A RAPID LITERATURE REVIEW OF HEALTH LITERACY AS A DETERMINANT OF FAMILIAL OBESITY LEVELS

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ABSTRACT

Obesity can result in increased medical costs, risk for chronic diseases, and decreases in quality of life. Multiple factors influence an individual's weight; however, their health literacy level is one factor that influences a person's ability to make informed health choices and is often overlooked in the literature. This rapid literature review examines the prevalence, determinates, and costs associated with obesity as well as barriers individuals face in addressing the condition. Health Literacy is examined as a social determinant of health and a contributing factor to obesity. Although there is a large body of literature addressing both obesity and health literacy separately, a literature search identified only three publications which met inclusion criteria examining the relationship between obesity and health literacy. Although there are a small number of included articles and limited scope of the review, the lack of formative research did identify a significant gap. More studies are needed to define the impact and design interventions for the public. Understanding how low health literacy impacts individual's ability to seek and understand health messages, and to make changes in their lives is of public health significance.

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LIST OF ABBREVIATIONS

BRFSS-Behavioral Risk Factor Surveillance System

CAD-Coronary Artery Disease

CBPR-Community Based Participatory Research

CDC-Centers for Disease Control and Prevention

HANES- US Health Literacy Scale

HBM-Health Belief Model

HL-Health Literacy

HLQ- Health Literacy Questionnaire

NVS-Newest Vital Sign

OA-Osteoarthritis

REALM-Rapid Estimate of Adult Literacy in Medicine

SDOH- Social Determinants of Health

STOFHLA-The Short Test of Functional Health Literacy in Adults

TB/TTG- Teach Back, Teach to Goal

TOFHLA-Test of Functional Health Literacy in Adults

WHO-World Health Organization

PREFACE

I would like to thank all those whose support and encouragement enabled me to persevere and finish my degree.

First, I would like to thank my committee Dr. Elizabeth Felter and Anna Voelker for being willing to work with me through this process. I learned a great deal about my topic and was able to improve my research and writing skills. I would especially like to thank Dr. Felter for the support, meetings and for dealing with my endless emails.

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1.0 INTRODUCTION

In the United States, more than two in three adults are now considered to be overweight or obese (CDC, 2018). Obesity results in greater costs for not only the individual, but also the health care system. Individuals experiencing obesity are at increased risk for diseases such as osteoarthritis (OA), coronary artery disease (CAD), type II diabetes, cancers, sleep apnea, high blood pressure, and fatty liver disease (WHO, 2018). The costs are not only physical but also financial; the estimated annual increased cost of health care for an obese individual vs. a normal weight individual is $1,429 (CDC, 2018). Healthy People 2020 identified goals for the reduction of obesity in both adults (NWS-9) and children and adolescents (NWS 10.4) of 10% from the baseline. The most recent data shows that instead, obesity has risen in both categories, indicating that there is still considerable work to be done at the national-level (Healthy People 2020).

Obesity is a complex health issue. Multiple contributors to obesity have been identified including genetics, medication use, and lifestyle factors. One area that has been identified as an upstream factor for many chronic diseases, including obesity, is health literacy, which is distinct from overall, or prose literacy. Low prose literacy may affect health literacy; however, the association between them is complex. For example, an individual may have high overall literacy and still have low health literacy. Low or limited health literacy skills are more prevalent among certain population groups and may

contribute to poor health outcomes. Health information often includes highly technical terms, information and requires an individual to possess numeracy and critical evaluation skills. (USDHHS, 2013). The Office of Health and Human Services (2018) notes that "Persons with limited health literacy skills are more likely to have chronic conditions and are less able to manage them effectively, limited health literacy skills are associated with an increase in preventable hospital visits and admissions." Thus, an individual experiencing a chronic illness such as obesity combined with a co-morbid illness which may be affected by the weight status may have poorer outcomes as a result of limited literacy skills. Exploring interventions directed toward this issue is about meeting individuals and families where they are and attempting to bridge the gap in order to prevent further complications.

This review seeks to answer two central questions:

Q1: What is the relationship between the health literacy levels of parents and the weight of their children?

Q2: Does raising the health literacy of parents lead to a change in obesity levels in children?

To answer these questions, a literature review was conducted informed by a systems model which is inclusive of both intrinsic (internal) and extrinsic (external) causative factors. A model developed Nutbeam (2008) views health literacy as an "asset that can increase capacity for health action (personal, social and environmental)." Thus, according to Nutbeams' model, an individual who possesses increased levels of health literacy will be able to participate more fully in health promotion activities on multiple levels.

The purpose of this synthesis is to contribute to future work that seeks to comprehensively evaluate outcome measures of interventions that address health literacy, specifically focusing on weight status.

2.0 BACKGROUND

According to the World Health Organization (WHO), health is defined as “a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity” (International Health Conference, 2002). Obesity has an impact on every aspect of the WHO definition of health.

According to Harvard University in 1990, obese adults made up less than 15 percent of the population in most U.S. states (2018). By 2010, 36 states had an obesity rate of 25 percent or higher, with 12 of those states reporting rates 30 percent or higher. (Epidemic of Obesity: U.S. Obesity Trends," 2016). About 93.3 million adults were considered obese in 2016, which represented 39.8% of the population, more than double the rate from twenty-five years before. Additionally, for children ages 2-19 years, the prevalence was 18.5% or 13.7 million cases. There were disparities noted among populations. For example, Hispanics (47%) and non-Hispanic blacks (46.8%) demonstrated increased rates in both adult and childhood obesity rates when compared to non-Hispanic whites (37.9%) (Centers for Disease Control and Prevention, 2018).

BMI, or body mass index is the most common method used to classify weight status. BMI is a ratio of height vs. weight. In adults, overweight is defined as a BMI of greater than or equal to 25, while obesity is defined as greater than or equal to 30. Children have different standards for measuring BMI dependent upon age. (Obesity and overweight, 2018). Children ages 2-19 are demonstrating increased rates of obesity, currently approximately one in six are considered obese (NIDDK, 2017). In addition, one

in 13 have extreme obesity defined as being 100 pounds over the ideal weight, having a BMI of 40 or more, or a BMI of 35 with co-morbid conditions (CDC, 2018).

2.1. OBESITY IN CHILDHOOD

Childhood is a time of growth and development, both physically and psychologically. A child who is experiencing obesity, is likely to face numerous other challenges when compared to other children (Kaithakkoden, 2015). For example, children have an increased risk of cardiovascular disease and issues that are associated with that like high blood pressure and cholesterol. Additionally, developing pre-diabetes places a child at increased risk for actual diabetes long term, increasing the risk by 5-15 times (Serving Kids Hope, 2016).

Sleep problems such as sleep apnea are not uncommon in obese children, and place additional strain on the cardiovascular system and interfere with growth and development. Poor sleep patterns can also make school and extracurricular activities difficult for the child. (Serving Kids Hope, 2016.)

Obese children and adolescents are more likely to become obese adults. “About a third (26 to 41%) of obese preschool children were obese as adults, and about half (42 to 63%) of obese school-age children were obese as adults.” (Serdula MK, et al., 1993). Negative attitudes persist around weight, even among family members. This stigma can contribute to unhealthy eating habits (e.g. binge eating) and decreased physical activity (Serdula MK, et al., 1993). This suggests the need for intervention as early as possible,

taking a proactive approach to encourage appropriate weight-for-height and prevent long-term health, social, behavioral, and economic consequences.

2.2 OBESITY IN ADOLESCENCE

Adolescence is a time of continued growth and development for an individual. A major change during this time is the onset of puberty. The average age for reaching puberty in the United States in girls is 10.5 years old, but it ranges from seven to 13 years old. The average age of menarche is 12-and-a-half to 13 years of age, while in boys, onset of puberty is from nine to 14 years, but on average starts at 11.5 to 12 years old (Duke Health, 2017). Research shows that experiencing obesity may decrease the age that children enter puberty, thus placing them at risk for various health problems e.g. metabolic syndrome (Bradner, & Lustig,2008). During this time period, many individuals also experience a decline in activity levels also placing them at increased risk for weight gain which exacerbates weight gain. (Bradner, & Lustig,2008).

Early intervention, particularly for children, is key in preventing future complications. Children often learn by observing parental behaviors, and behaviors formed in childhood can be difficult to change in later life. (Russ, Larson, Tullis, & Halfon, 2013). Research suggests that multilevel, multigeneration interventions may be most successful in creating lasting change and therefore making meaningful impact.

2.3 SOCIAL & PSYCHOLOGICAL IMPACT ON YOUTH

There are profound psychological effects of obesity that can contribute to a lower quality of life, particularly in youth. One study found that obese adolescents and children were viewed more negatively than obese adults or senior citizens despite the fact that they have less personal responsibility and more environmental causality for their weight status. (Sikorski, Luppa, Brahler, Konig, & Riedel-Heller, 2012). These effects can lead to decreases in self-esteem, feelings of depression, and isolation from social groups. This can worsen unhealthy eating behavior, decrease activity levels and health seeking behaviors which further intensifies the problem.(Sikorski, Luppa, Brahler, Konig, & Riedel-Heller, 2012).

Socially and psychologically, children experiencing obesity also have extra challenges. Childhood is a life period when the self-esteem is developing and often dependent on the opinion of peers and social acceptance. For young people, self-esteem can be based on superficial things such as clothing, facial appearance and weight. According to Fraser-Thill, (2010) “Obese 9 to 12-year-olds had self-esteem issues that went far beyond physical self-worth. In other words, obese tweens tended to be unhappy with themselves in various ways — including socially - not just unhappy with their appearance.” Children in this age group felt out of place in comparison to slimmer peers, and as a result had lower self-esteem.

Behaviorally, obesity also has an impact on the child. “Parents noted that their obese children had more "internalizing" problems — problems in which anger is directed inward, which may manifest as depression, anxiety or eating issues” (Fraser-Thill, 2010).

Internalizing behavior may further exacerbate problems and make successful weight control more difficult for the child. Researchers found that females are at greater risk than males, 34% of obese white 13-14-year-old girls had low self-esteem (defined as < 10th percentile) compared to 8% of non-obese white girls (Kaithakkoden, 2015).

2.4 HEALTH LITERACY

While there are many contributing factors in the development of obesity, health literacy is an important area of consideration. According to Nutbeam (2000), there are three classifications of literacy, which are not measures of achievement, but rather a progression from basic to more advanced skills in terms of what literacy at that level enables the individual to do.

The first is basic/functional literacy are basic skills in reading and writing to be able to function effectively in everyday situations, also can be thought of as prose literacy. The second is communicative/interactive literacy. This is a more advanced set of cognitive and literacy skills, which, when combined with social skills, can be used to actively participate in everyday activities to extract information and get meaning from different forms of communication, and to apply new information to changing situations. The final is termed critical literacy. These are the most advanced cognitive skills which, together with social skills, can be applied to critically evaluate information, and used to exert greater control over life events and situations.

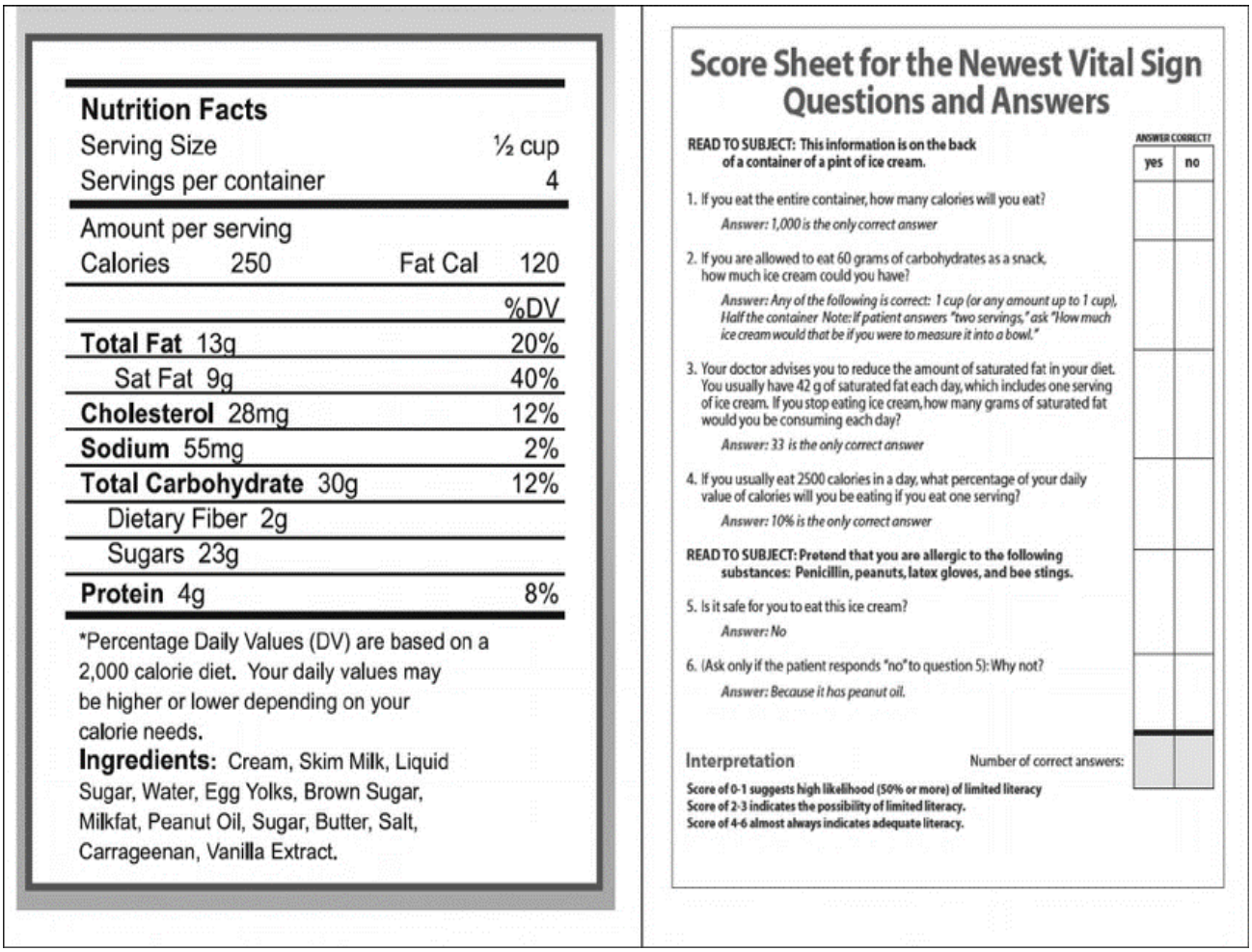
Distinct from literacy, is health literacy. Health literacy is defined as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (CDC, 2018). Levels of health literacy can be predicted by a person’s age, race, education status, culture, prior knowledge, demands of the situation, and health status. Health Literacy is multidimensional and includes elements such as numeracy, or the ability to understand and apply simple mathematical concepts, scientific literacy, and cultural literacy, which is the ability to understand and participate in a given culture (USDHHS, n.d.). Baker (2014) notes, “When patients have low overall literacy skills but high verbal fluency, their verbal fluency can mask their inability to interpret written information.” Therefore, it is appropriate to note the levels of health literacy in the population, as well as the skills that a person at each level may demonstrate when interacting within the healthcare system.

Culture impacts health literacy, influencing the reasons a person seeks out and interacts with healthcare system. Additionally, how individuals respond to recommendations to change for lifestyle changes and treatment may vary. For example, research by Juckett (2013) showed that Latino patients faced significant obstacles in obtaining healthcare due to culture. Many hospitals and healthcare facilities lack trained interpreters and in addition many Latino patients are accustomed to self-treating or use of alternative therapies.

Health literacy also includes numeracy skills for example, calculating dosages and blood sugar measurements, understanding nutrition labels or calculating co-pays for a health plan. Those with limited health literacy may have difficulty with these tasks or make errors leading to physician office or emergency room visits (Health.gov, n.d.)

2.4.1 MEASUREMENT OF HEALTH LITERACY

Standardized measurement of health literacy is accomplished using several methods. The Short Test of Functional Health Literacy in Adults (STOFHLA) is one example of a commonly used assessment tool. The Newest Vital Sign (NVS) assessment, shown below in Figure 1, is another assessment tool being used to quickly assess health literacy levels. Developed in 2005, The NVS is an assessment tool which can be rapidly administered in a clinical setting. The patient is presented with a nutrition label and asked to answer six questions based on the information provided. Questions focus on caloric and nutritional intake. Responses are recorded as either correct or incorrect, with correct responses being summed. A patient who responds with 4 or more correct responses is likely to have adequate health literacy, patients who respond with 2 or 3 correct responses have a possibility of limited health literacy, and patients who respond with 0 or 1 correct responses have a high likelihood of limited health literacy (Medicine, 2018). Administration time is between two-six minutes. Table 1 provides a listing and comparison of some additional commonly used health literacy assessment instruments.



Nutrition Facts

Serving Size	½ cup
Servings per container	4
Amount per serving	
Calories 250	Fat Cal 120
	%DV
Total Fat 13g	20%
Sat Fat 9g	40%
Cholesterol 28mg	12%
Sodium 55mg	2%
Total Carbohydrate 30g	12%
Dietary Fiber 2g	
Sugars 23g	
Protein 4g	8%

*Percentage Daily Values (DV) are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Ingredients: Cream, Skim Milk, Liquid Sugar, Water, Egg Yolks, Brown Sugar, Milkfat, Peanut Oil, Sugar, Butter, Salt, Carrageenan, Vanilla Extract.

Score Sheet for the Newest Vital Sign Questions and Answers

READ TO SUBJECT: This information is on the back of a container of a pint of ice cream.

ANSWER CORRECT?

	yes	no
1. If you eat the entire container, how many calories will you eat? *Answer: 1,000 is the only correct answer*		
2. If you are allowed to eat 60 grams of carbohydrates as a snack, how much ice cream could you have? *Answer: Any of the following is correct: 1 cup (or any amount up to 1 cup), Half the container Note: If patient answers "two servings," ask "How much ice cream would that be if you were to measure it into a bowl."*		
3. Your doctor advises you to reduce the amount of saturated fat in your diet. You usually have 42 g of saturated fat each day, which includes one serving of ice cream. If you stop eating ice cream, how many grams of saturated fat would you be consuming each day? *Answer: 33 is the only correct answer*		
4. If you usually eat 2500 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving? *Answer: 10% is the only correct answer*		
READ TO SUBJECT: Pretend that you are allergic to the following substances: Penicillin, peanuts, latex gloves, and bee stings.		
5. Is it safe for you to eat this ice cream? *Answer: No*		
6. (Ask only if the patient responds "no" to question 5): Why not? *Answer: Because it has peanut oil.*		
Number of correct answers:		

Interpretation

Score of 0-1 suggests high likelihood (50% or more) of limited literacy
Score of 2-3 indicates the possibility of limited literacy.
Score of 4-6 almost always indicates adequate literacy.

Source: nih.gov, 2005

Figure 1: The Newest Vital Sign Assessment Tool

Table 1: Health Literacy Assessment Instruments

Instrument	Use	Notes
US Health Literacy Scale (HALES)	Comprehensive, designed to differentiate between health-related competencies in multiple domains and between health literacy tasks and skills	
Health Literacy Questionnaire (HLQ)	Designed to conceptualize cultural and conceptual knowledge, speaking and listening skills, writing and reading skills, and numeracy	
Newest Vital Sign (NVS)	Developed to measure reading, comprehension, and numeracy using a nutritional label and a 6-item questionnaire. Brief assessment allows for rapid use in clinical setting	Developed in 2005 Administration time ranges from 2-6 minutes
Rapid Estimate of Adult Literacy in Medicine (REALM)	Considered “gold standard”	Only measures reading and pronunciation skills, and may be culturally insensitive or inappropriate for non-native English speakers
The Short Test of Functional Health Literacy in Adults (STOFHLA)	Uses two short passages with missing words, individual is instructed to choose the word that would fit into the passage. Numeracy is not assessed.	Developed in 1999
Test of Functional Health Literacy in Adults (TOFLHA)	Considered “gold standard”	Only measures reading and pronunciation skills, and may be culturally insensitive or inappropriate for non-native English speakers

Source: (“Medicine," 2018.)

2.4.2 HEALTH LITERACY LEVELS

In the United States, only 12% of adults have proficient health literacy, according to the National Assessment of Adult Literacy (healthaffairs.org, 2017). It was not until 2003, that the United States Department of Education, National Assessment of Adult Literacy (NAAL) contained a health literacy measurement component. Nearly nine out of ten adults may lack the skills needed to effectively manage their health and prevent disease. Disparities exist among populations with respect to health literacy proficiency, populations most at risk include; older adults, racial and ethnic minorities, people with less than a high school degree or GED, people with low income levels, non-native speakers of English, those with compromised health status, and migrants. The National Center for Education Statistics (2003) conducted a survey with a focus on health literacy which found a majority of adults had *intermediate* health literacy, over 75 million adults combined had basic and below basic health literacy. Women scored 6 points higher on average than men.

Research conducted by Griffey (2014) sought to understand whether there was an association between health literacy and a return visit to the emergency department within 14 days of the previous visit. It was found that 36.8% of patients with inadequate health literacy made return visits to the ED within 14 days" (Griffey et al, 2014). Also noted was that in patients with low health literacy, unscheduled returns to the ED may reflect a lack of comprehension of instructions for medications, return instructions, follow-up plans, or other reasons resulting in failure of patients to activate follow-up plans as intended.

Feelings of stigma and shame and overall entering the healthcare system sicker than counterparts were additional effects noted in patients with lower health literacy levels (Griffey et al, 2014).

Communication barriers can also prove to be problematic and place patients at in increased risk of hospitalization or negative outcomes. Table 3 below shows literacy levels of the population in addition to skills that an individual at that level may possess.

Table 2: Levels of Health Literacy

Level of Health Literacy	Population %	Skills demonstrated by this population
Below Basic	14%	Adults at the below basic level have only the most elementary literacy skills. An adult at the below basic literacy level might be able to locate and circle the date of a medical appointment on a hospital appointment slip.
Basic	29%	Adults at the basic level have the skills necessary to perform simple, everyday activities. An adult at the basic literacy level might be able to state two reasons a person with no symptoms of a disease should be tested for the disease based on information in a clearly written pamphlet.
Intermediate	44%	Adults at the intermediate level have the literacy skills necessary to perform moderately challenging activities An adult with intermediate literacy skills might be able to determine a healthy weight range for a person of a specified height, on the basis of a graph

TABLE 2 CONTINUED

Proficient	12%	Adults at the proficient literacy level have the skills to perform complex activities An adult at the proficient level might find the information required to define a medical term by searching through a document.

Source: CDC, 2003

2.5 MEDIA LITERACY

In 2011, about 30.2% (2.1 billion) of the world's population had access to the Internet, this includes 78.3% of North America. Searching for health information online is increasingly common, and internet users who look for health-related information include those individuals with limited health literacy skills **(**WebMD.com**,** 2012). E-health literacy can be defined as "The ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem" (Norman & Skinner, 2006).

Internet searches on smartphones and social media websites and apps are becoming more common and transforming healthcare. According to "The potential of many of the available and planned specialized mobile apps in reducing healthcare costs and improving clinical outcomes is huge" (Bolous, 2012).

Social media and social networking now reach 80% of active Internet users in the USA, and this is growing. According to pewinternet.org (2018), 88% of internet-active Americans ages 18-29 and 78% of those between 30-49 report using at least one social

media platform. Use among those aged 50-64 is slightly lower at 64% and 37% of those 65+ report using a social media platform. Over half (58%) report that the information found on their search impacted their health decisions, while 39% say the information changed the way they cope with a chronic condition or manage pain.

When individuals were surveyed about information found during an online search, 41% reported a medical professional confirmed their diagnosis, while 35% said they did not visit a clinician for follow-up. Those searching for health information online are not homogenous: Women are more likely to search than men, as are those who are college educated, those who earn $75,000 per year or more, white adults and younger adults. According to the Pew Internet and American Life Project, there are more than 800 million active Facebook users (half of them log on each day) and 100 million active Twitter users, therefore health messages posted on these platforms will likely reach a high number of individuals (pewinternet.org, 2018). According to Ottenhoff, (2012), “41% of people say social media would affect their choice of a specific doctor, hospital or medical facility and 30% of adults say they are likely to share information about their health on social media sites with other patients”. The CDC has best practice guidelines for use of Twitter as a platform to share health information. These guidelines include having clearly defined objectives, keeping messaging simple (using 120 characters or less), knowing the target audience, and lastly regular evaluation of posts for user engagement and comments (CDC, 2018).

There are risks to obtaining health information from media sources. According to the CDC (2018) some of the risks include; spreading incomplete or misinformation, information that users are not able to understand, and users being able to freely write and

post comments on pages may misinform others. To mitigate some of these risks, the CDC and other experts offer guidelines, training and marketing materials focusing on health and media literacy. Suggestions include tailoring the material to the audience, designing messages that are participatory and user-centered, and regular monitoring updating of information (CDC, 2018). Figure 2 below shows a screen from a free app, The Plain Language Medical Dictionary a widget from the Michigan Health Literacy Awareness project (U-M Library," 2015). This smartphone app allows patients at various health literacy levels to access and understand information in layman terms.

NIH developed a scale for assessment of E-health literacy, eHEALS: The eHealth Literacy Scale, was developed. eHEALS is a self-report tool that can be administered by a health professional and is based on an individual's perception of her or his own skills and knowledge within each domain. "The instrument provides a general estimate of consumer eHealth-related skills and can be used to support clinical decision-making with individuals and health promotion planning with specific populations. (Norman & Skinner, 2006). This assessment is a 10-item instrument with, 5-point Likert scale questions. It measures knowledge of existing eHealth resources, how to find resources, how to evaluate, how to use resources and how to apply eHealth resources to health problems. It can be administered to a multicultural population, ages 12-91 years, and is currently in use in 10 countries. (Norman & Skinner, 2006).

Source: U-M Library, 2015

Figure 2: The Plain Language Medical Dictionary

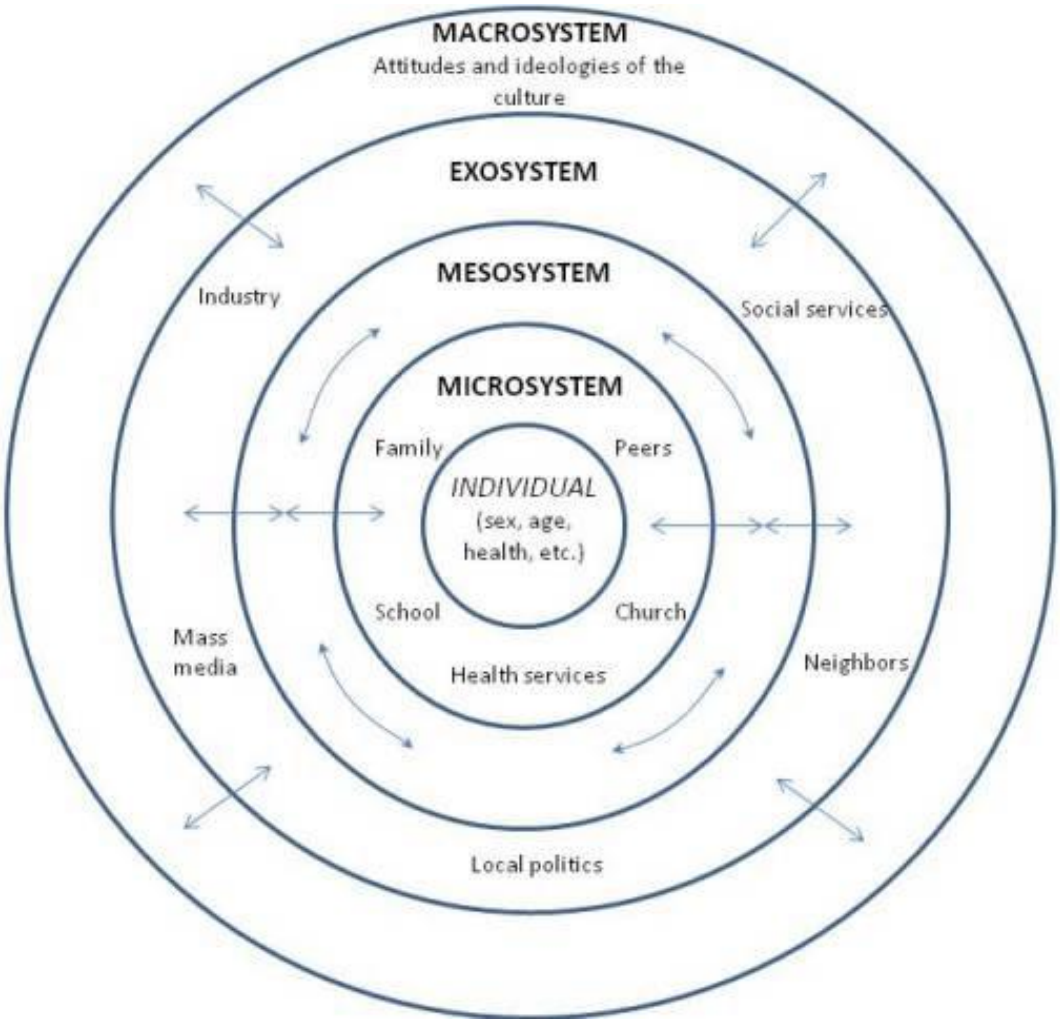
2.6 SOCIAL DETERMINANTS OF HEALTH

Public health practitioners know that multiple influences shape the individual and contribute to health or development of disease. These conditions are known as the Social Determinants of Health (SDOH). The SDOH are the environmental conditions in which

people grow, live, work and age. (Healthy People 2020, n.d.) For example, the SDOH can include:

- Income
- Neighborhood & Community Conditions
- Education
- Social Support
- Housing Conditions and Availability
- Access to Health Services.

The Socioecological Perspective is another method to examine the impact that health knowledge has on the individual. (health.gov, 2005). This model illustrates the macro and micro levels that impact health and health outcomes. The “layers” of influence that have an effect on individuals and families can contribute to positive or negative outcomes and should considered by public health practitioners when researching problems or designing interventions. Figure 3 below provides a visual depiction of the model.



Source: Researchgate.net

Figure 3: The Socio-Ecological Model

At the individual level, programs “which meet people where they are” are more likely to be accepted and maintained. Physical activity, food preparation and consumption often have deep cultural, personal and traditional roots and should be respected. Health literacy at the individual level can be understood of as how do levels of knowledge and the ability to apply this affect myself?

Social and cultural norms are prevalent within a community, thus making modifications can be challenging. Socially acceptable attitudes regarding food, body image and weight are among the most difficult to alter. However, these changes can have a lasting and powerful effect on health status. “Shared assumptions of appropriate behaviors, based on the values of a society, are reflected in everything from laws to personal expectations” (health.gov," 2015). Health literacy’s influence at the social level can be understood in the following ways; How does the person communicate within groups they are in? Can they give and receive needed information? Does the individual feel accept within social groups and acceptable to one’s self?

The Built Environment is comprised of the places and spaces which have been created or modified by people. This includes parks, buildings and transportation systems. The built environment also includes access to food, and the “walkability” or “bikability” of an area an individual lives in. Health Literacy at this level examines the influence of the environment and the individual’s ability to successfully negotiate it to meet their needs.

Policies and legislation related to obesity vary. Nationally, initiatives such as Healthy People 2020 include objectives that serve to measure progress toward health goals. Weight status of adults and children are measured goals of HP2020. There are 22 nutrition and weight status goals in HP2020. Some of the objectives include reducing consumption of calories from sugar and reducing iron deficiency in children and females. Also included are objectives to increase consumption of dark leafy green vegetables, whole grains, and to increase the proportion of physician visits that include diet and nutrition counseling. Policy level objectives related to weight included in HP2020 include increases in the number of schools that provide fruit or vegetables to children at lunch,

decreasing the number of schools that sell sugar sweetened beverages and increasing the number of Americans who have regular access to a food outlet that sells a variety of foods (Healthy People 2020, n.d.).

Individual states also have anti-obesity initiatives, for example, certain states have implemented laws concerning foods sold to children in schools. Research by Hennessy et al., (2014) found that “Children living in states with weak competitive food laws for middle schools had over a 20% higher odds of being overweight or obese than children living in states with either no or strong school competitive food laws”.

2.6.1 HEALTH LITERACY POLICY

National Policies are also in place for health literacy, such as the National Action Plan to Improve Health Literacy, and goals outlined in HP2020. The National Action Plan to Improve Health Literacy is based on two core principles: 1) People have the right to health information that helps them make informed decisions; 2) Health services should be delivered in ways that are easy to understand and that improve health, longevity, and quality of life ("National Action Plan to Improve Health Literacy - health.gov," 2019). HP2020 goals related to health literacy are included in the five SDOH, which are 1) Economic Stability, 2) Education, 3) Health and Health Care, 4) Neighborhood and 5) Built Environment and Social and Community Context. Health Literacy is included in the Health and Health Care domain (Healthy People 2020, n.d.).

The effects of the policy level health literacy understanding on an individual can be understood as is the individual able to be an active participant in their environment? Do

they understand how policies affect themselves and others? Do they feel self-efficacy and empowered to make a change when needed?

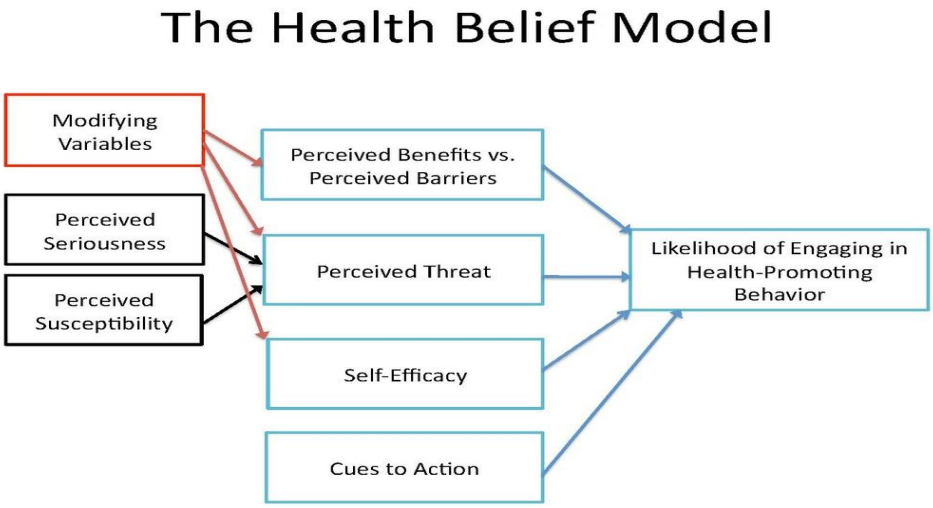
2.6.2 RELEVANT HEALTH BEHAVIOR MODELS

The Health Belief Model (HBM) can be used to explain and predict health behaviors. Health behaviors which are actions taken by an individual that affect health state. This is a useful knowledge base for stakeholders when designing interventions aimed at a target population.

The HBM is based on an individual's perception of risk and severity of experiencing an event, and the perceived obstacles they face to change. A later addition to this model is the concept of self-efficacy. This concept helps the model fit with challenges which could be influenced by disparities in knowledge or services. Examples of challenges are both unhealthy and unsafe behaviors. The concept of self-efficacy refers to the competence to perform a behavior to reduce the risk of experiencing the event. According to the HBM, a person may only begin to act when a cue is given that there is a risk or reason to do so. (Razmara, Aghamolaei, Madani, Hosseini, & Zare, 2018).

According to a 2018 article by Larki, Tahmasebi, and Reisi, "This model has emphasized the role of moderating factors (demographic, social, and structural factors) and individual perceptions (perceived sensitivity, perceived severity, perceived benefits, perceived barriers, guidance for action, and self-efficacy) in determining the likelihood of performing a behavior". Using the HBM, shown in figure 4 below as a model for understanding obesity, health literacy can be thought of as a skill an individual has to increase the likelihood of taking necessary actions to improve health or prevent negative

outcomes**.** Findings in a recent study indicated that self-efficacy is associated with adhering to a diet, engaging in physical activity, not smoking, and utilizing common weight management strategies in patients with low health literacy, while additionally demonstrating a positive relationship between self-efficacy and self-care behaviors (Larki, Tahmasebi, & Reisi, 2018).



Source: Alcock, L (2016)

Figure 4: The Health Belief Model

2.7 ECONOMIC IMPACTS OF OBESITY AND LOW HEALTH LITERACY

The costs associated with low health literacy occur across multiple levels, affecting the system as a whole as well as the individual. These costs can be substantial and are estimated at 3–5% of the total United States health care cost; and on the patient level: $143–7,798 per person (Eichler, Wieser & Brügger, 2009).

In the United States, limited health literacy is estimated to account for 7-17% of all healthcare costs or approximately $612 billion dollars, meanwhile costs were estimated at 3–5% of the total health care budget for Canada in 2009 (WHO, 2013). A 2007 analysis calculated that individuals with low health literacy cost, on average, an additional $993 per admission (Leuck, 2007). Obesity in addition to its healthcare costs, is an expensive condition to the healthcare system, as well as for the individual.

For the individual, increased costs can come in many forms. According to Peng (2008), for obese individual, there are five top financial impacts. One such cost is extra airline travel costs. Airlines may require an obese individual to buy an extra ticket, and in addition heavier passengers require more fuel for air travel resulting in increased spending. Airlines spent an additional spent $275 million on an additional 350 million gallons of fuel, according to a 2004 Centers for Disease Control report. Another area of added expense is increased gasoline use. Increased weight burns more gasoline in cars, too. Americans pumped 938 million more gallons of fuel a year than they did in 1960 because of weight. That adds up to roughly $3.55 billion in increased annual gas expenditures. Financial impacts can also come in the form of losses. Another impact of obesity is fewer work hours. On average, obese workers tend to lose a week of work a

year due to ailments related to their condition. A company of 1,000 employees loses $285,000 a year due to obese employees' absenteeism. In addition to fewer work house, individuals may earn lower wages. Obese men and women earn, on average, $3.41 per hour less than their peers. Over the course of a year, that amounts to $7,093 in lost income. Finally, overall higher medical costs. Overweight males incur medical costs that are $170 more annually than their average weight co-workers, while overweight females incur costs $495 higher than their counterparts.

The healthcare system also incurs additional costs obese individuals. Oversized wheelchairs can cost about $2,500, eight times the cost of an ordinary wheelchair, while operating tables that are strong enough to support the severely obese can cost $30,000 (Peng, 2008). Childhood obesity alone is responsible for $14 billion in direct medical costs (Eichler, Wieser, & Brügger, 2009).

One way some healthcare plans are attempting to decrease these costs is to encourage primary care visits. For example, certain health plans offer monetary incentives. Tufts health plan offers a $55 well care card at the completion of a member's annual visit, while WellCare of Georgia offers a $30 gift card if a member sees a PCP within 90 days of enrollment (Mingeualt, 2017). Minuteman Health of Massachusetts also offers an incentive of $50 for visiting a PCP in a calendar year, 9300 members or 40% took advantage of the program in 2016 (Mingeualt, 2017). The program encourages building a relationship with a provider, early identification and treatment of conditions as well as reducing the need for more expensive referrals to specialists.

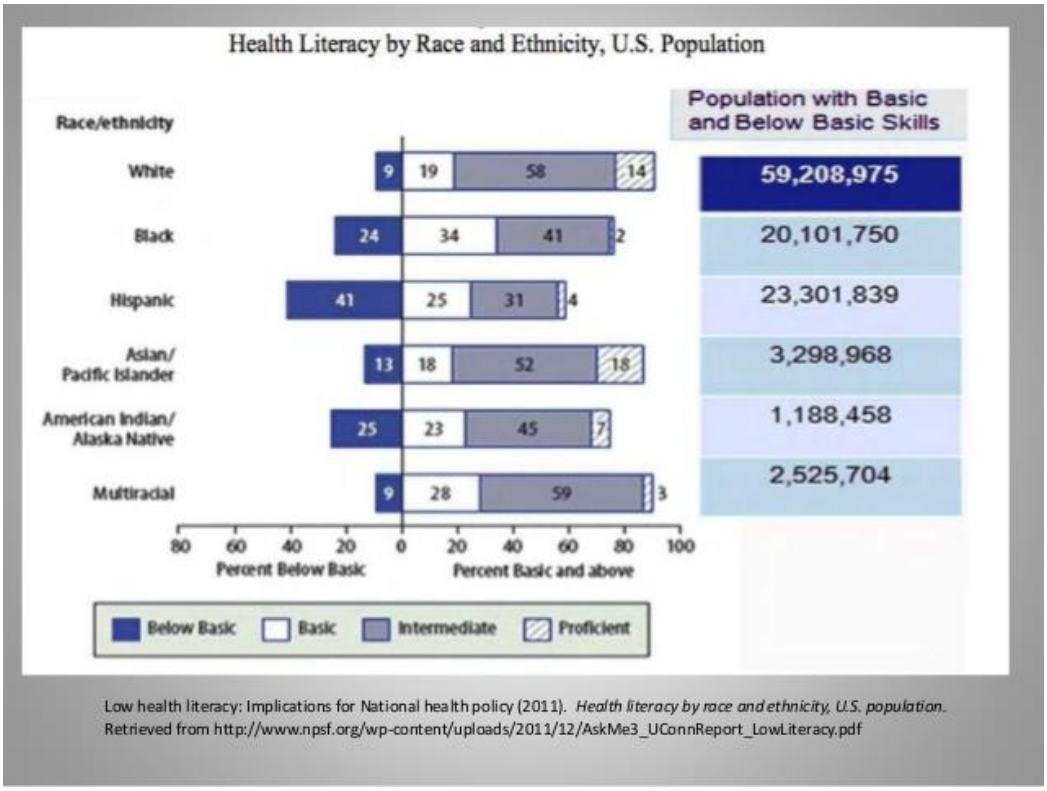
An additional consideration is the reimbursement that physicians receive from third party payors for obesity counseling. This payment was only made available beginning in

November 2011 and is $25 for 15 minutes. The patient must have a BMI of 30 or more (obese). For a patient for may be at risk of becoming obese i.e. a BMI of 27 (overweight) this would not be a covered service (Dowling, 2018)

The savings that could be achieved by improving health literacy are estimated to be between $106 billion and $238 billion (healthycommunitieshealthyfuture.org, 2015). Which translates into enough funds to insure every one of the more than 47 million persons who lacked coverage in the United States in 2006, according to recent Census Bureau estimates (census.gov, 2018).

2.7.1 DEMOGRAPHICS AND HEALTH LITERACY

The majority of those with low health literacy skills are native born, white Americans, however racial and ethnic minorities are disproportionately affected by low health literacy levels (Vernon et al., 2007). For example, 58% of African Americans or 20.1 million individuals and 66% or 23.3 million individuals have “basic” or “below-basic” health literacy skills compared to 28% of Whites. Only 2% of African Americans were considered “proficient” in health literacy, with Asian/Pacific Islanders having the highest “proficient” health literacy levels at 18%. Figure 5 below provides a visual breakdown of health literacy by race and ethnicity.



Source: npsf.org

Figure 5: Health Literacy by Race and Ethnicity, U.S Population

2.8 SUMMARY

Obesity is a public health problem because of the range of health implications across the life span, as well as the increased costs to the healthcare system and individuals. Health literacy is a public health problem because individuals with less than adequate levels of health literacy experience disparities in accessing and understanding health information which can contribute to an increase in negative health outcomes.

Theories support the relationship between obesity and socio ecological factors an individual experiences in life. An individual's health literacy level has an impact across all levels of the socioecological model, and therefore is an important consideration for improving outcomes.

The next section will explore current research and interventions related to both childhood obesity and health literacy.

3.0 METHODS

3.1 SEARCH STRATEGY

The search was completed through Google Scholar, JSTOR, PubMed, and Scopus, which also included ProQuest. These were chosen for their broad coverage range of the social sciences as well as health communication topics. The databases were searched for coverage up to February 27th, 2019. Any additional articles were extracted using reference lists at the end of key articles. The Boolean terms “AND” and “OR” were used for the search. The keyword search was limited to terms which appeared in the main title and abstract. This limitation was important as the articles must exclusively include some element of measuring health literacy in an intervention with children, their families, or both. This ensured the greatest reach of relevant articles and the narrowing down of the number of articles found. The terms in Figure 6 formed the parameters of the search**.** Child was defined as all children ages 0-19 years of age. “Adolescent” was defined using the World Health Organization (WHO, 2018) standards of adolescents ages 10-19 years old, and young children were classified as ages 0-9 years old. After the search was conducted, various term searches were completed and tested for the range of capture for each term (Figure 1 and 2), the search terms for this synthesis were narrowed.

Obesity	Children	Family	Literacy	Interventions
Overweight Obese Obesity	Youth Infant Child Adolescent	Caregiver Kin(ship)* Famil(ies)* Parent(s)	Health Literacy	Interventions

Figure 6: Terms Used in the Search, by Domain

Terms in the main keyword search include: • (child* OR adolescent* OR child* OR infant* OR child* OR youth*) AND obesity OR overweight • (parent* OR caregiver* OR famil* AND obesity) AND (child* OR adolescen* OR child* OR infant* OR child* OR youth*) • AND Health Literacy*AND Intervention* AND Health Literacy*

Table 3. PubMed Search Terms

PubMed Terms Search (All Years)		
Search Terms or Strategies Used (Limits: No MESH and no keyword search.)	# of Hits/Results	Notes
Childhood Obesity	17587 **Title/Abstract**	
Health Literacy	3079 **Title/Abstract**	

Table 3 Continued		
Adolescent Obesity	41509 **Title/Abstract**	
Health Literacy AND Intervention	2026 **Title/Abstract**	Term search results include childhood obesity AND (hasabstract[text] AND Humans [Mesh] AND (infant [MeSH] OR child [MeSH] OR adolescent [MeSH]))
Obesity AND Intervention AND Health Literacy	224 **Title/Abstract**	
Childhood Obesity AND Health Literacy AND Intervention AND Scale OR Measure	5 **Title/Abstract**	("pediatric obesity"[MeSH Terms] OR ("pediatric"[All Fields] AND "obesity"[All Fields]) OR "pediatric obesity"[All Fields] OR ("childhood"[All Fields] AND "obesity"[All Fields]) OR "childhood obesity"[All Fields]) AND ("health literacy"[MeSH Terms] OR ("health"[All Fields] AND "literacy"[All Fields]) OR "health literacy"[All Fields]) AND ("methods"[MeSH Terms] OR "methods"[All Fields] OR "intervention"[All Fields]) AND ("weights and measures"[MeSH Terms] OR ("weights"[All Fields] AND "measures"[All Fields]) OR "weights and measures"[All Fields] OR "scale"[All Fields])

3.2 INCLUSION CRITERIA

Inclusion criteria considered what was considered in previous articles to help limit the scope of research.

- Articles must be peer-reviewed;
- The language of the publication must be in English only;

- The intervention must include outcome measures and evaluation related to health literacy, including assessment of health literacy
- The research should involve children, caregivers, or the whole family
- A scale should be used to measure pre/post intervention results

For this synthesis, the time frame was limited to literature published since 2000, additionally the literature search was inclusive of publications on a global scale due to the potential for limited scope of available research. The decision not to include measured weight change as an outcome in inclusion criteria was based upon both the limited amount of available research.

3.3 DATA EXTRACTION

Data taken from eligible studies included information on study design, and relevant outcomes. Information extracted for study design included total sample size and composition, time period studied and geographical area. The outcome measures included information on changes in knowledge and behavior related to the intervention. Information on assessment instruments used was also collected.

4.0 RESULTS

The results of the literature review are found in Table 2, while themes and outcome measures are listed in table 3. Additionally, the process that was used to evaluate inclusion of articles is below in figure 2.

Three studies were selected from the 250 publications identified following the rapid review (Figure 5). Preliminary title and abstract review, as well as checking for duplicates across the databases led to the exclusion of 35 publications. After cross checking the reference list for duplicates, the potential number examined for further review was 204.

The primary reason for publications not being included in full review was failing to meet the full inclusion criteria. Three publications were identified and selected for full review (Table 4). For example, one article was a doctoral dissertation which examined the effect of support calls as a health literacy intervention (Hou, 2016).

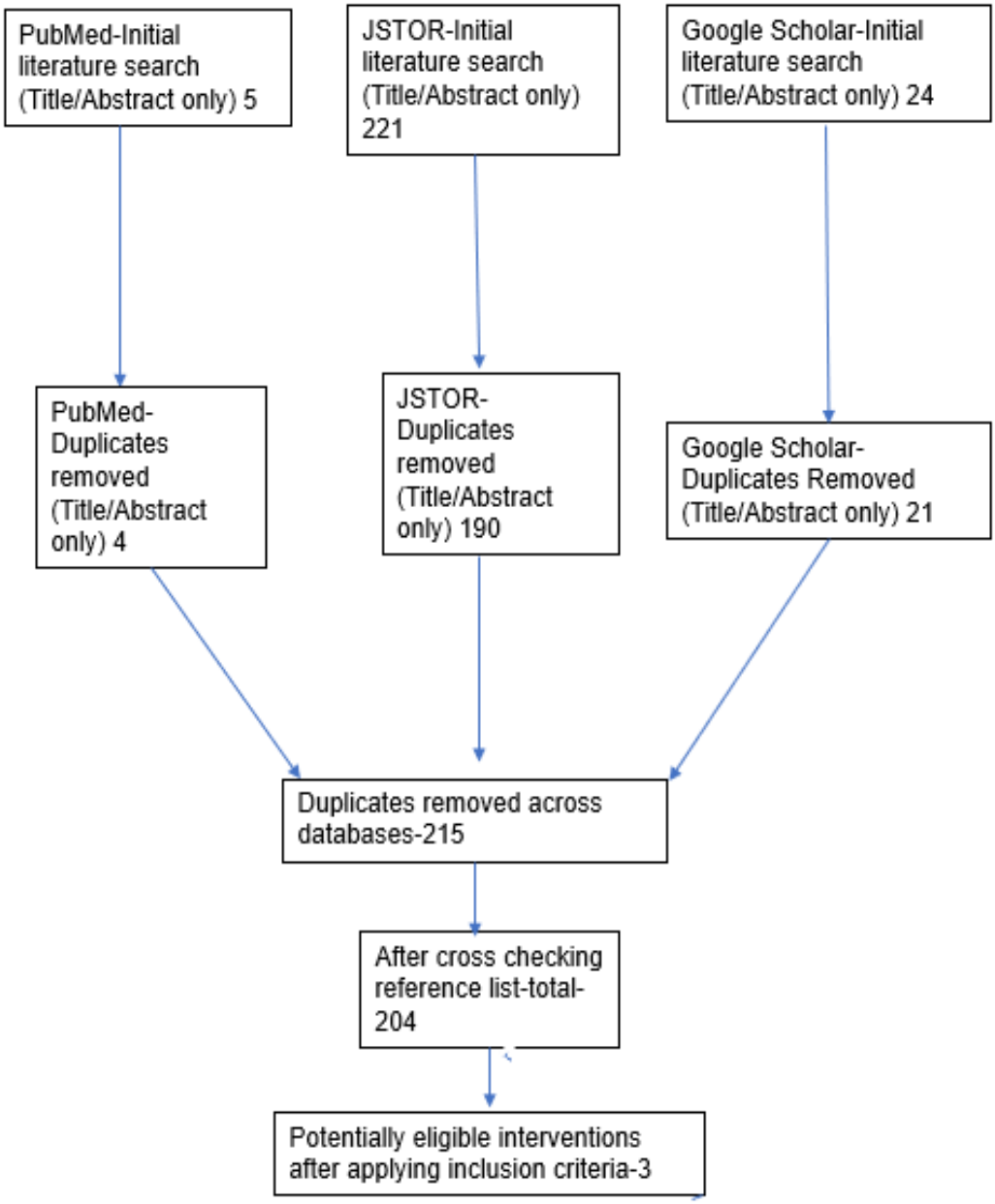


Figure 7: Process to Evaluate Inclusion and Exclusion of Articles

4.1 INTERVENTION CHARACTERISTICS

Only three studies (Table 4) were identified that met the full inclusion criteria and represented interventions with a health literacy focus on a parent/child dyad. Two studies were conducted in 2013, and one in 2017. All studies were conducted in the United States.

One study was a pilot study by Fleary, Heffer, McKyer and Taylor (2013) and published in *The Journal of Family Medicine.* This study explored the relationship between lack of knowledge and skills and the parent's ability to seek preventative healthcare. The purpose of the study was to pilot an intervention delivered to parents of children to improve health literacy, and to increase practical skills to make more positive life choices. The author notes that this study was originally conceptualized using Bronfenbrenner's Socio Ecological Model which has predictive value for health literacy (Fleary, Heffer, McKyer & Taylor (2013). The units of analysis were study specific measures developed to assess health literacy which included socioeconomic and sociocultural components reflective of the Bronfenbrenner model. The author completed focus groups with participants following preliminary assessments which were at a 7th grade or below reading level. The intervention was developed using information from the focus groups as well as the assessments and administered over five weekly 90-minute sessions.

Another study included was an RCT conducted by Gross et al, (2017) and published in *The Journal of Obesity.* This study explored infant activity at three months and the relationship to health literacy. The purpose was to test the effect of a primary

care-based child obesity intervention called “Starting Early” which promoted infant activity in low income Hispanic families. The authors note that lower infant physical activity has been associated with increased infant body fat and therefore becoming overweight (Gross et al, 2017). The units of assessment were telephone surveys administered in either English or Spanish at infant age three months. Health Literacy was assessed using the NVS. 456 mother/infant dyads completed this assessment.

Finally, the third study was a quasiexperimental study conducted by Zoellner et al. (2017) and published in the *Journal of Preventing Chronic Disease.* This study explored the influence of parent health literacy status on reach, attendance, retention and outcomes in a family-based obesity treatment program. The purpose of this study was to trial the assessment iChoose. According to the author, this intervention significantly decreased child weight status in the range of effects of previous trials. There was no main intervention on child screen time, however this study noted that parent health literacy status did have an impact on this variable. Children of parents with low health literacy demonstrated an additional 1 hour per day of screen time, which amounted to a child health disparity (Zoellner et al, 2017). The units of analysis for this study were the NVS, as well as items taken from the BRFSS (Behavioral Risk Factor Surveillance System), and the Godin Leisure Time Exercise Questionnaire.

Table 4: Interventions by Outcome Measures, Outcome, and Sample

Reference Year, Name	Intervention Type	Sample	Finding	Misc.
Fleary, S., Heffer, R. W., McKyer, E. L., & Taylor, A. (2013). A parent-focused pilot intervention to increase parent health literacy and healthy lifestyle choices for young children and families.	Pilot Study assessing HL of mothers recruited from Head Start and teenage pregnancy Agencies.	Recruited 21 Mothers of young children, Mean age of mother=23.14 yrs. 21 mothers recruited, 13 enrolled and 9 completed all measures at 1 month.	Participants' knowledge of the relationship between diet/nutrition and disease (Disease) was significantly lower at posttest when compared to pretest, Participants also gained knowledge about stress, sleep hygiene and physical activity during the intervention. Parents enrolled demonstrated increased HL following intervention.	Study specific measure of HL, included socioeconomic and sociocultural information
Zoellner, J. et al. (2017). The Influence of Parental Health Literacy Status on Reach,	Quasiexperimental Trial exploring the reach, attendance and outcomes in a three-month multicomponent family-based program to treat childhood obesity	101 enrolled children-52% male, 60% black 94 enrolled parents-93% female, 60% black, mean age 39.7 yrs.	The intervention significantly decreased child weight status in regardless of HL status, however the	NVS-Newest Vital Sign used as measurement

Table 4 Continued

Attendance, Retention, and Outcomes in a Family-Based Childhood Obesity Treatment Program, Virginia, 2013-2015.	(iChoose). Study was conducted in the Dan River region of Virginia.		children of low HL parents saw a more significant change (z=0.06 lowHL) vs (z=0.05 highHL) children of parents with low HL decreased screen time by 2.35 units (1 unit= approx. I hr.)	
Gross., Mendelsohn., Yin, Tomopoulos , Gross, Scheinmann & Messito (2017). Randomized controlled trial of an early child obesity prevention intervention: Impacts on infant tummy time.	Randomized controlled trial (RCT) Completed at a large NYC hospital and a neighborhood health clinic Explored infant activity at 3 months and tested the efficacy of a primary care-based child obesity intervention	456 mother infant dyads completed the 3-month assessment. 221 intervention cases, 235 control. Mean infant age was 3.4 months	Low Health literacy was associated with decreased floor time (unrestrained physical activity) in infants	NVS used to assess health literacy in mothers Intervention group was more likely to practice tummy time-86.4% vs 78.9%

5.0 STUDY OUTCOMES

Several types of outcome measures were used by the authors of the publications included in this review. Health Literacy was assessed in each study. Parental knowledge of health and the ability to understand and seek preventative healthcare, infant activity time, and finally reach/attendance at a family-based obesity treatment program were the outcomes measured. The results are summarized in Table 4. The most common assessment tool utilized in the publications was the NVS.

The article by Fleary, Heffer, McKyer and Taylor (2013) found that insufficient parental health literacy posed a barrier to the prevention of obesity in children. The authors noted that this study was innovative due to linking knowledge to behavior, with the opportunity to immediately practice the skills. 70% of participants introduced a new behavior, 55% eliminated an unhealthy behavior, 27% maintained a healthy behavior and 100% were working on improving their relationship with their children (Fleary, Heffer, McKyer and Taylor, 2013).

Research conducted by Gross et al (2017) demonstrated a relationship between low health literacy and unrestrained infant movement. The authors noted parents reported infrequently receiving information regarding use of movement restricting devices (e.g. bouncy seat) and that messages were confusing and inconsistent. Increased unrestrained movement in infancy builds muscle and is associated with earlier motor development and future physical activity. The authors go on to mention the significance of low infant physical activity being associated with total increased infant body fat, rapid weight gain and risk for becoming overweight in adulthood (Gross et al, 2017).

Additionally, it was noted that few studies have reported on infant activity and instead focused on infant feeding. As such, this is an important focus area. Parents were assessed for baseline health literacy level. They then participated in role modeling as well as education sessions to provide them with tools to be successful in choosing healthy behaviors. Parents completing this intervention demonstrated a significant increase in unrestrained floor time, 28.9% pretest vs 40.6% post intervention (Gross et al, 2017).

A limitation of this study was the population was comprised solely of Hispanic and Latina mothers. Further research with more diverse populations is warranted to see if the results of the study prove to be generalizable.

Additionally, the article by Zoellner et al (2017) examined the influence of parental health literacy status on weight related child outcomes**.** "One systemic review found that adults with low HL are up to 4 times more likely than adults with high HL to exhibit negative health behaviors that affect child health" (Zoellner et al, 2017). Although no significant differences in health literacy were noted in parents who enrolled their children or not, 34% of enrolled parents in the study had low HL, which the author noted. The authors also highlighted that there was a void in the literature addressing child health equity including programs designed to meet the HL needs of parents.

Overall, the authors concluded that interventions directed at health literacy can improve outcomes for overweight or obese children. It was suggested that longer post intervention follow ups, studies on a larger scale, and those that involve assessment of movement vs. feeding can improve the correlation between health literacy and child obesity. In addition, the authors collectively noted a gap in available validated health

literacy measures for children, especially 8-12 years old as well as a lack of formative research with a focus on health literacy.

6.0 DISCUSSION

The research questions for this review were 1) was what is the relationship between the health literacy levels of parents and the obesity status of their children, and 2) was does raising the health literacy of parents lead to a change in obesity levels in children? My hypothesis for research question 1 was that there would be evidence to show that low health literacy in parents has an impact on the development of obesity in children, while my hypothesis for research question 2 was that an increase in health literacy of parents would lead to a change in obesity levels of their children.

Consistent with expectations, there is a demonstrated correlation between increased health literacy and changes in weight (Fleary et al, 2013). Research showed that when parents or caregivers with low health literacy are provided with skills and support, that children demonstrate more positive health outcomes (e.g. weight changes). One example of this was demonstrated by in the study by Zoellner et al, (2017) which noted statistically significant decreases in Z-scores of children's BMI.

The results of this review highlighted the lack of available research on the relationship between health literacy and obesity. There were very few interventions which had a health literacy focus, most interventions were focused on improvements in diet and exercise. Health literacy levels have an impact on health behaviors, with individuals who have low levels experiencing a disparity.

Interventions involved strengths-based approaches which involved equipping parents with tools to support healthy weight status in their children. A strengths-based approach values the skills, knowledge and background of an individual to maximize

potential, building skills in a supportive, collaborative way. Success in caregiver interventions included tools to help mediate stress and improve relationships with their children such improving sleep hygiene and meditation.

A potential intervention to increase health literacy in parents could include using a suggested framework by the United Stated Department of Education, (2011). The Early Learning and Development Standards state that programs, professionals, and systems should optimize parents' role as their children's first teachers and that programs and offerings must be appropriate for all families, including linguistically and culturally. An example of this are the standards that describe key developmental milestones starting at birth, including social-emotional, linguistic, literacy and cognitive domains. This framework is participatory and requires parents and caregivers to take an active role as the child's first teacher. Utilizing this framework combined with plain language in health communication may improve self-efficacy and additionally knowledge of parents and better health outcomes.

Educational materials such as those developed by Ohio chapter of The American Academy of Pediatrics' Ounce of Prevention and Pound of Cure program for childhood obesity offer health communication messages written in plain language. These materials are part of toolkits that are age specific. The aim is to provide ongoing, simple, evidence-based messages and are targeted at the parents of children. (Ohio Chapter, American Academy of Pediatrics, 2017).

Community- based participatory research (CBPR) is another strategy used that was identified in the literature search and is considered the "gold standard" for engaging community members in intervention research (Trinh-Shevrin et al, 2017). This strategy

benefits the community by strengthening local capacity and sustainability of programs by actively including members in design and delivery of interventions. In this model, strengths of all involved are recognized and a balance between action and research is promoted which further contributes to both the community as well as enabling further development of intervention (Jernigan, 2009). A health promotion intervention using this approach demonstrated a 30% lower prevalence of obese and overweight children in the intervention vs. control group (Hou, 2016). Using this strategy for engagement in health promotion programming, stakeholders may be more likely to see higher levels of engagement and retention with one program utilizing this model demonstrating that approximately half of the participants attended 50% or more of the community meetings at the two-year mark (Davison, Jurkowski, Li, Kranz & Lawson,2013).) This represents a potential for increased reach of programming at a reduced cost.

Additionally, strategies such as Teach Back or Teach to Goal (TB/TTG) have been shown to increase understanding in parents with adequate and lower levels of health literacy (Dewalt, 2009). According to Teach Back or Teach to Goal are “literacy-sensitive, multi-session educational interventions that teaches patients self-care skills until they reach learning goals” Participants in a TB/TTG intervention showed that when this method was used, average of 68% of the information provided was retained (O’Sullivan, 2014). Additionally, another consideration is that studies have demonstrated that print education materials developed using best practices result in only small knowledge gains compared to materials that do not meet these design principles. (Davis, Fredrickson et al. 1998).

Although some individuals may find the TB/TGG strategy intimidating, it can also help to highlight health topics which patients find challenging vs. those which are more

easily grasped and therefore contributing to program development and formative research. Many TB/TGG studies focused on heart disease or diabetes, with participants in one study reducing readmission rate from 23.1% to 12.9% and improving comprehension from 63.9% to 88.9% respectively (Dewalt, 2009). In addition, research involving TB/TTG conducted by Juckett (2013) argued that “the extra time necessary for this technique is justified by the prospect of much better patient understanding and adherence”.

Additionally,, it was noted that there is potential for use of the TB/TGG in a larger population. There is evidence an estimated 40% of U.S parents have low health literacy, contributing to unmet healthcare needs, increased costs, being uninsured and increased utilization of the emergency department for nonurgent reasons (Dewalt, 2009). Broader studies can promote culturally-competent interventions that allows for more variability in recruitment, design, and understanding of the lived experience of obesity, health literacy and health outcomes. All of which suggests that policy for improving child health equity should include a framework and intervention for improving health literacy. Stakeholders such as state and federal governments, hospitals and third-party payors likely would see cost benefits from improvements in health literacy.

According to a report from U.S. Department of Health and Human Services (2008), best practice recommendations for improving health literacy include; 1) Promote universal access to health information by placing information in easily accessible areas, redesigning information when necessary, and encouraging professional health care provider organizations to distribute understandable materials for their members to use with their patients and families, 2) Addressing health literacy as part of disparities

initiatives including cultural and linguistic competence when developing health materials 3) Encouraging public insurers to model improvements and innovations by developing accessible materials and methods for communicating with individuals with limited health literacy. This would help Medicare and Medicaid beneficiaries while providing models for the private sector, finally 4) Promotion of health education and health professional standards".

Health literacy begins to develop in childhood, and school can provide an important training ground for many of the skills necessary to protect and promote health across the lifespan. There are currently no widely-adopted national standards designed to improve elementary and high school students' health literacy skills. Adopting a as a national priority the goal of improving the skills of both the general population and the skills of health professionals can help patients and providers "speak the same language" U.S. Department of Health and Human Services (2008).

A 2003 report by healthaffairs.org, states that "Active, health-literate consumers can go online and get the latest information on sophisticated technological innovations; they create demand for the latest technology". Patients with low literacy may sit on the other side of the digital divide and are not able to function as "informed" consumers. The author goes on to argue that if overall literacy the population is improved, patients reading problems will be eliminated. However, understanding health communication involves understanding often complex health issues. Still, changes would occur over time, most likely a generation or more (healthaffairs.org, 2003).

Obesity continues to be a growing public health concern, with levels increasing from 15% in the 1990's to 25% in 2010 (CDC, 2018). Meanwhile health literacy levels in

the population change slowly, remaining relatively constant with only 12% of adults having the highest proficiency (nnlm.gov, 2018). While there are many factors which influence the development of obesity in children, research supports health literacy levels as a promising focus area. More primary interventions and thus formative research is needed.

7.0 LIMITATIONS

This review has several limitations. It was limited to articles available through three online databases available to access through the University of Pittsburgh. One search engine used was Google Scholar has limitations due to the algorithm it uses, it makes a guess at what is considered a scholarly source and as such requires the researcher to evaluate information. Few relevant articles were found due to the limited scope of the research questions, and available peer reviewed research. This research was also limited to publications in English only. It is possible that there are additional studies meeting the criteria were not retrieved. The search also turned up several documents that were not yet peer reviewed and these were not included. The publications also utilized participants from three Eastern U.S sites only, studies in other geographic areas may not yield the same results.

This research was a rapid review that was conducted over a brief period by one person. Another significant limitation is that much of the formative research that has been done on childhood obesity did not include an intervention related to health literacy or did not include a parent/child dyad.

Additionally, in the interventions selected for inclusion participation was voluntary, and is a potential source of bias. Larger, cross-sectional studies could help to increase generalizability.

8.0 PUBLIC HEALTH SIGNIFIGANCE

This review examined the current, existing literature on obesity and health literacy to determine the relationship.

Describing the relationship between an element of the socio-ecological environment such as health literacy, and the development of obesity is of public health significance to help eliminate help disparities in the population.

Although the review concluded that there was insufficient evidence, it was able to identify strategies which may improve outcomes. The themes which emerged were that interventions which are participatory and strengths-based may improve overall health outcomes by identifying needs unique to the target population and b) carryover of new information and skills improves with higher self-efficacy. The economic impacts of potential improvements in both health literacy and obesity are significant.

Finally, because obesity is an ongoing and increasing problem, public health officials would benefit from research that may identify low cost, primary interventions. This would reduce the burden on the healthcare system and improve individuals' lives. The review outlines suggestions for improving health literature and communication.

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