HEALTH LITERACY, HEALTH DISPARITIES AND SOURCES OF HEALTH INFORMATION IN US OLDER ADULTS

A Dissertation

Submitted to the School of Nursing

Duquesne University

In partial fulfillment of the requirements for
the degree of Doctor of Philosophy

By

Carolyn Crane Cutilli

May 2015
Copyright by

Carolyn Crane Cutilli

2015
HEALTH LITERACY, HEALTH DISPARITIES AND SOURCES OF HEALTH INFORMATION IN US OLDER ADULTS

By

Carolyn Crane Cutili

Approved March 31, 2015

_____________________________
Lynn Simko PhD RN CCRN
Professor of Nursing
(Committee Chair)

_____________________________
Alison Colbert PhD PHCNS-BC
Professor of Nursing
(Committee Member)

_____________________________
Ian Bennett MD PhD
Assistant Professor of Medicine
(Committee Member)

_____________________________
Mary Ellen Glasgow PhD RN FAAN
Dean, School of Nursing
Professor of Nursing
ABSTRACT

HEALTH LITERACY, HEALTH DISPARITIES, AND SOURCES OF HEALTH INFORMATION USED BY US OLDER ADULTS

By
Carolyn Crane Cutilli
May 2015

Dissertation supervised by Dr. Lynn Simko

This descriptive study is a secondary analysis of the National Assessment of Adult Literacy (NAAL) 2003, a large scale national assessment which included health literacy. It examined the relationships between health literacy and demographic/background characteristics in older adults (age 65 and over) related to health literacy and disparities, and sources of health information. Key findings include: 1) results support most relationships described in the conceptual model and literature associated with health literacy and disparities; 2) there are similarities and difference in the utilization of health information sources based on health literacy level; and 3) the results support established health literacy predictive relationships, and identify variables (knowledge/skills, health education) that make the model more robust.

Older adults with lower health literacy have a tendency to have less income and education, rate their health as poor or fair, have visual or auditory difficulties, and need help with
tasks such filling out forms, reading newspaper or writing notes. When seeking health information, older adults with lower health literacy \((Below \ Basic/Basic)\) used less sources (newspapers, magazine, internet, books, radio/TV, family/friends/co-workers, doctors/health care providers) with less frequency. As health literacy increased, the number of older adults using all sources of health information increased. Doctor/health care provider was the source used by the greatest percentage of older adults “A lot” regardless of health literacy level. The internet was not a preferred source of health information with a large percentage of older adults not using it at all.

Several variables associated with lower health literacy are also linked to health disparities such as income, education, and disabilities. Future research on interventions that address the health literacy needs of older adults based with lower income and education, and disabilities may potentially impact health disparities. Results from the regression demonstrated that income, education, help with filling out forms or reading newspaper, and utilizing the following health information sources (doctor/health care provider, books, internet, and magazines) are predictive of health literacy. Only income and education are in the literature as impacting health literacy. Adding the other significant variables has the potential to make the model more robust.
DEDICATION

This is dedicated to my family, friends, and colleagues who have provided encouragement through the years as I completed my PhD journey.

To my husband, Bruce Cutilli, thanks for all you have done to keep me going…listening, a shoulder to cry on, driving all the time and taking a computer everywhere so I can work on my studies....

To my children, Ben, Greg, and Jenna Cutilli, thanks for the repeated question to motivate me …“aren’t you done yet?”

To my mother, Peggy Crane…thanks for the reminding me of your goal…to live long enough to see me graduate. To my dad, James Crane, who passed away 13 years ago, thanks for always supporting me to be a nurse.

To my brother and sister-in-law, Jim and Cynthia Crane…thanks for always checking on my progress and the words of encouragement.

To my nephews, Derek and Spencer Crane, thanks for sharing your knowledge about statistical analyses and software programs.

To the rest of my family, Nancy and Vincent Cutilli and Tami Eldridge, thanks for helping when I was traveling with my doctoral studies.

To my friends and work colleagues…thanks for always listening, supporting and telling me that quitting was never an option.

To my Cohort 12 colleagues, especially Cindy Schaefer…it has been a great ride, thanks for taking it with me…we have stuck together to the very end!
ACKNOWLEDGEMENTS

I would like to acknowledge the patient guidance, and tremendous support of my committee chair, Dr Lynn Simko, and my other committee members, Dr. Alison Colbert and Dr. Ian Bennett. Your words of wisdom have guided me through my research and contributed greatly to my knowledge and skills as a scientist. I also want to acknowledge the Duquesne Nursing Faculty who provided my foundational knowledge as a nurse scientist and the opportunities to write about various aspects of health literacy and patient and family education throughout my course work. I also want to acknowledge my statistician, Anand Bhattacharya...who has increased my statistical knowledge multifold and tolerated my endless questions.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>iv</td>
</tr>
<tr>
<td>Dedication</td>
<td>vi</td>
</tr>
<tr>
<td>Acknowledgement</td>
<td>vii</td>
</tr>
<tr>
<td>Chapter One: Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1.1 Overview</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Purpose of Study</td>
<td>11</td>
</tr>
<tr>
<td>1.3 Research Questions</td>
<td>12</td>
</tr>
<tr>
<td>1.4 Definition of Terms</td>
<td>12</td>
</tr>
<tr>
<td>1.5 Assumptions</td>
<td>14</td>
</tr>
<tr>
<td>1.6 Limitations</td>
<td>14</td>
</tr>
<tr>
<td>1.7 Significance to Nursing</td>
<td>15</td>
</tr>
<tr>
<td>1.8 Summary</td>
<td>16</td>
</tr>
<tr>
<td>Chapter Two: Review of Literature</td>
<td>18</td>
</tr>
<tr>
<td>2.1 Introduction</td>
<td>18</td>
</tr>
<tr>
<td>2.2 Health Literacy</td>
<td>18</td>
</tr>
<tr>
<td>2.3 Conceptual Model</td>
<td>21</td>
</tr>
<tr>
<td>2.4 Older Adults</td>
<td>24</td>
</tr>
<tr>
<td>2.5 Measuring Health Literacy</td>
<td>25</td>
</tr>
<tr>
<td>2.6 National Assessment of Adult Literacy (NAAL)</td>
<td>29</td>
</tr>
<tr>
<td>2.7 Cognitive Changes in Older Adults</td>
<td>39</td>
</tr>
<tr>
<td>2.8 Health Literacy in Older Adults</td>
<td>41</td>
</tr>
</tbody>
</table>
Variables..............................................................................................................82
Statistical Analyses..............................................................................................83
Results..................................................................................................................84
Discussion.............................................................................................................89
Limitations............................................................................................................93
Conclusion.............................................................................................................94
References...........................................................................................................97
Figure 1................................................................................................................106
Table 1................................................................................................................107
Table 2................................................................................................................108
Table 3................................................................................................................110
Table 4................................................................................................................112
Table 5................................................................................................................113
References..........................................................................................................114
CHAPTER ONE

INTRODUCTION

1.1 Overview

Older adults in our country are at risk for suboptimal health care due the prevalence of low health literacy. The older adult population has been associated with the highest rate of low health literacy (Gazmararian et al., 1999; Kutner, Greenberg, Jin, & Paulsen, 2006; Wolf, Gazmararian, & Baker, 2005). Health literacy is most often defined as the ability of an individual to understand health information to the extent needed to make informed decisions (Ratzen & Parker, 2000). This is an adaptation of the original definition by Ratzen and Parker (“informed decisions “replaces “appropriate decisions”), reflecting the focus on patient centered care. For the purposes of this study, health literacy is defined as “the ability of US adults to use printed and written health-related information to function in society, to achieve one’s goals and to develop one’s knowledge and potential,” (Kutner et al., 2006, p.2). Older adults have the greatest risk of poor health outcomes related to low literacy, putting them at a disadvantage when managing their health care compared to younger individuals.

This study examined the association between and among health literacy, health disparities, sources of health information/health information-seeking behavior, and demographic and background characteristics (socio-demographic factors, language and math skills, computer access and knowledge, health status, and disabilities) in US older adults. The study was a secondary analysis of The National Assessment of Adult Literacy (NAAL) 2003 which examined the literacy/health literacy and background variables of the US population (Kutner et al., 2006). The results of the study provide information for
health care professionals to utilize when developing interventions to counteract the effects of low health literacy, thus, minimizing the effects of low health literacy. This chapter provides an overview of the following topics: health literacy, the NAAL, sources of health information /health information-seeking behavior, health disparities, the older adult population, definitions and study design/questions.

1.1.2. Background

To utilize resources efficiently and make informed health care decisions, it is critical for older individuals to have sufficient health literacy to understand health information. In recent years the United States (US) population has been asked by payers (i.e. government and insurance companies) and regulatory agencies (i.e., The Joint Commission) to play a more active role in managing their health to control costs and improve safety (The Joint Commission, n.d.). To effectively manage their health, individuals need to understand health information and the health care system.

Research in the older adult population has shown that low health literacy has been associated with increased mortality, worse physical functioning and mental health, fair/poor rating of health, and medication non-adherence (Baker et al., 2007; Chew, Bradley, Flum, Cornia, & Koepsell, 2004; Raehl, Bond, Woods, Patry, & Sleeper, 2006; Sudore et al., 2006; Wolf et al., 2005). Older individuals with chronic illnesses (asthma, diabetes, and congestive heart failure) and lower health literacy scores also have lower mean knowledge scores about their chronic condition (Gazmararian, Williams, Peel, & Baker, 2003).

The federal government views health literacy as key to quality health care as noted by the inclusion of health literacy in the Healthy People 2010 and 2020 initiatives.
(Healthy People 2020, n.d.; U.S. Department of Health and Human Services (HHS), 2000), the publication of the Institute of Medicine Report entitled *Health Literacy: A Prescription to End Confusion* (Nielsen-Bohlman, Panzer, & Kindig, 2004), and the addition of health related questions to the NAAL. The NAAL was sponsored by the Department of Education to examine adult literacy in the US adult population. The federal government provided resources for public and private researchers from various fields such as nursing and education to utilize the NAAL health literacy data to build knowledge about literacy and health literacy in their respective disciplines.

1.1.3 Health Literacy in the older adult population

The concept of health literacy is relatively new in the health care literature, first appearing in the early 1990s. The term health literacy has been subject to concept analysis and definition refinement through the years, however the definition most widely used in government publications refers to the individual’s ability to understand health care information to make appropriate (informed) health care decisions (Ratzen & Parker, 2000). Health literacy ability, like literacy skills, varies greatly from individual to individual, and is associated with numerous factors including but not limited to age, gender, education, race, and income (Baker et al., 2007; Gazmararian et al., 1999; Kutner et al., 2006). Insufficient health literacy is described in various terms including inadequate, marginal, or low by various health literacy tests.

Health literacy in the older adult population refers to the health literacy of individuals age 65 or older. As tools to measure health literacy were developed in the early to mid 1990s, researchers began to examine the relationship between health literacy and demographic variables along with the understanding of health information, health
Health literacy has been found to have a direct effect on a range of health outcomes (Cho, Lee, Arozullah, & Crittenden, 2008).

Health literacy is considered a crucial aspect of health care due its relationship and impact on health related outcomes (health knowledge, frequency of hospitalization, use of preventative care, the ability to complete activities of daily living and cost). Greater knowledge of medical treatment and disease processes is associated with higher health literacy (Kim et al., 2001; Wilson, Racine, Tekieli, & Williams, 2003). Patients with marginal or inadequate health literacy were more likely to be hospitalized (Baker et al., 2002). Older adults with inadequate health literacy utilized less preventive care (Miller, 2004; Scott, Gazmararian, Williams, & Baker, 2002), and had difficulty with activities of daily living and activity limitations (Wolf et al., 2005).

The cost implications of low health literacy are related to utilization of health care resources. Overall, individuals with low health literacy have increased health care costs resulting from utilization of health care resources in a less efficient manner (Nielsen-Bohlman et al., 2004). The Medicare population uses health care services to treat disease more often than services to prevent poor outcomes from disease (Nielsen-Bohlman et al., 2004). Recent studies have demonstrated that individuals with low health literacy have more frequent utilization of emergency services and increased rates of hospitalization (Baker et al., 2002; Howard, Gazmararian, & Parker, 2005).

1.1.4 National Assessment of Adult Literacy (NAAL) 2003

The federal government through the U.S. Department of Education, Institute of Educational Sciences, National Center for Education Statistics (NCES), implemented the
National Assessment of Adult Literacy in 2003. The NAAL was designed specifically to gain knowledge about literacy and health literacy in the US population. It was a large scale national assessment which examined the English literacy and health literacy in relationship to various background demographics/characteristics. The NAAL evaluated prose, document, and quantitative literacy. Literacy and health literacy levels are defined as below basic, basic, intermediate and proficient. The NAAL examined health literacy through health related tasks embedded in the survey (White & Dillow, 2005). The test was designed to provide estimation of health literacy for populations such as older adults.

The health literacy measurement tasks in the NAAL include 28 health literacy tasks embedded in the literacy tasks (White, 2008). Six of the questions were previously used in the 1992 National Adult Literacy Survey (NALS). The other twenty-two questions were developed by experts in health and education who assisted in the development of health literacy tools to use in research and clinical practice (White, 2008).

The initial results of the NAAL show that 43% of the US population has basic or below basic literacy level for prose material (Kutner et al., 2007). In regards to health literacy, 36% had basic or below basic skill levels. The background demographics/characteristics most commonly associated with limited health literacy include age sixty-five and older; male; Black or Hispanic; minimal exposure to English language; less than a high school diploma; living at or below the poverty line; overall poor health rating; limited seeking of sources of health information (especially from the internet); one or more disabilities; utilizing fewer preventive health measures and using Medicaid, Medicare, or no insurance (Kutner et al., 2007).
1.1.5 Conceptual model

The conceptual model, “Causal Pathways between Limited Health Literacy and Health Outcomes” (Paasche-Orlow & Wolf, 2007), provides the theoretical framework for this study. This model was developed by the authors after a thorough review of the literature on health literacy. The authors state that the model is not heavily driven by empirical evidence because there is limited relevant data, and should not be viewed as a deterministic cause and effect schema, but rather the model focuses on what are believed to be the most direct paths between health literacy and health outcomes.

The model denotes that patient and system-level factors affect health care access and utilization, medical encounters, and self-care, leading to health outcomes. In the model, numerous variables are associated with an individual’s health literacy such as gender, race, income, education, vision, hearing, and language. The individual utilizes his or her health literacy abilities when encountering the health system and caring for him/herself. In the model, the patient’s knowledge is classified as a patient factor under self-care, and health education is an extrinsic factor under self care. This study will utilize the “Causal Pathways” model to guide the examination of relationships between and among health literacy, background variables (associated with health literacy and health disparities) and sources of health information in older adults.

1.1.6 Older Adult

This study focused on the health literacy of individuals age 65 and older, which is the oldest age group identified in the 2003 NAAL. There are several terms used to describe this age group in the literature including older adults, elderly, and geriatric. The World Health Organization (WHO) states that the age at which individuals are classified
as older adults or elderly is not consistent across the world; however WHO has defined it as age 60 and over (World Health Organization, 2010). According to the Merriam Webster Dictionary, geriatric has two definitions: the branch of medicine that addresses the diseases and problems of aging people or old age, and an aged person (2010). Because all of these terms are used in the literature reviewed for this study and are often used to describe the same population of individuals age 65 or older, older adult and geriatric was used interchangeably in this study, and referred to individuals age 65 and older (including most of the NAAL oldest age category).

1.1.7 Measuring Health Literacy

The design of the health literacy tasks in the NAAL was influenced by the health literacy tools developed since the early 1990s. Tools were predominantly used to measure health literacy in the research setting, although several were developed with the intent to apply them in the clinical setting. The most common tools discussed in literature are Test of Functional Health Literacy in Adults (TOFHLA) (Parker, Baker, Williams, & Nurss, 1995), the Rapid Estimate of Adult Literacy in Medicine (REALM) (Davis et al., 1993), the Newest Vital Sign (RW. ERROR - Unable to find reference:179), and the single item questionnaire (Chew, Bradley, & Boyko, 2004; Wallace, Rogers, Roskos, Holiday, & Weiss, 2006).

These tools evaluate health literacy through various approaches (i.e., reading/pronouncing medical terms, reading health information, completing tasks such as determining the nutritional content of a food item, or completing a questionnaire about the help needed to fill out health information documents). In addition, each tool provides
a unique description of the individual’s health literacy ability (i.e., grade level, adequate or inadequate, low).

1.1.8 Educational Attainment and health literacy

This study examined the relationships between health literacy and educational attainment from the NAAL data for individuals age 65 and older. Research examining the relationship between health literacy and education demonstrates that usually the higher the level of education, the higher an individual’s health literacy (Kutner et al., 2006). However, this relationship does not always hold true. The NAAL shows that fifteen percent of adults with a high school diploma and three percent of adults with a bachelor’s degree had below basic health literacy (White, 2008).

Research has also shown that health literacy levels are consistently two to three years lower than the reported grade level completed (Wilson & McLemore, 1997). Thus an individual with an eleventh grade education, will most likely have a health literacy grade level of eighth to ninth grade. As expected there is an association between low health literacy and low educational attainment (Chew et al., 2004; Gazmararian et al., 1999; Kutner et al., 2006; Sudore et al., 2006).

1.1.9 Cognition Changes in the Older Adult Population

Understanding the cognitive changes that occur in older adults enhances our insight into their higher rate of low health literacy. In the geriatric population, cognitive decline is viewed as a common, albeit complicated process. The ability of an older individual to learn is based on the function of cognitive processes (Park & Schwarz, 2000). Cognitive processes are divided into four aspects: sensory functioning, processing
speed, working memory, and inhibition. These cognitive processes are viewed as contributors to cognitive decline (Craik & Salthouse, 2000).

More frequently older individuals experience a decline in cognitive process resulting from a decrease in sensory function, processing speed, and working memory, and the inability to inhibit extraneous stimuli or information when completing cognitive tasks (Craik & Salthouse, 2000; Park & Schwarz, 2000). For those individuals who do not experience a decline in cognitive processes or maximize the utilization of past experiences to guide them through a task, they experience gains which aid them in completing cognitive tasks (Craik & Salthouse, 2000). Knowledge about geriatric cognition enhances the health care provider’s understanding of health literacy in the older adult and the relationships identified in this study.

1.10 Sources of Health Information/Health Information – Seeking Behavior

One of the background variables explored in the NAAL 2003 was sources of health information utilized by individuals. By understanding where individuals seek information health care providers may assist individuals in acquiring information which has the potential to affect health outcomes. The theoretical framework for this study places the acquisition of health information under self care. Self care is considered a patient factor which interacts with health literacy and has the potential to affect health outcomes.

In the literature sources of health information are described more often as health information-seeking behavior (HISB). Lambert and Loiselle (2007) completed a concept analysis of HISB and concluded that researchers attempt to explain and/or predict individuals’ pursuit of health information under the assumption that seeking information
is central to health and illness behaviors. Individuals were often classified as “seekers” or “avoiders” of health information, however the concept analysis emphasizes that individual’s HISB is not just a single behavior, rather an accumulation of ways to gain information with related behaviors. Patterns of HISB reflects the individual’s decisions about amount of information desired and methods used to pursue information, not just seeking or avoiding information (Lambert & Loiselle, 2007). The amount of health information readily available on the internet in the last decade has spurred research on internet use. The sources of information evaluated in the NAAL include print such as newspapers, magazines, books and the internet; and non-print sources such as radio/TV; family, friends, and co-workers; and health care professionals (Kutner et al., 2006).

NAAL participants were asked if they utilize these sources “a lot,” “some,” “a little,” or “none.”

This secondary analysis of the NAAL examined where and to what extent older adults seek health information in relation to health literacy. For older adults to make informed health care decisions they need to understand their health (Gazmararian et al., 1999). Results of this study will help health care professionals target educational efforts for this population.

1.1.11 Health Disparities

“Health disparities” is a common term in health care literature and is defined “as differences in the incidence, prevalence, mortality, burden of diseases and other adverse health conditions or outcomes that exist among specific population groups in the United States,” (National Association of Chronic Disease Directors, 2006, "Health Disparities,” para. 2). Healthy People 2010 states that the goal is “is to eliminate health disparities
among different segments of the population,” (U.S. Department of Health and Human Services (HHS), 2000, "Goal 2," para.1) In Healthy People 2020, that goal was expanded even further: “to achieve health equity, eliminate disparities, and improve the health of all groups,” (Healthy People 2020, n.d., "Disparities," para. 3). Most research has focused on the associations between and among health literacy levels and factors that are linked to health disparities such as race, gender, education, and income. On the whole, minority individuals (i.e., African American, Hispanic) and individuals with lower education and income have lower levels of health literacy (Chew et al., 2004; Kutner et al., 2006; Sudore et al., 2006; White, 2008). This study examined the relationships between and among health literacy and factors such as gender, geographical location, race, disability, education and income that are associated with health disparities in the older adult population.

1.2 Purpose of study

The purpose of this study was to examine the relationships between and among health literacy and background demographics/characteristics in the older adult population using de-identified data from the NAAL 2003. The background variables chosen for this study have been identified in the literature (by empirical research and the proposed conceptual model) as associated with health literacy levels, health disparities, and sources of health information. The background demographics/characteristics include region of country, gender, race, country of birth, marital status, U.S. citizenship, English understanding and reading, understanding medication and dosage, language usually spoken, household income, educational attainment, number of computers in home, seeking information on internet, email use, assistance with cognitive tasks (completing
forms, reading newspapers, writing notes, solving math problems), sources of print and nonprint health information (newspapers, magazines, internet, radio/TV, books, family/friends/co-workers, doctor/health care provider), health insurance, health status, vision, hearing, and learning disability.

1.3 Research Questions

This study sought to answer the following questions:

1. What socio-demographic (educational attainment, income, race, region of the country, gender, marital status, US citizenship, country of birth), background (computer usage, cognitive tasks, language, health status, vision, hearing, disabilities), and extent of health information use (sources of health information) variables are associated with older adult’s health literacy.

2. What variables related to health literacy, health disparities and sources of health information are predictive of the health literacy of older adults?

1.4 Definitions of Terms

Health literacy. The NAAL uses a definition of health literacy that focuses on a purposeful or functional concept of health literacy. “The NAAL defines health literacy as the ability of US adults to use printed and written health-related information to function in society, to achieve one’s goals and to develop one’s knowledge and potential,” (Kutner et al., 2006, p. 2). The NAAL classifies health literacy skills into three types: prose, document, and quantitative (Kutner et al., 2006). Health literacy tasks are grouped into three health care domains: clinical, preventative, and navigation of the health care system (Kutner et al., 2006). For this study the NAAL definition will be used.
Older Adult and Geriatric. For the purposes of this study and literature reviewed, the definition of older adult and geriatric was defined as age 65 or older (Cutilli, 2007; White, 2008; World Health Organization, 2010).

Sources of health care information. The NAAL describes sources of health care information as coming from traditional print sources such as newspapers, magazines, and books or brochures; nontraditional sources such as the internet; nonprint media such as the television and radio; and interactions with health care professionals, family, friends, and co-workers. (Kutner et al., 2006).

Health Information-Seeking Behavior (HISB). In the literature, HISB is a term used to describe the behaviors of individuals as they seek health information. In research studies focused on sources of health information, HISB represents the concept of seeking health information from various sources. Although this term is not used in the NAAL, HISB provides a foundation for understanding the literature supporting this study. No common HISB definition exists, however the underlying meaning focuses on seeking health information. (Lambert & Loiselle, 2007).

Background Demographic/Characteristics. NAAL participants completed an extensive background questionnaire providing information on numerous variables which will be used to examine relationships with health literacy. Background demographics/characteristics are placed in the following categories: general and language variables, educational background, literacy practices, demographic information, household income, and health (health status, preventive health practices, health insurance coverage, and sources of health information) (White & Dillow, 2005).
Health Disparities. Although no single encompassing definition of health disparities exists, the description of health disparities in the Healthy People 2020 document provides a general idea of the concept. Health disparity is a health difference closely associated with the following factors: disability, racial/ethnic group, religion, geography, gender; age, socioeconomic status, mental health, sexual orientation or gender identity, or other factors linked to exclusion or discrimination (Healthy People 2020, n.d.)

1.5 Assumption

The assumptions of this study were as follows:

1. The NAAL study was conducted in a manner that assures representation of the United States population.

2. The variables in the NAAL were chosen based upon review of the literature and expert opinions on future trends that will impact literacy/health literacy.

3. The NAAL design and implementation represented an effective and efficient approach to collecting information about literacy/health literacy of the United States population.

4. The 2003 NAAL data was collected for the purpose of utilization in studies such as this one.

1.6 Limitations

The limitations of this study are as follows:

1. Study methodology. The greatest limitation of this study is the methodology of secondary analysis. Unlike primary analysis, the researcher in secondary analysis must accept the method of collection and the data “as is”. The researcher cannot
design the study based on the questions to be answered. Rather the researcher
designs questions based on the data available. Despite this limitation, secondary
analysis of the NAAL allowed the researcher to use data from a large sample in a
rigorous national study. The second methodology limitation is the descriptive
correlational approach, which only allows for the examination of relationships
(associations) between the variables. This study cannot determine cause and effect
by manipulating and controlling variables.

2. Study design. Due to participant time constraints, no participant completed all 28
health literacy tasks embedded in the 152 literacy tasks. Thus, a score for the
health literacy tasks for each participant does not exist. Scores are determined by
grouping and weighting answers based on background variables, and have
associated measuring errors.

3. English health literacy. The focus of this study was to examine English health
literacy. Although a majority of health information is written in English, Spanish
language information also exists in increasing numbers. Thus, the impact of low
health literacy may be exaggerated in this study due to the focus on English.

1.7 Significance to Nursing

Advances in the treatment and management of diseases have improved health
outcomes (e.g., life expectancy, survival from cancer). However, these advances are
somewhat negated if older adults cannot understand how to care for themselves and
receive services in our health care system. Because the nursing profession constantly
strives to improve health care outcomes, it is imperative that a full understanding of
health literacy and the impact on older adults in our society be explored. Through this study, the relationship between and among health literacy, background variables, and sources of health information was examined. The relationships between health literacy, background variables, and sources of health care information provided knowledge for nursing in the following areas:

1. Description of the prevalence of various levels of the health literacy in the older adult population.
2. Identification of background characteristics associated with health literacy as well as health disparities and potential for health literacy to impact disparities.
3. Description of background variables (e.g., education, race, gender, income, computer use, health status) associated with various levels of health literacy in the older adult population.
4. Description of sources of health information sought by older adults from various health literacy levels.

The associations discovered provide a foundation for health care providers to strategize and implement effective methods to help older adults understand their health, how to care for themselves and negotiate the health care system.

1.8 Summary

Health literacy refers to the “ability of US adults to use printed and written health-related information to function in society, to achieve one’s goals and to develop one’s knowledge and potential,” (Kutner et al., 2006, p.2). For the older adult population, who uses a large quantity of health care services to manage chronic illnesses and health changes related to aging, understanding how to care for one’s self is critical. Through the
NAAL 2003, the older adult population has been identified as having the largest proportion of individuals with low health literacy (Kutner et al., 2006). Health care professionals need to develop interventions to help older individuals access and use effective and efficient health care information to make patient-centered health care decisions.

Older adults enter the health care system as individuals with specific needs, knowledge, skills, and health issues. The knowledge from this study should not be considered as “one size fits all.” The nurse needs to take this knowledge, as they work with older adults, as a general guide that can be flexed and adapted for a specific patient encounter or patient population. The practicing nurse may be able to use the results of this study to identify patients at risk for low health literacy and to provide health information where older adults seek it.
CHAPTER TWO

REVIEW OF LITERATURE

2.1 Introduction

This literature review provided a framework to support the design of this study. Topics presented and summarized in the review include health literacy definitions, health literacy conceptual model for this study, NAAL design and initial findings, cognitive changes in older adults, health literacy findings in older adults, sources of health information/health information-seeking behavior, and health disparities. The goal of this chapter is to present the current literature on health literacy in older adults to support the research questions and design of this secondary analysis.

2.2 Health Literacy

The term “health literacy” was used for the first time in a 1974 paper, Health Education as Social Policy, when the author called for minimum health literacy standards for all school grade levels (Simonds, 1974). During this time period research focused on the link between literacy and health outcomes. Doak, Doak, and Root (1996) identified the gap between health information materials and patient’s ability to understand this information. The National Literacy Act of 1991 created an opportunity to examine literacy on the national level. As a result of this act, the United States implemented the National Adult Literacy Survey (NALS) and the International Adult Literacy Survey (IALS). The results of the surveys spurred research into the links between literacy and health and set the foundation for health literacy (Rudd, Kirsch, & Yammamoto, 2004).
2.2.1 Definition

The definition of health literacy has evolved through the years. When initially hearing the term health literacy, one may conclude that health literacy is simply the ability to read health information; similar to the simple view of literacy as the ability to read. However, the definition has broadened and refined over the years to include the functional aspects of health literacy. In 1999 the American Medical Association (AMA) issued two definitions of health literacy; one broad definition and one focused on functional aspect. The AMA’s Ad Hoc Committee on Health Literacy defined health literacy as “constellation of skills, including basic reading and numerical tasks required to function in the health care environment” (AMA, 1999, p. 553). The AMA’s Council of Scientific Affairs’ functional definition of health literacy is “the ability to read and comprehend prescription bottles, appointment slips, and the other essential health-related materials required to successfully function as a patient,” (AMA, 1999, p. 552).

At the present time, the most common definition is as follows: “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions,” (Ratzen & Parker, 2000, p.vi). This definition was developed for the National Library of Medicine’s Health Literacy Bibliography and used in Healthy People 2010. This is the definition which has provided the foundation for the NAAL definition of health literacy. Because the NAAL focuses on written (printed) functional health literacy, the definition of health literacy for the assessment was defined as “The ability to comprehend and use printed and written health information to function in society, to achieve one’s goals and to develop one’s knowledge and potential,” (Kutner et al., 2006, p. 2). This is the same
definition which was used in the National Adult Literacy Survey (NALS) in 1992 when health literacy questions first appeared in a national literacy assessment.

2.2.2 Concept analysis

Health literacy has been subject to concept analysis. Speros (2005) used Walker and Avant’s concept analysis method to examine health literacy through literature review. The characteristics associated most frequently with the concept and appearing in references are known as attributes. Speros identified the following attributes: reading skills, numeracy skills, comprehension, and capacity to use health information in decision-making for successful functioning in the patient role. Speros also identified the antecedents, literacy and health related experiences, which occur before the concept is present.

The concept analysis demonstrated that the consequences or outcomes from having health literacy are improved self-reported health status, lower health care costs, increased health knowledge, shorter hospitalizations, and decreased use of health services. Speros’ concept analysis concludes with list of categories or classifications (known as empirical referents) which are used to demonstrate the occurrence of the concept. Speros identified The Test of Functional Health Literacy in Adults (TOFHLA) and the National Assessment of Adult Literacy (NAAL) as empiric referents. Additional empiric referents used in research and the clinical setting are the Rapid Estimate of Adult Literacy in Medicine (REALM) and the Newest Vital Sign (NVS). The concept analysis of health literacy provides a greater understanding of the term.
2.3 Conceptual Model

The conceptual model for this study is entitled “Causal Pathways between Limited Health Literacy and Health Outcomes,” (Paasche-Orlow & Wolf, 2007) (Figure 1). The model was developed based on the current evidence to explain the associations between health outcomes and limited health literacy. The model seeks to fully understand and refine the causal mechanisms of this relationship. Passche-Orlow and Wolf (2007) state that definitions of health literacy often focus on the individual (ability or capacity to understand and make decisions), but they feel that it is important to understand the contextual aspects of a health care encounter. In the model the causal mechanisms which impact the health outcome are due to patient characteristics and health care system attributes. The model notes three distinct points along the health care continuum where health literacy has an impact: health care access/utilization, patient-provider relationship, and self care.

Paasche-Orlow and Wolf (2007, p. 23) state that this model is not a “deterministic cause-and-effect schema” rather a “component-cause model;” meaning that the relationships can be anywhere on the spectrum from a probability distribution to the results of a “criterion-driven process”. The model is based on limited empirical evidence and most studies have been cross sectional which impedes efforts to establish cause and effect. The conceptual framework is focused on the factors that might impact the most direct paths between health and health literacy. However this approach leads to a framework that is incomplete and does not incorporate all important phenomena related to the relationship between health literacy and health. Examples include health literacy measurement issues, the non-fixed nature of health literacy, and the potentially non-linear
relationships between health literacy and health outcomes. The model also does not stipulate the specific “nature of causation”; variables can potentially act as mediators and/or moderators (Paasche-Orlow & Wolf, 2007, pS24). There have been no long term studies to identify how the variables function; variables may change in differing context. The model attempts to strike a balance between the multitudes of factors that have been related to the health literacy health outcomes relationship.


**2.3.1 Factors**

The model displays the factors which impact an individual’s health literacy including race/ethnicity, education, age, occupation, income, social support, culture,
language, employment, vision, hearing, verbal ability, memory, and reasoning. The following variables were chosen for this study based on the impact they have on health literacy according to the model: region of country, race, country of birth, U.S. citizenship, English understanding and reading, understanding medication and dosage, language usually spoken, household income, educational attainment, vision, hearing, and learning disability. In addition, the model highlights the patient and non-patient factors (individual and system level factors) which influence access, utilization, interactions and self-care. All these factors have the potential to affect health outcomes (Paasche-Orlow & Wolf, 2007).

2.3.2 Access and utilization

Access and utilization are influenced by the patient’s navigation skills, self-efficacy and perceived barriers; and the system’s complexity, acute care orientation, and tiered delivery model. Paasche-Orlow and Wolf (2007) note that the concept of navigation has been advanced to highlight the skills needed by individuals to maneuver through the health care system to obtain care.

2.3.3 Provider patient interaction

The provider-patient interaction is affected by patient’s knowledge, beliefs, and participation in decision making; and the provider’s communication skill, teaching ability, time and patient-centered care (Paasche-Orlow & Wolf, 2007). Patients with limited health literacy may know less about their diseases, feel shame and as a result, are less engaged when interacting with the health care provider. Providers need to have skills to identify those with low health literacy as well as to effectively teach patients about their health. This study provided information on the health literacy of older adults.
2.3.4 Self-care

Self-care (self-management) focuses on the decisions and everyday activities in which patients engage to manage their health. The patient’s ability to care for himself is impacted by patient’s motivation, problem solving, self-efficacy, and knowledge/skills; and extrinsic factors such as support technologies, mass media, health education, and resources (Paasche-Orlow & Wolf, 2007). Although the exact relationship of self-care patient factors to health literacy and ultimately health outcomes is not clear, the limited empiric evidence suggest that these factors play a role (i.e., mediator, moderator). Extrinsic factors can have a negative and positive impact on health outcomes. Inconsistent or conflicting health information can confuse patients, however extrinsic factors such as resources can provide opportunities to support patients as they strive to care for themselves. This study examine the following patient variables related to self care knowledge/skills: health literacy, understanding medication and dosage, seeking information on internet, email use, and assistance with cognitive tasks (completing forms, reading newspapers, writing notes, solving math problems). Extrinsic factors examined include sources of print and nonprint health information (newspapers, magazines, internet, radio/TV, books, family/friends/co-workers, doctor/health care provider).

2.4 Older Adults

WHO states that “although there are commonly used definitions of old age, there is no general agreement on the age at which a person becomes old,” (World Health Organization, 2011, "Proposed working definition," , para. 2). Most countries from the developed world have chosen the chronological age 65 as the definition of the older adult. However the United Nations’ standard chronological criterion for the older adult is
60+ years (United Nations, 2007). The oldest age group in the NAAL is age 65 and older. This age group, referred to as older adults, was the population for this study.

2.5 Measuring Health Literacy

In an effort to identify individuals with low health literacy, several health literacy assessment tools have been developed over the past 20 years. Although these tools were not used to assess health literacy in the NAAL, they have been used in the health literacy literature and to some extent are similar to the NAAL tasks; thus, an understanding of the tools is essential. Generally, these tools, particularly the more recent ones, were designed to screen for the risk of low health literacy, and are limited in the amount of information they provide about the actual health literacy of the individual. This is not an exhaustive list of tools rather it is a list of the most common ones used in the literature.

2.5.1 Rapid Estimate of Adult Literacy in Medicine (REALM)

Davis et al (1991) first published the *Rapid Estimate of Adult Literacy in Medicine* (REALM). The tool contained 125 health related words. In 1993 Davis et al published a revised tool called the shortened version of the REALM. The REALM development was based on common tools used to assess literacy such as the Wide Range Achievement Test Revised (WRAT-R). The WRAT-R is a word recognition tool which asks the individual to read a list of 42 words placed in order of increasing difficult (Jastak & Wilkinson, 1984). The test continues until the individual mispronounces 10 consecutive words. The individual’s literacy is determined by converting the number of words pronounced correctly to a grade level (Davis et al., 1993).

The REALM contains health-related words which are presented in order of increasing difficulty. The individual is asked to read the list of words (they are
encouraged to read all the words and can say blank if they do not know the word) and is given credit for the number of words that are pronounced correctly (Davis et al., 1993). The REALM initially had 125 words, however it was shortened to 66 words to make it more realistic for use in the busy clinical setting (2-3 minutes for administration). The following are examples of words found in the REALM: fat, stress attack, hormones, bowel, prescription, menopause, directed, inflammatory, potassium, and osteoporosis. From the raw score a patient’s health literacy is placed into grade ranged estimates (i.e., 3rd grade and below, 4th to 6th grade, 7th to 8th grade, high school). The shortened version of the REALM correlated well with three other standardized reading tests at p<.0001: the WRAT – R (.88), Peabody Individual Achievement Test-Revised (PIAT-R) (.97), the Slosson Oral Reading Test-Revised (SORT-R) (.96). The test-retest reliability was 0.99 at p< 001.

Although the REALM has been used extensively in research, the limitations of this tool have been noted in several articles. Shea and colleagues (2004) demonstrated discordance between the scores of Caucasians and African Americans with identical educational attainment; thus questioning if the REALM is racially bias. McCormack et al (2010) and Weiss (2005) noted that the REALM focused on the reading ability and did not evaluate numeracy skills. In contrast the NAAL evaluates numeracy skills in addition reading and provides a specific health literacy level for a population.

2.5.2 The Test of Functional Health Literacy in Adults (TOFHLA)

Having sufficient health literacy requires an individual to have skills to comprehend health information and be able to understand mathematical concepts (numeracy skills) related to health care. The Test of Functional Health Literacy in Adults
(TOFHLA) was developed to assess reading comprehension and numeracy skills (Parker et al., 1995). This instrument measures skills by having the patient use actual hospital materials (i.e., upper gastrointestinal tests, patient rights and responsibilities and a hospital consent form). The numeracy section uses labeled prescription vials. The TOFHLA also has a Spanish version. Because the TOFHLA administration takes 22 minutes, a shortened version of the assessment called the S-TOFHLA was developed (12 minute administration time) which contains 4 numeracy items and 36 reading comprehension items. The S-TOFHLA Cronbach’s alpha was 0.68 for the 4 numeracy items and 0.97 for the 36 reading comprehension items. The correlation (Spearman) between the S-TOFHLA and the REALM was .80. The authors agree that the reliability of the numeracy section is modest and its correlation with the REALM is 0.61. Like the TOFHLA, the NAAL evaluates both reading and numeracy skills, and is able to assign an extremely specific health literacy level to specific population.

2.5.3 The Newest Vital Sign (NVS)

The Newest Vital Sign (NVS) was developed to screen reading comprehension and numeracy skills which are essential for adequate health literacy in the fast-paced clinical setting (Weiss et al., 2005). The assessment contains a nutrition label with 6 corresponding questions in English or Spanish which take 3 minutes to administer. Reliability or internal consistency was measured by using Chronbach’s alpha and resulted in alpha > .76 for English and .69 for Spanish. The validity was determined by measuring correlations with the TOFLHA. By plotting receiver-operating characteristics (ROC) curves based on the TOFLHA definition of limited literacy (score<75) and calculating likelihood ratios for cutoff scores on the NVS, the NVS had an area under the ROC curve.
of 0.88 for English and 0.72 for the Spanish version. Individuals with more than 4 correct answers are unlikely to have low health literacy. Individuals with fewer than 4 correct answers have the possibility of low health literacy. The NVS is able to screen for risk of low health literacy, but is unable to provide a specific health literacy level to guide intervention.

2.5.4 Single item screeners

To quickly identify patients for low health literacy in the clinical environment, clinicians have developed single question screening assessments. Several questions have been tested including “How often do you have someone help you read hospital materials?” (Chew et al., 2004, p. 588); "How confident are you filling out medical forms by yourself" (Chew et al., 2004, p. 588); and “How often do you need to have someone help you when you read instructions, pamphlets, or other written material from your doctor or pharmacy?” (Morris, MacLean, Chew, & Littenberg, 2006, "Method" para 2). Any individual that indicates needing help or lacking confidence should be considered at risk for low health literacy. Research studies have established validity by comparing the results of the single question screener to the REALM and STOFLHA. The AUROC for detecting limited and/or marginal health literacy ranged from 0.73 [95% CI= 0.69- 0.78] to 0.87 [95% CI= 0.78 – 0.96] (Chew et al., 2004; Morris et al., 2006; Wallace et al., 2006). Like the NVS, this tool only identifies those at risk for low health and does not provide an assessment of health literacy for guidance in intervention development.

2.5.5 NAAL assessment

The NAAL assessment of health literacy has the individual answer health related questions in 3 different formats: prose, document, and numeracy (RW.ERROR - Unable
to find reference:597). The specific details of the assessment questions will be describe in depth in the NAAL section of this chapter.

2.6 National Assessment of Adult Literacy (NAAL)

The National Assessment of Adult Literacy (NAAL) was implemented in 2003-2004 by the U.S. Department of Education, and National Center for Educational Statistics. The NAAL had a population of approximately 19,000 individuals from United States (U.S.) households and prisons. The focus of the NAAL was to examine the English adult literacy in the United States since the 1992 National Adult Literacy Survey (NALS). Both the NALS and NAAL also contained health related questions. The NAAL increased the number of health literacy questions to further the understanding of the health literacy of our nation. The NAAL also included an extensive assessment of demographic and background characteristics (RW.ERROR - Unable to find reference:597). This information provides an opportunity to examine relationships between health literacy and these characteristics.

2.6.1 Tasks and levels

The assessment of health literacy focused on the examination of prose, document, and quantitative literacy using twenty-eight health-related questions centered on clinical, preventative, and health system navigation domains (Kutner et al., 2006). The clinical domain involves activities such as medications, patient-provider interaction, diagnosis and treatment of illness, and clinical encounters. Examples include completing a patient information form and comprehending medication dosing. The prevention domain focuses on self-care, preventing disease, illness self-management, early intervention with health issues, and maintaining and improving health. Examples include following guidelines for
preventive health services, recognizing the need for health care professional, and comprehending the impact of exercise and eating habits on health. Health care system navigation involves patient rights/responsibility and understanding the system. Examples include informed consent, health insurance coverage, and public program eligibility.

Each health literacy task is on the prose, document or quantitative scales of the NAAL. A set performance level was recommended for each literacy level by the National Research Council’s Board on Testing and Assessment (BOTA) Committee on Performance Levels for Adult Literacy. NCES followed the BOTA committee’s recommendation to establish four literacy levels: Below Basic, Basic, Intermediate, and Proficient. These levels were determined after reviewing information from the previous assessment of 1992 and the 2003 assessment including comments from stakeholders such as practitioners. The score ranges for each level was determined by judges using the Bookmark method. Initially the judges described the literacy skills of adults in each of the four groups. These performance levels were used to determine which assessment tasks would be bookmarked for each level as “likely” for the person at that level to get it right. “ Likely” was defined as two out of three times. Statistical procedures aided in determining the sixty-seven percent probability of performing it correctly. The bookmarks were determined for the literacy scales (prose, document, quantitative). The cut scores based on the bookmark approach were further refined using the “quasi-contrasting groups approach.” The scores were compared to background variables like education of the previous 1992 assessment (Baldi, 2009).
2.6.1.2 Literacy levels

_Below Basic_ health literacy is characterized as “no more than the most simple and concrete literacy skills,” (Kutner et al., 2006, p. 5) and is the score range of 0 to 184. Individuals with _Below Basic_ health literacy have the following skills: locate “easily identified information in short, commonplace prose texts…easily identifiable information and following written instructions in simple documents…numbers and use them to perform simple quantitative operations (primarily addition) when the mathematical information is very concrete and familiar,” (Kutner et al., 2006, p. 5). Examples of these skills include: “Identify how often a person should have a specific medical test, based on information in a clearly written pamphlet,” “What is permissible to drink before a medical test, based on a set of short instructions,” “Circle the date of a medical appointment on a hospital appointment slip,”(Kutner et al., 2006, p. 6).

_Basic_ health literacy is characterized as “skills necessary to perform simple and everyday literacy activities,” (Kutner et al., 2006, p. 5) and has a score range of 185-225. The following are key abilities demonstrated with basic health literacy: “reading and understanding information in short, commonplace prose texts; reading and understanding information in simple documents; locating easily identifiable quantitative information and using it to solve simple, one–step problems when the arithmetic operation is specified or easily inferred,” (Kutner et al., 2006, p. 5). The following are examples of tasks for _Basic_ health literacy: “Give two reasons a person with no symptom of a specific disease should be tested for the disease, based on information in a clearly written pamphlet,” and “Explain why it is difficult for people to know if they have a specific chronic medical
condition, based on information in a one page article about the medical condition,” (Kutner et al., 2006, p. 6).

Intermediate health literacy is described as “skills necessary to perform moderately challenging literacy activities,” (Kutner et al., 2006, p. 5) and has a score range of 226-309. The tasks at this level include “reading and understanding moderately dense, less commonplace prose texts as well as summarizing, making simple inferences, determining cause and effect, and recognizing the author’s purpose; locating information in dense, complex documents and making simple inferences about the information; and locating less familiar quantitative information and using it to solve problems when the arithmetic operation is not specified or easily inferred,” (Kutner et al., 2006, p. 5). Examples of intermediate tasks include “Identify three substances that may interact with an over-the-counter drug to cause a side effect, and ” Determine a health weight range for a person of a specified height, based on a graph that relates height and weight to body mass index (BMI),” (Kutner et al., 2006, p. 6).

Proficient health literacy is characterized as “skills necessary to perform more complex and challenging literacy activities,” (Kutner et al., 2006, p. 5) and has a score range of 310-500. Individuals with proficient health literacy are able to do the following activities: “reading lengthy, complex, abstract prose texts as well as synthesizing information and making complex inferences;” “integrating, synthesizing, and analyzing multiple pieces of information located in complex document;” and “locating more abstract quantitative information and using it to solve multistep problems when the arithmetic operations are not easily inferred and the problems are more complex,” (Kutner et al., 2006, p. 5). Tasks demonstrating proficient health literacy are “Evaluate
information to determine which legal document is applicable to a specific health care situation,” Find the information required to define a medical term by searching through a complex document,” and “Calculate an employee’s share of health insurance costs for a year, using a table that shows how the employee’s monthly cost varies depending on income and family size,” (Kutner et al., 2006, p. 6).

2.6.2 Health Literacy in America

The NAAL participants’ overall literacy scores were very similar to their health literacy scores, although not identical. Over half (53%) of the participants had intermediate health literacy. Thirty-six percent had below basic or basic health literacy: 14% with below basic and 22% with basic health literacy. This represents approximately one-third of the population. Twelve percent had proficient health literacy (Kutner et al., 2006).

2.6.2.1 Gender

The average health literacy score is 6 points higher for women (248) compared to men. More men than women had Below Basic health literacy (4 percentage points margin). There are more women with Intermediate health literacy than men by 4% points. No significant difference was noted for Basic and Proficient health literacy levels between men and women (Kutner et al., 2006).

2.6.2.2 Ethnicity and Race

For the NAAL, race/ethnic classifications included White, Black, Hispanic, Asian/Pacific Islanders, American Indian/Alaska Native, and Multiracial. White and Asian/Pacific Islander adults had the highest average health literacy. Hispanic adults had the lowest average health literacy (197). White and Asian/Pacific Islander adults had the
highest percentage of adults with proficient health literacy. Approximately 50% of White, Asian/Pacific Islander and Multiracial adults had *Intermediate* health literacy in contrast to 41% of Black adults and 31% of Hispanic adults. A higher percentage of Black, Hispanic, and Multiracial adults had *basic* health literacy. (Kutner et al., 2006; White, 2008).

2.6.2.3 Language

The NAAL evaluated the impact of language on health literacy by asking individuals about the languages they speak and now and prior to formal education. Individuals who spoke English only before starting school compared to individuals who spoke a non-English language only have the highest average health literacy. Adults who spoke English only or English and another language had average health literacy at the *Intermediate* level. Adults who speak Spanish only before starting school had the average health literacy in the *Below Basic* level with 55% in the below basic health literacy (Kutner et al., 2006).

2.6.2.4 Age

The NAAL examined the health literacy of adults in the following age groups: 16-18, 19-24, 25-39, 40-49, 50-64, and 65 and older. Individuals who are age 65 and older when compared to the rest of the age groups had the lowest health literacy average (214). Age 25 to 39 adults had the highest health literacy average. The percentage of adults with an average health literacy level in the *Intermediate* range was 53-58% in all age groups except 65 and older which had 38%. Additionally more adults in the 65 and older age group had *Below Basic or Basic* levels of health literacy and a lower percentage of *Proficient* than other age groups (Kutner et al., 2006). The following is the percentage of
adults age 65 and older with the four literacy levels: Below Basic (29 %), Basic (30 %), Intermediate (38 %), and Proficient (3 %) (White, 2008).

2.6.2.5 Educational Attainment

The education of the participants was divided into 9 groups: “still in high school, less than/some high school, GED/high school equivalency, High school graduate, Vocational/trade/business school, some college, associate’s/2 year degree, bachelor’s degree, and graduate studies/degree,”(Kutner et al., 2006, p. 14). For the purposes of this paper, only the relationship between health literacy and education of adults who no longer attend high school will be discussed. Overall, the higher the level of formal education the higher the average health literacy score, however, there were adults with Below Basic health literacy in every educational group (49 % for “less than or some a high school education” to 3 % for “graduate studies/degree”). Each group also had adults with proficient health literacy although the percentage of those with proficient decreased as the years of formal education decreased (33 % for “graduate studies/degree” to 1 % for less than a high school education). (Kutner et al., 2006).

Regardless of the educational group, intermediate health literacy was the most common level except for adults who had less than a high school education (Below Basic was the most common) (Kutner et al., 2006). For adults with “less than or some high school education” the average health literacy score was much lower at 184 when compared to high school graduates or GED at 232 (White, 2008). Twenty-four percent of adults age 65 and older did not earn a high school diploma compared to 14 % of younger adults. Additionally fewer adults age 65 and older had postsecondary education.

Educational attainment is as follows for adults age 65 and older: 24 % have “Less than
high school/some high school,” 39 % have “high school or GED,” 20 % have
“Vocational or some college,” and 18 % are “College graduate or higher,” (White, 2008).

2.6.2.6 Poverty Threshold

The NAAL had five poverty threshold categories: “below poverty threshold, 100-
125\% of poverty threshold, 126-150\% of poverty threshold, 151-175\% poverty threshold,
and above 175\% of poverty threshold,” (Kutner et al., 2006, p. 14). The average health
literacy score rose along with the income rising above the poverty level. Average score
for adults below the poverty level was 205 and for adults above 175 \% of poverty level
the average score was 261.

2.6.2.7 Self-reported overall health

Self-reported overall health was separated into five categories: poor, fair, good,
very good, and excellent. For adults who rated their health as poor had an average health
literacy score of 196 with 42 \% Below Basic, 27 \% Basic, and 29 \% Intermediate. For
adults with fair overall health, the average health literacy was 207 and health literacy
levels were evenly divided among Below Basic, Basic, and Intermediate (approximately
33 \%). Fifty-one percent of patients with good overall health have Intermediate health
literacy followed by 27 \% with Basic, and 16 \% with Below Basic with the average score
being 234. Adults who rated their overall health as very good (average health literacy
score of 254) or excellent (average health literacy score of 262) had similar distribution
of health literacy scores: approximately 15 \% had Proficient, 58 \% had Intermediate, 18
\% had Basic, and 9 \% had Below Basic (Kutner et al., 2006).

Adults age 65 and older like the younger age groups had increasing overall health
with increasing health literacy. When looking at educational attainment in relationship to
health literacy and overall health status, as the overall health status improved (moving from poor to excellent) as health literacy increased regardless of educational level. However, the health literacy level for adults with some college and self reported poor health is higher than the health literacy level of adults with graduate level education and poor overall health (Kutner et al., 2006).

2.6.2.8 Disability

Adults with one or more disabilities (learning disability, hearing, vision or “others”) had a mean health literacy score (226) which is lower than the mean (253) for adults without disabilities. More adults with disabilities (one or more) have Basic and Below Basic health literacy when compared to those without disability (Below Basic 23 %, Basic 26 %, Intermediate 45 %, and proficient 7 %). Individuals age 65 and older with one or more disabilities had Below Basic health literacy (White, 2008).

2.6.2.9 Sources of health information

The NAAL examined how adults sought sources of health information in print (newspapers, magazines, books, brochures, and the internet) and non print (radio and television, conversation with family, friends, or coworkers or conversations with health care professionals) format. The participants classified the extent to which they utilized print and non-print into the following categories: a lot, some, a little, or none (Kutner et al., 2006).

2.6.2.9.1 Print sources

The extent to which adults in each health literacy level utilized magazines and books or brochures was very similar. Forty percent of those with Below Basic did not use at all; approximately 62 to 75 % of those with Basic, Intermediate, and Proficient utilized
the source “a little” or “some.” Although use of the newspaper had similar percentages, there was a greater percentage of adults in the Basic, Intermediate and Proficient levels that did not use the newspaper for health information (19 to 24 %). A profound difference was noted between health literacy levels and internet use. The internet was not used by 80 % of adults with Below Basic, 58 % with Basic, 33 % with Intermediate, and 15 % with Proficient (Kutner et al., 2006). Of adults 65 and older 77 % did not use the internet for health care information and their average health literacy score was 203 (White, 2008). Of the older adults who did use the internet, the average health literacy scores were 249 for “a little” use, 250 for “some” use, and 235 for “a lot” of use.

2.6.2.9.2 Non-print sources of health information

A higher percentage of adults with Below Basic health literacy used the radio and television “a lot” (33 %) and “none” (14 %) when compared to the other health literacy levels. There is an inverse relationship between the overall the percentage of adults who use television and radio “a lot” and “a little”; as the health literacy level increases “a lot” use decreases (33 to 17 %) and “a little” increases (19 to 30 %). Adult who use radio and television “some” increases with health literacy between Basic and Intermediate then levels off (34 to 44/43 %). All literacy levels have a percentage of individuals who do not use the radio and television for health information (7 to 14 %).

As health literacy increases the percentage of adults who get health information from family, friends or coworkers increases (77 to 95 %). Twenty-four percent of adults with Below Basic and 15 % with Basic health literacy did not use family, friends or coworkers for health information. Similar to family, friends and co-workers, the use of health care professionals for information increased as health literacy increased from
Below Basic to Intermediate (82 to 92 %), however it leveled-off with the same percentage of use for adults with Proficient (92 %). The percentage of adults who use health care professionals “a lot” decreased with Intermediate and Proficient levels (34 to 30 %). The percentage of use for “a little” and “some” increased with increasing health literacy. Eighteen percent of adults with Below Basic sought no health information from health care professionals (White, 2008).

2.6.2.9.3 Summary

Overall the average health literacy scores were highest for adults who sought health information from all sources “a little” or “some.” The average health literacy score was lowest for seeking health information “none” and the next highest for seeking health information “a lot,” (White, 2008)

2.7 Cognitive changes in older adults

Comprehending the cognitive processes that impact learning for older adults can best be understood by examining the “resources” that have been associated with cognitive decline. These resources include sensory function, processing speed, working memory and inhibition (Park & Schwarz, 2000). It is theorized that these four resources are implicated in older adults’ cognitive changes.

2.7.1 Sensory function

Sensory function is utilized to take in information. In the older adult sensory function such as sight and hearing are often impaired, and the impact on the older adult’s ability to learn is obvious. However, when sensory dysfunction is improved through adaptive aids such as hearing aids or glasses, some older adults continue to have difficulty perceiving information. Thus perceiving information involves more than having
the capacity to take in information (Craik & Salthouse, 2000). Older adults are noted to have greater impairment with perception dependent activities when compared to verbal cognition activities (Jenkins, Myerson, Joerding, & Hale, 2000). The relationship between cognition and perception is unclear: does impairment in the general nervous system affect all aspects of cognition/perception or does the decrease in perception cause cognitive impairment? Perception is impacted by the link between the cortex and the brain stem, and this link may be not as strong as possible in the older adult (Craik & Salthouse, 2000).

2.7.2. Processing speed

Processing speed refers to a “resource” that is defined as an integration of several cognitive functions in order to complete tasks in a timed approach (Craik & Salthouse, 2000). Theoretically, the differences in cognitive task performance are related to older adults’ slower speed of mental task completion (Park & Schwarz, 2000). Processing speed is viewed as a sensitive index of changes that occur in older adults’ brain structures impacting cognition (Rabbitt et al., 2006). Slowed processing speed is viewed as global and impacts all aspects of cognitive functioning including tasks that do not have a time element (Park & Schwarz, 2000).

2.7.3 Working memory

Working memory is defined as the ability to use newly learned information to complete a task which demands “manipulation, storage, and transformation” of the information (Park & Schwarz, 2000). It is also viewed as the available cognitive means used to complete tasks. Working memory demands that the individual “store and process information simultaneously” (Park & Schwarz, 2000). Working memory is a sensitive
indicator of an adult’s cognitive aging. Older adults repeatedly demonstrated difficulty in
completing tasks with large working memory requirement (Salat, Kaye, & Janowsky,
2002).

2.7.4. Inhibition

Like sensory function, processing speed, and working memory, inhibition is
defined as a separate concept however, it plays an integrated role with the other concepts
in understanding changes in cognition with age. The theory of inhibition refers to the
individual’s ability to ignore or block information not relevant to the mental task. The
presence of non-pertinent information adds more demand to working memory and causes
distraction. For individuals who are unable to disregard irrelevant information, the
performance of cognitive tasks is more difficult (Park & Schwarz, 2000).

Older adults appear to be more susceptible to distraction from irrelevant
information than younger adults, thus having greater difficulty with cognitive tasks (Park
& Schwarz, 2000). However, controversy exists about the inhibition theory. There are
studies which support the theory (Bertoli & Probst, 2005; Bowles & Salthouse, 2003;
Lustig, Hasher, & Tonev, 2006) and others that question the impact of irrelevant
Continued research is warranted. Theories about the age-related changes in cognition, aid
in understanding the impact on health literacy and other background characteristics.

2.8 Health Literacy in the Older Adults

2.8.1 Age

Several studies note that there is an inverse relationship between age and health
literacy (Baker, Gazmararian, Sudano, & Patterson, 2000; Baker et al., 2002; Benson & Forman, 2002; Buchbinder, Hall, & Youd, 2006; Chew et al., 2004; Morrow et al., 2005; Raehl et al., 2006; Williams et al., 1995; Wilson et al., 2003). On the whole, as adults aged their health literacy scores decreased. However, it is not clear from the literature whether age is an independent predictor of health literacy. In one study when adjusting for educational attainment, age was not a significant factor impacting health literacy scores (Buchbinder et al., 2006). In another study when controlling for ethnicity, immigration status, race, educational achievement and gender the inverse relationship between age and health literacy continued (Cordasco, Asch, Franco, & Magione, 2009).

2.8.2 Gender

The relationship between gender and health literacy is not clear. Results from studies using the REALM showed that women score higher and low health literacy is associated with being male (Baker et al., 2000; Benson & Forman, 2002; Cho et al., 2008; Wilson et al., 2003; Wood, 2005). No significant relationship between health literacy and gender is seen in several studies (Benson & Forman, 2002; Gazmararian et al., 1999; Kutner et al., 2006; Wilson et al., 2003).

2.8.3 Race

Outside of the NAAL most studies were limited to participants who were Caucasian, African American or Hispanic. Individuals from African American backgrounds had a higher percentage of individuals with inadequate or marginal health literacy in comparison to Caucasians (Baker et al., 2002; Cho et al., 2008; Gazmararian et al., 1999; Sudore et al., 2006; Volandes et al., 2008). Two studies noted that Hispanic
individuals had higher rates of inadequate or marginal health literacy (Baker et al., 2000; Williams et al., 1995).

2.8.4 Educational Attainment

Consistently research studies note a positive relationship between educational attainment and health literacy in the general population as well as the older adult population (Cutilli, 2007). Similar to the NAAL, studies of older adults has shown that usually a higher level of educational attain corresponds with a higher level of health literacy (Baker et al., 2000; Benson & Forman, 2002; Buchbinder et al., 2006; Williams et al., 1995). Several studies demonstrate an association between low educational attainment and limited health literacy (Chew et al., 2004; Gazmararian et al., 1999; Sudore et al., 2006).

Although a positive relationship exists between educational attainment and health literacy level, the educational attainment grade does not correspond directly to the health literacy grade. Studies have consistently shown that the health literacy grade level is lower than the highest obtained educational grade level (Cho et al., 2008; DeWalt et al., 2004; Wilson & McLemore, 1997). The gap between the educational and health literacy grade levels is two to four years on the average. As noted in the NAAL, there are individuals with every level of education who have Below Basic and Basic health literacy. Thus determining health literacy level by educational attainment is not an accurate health literacy assessment method.

2.8.5 Socioeconomic factors

The following socioeconomic factors have been examined for relationships with health literacy: marital status, income, car ownership, public assistance, and employment.
No study has noted a relationship between health literacy and marital status. Some studies noted a positive relationship between income and low health literacy (Baker et al., 2002; Baker et al., 2007; Chew et al., 2004; Wolf et al., 2005). Other studies did not find “income” to be the best determinant of economic status. Additional economic markers included car ownership, use of public assistance, and “blue or white collar” work.

When examining medication adherence Raehl et al, (2006) noted that car ownership and health literacy level (determined by the REALM) positively predicted adherence, and predicted the negative relationship between food assistance and medication adherence. “Blue collar” occupation is linked to a higher rate of inadequate health literacy (Gazmararian et al., 1999). In another study, markers of socioeconomic status were not consistently related to functional health literacy (Williams et al., 1995).

2.8.6 Health status/ disease management

Consistent with the NAAL older adults with lower health literacy (described as limited or inadequate) had worse health status (including physical functioning), mental health, and diabetes when compared to individuals with higher health literacy (adequate) (Baker et al., 2000; D. Baker et al., 2002; Sudore et al., 2006; Wolf et al., 2005).

Overall the knowledge about a disease process correlated positively with health literacy, however not all studies showed a significant difference. For patients who manage cholesterol, asthma, and congestive heart failure, reading ability and health literacy had a positive relationship with disease knowledge (Gazmararian et al., 2003; Pepe & Chodzko-Zajko, 1997). This correlation did not exist in patient with hypertension and total knee or hip replacement surgery (Gazmararian et al., 2003; Wilson & McLemore, 1997). The relationship between health literacy and diabetes knowledge is
unclear since some studies report no association (Morris, MacLean, & Littenberg, 2006) and other report a association (Gazmararian et al., 2003).

The relationship between health literacy and medication knowledge/adherence consistently demonstrates that older adults with higher health literacy had greater knowledge and adherence (Chew et al., 2004; Morrow et al., 2005; Raehl et al., 2006; Wilson et al., 2003; Wilson et al., 2003) Often health literacy was the strongest predictor of knowledge and adherence.

2.8.7 Health Literacy and hospitalization/mortality

Overall, older adults with lower health literacy had increased hospitalized and usage of inpatient services (Baker et al., 2002; Cho et al., 2008; Howard et al., 2005). However Hispanic older adults had lower likelihood of hospital admission which did not correlate with health literacy level (Baker et al., 2002). Also in community dwelling older individuals, inadequate health literacy independently predicted “all-cause mortality and cardiovascular death,” (Baker et al., 2007).

2.9 Sources of health information/health information-seeking behavior

To fully discuss the topic “sources of health information” it is important to begin with the concept of “seeking health information.” The literature on “seeking health information” identifies and defines sources of health information. One of the most common terms related to seeking health information in the literature is “health information-seeking behavior” (HISB) (Lambert & Loiselle, 2007). This term lacks an exact definition and is often assumed to have an obvious meaning. In the literature HISB has been shortened to “information-seeking behavior.” HISB is the manner, specific methods, in which adults acquire knowledge about health risks, illness, and preventive
health measures. HISB has been examined in several contexts: preventive behavior, medical decision making, health-threatening situations, and behavior change (Lambert & Loiselle, 2007).

Another term linked to HISB is “consumer health information-seeking behavior” which is commonly found in the social and behavioral sciences literature (i.e., psychology, information and library science) (Baker & Pettigrew, 1999). This term has caused some controversy because health is not usually viewed as consumable (expendable), however this terminology can have political and economic implications (Stavri, 2001). To resolve this debate, the term “Personal Health Information-Seeking” has been recommended to be a more specific, accurate description of seeking health information (Stavri, 2001). This term is in greater accordance with research on health information seeking which focuses on individuals seeking information versus health professionals seeking for patients (Stavri, 2001).

2.9.1 Theory

The “Expanded conceptual model of health information seeking behaviors and the use of information for health care decisions” examines the variables (personal, conceptual) which impact information seeking and use (Longo, 2005). Demographic/socioeconomic, personal/familial health, genetics, education, culture/language, and attitude variables are classified as personal and influence active or passive seeking of health information. This model shows the relationships between variables which impact active or passive information seeking, and individual decision-making from health information to achieve desired outcomes.
2.9.2. Research

In recent years the major focus of research has been on HISB and the internet. Internet usage has been examined in relationship to other sources of health information and in specific patient populations.

2.9.2.1 Cancer

Some studies utilized data from the Health Information National Trends Survey (HINTS) to examine HISB in cancer patients. One study noted that there is no significant difference in internet usage for health information between younger and older adults when seeking for themselves. However, older individuals were less likely to seek information for others, find incidental information, or use the internet instead of other traditional media (Tian & Robinson, 2008). This study concluded that older adult cancer patients should be given written materials because they do not rely solely on the internet for information.

In another study, the strategies used by older men to learn about and manage prostate cancer were examined. The researchers noted that men’s functional health literacy was cultivated throughout their lives with cultural and social resources (Zanchetta, Perreault, Kaszap, & Viens, 2007). “Critical-information-seeking” skills were related to the following characteristics: home reading, encouraging educational environment (elementary) and families, and interest in learning (education) (Zanchetta, 2005).

2.9.2.2 Race/culture

The literature focusing on culture/race demonstrates that African American older participants used the health service professional (i.e., physician) as a main source of
information and more often when compared to younger participants (Gollop, 1997; Morey, 2007). Older participants also used several other sources such as radio, TV, internet, magazines, family and friends, but much less.

Two studies of Hispanics (Western Texas and Los Angeles, CA) demonstrated that Hispanics seek health information most often from family and friends (interpersonal network) (Cheong, 2007; Hsai, 1987). Neither of these studies focused on older individuals but do give us information about health information that all Hispanics seek including older individuals. Despite the 20 year difference between the two studies the interpersonal network continues to be the prominent source of information. The additional sources of health information used by the Hispanic population vary and depend on numerous factors (i.e., immigration timing, literacy, income, education). Hsai (1987) determined in 1987 that the best way to communicate health information was by providing the information in newspapers that community leaders read and spread through the interpersonal network. Cheong (2007) found that ethnically targeted TV was the secondary source used most often after the interpersonal network.

2.9.2.4 Internet/computer usage

Many studies have recently focused on the relationship between use of the internet and computers solely and variables such as literacy/health literacy, age, and race/culture. Use of the internet was dependent on age with older adults using the internet less than younger individuals for all purposes, however the gap between older and younger individuals has lessened over time (Campbell, 2005; Flynn, Smith, & Freese, 2006; Leung, Ko, Chan, Chi, & Chow, 2007; Lorence, Park, & Fox, 2006; Schneiderman, Lincoln, Cubow, & Kang, 2004). Older adults who were satisfied with their participation
in internet/computer workshops used the computer/internet for information (Leung et al., 2007). Flynn (2006) noted a positive relationship between openness-to-experience and years of education to using the internet for health information. When examining use of the internet for different kinds of information, Lorence et al., (2006) noted that older individuals use the internet for health information when compared to younger individuals. A positive relationship exists between use of the internet and the number of medications an older individual takes (Campbell & Nolfi, 2005; Campbell, 2005; Flynn et al., 2006). In contrast to the findings presented so far, older adults do not use internet information to modify the manner in which they participate in health care. For decision-making older adults utilize a physician centered model of care (Campbell, 2005; Campbell & Nolfi, 2005).

2.10 Health Literacy and Disparities

Similar to health literacy the definition of health disparities has evolved over time and incorporates various concepts. For Healthy People 2010 the following definition was used “…differences that occur by gender, race, ethnicity, education or income, disability, geographical location, or sexual orientation,” (U.S. Department of Health and Human Services (HHS), 2000). In 2003 the IOM defined disparities in healthcare as “…racial or ethnic differences in the quality of health care that are not due to access-related factors or clinical needs, preferences, and appropriateness of intervention,” (Smedley, Stith, & Nelson, 2003). In one of the latest version of the definition Healthy People 2020 defines health disparity as “a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their
racial or ethnic group; religion, socioeconomic status; gender; age; Mental health; cognitive; sensory, or physical disability; sexual orientation or gender identity; geography; or other characteristics historically linked to discrimination or exclusion” (U.S. Department of Health and Human Services, 2011, "Disparities", para 5).

Health disparities research has also developed in a similar manner to health literacy research; first describing issues in various populations, second increasing understanding of the underlying mechanism contributing to the problems, and finally developing interventions and examining outcomes (Cooper, 2011). There are also common challenges and themes between the health literacy and disparities which impact access, quality, and outcomes. Both have also tried similar interventions: clinician-patient communication and system approaches (Chin, Walters, Cook, & Huang, 2007; Sudore & Schillinger, 2009). Although health literacy and health disparity have much in common, there are three areas of difference: modifiability, others’ view and the individual’s experience (Cooper, 2011). Health literacy is viewed as concept that can be modified or changed in some manner; factors related to health disparity such as race or gender are not modifiable. Health literacy is usually invisible to others whereas race or gender is very apparent. The individual’s experience with either is impacted by both the modifiability and the ability of others to see or not see health literacy and disparities.

2.10.1 Education, literacy/health literacy, and health outcomes

Researchers are currently attempting to define the relationship between health literacy and health disparities. The question as to whether improving health literacy will reduce health disparities is currently being examined (Bennett, Chen, Soroui, & White, 2009; Schillinger, Barton, Karter, Wang, & Adler, 2006; Schillinger, 2011). The NAAL
provides data which can help us understand the relationships between health-related measures, health literacy and the factors which impact disparity such as race, gender, income, education, and geography. Health literacy has been identified as a mediator between education and self-rated health, preventive health measures (flu vaccine, mammograms, and dental care, health-literacy-related tasks (health, dosing medications, and appointments), and hemoglobin A1c (Bennett et al., 2009; Schillinger et al., 2006). Howard et al (2006) noted that health literacy explained the relationship between education and health scores (health, mental), but contrary to the prior studies there was no relationship with preventative care (flu vaccine, mammograms, dental care). Other studies demonstrated that literacy mediated the relationship between education and chronic illness and health conditions which impacted society and use of a patient electronic record (Sarkar et al., 2010; Sentell & Halpin, 2006).

2.10.2 Race, literacy/health literacy, and health outcomes

Several studies looked at the relationship between health literacy and race/ethnicity. Health literacy mediated the relationship between race and self-rated health, mental health, flu vaccine, liquid medication dosing, level of prostate-specific-antigen (PSA) at cancer presentation, and changes in advanced care preferences (Bailey et al., 2009; Bennett et al., 2009; Howard et al., 2006; Volandes et al., 2008; Wolf et al., 2006). It did not mediate the relationship with race and preventative care (mammography, dental care) and physical health.

These studies are mostly cross sectional and as a result, must be viewed cautiously due to multiple confounding factors such as issues with childhood development and health literacy measurement (Cooper, 2011; Schillinger et al., 2006;
Schillinger, 2011). Understanding the possible ways (mechanisms) that better health literacy can improve health in those at risk for disparities is essential for progress in the studies of health literacy and disparities.

2.10.3 Hypothesized mechanisms

Hypothesized mechanisms connect health literacy, disparities and outcomes (Cooper, 2011; Schillinger et al., 2006; Schillinger, 2011). Evidence is beginning to suggest that limited health literacy is linked to higher rates of illness, particularly chronic disease. This link may be influenced by contextual factors such as economic resources that determine living in an area with a higher incidence of chronic diseases (Cooper, 2011; Schillinger et al., 2006; Schillinger, 2011). For example, patients on warfarin with inadequate literacy had difficulty with stroke knowledge including signs and symptoms (Fang, Panguluri, Machtinger, & Schillinger, 2009).

2.10.4 Health literacy interventions impact on health disparity

Several different interventions have disproportionately affected (helped) vulnerable populations, thus identifying interventions that target groups at risk for health disparities. Examples of these interventions are health-literacy-sensitive diabetes and congestive heart failure programs, asthma teach-to-goal program, automated diabetes phone system, and visual medication schedules with “teach back.” (DeWalt et al., 2006; Machtinger et al., 2007; Paasche-Orlow et al., 2005; Rothman et al., 2004; Schillinger et al., 2008). Studies have also demonstrated that context is important and can impact the relationship between health literacy and health outcomes for vulnerable populations. The relationship between health literacy and diabetes and literacy and blood pressure were impacted by the context of the study (i.e., public hospital, private setting,) (RW.ERROR -
Unable to find reference:207; Powers, Olsen, Oddone, Thorpe, & Bosworth, 2008; Schillinger et al., 2006). Thus, interventions can be tailored for the context of the individuals/populations experiencing health disparities.

2.10.5 Summary

Health literacy and health disparities share commonalities; however they also have poignant differences. From a knowledge building perspective, both have evolved in a similar manner with definitions expanding over time to include factors impacting health literacy and health disparities, and research focusing on describing issues, identifying mechanisms, and developing interventions for health literacy and health disparities.

However, the differences between health literacy and health disparities become apparent when examining the modifiability of factors associated with both (health literacy factors may be more modifiable than factors associated with health disparities), and the ability of others to see the factors (i.e. race, visible disability) related to health literacy or disparities (Cooper, 2011).

2.11 Gaps in the Literature

2.11.1 Health literacy levels in older adults

Several large population studies including the NAAL have confirmed that older adults typically have lower health literacy when compared to younger adults. These studies also described the characteristics of older individuals who have low health literacy. However, none of these studies have the extensive background characteristics found in the NAAL to use for predicting health literacy levels. In this secondary analysis, background characteristics related to health literacy, socio-demographics,
sources of health information and health disparities risks were examined in relationship to health literacy levels.

2.11.2 Sources of health Information used by older adults

The limited literature on older adults’ sources of health information indicates that older adults prefer to obtain health information from their primary health care provider. However, this conclusion is based on a limited number of studies with small sample populations not representative of the United States population. This leaves a void in the knowledge we have about sources of health information used by older adults across the United States. The NAAL offers a large sample of older adults who represent the United States population. In addition to identifying the sources used by older adults, the NAAL is able to identify the sources used based on health literacy levels. This information can be used to predict sources for targeted health education.

2.11.3 Health literacy, sources of health information and health disparities

As noted from the literature, health literacy and health disparities research has followed a similar path. The literature shows that health literacy has played a mediating role in the relationship between variables such as education and race and other health outcomes (i.e., preventative care). By examining the relationship between background characteristics known to be associated with health disparities, health literacy, and sources of health information, the relationship between health literacy and disparities in the older adult population may be better understood.

2.12 Conclusion

The relationship between health literacy and other background characteristics such as sources of health information and factors associated with health disparities in the
older adults population needs to be examined. Findings from this secondary analysis of the NAAL will aid in identifying the type and extent of these relationships. This information will aid in addressing issues that inhibit older adults from receiving health information and are associated health disparities.
CHAPTER THREE

METHODOLOGY

3.1 Introduction

This study was a secondary analysis of the National Assessment of Adult Literacy (NAAL) focusing on health literacy. It was a descriptive correlational study which examined health literacy and socio-demographic/background characteristics related to health literacy, health disparities, and sources of health information in the older adult population. The NAAL has a complex design which allows for a large sample size representative of the US population, however does not provide individual assessment scores. This chapter describes the study design including the complex sampling procedure, technology used in the data collection, and the data analysis using custom software.

3.2 Design of the Study

The methodology used in this study was descriptive correlational in the setting of secondary analysis. Descriptive correlational studies are used to describe the relationships or associations between variables as opposed to determining cause and effect relationships (Polit & Beck, 2004). Secondary analysis uses data collected in another study to answer different research questions or examine new relationships (Polit & Beck, 2004). The NAAL data set is a large national data set which can be used to explore relationships between health literacy and socio-demographic/background characteristics associated with health literacy, health disparities, and sources of health information; a combination of data not available anywhere else.
This study examined the relationships involving health literacy and variables related to health literacy, health disparities, and sources of health information in the population age 65 and older. The demographic and background characteristics included in the NAAL are extensive. For the purposes of this study, socio-demographic and background characteristics were selected based on factors identified in the literature (conceptual model) which are associated with health literacy, health disparities and sources of health information. The variables are found in Table 1 in the variables section.

3.3 NAAL Health Literacy Definitions

In the NAAL health literacy is defined as “The ability to comprehend and use printed and written health information to function in society, to achieve one’s goals, and to develop one’s knowledge and potential,” (White, 2008, p. 3). This definition focuses on functional health literacy; using printed/written sources of health information to do something in society such as completing a diagnostic test.

3.4 Literacy Scales

The NAAL measured health literacy on three scales: prose, documentation, and quantitative (White & Dillow, 2005). Prose text can be delineated as expository, narrative, procedural, or persuasive (Greenberg & Jin, 2007). Documentation tasks focused on information in noncontinuous text in various formats (Kutner et al., 2006). Quantitative tasks used numerical information embedded in text (Kutner et al., 2006).

The health literacy tasks were divided into three health related subgroups: clinical, preventive, and health system navigation (Kutner et al., 2006). Clinical tasks focused on questions related to specific health topics such as diseases (White, 2008). The preventive tasks evaluated the knowledge of participants about health care behaviors related to
prevention of disease. The health system navigation tasks examined the participants’ ability to use the system to obtain necessary information and treatment. The tasks reflected real life situations: performing a prose type of activity when reading possible side effects of medication, using document skills to complete insurance forms or read a prescription, or implementing quantitative skills when calculating insurance coverage of a health care bill (White, 2008).

3.5 Sample

The sample for the NAAL was composed of US residents age 16 and older from households and state and federal prisons. The household sample size was 18,102 and the prison size was 1,156. These two sample groups were weighted to reflect or represent the total population; household sample is 99 percent of the sample weighted, and the prison sample is 1 percent of the sample weighted. The sample groups were combined for reporting (Kutner et al., 2006). Due to the small population of elderly prisoners who participated in the NAAL, this study included only adults age 65 and older in households. 3.5.1 Sampling design

The NAAL used a complex sample design to select the assessment respondents. The household sample included a probability sample of 35,365 households. “The household sample was selected on the basis of a four-stage, stratified area sample: (1) primary sampling units (PSUs) consisting of counties or groups of contiguous counties; (2) secondary sampling units (referred to as segments) consisting of area blocks; (3) housing units containing households; and (4) eligible persons within households,” (Greenberg & Jin, 2007, p. 6).
Six states requested additional participants to allow reporting on a state level: Kentucky, Maryland, Massachusetts, Missouri, New York, and Oklahoma. Because these states joined the study after the NAAL sample selection, the state sample was done separately. The sample for the State Assessment of Adult Literacy (SAAL) was completed in an identical manner to the NAAL, but independently of the NAAL. Then the samples were combined by using composite estimation during the estimation stage. For the purposes of this study, the NAAL and SAAL sample/participants were referred to as the NAAL sample/participants (Greenberg & Jin, 2007).

To increase participation of Blacks and Hispanics in the NAAL, the segments with a moderate to high concentration of these groups were oversampled (given a higher probability of being selected). The SAAL did not oversample minority groups.

Of the 35,365 sample households, 4,671 were not a dwelling unit or were vacant, making the sample unit 30,694 households. 25,123 households completed the screener and based on the results of the screening data, 23,732 participants were selected to complete the background questionnaire and assessment. Of the potential participants, 18,186 completed the background questionnaire, and 17,178 answered at least question on each of the three scales (Kutner et al., 2006).

3.5.2 Weighting and Variance

Because this is a complex sample design the selection process was different from a simple random sample where every adult in the focus population has an equal chance of being chosen. One way to address sampling errors with this design was to use sampling weights to make up for the potential that the probabilities of selection were not identical for all participants (Greenberg & Jin, 2007). Due to the use of clustered sampling, the
usual approaches for addressing sampling variability were not appropriate. Thus, all analyses of NAAL data incorporated a Taylor series procedure or some other procedure which takes the weights and complex sample design into consideration.

3.5.3 Assessment Completion

Another aspect in determining the sample was the completion of the screening, background questionnaire, and assessment. A participant’s assessment was considered complete if they answered the background questionnaire and at least one task from each of the three scales. A case was incomplete if any part of the screening or questionnaire was incomplete or the participant answered less than one task from each scale. For individuals who completed the questionnaire but failed to answer any literacy tasks, regression-based imputation methods were used to impute responses to one task on each scale by using NAAL background data (Greenberg & Jin, 2007).

3.5.4 Imputation

The imputation procedure was instituted to avoid unknown biases because the refusal to complete the assessment was not considered random. Data used for imputation included age, race/ethnicity, gender, education level, census region, country of birth, and metropolitan statistical area status. This included 859 participants who refused to complete the assessment for reasons besides mental disabilities and language. An additional 65 participants, who started to answer assessment questions but were unable due to mental disabilities or language, had an incorrect response on each scale imputed (Kutner et al., 2006). The final sample size was 18,102. This included 17,178 who finished the background questionnaire and assessment, plus the 859 who refused to do the
assessment and had inputed answers to one item on each scale, and 65 who started the assessment but were unable to answer due to mental disability or language issues.

3.5.5 Response

The final household sample response rate was 62%. Overall 3% of adults were unable to participate in the assessment because they were unable to communicate in English or Spanish or because they had a mental disability that prohibited them from participating. Another 3% were directed to an alternative assessment (the Adult Literacy Supplemental Assessment, or ALSA) due to their performance on the initial screening tasks. These participants were classified as Below Basic and their results were included in this report. Because the response rate for certain sections was less than 85%, analysis for the potential for nonresponse bias was instituted (Kutner et al., 2006).

3.5.6 Nonresponse bias

National Center for Education Statistics (NCES) requires nonresponse bias analysis when the response rate for a sample is not 85% or greater. The analysis for the household population showed that the background characteristics of the assessment participants differed from the background of the household members who refused to participate. Those who refused to participate in the screening were more likely to live in dwelling units in segments with high median income, small average household size, and large proportion of renters. Those who refused the background questionnaire were more likely to be male, age 30 or older, and in segments with high median income. By using weighting adjustments the bias was reduced. In general the analysis concluded that nonresponse bias was negligible at the screening and background questionnaire stages (Kutner et al., 2006).
3.6 Human subjects and ethical consideration

Participation in the NAAL was strictly voluntary. Participants completed a study consent form. Participants were assured that the information collected would be held in a secured and locked system available to only staff with the need to utilize the information. Each participant received an identification number which was used to record the data; eliminating the need for the data to be stored by using their name. The data used by the public is de-identified. For use of data without de-identification, special permission must be obtained from the NAAL administration. No physical harm resulted from the original collection of data. In the testing process, low literacy/health literacy participants may have been frustrated and embarrassed over their inability to complete tasks. The researcher obtained IRB exemption for this study due to the de-identified nature of the information.

3.7 Data Collection

The assessment was administered on a one-on-one situation using a computer-assisted personal interviewing (CAPI) system installed in a laptop computer. Whenever possible, the background questionnaire and assessment were completed in a private area. Participants were encouraged to use usual aids and other tools such eyeglasses, magnifying glasses, rulers, and calculators when completing tasks.

The assessment began with the 35 minute questionnaire on background information followed by seven core literacy tasks. The interviewers read questions about background information from the computer screen and placed responses into the computer. The CAPI system has follow-up probes for out of range values and contradictory information and skip patterns programmed into the software (Kutner et al.,
Topics in the background questionnaire included language, educational background and experiences, political and social participation, labor force participation, literacy practices, job training and skills, demographic information, family literacy, household income and welfare participation, health questions, and additional demographics.

After the background questions the participants were given a booklet with 7 initial assessment questions. The interviewers followed a script that described the assessment booklet and guided the participant through the assessment. After the participant completed the first 7 questions in the booklet, the interviewer used an algorithm to determine if the participant should continue with the main assessment or an alternative assessment, Adult Literacy Supplemental Assessment (ALSA). Adults with marginal literacy used the ALSA to demonstrate what they could and could not do when using reading various forms of print starting with simple tasks and sight words and then move onto highly contextualized material usually found at home or in the community. The interviewer read the ALSA script from a booklet and recorded the participant’s answers according to the response categories in the booklet. ALSA participants were handed the materials they were asked to read. Most ALSA participants struggled to answer the questions and were placed into the Below Basic level on the health scale. The participants were given an oral-reading fluency assessment (Fluency Addition to the NAAL, or FAN) after completing the main assessment or the ALSA (Greenberg & Jin, 2007). Results of the FAN were not discussed in the NAAL public use files and will not be discussed in this study.
The NAAL consisted of 152 tasks divided into 13 blocks with approximately 11 questions per block. Each participant was given a booklet with 3 blocks of questions. There were 26 different configurations of assessment booklets, thus, each block was paired with every other block and each block appeared in each of the three positions (first, middle, last). The participants were given guidance in using the booklet as needed throughout the assessment.

3.8 Data Analysis

The NAAL data is available for public use and is located on the National Center for Education Statistics (NCES) website. In addition, this study’s primary investigator attended a workshop sponsored by NCES and was given a disk with the public use file of the data from the NAAL. The NAAL data are analyzed using AM software which was specifically developed for the NAAL study design.

The distributions of variables included in this study were examined and characterized utilizing summaries. Demographic and characteristic variables were summarized using percents for categorical variables and means with standard deviations for continuous approximately normally distributed variables. To determine whether variables were statistically significantly different between independent groups, t-tests with Bonferroni adjusted alpha were used to compare groups. Simultaneous multiple linear regression procedures were utilized to determine which predictor variables were independently associated with outcome variables.

3.9 Variables

The NAAL collected extensive socio-demographic/background characteristics data in the background questionnaire from the participants in addition to the completion
of the health literacy tasks. Although examination of all background information in relationship to health literacy may provide interesting trends/patterns, variables for this study have been limited to those in which a potential relationship exists with health literacy, health disparities, and sources of health information based on the literature. As stated before, this study was limited to individuals age 65 or older, thus age was not be a manipulated variable. It is clearly documented through the NAAL and previous studies that older individuals have lower health literacy and more difficulty understanding health information when compared to younger individuals (Cavanaugh et al., 2008; White, 2008).

The list of variables for this study is contained in Table 1. The variables were selected based on the conceptual model, “Causal Pathways between Limited Health Literacy and Health Outcomes” and the literature on health literacy, health disparities, and health information-seeking behavior. In the model, multiple factors impact health literacy and were represented in this study by multiple variables in Table 1 such as income and education.

In the conceptual model, the individual’s health outcome is affected by access and utilization of health care, provider-patient interaction, and self care. The following variables were chosen to reflect self care patient factors (knowledge/skills), extrinsic factors (health education), and the literature on health literacy and health information seeking behavior as described in Chapter 2: email usage; frequency of seeking information on the internet; and how often seek health information from newspapers; magazines; internet; radio/TV; books; family, friends, and co-workers; and doctor and health care providers; and needing help with forms, reading newspaper, writing notes,
and math. Finally, self-report of overall health was chosen for this study due to the relationship with health literacy as noted in the literature review in Chapter 2.

Table 1

*Study Variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Elements</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Literacy</td>
<td>Categories:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Below Basic</td>
<td>Ordinal</td>
</tr>
<tr>
<td></td>
<td>Basic</td>
<td>Ratio</td>
</tr>
<tr>
<td></td>
<td>Intermediate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proficient</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Score</td>
<td></td>
</tr>
<tr>
<td>Region of country</td>
<td>Table</td>
<td>Nominal</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>White</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>Black or African American</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td></td>
</tr>
<tr>
<td></td>
<td>American Indian or Alaska</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Native Hawaiian or other</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pacific Islander</td>
<td></td>
</tr>
<tr>
<td>Country of birth</td>
<td>Table of countries</td>
<td>Nominal</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Marital status</td>
<td>A. Never married</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>B. Married, living with spouse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Married, spouse living elsewhere</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. Living as married</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E. Separated or divorced</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F. Widowed</td>
<td></td>
</tr>
<tr>
<td>U.S citizenship</td>
<td>Yes</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Understands spoken English</td>
<td>Very well</td>
<td>Ordinal</td>
</tr>
<tr>
<td></td>
<td>Well</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not well</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not at all</td>
<td></td>
</tr>
<tr>
<td>Ability to read English</td>
<td>Very well</td>
<td>Ordinal</td>
</tr>
<tr>
<td></td>
<td>Well</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not well</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not at all</td>
<td></td>
</tr>
<tr>
<td>Difficulty understanding medicine dosage</td>
<td>How difficult is it for you to understand the dosage information on over-the-counter medicines written in English?</td>
<td>Ordinal</td>
</tr>
<tr>
<td></td>
<td>1 No difficulty</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 Some Difficulty</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 Moderate Difficulty</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 Great deal of difficulty</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Options</td>
<td>Scale</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Language usually spoken now</td>
<td>Table</td>
<td>Nominal</td>
</tr>
<tr>
<td>What other language do you speak often now?</td>
<td>Table</td>
<td>Nominal</td>
</tr>
</tbody>
</table>
| Household income                              | A. $0 to $14,999 
B. $15,000 to $19,999 
C. $20,000 to $29,999 
D. $30,000 to $39,999 
E. $40,000 to $59,999 
F. $60,000 to $99,999 
G. $100,000 plus | Ordinal    |
| Educational attainment                         | A. Still in High School/Less Than High School (0-8 Years)/Some High School (9-12 Years but did not graduate) 
D. GED OR High School equivalency 
E. High School graduate (12 years; accelerated or early graduate program) 
F. Attended a vocational, trade or business school after high school/Some college: J. College graduate/Postgraduate | Ordinal    |
| Send or receive an e-mail Message             | Everyday 
A few times a week 
Once a week 
Less than once a week 
Never | Ordinal    |
| Find information on the internet              | Everyday 
A few times a week 
Once a week | Ordinal    |
<table>
<thead>
<tr>
<th>Question</th>
<th>Responses</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much help do you get from family members or friends with filling out forms?</td>
<td>A lot, Some, A little, None</td>
<td>Ordinal</td>
</tr>
<tr>
<td>How much help do you get from family members or friends with reading or explaining newspaper articles or other written information</td>
<td>A lot, Some, A little, None</td>
<td>Ordinal</td>
</tr>
<tr>
<td>How much help do you get from family members or friends with writing notes, letters (and email?)</td>
<td>A lot, Some, A little, None</td>
<td>Ordinal</td>
</tr>
<tr>
<td>How much help do you get from family members or friends with using basic arithmetic, that is, adding, subtracting, multiplying, or dividing, such as filling out order forms or balancing a checkbook?</td>
<td>A lot, Some, A little, None</td>
<td>Ordinal</td>
</tr>
<tr>
<td>How often seek health information from newspapers, magazines, internet, radio/TV, books, family, friends, co-workers, doctor, health care providers</td>
<td>A lot, Some, A little, None</td>
<td>Ordinal</td>
</tr>
<tr>
<td>Question</td>
<td>Response</td>
<td>Type</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Self-report of overall health</td>
<td>Excellent, Very good, Good, Fair, Poor</td>
<td>Ordinal</td>
</tr>
<tr>
<td>Difficulty seeing</td>
<td>Do you have any difficulty seeing the words and letters in ordinary newspaper print even when wearing glasses or contact lenses, if you usually wear them?</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>Yes, No</td>
<td></td>
</tr>
<tr>
<td>Difficulty hearing</td>
<td>Do you have any difficulty hearing what is said in a normal conversation with another person even when using a hearing aid, if you usually wear one?</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>Yes, No</td>
<td></td>
</tr>
<tr>
<td>Diagnosed with learning disability</td>
<td>Have you ever been diagnosed or identified as having a learning disability?</td>
<td>Nominal</td>
</tr>
<tr>
<td></td>
<td>Yes, No</td>
<td></td>
</tr>
</tbody>
</table>
3.10 Statistical approaches to data analysis

De-identified data from the NAAL was examined using AM Software designed for the NAAL. In AM Software, health literacy was the dependent variable and background characteristics were the independent variables. To answer research question 1, descriptive statistics were utilized to gain general knowledge about patterns and trends. This included measures of central tendency ("MML Means [Separate Variances]") with variability of distribution (standard deviation) and standard error for each background characteristic. Additionally, percentages of the population for each category within the background characteristic variable were determined using the NALS Table in AM Software. To examine the relationships between health literacy and demographic/background characteristics, bivariate descriptive statistics were utilized. This included t-tests with significance of p<.05 or Bonferroni adjusted alpha as needed.

To answer the second research question, background characteristics variables (independent variables) with half or greater significant relationships between categories from the bivariable analysis (t-tests) were entered into a multiple simultaneous linear regression model (MML Regression). AM Software placed all the variables into the regression model at once. The alpha for variables within the model was p<.05.

3.11 Summary

This study was descriptive correlational in the setting of secondary analysis, using data from the NAAL 2003. The NAAL was a national large scale study implemented in 2003 to evaluate the literacy of the US population. This study focused on the older adults. From the data, this study looked at the trends and patterns in the demographic and background characteristics and health literacy using univariate descriptive statistics.
Next, the study focused on bivariate analysis of the relationships between demographic and background characteristics and health literacy, health disparities risk factors, and sources of health information. Finally the study utilized simultaneous multiple linear regression to determine the relationships between and among health literacy, health disparities risk factors and sources of health information, and background variables to determine the strongest relationships. The results were used to confirm relationships in the conceptual model/literature and for predictive modeling. By understanding relationships between health literacy and demographic and background characteristics, interventions that will potentially impact health literacy, health disparities and health outcomes can be identified, developed and tested.
CHAPTERS FOUR AND FIVE

MANUSCRIPT RESULTS AND DISCUSSION

As is the current trend in the PhD Program in Nursing at Duquesne University, Chapters 4 and 5 deviate from the traditional dissertation which would include the results and analysis in Chapter 4 followed by Chapter 5 that would include discussion, limitations, conclusions, implications for practice and recommendations for future research. Instead, this final chapter of my dissertation includes the manuscript that will be submitted to a research journal for publication. The manuscript includes an abstract, introduction including review of the literature, methodology, results, and discussion sections. In addition, limitations to the study and conclusions are presented.
Health Literacy, Health Disparities and Sources of Health Information in US Older Adults

Carolyn Crane Cutili
Duquesne University

Author Note
Carolyn Crane Cutili, Doctoral Student, School of Nursing, Duquesne University
Correspondence concerning this article should be addressed to Carolyn Crane Cutili, 803 Nesbitt Road, Maple Glen, PA 19002 Email: bcutilli@yahoo.com
Abstract

This descriptive correlational study is a secondary analysis of the National Assessment of Adult Literacy (NAAL) 2003, a large scale national assessment which included health literacy. It examined the relationships between health literacy and demographic/background characteristics in older adults (age 65 and over) related to health literacy and disparities, and sources of health information. Results show that older adults with lower health literacy have less income and education, rate their health as poor or fair, have visual or auditory difficulties, and need help filling out forms, reading newspaper or writing notes. Additionally, when seeking health information, older adults with lower health literacy use less sources (print and non-print) less often. Regardless of health literacy level, older adults use the doctor/health care provider more than any other source, while using the internet least. Regression results demonstrated that income, education, help with filling out forms or reading newspaper, and utilizing health information sources (doctor/health care provider, books, internet, and magazines) are predictive of health literacy. Future research on interventions addressing health literacy needs of older adults may potentially impact health disparities, especially those associated with lower income and education.
Health Literacy, Health Disparities, and Sources of Health Information in US Older Adults

Introduction

Older adults in our country are at risk for suboptimal health due to their high rate of low health literacy (Kobayashi, Wardle, Wolf, & von Wagner, 2015; Kutner, Greenberg, Jin, & Paulsen, 2006; White, 2008). Research in the older adult population has shown that low health literacy is associated with increased mortality, worse physical functioning and mental health, and fair/poor rating of health (Baker et al., 2007; Bostock & Steptoe, 2012; Mottus et al., 2014; Smith et al., 2015). Older individuals with low health literacy and chronic illnesses (asthma, diabetes, and congestive heart failure) have lower mean knowledge scores about their chronic condition (Gazmararian, Williams, Peel, & Baker, 2003), utilized less preventive care (Chen, Hsu, Tung, & Pan, 2013; Miller, 2004; Scott, Gazmararian, Williams, & Baker, 2002), demonstrate less health promoting behaviors (Mahnoush et al., 2015) and have difficulty with activities of daily living and activity limitations (Wolf, Gazmararian, & Baker, 2005). Health literacy has been associated with a more rapid decline in executive function (Sequeira et al., 2013).

Many public and private organizations have made health literacy a priority and invested resources to help educate health care providers, including the American Medical Association (n.d.), Institute of Medicine (Nielsen-Bohlman, Panzer, & Kindig, 2004), The Joint Commission (n.d.), Pfizer (2015), and Agency for Health Care Research and Quality (2010). The Centers for Disease Control and Prevention (2014) emphasizes the importance of older adults having adequate health literacy to address health concerns often associated with aging. Health literacy as a national priority is also demonstrated by
its inclusion in Healthy People 2020 and the National Assessment of Adult Literacy (NAAL) 2003. The NAAL was implemented by U.S. Department of Education and is the first US large-scale assessment to measure health literacy. The NAAL defines health literacy as “the ability of US adults to use printed and written health-related information to function in society, to achieve one’s goals and to develop one’s knowledge and potential,” (Kutner et al., 2006, p.2). Analyses of the NAAL data provide information about the relationships between health literacy and background characteristics in US older adults.

Several characteristics examined in the NAAL have been identified as variables associated with health disparities. Healthy People 2020 defines health disparity as a health difference closely associated with the following factors: disability, racial/ethnic group, religion, geography, gender; age, socioeconomic status, mental health, sexual orientation or gender identity, or factors linked to exclusion or discrimination (Healthy People 2020, n.d.). The NAAL provides the opportunity to use a large scale national assessment to discuss possible relationships between health literacy and disparities in older adults.

According to the NAAL data, individuals who spoke English only before starting school have higher average health literacy compared to individuals who spoke a non-English language only. Individuals with one or more disabilities (learning disability, hearing, vision or “others”) have a lower mean health literacy score compared to adults without disabilities (Kutner et al., 2006). White and Asian/Pacific Islander adults had the highest average health literacy. Hispanic adults had the lowest average health literacy (Kutner et al., 2006; White, 2008). The association between gender and health literacy is
not clear (Benson & Forman, 2002; Gazmararian et al., 1999; Wilson, Racine, Tekieli, & Williams, 2003). Analysis of the NAAL data demonstrated no difference between the mean health literacy scores for genders (Kutner, 2006).

Studies of older adults have shown that usually a higher level of educational attainment corresponds with a higher level of health literacy (Baker, Gazmararian, Sudano, & Patterson, 2000; Benson & Forman, 2002; Buchbinder, Hall, & Youd, 2006; Williams et al., 1995). However, the health literacy grade level is consistently lower than the highest obtained educational grade level (Cho, Lee, Arozullah, & Crittenden, 2008; DeWalt et al., 2004; Wilson & McLemore, 1997). The literature notes a positive relationship between income and health literacy (Baker et al., 2002; Baker et al., 2007; Chew, Bradley, Flum, Cornia, & & Koepsell, 2004; Wolf et al., 2005). In the NAAL, the average health literacy score rose along with income rising above the poverty level (Kutner et al., 2006).

The NAAL provides an opportunity to examine sources of the health information used by older adults based on health literacy level. Current research on sources of health information (health information seeking behavior) is focused on internet usage. In the NAAL, overall the average health literacy scores were highest for adults who sought health information from the internet “a little” or “some,” and lowest for those sought internet health information “none” (White, 2008). Current research suggests that older individuals use the internet less than younger but the gap is closing (Kontos, Blake, Chou, & Prestin, 2014; Levy, Janke, & Langa, 2014; Pew Research Center, n.d.; Tennant et al., 2015). An eHealth Literacy Scale has been developed and tested in older adults to determine their ability to use e-health technologies (Chung & Nahm, 2015). Other studies
note that for older adults the physician is a main source of health information (Campbell & Nolfi, 2005; Morey, 2007).

This study was descriptive correlational in the setting of secondary analysis, using data from the National Assessment of Adult Literacy (NAAL) 2003. It examined the relationships between health literacy and demographic/background characteristics in older adults (age 65 and over) related to health disparities and sources of health information. The conceptual model for this study is entitled “Causal Pathways between Limited Health Literacy and Health Outcomes,” (Figure 1) (Paasche-Orlow & Wolf, 2007). The model depicts how health outcomes are impacted by individual’s health literacy, interaction with health care system and self care factors. The variables in the NAAL provide an opportunity to verify the relationships in the existing model/literature and identify the inclusion of other variables that may make the existing model more robust.

The research questions for this study are:

3. What sociodemographic (educational attainment, income, race, region of the country, gender, marital status, US citizenship, country of birth), background (computer usage, cognitive tasks, language, health status, vision, hearing, disabilities), and extent of health information use (sources of health information) variables are associated with older adult’s health literacy.

4. What variables related to health literacy, health disparities and sources of health information predict the health literacy of older adults?
Methods

The National Assessment of Adult Literacy (NAAL) 2003 was implemented through the U.S. Department of Education, Institute of Educational Sciences, National Center for Education Statistics (NCES). This large scale national assessment was designed to provide estimation of literacy and health literacy for US populations such as older adults. To decrease the burden on the participants, a fraction of the assessment items were administered to each participant resulting in no accurate individual score. NCES used marginal maximum likelihood (MML) models to estimate health literacy scores for populations. AM Software was developed to provide these estimates (National Center for Education Statistics, n.d.b)

The health literacy measurement included 28 health literacy questions embedded in the literacy tasks (White, 2008). The NAAL examined health literacy in relationship to various background demographics/characteristics. Specifically, the questions focus on functional health literacy tasks centered on the following domains: clinical (medications, diagnosis and treatment), preventative (self-care, preventing disease), and health system navigation (informed consent, health insurance coverage) (Kutner et al., 2006). The population’s health literacy (prose, document, and quantitative tasks), was categorized based on mean health literacy score: Below Basic (0-184), Basic (185-225), Intermediate (226-309) and Proficient (310-500) (White & Dillow, 2005). These categories were developed by a committee using the Bookmark method and “quasi-contrasting groups approach” (Baldi, 2009).
Sample

This study included 2,668 non-incarcerated older adults (age 65 and older) who were part of the 18,000 person household sample from the NAAL study. The household sample was determined through a four-stage, stratified area sample: primary sampling units (PSUs) of counties or groups of contiguous counties, secondary sampling units (segments) of area blocks, housing units with households, and finally eligible persons in households. This sample was weighted to represent the total United States population. The participant’s assessment was considered complete and included if the background questionnaire and at least one task from each of the three scales are answered.

For individuals who completed the questionnaire but failed to answer any literacy tasks, regression-based imputation methods were used (Greenberg & Jin, 2007). The imputation procedure was instituted to avoid non-random unknown biases due to refusal. The analysis concluded that nonresponsive bias was negligible at the screening and background questionnaire stages (Kutner et al., 2006). Participation in the NAAL was strictly voluntary.

Data Collection

The assessment was administered on a one-on-one situation using a computer-assisted personal interviewing (CAPI) system. Participants utilized everyday aids and other tools such as eyeglasses, magnifying glasses, rulers, and calculators when completing tasks. The assessment began with the 35 minute questionnaire on background information followed by seven core literacy tasks (Kutner et al., 2006). Topics in the background questionnaire include political and social participation, labor
force participation, literacy practices, job training and skills, family literacy, and areas
described in the research questions.

The ability of the subjects to participate in the main assessment was determined
by completion of 7 initial tasks. Those who struggled with these tasks were given an
alternate assessment designed to present easier tasks first and move onto highly
contextualized material usually found at home or in the community. The NAAL
consisted of 152 tasks divided into 13 blocks with approximately 11 questions per block.
Each participant was given a booklet with 3 blocks of questions. Health literacy
assessment questions were embedded in the assessment (Kutner et al., 2006).

For this secondary analysis, the data were accessed through the public-use file
“NAAL_2003_Health.am” (National Center for Education Statistics, n.d.b) located on
the NCES’ NAAL website (National Center for Education Statistics, n.d.a). In this large
database, missing data was managed during the data collection process. Imputed answers
were used to avoid bias resulting from refusal to answer questions.

Variables

Thirty-two variables from the National Assessment of Adult Literacy (NAAL)
2003 were chosen for this study. Variables were selected based on their identification in
the literature on health literacy, health disparities and sources of health information
(health information seeking behavior). The relationship of these variables to health
literacy is diagrammed in the study’s conceptual model, “Causal Pathways between
Limited Health Literacy and Health Outcomes” (Figure 1). The following variables that
have an impact on health literacy were examined: gender, educational attainment, race,
income, marital status, region, US Citizenship, country of birth, vision, hearing, language, and disabilities.

The model supports the concept that an individual’s health outcome is affected by access and utilization of health care, provider-patient interaction, and self care. Self care is conceptualized in the model as patient’s knowledge/skills and extrinsic factor such as health education, however the model does not identify specific variables. For this study the following variables represent self-care in the model: knowledge/skills (use of internet and email, understanding medication dosing, help needed with completing tasks such as writing notes, math, reading newspaper) and health education (newspapers, magazines, books, TV/Radio, family, friends and co-workers, and health care professionals). Finally, the variable, self-report of overall health was chosen for this study due to its relationship with health literacy as noted in the literature review. Because the study was a secondary analysis, some variables were removed from the study due to erroneous outcomes or error messages.

**Statistical Analyses**

The data was opened in AM Software for data editing and statistical analyses. A data filter was set for age 65 or older. Data editing such as removing non-applicable values and collapsing categories was completed as needed. Descriptive statistics include frequencies and measure of central tendency. To answer the first research question, bivariate analyses using independent t-tests with Bonferroni adjustments as needed were conducted to explore the relationships of health literacy with sociodemographic and background characteristics associated with health literacy, health disparities risk factors, and sources of health information.
In order to assist with the clinical interpretation of the differences, effects sizes were reported for the difference in health literacy for each variable. An effect size is considered to be the smallest immediate difference that is clinically meaningful in the target population for the outcome of interest (i.e. health literacy in this study). Reporting the differences between the groups using an effect size index provides a more accurate interpretation of the clinical significance of results. As per Cohen (1992), the difference between two group mean scores falls under the index Cohen’s d. Accordingly, an effect size of 0.20 is considered a small effect, 0.50 is considered a medium effect and 0.80 is considered a large effect. Medium and large effects are considered substantial to be of practical importance.

Finally to answer the second research question, a simultaneous multiple linear regression was conducted to determine the predictive relationships of study variables on health literacy. The selection of variables for regression was based on outcomes of the bivariate analyses. For inclusion the variable had to have at least half of the categories in the bivariate analyses demonstrate significance. The AM software allowed for the testing of the overall model, but did not provide a measure of the robustness of the model through the quantification of the variance explained. In addition while the AM software is able to test the contribution of each predictor to the overall model, it is unable to quantify the differences within each level of the predictor.

Results

Participants

The 2668 participants of this study represent older adults in the United States. Table 1 describes demographic characteristics of the sample population. The majority of
participants are female, white, married, have some high school or high school graduate, and earn above $40,000 per year. The mean health literacy score for older adults is 214 (Basic) with 59% of the population having Below Basic or Basic health literacy.

**Sociodemographic characteristics**

There was no difference between genders with the mean health literacy score in both males (214, 2.3) and females (214, 3.4) at the Basic level. Mean health literacy scores were at the Basic level (217, 2.2) for White/Hispanic category and Below Basic (182, 6.25) for Black and Other (including multi-racial) category with a significant difference demonstrating medium effect size. The variables related to U.S. citizenship, country of birth, and language usage could not be used due to erroneous data or error messages.

The variables in Table 2 demonstrated statistically significant differences between mean health literacy scores of categories within the variable. For income, as anticipated the mean health literacy score increased as income, however the mean score remained relatively constant for income greater than $60,000. The significant differences in health literacy occurred most frequently between the lowest income level and all others with medium to large effect size for almost all. Health literacy increased with educational attainment, demonstrating statistical differences between most categories with medium to large effect sizes.

**Background Characteristics**

**Knowledge/skills.** Table 2 shows the results for help with forms, reading a newspaper and writing notes. The health literacy level declined as the need for help increased. The most differences between mean health literacy scores are statistically
different with medium to large effect sizes. The older adult population that needed the most help had an average score in the *Below Basic* range (162-181) Even those who did not need help had *Basic* health literacy (221-225). Erroneous data or error messages prevented the use of variables related to understanding medication dosing and obtaining help with math.

**Health.** Variables related to health such as vision, hearing, and overall health are in Table 2. The mean health literacy scores for those who answered yes to vision (190) and hearing (203) difficulties were at the *Basic* level and statistically different than the scores of those who did not (p <.05). The effect size was medium and small respectively. For self-reported overall health, the mean health literacy score increased with improving health. Significance differences were found for the comparison of fair/poor health compared to good to excellent health with effect sizes ranging from small to large.

**Health education (sources of health information).** The results of the association between health literacy and health education or sources of health information are shown in Table 3 and 4. Table 3 presents mean health literacy scores/standard errors associated with frequency (A lot, Some, A little, and None) for each source of health information. This includes results of bivariate comparisons with statistical significance and effect size. Table 4 shows the percent of older adults associated with frequency, source of health information and health literacy level.

Table 3 shows that the majority of mean health literacy scores are classified as *Basic* for sources of health information and frequencies. Table 4 shows that as health literacy increases, the largest percent of older adults use most sources of health information “Some” or “A little.” One exception, older adults (41 to 47 %) at all health
literacy levels used the doctor/health care provider “A lot” when compared to other frequencies. There is a substantial increase in the percent of older adults who use sources “None” as health literacy decreases, especially for print sources. To provide a clearer picture of the sources used by older adults, the following paragraphs present the results according to health literacy level.

**Below Basic.** Table 3 shows that mean health literacy score of Below Basic is associated with older adults who use newspapers, magazines, books and doctor/health care providers “None.” The most differences between mean health literacy scores associated with Below Basic and other health literacy levels were statistically significant. The effect sizes ranged from medium to large with some of the greatest effect sizes (.8 to 1.08) noted for print sources such as magazines, books, and the internet. Table 4 shows that largest percentage of older adults with Below Basic health literacy use the following resources “None”: newspaper (32%), magazines (42%), books (41%), and internet (93%). As expected, the largest percentage of those with Below Basic health literacy use non-print sources such as radio/TV and family/friends/co-workers “Some,” and doctor/health care provider “A lot.”

**Basic.** The mean health literacy scores of older adults are Basic for most sources of health information and frequency levels (Table 3). The statistically significant differences between the means associated with Basic health literacy and other literacy level are few with small effect sizes except for Below Basic discussed above. Table 4 shows that largest percentage of older adults with Basic health literacy use magazines (42%) and internet (81%) “None.” Additionally, approximately two out of five use
newspapers, books, radio/TV and family/friends/co-workers “Some,” and use doctor/health care provider “A lot.”

**Intermediate.** In Table 3, older adults with Intermediate health literacy use newspapers and books “A lot,” magazines “Some,” and internet at all frequencies except “None.” The statistically significant differences between the means associated with Intermediate health literacy and other literacy level are limited with small to large effect sizes. In Table 4, approximately half of older adults with Intermediate health literacy use the following sources “Some”: newspapers, magazines, books, radio/TV, and family/friends/co-workers. Two out of three use the internet “None,” while two out of five use doctor/health care provider “A lot.”

**Proficient.** There were no mean health literacy scores at the Proficient level for any sources of health information/frequency. In Table 4, the greatest percentage of those with Proficient health literacy used the following four sources “Some”: newspapers (43%), magazines (59%), book (34%) and family/friends/co-workers (42%). The same percentage of adults also used books “A little.” Approximately two out of five used the internet “None,” radio/TV “A little,” and doctor/health care provider “A lot.”

**Regression**

From the original thirty-two variables, fifteen were placed into the regression analysis to determine which are statistically significant (p< .05) and have the greatest impact on the mean health literacy scores (Table 5). The estimates can be positive or negative depending on assigned value of categories within the variables. The following variables (estimate included) were significant: household income (4.284); educational attainment (9.249); get help filling out forms (6.213) and reading newspaper articles
(13.623); overall health (-5.698); and receive health information from doctors/health care providers (-5.228), books (-5.982), internet (-5.231), and magazines (-5.552).

Discussion

This secondary analysis of the NAAL was a unique opportunity to examine relationships between health literacy and demographic/background characteristics in the US older adult population. This study has three key findings: 1) results support most relationships described in the conceptual model and literature associated with health literacy and help identify potential ways to impact health disparities through health literacy interventions; 2) there are similarities and difference in the utilization of health information sources based on health literacy level; and 3) the results support established health literacy predictive relationships, and identify variables (knowledge/skills, health education) that make the model more robust.

For the first research question, the results demonstrate that most relationships in the conceptual model/literature between background variables and health literacy exist in the older adult population. Furthermore, the results show that several, although not all of the variables related to health literacy and health disparities may have potential to impact health outcomes in older adults. In the health disparities literature, gender is identified as a variable that impacts health conditions/outcomes. However, the results do not demonstrate a difference between mean health literacy scores and gender in this study. Thus, health disparities related to gender will most likely not be resolved through health literacy interventions.

In contrast, the literature on health literacy and health disparities repeatedly demonstrates that those from lower income brackets and lower educational attainment
have lower health literacy and experience health disparities. This study showed that there were significant differences in the mean health literacy score between the lowest income level/lowest educational level and most other income/educational levels. Interventions such as additional support for health management in communities with lower income and education may help older adults take care of their health and potentially prevent health disparities.

A strong relationship between health and health literacy was demonstrated through self-reported overall health. This is consistent with the literature noting that older adults with lower health literacy had worse health status (Baker et al., 2000; Baker et al., 2002; Mottus et al., 2014; Sudore et al., 2006; Wolf et al., 2005). The difference between vision and hearing mean health literacy scores were statistically significant. Knowing that disabilities are associated with health disparities, interventions that improve health literacy in this population should be piloted to determine if health disparities can potentially be minimized.

The first research question is also answered by examining sources of health information and health literacy. The sources used by older adults vary based on health literacy level although there are some similarities. Most recent studies on sources of health information or health information seeking behaviors have focused on using the internet. Older adults using the internet are more highly educated and have higher incomes (Pew Research Center, n.d.). Additionally those using the internet have higher health literacy and make better health care decisions (James, Boyle, Yu, & Bennett, 2013; Kobayashi, Wardle, & von Wagner, 2015). Studies show that older adults did not rely on the internet for information and have health care providers as the main source of
information (Gollop, 1997; Morey, 2007; Tian & Robinson, 2008). The results of this study support findings in literature. The implication for health care providers is to understand that older adults do not use the internet to the same extent as other segments of the population and it may not be the preferred source of health information. However, interventions to expose older adults to the internet should be explored to determine if there is a positive impact on their health literacy and health care decision making.

For the remaining sources of health information, as the health literacy level increased the number of sources used “Some” or “A little” increased; while those who used “None” decreased. Especially noteworthy is that the largest percentage of older adults regardless of health literacy level used “Doctor/Health Care Provider” “A lot.” It is imperative that providers make health education a priority and be prepared to be the main source of health information for older adults. At the same time providers need to meet the health literacy demands of all older adults and should be prepared to direct to print and non-print sources.

Although older adults with Below Basic and Basic health literacy use non-print sources more often than print, the use of print sources is not precluded. For these adults the newspaper would be the best print vehicle to communicate health information because it is used by a greater percent of this population compared to other sources. Non-print sources were used by all older adults, however using radio/TV and doctor/health care provider would be the best choice for health information in most cases. However, those with Proficient health literacy prefer family/friends/co-workers over radio/TV.

Because the largest percent of older adults with Below Basic and Basic health literacy seek sources “None” compared to Intermediate and Proficient, providers must
reach out to those with the lowest health literacy. As the fee for service model of health care finance is replaced by fee based on quality, providers have an opportunity to change their approach to patient and family education. Providers can try methods that engage patients and provide more education to meet the patients’ health literacy demands. This process is actually less difficulty if providers follow the principles of Universal Health Literacy Precautions (Agency for Healthcare Research and Quality, 2010), educating all older adults with using simple, everyday language. Because lower health literacy has been associated with decreasing cognitive ability, providing education that decreases the load on cognition is essential (Gakumo, Enah, Vance, Sahinoglu, & Raper, 2015; Kobayashi et al., 2015; Mottus et al., 2014; O'Conor et al., 2014; Tennant et al., 2015). Providers should also consider involvement and promotion of health education via “Radio/TV” and “Family/Friends/Co-workers.” These sources are used “Some” by older adults of all health literacy levels.

The second research question is addressed by the examination of variables in the regression analysis. Based on the conceptual model, two (income and education) of the nine significant predictors of health literacy have been identified as impacting health literacy. The other significant predictors have not been discussed in the literature. This study identified self-care variables related to patients’ knowledge/skill (help with forms and reading newspaper) and health education (sources of health information) that potentially impact health literacy. The literature on predicting health literacy using patients’ skills has focused on using single questions related to ability or confidence to complete tasks. These studies demonstrated that the use of screening questions is as effective as other more lengthy health literacy assessments such as the Rapid Estimate of
Adult Literacy in Medicine (REALM) or the Test of Functional Health Literacy in Adults (TOFHLA) (Wallston et al., 2014). For example, Chew, Bradley, and Boyko (Chew, Bradley, & Boyko, 2004, p.588) used the following questions to determine adequacy of health literacy: “How often do you have someone help you read hospital materials?” Like this question, the NAAL questions about knowledge/skills could provide the foundational work to pursue additional single question screening tools used to identify those with low health literacy.

Where patients seek health information has not been cited as a variable that predicts health literacy. In this study, four sources of information (doctors/health care providers, books, internet, and magazines) were found to be statistically significant in the regression analysis. Thus use (or lack of use) of these sources may have potential to predict health literacy. When educating older adults, providers should ask about the sources of health information used to help the provider understand patients’ health literacy levels and direct patients to reliable information they are more likely to use.

**Limitations**

This study is limited by being a secondary analysis. The principle investigator did not have control over the research questions and data collection of the original study. As a result, the analysis of data was limited by insufficient number of observations, and thus, several variables (i.e., language, citizenship,) could not be examined. To increase observations, categories of variables were collapsed (i.e., race, help with reading newspaper). By collapsing White and Hispanic into one category, any discussion about race in the US older adult population is limited by the lack of meaningful analysis. This may have also contributed to race not being significant in the regression analysis. The
variable “help with reading” was also collapsed into “help” versus “no help.” This may have impacted the estimate in the regression analysis since it was substantially higher than other variables’ estimates. Although the NAAL is the only large scale national study of health literacy in the United States, the data from the study is over 10 years old. Thus, the data does not reflect changes in the population such as technology skills and the increase or decline in the use of certain sources of health information such as the internet and newspapers.

**Conclusion**

This secondary analysis examined health literacy and multiple background questions in the US older adult population using the NAAL data. The results support most relationships described in the conceptual model and literature associated with health literacy and as a result have potential to impact health disparities through health literacy interventions. These results also demonstrate the similarities and difference in the utilization of health information sources based on health literacy level, support established health literacy predictive relationships, and identify variables (skills, knowledge) that make the model more robust.

The results confirm relationships already established in the literature between socio-demographic variables and health literacy. Lower health literacy in older adults is associated with income less than $15,000 (in 2003), high school graduate or less, vision and hearing deficits and fair/poor overall health. Income and education were the strongest predictors of health literacy when compared to other variables. Because these characteristics are also associated with health disparities, the potential role of health literacy in the decreasing disparities need to be examined. Interventions (e.g., community
health workers, post discharge phone calls) focused on older adults with these characteristics may impact their ability to manage their health and could potentially lessen disparities. Rubin et al. (2014) developed a program to train volunteers for meals on wheels as health literacy coaches for older adults.

Knowledge/skills and health education variables under self care (needing help with skills such as filling out forms, reading newspaper, and writing notes; and sources of health information) have an interactive relationship with health literacy. Knowledge/skill/health education variables were not only utilized by older adults but can be an indicator of health literacy. In this study the first two knowledge/skills listed above were identified as predictive, and thus, have the foundational potential to be used as single item screener questions, and make the conceptual model more robust.

Sources of health information results demonstrated some similarities and differences by health literacy level. They showed that the opportunity to educate older adult patients, regardless of health literacy level, is during the interaction with the doctor/health care provider, and the internet is not the preferred source. Results also show that as health literacy decreases the percent of older adults using all health information sources decreases. Thus, those with lower health literacy may need the health care system to reach out and engage them in learning about health concerns. Future research should be focused on interventions which engage older adults. Sources of health information (i.e., doctors/health care providers, books, internet and magazines) used by older adults, like knowledge/skills of filling out forms and reading the newspaper, are predictive of health literacy. They may provide the foundation for determining additional single item
screeners for identifying those with low health literacy, and make the conceptual model more robust.
References


and older adults. *Journal of Medical Internet Research, 17*(3), e70. doi: 10.2196/jmir.3992.


Table 1  
*Socio-demographic Characteristics of the Participants*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Categories</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
<td>55</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>White</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>3</td>
</tr>
<tr>
<td>Region</td>
<td>South</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Midwest</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Northeast</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>West</td>
<td>19</td>
</tr>
<tr>
<td>Marital Status</td>
<td>Married/Living as married</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Separated, divorced or widowed</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Never married</td>
<td>4</td>
</tr>
<tr>
<td>Education</td>
<td>Some High School/High School Graduate /GED</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Vocational School or Some College</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>College Graduate/Graduate School</td>
<td>17</td>
</tr>
<tr>
<td>Household income</td>
<td>Above $40,000</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Below $40,000</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Difficulty hearing</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Learning disability</td>
<td>1</td>
</tr>
<tr>
<td>Health Literacy Level</td>
<td><em>Below Basic</em></td>
<td>29</td>
</tr>
<tr>
<td></td>
<td><em>Basic Health</em></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td><em>Intermediate</em></td>
<td>38</td>
</tr>
<tr>
<td></td>
<td><em>Proficient</em></td>
<td>3</td>
</tr>
</tbody>
</table>
Table 2
Comparison of Health Literacy Mean Scores by Education, Income, Help with Tasks, and Health (vision, hearing and overall) Effect Sizes reported for Significant differences only

<table>
<thead>
<tr>
<th>Variable</th>
<th>HL Mean</th>
<th>Standard Error</th>
<th>Effect Sizes</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. $0-$14999</td>
<td>183.0</td>
<td>4.1</td>
<td>0.4</td>
<td>0.5</td>
<td>0.7</td>
<td>0.8</td>
<td>1.3</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>2. $15000-$19999</td>
<td>201.6</td>
<td>4.1</td>
<td>NS</td>
<td>NS</td>
<td>0.6</td>
<td>1.2</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. $20000-$29999</td>
<td>212.3</td>
<td>4.7</td>
<td>NS</td>
<td>NS</td>
<td>0.7</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. $30000-$39999</td>
<td>219.2</td>
<td>5.2</td>
<td>NS</td>
<td>0.8</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. $40000-$59999</td>
<td>227.3</td>
<td>5.0</td>
<td>NS</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. $60000-$99999</td>
<td>252.6</td>
<td>6.7</td>
<td>NS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. $100000+</td>
<td>241.3</td>
<td>11.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bonferroni Adjusted alpha = 0.00244, NS = Not significant

<table>
<thead>
<tr>
<th>Variable</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Still in high school/Less than/some high school</td>
<td>167.2</td>
<td>4.8</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>2. GED/high school equivalency</td>
<td>194.5</td>
<td>7.2</td>
<td>NS</td>
<td>0.7</td>
</tr>
<tr>
<td>3. High school graduate</td>
<td>216.1</td>
<td>2.8</td>
<td>NS</td>
<td>0.8</td>
</tr>
<tr>
<td>4. Vocational/some college/Associate degree</td>
<td>224.5</td>
<td>3.7</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>5. College+</td>
<td>250.7</td>
<td>4.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bonferroni Adjusted alpha .005, NS = Not significant

<table>
<thead>
<tr>
<th>Variable</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Excellent</td>
<td>231.2</td>
<td>6.4</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>2. Very good</td>
<td>231.7</td>
<td>4.0</td>
<td>0.4</td>
<td>0.8</td>
</tr>
<tr>
<td>3. Good</td>
<td>212.9</td>
<td>3.2</td>
<td>0.4</td>
<td>0.7</td>
</tr>
<tr>
<td>4. Fair</td>
<td>191.6</td>
<td>3.8</td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>5. Poor</td>
<td>179.0</td>
<td>8.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bonferroni Adjusted alpha .005, NS = Not significant

<table>
<thead>
<tr>
<th>Variable</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Get help with forms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. A lot</td>
<td>162.6</td>
<td>5.9</td>
<td>0.7</td>
</tr>
<tr>
<td>2. Some</td>
<td>203.4</td>
<td>6.2</td>
<td>NS</td>
</tr>
<tr>
<td>3. A little</td>
<td>216.5</td>
<td>4.1</td>
<td>NS</td>
</tr>
<tr>
<td>4. None</td>
<td>225.3</td>
<td>2.4</td>
<td></td>
</tr>
</tbody>
</table>

Bonferroni Adjusted alpha .008, NS = Not significant

<table>
<thead>
<tr>
<th>Variable</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help with writing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. A lot/some</td>
<td>175.2</td>
<td>6.6</td>
</tr>
<tr>
<td>2. A little</td>
<td>201.0</td>
<td>6.2</td>
</tr>
<tr>
<td>3. None</td>
<td>220.8</td>
<td>2.2</td>
</tr>
</tbody>
</table>
Bonferroni Adjusted alpha .017

<table>
<thead>
<tr>
<th>Help with Newspaper</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A lot, Some, A little</td>
<td>181.3</td>
<td>4.8</td>
<td>0.8</td>
</tr>
<tr>
<td>2. None</td>
<td>223.1</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Difficultly seeing</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Yes</td>
<td>189.8</td>
<td>5.2</td>
<td>0.5</td>
</tr>
<tr>
<td>2. No</td>
<td>218.6</td>
<td>2.1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Difficulty hearing</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Yes</td>
<td>203.3</td>
<td>4.3</td>
<td>0.3</td>
</tr>
<tr>
<td>2. No</td>
<td>217.1</td>
<td>2.2</td>
<td></td>
</tr>
</tbody>
</table>

*Effect sizes reported only for comparisons significant at Bonferroni adjusted alpha or p<.05 for t-test results*
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Error</th>
<th>Effect Sizes for Pair-wise Comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Receive health issue information from newspapers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. A lot</td>
<td>227.2</td>
<td>4.9</td>
<td>NS</td>
</tr>
<tr>
<td>2. Some</td>
<td>221.8</td>
<td>2.7</td>
<td>0.3</td>
</tr>
<tr>
<td>3. A little</td>
<td>207.8</td>
<td>3.8</td>
<td>0.4</td>
</tr>
<tr>
<td>4. None</td>
<td>182.4</td>
<td>5.7</td>
<td></td>
</tr>
<tr>
<td>Bonferroni Adjusted alpha .008, NS = Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Receive health issue information from magazines</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. A lot</td>
<td>223.0</td>
<td>3.6</td>
<td>NS</td>
</tr>
<tr>
<td>2. Some</td>
<td>226.6</td>
<td>2.6</td>
<td>NS</td>
</tr>
<tr>
<td>3. A little</td>
<td>212.6</td>
<td>4.6</td>
<td>1.1</td>
</tr>
<tr>
<td>4. None</td>
<td>171.5</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Bonferroni Adjusted alpha .008, NS = Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Receive health issue information from internet</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. A lot</td>
<td>235.4</td>
<td>6.1</td>
<td>NS</td>
</tr>
<tr>
<td>2. Some</td>
<td>249.9</td>
<td>5.1</td>
<td>NS</td>
</tr>
<tr>
<td>3. A little</td>
<td>249.1</td>
<td>7.5</td>
<td>0.9</td>
</tr>
<tr>
<td>4. None</td>
<td>203.1</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>Bonferroni Adjusted alpha .008, NS = Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Receive health issue information from radio/TV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. A lot</td>
<td>204.3</td>
<td>3.5</td>
<td>0.3</td>
</tr>
<tr>
<td>2. Some</td>
<td>219.1</td>
<td>2.7</td>
<td>NS</td>
</tr>
<tr>
<td>3. A little</td>
<td>222.9</td>
<td>4.7</td>
<td>0.5</td>
</tr>
<tr>
<td>4. None</td>
<td>191.5</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>Bonferroni Adjusted alpha .008, NS = Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Receive health issue information from books</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. A lot</td>
<td>228.3</td>
<td>4.3</td>
<td>NS</td>
</tr>
<tr>
<td>2. Some</td>
<td>222.9</td>
<td>2.3</td>
<td>NS</td>
</tr>
<tr>
<td>3. A little</td>
<td>216.6</td>
<td>4.0</td>
<td>0.8</td>
</tr>
<tr>
<td>4. None</td>
<td>171.5</td>
<td>5.1</td>
<td></td>
</tr>
<tr>
<td>Bonferroni Adjusted alpha .008, NS = Not significant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Receive health issue information from family members or friends or co-workers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. A lot</td>
<td>209.2</td>
<td>5.1</td>
<td>NS</td>
</tr>
<tr>
<td>2. Some</td>
<td>218.8</td>
<td>3.0</td>
<td>NS</td>
</tr>
</tbody>
</table>

109
<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A little</td>
<td>221.5</td>
<td>4.5</td>
<td>0.5</td>
</tr>
<tr>
<td>None</td>
<td>197.0</td>
<td>3.4</td>
<td></td>
</tr>
</tbody>
</table>

Bonferroni Adjusted alpha .008, NS = Not significant

Receive health information from doctors/health care providers

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot</td>
<td>216.1</td>
<td>2.3</td>
<td>NS</td>
</tr>
<tr>
<td>Some</td>
<td>218.0</td>
<td>3.0</td>
<td>NS</td>
</tr>
<tr>
<td>A little</td>
<td>212.8</td>
<td>5.8</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>177.6</td>
<td>6.6</td>
<td></td>
</tr>
</tbody>
</table>

Bonferroni Adjusted alpha .008, NS = Not significant
* Effect sizes reported only for comparisons significant at Bonferroni adjusted alpha
<table>
<thead>
<tr>
<th>Sources of Health Information</th>
<th>A lot %</th>
<th>Some %</th>
<th>A little %</th>
<th>None %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Below Basic (0-184)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newspaper</td>
<td>12%</td>
<td>30%</td>
<td>26%</td>
<td>32%</td>
</tr>
<tr>
<td>Magazine</td>
<td>9%</td>
<td>27%</td>
<td>21%</td>
<td>42%</td>
</tr>
<tr>
<td>Books</td>
<td>10%</td>
<td>28%</td>
<td>21%</td>
<td>41%</td>
</tr>
<tr>
<td>Internet</td>
<td>2%</td>
<td>2%</td>
<td>3%</td>
<td>93%</td>
</tr>
<tr>
<td>Radio/TV</td>
<td>30%</td>
<td>35%</td>
<td>20%</td>
<td>15%</td>
</tr>
<tr>
<td>Family/friends/coworkers</td>
<td>17%</td>
<td>34%</td>
<td>22%</td>
<td>27%</td>
</tr>
<tr>
<td>Doctor/Health Care Providers</td>
<td>41%</td>
<td>29%</td>
<td>18%</td>
<td>12%</td>
</tr>
<tr>
<td><strong>Basic (185 to 225)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newspaper</td>
<td>22%</td>
<td>39%</td>
<td>23%</td>
<td>16%</td>
</tr>
<tr>
<td>Magazine</td>
<td>9%</td>
<td>30%</td>
<td>21%</td>
<td>42%</td>
</tr>
<tr>
<td>Books</td>
<td>17%</td>
<td>45%</td>
<td>21%</td>
<td>17%</td>
</tr>
<tr>
<td>Internet</td>
<td>5%</td>
<td>8%</td>
<td>6%</td>
<td>81%</td>
</tr>
<tr>
<td>Radio/TV</td>
<td>27%</td>
<td>46%</td>
<td>20%</td>
<td>7%</td>
</tr>
<tr>
<td>Family/friends/coworkers</td>
<td>14%</td>
<td>39%</td>
<td>26%</td>
<td>21%</td>
</tr>
<tr>
<td>Doctor/Health Care Providers</td>
<td>43%</td>
<td>38%</td>
<td>14%</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Intermediate (226 to 309)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newspaper</td>
<td>26%</td>
<td>43%</td>
<td>20%</td>
<td>11%</td>
</tr>
<tr>
<td>Magazine</td>
<td>21%</td>
<td>50%</td>
<td>20%</td>
<td>9%</td>
</tr>
<tr>
<td>Books</td>
<td>20%</td>
<td>48%</td>
<td>23%</td>
<td>9%</td>
</tr>
<tr>
<td>Internet</td>
<td>8%</td>
<td>17%</td>
<td>10%</td>
<td>65%</td>
</tr>
<tr>
<td>Radio/TV</td>
<td>21%</td>
<td>47%</td>
<td>25%</td>
<td>7%</td>
</tr>
<tr>
<td>Family/friends/coworkers</td>
<td>15%</td>
<td>41%</td>
<td>30%</td>
<td>14%</td>
</tr>
<tr>
<td>Doctor/Health Care Providers</td>
<td>43%</td>
<td>38%</td>
<td>15%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Proficient (310 and above)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newspaper</td>
<td>23%</td>
<td>43%</td>
<td>23%</td>
<td>11%</td>
</tr>
<tr>
<td>Magazine</td>
<td>7%</td>
<td>59%</td>
<td>29%</td>
<td>5%</td>
</tr>
<tr>
<td>Books</td>
<td>27%</td>
<td>34%</td>
<td>34%</td>
<td>5%</td>
</tr>
<tr>
<td>Internet</td>
<td>4%</td>
<td>26%</td>
<td>29%</td>
<td>41%</td>
</tr>
<tr>
<td>Radio/TV</td>
<td>14%</td>
<td>33%</td>
<td>46%</td>
<td>7%</td>
</tr>
<tr>
<td>Family/friends/coworkers</td>
<td>18%</td>
<td>42%</td>
<td>35%</td>
<td>5%</td>
</tr>
<tr>
<td>Doctor/Health Care Providers</td>
<td>47%</td>
<td>22%</td>
<td>29%</td>
<td>2%</td>
</tr>
<tr>
<td>Predictors</td>
<td>Estimate</td>
<td>Standard Error</td>
<td>t Statistic</td>
<td>p value</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>------------</td>
<td>----------------</td>
<td>-------------</td>
<td>---------</td>
</tr>
<tr>
<td>Constant</td>
<td>219.522</td>
<td>17.479</td>
<td>12.559</td>
<td>0.001*</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td>-8.247</td>
<td>4.137</td>
<td>-1.994</td>
<td>0.051</td>
</tr>
<tr>
<td>Approximate household Income (8 categories)</td>
<td>4.284</td>
<td>1.004</td>
<td>4.266</td>
<td>0.001*</td>
</tr>
<tr>
<td>Educational attainment (6 categories)</td>
<td>9.249</td>
<td>1.531</td>
<td>6.039</td>
<td>0.001*</td>
</tr>
<tr>
<td>Difficultly seeing words and letters in newspapers even with glass/lenses</td>
<td>2.709</td>
<td>4.038</td>
<td>0.671</td>
<td>0.505</td>
</tr>
<tr>
<td>Difficulty hearing in normal conversation even with hearing aid</td>
<td>-2.496</td>
<td>4.316</td>
<td>-0.578</td>
<td>0.565</td>
</tr>
<tr>
<td>Get help from family/friends filling out forms</td>
<td>6.213</td>
<td>2.098</td>
<td>2.962</td>
<td>0.004*</td>
</tr>
<tr>
<td>Get help from family/friends to read newspaper articles</td>
<td>13.623</td>
<td>4.561</td>
<td>2.987</td>
<td>0.004*</td>
</tr>
<tr>
<td>Get help from family/friends to write notes</td>
<td>5.387</td>
<td>2.855</td>
<td>1.887</td>
<td>0.064</td>
</tr>
<tr>
<td>Overall health</td>
<td>-5.698</td>
<td>1.694</td>
<td>-3.364</td>
<td>0.001*</td>
</tr>
<tr>
<td>Receive health information from doctors/health care providers</td>
<td>-5.228</td>
<td>1.942</td>
<td>-2.691</td>
<td>0.009*</td>
</tr>
<tr>
<td>Receive health issue information from books</td>
<td>-5.982</td>
<td>2.32</td>
<td>-2.578</td>
<td>0.012*</td>
</tr>
<tr>
<td>Receive health issue information from internet</td>
<td>-5.231</td>
<td>2.272</td>
<td>-2.303</td>
<td>0.025*</td>
</tr>
<tr>
<td>Receive health issue information from magazines</td>
<td>-5.552</td>
<td>2.177</td>
<td>-2.55</td>
<td>0.013*</td>
</tr>
<tr>
<td>Receive health issue information from newspapers</td>
<td>-3.663</td>
<td>2.093</td>
<td>-1.751</td>
<td>0.085</td>
</tr>
<tr>
<td>Receive health issue information from radio/TV</td>
<td>2.21</td>
<td>1.924</td>
<td>1.149</td>
<td>0.255</td>
</tr>
<tr>
<td>Root MSE</td>
<td>41.922</td>
<td>1.731</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

* * p < 0.05
References


doi:10.1001/archinte.165.17.1946


