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Differences in Health Literacy and Healthcare Utilization for Uninsured Patients With Type II Diabetes

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LOYOLA UNIVERSITY OF CHICAGO

DIFFERENCES IN HEALTH LITERACY AND HEALTHCARE UTILIZATION FOR
UNINSURED PATIENTS WITH TYPE II DIABETES

A DISSERTATION SUBMITTED TO
THE FACULTY OF THE GRADUATE SCHOOL
IN CANDIDACY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

PROGRAM IN SOCIAL WORK

BY

WHITNEY KEY TOWEY

CHICAGO, IL

DECEMBER 2022

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Dedicated to my daughter, Ann Townsend.

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ABSTRACT

Un- and under-insured individuals have lower access and less health literacy than their insured counterparts. This is a major public health problem as lower health literacy leads to unhealthy communities which have higher chronic disease rates. This quantitative dissertation uses data from a public health hospital system to understand the relationship between health literacy and healthcare utilization. The Andersen Model has been applied to determine whether, or to what extent, health literacy explains the relationship between the identified predisposing and enabling factors and the outcomes of appropriate utilization of care by controlling for variables associated with health literacy. A sample from Cook County Health was extracted to assess for predisposing factors, enabling factors, and need of healthcare utilization and a regression was used. Results show that high health literacy has negative significant influence on ACHN visits ($B = -0.129$; $p < 0.001$) and negative influence on ED encounters ($B = -0.012$; $p > 0.019$) although not significant. This study allows for more investigation on health literacy among healthcare utilization and how best to address health literacy as an effort to increase health equity in the community.

CHAPTER 1

INTRODUCTION AND SPECIFIC AIMS

This paper is to introduce and frame the scope and aims of the research proposal. Health literacy is a national agenda item and this paper demonstrates why this is an important issue and aims to understand how this affects health outcomes of the community. Healthcare utilization of uninsured patients with chronic conditions is a social work, public health, and ultimately a social justice issue; understanding the disparities and inequities within the system is a way to rectify it. As the reader will see, the literature provides strong evidence of a relationship between predisposing, enabling, and need factors and the utilization of preventive care, and there is limited research that investigates health literacy as it is applied to the Andersen Model and utilization of the healthcare system.

Health has been a national priority among government agencies for the past decade. For example, the National Quality Forum launched an initiative in 2017 to improve health equity and healthcare quality, particularly for communities, populations, and socioeconomic, racial, and ethnic groups where health disparities persist (NQF, 2017). The goals are:

- Identifying disparities and those affected by health inequity, by promoting a common understanding and standardized language around health inequity, and gathering innovative strategies for social risk factor data collection
- Influencing performance measurement, by facilitating the development of needed measures to promote health equity and reduce disparities
- Inspiring implementation of best practices and innovative approaches by disseminating best practices and innovative interventions as well as lessons learned, and by creating practical, applied guidance

- Informing payment by convening thought leaders and experts to explore the impact of payment on health equity, as well as emerging issues related to risk adjusting performance measures for social risk factors such as income, education, and health literacy. (NQF, 2017)

A way to achieve health equity is through health literacy because it promotes a common understanding and standardized language (Berkman et al., 2011; Sorenson et al, 2012).

Health literacy is closely related to health-related costs. Health literacy deficits have led to disparities in health care and an increase in health care expenditures in the United States.

Health literacy, along with the complexity of a continuously evolving health care system, is and will remain a barrier to the delivery and accessibility of quality health care until efforts are made to address this issue. The challenges surrounding health literacy have resulted in adverse health outcomes and well as increased healthcare expenditures, especially for chronic conditions.

Health literacy is one of the social determinants that impact health outcomes. Social determinants are driving the cost of health care expenditures; social work, public health and the medical field need to invest in understanding this relationship in an effort to reduce health care costs (Yach, Hawkes, Gould, & Hofman, 2004; Yach, Stuckler, & Brownell, 2006).

Specific Aims

A retrospective cohort design was constructed to understand the relationship between low health literacy and adherence to guidelines for the number of visits recommended for those diagnosed with a chronic disease established by the National Committee for Quality Assurance (NCQA). This study is using electronic health records from a public hospital system in Chicago. Using Andersen's Model of Healthcare Use for Vulnerable Populations (1995), health literacy is examined to understand whether, and to what extent, it mediates (i.e. explains) or moderates (i.e. affects the strength and/or the direction of) the relationship between a broad set of predisposing

and enabling factors and the four outcomes of interest (Baron & Kenny, 1986). The exploration of these relationships will establish valuable information to guide development of targeted interventions.

1. Determine the extent to which individuals diagnosed with a chronic disease with low health literacy differ from individuals diagnosed with a chronic disease with higher health literacy in meeting established care guidelines (a person with diabetes visits their primary care provider (PCP) 4 times per year on average) (Beck et al., 2018).
2. Determine the extent to which individuals diagnosed with a chronic disease with low health literacy differ from individuals diagnosed with a chronic disease with higher health literacy in their use of emergency care (ED care).
3. Determine whether, or to what extent, health literacy explains the relationship between the identified predisposing and enabling factors and the outcomes of appropriate utilization of care.

CHAPTER 2

LITERATURE REVIEW

This literature review outlines factors that contribute to healthcare utilization and health literacy. As the literature below presents, health literacy has been considered to be a weak predictor in utilization. This study aims to explain the gap in the literature between health literacy and the utilization of the healthcare system.

There are many different definitions of health literacy that each profession uses (Appendix A: Glossary of Health Literacy Terms). Medical and public health professionals have similar yet different language when describing the same concept. Sorenson and colleagues (2012) synthesized the language between the two professions to address the similarities and differences between the two. They noticed main differences in the way health literacy was defined and measured which accounted for the various ways stakeholders define, conceptualize and measure it. What was found by the researchers was that there is no gold standard that exists for measuring health literacy, and studies differed not only in the tools used but also in specifications of thresholds for distinguishing between health literacy levels (Berkman et al., 2011).

Health literacy is a term that was coined by the medical field in the 1970s encompassing the capacities of people needed to keep up with the demands of health and navigation in a modern society (Berkman, 2011). Literacy has traditionally been defined as the ability to read and write; however, a more modern definition has emerged comprised of four main concepts:

1. literacy as an autonomous set of skills;
2. literacy as applied, practiced and situated;
3. literacy as a learning process; and
4. literacy as text (Sorenson et al., 2012).

As the traditional definition evolved into the healthcare sector, it was applied to the reading and understanding of reading and acting upon written health information, communicating needs to health professionals, and understanding health instructions (2012).

Previous research on health literacy relates to an individual's possession of requisite skills for making health-related decisions, meaning that health literacy must always be examined in the context of the specific tasks that need to be accomplished (Berkman et al., 2011; Sorenson et al., 2012). However, health literacy must also include not only a person's ability, but also the complexity of the tasks at hand. Much of the literature on health literacy focuses on the capacity of individuals in the context of health activities (Paasche-Orlow & Wolfe, 2007). However, it is important to underscore the importance of a contextual appreciation of health literacy. As such, causal mechanisms of the health literacy-health outcomes relationship are due not only to patient-level characteristics, but also to those attributes of the healthcare system. Therefore, it is important to recognize both individual and system-level factors (Paasche-Orlow & Wolf, 2007; Nutbeam, 2008; Marmot et al., 2008; Hieman & Artiga, 2015).

Health literacy has become not just the ability to read for adults but the ability to understand these complex health care systems and their terminology. A statement from the World Health Organization (WHO) Commission on the Social Determinants of Health identified literacy as having a “central role” in determining inequities in health in both rich and poor

countries (WHO, 2007). Some research has examined the role of health literacy and found significant health outcomes as it effects individuals of every age, race/ethnicity, and education and income level. One study concluded that there are three casual pathways of how one obtains more health literacy: (1) access and utilization of healthcare; (2) patient-provider relationship; and (3) self-care (Paasche-Orlow & Wolf, 2007). However, despite these three pathways, there has never been a consensus on what the operationalization of health literacy is.

Basic and functional literacy is a main tenant of health literacy. In DeWalt and colleagues' 2004 systematic review, they found that low or inadequate literacy (compared to adequate literacy) was strongly associated with poorer knowledge or comprehension of health care services and health outcomes. Limited literacy was also associated with higher probability of hospitalization, higher prevalence and severity for some chronic diseases, poorer global measures of health, and lower utilization of screening and preventive services (2004). Knowing that the relationship between literacy and health outcomes is significant, it would be beneficial to screen for basic literacy levels within the medical system. Health literacy affects the ability to understand both written and oral communications which are key to successful patient-provider interactions (Doak, Doak, Fnedell, & Meade, 1998). Health literacy was specifically and widely examined for the first time during the 2003 National Assessment of Adult Literacy (NAAL), which included a measure of health literacy The NAAL study included a nationally representative sample of 19,000 participants (aged 16 and above). Health literacy was broken down into four levels: below basic, basic, intermediate and proficient and the results are described below (Table 1) (White, 2008). According to the NAAL, only 12% of adults living in the United States have proficient health literacy and 77 million people, some one third of adults,

would have difficulty with common health tasks, such as following directions on a medication label or using a simple chart to determine when a child is due for her vaccinations (White, 2008). Patients with low health literacy report significant difficulties navigating the healthcare system with its increasing complexities and literacy demands. Signage, medication instructions, and examination preparation documents, as well as written consent forms often contain medical jargon and abbreviations, which can pose even greater challenges to those who have difficulty with reading comprehension (Schwartzberg, VanGest, & Wang, 2005). Also, patients with low health literacy have less understanding of their medical conditions and their prescribed treatments (American Medical Association [AMA], 2017; Bains & Egede, 2011; Wolf et al, 2011).

Table 1. NAAL Results and Category Definitions and Examples

Health Literacy Level	Task Examples	Percentage of Respondents
Proficient	Using a table, calculate an employee's share of health insurance costs for a year	12%
Intermediate	Read instructions on a prescription label, and determine what time a person can take the medication	53%
Basic	Read a pamphlet, and give two reasons a person with no symptoms should be tested for a disease	21%
Below Basic or Low Health Literacy	Read a set of short instructions, and identify what is permissible to drink before a medical test	14%

People with the greatest healthcare needs may have the least ability to read and comprehend information needed to function successfully as patients (AMA, 2017). Low health

literacy is prevalent among adults and is independently associated with poor health status (Baker, et al, 2002; National Research Council, 2004; Schilhnger, et al, 2006; Weiss, Hart, McGee, & D'Estelle, 1992). Patients with low health literacy face a host of communication challenges that include, but are not limited to, the comprehension of written materials which interact to influence health outcomes (National Research Council, 2004). Low health literacy leads to substandard care by impeding effective interaction between patients and their healthcare providers (Berkman, et al, 2004; Dewalt, et al, 2004; Pignone, DeWalt, Sheridan, Berkman, & Lohr, 2005).

Functional, Interactive, and Critical Health Literacy

As is the case in general literacy and numeracy, differences in personal skills have been categorized as functional, interactive, and critical health literacy. Such a classification has the advantage of signaling the impact that skill-level differences may have on health-related decisions and actions.

Functional health literacy describes basic-level skills that are sufficient for individuals to obtain relevant health information (for example, on health risks and on how to use the health system) and to apply that knowledge to a range of prescribed activities (Yen et al., 2021). Individuals with these basic health literacy skills are generally able to respond well to education and communication that are directed to clearly defined goals and specific contexts, such as medication adherence, participation in prevention activities, and some behavioral change (2021).

Interactive health literacy describes more advanced literacy skills that enable individuals to extract health information and derive meaning from different forms of communication; to apply new information to changing circumstances; and to engage in interactions with others to extend the information available and make decisions (Yen et al., 2021). Individuals with these

higher-level skills are better able to discriminate between different sources of information and to respond to health communication and education that are more interactive and accessible through structured communication channels (for example, school health education, mobile apps, interactive websites).

Critical health literacy describes the most advanced literacy skills that can be applied to critically analyze information from a wide range of sources and information relating to a greater range of health determinants (Yen, et al., 2021). Individuals with these most advanced skills can obtain and use information to exert greater control over life events and situations that have an impact on health. Application of these skills may include appraisal of information about personal health risks; understanding of the social, economic, and environmental determinants of health; and collective organizing and action (for example, by engaging in organized advocacy/lobbying on social and environmental health issues) (2021). This type of health literacy can be more obviously linked to population benefit alongside individual-level benefits.

The concept of functional health literacy aligns more closely to the immediate and necessary goals of clinical care and some public health priorities. In this context, health literacy is a commonly used term to describe a set of individual literacy capacities that act as a mediating factor in health and clinical decision making. Low or inadequate health literacy may be seen as a relatively stable patient characteristic, a risk that needs to be managed in the process of providing clinical care (Nutbeam, 2008). The implications of this risk are that clinicians need to modify their communication with patients in response to lower levels of health literacy and, where possible, reduce the organizational demands and complexity faced by patients in a clinical environment (Yen, et al., 2021). In such circumstances, people need the knowledge and skills

required to achieve outcomes that are determined primarily by those providing health care. Community health education can also be similarly task based and goal directed, promoting improved knowledge and specific behavior changes. This focus on individual behaviors rather than on the social and contextual determinants of health and inequity is common in both clinical and public health practice and has been referred to as “lifestyle drift,” whereby upstream social determinants of health inequalities are reconfigured downstream in ways that give precedence to individual behavior change (Marmott & Allen, 2004).

The concepts of interactive and critical health literacy connect more closely to contemporary models of health promotion and health consumer engagement. In this case, health literacy has been viewed as a personal and population asset offering a route to greater autonomy and control over health decision making (Mårtensson & Hensing, 2012; Nutbeam, 2008). Through this focus on transferable skills development, shared decision making, and empowerment, the concept of health literacy can be connected more readily to the social determinants of health. Developing transferable skills, supporting critical thinking about the determinants of health, and empowering people to act require a fundamentally different approach to health communication methods and content. Achieving such outcomes requires the use of more interactive and adaptable communication methods (to incorporate consumer preferences and enable the development of skills in shared decision making) and a significant widening of content (to include the social determinants of health and to support the development of skills in social mobilization and consumer advocacy). This approach stands in marked contrast to many established communication models based on changing specific knowledge, attitudes and

behaviors. Rethinking health communication in this way can have a transformative influence on the purpose and methodologies of modern health and patient education.

Economics of Health Literacy

Preliminary studies have pointed to an increase in medical expenditures for people with low health literacy (AMA, 2017; Gazmararian et al, 1999) as a result of delayed preventive care. Research has also found low health literacy among women to be associated with decreased use of preventive services, increased use of acute care, including emergency room visits, and less medical screening including mammography and Pap smears (Lindau, Tomori, McCarville, & Bennett, 2001). Recent studies have found that health literacy contributes to disparities attributed to race/ethnicity and educational attainment in self-rated health and utilization of some preventive healthcare services by older adults (Bennett, Chen, Soroui, & White, 2009). However, Bennett and colleagues noted that among a cohort of Medicaid recipients, low health literacy was not an additional risk factor for underutilization of services and, importantly, higher health literacy was not a protective factor (Bennett, Switzer, Aguirre, Evans, & Barg, 2006).

Low health literacy has been associated with decreased utilization of preventive healthcare, increased use of emergency care, increased hospital admissions, increased healthcare costs and poor health outcomes in adults (Weiss & Palmer, 2004; Baker et al, 2002; National Research Council, 2004; Osborn, Paasche-Orlow, Bailey, & Wolf, 2011; Roter, Rudd, & Comings, 1998; Schilhnger, Barton, Karter, Wang, & Adler, 2006). A 2004 systematic review concluded that low health literacy was associated with adverse health outcomes (Dewalt et al, 2004). Additionally, health literacy has been shown to be independently associated with disease knowledge, and self-report of morbidity (Gazmaranan, Williams, Peel, & Baker, 2003). In 2006

Sentell and Halpin employed National Assessment of Adult Literacy (NAAL) data to explore the relationship between health literacy and health disparities and concluded that literacy was a more powerful predictor of adult health status than education or race (Sentell & Halpin, 2006).

Education and socio-economic status are two main domains that determine health literacy status. It has been found that poor health literacy is associated with poorer health outcomes (Nutbeam, 2008; Paasche-Orlow & Wolf, 2007; DeWalt et al., 2004). One way to increase health literacy is by expanding access to healthcare for needed care (Sørensen, Van den Broucke, Fullam, Doyle, Pelikan, Slonska, & Brand, 2012). However, many health researchers feel that health literacy is given too low a priority and that low levels of health literacy may be a contributor to the substantial increase use of healthcare services. Poor health status and higher use of health services by patients with limited literacy appear to translate into higher costs for these patients (Schwartzberg, VanGeest, & Wang, 2005). This increase in health care costs is a result of higher rates of hospitalization, utilization of emergency rooms, and inefficient use of various health care services (Ishikawa & Yano, 2008, p. 117). Individuals with a lack of health knowledge and reported poor health status are more likely to be hospitalized compared to more literate persons (Schwartzberg et al., p. 25). Following Paasche-Orlow and Wolfe's (2007) three pathways of health literacy—(1) access and utilization of healthcare; (2) patient-provider relationship; and (3) self-care—the subsequent are challenges that the healthcare system faces when discussing health literacy.

Health literacy is a critical component of economic growth. Indicators of higher socioeconomic status are education, income, and employment, with researchers emphasizing the latter. Employment thus has a higher correlation of health outcomes. Healthier workers are

physically and mentally more energetic and robust and they are more productive and earn higher wages. They are also less likely to be absent from work because of illness (or illness in their family) (Bloom, Canning, & Sevilla, 2001; Ross & Wu, 1995; Adler, Boyce, Chesney, Cohen, Folkman, Kahn & Syme, 1994). Full-time employment also has certain benefits, such as health insurance, paid leave for illness, and vacation. These benefits increase the individuals' access to quality healthcare, for both mental and physical health (Adler et al, 2001). Health literacy is associated with individuals with a higher network of resources.

Barriers to Individual Health Literacy

There are many factors that shape health literacy, such as social determinants, neighborhood effects, and individual factors. One predictor to health literacy is understanding the social determinants of health and how literacy mediates or moderates those relationships. Social determinants of health are “the structural determinants and conditions in which people are born, grow, live, work and age” (Marmot et al., 2008). They include factors like socioeconomic status, education, the physical environment, employment, and social support networks, as well as access to health care. Racial minorities, low-income and other vulnerable communities experience health disparities more than the general population. Kaiser Family Foundation (2017) defines health disparities as “differences in health outcomes that are closely linked with social, economic, and environmental disadvantage”. Researchers have suggested that social factors such as education, race, and socio-economic status, account for over a third of total deaths a year (Hieman & Artiga, 2015). As time progressed, these determinants started to be recognized as factors in physical health and finally into mental health and substance abuse however funding for primary or tertiary care for these effects have yet to happen. This is mostly because the

reimbursement system influences the delivery of care and it is hard to reimburse for medical services that are not medical in nature.

Social inclusion/exclusion is explained by ways in which stigmatized and disadvantaged communities should be helped to play a stronger role in society. In the context of health care system, marginalized populations can be identified as those with stigmatizing illnesses such as mental health and behavioral health disorders. Within the addiction and behavioral health fields, health literacy is still lacking in the literature. Research that has been conducted is limited in scope and rigor. One study found that health literacy was not a predictor in mental health functioning and addiction recovery outcomes; however, it can be a contributor to the utilization of the healthcare system (Lincoln, Paasche-Orlow, Cheng, Lloyd-Travaglini, Caruso, Saitz, & Samet, 2006). Individuals with mental and behavioral health issues (those with mental health and substance use disorders) are more likely to be uninsured and therefore have less access than those without a mental health diagnosis (Lincoln et al., 2006). This is important because this will help shape interventions in the future on either a community or individual level.

Access and utilization of care. Many patients with chronic illnesses receive care from multiple physicians with various specialties in different health care facilities. Frequently these physicians do not communicate amongst each other on patients' medical status or backgrounds which leaves each of these patients with the burden of interpreting and relaying this crucial information regarding their health information or treatment regimens/plans to the various physicians (Wolf et al., 2011); patients then become the “medical messenger” and assume this difficult role in deciphering and understanding complex medical information (Laditka, Laditka,

& Mastanduno, 2003). This is a greater challenge for those patients with low health literacy skills and poor understanding of medical concepts.

Included in this is geographic location of the consumer. Access to health care, especially specialty care, is limited. There is a decrease in workforce in rural areas thus making practitioners less available for individuals who live in these communities (Heiman & Artiga, 2016). This creates a large disparity in access and utilization of care. Many rural patients travel across counties, some even hundreds of miles, to receive appropriate care (Glazier, Bajcar, Kennie, & Wilson, 2006). This is more difficult if the care is chronic and the individual needs to see the doctor multiple times a week.

Insurance coverage is a significant factor in access and utilization of healthcare. Most recent studies have focused on the effects of health insurance on healthcare utilization or costs and have demonstrated a strong association. Fang et al. (2012), Kondo et al. (2013) indicated a significant positive correlation between health insurance and healthcare utilization and costs. Previous research has established that the uninsured have worse health outcomes (Baker, et al, 2002; National Research Council, 2004; Schilhnger, et al, 2006; Weiss, Hart, McGee, & D'Estelle, 1992). This is strongly correlated to health literacy; a systematic review shows that low health literacy is also associated with differential use of certain health care services, including increased hospitalizations and emergency care and decreased mammography screening and influenza immunizations regardless of insurance coverage (Berkman et al., 2011).

Provider factors. As stated above, low health literacy leads to substandard care by impeding effective interaction between patients and their healthcare providers due to communication barriers (Berkman, et al, 2004; Dewalt, et al, 2004; Pignone, DeWalt, Sheridan,

Berkman, & Lohr, 2005). More medical professionals are expected to collaborate in interdisciplinary teams which can be challenging. Training the medical workforce to work within newly designed systems to include inter-professional teams and current research and data can be an issue as creating these teams and systems cost a significant amount upfront. Professionals now must understand not only the clinical components of care, but policy, payment models, and more which adds to the strain of the professional. Practitioners also must not only evaluate new clinical models of care, but also implement them (implementation science). Implementation science has been integral for public health practitioners for years as it has incorporated multiple determinants of health and health behavior (Glanz & Bishop, 2010). Implementation science is rooted in the health belief model, the transtheoretical model, social cognitive theory, and the ecological model which has shaped public health and social work professions.

Practitioners also must take into consideration the stigma associated with the diagnosis and treatment of a disease. There also must be a trust between physician and patient because if there is not a mutual trust it could cause a barrier between access and utilization of care (Gamble, 1997). For example, African Americans may be skeptical of medical professionals because of the exploitation of African Americans during the Tuskegee Syphilis Study (1997). On the other hand, there needs to be cultural congruity of the clinician, possibly more along lines of cultural humility in which clinicians are not making assumptions about clients, not imposing own cultural views, and allowing client to be the master of their own narrative. The importance of policies that train clinicians in this arena and value such interventions, places increasing pressure on training programs to provide adequate and proficient clinical training.

Patient factors. Limited health literacy is strongly associated with other socioeconomic indicators, including educational attainment, race/ethnicity, and age (Paasche & Wolf, 2007). Limited education, difficulty with written communication, or lack of familiarity with medical terms are all characteristics that impair their individual ability to successfully interact with the health care system. Self-empowerment is essential to successful patient education and to negotiating the complexities of today's health care system. Lack of self-empowerment due to low health literacy increases the likelihood that patients will not understand therefore not learn what they need to know to receive the proper care they require.

Studies have detected a relationship between inadequate health literacy and the development of beliefs (primarily with medications) and adherence. According to the theory of reasoned action (TRA), a patient's knowledge and ability to obtain knowledge are influential in the development of beliefs (Gatti, Jacobson, Gazmararian, & Kripalani, 2009). Patients with inadequate health literacy skills tend to develop beliefs based on a poor understanding of treatments and medications which may adversely affect their decision making or compliance with prescribed medical treatments. Therefore, a link lies between the functional health literacy skills required for patients to make sound decisions regarding their health and the ability to comprehend disease management strategies defined by NQF standards.

In addition, many studies indicate that healthcare utilization and costs are influenced by demographic or socioeconomic factors such as age, gender, marital status, education, health insurance, standard of living, and urban residence. Hansen et al. (2012) and Saeed et al. (2013) found that health status, income, health insurance, and other demographic factors are strong

determinants of healthcare utilization. Patient factors may be more important than supply factors in explaining the differential use of health services (Wang, Chen, & Si, 2018).

Self-care. Health literacy as an individual level educational and awareness outcome topped the priorities of the three community-based health trainers and educators with the notion of “knowledge is power.” Self-management and self-care of chronic illnesses and adhering to medication were the behavioral commitment induced by understanding the severity of consequences. Health literacy as having access to health services as human rights by way of increasing health insurance enrollment was endorsed as the definition of health and well-being by the three multi-site health promotion and healthcare enrollment organizations (one director and staff from each organization). Empowerment-based health literacy was conceptualized as knowledge, attitude, and behavior, contributing to improved health and well-being. The attributes to be focused on were: confidence in navigating the healthcare system; confidence about the ability to achieve health-related goals; commitment to achieving health-related goals; awareness of constructive general health practices (such as healthy eating and exercise); awareness of resources for good health; awareness of general health risks of certain behaviors and conditions (such as smoking and obesity); utilization of preventive medical services such as annual physicals, mammograms, and prostate exams; appropriate utilization of medical services for treatment of health conditions; and perceived ability to obtain health services as needed.

Many patients today are managed and treated as outpatients even after surgical procedures which require them to exercise and perform self-care measures at their homes. Home-care instructions, especially for complicated medical problems or procedures, can be prescribed in the form of designed personalized education programs. Unfortunately, very few if any of this

personalized education programs exist or are available to many patients (Heiman & Artiga, 2015).

Advancements in the development of new and effective medications have greatly benefited patients. However, the number of medications has grown tremendously ranging to more than 11,000 prescription drugs which has made medical care intricate (Schwartzberg et al., 2005, p. 27). Adherence to drug regimen instructions may be complex and difficult to follow. The 2003 National Assessment of Adult Literacy estimated that forty-five percent of all Americans adults—over 90 million people—have difficulty understanding and acting on health information (Kirsch, Junegeblut, Jenkins, & Kolstad, 1993). This is even more evident with more complex information such as prescriptions and chronic disease management (1993). Health literacy issues as a result of a poor understanding of medication instructions may lead to adherence problems such as ineffective treatments or potentially fatal complications.

Chronic Disease Factors

The challenges surrounding health literacy have resulted in adverse health outcomes and well as increased healthcare expenditures, especially for chronic conditions. Chronic diseases have significant health and economic costs in the United States. According to the Center of Disease Control (CDC), the top chronic disease in the United States are heart/cardiovascular disease, cancer, chronic lung disease, stroke, Alzheimer's, diabetes, and chronic kidney disease (CDC, 2019). Among the uninsured population, the most common chronic diseases are cardiovascular and diabetes (Chapel, Ritchey, Zhang, & Wang, 2017). Because cardiovascular disease is defined to encompass everything related to heart and vascular abnormalities (heart attack, heart disease, stroke, heart failure, arrhythmia, heart valve problems) and comprised of a

multitude of diagnostic tests (heart disease, hypertension, hyperlipidemia, etc) (American Heart Association, 2019), diabetes will be used as a representative of all chronic diseases.

Chronic conditions should be managed in a primary care setting and not treated in costly episodic and acute care settings, such as the emergency department. Primary care settings allow for diagnostic and management of care. Healthy adults should see their primary care physician once a year (Beck, 2017). A person who has multiple chronic medical problems, new ongoing concerns or is taking medications that need to be titrated should see the doctor on a more regular basis per the recommendations from the National Committee for Quality Assurance (NCQA). For example, a person who has diabetes should see the doctor every three months in order to monitor and obtain adequate blood glucose levels (2017). Because the A1C measures the amount of advanced glycosylated end products (AGEs) that have accumulated in the bloodstream during the prior three months, the measurement is translated into a person's average blood sugar level for this time, also known as the estimated average glucose (eAG) (2017).

The wide-spread lack of proper management and control of type 2 diabetes in the United States has had devastating consequences on individuals and on the US healthcare system. Forty-five percent of the 25.6 million adults with type 2 diabetes (CDC, 2011) have inadequate glycemic control, defined as hemoglobin A1c greater than 7% (Cheung, Ong, Cherny, Sham, Tso, & Lam, 2009). Furthermore, eighty-eight percent of adults with type 2 diabetes have inadequate control of all three measures of good diabetic control: glycemic control (HbA1c < 7.0%), lipid control (LDL-C < 100 mg/dL), and blood pressure control (SBP < 140/80 mmHg) (Cheung et al., 2009). The total estimated cost of diagnosed diabetes in 2017 is \$327 billion,

including \$237 billion in direct medical costs and \$90 billion in reduced productivity (American Diabetes Association, 2018).

Racial/ethnic minorities and individuals living in poverty are the most vulnerable to poor diabetic control and increased diabetes health care utilization. Complex genetic, biological, social, economic, and lifestyle factors contribute to the increased prevalence and poorer outcomes in low-income and minority individuals (Candib, 2007; Ejebe, 2015). Approximately 7 million Americans have undiagnosed diabetes (CDC, 2011), and there are no significant racial/ethnic differences in the rates of undiagnosed diabetes, meaning the rates of undiagnosed diabetes are not significantly higher in racial/ethnic minorities as compared to Whites (Cowie, Rust, Holt, & Eberhardt, 2003). However, there are clear racial/ethnic difference in the prevalence of diagnosed type 2 diabetes with 7.1% of non-Hispanic Whites, 11.8% of Hispanics and 12.6% of non-Hispanic blacks having type 2 diabetes, with adjustment for sub-group age differences (CDC, 2011). Minorities have lower rates of accordance with recommended guidelines for glycemic control, blood pressure, lipids, and self-monitoring of blood glucose compared to non-Hispanic Whites (Axon, Gebregziabher, Echols, Gilbert, & Egede, 2011; Sequist, Adams, Zhang, Ross-Degnan, & Ayanian, 2006; Egede, Gebregziabher, Lynch, Gilbert, & Echols, 2011). Poor rates of glycemic control among non-Hispanic blacks and Hispanics persist even after accounting for socioeconomic status and access to health care (Saydah, Cowie, Eberhardt, De Rekeneire, & Narayan, 2007). Minorities are more likely to have diabetes-related complications including end stage renal disease and diabetic retinopathy (Lanting, Joung, Mackenbach, Lamberts, & Bootsma, 2005). Diabetes related mortality rates are higher in minorities (Carter, Pugh, & Monterrosa, 1996). Minorities also have higher rates of ambulatory

sensitive health care utilization (Laditka, Laditka, & Mastanduno, 2003) and diabetes related medical expenditures (ADA, 2018). Understanding and acknowledging the socioeconomic context in which racial/ethnic minorities and individuals living in poverty manage their diabetes is critical to untangling these health-related disparities with ultimately building health literacy for chronic disease maintenance.

Diabetes self-management education is effective in enhancing diabetic control (Schillinger, Barton, Karter, Wang, & Adler, 2006). In order to combat the tremendous individual and societal impact of diabetes, existing diabetes guidelines emphasize continual diabetes self-management education (Beck et al., 2018). Diabetes self-management education is the “process of facilitating the knowledge, skill, and ability necessary for diabetes self-care” and typically incorporates components such as healthy eating, being active, monitoring blood glucose, taking medication, problem solving, reducing risks, and healthy coping (2018). The overall objectives of diabetes self-management education are to achieve glycemic control and avoid acute and chronic complications that can lead to reduced quality of life, increased health care utilization, and increased medical expenditures (2018).

Randomized controlled trials have shown diabetes self-management education leads to improvements in patient self-management behaviors (Norris, Engelgau, & Narayan, 2001; Brown, 1988) and reductions in hemoglobin A1c (Norris, Lau, Smith, Schmid, & Engelgau, 2002; Gary, Genkinger, Guallar, Peyrot, & Brancati, 2003; Ellis, Speroff, Dittus, Brown, Pichert, & Elasy, 2004). In particular, diabetes self-management education seems to be consistently associated with reduced hemoglobin A1C (HbA1c) (Norris et al., 2002; Ellis et al., 2004). In a meta-analysis of diabetes self-management educational interventions, the intervention decreased

HbA1c by 0.76% at immediate follow-up, 0.26% at 1-3 months of follow-up, and by 0.26% at greater than 4 months follow-up (Norris et al., 2002). However, the small numbers of racial/ethnic minorities in these study samples make subgroup comparisons difficult (Gary et al., 2003).

Although there is more limited research on the impact of diabetes self-management education on healthcare utilization and medical expenditures (Norris et al., 2001), it has been associated with fewer hospitalization and less hospital charges due to increased use of primary and preventive services and lower use of acute inpatient services (Robbins, Thatcher, Webb, & Valdmanis, 2008; Duncan, Birkmeyer, Coughlin, Li, Sherr, & Boren, 2009; Boren, Fitzner, Panhalkar, & Specker, 2009). Importantly, diabetes self-management education is most effective with regular reinforcement (Norris et al., 2001; 2002) and follow-up support (Heinrich, Schaper, & de Vries, 2010). Existing diabetes self-management education theory suggests that changes in patient behavior via improvements in patient health literacy and patient activation will lead to improvements in clinical outcomes as well as changes in patterns of health care utilization (Norris, S. L., Nichols, et al., 2002). Research on diabetes self-management education has looked at a wide array of intermediate, short term, and long term outcomes, as documented in the list of outcomes reviewed for diabetes self-management interventions in order to inform the Taskforce to Revise the National Standards for Diabetes Self-Management Education (Norris, S. L., Nichols, et al., 2002). Many state Medicaid programs provide coverage for diabetes self-management education. In addition, the 2010 Patient Protection and Affordable Care Act includes chronic disease management as one of 10 essential health benefits required for all health insurance plans (Patient Protection and Affordable Care Act, 2010).

Differential access to diabetes self-management education in vulnerable populations may mediate or moderate disparities in diabetic outcomes, health care utilization, and medical expenditures. Existing research often points to the fact that vulnerable populations tend to have worse diabetes self-management including worse medication adherence, diabetic foot care, self-monitoring of blood glucose, diet, and physical activity modification (Shenolikar, Balkrishnan, Camacho, Whitmire, & Anderson, 2006; Oster, Welch, Schild, Gazmararian, Rask, & Spettell, 2006). However, this difference in behavior may be due to differential access to diabetes self-management education. Alternatively, diabetes self-management education may not be equally effective in vulnerable populations. Highly tailored, intensive, and culturally relevant diabetes self-management programs have been shown to be effective among racial/ethnic minorities in improving glycemic control (Norris et al. 2001; 2002; Ejebe, 2015) and reductions in diabetes related utilization and costs (Norris, Nichols et al., 2002). However, vulnerable populations may not respond similarly to interventions designed for the general population for a whole host of reasons including language barriers, cultural beliefs, issues with transportation, childcare, leaving work, health literacy, and financial challenges (Glazier, Bajcar, Kennie, & Willson, 2006). Previous research has found that even after receiving diabetes self-management education, persistent differences in receipt of diabetes preventive care services remain by race/ethnicity (Kurian & Borders, 2006). There is evidence to suggest that minority patients may need more intensive diabetes care management than their white counterparts due to increased social disadvantages (Okeke, Keenan, Weinger, Abrahamson, & Hsu, 2013). More intensive culturally tailored interventions have proven to be effective in vulnerable populations (Glazier, Bajcar, Kennie, & Willson, 2006). However, most racial/ethnic minorities and low-income individuals

often do not have access to intensive culturally tailored interventions in usual care, rather they have access to diabetes self-management education developed for the general population. Existing research on diabetes self-management education is often on homogenous racial/ethnic populations making it difficult to determine how the effectiveness of diabetes self-management education may differ based on race or income. Despite the emphasis on diabetes self-management education as a key component of diabetes care, diabetes utilization, and reducing diabetes related health disparities, to date there have been no studies on the exploring the potential mediating or moderating role of health literacy on diabetes self-management and health care utilization.

It is known that higher health literacy leads to better health outcomes (Bennet, Chen, Soroui, & White, 2009; Howard, Gazmararian, & Parker, 2005). Although higher health literacy is common among developed countries, it does not always translate to the entire population (Nutbeam, 2008) hence why it is important to understand it better. Chronic disease rates are disproportionately escalating among lower-income and individuals of minority status because certain social determinants of health, such as the lack of education and resources in the community (Yach, Hawkes, Gould, & Hofman, 2004; Yach, Stuckler, & Brownell, 2006). This can be attributed to employment (and subsequently the insurance status of the individual) and access, utilization, and navigation of the healthcare system (Yach, Hawkes, Gould, & Hofman, 2004; Yach, Stuckler, & Brownell, 2006). To improve community health outcomes, it is imperative to understand how health literacy affects utilization of health care.

Previous research has well documented how factors effect utilization of the healthcare system (Lincoln et al., 2006; Nutbeam, 2008) in terms of barriers, relationships with the

healthcare system, and chronic disease diagnosis. However, despite all of this evidence, health literacy has not been considered to be a strong predictor in utilization of the healthcare system. This is important because health literacy has been strongly correlated with variables that have driven utilization of healthcare. This study fills the gaps from previous studies and aims to explain the relationship between health literacy and the utilization of the healthcare system.

CHAPTER 3

THEORETICAL FRAMEWORK

There are two main theories that drive this research, systems and macro theory, and a framework which is used to best apply the research question and aims. This study will add to the existing theories by applying the Andersen Model to the study of health literacy.

Systems Theory

Systems theory is a combination of multifactorial explanations of how interventions engage with individuals, families, communities, and other social agencies (Payne, 2016). The leading framework of this theory is the ecological framework, or person-in-environment. The person-in-environment perspective in social work, developed by Bronfenbrenner, is a practice-guiding principle that highlights the importance of understanding an individual and individual behavior in light of the environmental contexts in which that person lives and acts (Stokols, 1996). Bronfenbrenner believed that a person's development was affected by everything in their surrounding environment. He divided the person's environment into five different levels: the microsystem, the mesosystem, exosystem, the macrosystem, and the chronosystem. This supports Paasche-Orlow and Wolfe's (2007) pathways to health literacy by understanding the contexts and systems that mitigate health literacy.

The microsystem is the system closest to the person and the one in which they have direct contact; it is the most influential level of the ecological systems theory. Relationships in a microsystem are bi-directional (Darling, 2007). Reactions to the people in the microsystem will affect how they treat the individual in return. The mesosystem consists of the interactions between the different parts of a person's microsystem. The mesosystem is where a person's

individual microsystems do not function independently but are interconnected and assert influence upon one another (2007). These interactions have an indirect impact on the individual. The exosystem is the system that does not involve the person as an active participant but still affects them (2007). This would include decisions that have bearing on the person, but the person has no participation in the decision-making process. The macrosystem is the largest and most distant collection of people and places to the individual that still exercises significant influence. It is composed of the individual's cultural patterns and values, specifically dominant beliefs and ideas, as well as political and economic systems (2007). The chronosystem adds the dimension of time, which demonstrates the influence of both change and constancy in the person's environment. The chronosystem may thus include a change in family structure, address, parent's employment status, in addition to immense society changes such as economic cycles and wars (2007).

Macro Theory

According to Payne (2016), macro theory focuses on social and educational development, in order to form a bridge between problem-solving and empowerment objectives in social work. Macro theory incorporates frameworks from the fields of education and economics to address social inequities in the community. Social development merges social progress with economic development which specifically targets poverty and social exclusion. This is shaped by four principles of practice: activation, capacity-building, social capital, and social inclusion/exclusion.

Practice of activation is to engage people who are immobilized from making progress to do so for personal development. This concept is developed from the theory of change, which explains the process of change by outlining causal linkages in an initiative (i.e. shorter-term,

intermediate, and longer-term outcomes) (Archibald, Sharrock, Buckley, & Cook, 2016). The Annie Casey Foundation adapted this organizational definition to one that is directed to community development and change that emphasizes community context and other assumptions on which you have based your change (Annie, 2004). By outlining the context and community assumptions, it is beneficial for the researcher and practitioner to articulate and plan for the change they wish to see in the community. Health literacy is more often than not viewed as a personal level issue and not a system level issue. The system needs to be designed to accommodate different levels of health literacy costs will increase because of the lack of health literacy and needed care.

Capacity-building is to empower marginalized individuals to participate more effectively in their community. This is built from community organization theory, which is a participatory decision-making process that empowers communities to improve outcomes (Ross & Lappin, 1967) and community development theory which focuses on the centrality of oppressed people in the process of overcoming externally imposed social problems (Tan, 2009). By investing in communities to understand that there is a problem of health literacy and work with them to address it, public health and social workers can start to close the communication gap on health disparities and start conversations with them on how to mitigate them.

Social capital increases the infrastructure as a resource for individuals and communities. There is a strong relationship between social capital and health outcomes. There have been significant studies that show that the more social capital one has, the better health that individual has (Gottlieb, 1985; Sarason, Levine, Basham, & Sarason, 1983). Social capital is a critical factor in health information resources, efficacy, and behavior intention. Individuals who have

high social capital are more likely to have higher self-efficacy skills when it comes to health information, navigate the healthcare system better, and have stronger intention to seek health information (Kim, Lim, & Park, 2015). Researchers have discovered that health literacy had positive effects on social capital and health information however, not with health information-seeking behaviors (Kim, Lim, & Park, 2015).

Social inclusion/exclusion is explained by ways in which stigmatized and disadvantaged communities should be helped to play a stronger role in society. In the context of health care system, marginalized populations can be identified as those with stigmatizing illnesses such as mental health and behavioral health disorders. Individuals with mental and behavioral health issues are more likely to be uninsured and therefore have less access than those without a mental health diagnosis (Lincoln et al., 2006). This is important because this will help shape interventions in the future on either a community or individual level.

Utilizing these principles of macro theory, health literacy can be better operationalized at the population level. In order to build health literacy, one would need to implement capacity building techniques, capitalizing on community organization and community development theories. For marginalized populations to adopt health-positive behaviors, activation of health knowledge needs to occur. These techniques are derived from community organization and community development theories. These theories can be the groundwork of health literacy and the driving force to increase it as well as add to the literature on macro theory.

Andersen Model

In order to understand the complex relationship between health literacy and healthcare use, the Andersen's Behavioral Model of Health Services Utilization (1995) was employed.

Outlined in the 1960s and later expanded by Andersen in 1995, the multilevel model incorporates both individual and contextual determinants of health services use. It proposes that healthcare use is influenced by predisposing, enabling and need factors (Andersen, 1995; Bradley et al, 2002; Gelberg, Andersen, & Leake, 2000). The Model has been validated and has been applied in numerous systematic reviews on different aspects of health care utilization (Babitsch, Gohl, & von Lengerke, 2012). Predisposing factors are defined as characteristics that exist prior to use of health services, including demographic characteristics (race, ethnicity and educational status), social structure and health beliefs. Enabling factors include personal/family and community characteristics that must be present for healthcare use to take place. These include social support and physical and financial access to healthcare. Finally, need factors account for the greatest amount of variance in the severity of disease (followed by predisposing and enabling factors), are comprised a biometric threshold that constitutes managed/unmanaged (Andersen, 1995). The Andersen model is a widely used conceptual framework employed to explore and understand healthcare utilization among all populations; however, work has been done to update the model with regard to vulnerable populations. Although the literature provides strong evidence of a relationship between predisposing, enabling, and need factors and the utilization of preventive care, there is limited research that investigates health literacy as its applied to the Andersen Model and utilization of the healthcare system.

Application of the Andersen Model. Variables associated with health literacy, which have been identified in the literature, have been implemented into the Andersen Model to understand the mediating or moderating effects of health literacy on health care utilization.

Predisposing factors. Individual predisposing factors include the demographic characteristics of age and sex as “biological imperatives,” social factors such as education, occupation, ethnicity and social relationships (e.g., family status), and mental factors in terms of health beliefs (e.g., attitudes, values, and knowledge related to health and health services). Contextual factors predisposing individuals to the use of health services include the demographic and social composition of communities, collective and organizational values, cultural norms and political perspectives (Babitsch, Gohl, & von Lengerke, 2012). Identified predisposing characteristics for this study include age, sex, ethnicity, educational attainment, marital status, income and English proficiency. Correlation between health literacy rates and income, education, and functional literacy have been studied extensively (DeWalt et al., 2004; Yach, Hawkes, Gould, & Hofman, 2004; Yach, Stuckler, & Brownell, 2006; Nutbeam, 2008).

Enabling factors. Organizational factors are considered to serve as conditions enabling services utilization. Organizational factors entail whether an individual has a regular source of care and the nature of that source (Babitsch, Gohl, & von Lengerke, 2012). They also include means of transportation, travel time to and waiting time for health care. Enabling resources include employment status, housing and food insecurity, and transportation needs. Studies have associated social determinants with health literacy (Paasche-Orlow and Wolfe, 2007; Glanz & Bishop, 2010).

Need. At the individual level, Andersen and Davidson differentiate between perceived need for health services (i.e., how people view and experience their own general health, functional state and illness symptoms) and evaluated need (i.e., professional assessments and objective measurements of patients’ health status and need for medical care) (Babitsch, Gohl, &

von Lengerke, 2012). Need factors for healthcare utilization are the diagnosis of DM. Diabetes Mellitus (DM), or diabetes, is a disease in which blood glucose, or blood sugar, levels are too high. Insulin is a hormone that helps the glucose get into your cells to give them energy. With type 1 diabetes, the body does not make insulin. With type 2 diabetes, which is more common, the body does not make or use insulin well. Without enough insulin, the glucose stays in in blood (CDC, 2019). Diabetes 2 diagnosis will be the variable to be investigated as it is the most common among adults.

Health behavior. Health behavior is conceptualized as chronic disease management and will be measured by the following variables: assignment of a primary care provider, location of health services, type of provider, and number of visits, which are national standards (Beck, 2017; NQF, 2019). The number of visits to the primary care provider is also the outcome variable.

Research Questions

This research is intended to address health literacy among an uninsured population in Cook County, IL. The overarching question guiding this research is: How does health literacy affect utilization of the health care system for the uninsured diagnosed with a chronic disease?

1. Aim: Determine the extent to which individuals diagnosed with a chronic disease with low health literacy differ from individuals diagnosed with a chronic disease with higher health literacy in meeting established care guidelines (a person with diabetes visits their primary care provider (PCP) 4 times per year on average) (Beck et al., 2018).
2. Aim: Determine the extent to which individuals diagnosed with a chronic disease with low health literacy differ from individuals diagnosed with a chronic disease with higher health literacy in their use of emergency care (ED care).

3. Aim: Determine whether, or to what extent, health literacy explains the relationship between the identified predisposing and enabling factors and the outcomes of appropriate utilization of care.

CHAPTER 4

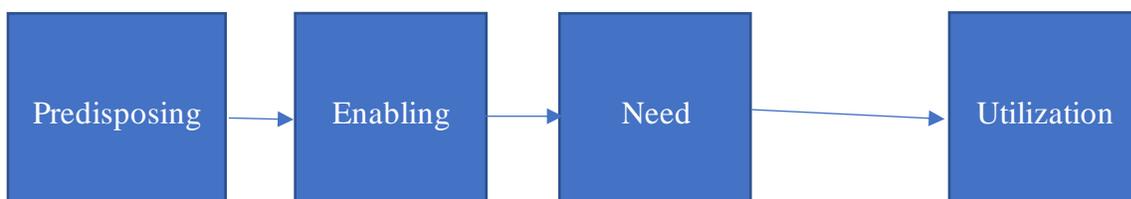
METHODOLOGY

This chapter outlines the methodological approaches used for assessing the influence health literacy among uninsured patients. Variables are identified and organized based on the Andersen Model (1995) adapted for vulnerable populations as developed in the previous chapter. This model is commonly used in studies to understand utilization of health care by examining three individual level domains: those factors that predispose people to utilize care (e.g., demographics), factors that enable use (e.g., ability to pay), and factors associated with need for the specific service (Andersen, 1995). This research is using data collected from Cook County Health (CCH) electronic medical records. This data is appropriate for this study because CCH serves the highest number of uninsured patients in Cook County. This section will describe the data source for this study, details of the dependent and independent variables, research questions and statistical methodology.

Model

The proposed model is Figure 1:

Figure 1. Andersen Model



Design

This is a retrospective cohort observational design where diagnostic and risk factor data will be extracted from patient medical records at CCH for two years (2015-2017). A two-year time frame was determined from the literature (CDC, 2019; Bernell & Howard, 2016) where a chronic condition is defined as lasting 3 months or more. This timeframe allows for sufficient management of a chronic disease in a primary care setting and mitigates the length of chronic disease diagnosis as individuals captured will have varying degrees of severity.

Sample

Cook County Health (CCH) has a 180-year history of caring for the region's most vulnerable populations experiencing poverty and other health-related social needs. Cook County Health (CCH or System) is one of the largest public health systems in the United States, providing a range of health services regardless of a patient's ability to pay. Through the health system and the health plan, CCH serves more than 500,000 unique individuals annually. It operates two hospitals, fifteen community health centers, correctional healthcare services for the county jail and juvenile detention center, a comprehensive medical home for patients with HIV/AIDS, and the Cook County Department of Public Health (CCDPH) serving suburban Cook County. CCH's patients are some of the most economically disadvantaged and disconnected from regular care in the region. 60% of the patients that CCH serves are uninsured.

In fall 2012, leveraging the Affordable Care Act (ACA), CCH launched CountyCare as a demonstration project through a U.S. Centers for Medicare and Medicaid Services (CMS) 1115 Waiver granted to the state of Illinois to early-enroll newly eligible low-income Cook County adults into a Medicaid managed care program. Many of CountyCare's 300,000+ members are

long-standing CCH patients who previously received care, in keeping with CCH's mission to care for all regardless of their ability to pay. In 2016, the number of uninsured individuals in Cook County (9%), the state of Illinois (7%) and the country (10%) were at a historic low; a direct result of the Affordable Care Act. Despite this, CCH has continued to provide more than 50% of all the charity care in Cook County. In fact, CCH's proportion of charity care since the enactment of the ACA has risen despite decreases experienced by other health care systems. In the years following the ACA, state and federal actions resulted in fewer people with coverage, which placed additional demands on CCH for charity care.

Records from CCH emergency departments (ED) and out-patient, primary care, ambulatory health care network (AHCN) clinics will be requested for uninsured patients for the year starting in 2017. If patients were seen multiple times in the year, the first encounter will be used as the baseline. Diagnostic and risk factor assessments will be extracted to measure health literacy, chronic disease management, and substance use disorder. Inclusion criteria are all uninsured patients ages 18-65 at CCH sites that have been assessed for health literacy and have a diagnosis of diabetes type 2. Valid allowable exclusions include patients who were a permanent resident of a nursing home, pregnant, died or were in hospice or palliative care during the measurement years.

Cook County Health operates its own Institutional Review Board through the Office of Research & Regulatory Affairs and provides administrative support to the IRB, review process for all protocol applications, feedback to investigator, correspondence with investigators, and educational programs and audits. The CCH IRB process is an online form that the principal investigator (PI) completes for the study. Because the PI is a CCH employee, additional training

and orientation to CCH was not needed for this study, except for the mandatory IRB presentation. This study was approved by expedited review by the IRB chairperson. Secondary approval of this study went through the Loyola University Chicago IRB and was approved as collaborative research. Because this is a retrospective analysis using secondary data, there are limited ethical considerations. The main consideration would be loss of privacy due to identification of individuals through chronic condition type and primary care provider visits, however all data given to the PI was deidentified and kept securely on a password-protected server.

Data Collection

This is an analysis using secondary data of diagnostic and risk factor data extracted from electronic patient medical records at CCH for two years (2015-2017). When patients come into CCH's outpatient facilities (either the hospitals or Ambulatory Care Health Centers) a number of risk assessments are taken to better understand the patients' medical, behavioral, and social needs. Systematic screening for care coordination needs is designed to trigger chronic disease self-management support; support for coordinating appointments, tests, and transportation; and referral to community-based services. Screening is administered through an adult or pediatric Health Risk Assessment (HRA), which is a 20-item tool that assesses physical and mental health status, health care use and diagnoses, and social needs including housing, inter-personal violence, food insecurity, utilities, and medical transportation. The HRA incorporates three key elements – an extended questionnaire, a risk calculation or score, and some form of feedback i.e. face-to-face with a health advisor or an automatic online report (Goetzel et al., 2011). It is a systematic approach to collecting information from individuals that identifies risk factors,

provides individualized feedback, and links the person with at least one intervention to promote health, sustain function and/or prevent disease (2011).

The HRA is integrated into both the Cerner Electronic Health Record (EHR) and Consensus, a care coordination electronic platform. This allows for direct electronic entry by clinical staff that primarily uses the EHR, and care coordination staff who primarily use Consensus, during administration of the HRA. The EHR and Consensus sync HRA data daily. Since these data platforms are used throughout the health system, all users are able to see when the HRA was most recently completed, regardless of clinical delivery site within the system. Data will also be extracted from the EHR to study utilization rates and place of care (ED versus primary care site). Inclusion criteria are all uninsured patients ages 18-65 at CCH sites that have been assessed for health literacy and have a diagnosis of diabetes type 2. Valid allowable exclusions include patients who were a permanent resident of a nursing home, pregnant, died or were in hospice or palliative care during the measurement years.

Measurement and Variables

Below outlines how the variables for this study are conceptualized and measured.

Dependent variable. Healthcare utilization is the dependent variable. Proper utilization of the health system is dependent on chronic disease condition. Diabetes is the chosen chronic condition for this research because of the prevalence of the disease in the uninsured population; two million adults <65 years of age with diabetes had no health insurance coverage (Stark Casagrande & Cowie, 2012). The NQF standards for a person with diabetes is to visit their primary care provider (PCP) 4 times per year (Beck et al., 2018; NQF, 2019). This is a nominal

variable and is calculated on how many times a patient had visited an ambulatory community health network (ACHN) center, where primary care services are delivered, in a two-year span.

Independent variable. Health literacy is the independent variable in the analysis. A binary dichotomous variable to measure health literacy will be created. CCH measures health literacy using the instrument that Chew and colleagues developed (2008) and focuses on functional literacy as a proxy for health literacy. The responses are scored on a Likert scale from 0 to 4, with 0 meaning high health literacy and 4 meaning low health literacy. The wording of the response choices for 2 of the 3 questions (Help Read and Problems Reading) vary slightly from the published responses; instead of always, often, sometimes, occasionally, or never, participants were asked to choose between all of the time, most of the time, some of the time, a little of the time or none of the time to improve participant understanding.

1. “How often do you have someone (like a family member, friend, hospital/clinic worker or caregiver) help you read hospital materials?” (Help Read)
2. “How often do you have problems learning about your medical condition because of difficulty understanding written information?” (Problems Reading)
3. “How confident are you filling out forms by yourself?” (Confident with Forms)

Per Chew et al. (2008), to assess for “good” vs “poor” health literacy, patients are stratified based on their scores. If a patient answered with a 2 or higher on two of the three questions, they are deemed to have poor health literacy. Subsequently, if a patient scored with a 1 or lower on two of the three questions, they are considered to have high health literacy. This bivariate stratification will create the control group (moderate/high health literacy) from the comparison group (low health literacy).

Additional variables. This exploratory study will examine a range of possible factors associated with efficient utilization of the health care system. Identification of independent variables was guided by the Andersen Model (1995), as adapted in the previous section, and selected based on availability in the data set. Consistent with the Andersen model, variables were partitioned into predisposing characteristics, enabling resources, and need. The database allowed for the exploration of the importance of other factors which have yet to be identified in the literature such as housing and food insecurity.

Predisposing factors. Predisposing characteristics include age, sex, race, marital status, and primary language. All variables were taken at baseline.

- **Age:** Age was included as a continuous variable. Patients ages 18-65 are only to be included.
- **Sex:** Sex categorized individual's sex based off their medical record. This is a bivariate measure of male or female.
- **Race:** Race was categorically defined as: non-Hispanic White, Black, Hispanic, and other.
- **Marital Status:** Marital status was categorized as single, married, separated, divorced, widowed, and other (domestic partner/civil union).
- **Language:** Primary language spoken was categorically collected as English, Spanish; Polish and other.

Enabling factors. Enabling resources include social determinants of health such as housing and food insecurity. Social determinants of health have demonstrated significant association on health literacy and therefore are included in this study. These measures are taken

at baseline. Data regarding how these variables are measured are unknown, therefore the coding will happen after the proposal goes through the IRB process and data is procured. All these variables are collected during the intake process and are available in the patient electronic medical record.

- **Housing:** This is dichotomous question with a bivariate yes/no answer to the question *Do you need help in getting housing?*
- **Food insecurity:** This is a dichotomous question with a bivariate yes/no answer to the question *Do you need help in obtaining food?*

Need. Need factors for healthcare utilization is the severity of the diagnosis of DM. Everyone in the sample will have a diagnosis of DM. Diabetes Mellitus (DM), or diabetes, is a disease in which your blood glucose, or blood sugar, levels are too high. Insulin is a hormone that helps the glucose get into your cells to give them energy. With type 1 diabetes, the body does not make insulin. With type 2 diabetes, which is more common, the body does not make or use insulin well. Without enough insulin, the glucose stays in in blood (CDC, 2019). Diabetes 2 diagnosis will be the variable to be investigated as it's the most common among adults. Although everyone in this study will have a diagnosis of DM and therefore is a condition of the study, the severity of the disease (managed or unmanaged) is included as a need factor. Managed diabetes is considered to have HbA1C levels of less than 6.5 percent per American Diabetes Association standards (2012). Unmanaged diabetes is considered to be levels of HbA1C levels over 6.5 percent.

The World Health Organization developed The International Classification of Diseases (ICD), which is used to code and classify morbidity and mortality data (WHO, 2019). This

coding system is universally used by government and healthcare systems to understand incidence and prevalence rates of certain diseases and is continuously revised and updated to include recent trends. The ICD is commonly used to document disease and health conditions in medical health records and used for insurance reimbursement. For the purpose for this study, electronic medical records will be pulled to identify individuals with diabetes through diagnostic codes. The code for Type 2 diabetes mellitus is E11 and the hemoglobin A1c code is R73.09.

Health behavior. Chronic disease management will be measured by the following variables. The assignment of a Primary Care Provider (PCP) will be a dichotomous variable representing if a patient has a PCP or not. The use of emergency services (ED encounters) as a continuous variable will be collected. Diagnostics of the ED encounters will be identified categorically based on disease condition at time of the ED visit (and hence will inform the reason for said visit). Combined, these variables will indicate the management of DM and efficient use of the healthcare system, per NQF guidelines. For example, if the patient comes to the emergency department for an infected foot wound due to diabetes, this will be an indicator of poor disease management.

Plan for Analysis

The overall objective of this study was to understand how health literacy effects the utilization of the healthcare system. A regression analysis was used to test the effects of predisposing, enabling, need, and vulnerable factors on health literacy and the utilization of the healthcare system.

Regression is a statistical tool to predict the dependent variable with the help of one or more than one independent variable. To predict the dependent variable, one or multiple

independent variables are chosen. This helps in the process of validating whether the predictor variables are good enough to help in predicting the dependent variable (Allison, 1999).

Regression analyses are useful when the independent variable is either continuous or dichotomous (health literacy is a dichotomous variable) and the dependent variable is continuous (ACHN visits). This will be used to test Aim 1. In Aim 2, a logistic regression will be used as emergency room usage will be dummied into a bivariate analysis (use/no use) with health literacy as a bivariate. The second analysis for Aim 2 will be a linear regression using only individuals who went to the ED predicting number of encounters for patients with high health literacy.

A regression analysis formula tries to find the best fit line for the dependent variable with the help of the independent variables. The regression equation is: $y = \beta_1 x + \beta_0 + e$ where the dependent variable is y , the independent variable is x , β_0 is the intercept of y and β_1 is the slope of x , the regression coefficient (Allison, 1999).

Assumptions of a regression analysis. There are four assumptions associated with a linear regression model: linearity, homoscedasticity, independence, and normality.

Linearity. The first assumption of linear regression is that there is a linear relationship between the independent variable, x , and the dependent variable, y . The expected value of dependent variable is a straight-line function of each independent variable, holding the others fixed. The slope of that line does not depend on the values of the other variables. The effects of different independent variables on the expected value of the dependent variable are additive.

Homoscedasticity. The variance of residual is the same for any value of X or “having the same scatter.” For this to happen in the data, the points must be about the same distance from the line.

Independence. Observations are independent of each other.

Normality. For any fixed value of X, Y is normally distributed.

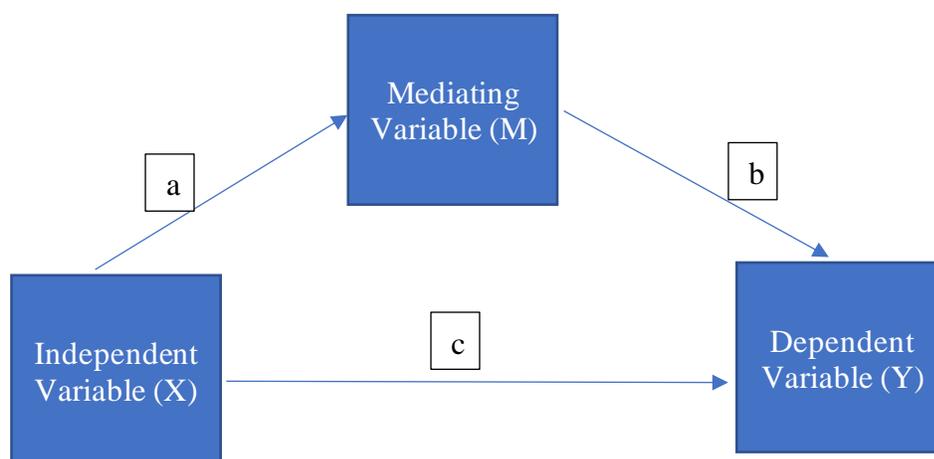
Assumptions of statistical analysis. Most statistical analyses are based on a set of assumptions. When the assumptions are violated, the results of the analyses can be misleading or incorrect (Allison, 1999). The four main assumptions upon which descriptive and inferential statistical analyses are based are (a) the data have a normal distribution; (b) there is homogeneity of variances, i.e., data from multiple groups have the same variance; (c) the data have a linear relationship; and (d) the data are independent (Allison, 1999).

Descriptive statistics. The main assumption when describing ratio-level variables is that the data have a normal distribution. The measures of central tendency and dispersion that were conducted to test for normal distribution in this study included the variable mean, standard deviation, median, range, mode, skewness and kurtosis. Skewness is a measure of the lack of symmetry of a distribution curve, compared to a normal curve. Kurtosis is a measure of whether the distribution curve is heavy-tailed, i.e., there are outliers in the data, or light-tailed. Levels of skewness and kurtosis that meet the assumption of a normal distribution fall between -2 and $+2$ (Allison, 1999).

Path analysis. To test for mediating effects (Aim 3), a path analysis using the Sobel test (1982) is used. The Sobel test is most common and highly recommended method (Mackinnon, Lockwood, Hoffman, West, & Sheets (2002)). The logic is to determine if the relationship

between X (IV) and Y (DV) has been significantly reduced after the inclusion of M (mediating variable) (Figure 2). In this model, X is the assignment of a PCP, the Y is the ACHN encounters, and M is health literacy. In Sobel Test, the indirect effect is generated by multiplying two coefficients, the partial regression effect for M predicting Y (b) and the simple regression effect for X predicting M (a). The equation of the Sobel test is: $z_{ab} = \frac{ab}{\sqrt{b^2Sa^2 + a^2Sb^2}}$.

Figure 2. Path Analysis



CHAPTER 5

RESULTS

This chapter outlines the results of the study. This research is intended to address health literacy among an uninsured population in Cook County, IL. The overarching question guiding this research is: How does health literacy affect utilization of the health care system for the uninsured diagnosed with a chronic disease?

1. Aim: Determine the extent to which individuals diagnosed with a chronic disease with low health literacy differ from individuals diagnosed with a chronic disease with higher health literacy in meeting established care guidelines (a person with diabetes visits their primary care provider (PCP) 4 times per year on average) (Beck et al., 2018). The hypothesis is that high health literacy would determine higher engagement in primary care, therefore meeting the established care guidelines.
2. Aim: Determine the extent to which individuals diagnosed with a chronic disease with low health literacy differ from individuals diagnosed with a chronic disease with higher health literacy in their use of emergency care (ED care). The hypothesis is that patients with higher health literacy would not have a higher utilization of ED care.
3. Aim: Determine whether, or to what extent, health literacy explains the relationship between the identified predisposing and enabling factors and the outcomes of appropriate utilization of care. The hypothesis is that health literacy is a mediating factor in healthcare utilization.

Overview

The data was extracted from patients' electronic health records (EHR) and was assigned the following variables in different spreadsheets: Facility_MRN, Fin_MRN, and emergency department diagnostic codes. The Facility_MRN is a medical record number (MRN). The medical record number is how to identify each individual patient. A MRN is consistent throughout the health system, meaning a person is assigned the same MRN for every visit. The second spreadsheet identified the financial number, coded as Fin_num. This is assigned to every encounter that the patient has with the health system and is used to define which encounter the person visited (ED vs ACHN site). Each ACHN site has a different code therefore each site had to be identified to ensure an ED visit would not be marked as a primary care visit. Finally, the third Excel document had the diagnostic code for the ED visit. When someone is diagnosed with something, they are assigned a diagnostic code for billing purposes. Cook County Health Diagnosis Codes are ICD10 format. Since patients are often diagnosed with multiple conditions during an ED encounter, identification of each condition (primary, secondary, and tertiary) had to be coded.

When coding for ED diagnoses, the most frequent condition for the cumulative experience was used (i.e. if someone was admitted 12 times, 6 for diabetes, 4 for obesity, 2 for depression etc., it was coded it as diabetes). If it was different presenting issues but also included diabetes as a secondary diagnosis, it was coded as diabetes if that condition contributed to the ED encounter (i.e. primary condition was numbness of the limbs and the secondary was diabetes, the encounter was coded as diabetes). Most individuals with an ED admittance had a pattern of diagnosis. A diagnosis of "other" that meant that there was not a clear correlation of admittance

(i.e. dog bite, oral pain, headache). Most individuals who had an admittance diagnosis of abdominal pain also had a diagnosis of diabetes. Because of the way the data was extracted from the patient EHR, comorbidity could not be accounted for. ED visits of less than two within the two-year span or less were not counted in the analysis for sake of time, as those could be described as actual emergency visits. For Aim 2, a logistic regression was conducted; therefore, ED encounters were dummied to a bivariate (yes/no) variable. For the second step of the analysis, all “no” encounters were removed from the model and the ED encounter variable went back to a continuous variable to reflect the number of visits a patient went to the ED in they two year time span.

Diagnostic conditions were categorized into generalized conditions. Examples of this are stomach cancer and prostate cancer were labeled as “cancer”; kidney disease, acute kidney failure, and anything associated with renal issues were coded as “renal failure”; depression, anxiety, and schizophrenia were coded as “mental health”. The diagnostics were then dummied to see the difference between each reason for the ED visit.

Demographic factors such as race, marital status, and sex were dummied to reflect nuances between each variable. The variables were then renamed to reflect the base case of the variable. Because of the way CCH classifies race, the “other” category is inclusive of mix -races, Asian, Pacific Islander, and Native American identities. In addition, there was not a classification of patients identifying as “white Hispanic”. The base case for male is female because CCH classifies gender as biological sex (something they has since changed to be more inclusive) and the base case for Spanish speaking is English speaking, as the other language category is so low.

When the raw data was downloaded, there were a total of 3,020 patients that have been identified as uninsured with type II diabetes. The data was then cleaned to eliminate all patients without health literacy scores, which brought the patient number to 2,965. After the data was cleaned and standardized, ensuring all data collection points were accounted for, the total number of patients were 2,197 (N=2,197). Frequency distributions and descriptive statistics of the data are shown in Tables 2 and 3.

Table 2. Frequency Distribution

Frequency Distribution		N=2,197
	N	Percentage
Health Literacy		
Low	1,159	52.8%
High	1,038	47.2%
Sex		
Male	1,136	51.7%
Female	1,061	48.3%
Age		
18-30	35	1.6%
31-40	216	9.8%
41-50	631	28.7%
51-60	852	38.8%
61-65	463	21.1%
Race		
White	223	10.2%
Black	373	17.0%
Hispanic	918	41.8%
Other	683	31.1%
Marital Status		
Single	813	37.0%
Married	962	43.8%
Separated	163	7.4%
Divorced	123	5.6%
Widowed	89	4.1%
Other	47	2.1%
Language		
English	1,247	56.8%
Spanish	725	33.0%

Polish	55	2.5%
Other	169	7.7%
Primary Care Provider		
No	461	21.0%
Yes	1,736	79.0%
Homeless		
No	2,174	99.0%
Yes	23	1.0%
Food Insecure		
No	1,760	80.1%
Yes	437	19.9%
ED Diagnostics		
Diabetes	228	10.4%
Hypertension	193	8.8%
Abdominal Pain	25	1.1%
Asthma	24	1.1%
Cancer	8	0.4%
Renal Failure	25	1.1%
Mental Health	16	0.7%
Other	73	3.3%
N/A	1,605	73.1%

Table 3. Descriptive Statistics				N=2,197	
	N	Minimum	Maximum	Mean	Standard Deviation
Number of ACHN Visits	2,963	0	11	1.35	0.897
Number of ED Visits	4,653	0	45	2.12	3.43

Analysis

Aim 1. Determine the extent to which individuals diagnosed with a chronic disease with low health literacy differ from individuals diagnosed with a chronic disease with higher health literacy in meeting established care guidelines (a person with diabetes visits their primary care provider (PCP) 4 times per year on average) (Beck et al., 2018).

The next analysis was testing the relationship of health literacy and ACHN visits, controlling for independent variables. A multiple linear regression analysis was conducted to test ACHN visits to health literacy controlling for independent variables such as age, race, sex, language, marital status, housing and food insecurity, and assignment of a primary care physician (PCP). Before estimating the research model, the multicollinearity was tested among the independent variables. The result indicates that there is no multicollinearity problem with all the VIF values less than 10. The adjusted R^2 was 0.032 demonstrating that this model explains 3% of variation of ACHN visits. The model in Table 4 demonstrates that high health literacy has negative significant influence on ACHN visits ($B = -0.129$; $p < 0.001$); meaning that patients with low health literacy have a higher rate of ACHN visits. In addition, it shows that the assignment of a PCP has positive significant influence on ACHN encounters ($B = 0.268$; $p < 0.001$) (Table 4).

Table 4. Multiple Linear Regression of Health Literacy on ACHN Encounters

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	0.965	0.127		7.575	0	0.715	1.214
High Health Literacy	-0.129	0.041	-0.072	-3.135	0.002	-0.209	-0.048
Predisposing							
Age	0.004	0.002	0.037	1.682	0.093	-0.001	0.008
Male	0.059	0.039	0.033	1.532	0.126	-0.017	0.135
White	0.126	0.07	0.042	1.801	0.072	-0.011	0.263
Black	-0.179	0.069	-0.075	-2.609	0.009	-0.314	-0.044
Hispanic	0.043	0.045	0.024	0.952	0.341	-0.046	0.132
Married	0.022	0.039	0.012	0.561	0.575	-0.055	0.098
Spanish Speaking	-0.001	0.054	-0.001	-0.024	0.981	-0.107	0.104
Enabling							
Homeless	0.217	0.187	0.025	1.163	0.245	-0.149	0.584
Food Insecure	0.003	0.049	0.001	0.057	0.954	-0.093	0.099

Heath Behavior							
Assigned PCP	0.268	0.048	0.122	5.582	0	0.174	0.362

Aim 2. Determine the extent to which individuals diagnosed with a chronic disease with low health literacy differ from individuals diagnosed with a chronic disease with higher health literacy in their use of emergency care (ED care).

The next analysis was testing the relationship of health literacy between ED encounters, controlling for independent variables. A logistic regression analysis was conducted to test ED encounters to health literacy controlling for independent variables such as age, race, sex, language, marital status, housing and food insecurity, and assignment of a primary care physician (PCP). The model in Table 5 demonstrates that high health literacy is not correlated significantly with ED encounters ($B = -0.012$; $p > 0.05$). However, the assignment of a PCP on ED encounters is significant ($B = 1.595$; $p < 0.001$).

Table 5. Logistic Regression of High Health Literacy on ED Encounters

	B	S.E.	Wald	df	Sig.	Exp(B)
Constant	-1.001	0.352	8.099	1	0.004	0.367
High Health Literacy	-0.012	0.109	0.011	1	0.915	0.988
Predisposing						
Age	-0.025	0.006	18.496	1	0	0.975
Male	-0.281	0.102	7.605	1	0.006	0.755
White	-0.022	0.204	0.012	1	0.913	0.978
Black	0.4	0.19	4.437	1	0.035	1.492
Hispanic	0.257	0.12	4.575	1	0.032	1.293
Married	-0.204	0.104	3.864	1	0.049	0.816
Spanish Speaking	-0.269	0.15	3.208	1	0.073	0.764
Enabling						
Homeless	0.88	0.466	3.565	1	0.059	2.412
Food Insecure	0.322	0.118	7.474	1	0.006	1.38
Health Behavior						
Assigned PCP	1.595	0.181	78.033	1	0	4.927

The second step of the model was to remove all cases that did not have an ED encounter (N=). A linear regression was then conducted to understand if high health literacy was correlated to number of ED visits a patient had. Before estimating the research model, the multicollinearity was tested among the independent variables. The result indicates that there is no multicollinearity problem with all the VIF values less than 10. Table 6 shows that high health literacy has a not significant, negative relationship on number of ED visits (B=-0.93; $p>0.05$). Additional significant variables that did predict higher ED encounters were Spanish-speaking (B=1.688; $p<0.05$) and patients who are housing insecure (B=4.568; $p<0.05$).

Table 6. Linear Regression of High Health Literacy on number of ED encounters

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error				Lower Bound	Upper Bound
(Constant)	6.055	1.476		4.103	0	3.156	8.953
High Health Literacy	-0.93	0.436	-0.099	-2.132	0.033	-1.786	-0.073
Predisposing							
Age	-0.037	0.023	-0.066	-1.579	0.115	-0.082	0.009
Male	0.513	0.391	0.055	1.313	0.19	-0.255	1.281
White	-0.583	0.841	-0.032	-0.694	0.488	-2.235	1.068
Black	-1.12	0.776	-0.09	-1.443	0.149	-2.645	0.404
Hispanic	-0.003	0.461	0	-0.006	0.995	-0.907	0.902
Married	-0.377	0.397	-0.039	-0.949	0.343	-1.157	0.403
Spanish Speaking	1.688	0.617	0.163	2.734	0.006	0.475	2.901
Enabling							
Homeless	4.568	1.596	0.119	2.862	0.004	1.433	7.702
Food Insecure	0.638	0.435	0.061	1.466	0.143	-0.217	1.493
Health Behavior							
Assigned PCP	0.82	0.785	0.043	1.044	0.297	-0.723	2.362
ED Diagnostic							

Code							
Diabetes	0.883	0.626	0.092	1.411	0.159	-0.347	2.113
Hypertension	0.979	0.637	0.098	1.537	0.125	-0.272	2.229
Abdominal Pain	1.789	1.076	0.077	1.663	0.097	-0.324	3.902
Asthma	0.268	1.09	0.011	0.246	0.806	-1.873	2.408
Cancer	0.964	1.724	0.024	0.559	0.576	-2.422	4.351
Renal Failure	0.976	1.074	0.042	0.909	0.364	-1.134	3.085
Mental Health	0.455	1.286	0.016	0.354	0.724	-2.07	2.98

Aim 3. Determine whether, or to what extent, health literacy explains the relationship between the identified predisposing and enabling factors and the outcomes of appropriate utilization of care.

A path analysis was conducted to test the mediating relationship of health literacy between assignment of a PCP and ACHN encounters using a Sobel test (1982). A regression analysis was conducted to test the significance of having a PCP and health literacy. The relationship between assignment of a PCP and health literacy was not significant ($B = -0.022$; $p > 0.390$) (Table 7). Because of the insignificance of this relationship, the remainder of the path analysis could not be completed to test the mediating relationship between health literacy and ACHN encounters.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std Error	Beta		
constant	0.490	0.023		21.078	<0.001
PCP	-0.022	0.026	-0.018	-0.860	0.390

CHAPTER 6

DISCUSSION

This chapter reviews the results of the analysis and discusses the outcomes in relation to the supporting literature. Some results of this study were unexpected while others congruent with the literature. Hypotheses for Aims 1 and 3 are not supported. The results for Aim 1 are contradictory to the literature and yielded surprising results, discussed further below. The results for Aim 3 could not be completed due to the insignificant relationship of the first step of the model.

General Discussion

For Aim 1, the model in Table 5 demonstrates that high health literacy has negative significant influence on ACHN visits; or patients with low health literacy have a higher attendance of ACHN visits. This is contrary to the literature that says that a higher health literacy corresponds with increased primary care visits. Low health literacy has been associated with decreased utilization of preventive healthcare, increased use of emergency care, increased hospital admissions, increased healthcare costs and poor health outcomes in adults (Weiss & Palmer, 2004; Baker et al, 2002; National Research Council, 2004; Osborn, Paasche-Orlow, Bailey, & Wolf, 2011; Roter, Rudd, & Comings, 1998; Schilhnger, Barton, Karter, Wang, & Adler, 2006). This finding is surprising as the opposite is expected; this is contradictory to the literature. Speculation could be that higher health literacy might correspond with feeling equipped to manage symptoms at home before seeking out healthcare. Patients with chronic

conditions have lived with the disease (although time of diagnosis was not accounted for in this study) and may feel like they know how to manage their symptoms and are less likely to seek care unless it is urgent. There could also be a fear of the cost of care, because of lack of insurance, therefore the patient may feel more confident in managing their symptoms on their own. Another speculative reason could be that when the patient attends a primary care visit, they may not see their PCP and may see another provider at the clinic. In this scenario, the patient may not want to return to the ACHN site because they would not be guaranteed to see their PCP and would need to reexplain their patient history. Research shows that the patient/provider relationship is integral to health literacy (Sorenson et. al., 2012; Nutbeam, 2008; Paasche-Orlow, 2007) and the lack of provider consistency when visiting the ACHN site may deter a patient returning.

As such, the main result that is supported by the literature is that the assignment of a PCP has positive significant association on ACHN encounters (Table 5). This corroborates Paasche-Orlow's (2007) work that states that the patient/provider relationship is integral in disease management and engagement with the healthcare system. This has also been demonstrated in several systematic reviews (Sorenson et al., 2012; Nutbeam, 2008).

For Aim 2, high health literacy has a negative influence on ED encounters; or patients with low health literacy utilize the ED more than patients with high health literacy. This is supported by the literature because the more health literacy someone has, the less they would utilize the ED and would, presumably, have better disease management. This is also supported by the significant, positive influence that assignment of a PCP has on ED encounters. Limited literacy was also associated with higher probability of hospitalization, higher prevalence and

severity for some chronic diseases, poorer global measures of health, and lower utilization of screening and preventive services (DeWalt et al., 2004). Low health literacy is also associated with decreased use of preventive services, increased use of acute care, including emergency room visits, and less medical screening (Lindau, Tomori, McCarville, & Bennett, 2001).

This somehow contradicts the findings from Aim 1 where patients with low health literacy also have a higher rate of ACHN visits. Reasoning for this could be the various factors that Paasche-Orlow (2007) outlined: access and utilization of care, provider factors, patient factors, and self-care. The current healthcare system is a fractured one and if a patient is seeing multiple providers and not ensuring if the patient fully understands the instructions or explanation of what is happening, the patient would be more likely to visit the ED than a patient with higher health literacy who does understand the medical interaction (Wolf et al., 2011). This could be a result of provider factors not taking the time to fully engage with the patient because of time constraints (Berkman et al., 2004) or the patient not feeling able to ask for clarification during the provider encounter (Paasche-Orlow, 2007). This would also speak to the quality of the provider-patient interaction and how that could be an opportunity to increase health literacy of the patient, ultimately increasing preventative care through primary care engagement and a reduction of ED visits. Although this is outside of the scope of this study, it is an important aspect to consider especially since there is a higher utilization of emergency care among patients with low health literacy.

Another finding was the number of negative relationships to ED encounters and social variables (age, sex, marital status and language). This could be because of the number of protective factors identified in the literature (education, employment, income) were not

accounted for in the sample and therefore could not be investigated (see limitations section).

There could also be a bias of the patient to go to the ED for chronic care due to stigma, perceived bias of the provider, and medical history (Gamble, 1997).

One variable that was significant in Aim 2 was that individuals who are housing insecure are more likely to use the ED. Although the total of the sample that identified as housing insecure was 1%, they were more likely to go to the emergency department. Studies have demonstrated that individuals who are housing insecure are more likely to be diagnosed with chronic conditions of medical, psychiatric, and social problems such as tuberculosis, HIV infection, hepatitis, alcoholism and substance use, skin and foot disease, schizophrenia and related psychoses, malnutrition, and trauma (D'Amore, Hung, Chang, & Goldfrank, 2001; Morris & Gordon, 2006). The homeless are also less likely to be integrated into any type of primary care system and routinely utilize emergency departments for a majority of their health care needs. This follows the trend in where the emergency department is a safe refuge from inclement weather, especially in Chicago where the temperatures in the winter are often below freezing and summers can result in heat stroke.

Because of the way the data was extracted from the patient EHR, comorbidity could not be accounted for. By observation only, the most frequented causes for an ED encounter were hypertension and renal failure, besides diabetes. Most individuals who had an admittance diagnosis of abdominal pain also had a diagnosis of diabetes, however the cumulative ED diagnosis was abdominal pain. The most common causes of renal failure are diabetes and high blood pressure. Unmanaged diabetes can lead to uncontrolled blood sugar levels and consistently high blood sugar can damage the body's organs, including the kidneys (Mayo Clinic, 2022). It is

important to note that compounding chronic disease conditions lead to more complex patients and therefore higher care. What was striking about this analysis was that there was a negative, insignificant relationship between PCP assignment and health literacy (Aim 3, Table 7). This is contrary to the literature that states that the relationship with a PCP is a protective factor of health literacy (Paasche-Orlow, 2007). Although Paasche-Orlow describes the nature of the relationship between the PCP and the patient as the protective factor, this data strictly uses assignment and therefore the nature of the relationship cannot be evaluated (i.e., quality of the relationship). However, this information could be used for the future to establish nurturing patient/provider relationships moving forward.

More Americans are developing diabetes earlier, even in childhood, because of long-term societal shifts toward sedentary lifestyles and unhealthy diets (NQF, 2019). Younger patients often have a harder time managing their disease, develop complications faster, and tend to have less consistent access to medical care (Beck et al., 2018). Some patients ration their medications and limit doctor visits to avoid the hefty out-of-pocket costs of increasingly common high-deductible insurance plans, backed for years by employers, insurers and policymakers (Bloom Canning, & Sevilla, 2001). Understanding how health literacy can contribute to the influence of severity of disease is important to help alleviate the chronic condition.

Health Literacy as a Social Determinant of Health

Health status is determined fundamentally by the conditions in which we are born, grow, live, and age. These conditions include our physical environment, access to education, adequate housing, employment, and income, sometimes referred to as the social determinants of health (Nutbeam & Lloyd, 2020). By investing in communities to understand that there is a problem of

health literacy and work with them to address it, public health and social workers can start to close the communication gap on health disparities and start conversations with them on how to mitigate them.

Health Literacy as an Independent Determinant of Health

Pelikan and colleagues have systematically examined the data to investigate whether health literacy is an independent determinant of health, a mediating variable between other determinants and health, or a variable moderating the effects of other determinants on health (Pelikan, Ganahl, & Roethlin, 2018). Pelikan et al. (2018) compared “comprehensive” health literacy (measured by HLS-EU) (Sørensen et al., 2015) with “functional” health literacy using the Newest Vital Sign measure (NVS) (Weiss & Palmer, 2004) and used a single question on self-assessed health as a dependent variable. The study concluded that comprehensive health literacy as measured by the HLSEU influences health mostly as a direct determinant and that only some of its association takes place by moderation or mediation of other determinants of health (Pelikan et al., 2018). The same relationships were not observed when only the more limited NVS measure was used for analysis. This effect was observed independently of other demographic and socioeconomic indicators.

Health Literacy as a Mediating Determinant of Health

Although this analysis could not demonstrate a mediating relationship, studies have exhibited support that mediating, and potentially moderating, relationships do exist, and how health literacy can be used to address health inequities in the community. Stormacq and colleagues examined in closer detail the mediating relationship among socioeconomic status, health literacy, and different health outcomes (Stormacq, Van den Broucke, & Wosinski, 2019)

building on earlier reviews by Paasche-Orlow (2007) and Sørensen et al. (2012). Prior reviews considered socioeconomic and sociodemographic (racial and gender-related) characteristics that were associated with poor health literacy and important theoretical insights into the existence of the relationship, however neither fully examined the nature of the relationship. Stormacq and colleagues (2019) confirmed that some established social determinants is correlated to individual and population health literacy. People with higher levels of educational attainment, better jobs, and higher income tend to have better access to health information and better access to resources with which to act on this information (Stormacq, Van den Broucke, & Wosinski, 2019).

A main finding from Stormacq and colleagues was the potential mediating role of health literacy. Understanding in greater detail the nature of this observable relationship is important for considering what might be done in response. Their study indicates that poor social and economic conditions are consistently associated with poorer health literacy in populations (Stormacq, Van den Broucke, & Wosinski, 2019). The strongest association is found between educational attainment and health literacy. Discussed in further detail in the limitations section, educational attainment was partially captured for this dataset and ultimately had to be eliminated from the analysis. Because Stormacq and colleagues found a strong correlation between education and health literacy, education attainment is a confounding factor for this study and therefore limits internal validity.

Stormacq also found that income, occupation, and race/ethnicity were also consistently associated with health literacy (Stormacq, Van den Broucke, & Wosinski, 2019). These findings are consistent with previous reviews (Paasche-Orlow & Wolfe, 2007; Sørensen et al., 2012). Similarly to education attainment, income and employment variables were not available in this

dataset however it can be concluded that since this sample was of uninsured individuals engaging with a safety-net healthcare provider, the interaction of income and employment may not have had the same effect as they did in the Stormacq study.

Research Needs and Practice Implications

Poor health literacy is a liability to the community because of the residual effects that are manifested. Researchers and practitioners committed to social justice need to be cognizant of the pathways that lead to health inequities in the community and commit to resolve them. If there is a strong correlation between poor health literacy and poor health outcomes, it behooves public health and social workers to remedy this effect.

Because of the many ways health literacy is conceptualized, a universal language needs to be created when addressing these issues. Many health literacy interventions are aimed at the individual and very few address population needs. A reliable and valid way of measuring health literacy needs to be implemented at the population level to gauge where gaps are in the capacity building of health literacy. This study used an instrument consisting of three questions:

1. “How often do you have someone (like a family member, friend, hospital/clinic worker or caregiver) help you read hospital materials?” (Help Read)
2. “How often do you have problems learning about your medical condition because of difficulty understanding written information?” (Problems Reading)
3. “How confident are you filling out forms by yourself?” (Confident with Forms)

Although this instrument was sufficient for the purposes of this study, it in no way is comprehensive and is applicable for all populations. A more inclusive instrument needs to be

standardized and implemented across healthcare systems in order to best measure and quantify health literacy rates among patients.

To begin this research, a quantitative approach needs to happen first to determine what variables can be accurately measured in population scope as well as be reliable indicators of health literacy. Using the research of Paasche-Orlow and Wolfe (2007), variables are identified and outlined at the individual and community level. In order to extrapolate these variables to the community level careful consideration must be taken to make sure the researcher does not commit an ecological fallacy or confound individual characteristics to the general population. Characteristics and behaviors such as the conceptualization of self-care could be easy to conflate. The researcher must be thoughtful in his/her approach to operationalize these variables.

For this research to begin, there needs to be identification of existing variables from a national dataset based from the predictors of health literacy outlined by Paasche-Orlow and Wolfe (2007). In the selection of these variables, the researcher needs to be thoughtful in how these were operationalized, measured, and collected. Using theories such as community organization and community development theories to conceptualize capacity development and theory of change at the activation level, researchers can hypothesize what variables could create a change in health literacy. These hypotheses can drive research as well as practical implications for social workers to alleviate community health inequalities via health literacy interventions.

As illustrated above, social determinants have a significant influence on health literacy. Researchers have started to investigate if the relationship mutual, rather than directional. Both Pelikan (2018) and Stormacq (2019) argue that health literacy is a potentially modifiable influence on the social determinants of health that could contribute to improvements in health

disparities and potentially offer a midstream intervention to address health inequity. Although this analysis could not demonstrate a mediating relationship, studies have exhibited support that mediating, and potentially moderating, relationships do exist and how health literacy can be used to address health inequities in the community.

Trends within the hospital system are looking at stratification of chronic disease conditions by sex, race, ethnicity, and language. As of recent, many hospitals have been pressured by Centers of Medicaid and Medicare Services (CMS) and private insurance companies to start looking at chronic conditions at a deeper level. The Institute for Healthcare Improvement (IHI) has outlined strategies to achieve health equity starting at the stratification of data in terms of race and ethnicity; such analytics can help identify trends in chronic conditions that can help identify preventative and primary interventions (Wyatt, Landerman, Botwinick, Mate, & Whittington, 2016). By intervening before a condition gets worse, a hospital system can save money on ED visits and admission rates as well as contribute to the health equity of a community. Many hospitals have begun to implement these data points within their systems. However, hospitals can enhance this work by identifying mediating factors to chronic conditions, such as health literacy, as a preventive mechanism to identify disease conditions before they manifest and become chronic.

Within the addiction and behavioral health fields, health literacy is still under-developed. Research that has been conducted is limited in scope and rigor. One study found that health literacy was not a predictor in mental health functioning and addiction outcomes (Lincoln, Paasche-Orlow, Cheng, Lloyd-Travaglini, Caruso, Saitz, & Samet, 2006) however it can be a contributor to the utilization of the healthcare system. Individuals with mental and behavioral

health issues are more likely to be uninsured and therefore have less access than those without a mental health diagnosis (Lincoln et al., 2006). This is important because this will help shape interventions in the future on either a community or individual level.

As stated above, health literacy could be used as an indicator of the quality of patient/provider interactions. Because both provider and patient factors are indicators of health literacy, health literacy could be used as a quality metric of the patient/provider relationship; meaning that the more time providers spend with the patient, explaining their health status, and ensuring that the patient comprehends what the provider is saying would lead to increased health literacy (Berkman et al., 2004). Consequently, the more time a patient spends with the provider, they would feel more comfortable talking about what barriers they have in obtaining good health and what the provider could do to assist them (Paasche & Wolf, 2007).

COVID-19 pandemic and telehealth. The coronavirus pandemic (COVID-19) has exacerbated gaps in the healthcare system as it preyed on chronic diseases. Diabetes, in particular, was an underlying condition in nearly 40% of U.S. COVID-19 deaths early in the pandemic (CDC, 2022). In the early days of the pandemic, the CDC and other agencies recommended that hospitals and medical offices suspend elective procedures and nonessential visits to limit spread of the virus, protect medical staff from unnecessary exposure to disease, and protect high-risk patients from coming to the hospital, ambulatory care clinics and emergency department for non-COVID-19 symptoms and chronic disease management (CDC, 2022; CCH internal memo). ACHN clinics halted in-person appointments for many patients with chronic conditions like diabetes, limiting disease management opportunities.

Telehealth and phone calls addressed some needs however not all care could be delivered remotely. Patients were not able to get blood drawn for regular HbA1C readings and diabetes management. Telehealth was also limited in scope that some of the most vulnerable patients do not have smartphones or a reliable internet connection, nor did all physicians have secured computers and internet to access patient records (Baken, 2020). And after some wound-care centers closed, remote monitoring couldn't provide care that relies on touch and feel, such as evaluating the chronic sores that diabetes patients are prone to suffer- significant factors that contribute to health literacy (Paasche-Orlow & Wolf, 2007). This situation led to many patients becoming fearful and reluctant to seek care until they were in crisis. Telehealth is an opportunity to develop health literacy alongside technical literacy.

Limitations

There are several limitations to this study. First of which is that several variables that were intended to be captured for this study were not available in the data. Cook County Health has a structured intake form that asks multiple social determinant questions to best serve the patient. However, most of these questions are optional. Questions regarding employment, education status, transportation, and relative health risk were either partially filled out or not captured at all. To standardize the data, all variables with significant missing data points were removed.

This missing data is important as several variables that were missing are also strong indicators of health literacy. Detailing the missing variables from the data set could result in confounding variables, limiting the internal validity of the study. This is to highlight that education level of the patient is an important determinant of health literacy and therefore could

have been a predictor of better health care utilization. Although the income and employment variables were not available in the dataset, one can assume that since all the patients were uninsured and presenting at a safety-net hospital, those variables may not have been significant factors in the analysis.

If this study was going to be replicated, variables included in this analysis would include all variables listed, especially the data that was useful in determining correlation of health literacy and healthcare utilization: race, language, and assignment of a PCP. To increase internal validity, additional variables such as educational attainment would have to be included as education is a strong predictor of health literacy. Conversely, external validity is strong as the sample for this study is reflective of the entire CCH patient population in terms of demographics. In Stroger Hospital, one of two CCH hospitals, for diabetes 43.3% females have diabetes (study sample is 48.3%) and 43.1% of Hispanics (study sample is 41.8%) (Cook County Health, internal memo).

Comorbid conditions were not included in this analysis. Since nearly 10% of the diagnoses in the ED were a chronic condition- hypertension, cancer, renal failure- and all patients had a type II diabetes diagnosis, the multiple chronic issues could have amplified the risk for increased healthcare utilization. Compounding symptoms of chronic conditions can exacerbate any disease state and lead to increased emergency department visits and hospitalizations (Lanting et al., 2005).

Patient records did not indicate HbA1C levels, therefore the need of the Anderson Model could not be assessed in this study. Since the HbA1C levels were not known, the patients could not be stratified into groups of “high need” and “low need”. The need is important as it would

have been used to identify managed diabetes vs unmanaged; managed diabetes is considered to have HbA1C levels of less than 6.5 percent per American Diabetes Association standards (2012) and unmanaged diabetes is considered to be levels of HbA1C levels over 6.5 percent.

Finally, SPSS is not the recommended statistical software for conducting mediation analyses because conducting a path analysis using SPSS requires multiple regressions and calculations of the indirect effect and the significance of said indirect effect. Path analysis using SPSS creates the problem of alpha inflation by conducting multiple tests. However, SPSS was the software the researcher has had the most experience with and had it easily available. If the researcher was to conduct the study again, they may choose to use a different software.

CHAPTER 7

CONCLUSION

A positive development in the healthcare field is that more attention has been dedicated on health literacy; health literacy is a central focus of Healthy People 2030. One of the initiative's overarching goals demonstrates this focus: "Eliminate health disparities, achieve health equity, and attain health literacy to improve the health and well-being of all" (Office of Disease Prevention and Health Promotion [ODPHP], n.d.). Healthy People 2030 addresses both personal health literacy and organizational health literacy and provides the following definitions: "Personal health literacy is the degree to which individuals have the ability to find, understand, and use information and services to inform health-related decisions and actions for themselves and others"; and "Organizational health literacy is the degree to which organizations equitably enable individuals to find, understand, and use information and services to inform health-related decisions and actions for themselves and others" (ODPHP, n.d.). These definitions are a change from the health literacy definition used in Healthy People 2010 and Healthy People 2020: "the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (ODPHP, n.d.). This change represents a shift in policy on how health literacy is defined and operationalized. It includes a) emphasizing people's ability to use health information rather than just understand it; b) focusing on the ability to make "well-informed" decisions rather than "appropriate" ones; c) incorporating a public health perspective; and d) acknowledging that organizations have a

responsibility to address health literacy (ODPHP, n.d.).

Having health literacy be one of the pillars of Healthy People 2030 is an important milestone as it shows that government and healthcare are understanding how significant health literacy is to health equity. By increasing health literacy, healthcare systems can address chronic conditions from a social determinant standpoint and start preventative and early interventions to manage chronic conditions.

APPENDIX A

GLOSSARY OF HEALTH LITERACY TERMS

<i>World Health Organization (2007)</i>	The cognitive and social skills which determine the motivation and ability of individuals to gain access to understand and use information in ways which promote and maintain good health.
<i>American Medical Association (2017)</i>	The constellation of skills including the ability to perform basic reading and numeral tasks required to function in the healthcare environment.
<i>Nutbeam (2008)</i>	The personal, cognitive and social skills which determine the ability of individuals to gain access to, understand, and use information to promote and maintain good health.
<i>National Academies of Sciences, Engineering & Medicine (2017)</i>	The individuals' capacity to obtain, process and understand basic health services needed to make appropriate health decisions.
<i>Kickbusch, Wait, & Maag (2005)</i>	The ability to make sound health decision(s) in the context of everyday life- at home, in the community, at the workplace, the healthcare system, the market place, and the political arena. It is a critical empowerment strategy to increase people's control over their health, their ability to seek out information and their ability to take responsibility.
<i>Zarcadoolas, Pleasant, & Greer (2005)</i>	The wide range of skills, and competencies that people develop to seek out, comprehend, evaluate, and use health information and concepts to make informed choices, reduce health risks and increase quality of life.
<i>Paasche-Orlow & Wolfe (2007)</i>	An individual's possession of requisite skills for making health decisions, which means that health literacy must always be examined in the context of the specific tasks that need to be accomplished. The importance of a contextual appreciation of health literacy must be underscored.
<i>Pavlekovic (2008)</i>	The capacity to obtain, interpret, and understand basic health information and services and the competence to use such information.
<i>Rootman & Gordon-Elbihbety (2008)</i>	The ability to access, understand, evaluate and communicate information as a way to promote, maintain, and improve health in a

	variety of settings across the life course.
<i>Ishikawa & Yano (2008)</i>	The knowledge, skills, and abilities that pertain to interactions with the healthcare system.
<i>Mancuso (2008)</i>	A process that evolves over one's lifetime and encompasses the attributes of capacity, comprehension, and communication. The attributes of health literacy are integrated within and proceeded by the skills, strategies, and abilities embedded within the competencies needed to attain health literacy.
<i>Yost et al. (2009)</i>	The degree to which individuals have the capacity to read and comprehend health-related print material, identify and interpret information presented in graphical format (charts, graphs and tables), and perform arithmetic operations in order to make appropriate health and care decisions.
<i>Adams et al. (2009)</i>	The ability to understand and interpret the meaning of health information in written, spoken or digital form and how this motivates people to embrace or disregard actions relating to health.
<i>Adkins & Corus (2009)</i>	The ability to derive meaning from different forms of communication by using a variety of skills to accomplish health-related objectives.
<i>Freedman et al. (2009)</i>	The degree to which individuals and groups can obtain process, understand, evaluate, and act upon information needed to make public health decisions that benefit the community.
<i>Sorenson et al. (2012)</i>	Health literacy is linked to literacy and entails people's knowledge, motivation and competencies to access, understand, appraise, and apply health information in order to make judgements and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course.

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