❑ | Allergic | ❑ |
| Flu | ❑ | Pelvic | ❑ | Menstrual | ❑ |
| Pill | ❑ | Jaundice | ❑ | Testicle | ❑ |
| Dose | ❑ | Infection | ❑ | Colitis | ❑ |
| Eye | ❑ | Exercise | ❑ | Emergency | ❑ |
| Stress | ❑ | Behavior | ❑ | Medication | ❑ |
| Smear | ❑ | Prescription | ❑ | Occupation | ❑ |
| Nerves | ❑ | Notify | ❑ | Sexuality | ❑ |
| Germs | ❑ | Gallbladder | ❑ | Alcoholism | ❑ |
| Meals | ❑ | Calories | ❑ | Irritation | ❑ |
| Disease | ❑ | Depression | ❑ | Constipation | ❑ |
| Cancer | ❑ | Miscarriage | ❑ | Gonorrhea | ❑ |
| Caffeine | ❑ | Pregnancy | ❑ | Inflammatory | ❑ |
| Attack | ❑ | Arthritis | ❑ | Diabetes | ❑ |
| Kidney | ❑ | Nutrition | ❑ | Hepatitis | ❑ |
| Hormones | ❑ | Menopause | ❑ | Antibiotics | ❑ |
| Herpes | ❑ | Appendix | ❑ | Diagnosis | ❑ |
| Seizure | ❑ | Abnormal | ❑ | Potassium | ❑ |
| Bowel | ❑ | Syphilis | ❑ | Anemia | ❑ |
| Asthma | ❑ | Hemorrhoids | ❑ | Obesity | ❑ |
| Rectal | ❑ | Nausea | ❑ | Osteoporosis | ❑ |
| Incest | ❑ | Directed | ❑ | Impetigo | ❑ |
| *List 1 score* | _____ | *List 2 score* | _____ | *List 3 score* | _____ |

***Raw score*** _____

Directions:

1. Give the patient a laminated copy of the REALM form and score answers on an unlaminated copy that is attached to a clipboard. Hold the clipboard at an angle so that the patient is not distracted by your scoring. Say: "I want to hear you read as many words as you can from this list. Begin with the first word in List 1 and read aloud. When you come to a word you cannot read, do the best you can or say, 'blank' and go onto the next word."
2. If the patient takes more than five seconds on a word, say "blank" and point to the next word, if necessary, to move the patient along. If the patient begins to miss every word, have him or her pronounce only known words.
3. Count as an error any word not attempted or mispronounced. Score by marking a plus (+) after each correct word, a check (✔)after each mispronounced word, and a minus (–) after words not attempted. Count as correct any self-corrected words.
4. Count the number of correct words for each list, and record the numbers on the "Score" line. Total the numbers, and match the score with its grade equivalent in the table below.

### Scores and Grade Equivalents for the REALM Questionnaire

*Grade equivalent*

| *Raw score* | *Grade range* |
|---|---|
| 0 to 18 | Third grade and below; will not be able to read most low-literacy materials; will need repeated oral instructions, materials composed primarily of illustrations, or audio or video tapes |
| 19 to 44 | Fourth to sixth grade; will need low-literacy materials, may not be able to read prescription labels |
| 45 to 60 | Seventh to eighth grade; will struggle with most patient education materials; will not be offended by low-literacy materials |
| 61 to 66 | High school; will be able to read most patient education materials |

Curriculum Vitae

# AIMEE M. MOYNIHAN, MSED, CHES

## EDUCATION:

**WALDEN UNIVERSITY** 2008-present

*P.H.D. candidate in Public Health with an emphasis in*
*Community Health Promotion & Education and Women's Health topics,* ***GPA 4.0/4.0***
*Anticipated graduation February 2015*

**UNIVERSITY OF KANSAS** 1996-1999

*P.H.D. in Health Psychology, completed three semesters (13 credits)*
*Masters Degree in Community/Public Health Education and Nutrition, June 1999,* ***GPA 3.89/4.0***
*CHES Certified, October 1998, Member of Golden Key Society*

**EMORY UNIVERSITY**

1990-1994

*BS Psychology, Pre-Medicine*

***Founding member of Alpha Phi Sorority, Theta Pi Chapter***
*Vice president of The Alcohol and Drug Education Committee (ADEC)*

## CERTIFICATIONS:

**National Board for Certifications**

| | |
|---|---|
| Certified Health Education Specialist (CHES) | 1999-present |
| Training Administrators of Graduate Medical Education (TAGME) | 2014-2019 |

## PROFESSIONAL EXPERIENCE:

**Emory University School of Medicine**, Atlanta, GA 03/10-present

Department of Gynecology and Obstetrics, Residency Program

*Residency Program Coordinator*
*Senior Associate Program Director 03/10 – present*

- Direction, leadership and day to day management of educational and departmental activities pertaining to the GYN/OB residency program consisting of 37 residents
- Establishes the schedule of program office activities, prioritizing program related tasks and deadlines
- Ensures program compliance with regulatory agency standards and maintains essential documents required for program viability
- Functions as liaison between residents, departments, attending physicians, administration, hospitals and outside institutions such as GME Track and the ACGME WebADS system
- Compiles and tabulates data for surveys, questionnaires, census reports, accreditation reports and order forms and documents required by internal and external agencies
- Assist in the recruitment, evaluations and selection of residents
- Initiation and administration of residency program budget, including projections of future needs.
- Plan, organize and schedule new house staff orientation.
- Implemented successful completion of site visit and continued accreditation

**Emory University School of Medicine**, Atlanta, GA 11/08-04/10
Department of Gynecology and Obstetrics, Division of Family Planning

*Senior Associate Program Director, 11/08 – 3/10*

- Oversight of Family Planning Fellowship administrative responsibilities
- Establish relationships within the University and in metro-Atlanta such that the requirements of the Family Planning Fellowship were fulfilled
- Administrative responsibility for the enhancement and coordination of the required educational responsibilities
- Implemented successful completion of site visit and accreditation

**Emory University Regional Training Center**, Region IV, Atlanta, GA 11/00-10/08
Emory RTC is the DHHS, Office of Family Planning Title X Region IV training center which provides continuing education and training services for clinicians and staff to 1,200 family planning communities in eight southeastern states.

*Assistant Director, 10/05 – 11/08*

- Coordinator/project manager for General Training events in Alabama, Florida and Kentucky related to reproductive health, adolescent pregnancy, HIV prevention, STI prevention, sexual assault/domestic violence prevention, diabetes, obesity, heart health and cervical cancer screening (40 events/year for ~30 clinicians).
- Project manager for Colposcopy for Advanced Practice Program (intensive week course, 2-4/year for 20-30 clinicians).
- Coordinator/event manager for Annual Women & Their Health Conference (~300 clinicians/yr).
- Coordinator for Providing Colposcopy Equipment in deserving Region IV Title X clinics.
- RTC representative at regional, bi-regional, and national conferences.
- Monitor and manage DHHS and CDC federal grants, budgets and prepare operational reports and continuing grant proposals.
- Developed continuation budgets and budget justifications.
- Project Manager for CDC HIV Integration projects.
- Project manager for RTC Quality Assurance and budget oversight for 15+ grants over the course of employment.
- Prepared progress reports, evaluations, evaluation analysis and final reports for multiple grants.
- Assists director with day-to-day operations of the organization including strategic planning, development and implementation of programs.
- On a monthly basis, reviewed financial reports for accuracy, resolved billing issues with accounts payable.
- Lead staff liaison with Emory departments (Office of Sponsored Programs, Office of Grants and Contracts, GYN/OB Department) and DHHS Regional Office, Region IV

*Senior Program Associate, 10/03 – 10/05*

- Coordinator for General Training in Alabama and Kentucky (40 events/year for ~30 clinicians).
- Assisted director with agency management matters, including federal grant development, budgeting, operational reporting, and supervision of personnel.
- Co-managed eight-state teenage pregnancy prevention project in DHHS Region IV, overseeing 10 programs (including annual site visits) and administering grant-related matters.
- Co-coordinated Colposcopy for Advanced Practice Program in Region IV.
- Coordinated provision of Colposcopy Equipment in deserving Region IV Title X clinics.
- Coordinated all logistics for Region IV Annual Women & Their Health Conference for 300 clinicians.
- RTC representative at regional, bi-regional, and national conferences.

- Over saw regional project on OPA Priority of Integration of HIV testing and counseling in Title X Family Planning clinics.
- Managed quality assurance and budget oversight for 15+ grants.
- Project manager for HIPAA compliance within SE region and related conferences.

*Instructional Specialist, 11/00- 10/03*

- Coordinator for General Training in Alabama and Kentucky (40 events/year for ~30 clinicians).
- Project manager for HIPAA compliance within SE region and related conferences.
- Project manger for the Regional Clinical Needs Assessment.
- Co-project manager for Region IV Special Initiative in Teenage Pregnancy Reduction.
- Co-Project manager for the HIV/CDC Teen Prevention Service Training Grant.
- Co-coordinator for Annual Women & Their Health Conference (~350 clinicians/yr).
- Editor for the Emory RTC newsletter.
- Project manager for RTC Quality Assurance and budget oversight for 15+ grants.
- Participant in the Cervical Cancer Screening Management Project Workgroup.
- RTC representative at regional, bi-regional, and national conferences.
- Monitor and manage federal grants and prepare operational reports.
- Monitor and manage federal budgets and financial reporting.
- Update and refine curricula as needed.

**Independent Event Consultant,** Atlanta, GA 10/02-02/03

- Coordinated the National Conference on the HIPAA Privacy Rule sponsored by the US Department of Health and Human Services Office for Civil Rights, Emory Healthcare at Emory University and the Morehouse School of Medicine (3500+ in attendance).
- Responsibilities included development of marketing strategy and collateral piece design, website management, registration database design and management, budget management, logistics planning, coordination of event staff and conference evaluations.

**Watkins Health Center at the University of Kansas**, Lawrence, KS 1998-2000

*Student Health Services Health Educator, 10/98-05/00*

- Coordinator of the "Safe Spring Break" committee.
- Coordinator of the "Alcohol Responsibility Week" committee.
- Coordinator of "Watkins Annual Health Fair" committee.
- Co-coordinator of "Hawk Nights" – Alternative Program for KU Alcohol Task Force.
- Editor of The Beak Healthy Newsletter – semester distribution.
- Taught the Smoking Cessation Program for college students.
- Co-taught the Peer Health Advising class, HSES 265.
- Guest lecturer for the Department of Health, Sport, and Exercise Science.

**Watkins Health Center at the University of Kansas**, Lawrence, KS 1997-1998

*Coordinator for the Center for Peer Health Promotion, 9/97-10/98*

- Recruited, trained and supervised 25 Peer Health Educators.
- Successfully wrote two continuation grants for the Center.
- Revised and implemented training manual and course for new educators.
- Established and maintained support from University organizations.
- Created, pamphlets, fliers, newsletter, advertisements and displays.

**BSH, Inc.**, Lawrence, KS 1995-1998

*Assistant Manager, 9/95-10/98*

- Managed 85 employees and implemented training program for new employees.
- Managed book keeping and submittal of necessary reports to corporate office.

- Maintained all required inventory at optimal levels.

**Southwestern Illinois College,** Belleville, IL 1994-1995

Associate Professor Assistant, *6/94 – 8/95*

- Implemented didactic portion of EMT-Basic program.
- Provided hands-on training and demonstrated proper techniques as a registered EMT-Basic.

## PUBLICATIONS AND PRESENTATIONS:

**PUBLICATIONS**

2007, CHOICES, Managing Contraception, Bridging the Gap Communications.

**PRESENTATIONS**

Moynihan A and Arluck JC. Talk Tech Session: How to Incorporate Recognition Technology Through the Creation of QR Tags. Round Table Presentation, 2014 APGO/CREOG Conference

Collins, E., Arluck, JC, Brodgon, G., Heyl, Moynihan, A., Roberts, Ca. Improving case log reporting. Poster Presentation - Emory University, Atlanta, GA 2012

## COMMITTEE MEMBERSHIPS/GROUP INVOLVEMENT:

**NATIONAL**

- **National Commission for Health Education Credentialing, Inc. CHES Certified,** *1999-present*
- **Council on Resident Education in Obstetrics and Gynecology,** *ACOG, July 2010 - present*
- **Association of Professor of Gynecology and Obstetrics,** *July 2010 – present*

**INSTITUTIONAL**

- **GYN/OB Resident Progress and Promotions Committee,** *Emory University, 2010 – present*
- **GYN/OB Resident Application Committee,** *Emory University, 2010 – present*
- **GYN/OB Residency Administration/Education Committee,** *Emory University, 2010 – present*
- **GYN/OB Medical Education Committee,** *Emory University, 2010 – present*
- **Council of Emory Residency Training Administrators,** *Emory University, March 2010 - 201t*
- **GYN/OB Emory Healthcare Operations Committee,** *Emory University, 2008-2010*
- **GYN/OB Emory Healthcare Budget Committee,** *Emory University, 2008-2010*
- **Emory Graduate Medical Education Committee,** *Emory University, 2010-present*
- **Emory Graduate Medical Education Subcommittee – Education,** *Emory University, 2014-present*

**OTHER**

- **Junior League of Atlanta, Inc.,** *Atlanta, GA, 2001-present (Board of Directors 2009-2010, Nominating committee 2010-2012, Board of Directors 2012-2013, Nominating committee 2014-2016, Advisory Planning committee 2014-2015)*

## HONORS/AWARDS:

**Outstanding Staff Member Award,** *Emory University, Department of Gynecology and Obstetrics 2010-2011*