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Health Literacy and Alcohol Use Behaviors in High School Students

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HEALTH LITERACY AND ALCOHOL USE BEHAVIORS IN HIGH SCHOOL

STUDENTS

by

Rebecca A. Parizek

A Dissertation Submitted in

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ABSTRACT

HEALTH LITERACY AND ALCOHOL USE BEHAVIORS IN HIGH SCHOOL
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by

Rebecca A. Parizek

The University of Wisconsin-Milwaukee, 2020
Under the Supervision of Professor Jeanne Erickson

Limited health literacy and alcohol use increase adolescents' risk for preventable disease burden and adverse outcomes. The Framework for Studying Adolescent Health Literacy (Manganello, 2008) guided this cross-sectional study focused on relationships between high school students' health literacy and alcohol use. The aims were to describe health literacy in a sample of high school students, explore relationships between health literacy and individual traits, and examine relationships between health literacy and alcohol use. Health literacy was assessed with the Newest Vital Sign. Alcohol use was assessed with questions from the Youth Risk Behavior Survey. An electronic survey was used to collect data from 39 students (response rate = 5.3%, 39/737) attending a private Midwest high school during the spring of 2020. Most students (76.9%, 30/39) had adequate health literacy. Males were more likely to have adequate health literacy than females, but there were no other differences in health literacy based on individual traits. Many students (42.9%, 15/35) reported drinking, and 18.2% (6/33) reported drinking in the past 30 days. Lifetime and current alcohol use were comparable between students with adequate and limited health literacy. There were no differences in alcohol use based on students' health literacy. Only students with adequate health literacy reported drinking before age 13 years (15.4%, 2/13), drug or alcohol use (42.8%, 3/7) and alcohol use (20.0%, 1/5) before last sexual intercourse. Only students with adequate health literacy reported binge drinking (10.3%, 3/29), riding with someone under the influence (17.9%, 5/28), and drinking and driving (10.5%, 2/19) in the past 30 days. In conclusion, even students with adequate health literacy engage in unsafe alcohol use. Parents, educators, and clinicians need to monitor all students for warning signs of alcohol use and misuse. This study adds evidence about health literacy and alcohol use in students at one high school.

DEDICATION

To my family.

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CHAPTER I

INTRODUCTION

Literacy is the best predictor of self-reported health status (Prins et al., 2015). Adolescents with limited literacy engage in more risk-taking behaviors than their peers with adequate literacy (DeWalt & Hink, 2009) and are more likely to have poor health outcomes (Diehl, 2011). Health literacy is a lifelong process that begins in childhood (Bröder et al., 2017). Health-related behaviors are typically established during adolescence (Okan et al., 2018), and adolescents need adequate health literacy to establish and maintain healthy behaviors (The American Cancer Society, the American Diabetes Association, the American Heart Association, 2008). Most adolescents report an interest in health-related information (Park et al., 2017). However, adolescents with limited health literacy find health-related information difficult to understand and are less likely to adhere to instructions (Brown et al., 2007). They also report poorer general health, poorer diet, and more problem behaviors including increasing substance use across time (Park et al., 2017).

Most of the serious health-related problems during adolescence result from the same risk-taking behaviors that contribute to the primary preventable causes of disability, disease, and death: inactivity, promiscuity, substance abuse, tobacco use, unhealthy diet, and violence including suicide and homicide (Kann et al., 2018). Underage alcohol use is a risk-taking behavior associated with altered brain development and other risk-taking behaviors resulting in unintentional injury and death (CDC, 2018). Understanding relationships between adolescents' health literacy and alcohol use behaviors has the potential to identify targets for interventions that will delay and decrease adolescents' alcohol use. Delaying and decreasing adolescents' alcohol use will improve health outcomes by protecting them from altered brain development, unintentional injury, and death. The purpose of this research was to explore relationships between high school students' health literacy and their alcohol use behaviors.

Health Literacy

Health literacy was first defined by the National Health Education Standards (NHES) as "the capacity of an individual to obtain, interpret, and understand basic health information and services and the competence to use such information and services in ways that are health-enhancing" (Joint Commission on National Health Education Standards, 1995, p. 5). The NHES definition was created for adolescents yet has been applied to other populations. In 2003, the NHES definition was expanded to underscore that health literacy is on a continuum. "The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (Parker et al., 2003, p. 147), is the definition included in the 2004 Institute of Medicine (IOM) report *Health Literacy: A Prescription to End Confusion* (Institute of Medicine [IOM] Committee on Health Literacy, 2004).

Adolescents

Tremendous psychological and physiological changes occur during adolescence. The adolescent period is typically defined by age but there is not a universally accepted age range. The World Health Organization (2018) defines adolescence as the period from 10 to 19 years. The United States Department of Health and the Food and Drug Administration define adolescence as the period from 12 to 21 years. Acknowledging that an age of 21 years is an arbitrary demarcation, the American Academy of Pediatrics defines adolescence as the period from 11 to 21 years because evidence suggests that the brain is not fully developed until the third decade of life (Hardin et al., 2017). Normal brain development predisposes adolescents to risk-taking behaviors. Within the brain, the reward-seeking system develops during early to mid-adolescence whereas the cognitive control system does not develop until late adolescence into young adulthood. Once the cognitive control system develops then

adolescents are better able to discern cause and effect as well as process and interpret emotions (McNeely & Blanchard, 2009).

Alcohol

Alcohol depresses the central nervous system and can alter behavior, coordination, memory, mood, reasoning, physical control, and self-control. It also elevates blood pressure and heart rate. The effects of alcohol vary based upon the amount and rapidity of alcohol consumption as well as food consumption prior to drinking. The effect of alcohol is also influenced by individual traits such as age, race/ethnicity, gender, health status, and family history of alcohol abuse. Parameters for moderate drinking vary by gender but usually refer to one standard drink for females and two for males. There is roughly 14 grams of pure alcohol in one standard drink. One standard drink is 12 ounces of 5% alcohol content for beer, five ounces of 12% alcohol content for wine, or a shot of 40% alcohol content for liquor. Excessive drinking includes heavy and binge drinking. Heavy drinking is defined by more than eight drinks per week for females and more than 10 drinks per week for males. Heavy drinking increases the risk for addiction, cancer, injury, heart disease, and liver diseases as well as problems with family, friends, and at work. Binge drinking is reaching a blood alcohol concentration (BAC) of 0.08%. Binge drinking is defined as four drinks for females and five drinks for males within a few hours. Binge drinking increases the risk for alcohol poisoning, unintentional injury, motor vehicle accidents (MVA), violence, and death. Due to the harmful effects of alcohol, certain populations such as minors should not drink (National Institute on Alcohol Abuse and Alcoholism, 2019).

Background and Significance of Underage Alcohol Use

Underage alcohol use is a preventable public health problem that contributes to altered brain development, unintentional injury, and death. The minimum legal age for alcohol is 21 years, yet minors consume 11% of all alcohol sold in the United States

(Division of Population Health et al., 2018). According to the 2017 Youth Risk Behavior Survey (YRBS), 60.4 % of high school students report consuming at least one alcoholic beverage during their life. The lifetime prevalence rate for alcohol use is higher among females (62.6%) than males (58.1%). Almost 30% of high school students report drinking alcohol in the past 30 days. More females (31.8%) than males (27.6%) report drinking alcohol in the past 30 days. Initiation to alcohol typically begins during early adolescence and increases throughout high school. More than 18% of high school freshman, 27% of sophomores, 34.4% of juniors, and 40.8% of seniors report drinking alcohol in the past 30 days (Kann et al., 2018).

Adolescent Brain Development

Typical brain maturation trajectory is from lower order to higher order regions (Squeglia et al., 2014). The dual model refers to the maturational imbalance between two distinct regions within the brain that follow different trajectories and mature at different rates (Harden et al., 2017). The frontal lobe of the brain is associated with cognitive, emotional, executive, and social functions. It also controls planning, reasoning, and voluntary movement. Within the frontal lobe are the limbic system and the prefrontal cortex. The limbic system is the center of emotions. The hippocampus, within the limbic system, is essential for forming memories. Within the limbic system, the involuntary incentive processing or reward-seeking system develops during early to mid-adolescence. The prefrontal cortex is associated with personality and complex cognitive skills including discerning good from bad, sorting out conflicting thoughts, assessing cause and effect, and controlling impulses. Within the prefrontal cortex, the cognitive control system develops during late adolescence into young adulthood (McNeely & Blanchard, 2009). The difference in timing of brain system development causes the involuntary reward-seeking system to usurp adolescents' cognitive control (Shulman et al., 2016). Once the cognitive control

system develops, adolescents are better able to discern cause and effect (McNeely & Blanchard, 2009).

Reward-seeking is a risk-factor for substance use (National Research Council and IOM, 2009). Delaying initiation to alcohol is protective against alcohol use disorders (Levy et al., 2016). Alcohol use disorder (AUD) is "a problematic pattern of alcohol use leading to clinically significant impairment or distress" (American Psychiatric Association, 2013, p. 490). The lifetime prevalence of AUD is directly related to age of initiation to alcohol (Levy et al., 2016; Noël, 2014). Almost half (47%) of adults with alcohol dependence began drinking before they were 14 years old (Hingson et al., 2006). Youth who begin drinking alcohol when they are 15 years old have a 38% chance of developing an AUD whereas delaying initiation to alcohol until 17 years decreases the risk to 28% (Noël, 2014). Only 9% of adults with alcohol dependence began drinking after reaching the minimum legal age (Hingson et al., 2006). Early onset of AUD is associated with increased disease severity, decreased treatment response, and greater risk of relapse (Windle & Zucker, 2010).

There are also relationships between the amount of alcohol consumed and the neurotoxic effects of alcohol on adolescents' brain development (Peeters et al., 2014). Minors tend to consume more alcohol per occasion than adults, and binge drinking accounts for more than 90% of underage alcohol consumption. According to the 2017 YRBS, 13.5% of high school students report binge drinking in the past 30 days. Stratified by grade, 7.3% of freshman, 11.4% of sophomores, 15.4% of juniors, and 20.4% of seniors report binge drinking in the past 30 days. Analogous to lifetime and past 30 day use, more females (14.1%) than males (12.8%) report binge drinking in the past 30 days (Kann et al., 2018). Binge drinking appears to increase salience for alcohol (Noël, 2014) and predisposes adolescents to AUDs (Peeters et al., 2014).

Regardless of cause, underage alcohol use alters brain structure and function. White matter enhances communication between brain regions, and the most consistently reported change associated with underage alcohol use is impaired white-matter integrity in the frontal lobe. Even modest deviations from typical neurodevelopment impact cognitive, emotional, social, and executive functions (Squeglia et al., 2014) such as memory, response inhibition, switching between tasks, and goal attainment (Duckworth & Steinberg, 2015).

Unintentional Injuries and Death Associated with Underage Alcohol Use

Alcohol use precipitates risk-taking behaviors such as drunk driving, risky sexual activity, and violence that can cause unintentional injuries or death. External causes of death such as unintentional injuries (40.6%), suicide (19.2%), and homicide (14.4%) peak in youth ages 10 to 24 years (Heron, 2019). During 2013, underage alcohol use contributed to roughly 119,000 emergency department visits. Underage alcohol use also contributes to the death of more than 4,300 youth every year with associated costs reaching $24 billion (Center for Disease Control and Prevention [CDC], 2018).

Motor vehicle accidents, the primary cause of adolescent death in the United States, are an example of unintentional injury resulting from alcohol use. According to the 2017 YRBS, 5.5% of high school students report driving under the influence of alcohol and 16.5% of high school students report riding with a driver who was under the influence of alcohol in the past 30 days. These risk-taking behaviors contribute to the death of six adolescents every day. Twenty percent of adolescent male drivers involved in fatal MVAs had been drinking, and 15% had a BAC of at least 0.08%. Adolescents ages 15 to 19 years comprise 6.5% of the population in the United States, yet almost 8% of the costs from motor vehicle injuries or more than $13 billion are attributable to this age group (CDC & National Center for Injury Prevention and Control, 2019).

Adolescents who engage in substance use are also more likely to engage in risky sexual activity. Unprotected sexual activity is a risk factor for sexually transmitted infections (STI) and pregnancy; notably pregnancy prior to age 15 years (Division of Adolescent and School Health & National Center for HIV/AIDS, Viral Hepatitis, STD, 2018). Almost 19% of sexually active high school students report using alcohol or drugs prior to their last sexual intercourse. Stratified by grade, 21.3% of freshman, 19.7% of sophomores, 14.2% of juniors, and 20.3% of seniors report using alcohol or drugs prior to their last sexual intercourse (Kann et al., 2018).

Approximately half of all adolescent-mothers drop out of high school (Division of Reproductive Health & CDC, 2019). Adolescents who drop out of high school are more likely to experience adverse health outcomes related to riskier health-related behaviors such as obesity, limited physical activity, and smoking. Overall, high school dropouts are about twice as likely to report having heart disease and diabetes than high school graduates. White high school dropouts are more likely to have asthma, diabetes, heart disease, stroke, and stomach ulcers. Black high school dropouts are more likely to have asthma, diabetes, hypertension, hepatitis, and stomach ulcers. Hispanic high school dropouts are more likely to have diabetes (Vaughn et al., 2008). Furthermore, children of high school dropouts are more apt to have chronic health problems, give birth during adolescence, be incarcerated during adolescence, and drop out of high school (Division of Reproductive Health & CDC, 2019).

Introduction to the Problem: Limited Health Literacy

For youth, literacy skills focus on the ability to read and write (Department of Education, 2019). However, adolescent literacy requires skills beyond the ability to read and write. Adolescent literacy also requires the ability to discuss, interpret, and understand a variety of texts across a variety of contexts (International Reading Association, 2012). The Program for the International Assessment of Adult Competencies states that literacy skills

support knowledge development, goal attainment, and participation in society (Rampey et al., 2016). Health literacy is the ability to obtain, process, understand, and use health-related information to make appropriate health-related decisions (U.S. Department of Health and Human Services, 2010). Nutbeam (2000) identified three escalating levels of health literacy: functional, interactive, and critical. Functional health literacy refers to basic reading and writing skills. Interactive health literacy is the ability to process and understand health-related information. Critical health literacy is the ability to make appropriate health-related decisions (Nutbeam, 2000).

There is an urgent need to improve adolescents' health literacy skills; especially their ability to process and understand health-related information so they are equipped to make appropriate health-related decisions. Almost all adolescents (99%) have Internet access, and 67% report using the Internet to look up health-related information (Lauricella et al., 2018). As they mature, adolescents become increasingly involved with their healthcare (U.S. Department of Health and Human Services, 2010) and want to obtain health-related information (Hagell et al., 2015). However, in the United States, 63.5% of young adults ages 18 to 24 attained health literacy scores 14% below the median (Rubin, 2016). Adolescents with limited health literacy are less likely to report being able to understand health-related information obtained from media sources, healthcare providers, and written materials than their peers with adequate health literacy. Furthermore, they are more likely to believe that information obtained from media sources is usually true (Manganello & Sojka, 2016).

There are relationships between adolescents' health literacy and health-related behaviors such as health promotion, sexual behaviors, medication use, and substance use (Fleary et al., 2018). Chang (2011) found a positive relationship between Taiwanese high school students' health literacy per the Short Test of Functional Health Literacy in Adults (s-TOFHLA) and health promoting behaviors such as life appreciation, nutrition, and social

support. Levin-Zamir et al. (2011) found a positive relationship between media health literacy and health promoting behaviors such as nutrition, physical activity, safety, sexual activity, and smoking in Israeli youth ages 13 to 17 years. Page et al. (2010) found that Hungarian students in grades 8 to 12 with low smoking media literacy per the Smoking Media Literacy Scale (SML) were more likely to smoke. Using an adapted version of the SML, Salgado et al. (2012) obtained the same results in Argentinian high school students. Using the Revised Alcohol and Tobacco Media Health Literacy Scale, Chang et al. (2016) found a statistically significant relationship between higher media health literacy and lower alcohol use in 10th grade Taiwanese students. Unlike Page et al. (2010) and Salgado et al. (2012), Chang et al. (2016) did not find a statistically significant relationship between media health literacy and smoking (Fleary et al., 2018). Furthermore, in Guatemalan youth ages 10 to 16 years (n=210), alcohol use was positively associated with health literacy per the Spanish version of the Newest Vital Sign (NVS).

Domain-specific adolescent health literacy research such as media health literacy, smoking health literacy, and mental health literacy is growing. Yet, only five studies conducted within the United States used a validated instrument to explore relationships between adolescents' general health literacy and health-related behaviors. Needham et al. (2010) examined relationships between health literacy, understanding of STI materials, and sexual risk-taking behaviors in females ages 16 to 21 years (n=127). Understanding of STI materials was lower in youth with limited health literacy but health literacy made no difference in sexual risk-taking behaviors (Needham et al., 2010). Shone et al. (2011) examined relationships between health literacy and acetaminophen use, knowledge, and comprehension of dosing instructions in youth ages 16 to 23 years (n=266). Youth with limited health literacy scored lower on all outcome variables (Shone et al., 2011). In youth ages 12 to 21 years (n=112), Dharmapuri et al. (2015) did not find a statistically significant

relationship between health literacy and medication adherence (Dharmapuri et al., 2015). Conflicting results were obtained from the two studies conducted in the United States to examine adolescents' health literacy and alcohol use. In youth ages 16 to 19 years (n=293), Chisolm et al. (2014) found a direct relationship between adequate health literacy, alcohol expectancies, and alcohol use (Chisolm et al., 2014). Park et al. (2017) aggregated alcohol use, marijuana use, and tobacco use into substance use and examined relationships between health literacy and health outcomes in youth ages 13 to 17 years (n=250). Their findings vary by the health literacy assessment instrument. Only data obtained from one of the three instruments indicates a statistically significant relationship between limited health literacy, baseline substance use, and increasing substance use over time (Park et al., 2017).

General adolescent health literacy research is limited by health literacy assessment instruments as well as a variety of operational definitions for health literacy (Ormshaw et al., 2013). Fifteen different instruments measured 31 unique components of health literacy in youth ages 11 to 18 years. Yet, most instruments measure their own idea of health literacy (Okan et al., 2018). Despite the plethora of instruments, most published adolescent health literacy research focuses on instrument development and/or intervention effectiveness rather than measuring the construct of health literacy (Ormshaw et al., 2013). With 12 definitions and 21 models of health literacy for youth, there are almost as many operational definitions as there are instruments to measure health literacy. These definitions and models address an assortment of age ranges and settings, such as education and healthcare systems (Bröder et al., 2017). The IOM Committee on Health Literacy states that a universal definition and framework will facilitate the understanding of health literacy (IOM Committee on Health Literacy, 2004).

<div align="center">**Conceptual Framework**</div>

This study used The Framework for Studying Adolescent Health Literacy by

Manganello (2008). This framework is based upon the two health literacy frameworks

presented in the 2004 IOM report *Health Literacy: A Prescription to End Confusion*

(Manganello, 2008)*.* The Health Literacy Framework (Figure 1) followed by the Potential

Points for Intervention in the Health Literacy Framework (Figure 2) provide a visual

description of health literacy and the systems that impact one's health literacy. According to

the Health Literacy Framework, literacy encompasses arithmetic, communication,

comprehension, reading, and writing skills. Literacy facilitates communication and

comprehension of health-related information. Health is influenced by one's cognitive skills,

emotional state, physical abilities, and social skills. Health literacy is the conduit between

one's literacy skills and health (IOM Committee on Health Literacy, 2004).

Figure 1

Health Literacy Framework
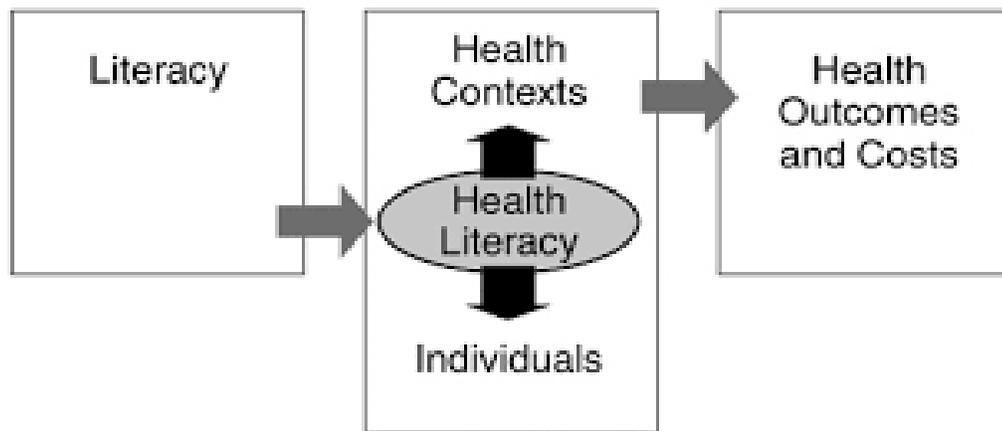
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The Potential Points for Intervention in the Health Literacy Framework modifies the Health Literacy Framework by including three systems that are potential points for intervention. The three systems that have the potential to influence health literacy are culture and society, the health system, and the education system. These systems of influence should assume responsibility for health literacy (IOM Committee on Health Literacy, 2004).

Figure 2

Potential Intervention Points
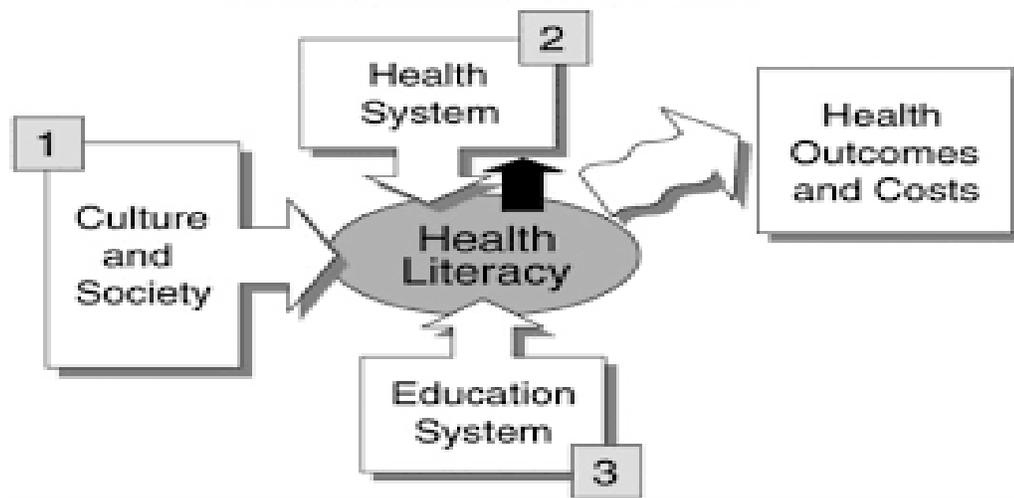
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The Framework for Studying Adolescent Health Literacy by Manganello (2008) is informed by the Ecological Model (Manganello, 2008). The Ecological Model considers the influence of the micro, meso, and macro-systems on development. During the developmental process, individuals create and reorganize their micro, meso, and macro-systems to align with personal goals. A change in one's role and/or setting results from a change in development and leads to further developmental change (Bronfenbrenner, 1979). The Framework for Studying Adolescent Health Literacy by Manganello (2008) proposes that individual traits predict health literacy and health outcomes (Figure 3). Family, peers, and systems influence

individual traits. Family and peers influence literacy skills, health outcomes, health-related behaviors and possibly health literacy skills (Manganello, 2008).

Figure 3

The Framework for Studying Adolescent Health Literacy by Manganello (2008)
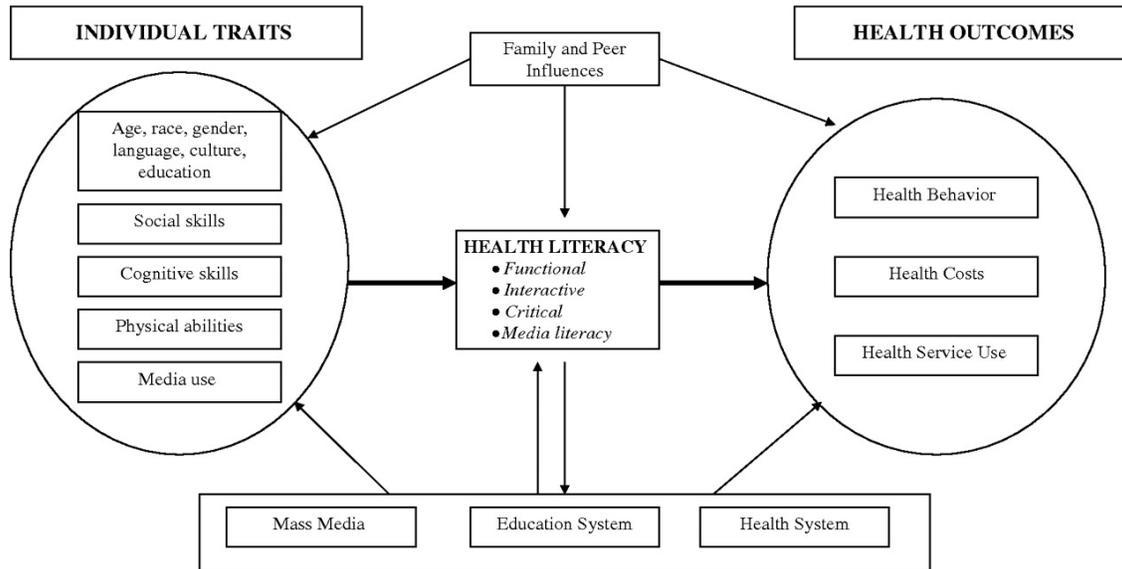
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The Framework for Studying Adolescent Health Literacy by Manganello (2008) includes three systems: mass media, the education system, and the health system. In the 2004 IOM report, media was included within the system of culture and society. However, adolescents are exposed to media for more than six hours a day. Media is a source of health-related information and influences adolescents' physical development, social development, and health-related behaviors. Therefore, mass media is considered a system in the Framework for Studying Adolescent Health Literacy by Manganello (2008). Adolescents need health literacy skills to obtain, process, and understand health-related information. They also need health literacy skills to assess the credibility of health-related information obtained from media sources. The education system directly influences adolescents' literacy skills and has the potential to teach health literacy skills (Manganello, 2008).

In the Framework for Studying Adolescent Health Literacy by Manganello (2008), health outcomes include health behaviors, health costs, and health service use. There is a proposed relationship between adolescents' health literacy and health outcomes. There is also a proposed relationship between adolescents' literacy and health-related behaviors including substance use. However, further research is needed to evaluate relationships between adolescents' health literacy and health-related behaviors (Manganello, 2008).

The Framework for Studying Adolescent Health Literacy by Manganello (2008) is appropriate for exploring relationships between adolescents' health literacy and alcohol use behaviors. This framework is designed for studying adolescents' health literacy and health outcomes. Inclusion of individual traits, family, peers, mass media, the education system, and the health system are fundamental to using a developmental lens to explore relationships between adolescents' health literacy and alcohol use behaviors.

Individual Traits

The tremendous cognitive, emotional, physical, and social development that occurs during adolescence contributes to adolescents' vulnerability to risk-taking behaviors (Squeglia et al., 2014). Erickson identified eight biologically fixed stages of psychosocial development across the lifespan. Past behaviors forecast present and future behaviors, and task mastery during prior stages is the foundation for present and future stages (Kail & Cavanuagh, 2016). Identity versus Role Confusion is the primary task of youth from 12 to 20 years, and when they establish social and occupational identities. Cognitive development impacts the formation of adolescents' identity and behavior (Shaffer & Kipp, 2010). The two main cognitive tasks during adolescence are (a) to develop the ability to integrate information pertinent to goals and (b) to develop behavioral guidelines to achieve goals (Brown et al., 2007). Cognitive control requires integrating information about one's internal state and external circumstances to elicit behaviors that align with personal goals (Shulman et al.,

2016). Adolescents striving to meet goals tend to be less sensitive to risks (Noël, 2014). Yet, adolescents must possess some amount of self-control to withstand intrinsic and extrinsic or social pressures to engage in alcohol use (Bröder et al., 2017).

Family and Peer Influences

Family and peers influence academic achievement (Mckown, 2013) and alcohol use behaviors (National Research Council and IOM, 2009). Parent-child relationships change during adolescence (Van Petegem et al., 2012), and autonomy and independent decision-making increase as adolescents rely less on their parents. Effective decision-making requires anticipating the future and making good choices even under stressful circumstances (Modecki et al., 2017). Around age 15 years, adolescents appear to have mature self-regulation in situations of low socioemotional arousal. However, they experience exaggerated socioemotional reactivity in situations of high socioemotional arousal, and differences in decision-making and risk-taking behaviors between adolescents and adults emerge (Shulman et al., 2016). Peers progressively influence healthy and unhealthy behaviors (Vahedi et al., 2018). Peer presence activates the reward center in adolescents' brains, and they prefer immediate rewards and take more risks when they are with their peers. They also tend to seek peers with a similar risk-taking affinity and partake in risk-taking behaviors with their peer group (Albert et al., 2013).

Mass Media

Exposure to alcohol via media is known to influence underage alcohol use (Quigley, 2019). Almost all adolescents have Internet access via their own computer, tablet, or smartphone through which they are exposed to unregulated alcohol advertising, peer posts, and questionable health-related information (Lauricella et al., 2018). Media promotes alcohol use by transmitting positive messages of alcohol use minus the negative consequences

(Committee on Substance Abuse, 2010) which shape alcohol expectancies (Chisolm et al., 2014) and influence alcohol use behaviors (Quigley, 2019).

The Education System

Literacy and health literacy are usually interconnected, and limited literacy is associated with poor health outcomes. Adolescents with limited literacy are more likely to engage in risk-taking behaviors such as substance use and violence (DeWalt & Hink, 2009). For example, adolescents attaining mostly A's in school are less likely to drink, initiate alcohol use prior to age 13, and binge drink than students receiving D's and F's (Rasberry et al., 2017). Textbook based health literacy education increases knowledge of both health-related concepts and health-related skills (Hubbard & Rainey, 2007). However, interactive school-based health education programs are two to four times more effective than non-interactive programs. Discussing ideas and experiences as well as practicing behavioral skills and receiving peer feedback helps to create group norms that value healthy lifestyles. Interactive health education also helps students develop the skills needed to establish and maintain healthy behaviors. It is thought that interactive health education would increase the effectiveness of school-based drug education by at least eight percent. There are three critical periods when interventions are most likely to be effective: prior to initial exposure, during initial exposure, and when prevalence increases (McBride, 2003).

The Health System

Most adolescents see a healthcare provider annually and want to learn about risk-taking behaviors from healthcare providers (Levy et al., 2016). Given that 18 years is typically the legal age of consent in the United States, parental permission is typically required to access healthcare resources. However, parental presence increases the likelihood that adolescents will lie about their risk-taking behaviors to healthcare providers (Fuzzell et al., 2016). Conversely, during private exams, adolescents are more likely to discuss risk-

taking behaviors such as alcohol, drugs, smoking, and sex (Gilbert et al., 2014). Most healthcare providers use clinical judgement instead of a validated screening tool to assess adolescent substance use. However, clinical judgement typically fails to detect adolescents who engage in alcohol use including those who report excess use (Levy et al., 2016).

This Research

This study is significant to nursing because understanding relationships between high school students' health literacy and alcohol use behaviors has the potential to delay and decrease adolescents' alcohol use. Findings from this study may be useful for informing interventions and identifying targets for interventions that will delay and decrease adolescents' alcohol use. Delaying and decreasing alcohol use has the potential to improve health outcomes by protecting adolescents from altered brain development, unintentional injury, and death.

Conceptual definitions for health literacy, adolescents, and alcohol use behaviors vary across populations and studies. Operational definitions that were used in this research:

- Health literacy: The ability to obtain, process, understand, and use health-related information to make appropriate health-related decisions.

- Adolescents: Youth between the ages of 13 and 20 years.

- Alcohol use behaviors: Adolescents' alcohol use and their overt actions while under the influence of alcohol.

This study was based on five assumptions:

1. Underage alcohol use is a preventable public health problem.

2. Adolescents want health-related information.

3. Lifelong health-related behaviors are typically established during adolescence.

4. Adolescents with limited health literacy find health-related information difficult to understand.

5. Delaying and decreasing alcohol use will improve health outcomes by protecting adolescents from altered brain development, unintentional injury, and death.

Research question: What are the relationships between high school students' health literacy and alcohol use behaviors. This research question was addressed by focusing on three specific aims:

1. Aim 1: Describe the health literacy of a sample of high school students.

2. Aim 2: Explore relationships between high school students' health literacy and their alcohol-related behaviors.

3. Aim 3: Examine relationships between high school students' health literacy and individual traits.

Methods

This was a cross-sectional study of up to 737 full-time students ages 13 to 18 years attending a private high school in northern Illinois. Health literacy was measured using the NVS. The NVS is a three-minute, six-item assessment of health literacy skills using the nutrition label from an ice cream container. The NVS stratifies health literacy into three categories: limited literacy likely, limited literacy possible, adequate literacy (Weiss et al., 2005). The NVS assesses literacy skills, numeracy skills, and the ability to process and understand health-related information but not the ability to make appropriate health-related decisions. Items from the 2017 YRBS were used to measure alcohol use behaviors. The Youth Risk Behavior Surveillance System monitors adolescents' risk-taking behaviors through the YRBS. Conducted by the Center for Disease Control and Prevention (CDC), the YRBS monitors trends and identifies factors that contribute to preventable disability, disease, and death. The alcohol-related questions on the YRBS capture categorical data (CDC, 2019). Demographic questions were associated with adolescents' health literacy and alcohol use behaviors. The surveys were administered electronically. Data collection took place during

the spring semester of 2020. No identifying information was collected, and data were entered into the statistical database SPSS on a password protected computer.

Data analysis was limited by small sample size and predominately categorical data. The demographic questions captured categorical data except for two of the survey questions which collected continuous data. Participants provided continuous data when they responded to the questions asking their age in years and their grade in school. The NVS and the alcohol use questions captured categorical data. Assumptions were violated, and nonparametric statistics were used. Descriptive statistics were used to summarize participants demographic data, health literacy scores, and alcohol use behaviors. Due to small numbers, whenever possible, categorical responses were collapsed to be dichotomous in order to run Fisher's Exact Test to look for statistical differences between groups. Fisher's Exact Test was used when the independent variable was nominal level data and the dependent variable was ordinal level data. Fisher's Exact Test was used to explore relationships between health literacy and individual traits and relationships between health literacy and alcohol use behaviors.

Dissertation Chapters and Manuscript Placement

This dissertation includes three manuscripts that were written for publication in peer-reviewed journals. Chapter II is a review of literature relevant to adolescents' literacy, health literacy, health literacy and behaviors, and health literacy and alcohol-related behaviors and contains two manuscripts. The Framework for Studying Adolescent Health Literacy by Manganello (2008) guided the review of literature. What is known versus what is unknown about relationships between adolescents' health literacy and individual traits, family and peer influences, and health outcomes are reviewed.

To follow the Committee on Health Literacy's call for a universal definition and framework to facilitate the understanding of health literacy, the first manuscript was written as a systematic review of studies measuring health literacy in adolescents. This review

describes and synthesizes definitions, theoretical frameworks, and instruments used to measure adolescents' health literacy. This manuscript, "Health literacy in US adolescents: A systematic review of the literature," was written for and submitted to *Health Education & Behavior*. The second manuscript is a synthesis of the literature about adolescents' health literacy and alcohol-related behaviors. This manuscript, "Health literacy and underage alcohol use: A systematic review of international literature," was written for and submitted to *The Journal of Adolescents.*

Chapter III outlines the study methods in detail. Chapter IV Results includes a third manuscript, "Health Literacy and Alcohol Use Behaviors in High School Students." This manuscript was written for submission to *The Journal of School Health* and describes the results of this study. Chapter V includes conclusions from the study and implications for education, policy, practice, and research with a focus on how the healthcare system, the education system, and social media are potential targets for nursing interventions to build health literacy skills and delay or decrease underage alcohol use.

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CHAPTER II

REVIEW OF THE LITERATURE

Chapter II is a review of literature relevant to adolescents' literacy, health literacy, health literacy and behaviors, and health literacy and alcohol-related behaviors. The Framework for Studying Adolescent Health Literacy by Manganello (2008) guided this review of the literature. What is known versus what is unknown about relationships between adolescents' health literacy and individual traits, family and peer influences, and health outcomes is reviewed.

To follow the Committee on Health Literacy's call for a universal definition and framework to facilitate the understanding of health literacy, one manuscript was written as a systematic review of studies measuring health literacy in adolescents. This review describes and synthesizes definitions, theoretical frameworks, and instruments used to measure adolescents' health literacy. This manuscript, Health literacy in US adolescents: A systematic review of the literature, was written for and submitted to *Health Education & Behavior*. A second manuscript is a synthesis of the literature about adolescents' health literacy and alcohol-related behaviors. This manuscript, Health literacy and underage alcohol use: A systematic review of international literature, was written for and submitted to *The Journal of Adolescents.*

Health literacy in US adolescents: A systematic review of the literature

Manuscript submitted to *Health Education & Behavior*

Abstract

The complexity of the United States healthcare system requires consumers to have literacy skills. Health literacy impacts health behaviors, disease management, and use of the healthcare system. In the landmark report, *Health Literacy: A Prescription to End Confusion*, the Institute of Medicine Committee on Health Literacy called for a universal definition and framework to build evidence and advance the science of health literacy. This systematic review was conducted to describe definitions, frameworks, measurement, and the evidence from adolescent health literacy research. PRISMA guidelines were followed to identify, select, and appraise adolescent health literacy research. CINAHL and PubMed were searched, and relevant reviews were examined for additional sources. Findings from 13 sources suggest that most studies use similar definitions but overlook frameworks. Comparing multiple instruments highlights how health literacy varies across and within studies. Inconsistent frameworks and instruments that fail to comprehensively measure the construct of health literacy remain barriers to building evidence and advancing the science. Healthcare providers and educators need to know the evidence so they can identify youth who are at risk for limited health literacy, teach at an appropriate level, and provide resource lists of credible websites. Tailoring health-related information may increase adolescents' understanding of health-related information and decrease their risk for unhealthy behaviors, ineffective disease management, and inappropriate use of the healthcare system. Researchers should use a definition that includes the four health literacy skills, a framework specific to adolescent health literacy research, and the most comprehensive instrument available to measure health literacy.

Keywords: health literacy; adolescents; systematic review

Introduction

The complexity of the United States (US) healthcare system requires consumers to have literacy skills. Literacy is a set of quantifiable skills encompassing listening, numeracy, reading, speaking, and writing that is inextricably linked with education (Institute of Medicine Committee [IOM] on Health Literacy, 2004). Literacy and health literacy (HL) are usually interconnected, and HL research is rooted in relationships between reading ability and health outcomes (Diehl, 2011; DeWalt & Hink, 2009). Literacy within the context of health, also known as HL, moved into the spotlight after the release of the 2004 Institute of Medicine (IOM) report *Health literacy: A prescription to end confusion*. HL affects adults' health-related behaviors, disease management, and use of the healthcare system. Young adults ages 18 to 24 years are more likely to have lower HL than any other age group (Rubin, 2016). Adolescents and young adults with limited literacy have limited understanding of health-related information and difficulty making healthy decisions (Manganello, 2008). Consequently, they may be at risk for unhealthy behaviors, ineffective acute and chronic disease management, and inappropriate use of the healthcare system.

Tremendous physiological and psychological development occurs during adolescence (Fetro, 2010). Parent-child relationships change, adolescents' independent decision-making increases (Van Petegem et al., 2012), and adolescents begin to establish health-related behaviors (Kann et al., 2018). Decision-making requires understanding a situation and how actions may impact the future (Noël, 2014). Decision-making is an essential component of HL (Fleary et al., 2018). Approximately two-thirds of adolescents report using the Internet to look up health-related information (Lauricella et al., 2018). Most adolescents can decipher through health-related information and create meaning within their environment and experiences (Fairbrother et al., 2016). However, adolescents with limited HL may not fully understand health-related information (Manganello, 2008).

The IOM Committee on HL recognized that there are relationships between literacy, HL, and health. Studies using the Rapid Estimate of Adult Literacy in Medicine (REALM), the Test of Functional Health Literacy in Adults (TOFHLA), and the Brief Version of the Test of Functional Health Literacy in Adults (S-TOFHLA) were able to measure basic print literacy of health-related terms and identify relationships between limited HL and poor health status, less knowledge about disease and disease management, lower rates of preventative care, and higher rates of hospitalization. However, the IOM Committee on HL acknowledged that HL research is limited by (a) instruments that fail to comprehensively measure HL, (b) multiple definitions, and (c) inconsistent conceptual frameworks. They also recommended research into relationships between literacy, HL, and health (IOM Committee on Health Literacy, 2004).

Evidence continues to support relationships between adults' literacy, HL, and health. Compared to adults with adequate HL, adults with limited HL tend to have poor health status, less knowledge about their disease and disease management, and less effective use of the healthcare system (Rubin, 2016; Zaidman et al., 2019). Children of parents with limited HL also tend to have poor health status as well as less knowledge about nutrition and asthma, poor dietary behaviors and asthma management, and higher rates of emergency department visits than children of parents with adequate HL (Zaidman et al., 2019). Many children (43%) have one of the 20 chronic diseases assessed by the National Survey of Child's Health, and almost 20% have at least two chronic diseases (Bethell et al., 2010). Responsibility for managing chronic diseases increases during adolescence (DeWalt & Hink, 2009).

This systematic review was conducted to describe the definitions, conceptual frameworks, measurement, and evidence from adolescent HL research. This review aims to answer four questions:

1. How is HL defined in adolescent HL research?

2. What conceptual frameworks are used in adolescent HL research?

3. What instruments are used to measure HL in adolescents?

4. What is the evidence from adolescent HL research?

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed to retrieve peer-reviewed publications in academic journals during November 2019. See Figure 1. Inclusion criteria were (a) published in the English language, (b) youth between 11 and 21 years, (c) used a measure of general HL, and (d) conducted within the US since some languages do not have comparable health-related terms (IOM Committee on Health Literacy, 2004). Publications that did not measure adolescents' general HL were excluded. Search terms were selected to exclude context specific definitions of HL such as mental HL and media HL. Search terms were "health literacy" and "adolescents or teenagers or young adults or teen or youth" not "mental" not "oral literacy" or "oral health literacy" not "adults." An electronic search of CINAHL Plus with Full Text yielded 57 publications. Bibliography mining and an electronic search of PubMed yielded six additional publications. Once abstracts or full-text articles were reviewed, 50 articles were eliminated because they included context specific uses of HL, adult populations, or did not measure general HL in adolescents. Inclusion criteria for age was based on the American Academy of Pediatrics definition but, due to the paucity of published research, studies in which the age range included but extended beyond 11 to 21 years were retained (n=2).

Results

Health literacy was defined in 11 studies, a framework was used in three studies, and six different instruments were used to measure HL in the 13 sources retained for review. Definitions, frameworks, instruments, and the evidence from adolescent HL research are

described in Table 1. All the studies were correlational; 11 were cross-sectional and two were longitudinal. Sample sizes ranged from 48 to 1,178 and the age range was nine to 23 years. Twelve studies surveyed a mix of male and female youth, and one study only surveyed females. Ten studies surveyed multiple races, two studies surveyed Black youth, and one study surveyed Black and/or Hispanic youth. Healthcare and education settings were the most common study sites, but one study surveyed youth from juvenile correction facilities and one study surveyed youth from community-based organizations. Three studies focused on youth with an underlying health condition: sickle cell disease, asthma or diabetes, and asthma symptoms in youth who have not been diagnosed with asthma.

Definitions of Health Literacy

Health literacy is "The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" (IOM Committee on Health Literacy, 2004, p. 20). Eight studies used a version of the IOM definition, one study used Nutbeam's (2000) definition, two studies created a definition, and two studies did not define HL. The eight studies that used a version of the 2004 IOM definition included the four core literacy skills "to obtain, process, and understand basic … information … to make appropriate health decisions" (Chisolm et al., 2011, p. 676; Chisolm et al., 2014, p. 2; Ghaddar et al., 2012, p. 28; Holstein et al., 2014, p. 167; Manganello & Sojka, 2016, p. 222; Needham et al., 2010, p. 506; Perry et al., 2017, p. 192; Shah et al., 2010, p. 195). Park et al. (2017) used Nutbeam's (2000) definition, 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" (Park et al., 2017, p. 885). The two studies that created a definition incorporated at least one of the four core literacy skills (Brown et al., 2007; Dharmapuri et al., 2015). Although two of

the studies did not operationally define HL, both studies assessed the ability to understand and use health-related information (Shone et al., 2011; Valerio et al., 2018).

Conceptual Frameworks

Three studies reported using a framework and 10 studies did not report using a framework. Guided by Manganello's (2008) Adolescent Health Literacy Model, only the Perry et al. (2017) study used a conceptual framework specific to adolescents' HL. Based on the two HL frameworks in the 2004 IOM report, the Adolescent Health Literacy Model proposes that family, peers, mass media, education, and healthcare influence individual traits which predict one's HL and subsequent health outcomes (Manganello, 2008). Chisolm et al. (2014) used Expectancy Theory which states that behavior is based upon anticipated consequences (Leonard & Blane, 1999). Brown et al. (2007) based their study and their instrument, the KidsPoll, on the National Health Education Standards that are used by the education system for work associated with 5th to 8th grade students' HL (Brown et al., 2007).

Instruments Used to Measure Health Literacy and Study Findings

In 13 studies, six instruments were used to measure HL: S-TOFHLA (n=1), REALM (n=2), Newest Vital Sign (n=4), Rapid Estimate of Adolescent Literacy in Medicine (n=9), KidsPoll (n=2), and eHEALS (n=1). EHEALS, a measure of electronic HL, was included because it was one of two instruments used by Ghaddar et al. (2012). See Table 2 for a description of the instruments. Studies used either one (n=9), two (n=3), or three (n=1) instruments to measure HL which ranged from 23% to 92%.

Brief Version of the Test of Functional Health Literacy in Adults

Chisolm et al. (2011) surveyed youth with asthma or diabetes to explore relationships between HL and sociodemographic factors, perceptions of health-related websites, and intent to use online health-related information from a resource list. Most of the youth were White and 99.2% attained scores indicating adequate HL on the S-TOFHLA. There was not a

statistically significant difference between youth with asthma and diabetes. Youth who were female, White, and older (16 to 18 years) had significantly higher mean HL scores than those who were male, non-White, and younger (13 to 15 years). The use of online health-related information was similar among youth with adequate and limited HL but those with adequate HL reported greater intent to use the resource list (Chisolm et al., 2011).

The Rapid Estimate of Adult Literacy in Medicine

Needham et al. (2010) surveyed youth at a reproductive clinic to explore relationships between HL and the ability to understand sexually transmitted infection (STI) information and risky sexual behavior. All the youth were female, and almost two-thirds attained scores indicating adequate HL on the REALM. Youth with limited HL had limited understanding of written STI information but there was no difference in risky sexual behavior (Needham et al., 2010).

Rapid Estimate of Adult/Adolescent Literacy in Medicine

Shone et al. (2011) used the REALM for youth 18 to 23 years and the Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen) for youth 16 and 17 years to explore relationships between HL and acetaminophen knowledge, identification, and dosing. Nearly two-thirds of the youth were reported to have adequate HL; however, HL was dichotomized into adequate and limited but the cutoff point was not reported. Youth with limited HL had less knowledge about acetaminophen, and they were less likely to correctly dose and identify products that contain acetaminophen (Shone et al., 2011).

The REALM-Teen

Holstein et al. (2014) surveyed juvenile offenders to explore if HL varies by gender, race/ethnicity, age, and type of juvenile correction facility. Two-thirds of the primarily male youth attained scores indicating adequate HL on the REALM-Teen. Youth who were female, White, and non-Hispanic had significantly higher mean HL scores than those who were male

and non-White. The mean HL score of youth from the secure sexual offender facility was significantly higher than those from the restitution, mental health, detention, and the secure gang facilities (Holstein et al., 2014).

Chisolm et al. (2014) explored relationships between HL, alcohol expectancies, and alcohol use of youth at adolescent medical clinics. Three-quarter of the youth attained scores indicating adequate HL on the REALM-Teen. In youth with adequate HL, alcohol expectancies predicted alcohol use and HL moderated relationships between six of the seven alcohol expectancies and alcohol use. In youth with limited HL, HL moderated the relationship between one of the seven alcohol expectancies and alcohol use. HL did not moderate relationships between alcohol expectancies and binge drinking, regular drinking, and problems from drinking (Chisolm et al., 2014).

Dharmapuri et al. (2015) surveyed primarily Black youth to explore relationships between HL and medication adherence. The median age was 16.1 years and the median grade in school was 11 but the median REALM-Teen score corresponded with sixth to seventh grade. The relationship between self-reported learning disability and medication adherence was significant but the relationship between HL and medication adherence was not significant (Dharmapuri et al., 2015).

Manganello & Sojka (2016) explored how HL impacts the ability of Black youth to obtain, understand, and process health-related information. Only 15% read at or above grade level on the REALM-Teen. However, 35% were reported to have adequate HL once the interpretation scale was lowered to include youth who read one grade below actual grade. Youth with limited HL preferred to obtain health-related information from school followed by healthcare providers, parents, and the Internet. Most reported being able to understand information from healthcare providers. Youth with limited HL were less able to understand

but more likely to believe health-related information from media sources than their peers with adequate HL (Manganello & Sojka, 2016).

Valerio et al. (2018) surveyed primarily female Black and/or Hispanic youth to explore relationships between HL and asthma self-care and morbidity. Overall, 31% attained scores indicating adequate HL but youth born in the US had significantly higher REALM-Teen scores than those born outside of the US. Although not statistically significant, females had higher REALM-Teen scores than males. Youth with higher REALM-Teen scores had significantly more asthma knowledge and asthma self-efficacy but relationships between HL and morbidity were not significant (Valerio et al., 2018).

The Newest Vital Sign

Shah et al. (2010) surveyed primarily White youth during pre-participation sports physicals to assess the feasibility of using the NVS and the impact of taking a health class on NVS scores. NVS administration time was less than three minutes. HL was dichotomized into low (0-2) and adequate (3-6), and 40.3% of the youth were reported to have adequate HL. More White females had adequate HL than White males, non-White females, and non-White males. Taking a health class did not impact NVS scores (Shah et al., 2010).

The REALM-Teen and the NVS

Perry et al. (2017) surveyed youth with sickle cell disease to assess relationships between HL and sociodemographic factors including the number of annual healthcare encounters. The REALM-Teen and the NVS scores were correlated. Overall, the sample scored below grade level on the REALM-Teen and the mean NVS score indicated limited HL. Females scored significantly higher on the REALM-Teen than males but there was not a statistically significant gender difference on the NVS. The relationship between HL and the number of annual healthcare encounters was not statistically significant (Perry et al., 2017).

The NVS and eHEALS

Ghaddar et al. (2012) used the eHeals and NVS for an online survey of primarily Hispanic youth from a school district that incorporated MedlinePlus into the curriculum. MedlinePlus is a credible source of online health information that is supported by the National Library of Medicine. Adequate HL scores were attained by 52.1% on the NVS and by 31.6% on eHeals. EHeals scores were significantly higher in students who attained scores indicating adequate HL on the NVS. Only 40.8% of the Hispanic students had adequate HL compared to 80.5% of the youth who selected "other" for their race/ethnicity. Youth with adequate HL were more likely to have heard of MedlinePlus compared to youth with limited literacy possible/likely (Ghaddar et al., 2012).

The KidsPoll

Brown et al. (2007) explored how pre-teens' perceptions of their ability to understand health-related information impacts their interest in learning about health and their motivation to engage in healthy behaviors. Most of the youth reported that health-related information is sort of or very easy to understand, that they are sort of or very interested in learning about health, and that they try to adhere to health recommendations all or most of the time; however, motivation to adhere to health recommendations decreases with age (Brown et al., 2007).

KidsPoll, the REALM-Teen, and the NVS

Park et al. (2017) used three instruments to assess HL and explore relationships between HL and health behaviors of high school freshman. All participants took the KidsPoll, and about 40% also took the REALM-Teen and the NVS. The REALM-Teen and the NVS scores were correlated but neither were correlated with the KidsPoll. According to the KidsPoll, most freshman had a moderate to high interest in health-related information.

Adequate HL scores were attained by 57% on the REALM-Teen and by 23% on the NVS (Park et al., 2017).

Trends in Adolescent Health Literacy Research

White youth have higher HL scores than their non-White peers and, except for findings from one of the two instruments in the study by Ghaddar et al. (2012), females have higher levels of HL than males. See Table 3 for a summary of the studies that report HL scores stratified by gender and/or race/ethnicity. Although percent, mean, and median provide different information (Salkind, 2011), this table shows that there is a gender and race/ethnicity disparity in adolescents' HL. This table also illustrates that HL instruments measure different components of HL, and that inconsistent statistical reporting of results and modified interpretation scales are barriers to adolescent HL research.

Discussion

In these 13 studies, the use of multiple definitions does not appear to be a barrier to advancing the science. However, inconsistent frameworks and instruments that fail to comprehensively measure HL were found to be barriers to adolescent HL research. All the studies measured at least one of the core HL skills, yet adolescent HL research does not meet recommendations for a consistent conceptual framework. Adolescent HL research should be theory based and guided by a framework specific to adolescents' HL such as Manganello's (2008) Adolescent Health Literacy Model.

Comparing multiple instruments highlights how HL varies across studies as well as within studies. Instruments may be correlated yet measure different components of HL. The TOFHLA, S-TOFHLA, REALM, REALM-Teen, and the NVS were all designed for use in healthcare settings, and healthcare providers must know what component(s) of HL are being assessed. Some of these instruments only measure adolescents' ability to pronounce health-related words whereas the NVS measure their ability to read, understand, and use health-

related information. The NVS is the most comprehensive instrument available to measure adolescents' HL yet it does not assess their ability to obtain information. An instrument that comprehensively assesses the construct of adolescents' HL would promote building evidence around this topic and advance the science. Until an instrument that comprehensively assesses the construct is developed, researchers should use the instrument that most comprehensively assesses the construct of HL. Instrument development should be guided by a framework specific for adolescent HL research such as Manganello's (2008) Adolescent Health Literacy Model.

Evidence from this systematic review suggests that relationships between adolescents' literacy, HL, and health resemble those in adults with limited literacy and in children of parents with limited literacy. Youth with limited HL tend to have less knowledge about disease and poor disease management. In the studies reviewed, youth who have been retained in school, youth with a learning disability, and, despite on-going contact with the healthcare system, youth with sickle cell disease appear to be at risk for limited HL (Dharmapuri et al., 2015; Park et al., 2017; Perry et al., 2017). Limited HL was associated with decreased understanding of written information about STIs, decreased understanding of an acetaminophen label and decreased ability to correctly identify and dose acetaminophen, decreased understanding of asthma and asthma management, and decreased understanding of information obtained from healthcare providers and media sources.

Adolescents and young adults with limited HL may have limited understanding of health-related information, and they may have difficulty making appropriate health decisions. Adolescents use the Internet to look up health-related information (Lauricella et al., 2018), and commonly use search engines and select websites within the top three hits rather than seeking online health-related information from specific websites. They do not typically check authorship, authority, or sponsorship even though approximately 11% of

health-related websites provide inaccurate information (Jain & Bickham, 2014). Healthcare providers and educators need to know the evidence from adolescent HL research so that they can identify youth who are at risk for limited HL, teach at an appropriate level, and provide their patients/students with credible health-related websites. Tailoring health-related information to the appropriate HL level may increase adolescents' understanding of health-related information and improve their ability to make healthy decisions, manage acute and chronic diseases, and appropriately use the healthcare system.

Limitations

There are several limitations to this review which sought to describe the definitions, frameworks, measurement, and evidence about adolescent HL research. First, only studies using an instrument to quantify general HL were included. This restricted the number of definitions and frameworks included for analysis. Second, only studies conducted within the US were included. As a result, instruments being used outside of the US were not included. HL has been measured using the same instrument across countries; however, linguistic and cultural differences make it difficult to generalize the evidence. Third, due to the paucity of published research in this area, the sample ranged from pre-teens to young adults.

Conclusion

This review describes the definitions, conceptual frameworks, measurement, and evidence about adolescent HL research. The evidence from 13 studies indicates that many adolescents and young adults have limited HL and may have difficulty making healthy decisions. The 2004 IOM report identified the healthcare and education systems as potential points for intervention to improve HL skills. Adolescents are living in a connected world with access to mobile media. Manganello's (2008) Adolescent Health Literacy Model includes mass media as a potential point for intervention to improve adolescents' HL skills. Healthcare providers and educators need to make intentional efforts to know the evidence

from adolescent HL research so that they can identify youth who are at risk for limited HL, teach at an appropriate level, and provide resource lists of credible health-related websites. Future research should focus on how HL affects adolescents' health-related behaviors, disease management, and use of the healthcare system. Researchers should use a definition that includes the four core HL skills, a framework that is specific to adolescent HL research, and the most comprehensive instrument available to measure adolescents' HL.

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Table 1

Studies included in this review that use an instrument to measure general health literacy in adolescents

Author, Year	Study Aim(s)	Sample, Setting	Operational Definition of Health Literacy	Theoretical Framework	Instrument(s): Health Literacy of Sample	Findings
Brown, Teufel, & Birch (2007)	Aim 1: Assess the ability of pre-teens to understand health-related information. Aim 2: Assess the interest of pre-teens in learning about health. Aim 2: Assess the motivation of pre-teens to adhere to what they learn about health.	Sample size: n=1,178 Age: 9-13 years; mean age: 10.5. Male: 48.3%, Female: 51.7%. Black: 15%, White: 66%, Hispanic: 17%. Setting(s): 11 centers that teach about health.	"The ability to understand health information and to understand that actions taken in youth affect health later in life, combined with the ability to access valid health information" p. 13.	National Health Education Standards	Instrument: KidsPoll. HL of sample: unable to assess.	Aim 1: Most pre-teens find health-related information sort of (41.0%) or very easy (37.1%) to understand but some find it sort of hard (15.3%) or very hard (6.5%) to understand. Aim 2: Most pre-teens are very (41.9%) or somewhat (37.5%) interested but some are very (12.6%) or sort of (8.0%) uninterested in learning about health.

						Aim 3: Most pre-teens try to adhere to what they learn about health all the time (33.4%) or most of the time (32.8%) or sometimes (19.0%) while some never (9.7%) or hardly ever (5.2%) to what they learn about health. Motivation to follow health-related information decreases with age.
Needham, Wiemann, Tortolero, & Chacko (2010)	Aim 1: Explore relationships between HL and the ability to understand STI written at an 8th grade reading level. Aim 2: Explore relationships between HL and	Sample size: n=127. Age: 16-21 years; mean age: 19.0±1.4. Female: 100% Black: 63.7%, White: 7.9%, Hispanic: 25.2%. Setting: a reproductive clinic (n=1).	''The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions'' p. 506.	No theoretical framework.	Instrument: REALM. Mean REALM score: 58.96±8.5. Sample with adequate HL per the REALM: 63%.	Aim 1: Youth with limited HL were less likely to understand written STI materials than those with adequate HL (7.54 v 9.08; $F[1.121] = 22.87$, $p<.001$).

	risky sexual behavior.					Aim 2: There was no difference in sexual risk-taking behaviors between groups (2.37 v 2.48; F[1,121] = .722, p=.397).
Shah, West, Bremmeyr, & Savoy-Moore (2010)	Aim 1: Assess feasibility of using the NVS to measure HL in the primary care setting. Aim 2: Assess if taking a health class influences HL.	Sample size: n=206. Age: 13-20 years; mean age: 15.0±1.3. Male: 53.4%, Female: 46.5%. White: 90.8%. Setting: preparticipation sports physicals in 5 primary care clinics.	"The ability to obtain, process, and understand the basic info needed to make appropriate health decisions" p. 195.	No theoretical framework.	Instrument: The NVS. Mean NVS score: not reported. Sample with adequate HL using a modified NVS interpretation scale in which adequate HL is defined as 3/6: 59.7%.	Aim 1: The NVS can be administered in less than 3 minutes. Aim 2: There relationship between HL and taking a health class was not statistically significant.
Chisolm, Hardin, McCoy, Johnson, Scheck McAlearney & Gardner (2011)	Aim 1: Explore relationships between HL and socio-demographic factors. Aim 2: Explore relationships between HL and perceptions of	Sample size: n=180. Age: 13-18 years. Male: 50%, Female: 50%. Black: 20%, White: 72.2%. Setting: 4 asthma and diabetes specialty care clinics.	"The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate healthcare decisions"	No theoretical framework.	Instrument: The brief version of the TOFHLA. Mean TOFHLA score: 88.9. Sample with adequate HL per the TOFHLA: 92%.	Aim 1: HL was similar among youth with asthma and diabetes. Youth who were female (91.0±14.1), 16-18 years (91.1±14.2), White (91.1±12.0) were

| health-related Web sites. Aim 3: Explore relationships between HL, the intent to use, and actual use within 90 days of initial interview of health-related Web site from a resource list. | Asthma: 49.4%, Diabetes: 50.6%. | p. 676. | | more likely to have higher mean HL scores than those who were male (86.9±16.8), 15-15 years (87.4±15.5), Black (80.6±24.5). Aim 2: Use of online health-related information was similar among youth with adequate (48.8%) and limited (42.9%) HL. Aim 3: Youth with adequate HL had greater intent to use and greater use within 90 days of initial interview the health-related Web sites from a resource list than those with limited HL. |

Shone, King, Doane, Wilson, & Wolf (2011)	Aim 1: Explore relationships between HL and knowledge about acetaminophen. Aim 2: Explore relationships between HL and identifying products that contain acetaminophen. Aim 3: Explore relationships between HL and understanding of medication dosing.	Sample size: n=266. Age: 16-23 years; mean age: 18.6±2.0. Male: 43.6%, Female: 56.4%. Black: 32.3%, White: 47.8%, Hispanic: 13.2%. Settings: 2 clinics and 4 schools (high school, vocational center, GED program, community college).	HL is not defined.	No theoretical framework.	Instruments: 1. REALM for sample >18 years old. 2. The Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen) for sample <18 years old. Mean scores: not reported. Sample with adequate HL per the REALM and the REALM-Teen: 64%.	Aim 1: Youth with limited HL had less acetaminophen knowledge (67.7%) than those with adequate HL (96.5%). Aim 2: Youth with limited HL were less likely to correctly identify products with acetaminophen (36.5%) than those with adequate HL (65.3%). Aim 3: Youth with limited HL and were less likely correctly dose medication (6.3%) than those with adequate HL (20.6%).
Ghaddar, Valerio, Garcia, & Hansen (2012)	Aim 1: Explore HL in a predominantly Hispanic population.	Sample size: n=261. Age: 14-20 years; mean age: 16. Male: 40.2%,	''The degree to which individuals have the capacity to obtain, process, and understand	No theoretical framework.	Instruments: 1. NVS (online), 2. eHEALS. Mean Scores:	Aim 1: 40.8% of the Hispanic students had adequate HL compared to

	Aim 2: Explore relationships between HL and exposure to MedlinePlus, a credible source of online health information.	Female: 59.8%. Hispanic: 84.3%, Other: 15.7%. Setting: 4 high schools.	basic health information and services needed to make appropriate health decisions'' p. 28.		NVS = not reported, eHEALS = 30.6%. Sample with adequate HL: NVS = 52.1%, eHEALS = 31.6%.	80.5% of the youth who identified as "other." Aim 2: Youth with adequate HL were more likely to have heard of MedlinePlus (61%) compared to youth with limited literacy possible (31.5%) and limited literacy likely (7.5%).
Holstein, Clifton, & Guo (2014)	Aim 1: Assess the HL of juvenile offenders in grades 5-12. Aim 2: Explore if HL varies by age, ethnicity, gender, race, or type of juvenile correction facility.	Sample size: n=174 Age: 12.2-20.9 years; mean age: 17.4±1.4. Male: 77%, Female: 23%. Black: 7.5%, White: 55.2%, Hispanic: 33.8%. Setting: 5 juvenile correction facilities.	"The degree to which an individual has the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" p. 167.	No theoretical framework.	Instrument: REALM-Teen. Mean REALM-Teen score: 60.2±7.7. Sample with adequate HL per the REALM-Teen: 66.7%.	Aim 1: The average grade level was 11/12 but the average REALM-Teen score was only grade 8/9. Aim 2: REALM-Teen scores were higher female (62.4±5.8), White (61.7±6.8), non-Hispanic (61.4±71.) than in male (59.6±8.1), non-White

						(58.3±8.3), non-Hispanic (57.8±8.4) youth, and in youth from the secure sexual offender facility (62.4±5.4) than those from restitution (61.5±7.5), mental health (60.4±7.2), detention (59.9±8.5), secure gang (57.7±7.8) facilities.
Chisolm, Manganello, Kelleher, & Marshal (2014)	Aim 1: Explore relationships between HL, alcohol expectancies, and alcohol use in adolescents. Aim 2: Explore if HL moderates relationships between alcohol expectancies and any alcohol use, binge drinking, regular drinking, and problems	Sample size: n=293. Age: 14-19 years. Male: 30.4%, Female: 69.6%. Black: 51.2%, White: 45%. Setting: 2 clinics Adolescent medical clinics.	"The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" p. 2.	Expectancy Theory	Instrument: REALM-Teen. Mean REALM-Teen score: not reported. Sample with adequate HL per the REALM-Teen: 75.8%.	Aim 1: Positive alcohol expectancies predict alcohol use in youth with higher HL. Aim 2: HL moderates the relationship between alcohol expectancies and any alcohol use; but it does not moderate relationships between alcohol

		related to drinking in the past six months.				expectancies and binge drinking, regular drinking, and problems related to drinking in the past six months.
Dharmapuri, Best, Kind, Silber, Simpson, & D'Angelo, (2015)	Aim: To explore the relationships between HL and medication adherence.	Sample size: n=112. Age: 12 – 21 years; median age: 16.1. Median grade: 11. Male: 36%, Female: 64%. Black: 94%, White: 1%, Hispanic: 3%. Setting: 1 adolescent health center.	"… having the ability to read, understand, and navigate within a health care system" p. 378.	No theoretical framework.	Instrument: REALM-Teen. Mean REALM-Teen score: not reported; median score: 57. Sample with adequate HL: not reported; median grade = 1, median REALM-Teen score = grade 6/7.	Aim 1: There is not a significant relationship between HL and medication adherence.
Manganello, A., & Sojka (2016)	Aim 1: Explore the ability of Black teens to obtain health-related information. Aim 2: Explore the ability of Black teens to	Sample size: n=48. Age: 14-17 years. Male: 30%, Female: 70%. Black: 100%. Setting: 2 community-based organizations.	"… one's ability to obtain, process, and understand basic health info and services needed to make appropriate health decisions" p. 222.	No theoretical framework.	Instrument: REALM-Teen. Mean REALM-Teen score: 53. Sample with adequate HL using a modified REALM-Teen interpretation scale in which adequate HL is	Aim 1: Teens with limited HL prefer to obtain health-related information from school (52%), HCPs (28%), parents (15%), internet (5%). Aim 2: Teens with limited HL

	Understand health-related information. Aim 3: Explore the ability of Black teens to process health-related information.				defined as reading one grade below, at, or above grade level: 35%.	were less likely to understand information from media sources (48%) and HCPs (86%) than their peers with adequate HL (77%, 94%). Aim 3: Teens with limited HL are more likely to believe health-related information from the TV (50%) and the internet (28%) than their peers with adequate HL (29%, 14%).
Park et al. (2017)	Aim 1: Assess HL using 3 instruments. Aim 2: Explore relationships between HL and health behaviors at baseline and at 6 month follow-up.	Sample size: n=182 Age: 13-17 years; mean age: 14.51±.73. Grade level: 9. Male: 43%, Female: 57%. Black: 48%, White: 18%, 2 or more races: 21%,	''… 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	No theoretical framework.	Instruments: 1. REALM-Teen, 2. NVS, 3. 4 of 8 items from the KidsPoll. Mean Scores: REALM-Teen = 57.39±7.47, NVS = 2.29±1.59,	Aim 1: The REALM-Teen and NVS are correlated but neither are correlated with the KidsPoll. Aim 2: Findings vary by instrument: sample with adequate HL

		Hispanic: 16%. Setting: 1 public high school.	maintain good health" p. 885.		KidsPoll = 11.05±1.84. Sample with adequate HL: REALM-Teen = 57%, NVS = 23%, KidsPoll = not reported.	varies from 23% with the NVS to 57% with the REALM-Teen.
Perry, Carter, Becker, Garcia, Mackert, & Johnson (2017)	Aim 1: Assess the HL of youth with SCD. Aim 2: Explore relationships between HL and socio-demographic factors including the number of annual healthcare encounters.	Sample size: n=75. Age: 10.3-18.4 years; mean age: 14.7±2.2. Male: 49.3%, Female: 50.7%. Black: 100%. Setting: 1 hematology clinic (n=1). Sample with SCD: 100%.	"The degree to which individuals have the capacity to obtain, process, and understand basic health info and services needed to make appropriate health decisions" p. 192.	The Adolescent HL Model by Manganello (2008).	Instruments: 1. REALM-Teen 2. NVS Mean Scores: REALM-Teen = 53.7± 12.8, NVS = 2.37±1.33. Sample with adequate HL: REALM-Teen = not reported, NVS = not reported. The REALM-Teen and NVS are correlated; but findings vary by instrument.	Aim 1: The average grade level was 8.7±2.2 but the mean REALM-Teen score correlated with grade 6/7 and the mean NVS score indicated that this sample may have limited HL. Aim 2: HL scores increased with grade. The mean REALM-Teen score for females (56.6) was significantly higher than males (50.7) but there was not a statistically

						significant gender difference in mean NVS scores. There was not a statistically significant relationship between HL and the number of annual healthcare encounters.
Valerio, George, Liu, Osakwe, & Bruzzese (2018)	Aim 1: Explore HL in Hispanic and Black teens with undiagnosed asthma and their socio-demographic factors including if they were born in the US. Aim 2: Explore relationships between HL and asthma self-care and morbidity.	Sample size: n=327. Age: 13-18 years; mean age: 15.8. Female: 84.7%, Male: 15.3%. Black and/or Hispanic: 100% Setting: 44 public high schools. Sample born in the US: 72.8%.	HL is not defined.	No theoretical framework.	Instrument: REALM-Teen. Mean REALM-Teen score: 55.93±9.17. Sample with adequate HL: 31%.	Aim 1: REALM-Teen scores were significantly higher in teens who were born in the US. Aim 2: Teens with higher REALM-Teen scores had significantly more asthma knowledge and asthma self-efficacy; relationships between HL and morbidity were not significant.

Key
HCP: healthcare provider
HL: health literacy
NVS: Newest Vital Sign
REALM: Rapid Estimate of Adult Literacy in Medicine
REALM-Teen: Rapid Estimate of Adolescent Literacy in Medicine
SCD: sickle cell disease
STI: sexually transmitted infection
TOFHLA: Test of Functional health literacy in Adults
US: United States

Table 2

Description of instruments that measure general health literacy in adolescents included in this review

Instrument	What it measures	Administration, Number of items, Scoring	Population for instrument testing	Validity	Reliability
Rapid Estimate of Adult Literacy in Medicine (REALM)	Measures: The ability to pronounce health-related words.	Duration: 2 minutes. Route: Verbal. Scores: Aggregated and categorized by ability to read at or below grade level. 0-18: ≤ 3rd grade, 19-44: 4/6 grade, 45-60: 7/8 grade, 61-66: 9/12 grade.	Sample size: n=203 for validity testing. Sample size: n=100 for test-retest reliability. Age: 16-86 years (Davis et al., 1993).	Convergent validity with the Slosson Oral Reading Test (SORT): r=.96. Convergent validity with the Peabody Individual Achievement Test – Revise (PIAT-R): r=.97. Convergent validity with the Wide Range Achievement Test - Revised (WRAT-R).: r =.88 (p < .0001).	Test-retest = .99 (p < .001).
Brief Version of the Test of Functional Health Literacy in Adults (S-TOFHLA)	Measures: Reading comprehension and numeracy.	Durations: 12 minutes. Route: Verbal. 50 items. Score: Aggregated and categorized by health literacy. 0-53: inadequate, 54-66: marginal,	Sample size: n=211. Age: 18+ (Baker et al., 1999).	Correlation with the REALM: .80.	Internal Consistency for numeracy: Cronbach's α .68. Internal Consistency for prose: Cronbach's α .97.

		67-100: adequate.			
The Newest Vital Sign (NVS)	Measures: The ability to read, understand, and use information written on a nutrition label.	Duration: 3 minutes. Route: Verbal. 6 items. Score: Aggregated and categorized by health literacy. 0-1: limited literacy likely, 2-3: limited literacy possible, 4-6: adequate health literacy.	Sample size: n=250. Age: 18 - 85 years (Weiss et al., 2005).	Correlation with the TOFHLA: r = .59, p<.001.	Internal Consistency: Cronbach's α .76.
			Sample size: n=97. Age: 7 - 17 years (Warsh et al., 2014).	Correlation with the Gray Silent Reading Test (GSRT): Spearman's Rho ρ = 0.71, *P* < .0001.	Cutoff scores for age 10-17 years: < 2: limited literacy likely, ≤4 adequate health literacy.
			Sample size: n=75. Age: 10 - 19 years (Perry et al., 2017).	Correlation with the Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen): r = .38, p<.01.	Internal Consistency: Cronbach's □ .63.
Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen)	Measures: The ability to pronounce health-related words.	Duration: 3 minutes. Route: verbal. 66 items. Score: aggregated and categorized by the ability to read at or below grade level.	Sample size: n=1,533. Age: 10 - 19 years (Davis et al., 2006).	Correlation with the Slosson Oral Reading Test-Revised (SORT-R): r = .93, p not reported. Correlation with the Wide Range	Internal Consistency: Cronbach's α .94.

		0-37: ≤ 3rd grade, 38-44: 4/5 grade, 45-58: 6/7 grade, 59-62: 8/9 grade, 63-66: ≥ 10th grade.		Achievement Test (WRAT): r = .83, p not reported.	
KidsPoll	Measures: Participants' perceptions of their ability to understand health promotion and disease prevention, to obtain health-related information, and to communicate about health-related information.	Duration: not reported. Route: hand-held keypad. 8 items. Score: each item receives a score.	Sample size: n=1,178. Age: 9-13 years (Brown et al., 2007).	Content and face validity: Advisory team.	Not reported.
eHEALS	Measures: Electronic health literacy.	Duration: not reported. Route: not reported. 8 items.	Sample size: n=664. Age: 13-21 years (Norman & Skinner, 2006).	Item-scale correlations between items: r = .51 - .76.	Cronbach's α .88. Test-retest: r = .68 - .40.

Table 3

Summary of the studies reporting the percent of youth with adequate health literacy or their mean and/or median health literacy scores stratified

by gender and race/ethnicity

Instrument, Study	Total	Female	Male	White	Black	Hispanic	Other	Non-Hispanic
TOFHLA, Chisolm et al. (2011)	92.2%	94.4%	90.0%	95.4%	77.8%		100%	
REALM, REALM-Teen, Shone et al. (2011)	64%	59.4%	40.6%	58.8%	21.8%	12.9%	6.5%	
REALM-Teen, Chisolm et al. (2014)	75.8%	72.5%	27.5%	50.0%	46.0%		4.0%	
NVS, Ghaddar et al. (2012)	52.1%	48.1%	58.1%			48.6%		80.5%
eHEALS, Ghaddar et al. (2012)	31.6% Mean Score: 30.6	Mean Score: 30.7	Mean Score: 30.5			Mean Score: 30.5		Mean Score: 31.2
NVS, Perry et al. (2017)	Mean Score: 2.4 ± 1.3	Mean Score: 2.42	Mean Score: 2.32					
REALM-Teen, Perry et al. (2017)	Mean Score: 53.7 ± 12.8	Mean Score: 56.6	Mean Score: 50.7					
REALM-Teen, Holstein et al. (2014)	67%	Mean Score: 62.4 ± 5.8	Mean Score: 59.6 ± 8.1	Mean Score: 61.7 ± 6.9		Mean Score: 57.8 ± 8.4		Mean Score: 61.4 ± 7.1
REALM-Teen, Holstein et al. (2014)	67%	Median Score: 64	Median Score: 63	Median Score: 64		Median Score: 61		Median Score: 64
NVS, Dharmapuri et al. (2015)	Median Score: 57	Median Score: 60	Median Score: 58					

Figure 1

PRISMA Flow Diagram

PRISMA 2009 Flow Diagram

Identification

Records identified through
database searching
(n = 57)

Additional records identified
through other sources
(n = 6)

Records after duplicates removed
(n = 63)

Screening

Records screened
(n = 63)

Records excluded
(n = 49)

Eligibility

Full-text articles assessed
for eligibility
(n = 14)

Full-text articles excluded,
with reasons
(n = 1: no instrument)

Studies included in
qualitative synthesis
(n = 0)

Included

Studies included in
quantitative synthesis
(meta-analysis)
(n = 13)

Health literacy and underage alcohol use: A systematic review of international literature

Manuscript submitted to *The Journal of Adolescents*

Abstract

Introduction: Underage alcohol use is a preventable risk-taking behavior that contributes to altered brain development, unintentional injury, and death in adolescents. Evidence suggests that adolescents with limited literacy are more likely to engage in risk-taking behaviors than their peers with adequate literacy. This systematic review was conducted to describe the instruments that measure health literacy and synthesize the evidence on adolescents' health literacy and alcohol use.

Methods: PRISMA guidelines were used to identify, select, and critically appraise published adolescent health literacy and alcohol use research. Electronic searches were conducted using CINAHL, ERIC, and PubMed during November 2019 and February 2020. Additional articles were identified through bibliography mining.

Results: The findings from the seven studies that met inclusion criteria vary by the instruments used to measure health literacy and the items and timeframes used to assess alcohol use. Health literacy is reportedly higher with proxy measures that assess literacy than with instruments designed to measure some component(s) of health literacy.

Conclusions: Many adolescents have limited health literacy and, despite minimum age laws, underage alcohol use and alcohol misuse appear to be common in the United States and in other countries. Healthcare providers need to talk with adolescent patients about their personal, family, and peer alcohol use behaviors and educate them about the risks of underage alcohol use using very basic language. Future research should be conducted using instruments and items that can be benchmarked against national data.

1. Introduction

Most of the serious health-related problems during adolescence result from risk-taking behaviors that contribute to preventable causes of disability, disease, and death (Kann et al., 2018). Normal brain development predisposes adolescents to risk-taking behaviors because the reward-seeking system develops during early to mid-adolescence, but the self-control system does not develop until late adolescence into young adulthood. Once the self-control system develops then adolescents are better able to discern cause and effect as well as process and interpret emotions (McNeely & Blanchard, 2009). Underage alcohol use is a risk-taking behavior that contributes to preventable alterations in brain development, unintentional injury, and death.

As they mature, adolescents become increasingly involved with their health (Lauricella et al., 2018) and want to obtain health-related information (Hagell et al., 2015). However, studies conducted in the United States suggest that many adolescents have limited health literacy (Dharmapuri et al., 2015; Park et al., 2017; Manganello & Sojka, 2016; Perry et al., 2017; Shah et al., 2010; Valerio et al., 2018). Health literacy, or literacy in the context of health, 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" (Institute of Medicine Committee on Health Literacy, 2004, p. 20). Adolescents with limited health literacy find health-related information including information from healthcare providers, the Internet, and on medicine labels difficult to understand. They are also more likely to believe information found on the Internet (Manganello & Sojka, 2016).

Literacy is the best predictor of self-reported health status (Prins et al., 2015). There is a direct relationship between adolescents' literacy and their health-related behaviors

(Manganello, 2008). Adolescents with limited literacy are more likely to have poor health outcomes (Diehl, 2011). Individual traits, family, and peers shape physiological and psychological development (Shaffer & Kipp, 2010) including academic achievement (Mckown, 2013) and alcohol-related behaviors (National Research Council and Institute of Medicine, 2009). Health literacy and alcohol-related behaviors are established during adolescence, and both impact the future (Chisolm et al., 2015). It is essential that adolescents have adequate health literacy because they are in the process of establishing lifelong health-related behaviors (Okan et al., 2018).

Generic adolescent health literacy research is limited by the instruments that assess health literacy. According to the most current systematic review, there are 15 different instruments that measure 31 unique components of health literacy in youth ages 11 to 18 years. However, most of the instruments measure their own idea of health literacy (Okan et al., 2018). Despite the plethora of instruments, most of the published adolescent health literacy research focuses on instrument development and/or intervention effectiveness rather than measuring the construct of health literacy.

While the literature shows that adolescents with limited literacy are more likely to engage in risk-taking behaviors than their peers with adequate literacy (DeWalt & Hink, 2009), a closer examination of the evidence about adolescents' health literacy and alcohol use is needed. The goal of this review is to identify and synthesize the literature on adolescents' health literacy and their alcohol use behaviors. The aims are to identify and describe the instruments used to assess health literacy, describe the health literacy and alcohol use behaviors of the youth in this sample, and to synthesize the evidence on health literacy and underage alcohol use.

2. Methods

This review is organized and presented following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Figure 1). The electronic databases CINAHL, ERIC, and PubMed were searched between November 2019 and February 2020 to retrieve peer-reviewed publications in academic journals. No date or geographical restrictions were imposed. Four research questions were used to guide this review.

(1) What are the characteristics of the instruments used to measure adolescents' health literacy?

(2) What is the health literacy of adolescents?

(3) What are the underage alcohol use behaviors of adolescents?

(4) Is there a relationship between health literacy and underage alcohol use?

2.1 Eligibility Criteria

The following inclusion criteria were used: (1) published in the English language, and (2) study results are specific to adolescents from 11 to 21 years. This age range aligns with the American Academy of Pediatrics' definition for the adolescent period; however, studies in which the age range included but extended beyond 11 to 21 years were retained (n=2; Amoah et al., 2019; Hoffman et al., 2017). Search terms "adolescents or teenagers or young adults," "health literacy," and "alcohol" were used to capture all studies assessing health literacy and alcohol use in adolescents.

2.2 Screening Process

The search in CINAHL identified 46 articles, and 41 were eliminated because they did not focus exclusively on adolescents or were unrelated. Five articles were screened and four were retained (Amoah et al., 2019; Brandt et al., 2019; Chisolm et al., 2014; Hawthorne, 1997). The search in PubMed identified 78 articles, and three were duplicates (Brandt et al.,

2019; Chisolm et al., 2014; Park et al., 2017). Two of the remaining 75 articles were screened and all 75 articles were eliminated because they did not focus exclusively on adolescents or were unrelated. The search in ERIC identified one article which was eliminated because it was unrelated. Three additional articles were identified through bibliography mining (Hoffman et al., 2017; König et al., 2018; Park et al., 2017). Studies using literacy as a proxy measure for health literacy yet purporting to explore relationships between health literacy and alcohol use behaviors were retained (n=2; Hawthorne, 1997; König et al., 2018). Seven sources from 1997 to 2019 met the inclusion criteria.

2.3   Data Extraction

To facilitate data analysis and synthesis, two tables were created to address the aims of this review. Table 1 includes a detailed description of the characteristics of instruments used to measure adolescents' health literacy in these seven studies. Table 2 includes a description of each study.

3. Results

The seven articles retained for this review explore relationships between adolescents' literacy (n=2) or health literacy (n=5) and alcohol use in five countries. Two of the studies were conducted in the United States (Chisolm et al., 2014; Park et al., 2017). The remaining studies were conducted in Ghana, Austria, Australia, Guatemala, and Denmark (Amoah et al., 2019; Brandt et al., 2019; Hawthorne, 1997; Hoffman et al., 2017; König et al., 2018). Two of the studies used literacy as a proxy for health literacy (Hawthorne, 1997; König et al., 2018). One of the studies used an instrument that was validated in adults to measure the health literacy of youth from 12 to 24 years (Amoah et al., 2019). The remaining four studies used at least one instrument that was validated in youth to measure the health literacy of their sample (Brandt et al., 2019; Chisolm et al., 2014; Hoffman et al., 2017; Park et al., 2017). In all but one of the studies (Amoah et al., 2019), all of the youth were under the minimum legal

age for alcohol. The age range across studies was between 10 and 24 years. The sample size ranged from 180 to 5,614 youth. All the studies included in this review are quantitative. One of the studies used a longitudinal design (Park et al., 2017) while the remaining six studies used a cross-sectional design.

3.1   *Characteristics of the Instruments Used to Measure Adolescents' Health Literacy*

Five different instruments were used to measure adolescents' health literacy in the articles retained for review: the Rapid Estimate of Adolescent Literacy in Medicine-Teen (REALM-Teen), the Newest Vital Sign (NVS), the KidsPoll, the European Health Literacy Survey (HLS-EU), and the Swedish Functional Health Literacy Scale (SFHL). See Table 1 for a description of these five instruments. The REALM-Teen is a word recognition test derived from education materials created by the American Academy of Pediatrics. It correlates health literacy with a reading grade level (Davis et al., 2006). The NVS uses the nutrition label from an ice cream container. It assesses the ability to understand and apply prose and numeracy (Weiss et al., 2005). The KidsPoll assesses perceptions of accessing and understanding health-related information, interest in and motivation to follow health-related information, and credibility of health-related information (Brown et all., 2007). The HLS-EU measures the ability to access, understand, appraise, and apply health-related information to manage health and disease (Sørensen et al., 2013). The SFHL Scale was developed from the Japanese Functional Health Literacy Scale. It assesses the ability to read and understand health-related information (Wångdahl & Mårtensson, 2015).

3.2   *The Health Literacy of Adolescents*

Proxy measures for health literacy were used in two of the studies. Literacy was the proxy for health literacy in the study of Australian youth by Hawthorne (1997), but the literacy of the sample was not reported (Hawthorne, 1997). Academic achievement and knowledge about alcohol were proxies for health literacy in the study of Danish students by

König et al. (2018). Most of the students reported average or above average grades (86.6%) and even more (95.8%) knew that consuming four to five alcoholic drinks per day is risky (König et al., 2018).

Health literacy was measured with three instruments in one of the studies, and with one instrument in the remaining four studies. Park et al. (2017) surveyed students attending ninth grade in the United States with the REALM-Teen, the NVS, and four items from the KidsPoll. The REALM-Teen scores and the NVS scores were positively correlated; yet, twice as many students attained adequate health literacy scores with the REALM-Teen (57%) than with the NVS (23%). The KidsPoll score indicates that most of the students were moderately to highly interested in health-related information (Park et al. 2017). In the other study conducted in the United States, 75.8% of the youth attending adolescent clinics attained scores on the REALM-Teen indicating adequate health literacy (Chisolm et al., 2014). Comparable to the study by Park et al. (2017), 28.1% of the students attending middle school in low socioeconomic areas of Guatemala attained scores on the NVS indicating adequate health literacy (Hoffman et al., 2017). Only 15.4% of the homeless youth in Ghana attained scores on the SFHL Scale indicating adequate health literacy. In this study, there was a positive correlation between health literacy and education. More than 13% of the youth had never been to school, and all these youth had limited health literacy. Among those who had been to primary school, only 13% had adequate health literacy whereas 21.6 % of the youth who had attended junior high school and 26.7% of the youth with vocational education had adequate health literacy (Amoah et al., 2019). In the final study, Brandt et al. (2019) surveyed Austrian students with 16 items from the HLS-EU but the health literacy of this sample was not reported (Brandt et al., 2019).

3.3 *Underage Alcohol Use Behaviors*

Each study used different items or timeframes to assess alcohol use behaviors. Two of the studies used the same item but the timeframe varied from lifetime to past 30 day alcohol use (Hoffman et al., 2017; Park et al., 2017). Three of the studies used three items (Amoah et al., 2019; Hawthorne, 1997; König et al., 2018), one study used four items plus the Comprehensive Expectancies of Alcohol instrument (Chisolm et al., 2014), and the remaining study used five items to assess alcohol use behaviors (Brandt et al., 2019). Alcohol use behaviors were self-reported and recall periods ranged from the past 30 days to lifetime. Except for the study by Amoah et al. (2019), all the youth surveyed were under the minimum legal age for alcohol.

In the studies that only assessed alcohol use, the lifetime prevalence rate was 18% in the study by Hoffman et al. (2017). Park et al. (2017) aggregated alcohol use, marijuana use, and tobacco use during the past 30 days into substance use. The prevalence rate of alcohol use was not reported, but substance use increased from 32% at baseline to 42% at six-month follow-up (Park et al., 2017).

The items and the timeframes varied in the three studies that used three items to assess alcohol use behaviors. Hawthorne (1997) stratified the timeframe for alcohol use into past month and lifetime but the number of pre-teens engaging in alcohol use was not reported (Hawthorne, 1997). Some of the youth in the study by Amoah et al. (2019) exceeded the minimum legal age for alcohol in Ghana. Almost two-thirds (63%) reported not drinking, 36.4% reported drinking some days, and 0.06% reported drinking every day during the past three months (Amoah et al., 2019). In the study by König et al. (2018), 79.6% reported drinking and 38.4% reported being intoxicated during the past month. Many of these youth (41.2%) also reported problems such as an accident or injury, fight, or regrettable sexual activity as a result of drinking alcohol (König et al., 2018).

The items and the timeframes also varied in the two studies that used five items to assess alcohol use behaviors. In the study by Chisolm et al. (2014), 45% reported drinking, 20% reported binge drinking, and 11.9% reported drinking at least once a month during the past six months. About a third (31.7%) of these youth reported problems such as a hang-over, fight, or regrettable sexual activity as a result of drinking alcohol. In the study by Brandt et al. (2019), 64% reported drinking and 41.9% reported being intoxicated. More than 48% reported drinking and 19.3% reported being intoxicated during the past month. More than half (53.5%) reported drinking alcohol before they were 14 years old (Brandt et al., 2019).

3.4   *Relationships Between Adolescents' Literacy or Health Literacy and Alcohol Use*

There are inconsistent relationships between literacy and underage alcohol use in the literature. Hawthorne (1997) found that limited literacy predicts typical use of two or more glasses of alcohol in males; however, the measure for literacy is not reported. The two proxy measures that König et al. (2018) used to assess literacy (an alcohol knowledge question, grades) yielded somewhat conflicting results. Using the alcohol knowledge question as a proxy for literacy, the adolescents who knew that consuming four to five drinks per day is risky were more likely to report alcohol use during the past month. Conversely, using grades as a proxy, the adolescents who reported above average academic achievement were less likely to report drinking alcohol during the past month. They also reported fewer problems as a result of drinking alcohol. The relationship between poor academic achievement and increased likelihood of drinking alcohol during the past month trended towards but did not reach statistical significance (König et al., 2018).

The relationship between health literacy and underage alcohol use is also unclear. After controlling for covariates, Park et al. (2017) found that adolescents with KidsPoll scores indicating limited health literacy, or limited interest in health-related information, were more likely to engage in substance use behaviors at baseline and at six-month follow-up.

However, they did not find a relationship between REALM-Teen or NVS scores indicating limited health literacy and greater substance use (Park et al., 2017). Chisolm et al. (2014) found that adolescents with REALM-Teen scores indicating adequate health literacy were more likely to report drinking alcohol than those with limited health literacy. Adolescents with adequate health literacy were also more likely to report drinking alcohol at least once a month, binge drinking, and problems as a result of drinking alcohol (Chisolm et al., 2014). Likewise, Hoffman et al. (2017) found that youth with NVS scores indicating adequate health literacy were more likely to report drinking alcohol than youth with limited health literacy (Hoffman et al., 2017). Conversely, Amoah et al. (2019) found that youth who attained adequate health literacy scores on the SFHL Scale were less likely to report drinking alcohol than those with limited health literacy. More youth with limited health literacy reported some alcohol use and only youth with limited health literacy reported daily alcohol use (Amoah et al., 2019). Although the effect size is small, Brandt et al. (2019) found that adolescents with limited health literacy were more likely to report lifetime and past month alcohol use, lifetime and past month intoxication, and drinking more alcohol per occasion than adolescents with adequate health literacy (Brandt et al., 2019).

4   Discussion

In this small sample of literature, the evidence about adolescents' health literacy is limited because the instruments measure different components of health literacy. Literacy is the foundation of health literacy; however, healthcare providers often use scientific terms that are not typically taught in school (Institute of Medicine Committee on Health Literacy, 2004). The difference between literacy and literacy in the context of health may explain why health literacy is reported as higher when using proxy measures such as grades than with instruments designed to measure some component(s) of health literacy. Between 57% and 76% of adolescents in this sample attained scores on the REALM-Teen indicating adequate

health literacy. The REALM-teen has demonstrated reliability and validity, and is correlated with general literacy and with health behaviors known to be associated with health literacy. However, it only assesses the ability to pronounce health-related words. Only about 25% of adolescents in this sample attained scores on the NVS indicating adequate health literacy. The NVS is a more comprehensive assessment of health literacy since it assesses the ability to understand and apply the prose and numbers written on a nutrition label. Regardless of the instrument used to measure health literacy, the evidence suggests that many adolescents have limited health literacy. Consequently, many adolescents may not understand health-related information and may not be able to use health-related information to make appropriate health decisions.

The evidence about underage alcohol use is also limited by this small sample. All the studies relied upon adolescents to self-report their alcohol use behaviors. Self-report may result in the underreporting or overreporting of behaviors (Brener et al., 2013). There was considerable variation in the alcohol use behaviors assessed and the timeframes in which they were assessed with recall periods ranging from the past month to lifetime. Furthermore, the minimum legal age for alcohol varies across countries from none to 21 years of age. The minimum legal age for alcohol in the United States is 21 years but the minimum legal age is 18 years in the other countries discussed in this review (Misachi, 2019).

Adolescents are using alcohol and using alcohol in ways that are unsafe and unhealthy. Underage alcohol use and alcohol misuse was common in the studies by Chisolm et al. (2014), Brandt et al. (2019), and König et al. (2018). About half of the youth reported lifetime alcohol use and about one-third reported being intoxicated and/or experiencing problems as a result of drinking alcohol. The lifetime prevalence of alcohol use among high school students in the United States is 60.4% as reported by the Youth Risk Behavior Survey

(YRBS). The YRBS is a national survey that monitors high school students' risk-taking behaviors (Kann et al., 2018).

Evidence from these studies suggests that cultural norms for alcohol use varies across countries. According to the YRBS, almost 30% of high school students in the United States reported drinking alcohol during the past month (Kann et al., 2018). In the studies reviewed, the youth in Austria (48%) and Denmark (79.6%) were most likely to report drinking alcohol during the past month. On the other hand, the youth in Ghana and Guatemala were less likely to report drinking alcohol in timeframes greater than the past 30 days. Yet, even in these studies, a substantial number of adolescents reported underage alcohol use.

The evidence about relationships between health literacy and underage alcohol use is limited and inconsistent. The findings vary by the instruments used to measure health literacy and the items used to measure alcohol use behaviors. Some of the studies found relationships between limited literacy or limited health literacy and greater alcohol use whereas some of the studies found a relationship between adequate health literacy and greater alcohol use. Family and peer influences may explain the mixed results. Parental educational attainment forms the foundation for their children's literacy skills (Rowe et al., 2016). Parental educational attainment also appears to influence their children's health literacy skills. In the study by Hoffman et al. (2017), most of the parents only had an elementary school education and most of the youth had limited health literacy. In the study by Chisolm et al. (2014), most of the parents had some college education and most of the adolescents had adequate health literacy. Limited health literacy was also associated with never attending school (Amoah et al., 2019) and being "held back" in school (Park et al., 2017).

Academic achievement may protect adolescents from alcohol use. According to findings from the YRBS, adolescents who attain mostly A's are less likely to drink alcohol, binge drink, or begin drinking alcohol before the age of 13 years compared to students

receiving lower grades (Rasberry et al., 2017). König et al. (2018) also found that adolescents with at or above average grades are less likely to drink alcohol than their peers with below average grades. Some of the studies in this review replicated factors known to influence underage alcohol use such as the quality of the parent-child relationship and parental or peer alcohol use. For example, König et al. (2018) found that a poor parent-child relationship is a risk factor for alcohol-related problems. Hawthorne (1997) found that pre-teens whose parents and/or peers drink alcohol are more likely to engage in alcohol use.

4.1   *Critical Considerations*

According to this review, many adolescents have limited health literacy and many adolescents drink alcohol. There is a causal relationship between exposure to alcohol-related media messages and underage alcohol use (Quigley, 2019). Almost all adolescents have Internet access through which they are exposed to unregulated alcohol advertising, peer posts, and questionable health-related information (Lauricella et al., 2018). Media messages inform alcohol expectancies. Both positive and negative alcohol expectancies are associated with greater alcohol use (Chisolm et al., 2014; König et al., 2018). Moreover, health literacy affects how adolescents interpret media messages. Adolescents with adequate health literacy may have more alcohol expectancies because their peers with limited health literacy are less likely to understand the nuances of media messages targeting adults (Chisolm et al., 2014). These adolescents are at risk for unsafe behaviors such as driving while intoxicated, risky sexual activity, and violence which can result in unintentional injuries and death. Decades of research show that adolescents rarely initiate conversations about unsafe behaviors with their healthcare providers. The literature suggests that conversations about unsafe behaviors are most productive when they are initiated by healthcare providers in private settings (Dalstrom et al., 2020).

4.2   Future Directions

Findings from this review highlight the need for research exploring relationships between adolescents' health literacy and underage alcohol use behaviors. First, evidence from these studies suggest that cultural norms for educational attainment and alcohol use vary across countries. Therefore, research should be conducted using instruments and items that can be benchmarked against national data. Second, evidence from this review indicates that positive and negative alcohol expectancies are associated with greater alcohol use. Research exploring relationships between adolescents' health literacy, alcohol expectancies, and alcohol use behaviors could inform the regulation of alcohol advertising. Third, healthcare providers need to initiate conversations with all adolescent patients about their personal, family, and peer alcohol use behaviors and use very basic language to educate them about the risks of underage alcohol use.

4.3   Limitations

There are several limitations to this review. Foremost, this is a targeted review designed to systematically synthesize the literature on adolescents' health literacy and alcohol use behaviors. Due to the paucity of literature exploring relationships between adolescents' health literacy and their alcohol use behaviors, this review included two studies that used proxy measures for health literacy. Second, six countries across four continents were represented in this review. The minimum legal age for alcohol varies across countries, and evidence from these studies suggests that cultural norms for alcohol use and educational attainment also varies across countries. Again, due to the paucity of literature, this review included a study in which some of the youth exceed the minimum legal age. Third, these studies may not be comparable; the age range spans from 10 to 24 years, different instruments were used to measure health literacy, and many different items and timeframes were used to assess alcohol use behaviors.

5   Conclusion

This review sought to identify and describe the instruments used to assess adolescents' health literacy, describe the health literacy and alcohol use behaviors of the youth in this sample, and to synthesize the evidence on adolescents' health literacy and their alcohol use behaviors. This is thought to be the first review to synthesize the evidence on adolescents' health literacy and underage alcohol use. The small body of international literature focused specifically on adolescents' health literacy and alcohol use yielded mixed results. The findings varied by the instruments used to measure health literacy as well as the items and timeframes used to assess alcohol use behaviors. Despite minimum age laws related to safe alcohol use, underage alcohol use and alcohol misuse appear to be common in the United States and in other countries. This systematic review provides some insight into relationships between health literacy and underage alcohol use, but the results may have limited generalizability.

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None

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Table 1

Description of instruments that measure general health literacy in adolescents included in this review

Instrument	What it measures, Number of items	Administration, scoring	Population it was tested in	Validity	Reliability
The Newest Vital Sign (NVS)	The ability to understand and apply prose and numeracy from a nutrition label Number of items: 6.	Administration time: about 3 minutes. Administration route: verbal. Scoring: summed, and categorized: limited literacy likely (0-1), limited literacy possible (2-3), or adequate literacy (4-6) health literacy.	Sample size: n=250. Age range: 18 to 85 years (Weiss et al., 2005).	Correlation with the Test of Functional Health Literacy in Adults (TOFHLA): r = .59, p<.001.	Internal Consistency: good. Cronbach's α .76.
			Sample size: n=97. Age range: 7 to 17 years (Warsh et al., 2014).	Correlation with the Gray Silent Reading Test (GSRT): Spearman's Rho ρ = 0.71, $P < .0001$ (strong).	Not reported.
			Sample size: n=75. Age range: 10 to 19 years (Perry et al., 2017).	Correlation with the Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen): r = .38, p<.01.	Internal Consistency: Acceptable. Cronbach's α .63.
Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen)	Measures: The ability to pronounce health-related words. Number of items: 66.	Administration time: about 3 minutes. Administration route: verbal. Scoring: summed and categorized: the ability to read at or below 3rd grade (0-	Sample size: n=1,533 Age range: 10 to 19 years (Davis et al., 2006).	Correlation with the Slosson Oral Reading Test-Revised (SORT-R): r = .93, p not reported (strong). Correlation with the Wide Range	Internal Consistency: High. Cronbach's α .94.

		37), 4th/5th grade (38-44), 6th/7th grade (45-58), 8th/9th grade (59-62), or at or above 10th grade (63-66).		Achievement Test (WRAT): r = .83, p not reported (strong).	
KidsPoll	Measures: The National Health Education Standards for health literacy: health promotion, the ability access to health information, the ability to talk about health issues. Number of items: 8.	Administration time: not reported. Administration route: hand-held keypad. Scoring: each of the 8 items receives a score.	Sample size: n=1,178. Age range: 9 to 13 years (Brown et al., 2007).	Content and face validity: Advisory team (researchers with health literacy expertise, child psychologist, parents, center directors, a pediatrician, the authors).	Not reported.
European Health Literacy Survey (HLS-EU)	Measures: 3 health-related domains: health care, disease prevention, health promotion. Number of items: 47.	Administration time: 20 to 30 minutes. Administration route: not reported. Scoring: not reported.	Sample size: n=99. Age range: 15 to 81 years (Sørensen et al., 2013).	Construct validity: Advisory panel of 25 experts.	Internal consistency: Cronbach's α: 0.51 to 0.91.
Swedish Functional Health Literacy Scale (SFHL)	Measures: The ability to read and understand health information. Functional health literacy. Number of items: 5.	Administration time: not reported. Administration route: not reported. Scores: Summed. Inadequate (<100), problematic 1000 – 1,000), sufficient >1,000).	Sample size: n=24. Age range: 18 to 75 years (Wångdahl & Mårtensson, 2015). Sample size: not reported. Age range: not reported (Amoah et al., 2019).	Content validity: By the authors based on feedback from the target group and professionals. Validity: Not reported.	Test–retest: 63% - 92% (M = 77.2%) agreement for the 5 items. Internal consistency: High. Cronbach's α .85.

Table 2

Studies included in this systematic review

Author / Year	Aims	Sample / Setting	Measure(s) and health literacy of sample	Items to measure alcohol use	Limitations	Health literacy / Alcohol Relationship	Findings
Hawthorne (1997)	Aim 1: Identify social background predictors of SU. Aim 2: Identify personal predictors of SU. Aim 3: identify school-related predictors of SU.	Country: Australia. Sample size: 3,019. Age in years: 11-12. Grade in school: 6. Male: 54% Female: 46% Race/ethnicity: not reported. Setting School(s): 86	Instrument: none. HL of sample: not measured.	1. At least 1 glass of alcohol in lifetime 2. At least 1 glass of alcohol in the past month 3. Usually 2 or more alcoholic drinks per occasion	Literacy is a proxy measure for health literacy. The measure used to quantify literacy is not reported. Literacy level of the sample was not reported.	In males, low literacy is associated with consuming at least 2 drinks per occasion.	Aim 1: Parental alcohol use predicts lifetime alcohol use in males (OR 1.7) and females (OR 2.4), past month alcohol use in females (OR 3.9), and 2 or more drinks per occasion in males (OR 2.2) and females (OR 2.0). Aim 2: Peer alcohol use predicts lifetime alcohol use in males (OR 3.3) and females (OR

							3.8), past month alcohol use in males (2.8) and females (2.9), and 2 or more drinks per occasion in males (OR 2.5). Aim 3: Low literacy predicts 2 or more drinks per occasion in males (OR 2.6)
Chisolm, Manganello, Kelleher, & Marshal, (2014)	Aim: Identify if HL effects alcohol expectancies and alcohol use behaviors.	Country: USA. Sample size: 293. Age in years: 14–19. Male: 30.4% Female: 69.6% Black: 51.2% White: 45.4% Setting Clinic(s): 2	Instrument: REALM-Teen. HL of sample: 75.8% adequate.	Alcohol use in the past six months: 1. Any use 2. At least once per month 3. 5 or more drinks per occasion 4. Problems from drinking Instrument: Comprehensive	Limited HL: 24.2%. This study did not focus on HL but on relationships between alcohol expectancies and alcohol use.	Higher HL is associated with alcohol use in the past six months.	Aim 1: HL moderates relationships between expectancies and alcohol use. In teens with higher HL, expectancies of sociability (OR 3.23), tension reduction (OR 2.83), liquid courage (OR 2.51), sexuality

					expectancies of alcohol.		OR 2.40), self-perception (OR .61) and cognitive - behavioral impairment (OR .55) predicted any alcohol use in the past six months.
Hoffman, Marsiglia, Nevarez, & Porta (2017)	Aim 1: Describe the HL of youth in Guatemala City. Aim 2: Identify relationships between HL and health-related behaviors associated with negative health outcomes.	Country: Guatemala. Sample size: 210. Age in years: 10-16. Male: 54.75%. Female: 45.3% Race/ethnicity: not reported. Setting School(s): 10	Instrument: NVS. HL of sample: 28.1% adequate.	Lifetime alcohol use	Limited HL: 71.9%; yet the average grades in school were mostly B's. Limited to areas of low SES. Lifetime alcohol use: 18%. Younger sample: M 12.6±1.01.	Higher HL is associated with lifetime alcohol use.	Aim 1: Most of the sample did not have adequate HL. Aim 2: Higher HL predicted higher levels of lifetime alcohol use (OR 1.59).
Park et al. (2017)	Aim 1: Assess HL in urban adolescents using three instruments.	Country: USA. Sample size: 180. Age in years: 13-17. Grade in school: 9.	Instruments: 1. REALM-Teen, 2. NVS, 3. KidsPoll. HL of sample:	Any substance use (alcohol, tobacco, marijuana) in the past month.	Alcohol use was aggregated into SU. HL varies by the instrument. For example, limited HL	1. REALM-Teen: none. 2. NVS: Prior to (but not after) controlling for	Aim 1: HL varied by instrument. Aim 2: With the KidsPoll, after controlling for

	Aim	Sample	HL Measurement	Outcome Variables			
	Aim 2: Examine relationships between HL and health-related behaviors.	Male: 43% Female: 57% Black: 48% Multiracial: 21% White: 18% Native American: 5% Asian: 2% Hispanic: 16% Setting School(s): 1	1. REALM-Teen: 57% adequate, 2. NVS: 23% adequate, 3. KidsPoll: unable to measure.		varies from 43% with the REALM-teen to 77% with the NVS. The KidsPoll measures attributes of HL, but not the construct of HL.	covariates, lower HL was associated with increasing SU over 6-months. 3. KidsPoll: (see next column).	covariates, there was a relationship between limited HL and greater SU at baseline (OR=0.87, p<.1) and at six-month follow-up (OR=0.82, p<.1).
König, Skriver, Iburg, & Rowlands, (2018)	Aim 1: Explore relationships between alcohol use and HL. Aim 2: Explore relationships between alcohol use and psycho-social factors.	Country: Denmark. Sample size: 2,768. Age in years: 15-16. Male: 48% Female: 52% Race/ethnicity: not reported. Setting School(s): 97	Instrument: none. HL of sample: not measured. Proxy items: 1. Self-reported grades in school. 2. Alcohol knowledge: "Is consuming 4-5 drinks per day risky?"	1. Frequency of alcohol use in the past 30 days. 2. Frequency of intoxication in the past 30 days. 3. Problems from alcohol use in past year.	Self-reported grades and 1 alcohol knowledge questions are proxy items for HL. 83.63% reported above average grades. 95.8% knew that 4-5 drinks per day is risky drinking.	Higher grades were associated with less alcohol use in the past 30 days and fewer problems from alcohol use in the past year. Relationships between poor school performance, greater alcohol use, and more problems from alcohol use were not	Aim 1: Above average grades were associated with less alcohol use (OR .60) and fewer problems from alcohol use (OR .58). Aim 2: Factors associated with alcohol use and risky alcohol use include being male, peer alcohol use, and problems with friends.

					statistically significant.		
Amoah, Koduah, Gyasi, Gwenzi, & Anaduaka, (2019)	Aim 1: Explore relationships between HL and socio-demographic factors among street involved youth in Ghana. Aim 2: Assess relationships between HL and socio-demographic factors and the health-related behaviors of smoking and alcohol use.	Country: Ghana. Sample size: 337. Age in years: 12-24. Male: 51%. Female: 49% Northern Tribes: 66.9%: Other Akan: 13.4% Asante: 9.2% Ewe: 8.6% Ga-Adangbe: 1.5% Non-Ghanaian: 1.5% Setting: not reported.	Instrument: Swedish Functional Health Literacy Scale (SFHL). HL of sample: 15% adequate.	Alcohol use in the past 3 months: 1. daily, 2. some days, 3. none.	Limited HL: 85%. 13.4% of the sample had never been to school. The population is limited to youth who have been living on the streets for at least 3 months.	Lower HL is associated with greater alcohol use.	Aim 1: Higher HL was associated with higher education (OR .40). Lower HL was associated with greater time on the streets (OR .37). Aim 2: Lower HL was associated with greater alcohol consumption (OR 9.5) but not smoking.
Brandt et al. (2019)	Aim 1: Examine relationships between HL and the health-related behaviors of smoking and alcohol use.	Country: Austria. Sample size: 5,614. Age in years: 13-17. Male: 45% Female: 55% Race/ethnicity: not reported.	Instrument: 16 items from European Health Literacy Survey (HLS-EU) that assesses ease of finding, understanding and appraising,	Frequency of: 1. lifetime alcohol use 2. lifetime intoxication 3. alcohol use in the past 30 days	The HL of the sample based upon their ease of finding, understanding, appraising, applying information is not reported.	Lower HL was associated with greater: lifetime alcohol use, lifetime intoxication, alcohol use in the past 30 days, intoxication on	Aim 1: Lower HL was associated with greater: lifetime alcohol use (β .03) and intoxication (β .08), alcohol use (β .07) and intoxication in

Aim 2: Examine relationships between components of HL and the health-related behaviors of smoking and alcohol use.	Setting School(s): the number of schools was not reported.	and applying health-related information. HL of sample: not reported.	4. intoxication in the past 30 days and 5. typical amount of alcohol consumed per occasion	the past 30 days, and amount per occasion.	the past 30 days (β .07), and amount per occasion (β .04). Aim 2: Understanding and appraising were associated with lifetime intoxication (β .29) and alcohol use (β .20) and intoxication in the past 30 days (β .41). Applying was associated with lifetime alcohol use (β .11) and amount of alcohol consumed (β .12).

Key
HL: health literacy
SES: socioeconomic status
SU: substance use

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Figure 1

Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines
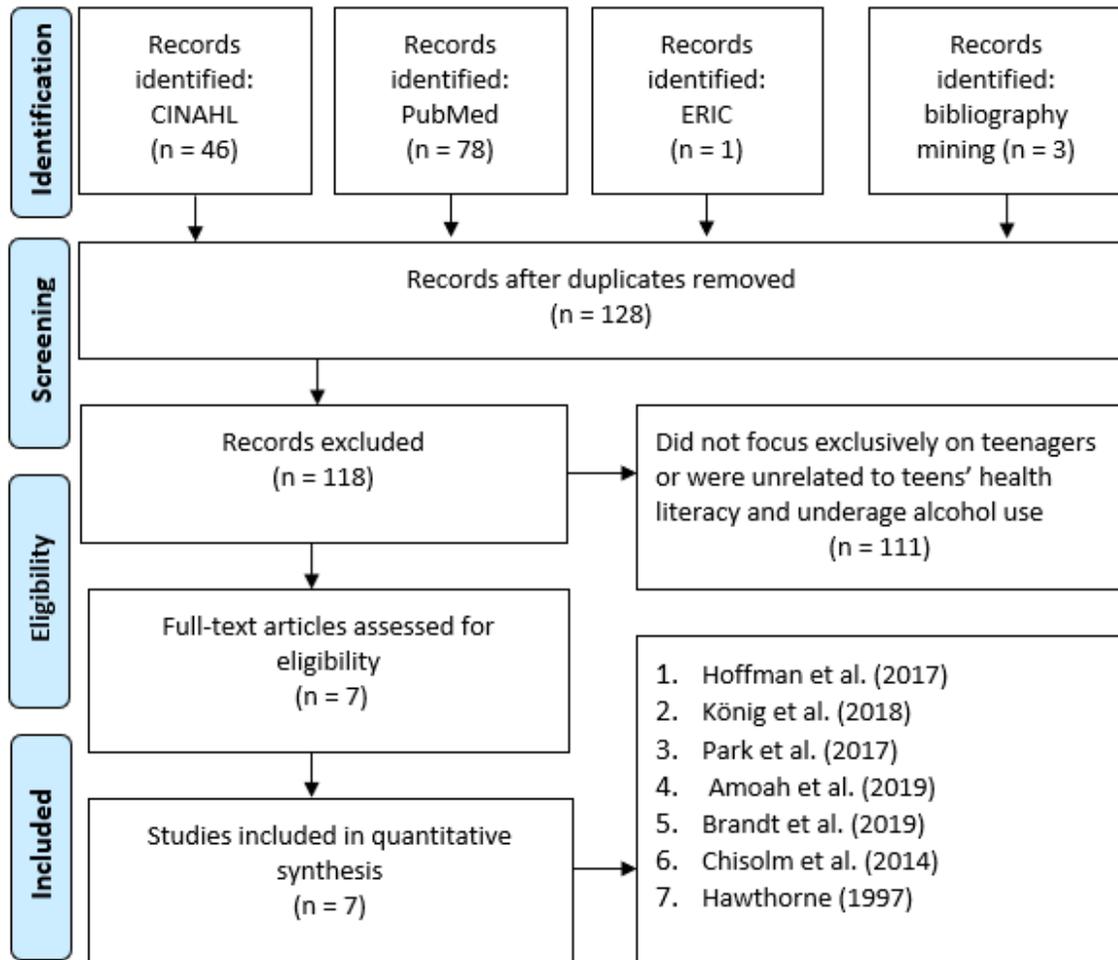
Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	2
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-4
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	4
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	n/a
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5-6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5-6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	5-6
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	6
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	6

CHAPTER III

METHODS AND PROCEDURES

The purpose of this chapter is to describe the methods and procedures that were used in this study that explored relationships between health literacy and alcohol use behaviors in a sample of high school students. Study methods include institutional review board (IRB) approval, the design, the sample and setting, the instruments, data collection, and data analysis. Study procedures include recruitment, the procedures for data collection, and information for participants and participants' parents/guardians. Study procedures were revised after in-seat instruction at the high school was cancelled due to the COVID-19 pandemic in spring 2020. The initial and the modified study procedures were planned in collaboration with the school principal. Research exploring relationships between high school students' ability to understand basic health information and their decisions about alcohol is useful for identifying potential targets for interventions that will delay and decrease underage alcohol use.

Design

This quantitative study is descriptive, correlational, and cross-sectional in design. The study design fits the objective of describing relationships between adolescents' health literacy and their underage alcohol use and behaviors while under the influence of alcohol. A quantitative and observation design was selected since the independent variable "health literacy" was not experimentally manipulated. A correlational and cross-sectional design was used to examine relationships between the variables at a single point in time. This design is efficient and allows for a large amount of data to be collected so that numerous relationships can be examined (Polit & Beck, 2017).

This study focused on one research question and three specific aims.

Research Question: What is the relationship between high school students' health literacy and alcohol-related behaviors?

Aim 1: Describe the health literacy of a sample of high school students.

Aim 2: Examine relationships between high school students' health literacy and their alcohol-related behaviors.

Aim 3: Explore relationships between high school students' health literacy and individual traits.

Institutional Review Board Approval #20.154

The initial study methods and procedures received IRB approval on March 3, 2020 (Appendix A). In response to Illinois shelter-at-home orders, an amendment was submitted to the IRB proposing that the study procedures be conducted online (Appendix B). Modifications included adding a student assent/consent form with an attestation statement form at the beginning of the survey and designing the survey so that it did not collect IP addresses. Rather than including an opt-out form in the parent/guardian letter, parents were asked to forward the survey link and password to their children who were 18 years or older and, if they were willing, to their children who were legal minors. The letter also specified that parents/guardians should only forward the link to their children who were students at the high school during the 2019-2020 academic school year. The amendment was approved on April 2, 2020. A second amendment was submitted to the IRB requesting reminder notices to increase the response rate (Appendix C). This amendment was approved on May 22, 2020.

Study Sample and Setting

This study was open to all students attending a private high school in northern Illinois. There were 737 students enrolled at the school during the spring semester of 2020. All students

met the following inclusion criteria: (a) 13 to 20 years old, (b) able to speak English and complete a survey in English, (c) able to independently enter data into a computer. Students were only able to access the survey if parents/guardians forwarded them the survey link and password. The student body was comprised of students from more than two dozen primary schools. Nearly half of the students received tuition assistance. Historically, most of the students pursue some post-secondary education. Student body demographics reflected the surrounding area with approximately the same number of male and female students, and about 80% of them were White (Austin et al., 2017).

Measures

The electronic survey was created and administered using Qualtrics software. The three main components of the survey were demographic questions, questions assessing students' health literacy, and questions related to their decisions about alcohol. Students were able to skip questions that they did not want to answer. Categorical responses were multiple choice, while numerical responses and the questions assessing students' ability to understand basic health information were fill-in the blank. The anonymize response option was selected to ensure that the survey was anonymous and no identifying information, such as names, birthdates, addresses, or IP addresses were collected. The option to prevent ballot box stuffing was selected so that students were only allowed to take the survey once. Qualtrics estimated that the survey took approximately 13 minutes to complete. See Appendix D for the survey questions and, when applicable, response categories.

Nine demographic questions focused on contextual factors associated with adolescents' health literacy, alcohol use, and behaviors under the influence of alcohol. Since the student body composition was mostly White, to maintain anonymity the responses to race/ethnicity were

limited to White; other, which included American Indian or Alaskan Native, Asian, Black, or Multiracial; Hispanic/Latino; prefer not to answer; and unknown.

The Newest Vital Sign (NVS) was used to assess health literacy. The NVS is a three-minute six-question screening tool that uses the nutrition label from an ice cream container to assess the reading and numeracy components of health literacy. Scores are summed, and categorized as limited literacy likely (0-1), limited literacy possible (2-3), or adequate literacy (4-6). The NVS was initially validated against the Test of Functional Health Literacy in Adults (r=.59) in an adult population (Weiss et al., 2005). It was validated against the Gray Silent Reading Test (r=.71) in youth ages seven to 17 years (Warsh et al., 2014) and against the Rapid Estimate of Adolescent Literacy in Medicine-Teen (r=.38) in youth ages 10 to 18 years with Sickle Cell Disease (Perry et al., 2017). Scores similar to Warsh et al. (2014) were obtained when the NVS was self-administered by youth in sixth-grade (Linnebur & Linnebur, 2018). The NVS has been administered electronically to high school students (Ghaddar et al., 2012).

Adolescents' decisions about alcohol and their behaviors while under the influence of alcohol were assessed using questions from or modified from the 2017 Youth Risk Behavior Survey (YRBS). The Youth Risk Behavior Surveillance System monitors risk-taking behaviors through the YRBS. Conducted by the Centers for Disease Control and Prevention (CDC), the YRBS is administered during odd years to approximately 15,000 high school students across the United States to monitor trends and identify factors that contribute to preventable disability, disease, and mortality. Nine questions from the 2017 YRBS address alcohol use and three of these questions are specific to risk-taking behaviors while under the influence of alcohol (Kann et al., 2018).

Recruitment and Data Collection

Recruitment and data collection were planned in collaboration with the school principal. Since the school is striving to be paperless, email is the typical and preferred form of communication with teachers, students, and parents/guardians. On March 9, 2020, the principal electronically sent letters describing the study to the teachers, students, and parents/guardians. In the original study procedures, parents could opt their minor children out of the study by email. Students interested in the study would meet with the principal investigator individually in prescheduled time slots over three weeks. Students would then give verbal consent and complete the electronic survey. However, on March 14, 2020, the school was closed indefinitely to in-seat instruction due to the COVID-19 pandemic. Modifications in recruitment and data collection were also planned in collaboration with the principal. On April 9, 2020, the principal electronically sent letters describing the study and study modifications to students' school appointed email addresses and parents/guardians. The parent/guardian letters included the link and password to the electronic survey. All students attending the school were informed and invited to participate to prevent potential bias and increase generalizability. The survey was open from April 9 through May 31, 2020.

Data Analysis

Qualtrics survey data were downloaded into SPSS version 26, which was used to organize and analyze the data. Statistical analyses were limited by small sample size and predominately categorical data. Frequencies were analyzed to check categorical variables for minimum and maximum values, valid and missing cases, and out of range variables. Descriptive statistics and nonparametric statistics were used. Descriptive statistics were used to summarize participants demographic data, health literacy scores, and data related to alcohol use behaviors.

Due to small numbers, whenever possible, categorical responses were collapsed to be dichotomous in order to run Fisher's Exact Test to look for statistical differences between groups. A significance level of 0.05 was used for all statistical tests. The summarized results of this study will be shared with the school principal. A manuscript describing the results was written for submission to *The Journal of School Health*, and is included in Chapter IV.

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Appendix A: Institutional Review Board Approval

UNIVERSITY of WISCONSIN
UW MILWAUKEE

Department of University Safety & Assurances

Leah Stoiber
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Engelmann 270
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New Study - Notice of IRB Full Board Approval

Date: March 3, 2020

To: Jeanne Erickson, PhD
Dept: Nursing

CC: Rebecca Parizek

IRB#: 20.154
Title: Health Literacy and Alcohol-related Behaviors in High School Students

After review of your research protocol by the University of Wisconsin – Milwaukee Institutional Review Board at a fully convened meeting held February 7, 2020, your protocol has been approved as governed by 45 CFR 46. Your protocol has also been granted approval to waive parental consent, as governed by 45 CFR 46.116(f), and granted approval to waive documentation of informed consent, as governed by 45 CFR 46.117(c).

This protocol has been approved on February 7, 2020 for one year. IRB approval will expire on February 6, 2021. Before the expiration date, you will receive an email notifying you how to keep the study open or close it.

Any proposed changes to the protocol must be reviewed by the IRB before implementation, unless the change is specifically necessary to eliminate apparent immediate hazards to the subjects. It is the principal investigator's responsibility to adhere to the policies and guidelines set forth by the UWM IRB, maintain proper documentation of study records and promptly report to the IRB any adverse events which require reporting. The principal investigator is also responsible for ensuring that all study staff receive appropriate training in the ethical guidelines of conducting human subjects research.

This study may be selected for a post-approval review by the IRB. The review will include an in-person meeting with members of the IRB to verify that study activities are consistent with the approved protocol and to review signed consent forms and other study-related records.

As Principal Investigator, it is your responsibility to adhere to UWM and UW System Policies, and any applicable state and federal laws governing activities which are independent of IRB review/approval (e.g., FERPA, Radiation Safety, UWM Data Security, UW System policy on Prizes, Awards and Gifts, state gambling laws, etc.). When conducting research at institutions outside of UWM, be sure to obtain permission and/or approval as required by their policies.

Contact the IRB office if you have any further questions. Thank you for your cooperation and best wishes for a successful project.

Respectfully,

Leah Stoiber

Leah Stoiber
IRB Administrator

Appendix B: Modification/Amendment – Institutional Review Board Expedited Approval

UNIVERSITY of WISCONSIN
UW **MILWAUKEE**

Department of University Safety & Assurances

Leah Stoiber
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lstoiber@uwm.edu

Modification/Amendment - IRB Expedited Approval

Date: April 2, 2020

To: Jeanne Erickson, PhD
Dept: Nursing

CC: Rebecca Parizek

IRB#: 20.154
Title: Health Literacy and Alcohol-related Behaviors in High School Students

After review of your research protocol by the University of Wisconsin – Milwaukee Institutional Review Board, your protocol has received modification/amendment approval for:

- Revising study materials and procedures related to recruitment, obtaining consent/assent, and survey administration, so that students independently complete the survey online outside of the school setting. Additionally, the number of participants has been increased. These changes have been made due to the school's closure during the COVID-19 pandemic.

IRB approval will expire on February 6, 2021. Before the expiration date, you will receive an email explaining you how to either keep the study open or close it.

Any proposed changes to the protocol must be reviewed by the IRB before implementation, unless the change is specifically necessary to eliminate apparent immediate hazards to the subjects. The principal investigator is responsible for adhering to the policies and guidelines set forth by the UWM IRB, maintaining proper documentation of study records and promptly reporting to the IRB any adverse events which require reporting. The principal investigator is also responsible for ensuring that all study staff receive appropriate training in the ethical guidelines of conducting human subjects research.

As Principal Investigator, it is also your responsibility to adhere to UWM and UW System Policies, and any applicable state and federal laws governing activities which are independent of IRB review/approval (e.g., FERPA, Radiation Safety, UWM Data Security, UW System policy on Prizes, Awards and Gifts, state gambling laws, etc.). When conducting research at institutions outside of UWM, be sure to obtain permission and/or approval as required by their policies.

Contact the IRB office if you have any further questions. Thank you for your cooperation, and best wishes for a successful project.

Respectfully,

Leah Stoiber

Leah Stoiber
IRB Administrator

Appendix C: Modified/Amended Submissions to the UWM Institutional Review Board

Melody Harries
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UNIVERSITY of WISCONSIN
UWMILWAUKEE

Department of University Safety & Assurances

Modification/Amendment - IRB Expedited Approval

Date: May 22, 2020

To: Jeanne Erickson
Dept: Nursing

CC: Rebecca Parizek

IRB #: 20.154
Title: Health Literacy and Alcohol-related Behaviors in High School Students

After review of your research protocol by the University of Wisconsin – Milwaukee Institutional Review Board, your protocol has received expedited modification/amendment approval for:

- Sending additional reminder to students and parents

IRB approval will expire on February 6, 2021. Before the expiration date, you will receive an email explaining how to either keep the study open or close it.

This study may be selected for a post-approval review by the IRB. The review will include an in-person meeting with members of the IRB to verify that study activities are consistent with the approved protocol and to review signed consent forms and other study-related records.

Any proposed changes to the protocol must be reviewed by the IRB before implementation, unless the change is specifically necessary to eliminate apparent immediate hazards to the subjects. The principal investigator is responsible for adhering to the policies and guidelines set forth by the UWM IRB, maintaining proper documentation of study records and promptly reporting to the IRB any adverse events which require reporting. The principal investigator is also responsible for ensuring that all study staff receive appropriate training in the ethical guidelines of conducting human subjects research.

As Principal Investigator, it is also your responsibility to adhere to UWM and UW System Policies, and any applicable state and federal laws governing activities which are independent of IRB review/approval (e.g., FERPA, Radiation Safety, UWM Data Security, UW System policy on Prizes, Awards and Gifts, state gambling laws, etc.). When conducting research at institutions outside of UWM, be sure to obtain permission and/or approval as required by their policies.

Contact the IRB office if you have any further questions. Thank you for your cooperation, and best wishes for a successful project.

Respectfully,

Melody Harries

Melody Harries
IRB Administrator

Appendix D: Survey Questions

1. How old are you in years?
2. What grade are you in?
   a. Ungraded or other grade
   b. Freshman or 9th grade
   c. Sophomore or 10th grade
   d. Junior or 11th grade
   e. Senior or 12th grade
3. Gender?
   a. Prefer not to answer
   b. Male
   c. Female
   d. Another gender identity that is not listed here
4. What is your Race / Ethnicity?
   a. Prefer not to answer
   b. White
   c. Other such as American Indian or Alaskan Native, Asian, Black, or Multiracial
   d. Hispanic / Latino
   e. Unknown
5. Were you born in the United States?
   a. No
   b. Yes
   c. Prefer not to answer
6. During the past 12 months, how would you describe your grades in school?
   a. None of these grades
   b. Mostly A's
   c. Mostly B's
   d. Mostly C's
   e. Mostly D's
   f. Mostly F's
   g. Not sure
7. Mother's level of education?
   a. Unknown
   b. Did not finish high school
   c. Graduated from high school
   d. Some education after high school
   e. Graduated from college
8. Father's level of education?
   a. Unknown
   b. Did not finish high school
   c. Graduated from high school
   d. Some education after high school
   e. Graduated from college
9. Are you currently eligible for free lunch?
   a. Unknown

b. No
c. Yes
d. Prefer not to answer

You will use the nutrition label from an ice cream container to answer the next 6 questions. You can look at the label as often as you want. These questions gage your ability to understand basic health information.

This information is on the back of a container of a pint of ice cream.

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.

10.   If you eat the entire container, how many calories will you eat? *Answer: 1,000*

11. 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.*

12. 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*

13. If you usually eat 2,500 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving? *Answer: 10%*

Pretend that you are allergic to the following substances: penicillin, peanuts, latex gloves, and bee stings.

14. Is it safe for you to eat this ice cream? *Answer: No*

15. Why not? *Answer: Because it has peanut oil.*

The next 14 questions ask about your decisions about using alcohol. Alcohol includes beer, wine, wine coolers, and liquor such as gin, rum, vodka, or whiskey. For these questions, drinking alcohol does not include drinking a few sips of wine for religious purposes.

16. How likely is it that you would feel relaxed, feel happy, feel more friendly and out-going, have a lot of fun, or forget your problems if you drank alcohol?
    a. Unlikely
    b. Likely
    c. Unsure

17. How likely is it that you would get into trouble with the police, harm your health, not being able to stop drinking, get a hangover, do something you would regret, or feeling sick if you drank alcohol?
    a. Unlikely
    b. Likely
    c. Unsure

18. How old were you when you had your first drink of alcohol other than a few sips?
    a. I have never had a drink of alcohol other than a few sips
    b. 8 years old or younger

c. 9 or 10 years old
d. 11 or 12 years old
e. 13 or 14 years old
f. 15 or 16 years old
g. 17 years old or older

19. Do any of your older siblings drink alcoholic beverages or get drunk?
    a. No
    b. Yes
    c. Unsure
    d. Not applicable

20. How many of your friends drink alcoholic beverages or get drunk?
    a. None
    b. A few
    c. Some
    d. Most
    e. All

21. During your life, on how many days have you had at least one drink of alcohol?

22. During the past 30 days, on how many days did you have at least one drink of alcohol?

23. During the past 30 days, on how many days did you have 4 or more drinks of alcohol in a row, that is, within a couple of hours (if you are female) or 5 or more drinks of alcohol in a row, that is, within a couple of hours (if you are male)?

24. During the past 30 days, what is the largest number of alcoholic drinks you had in a row, that is, within a couple of hours?

25. During the past 30 days, how many times did you ride in a car or other vehicle driven by someone who had been drinking alcohol?

26. During the past 30 days, how many times did you drive a car or other vehicle when you had been drinking alcohol?

27. Did you drink alcohol or use drugs before you had sexual intercourse the last time?

28. Did you drink alcohol before you had sexual intercourse the last time?
    a. I have never had sexual intercourse
    b. Yes
    c. No

29. During the past 30 days, how did you usually get the alcohol you drank?
    a. I did not drink alcohol during the past 30 days
    b. I bought it in a store such as a liquor store, convenience store, supermarket, discount store, or gas station
    c. I bought it at a restaurant, bar, or club
    d. I bought it at a public event such as a concert or sporting event
    e. I gave someone else money to buy it for me
    f. Someone gave it to me
    g. I took it from a store or family member
    h. I got it some other way

CHAPTER IV

RESULTS

Chapter IV describes the results of this study which explored relationships between high school students' health literacy and alcohol use behaviors. The following three aims were addressed:

1. Describe the health literacy of a sample of high school students.

2. Explore relationships between high school students' health literacy and individual traits.

3. Examine relationships between high school students' health literacy and their alcohol use behaviors.

The main results were synthesized into a manuscript that was written for *The Journal of School Health*, "Health literacy and alcohol use behaviors in high school students," and is presented in Part I of this chapter. For this manuscript, descriptive statistics were used to summarize response data. Due to the small sample size, whenever possible, categorical responses were collapsed to be dichotomous in order to run Fisher's Exact Test to look for statistical differences between groups. Following the manuscript, survey questions that were not addressed in the manuscript are addressed in Part II with more detailed tables with raw data and a more detailed discussion.

Part I

Health Literacy and Alcohol Use Behaviors in High School Students

Manuscript written for submission to *The Journal of School Health*

Abstract

BACKGROUND: Limited health literacy and alcohol use increase teens' risk for preventable disease burden and adverse outcomes.

METHODS: The Framework for Studying Adolescent Health Literacy by Manganello (2008) guided this cross-sectional study that explored relationships between health literacy and underage alcohol use. Using an electronic survey, health literacy was assessed with the Newest Vital Sign and alcohol use was assessed with questions from the Youth Risk Behavior Survey.

RESULTS: Data were collected from 39 students (response rate = 5.3%) attending a private Midwest high school during the spring of 2020. Most participants (76.9%) had adequate health literacy. Males had higher health literacy than females, but there were no other differences in health literacy between groups based on individual traits. Many participants (42.9%) reported drinking, and 18.2% reported drinking in the past 30 days. Lifetime and current alcohol use were comparable between participants with adequate and limited health literacy. Only students with adequate health literacy reported drinking before age 13 and binge drinking in the past 30 days.

CONCLUSIONS: Even students with adequate health literacy may engage in unsafe alcohol use. All students must be assessed for warning signs of alcohol use and misuse.

Keywords: Health literacy; Underage alcohol use; The Newest Vital Sign

Limited health literacy and underage alcohol use increase teens' risk for preventable disease burden and adverse outcomes. As they mature, teens increasingly make decisions about lifestyle behaviors, such as diet and substance use. Health literacy affects lifestyle decisions (U.S. Department of Health and Human Services, 2010) and is an important consideration when exploring teens' decisions about alcohol use.

Adolescence

Tremendous psychological and physiological growth occurs during adolescence. Families and friends influence teens' academic achievement (Mckown, 2013) and lifestyle behaviors, such as alcohol use (National Research Council and Institute of Medicine, 2009). Normal brain development predisposes teens to risky behaviors because the reward-seeking system develops during adolescence, but the cognitive control system does not develop until young adulthood (McNeely & Blanchard, 2009). Teens may have mature self-control in situations of low socioemotional arousal, but they may experience exaggerated socioemotional reactivity in emotionally charged situations. Being with friends can activate teens' reward-seeking system and contribute to the appeal of immediate rewards and risky behaviors (Shulman et al., 2016).

Health Literacy

Literacy is the best predictor of self-reported health status (Prins et al., 2015). For youth, literacy skills focus on the ability to read and write (Department of Education, 2019). However, teens need to be able to discuss, interpret, and understand a variety of texts across a variety of contexts (International Reading Association, 2012). Literacy in the context of health, health literacy, are the skills to find, understand, and use health-related information to make appropriate health-related decisions (Office of Disease Prevention and Health Promotion, 2020). Health literacy is a lifelong process that begins during childhood (Bröder et al., 2017). Teens

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increasingly make health-related decisions, and need to be able to understand and use health-related information (Greathouse et al., 2020). Most youth have the capacity to decipher health-related information to create meaning within the context of their environment and experiences (Fairbrother et al., 2016). Many adolescents have limited health literacy (Chisolm et al., 2011, 2014; Dharmapuri et al., 2015; Ghaddar et al., 2012; Holstein et al., 2014; Perry et al., 2017; Shah et al., 2010; Shone et al., 2011; Valerio et al., 2018), and adults in the youngest age bracket (18 to 24 years) have the lowest level of health literacy of adults of all ages, which adversely affects their ability to make healthy decisions (Rubin, 2016).

Underage Alcohol Use

Underage alcohol use remains a persistent problem in the United States despite policies and school-based alcohol prevention programs (Quigley, 2019). Underage alcohol use impacts teens' academic outcomes and affects families, schools, and communities (National Association of School Nurses [NASN], 2018). Alcohol depresses the central nervous system and can alter behavior, coordination, memory, mood, reasoning, physical control, and self-control (National Institute on Alcohol Abuse and Alcoholism, 2019). Underage alcohol use is associated with academic problems, alcohol use disorders, alcohol poisoning, altered brain development, suicide, violence, and risky behaviors including risky sexual behaviors and driving under the influence (Division of Population Health [DPH], National Center for Chronic Disease Prevention and Health Promotion [NCCDPHP], & Centers for Disease Control and Prevention [CDC], 2020b). Parental and friend alcohol use and life stressors including academic, family, and social problems are risk factors for underage alcohol use (Kail & Cavanuagh, 2016). Teens from families that condone alcohol are more likely to begin drinking at a younger age and experience

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alcohol-related problems (Yap et al., 2017). Teens with friends who drink are more likely to use and misuse alcohol (König et al., 2018).

Study Purpose

Prior research suggests that there may be relationships between teens' literacy and health-related behaviors, including substance use. The limited evidence about health literacy and underage alcohol use in the United States is conflicting and emerges from two studies using different methods and measures of health literacy. One study used the Newest Vital Sign (NVS) and the other study used the Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen). The NVS is one instrument that can be used to assess reading comprehension and math skills (Weiss et al., 2005). The REALM-Teen is another instrument that has been used to measure health literacy and focuses on the pronunciation of health-related words (Davis et al., 2006). Park et al. (2017) measured health literacy with the NVS and the REALM-Teen, aggregated alcohol use, marijuana use, and tobacco use into substance use, and followed a sample of 182 teens (13-17 years) for six months. Substance use increased from 32% at baseline to 42% after six-months. At six-month follow-up, they did not find a relationship between substance use and health literacy. In a contrasting study with a sample of 293 teens (14-19 years), Chisolm et al. (2014) found that teens with adequate health literacy on the REALM-Teen were more likely to report alcohol use. Research is needed to evaluate relationships specifically between teens' health literacy and health-related behaviors (Manganello, 2008).

The purpose of this research is to add evidence about relationships between high school students' health literacy and alcohol use. The three aims were to (a) describe the health literacy in a sample of high school students, (b) explore relationships between high school students'

health literacy and individual traits, and (c) examine relationships between high school students'

health literacy and alcohol use.

METHODS

This quantitative study is descriptive, correlational, and cross-sectional in design.

Conceptual Framework

This study was guided by The Framework for Studying Adolescent Health Literacy by

Manganello (2008). The Framework for Studying Adolescent Health Literacy proposes that

individual traits predict health literacy and subsequent health outcomes. Families and friends as

well as mass media, the education system, and the health system influence individual traits.

Teens need health literacy skills to find, understand, and assess the credibility of health-related

information to make healthy decisions. The education system is a major contributor to literacy

skills and has the potential to also build health literacy skills (Manganello, 2008).

Participants and Setting

The setting for this study was a private high school in the Midwest. The student body

comes from more than two dozen primary schools, and almost half receive tuition assistance.

Historically, most of the students pursue some post-secondary education. Student body

demographics reflect the community with roughly the same number of male and female students,

and about 80% are White (Austin et al., 2017). All students at the school met eligibility criteria

and were invited to participate in this study. Inclusion criteria were (a) 13 to 20 years, (b) able to

speak and complete a survey in English, and (c) able to independently enter data into a computer.

Instrumentation

The 13-minute online survey included 29 items: nine demographic questions, a 6-

question assessment of health literacy, and 14 questions about alcohol use. Health literacy was

assessed with the NVS. The NVS is a three-minute six question screening tool that uses the nutrition label from an ice cream container to assess the reading and numeracy (math) components of health literacy. Scores are summed, and categorized as limited literacy likely (0-1), limited literacy possible (2-3), or adequate literacy (4-6). The NVS was validated against the Test of Functional Health Literacy in Adults (r=.59) in adults (Weiss et al., 2005), the Gray Silent Reading Test (r=.71) in youth seven to 17 years (Warsh et al., 2014), and the REALM-Teen (r=.38) in youth 10 to 18 years (Perry et al., 2017).

Teens' alcohol use behaviors were assessed with questions from the 2017 Youth Risk Behavior Survey (YRBS). Conducted by the Center for Disease Control and Prevention (CDC), the Youth Risk Behavior Surveillance System monitors risk-taking behaviors through the YRBS. The YRBS is administered during odd years to approximately 15,000 high school students across the United States to monitor trends and identify factors that contribute to preventable disease, disability, and death (Kann et al., 2018).

The survey included multiple choice and fill-in the blank items. Students were able to skip questions, but only able to take the survey once. No identifying information was collected.

Procedures

Study procedures were planned in collaboration with the school principal. Originally, the survey was to be administered in-person at the school in the spring of 2020 with a waiver of parental consent so parents could choose to opt their minor children out of the study. Study procedures were revised after in-seat instruction was cancelled due to the COVID-19 pandemic. In the revised study procedures, parents received an email letter describing the study and asking them to forward the survey link and password to their high school children. At the beginning of the survey, there was an assent/consent form and an attestation statement so participants could

affirm being a student at the school, and that they read the assent/consent form and want to participate. The survey was open for seven weeks (April-May 2020) at the end of the school year.

Data Analysis

The survey was created using Qualtrics software, and data were downloaded and analyzed with SPSS version 26. Descriptive statistics were used to summarize responses. Due to the small sample size, it was not possible to analyze data to identify relationships using correlations and regression techniques. Whenever possible, categorical responses were collapsed to be dichotomous in order to run Fisher's Exact Test to look for statistical differences between groups. A significance level of 0.05 was used for statistical tests.

RESULTS

In this school, 737 students were eligible to participate in this study. Thirty-nine students completed all or part of the survey for a response rate of 5.3%. Participants were between 13 and 18 years (mean age = 15.97±1.2). All grades of students were represented. Most of the participants were female (71.8%), White (84.6%), and born in the United States (97.4%). All participants reported average or above average grades. Most of the participants' mothers (79.5%) and fathers (74.4%) graduated from college. No one reported being eligible for free lunch.

The first aim of the study was to describe the health literacy in a sample of high school students. Scores on the NVS ranged from 0 to 6, and the mean score was 4.4 (±1.8), which indicates adequate health literacy. Individual scores on the NVS indicate that 76.9% (30/39) of the participants have adequate literacy, 12.8% (5/39) have limited literacy possible, and 10.3% (4/39) have limited literacy likely. See Table 1 for the health literacy of the participants and their responses on the NVS.

Aim 2 was to explore relationships between high school students' health literacy and individual traits. Using Fisher's Exact Test, there was a difference in health literacy between males and females. Males were more likely than females to have adequate literacy. There were no other differences in health literacy between groups based on individual traits. See Table 2 for health literacy in groups based on individual traits.

Aim 3 was to examine relationships between high school students' health literacy and their alcohol use. In this sample, 57.1% (20/35) of the students reported never drinking more than a few sips of alcohol during their life. See Figure 1 for a comparison of the findings about underage alcohol use with the 2017 YRBS.

Using Fisher's Exact Test, no significant differences in alcohol use were found between students with adequate health literacy and students with limited health literacy. See Table 2 for alcohol use behaviors in groups based on health literacy. Students with adequate health literacy reported lifetime and past 30-day alcohol use at 43.3% (13/30) and 17.9% (5/28), respectively. This was comparable to students with limited health literacy, who reported lifetime and past 30-day alcohol use at 40% (2/5) and 20% (1/5), respectively. None of the students with limited health literacy reported drinking alcohol prior to age 13 years; alcohol or drug use prior to last sexual intercourse. None of the students with limited health literacy reported drinking at least four (female) or five (male) drinks within a couple of hours (binge drinking), riding with someone under the influence of alcohol, or driving under the influence of alcohol in the past 30 days. Of students with adequate health literacy, 15.4% (2/13) reported drinking alcohol prior to age 13 years, 42.8% (3/7) reported drug or alcohol use and 20.0% (1/5) reported alcohol use prior to last sexual intercourse. Of students with adequate health literacy, 10.3% (3/29) reported

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binge drinking, 17.9% (5/28) reported riding with someone under the influence of alcohol, and 10.5% (2/19) reported driving under the influence of alcohol in the past 30 days.

DISCUSSION

This study was underway during the COVID-19 pandemic when students were transitioned from in-seat learning to sheltering-at-home. The change in study procedures presented major barriers to the conduct of this study. The response rate was low, possibly due to parents not forwarding the link and password to their children, students not feeling comfortable responding to alcohol-related questions while at home with their parents, and the overall distraction to families and students due to the changes caused by the COVID-19 pandemic.

In this sample, 76.9% of students had adequate health literacy compared with 23.0% to 59.7% in other studies measuring health literacy with the NVS (Ghaddar et al., 2012; Park et al., 2017; Shah et al., 2010). Self-selection of students from a higher socioeconomic status (SES) attending a private high school may explain the high health literacy in this sample. The remaining 23.1% of the students in this study may have limited health literacy, indicating potential problems finding, understanding, and using health-related information. In this study, males had higher scores on the NVS, but previous evidence suggests that females may have higher health literacy (Chisolm et al., 2011, 2014; Dharmapuri et al., 2015; Holstein et al., 2014; Shone et al., 2011). Males in this study may have higher health literacy than females because the NVS consists of four math questions and two reading questions. In males, math skills strengthen during high school and by 12th grade they have stronger math skills than females (National Center for Education Statistics, 2015). There is also evidence that health literacy increases with age and grade, but that was not found in this study (Ghaddar et al., 2012; Perry et al., 2017). Evidence suggests that youth are at greater risk for limited health literacy if they are non-White,

not born in the United States, have parents without a post-secondary education, and are eligible for free lunch (Chisolm et al., 2011, 2014; Ghaddar et al., 2012; Park et al., 2017; Perry et al., 2017; Valerio et al., 2018).

Worrisome alcohol use behaviors were reported even though, aside from driving under the influence of alcohol, students in this sample reported lower rates of alcohol use compared to the YRBS sample. In this sample, 42.9% reported drinking and 22.3% reported drinking before they were 15 years old. Youth who begin drinking before they are 15 years old are six times more likely to develop alcohol dependence than those who delay alcohol use until they are 21 (DPH, NCCDPHP, & CDC, 2020a). Early onset alcohol dependence is associated with increased disease severity, decreased treatment response, and greater risk of relapse (Windle & Zucker, 2010). Underage alcohol use also increases the likelihood of risky sexual behaviors that may cause sexually transmitted infections, pregnancy, or both (DPH, NCCDPHP, & CDC, 2020c). In this study, three students reported alcohol or drug use and one student reported alcohol use prior to last sexual intercourse. Although students were sheltering-at-home, driving under the influence of alcohol was slightly higher in this sample than in the YRBS sample. In the United States, motor vehicle accidents are the primary cause of death in teens and contribute to the death of six teens per day (CDC & National Center for Injury Prevention and Control, 2019).

Higher SES and parental level of education have been associated with higher literacy (Rowe et al., 2016) and with greater alcohol use and misuse (Patrick et al., 2012). In this study, adequate health literacy did not appear to protect teens from alcohol use and misuse. Teens with adequate health literacy may be more skilled at understanding health-related information, yet still make unhealthy decisions during emotionally charged situations when their intrinsic drive for reward-seeking intensifies.

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Limitations

There are several limitations associated with this study. The electronic survey was completed by a small and homogeneous sample of primarily White students of higher SES attending a private high school. Because the survey was administered during the COVID-19 pandemic, it is unknown whether students reported on their behaviors in the past 30 days when they were home without friends or on their typical behaviors before the COVID-19 pandemic. Lastly, categorical responses were collapsed, and statistical analyses to identify relationships between variables were limited due to the small sample size. Nonetheless, this data adds evidence about the health literacy and alcohol use behaviors of students at one high school.

Conclusion

Teens need to be able to find, understand, and assess the credibility of health-related information to make healthy decisions. Health literacy is one of many factors that should be explored to understand how teens make decisions related to their health. Many students have limited health literacy, but even students with adequate health literacy may make unhealthy and unsafe decisions. Even when sheltering-at-home with their parents, some students in this study reported engaging in risky alcohol use. School nurses can collaborate with educators to teach students how to find, understand, and assess the credibility of health-related information so they can make healthy decisions and attain optimal health. Further research is needed to evaluate relationships between teens' health literacy and decisions about alcohol use.

IMPLICATIONS FOR SCHOOL HEALTH

The influence of the education system is second only to family. School is where most students make friends and where behavior norms are established and reinforced. The National Health Education Standards (NHES) published a framework to build health literacy skills in all

primary and secondary school students. The NHES provide the framework, but the curriculum can be tailored to student body needs. During grades three through 12, students need a minimum of 80 hours of health education per academic year (Joint Committee on National Health Education Standards, 2007).

In 2020, COVID-19 mitigation strategies led to unprecedented and evolving modifications in interactions between school personnel and students, and many interactions that would have occurred in-person took place virtually (CDC, 2020). School nurses and school personnel can use telehealth to meet a broad array of student health needs, including health education and health promotion (NASN, 2017a). Either in-person or via telehealth, school nurses and school personnel can support programs that build health literacy skills and programs that delay and decrease underage alcohol use. Telehealth can also be used to coordinate and monitor behavioral health services for adolescents who screen positive for alcohol use.

Evidence-based health education programs can build health literacy skills and improve students' ability to make healthy decisions (American School Health Association, 2014). Interactive skill-based health education helps students gain confidence in their ability to find, understand, assess credibility, and use health-related information. Information can be personalized as students reflect on influences of families, friends, and media (Greathouse et al., 2020). Health education content can be incorporated into anatomy and physiology, biology, health, physical education, psychology, and sociology courses. A health literacy screening tool can facilitate student-centered education by identifying students' health literacy levels. The NVS is a free health literacy screening tool. Education can then be tailored to an appropriate level to help students personalize the information (Greathouse et al., 2020).

Most adolescents have personal access to the Internet and use the Internet to find health-related information (Lauricella et al., 2018). School personnel can capitalize on this behavior and consider incorporating materials, such as the *MedlinePlus Evaluating Internet Health Information: Checklist,* into their health education curriculum. This is a free resource that can help users to discern credibility of online health-related information.

Underage alcohol use is a common problem, and school nurses and school personnel must assume that all teens are prone to engage in risky behaviors regardless of their ability to understand the health implications. School nurses and school personnel need to assess all students for warning signs of alcohol use and misuse. Changes warranting attention include decreased attendance or participation in school activities, disrupted growth and development, memory problems, police arrests, declining academic achievement, and unintentional injuries such as burns and falls (DPH, NCCDPHP, & CDC, 2020b). Either in-person or via telehealth, school nurses and school personnel need to talk with students in a private setting about lifestyle behaviors and screen for risky behaviors, preferably with a validated tool such as the CRAFFT Screening Tool for Adolescent Substance Abuse (Dalstrom et al., 2020). The CRAFFT is a free screening tool for adolescent substance abuse. School nurses can coordinate behavioral health services and monitor ongoing treatment for adolescents who screen positive for alcohol use (NASN, 2018).

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Table 1

Health Literacy of Participants and Correct Responses on the Newest Vital Sign (N=39)

Newest Vital Sign (NVS)	N	%
Dichotomized Categories of Health Literacy (HL)	HL of Sample	
0-3 Limited literacy likely/possible	9	23.2
4-6 Adequate literacy	30	76.9
NVS Questions and Answers	Correct Responses	
1. If you eat the entire container, how many calories will you eat? *Answer: 1,000.*	27	73.0
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.*	33	91.7
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.*	27	75.0
4. If you usually eat 2,500 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving? *Answer: 10%.*	25	75.8
5. Pretend that you are allergic to the following substances: penicillin, peanuts, latex gloves, and bee stings. Is it safe for you to eat this ice cream? *Answer: No.*	28	75.7
6. Why not? *Answer: Because it has peanut oil.*	32	86.5

Table 2

Health Literacy (HL), Individual Traits, and Alcohol Use Behaviors

	Limited HL		Adequate HL		Fisher's
	N	%	N	%	P
Individual Traits					
Grade					1.00
Lowerclassmen	5	21.7	18	78.3	
Upperclassmen	4	26.7	11	73.3	
Gender*					.040
Male	0	0.0	11	100.0	
Female	9	32.1	19	67.9	
Race/Ethnicity					.607
White	7	21.2	26	78.8	
Other	2	33.3	4	66.7	
Grades in school					.711
Mostly A's	5	20.8	19	79.2	
Mostly B's or C's	4	26.7	11	73.3	
Mother's level of education					1.00
Did not graduate from college	2	25.0	6	75.0	
Graduated from college	7	22.6	24	77.4	
Father's level of education					.197
Did not graduate from college	4	40.0	6	60.0	
Graduated from college	5	17.2	24	82.8	
Alcohol Use Behaviors					
Drank at least 1 day during their lifetime					1.00
No	3	15.0	17	85.0	
Yes	2	13.3	13	86.7	
Drank at least 1 day (past 30 days)					1.00
No	4	14.8	23	85.2	
Yes	1	16.7	5	83.3	
Binge drank (past 30 days)					.600
No	5	16.7	25	83.3	
Yes	0	0.0	3	100.0	
Friends drink alcohol or get drunk					.658
No	3	21.4	11	78.6	
Yes	3	13.6	19	86.4	
Rode with someone under the influence (past 30 days)					.559
No	6	20.7	23	79.3	
Yes	0	0.0	5	100.0	
Drove under the influence (past 30 days)					1.00
No	6	18.2	27	81.8	
Yes	0	0.0	2	100.0	

*Statistically significant

Figure 1

Comparison of Findings About Underage Alcohol Use with the 2017 Youth Risk Behavior Survey
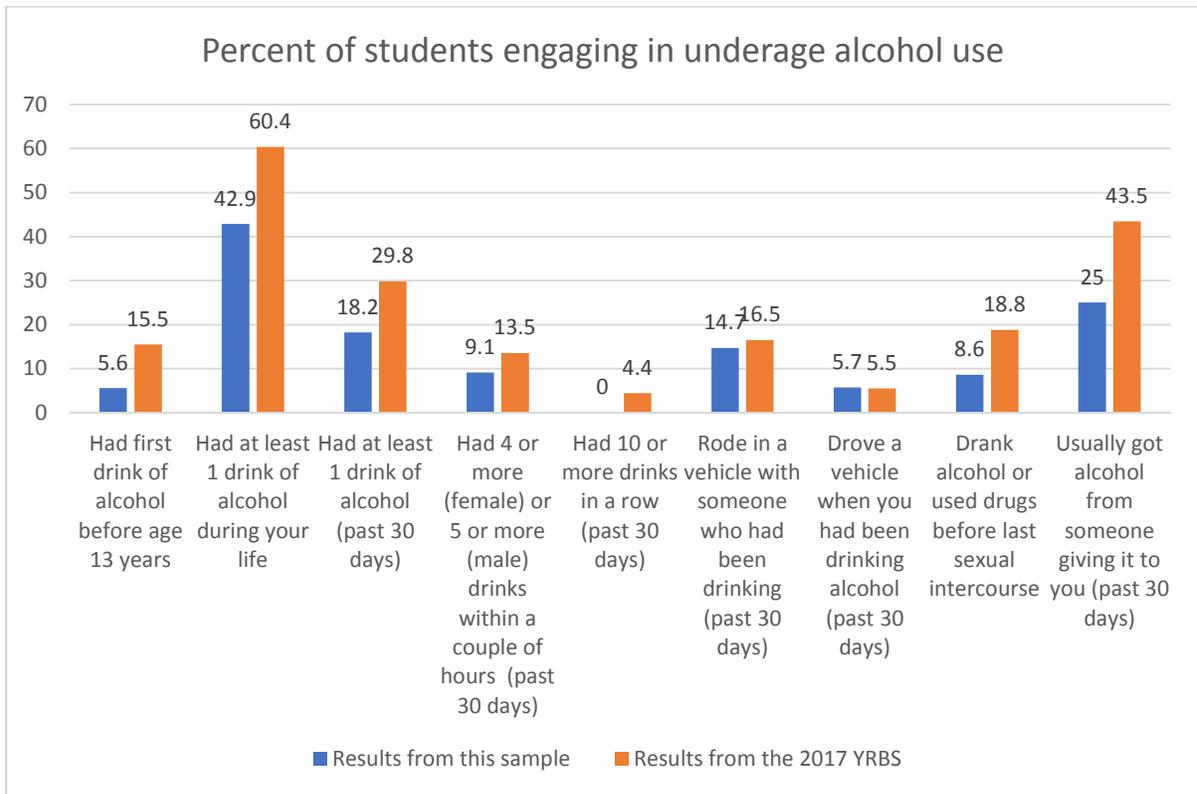
Part II

The nursing discipline embodies caring for individuals, families, and communities. Nursing is responsible for health promotion, illness prevention, and care of the ill, disabled, and dying (Edelman et al., 2014). Limited health literacy and underage alcohol use increase the risk for preventable disease burden and the opportunity for adolescents to attain optimal health. Understanding relationships between high school students' health literacy and their decisions about alcohol has the potential to identify targets for interventions to delay and decrease underage alcohol use. Delaying and decreasing alcohol use will improve health outcomes by protecting adolescents from altered brain development, unintentional injury, and death.

This part of Chapter IV includes survey questions that were not fully addressed in the previous manuscript with more detailed tables with raw data, more detailed results for each aim, and more focused discussion.

Study Sample

All 737 students from this private high school were eligible to participate in this study. Thirty-nine students completed all or part of the survey for a response rate of 5.3%. Participants were between 13 and 18 years (mean age = 15.97±1.2). All grades of students were represented. Most of the participants were female (71.8%), White (84.6%), and born in the United States (97.4%). All participants reported average or above average grades. Most of the participants' mothers (79.5%) and fathers (74.4%) graduated from college. No one reported being eligible for free lunch. See Table 1 for descriptive statistics from the demographic questions.

Aim 1: Describe the Health Literacy in a Sample of High School Students

Aim 1 was to describe the health literacy in a sample of high school students. The Newest Vital Sign (NVS) was used to assess health literacy because it assesses the ability to understand

and use health-related information, and is the most comprehensive assessment of health literacy. The NVS is a three-minute screening tool that assesses the ability to understand and apply the prose and numbers written on a nutrition label (Weiss et al., 2005). Scores are summed, and categorized as limited literacy likely (0-1), limited literacy possible (2-3), or adequate literacy (4-6). The NVS is a valid measure of health literacy in teens (Perry et al., 2017; Warsh et al., 2014; Weiss et al., 2005). Scores on the NVS ranged from 0 to 6. The mean score was 4.4 (±1.8), or in the adequate health literacy range. Correct responses to the six items ranged from 73.0% (27/37) to 91.7% (33/36). The question about the number of calories in the ice cream container received the most incorrect responses. The question about how much ice cream one could eat if allowed 60 grams of carbohydrates received the most correct responses. Individual scores on the NVS indicate that 76.9% (30/39) of the participants have adequate literacy, 12.8% (5/39) have limited literacy possible, and 10.3% (4/39) have limited literacy likely. See Table 2 for the health literacy of the participants and responses to the individual NVS items.

Aim 2: Relationships Between Health Literacy and Individual Traits

Aim 2 was to explore relationships between high school students' health literacy and individual traits. See Table 3 for detailed raw data of the participants' health literacy and individual traits. The small sample size limited statistical analyses of categorical data and specifically relationships between health literacy and individual traits. When appropriate, categories were collapsed to be dichotomous to explore for differences between groups based on health literacy and individual traits using Fisher's Exact Test. Limited literacy likely and limited literacy possible were collapsed to limited literacy. Gender was the only trait where there was a difference in health literacy between groups. In this sample, males were more likely than females

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to have adequate health literacy. See Table 4 for the results about relationships between health literacy and individual traits.

Aim 3: Relationships Between Health Literacy and Alcohol Use

In Aim 3, relationships between high school students' health literacy and their alcohol use behaviors were examined. To first answer this aim, students' alcohol use behaviors and expectancies were summarized. Teens' alcohol use behaviors were assessed with questions from the 2017 Youth Risk Behavior Survey (YRBS). Conducted by the Center for Disease Control and Prevention (CDC), the YRBS is administered during odd years to approximately 15,000 high school students across the United States to monitor trends and identify factors that contribute to preventable disease, disability, and death (Kann et al., 2018). Alcohol expectancies are personal beliefs about what will happen by drinking alcohol. In this study, alcohol expectancies were assessed using the alcohol expectancy outcome criteria from the study by König et al. (2018). To assess positive alcohol expectancies, participants were asked if they thought they would feel relaxed, feel happy, feel more friendly and out-going, have a lot of fun, or forget their problems if they drank alcohol. To assess negative alcohol expectancies, participants were asked if they thought they would get into trouble with the police, harm their health, not be able to stop drinking, get a hangover, do something they would regret, or feel sick if they drank alcohol (König et al., 2018). Since "unsure" was one of the three response categories and was chosen by some students, it was not possible to collapse the questions about positive and negative alcohol expectancies to be dichotomous. Thus, it was not possible to look for statistical differences in alcohol expectancies between groups based on health literacy using Fisher's Exact Test. See Table 5 for detailed raw data of the participants' health literacy and alcohol use.

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The first set of items collected data about age of initiation to alcohol use and the number of days students drank during their life. In this sample, when asked how old they were when they had their first alcoholic beverage, 58.3% (21/36) reported never drinking. Out of 15 students, 80% (12/15) reported drinking alcohol prior to age 17 years. Of these 12 students, two (16.7%, 2/12) reported drinking before they were 13 years old, 50% (6/12) reported drinking before they were 15 years old, and 33.3% (4/12) reported drinking before they were 17 years old. In response to how many days participants drank at least one alcoholic beverage, 57.1% (20/35) reported never drinking more than a few sips of alcohol during their life. Of the 15 students who reported drinking at least one alcoholic beverage, 53.3% (8/15) reported drinking on fewer than 10 days and 46.7% (7/15) reported drinking on at least 10 different days.

The second set of items collected data about students' current alcohol use behaviors. Students were asked how many days they drank, how many days they drank at least four (female) or five (male) drinks within a couple of hours (binge drank), and the largest number of alcoholic beverages they consumed during the past 30 days. Most participants (81.8%, 27/33) reported not drinking any alcohol in the past 30 days. Three participants reported binge drinking at least twice in the past 30 days. Of the six students who reported drinking in the past 30 days, five responded to the question about the largest number of drinks they consumed, which varied from one or two drinks to six or seven drinks within a couple of hours.

The third set of items collected data about alcohol-related behaviors. Students were asked how many times in the past 30 days they rode with someone under the influence of alcohol and drove when they had been drinking. They were also asked if they used drugs or drank alcohol before last sexual intercourse. Five participants (14.7%, 5/34) reported riding with someone under the influence of alcohol and two participants (5.7%, 2/35) reported driving under the

influence of alcohol in the past 30 days. Three participants (8.6%, 3/35) reported using drugs or alcohol and one student (2.9%, 1/35) reported drinking alcohol before last sexual intercourse.

The fourth set of items collected data about sibling and friend alcohol use, alcohol expectancies, and how they currently obtain alcohol. Many participants reported having siblings (48.3%, 14/29) and friends (61.1%, 22/36) who drink alcohol. About one-third (30.6%, 11/36) of the participants had positive alcohol expectancies, and thought that drinking alcohol would make them feel relaxed, happy, more friendly and out-going, and that they would have a lot of fun and forget their problems if they drank alcohol. Half (50.0%, 18/36) of the participants had negative alcohol expectancies, and thought that they would get into trouble with the police, harm their health, not be able to stop drinking, get a hangover, do something they would regret, or feel sick if they drank alcohol. In response to the question about obtaining alcohol, 88.2% (30/34) of the participants reported not drinking alcohol in the past 30 days. The four participants who responded to the question about how they obtained alcohol all had adequate health literacy. One obtained alcohol by buying it in a store, one by giving someone money to buy it for them, one by someone giving it to them, and one by taking it from a store or family member.

Limited Literacy Likely

In this sample, two participants had limited literacy likely. Neither reported drinking nor having siblings who drink. One of the participants reported having friends who drink. Neither participant reported riding with someone under the influence of alcohol, nor having positive or negative alcohol expectancies.

Limited Literacy Possible

In this sample, two of the four participants with limited literacy possible reported never drinking. One participant began drinking prior to age 15 years and one participant began

drinking prior to age 17 years. Three students with limited literacy possible responded to the questions about lifetime and past 30-day alcohol use. One participant reported never drinking more than a few sips of alcohol, two participants reported drinking at least one alcoholic beverage, and one student reported drinking in the past 30 days. No one with limited literacy possible reported binge drinking, riding with someone under the influence of alcohol, or driving under the influence of alcohol in the past 30 days. No one with limited literacy possible reported using drugs or alcohol before last sexual intercourse. Of these four students with limited literacy possible, no one reported siblings who drink, two reported having friends who drink, two had positive alcohol expectancies, and one had negative alcohol expectancies. The student with limited literacy possible who reported drinking in the past 30 days did not respond to the question about obtaining alcohol.

Adequate Literacy

In this sample, 56.7% (17/30) of participants with adequate literacy reported never drinking. Of the 13 students with adequate literacy who reported drinking at least one alcoholic beverage, 10 (76.9%) reported drinking before age 17 years. Of these 10 participants, 50.0% (5/10) began drinking before they were 15 years old and 20.0% (2/10) began drinking before they were 13 years old. Of these 13 participants, 46.2% (6/13) reported drinking on fewer than 10 days and 53.8% (7/13) reported drinking on at least 10 different days. Five participants with adequate literacy (17.9%, 5/28) reported drinking alcohol in the past 30 days, and three students reported binge drinking at least twice in the past 30 days. The largest number of drinks consumed within a couple of hours ranged from one or two drinks to six or seven drinks. Of those with adequate literacy, five students (5/28) reported riding with someone under the influence of alcohol and two students (2/29) reported driving under the influence of alcohol in

the past 30 days. Three students (3/29) reported using drugs or alcohol and one student (1/29) reported drinking alcohol before last sexual intercourse. Many participants with adequate literacy have siblings (58.3%, 14/24) and friends (63.3%, 19/30) who drink alcohol. About one-third (30.0%, 9/30) of the participants had positive alcohol expectancies and 56.7% (17/30) had negative alcohol expectancies.

When possible and appropriate, categories of responses to alcohol items were collapsed to be dichotomous to statistically explore for differences between groups based on health literacy and their alcohol use behaviors with Fisher's Exact Test. Limited literacy likely and limited literacy possible were collapsed to limited literacy. Using Fisher's Exact Test, no significant differences were found between groups based on health literacy. See Table 6 for high school students' health literacy and alcohol use.

Discussion

Most of the high school students in this sample were White, born in the United States, and had college-educated parents. Therefore, it is not surprising that the majority had adequate health literacy. Socioeconomic factors, such as race/ethnicity, parental educational attainment, and socioeconomic status (SES), are directly associated with language and literacy development (Rowe et al., 2016). Previous research suggests that White youth are more likely to have higher health literacy than their non-White peers. There is also evidence that youth are at greater risk for limited health literacy if they are non-White, not born in the United States, eligible for free lunch, and parents do not have a post-secondary education (Chisolm et al., 2011, 2014; Ghaddar et al., 2012; Holstein et al., 2014; Park et al., 2017; Perry et al., 2017; Valerio et al., 2018).

Socioeconomic factors such as race/ethnicity and parental educational attainment also are directly associated with numeracy skills. In fourth and eighth grades, Asian and White students

are more likely to have higher math skills than their Black and Hispanic peers. Students in fourth and eighth grade are also more likely to have higher math skills if they attend a Catholic school and have parents with a post-secondary education (National Center for Education Statistics, 2019). The only difference in 12th grade, is that male students are more likely to have higher math skills than their female peers (National Center for Education Statistics, 2015). The NVS uses four numeracy (math) questions and two reading questions to measure health literacy, which may explain why males had higher scores on the NVS than females in this study.

In this sample, an average of 78.9% answered the four numeracy questions correctly and an average of 81.1% answered the two reading questions correctly. Numeracy skills were stronger but reading skills were comparable to a study of Black youth with Sickle Cell Disease, where an average of 18.3% answered the numeracy questions correctly and an average of 82.7% answered the reading questions correctly (Perry et al., 2017). Participants in this study may have higher numeracy skills because the sample was primarily White students attending a Catholic high school with parents who graduated from college.

Poor literacy and numeracy skills may be particularly concerning when it comes to taking medications and understanding allergies (American Academy of Pediatrics, 2012). One study showed that adolescents and young adults with limited health literacy have difficulty understanding medication dosing (Shone et al., 2011). In this sample, almost 25% of the participants incorrectly answered the question on the NVS asking if it is safe to eat the ice cream if they have an allergy to peanuts. In children, peanuts are one of the most common triggers of severe allergic reactions, anaphylaxis, which has a quick onset and can be fatal (Sicherer & Simons, 2017). Future research on health literacy can explore reading and numeracy skills to understand and manage acute and chronic conditions.

Parents and Underage Alcohol Use

Higher parental educational attainment and SES are also associated with greater alcohol use by adolescents (Patrick et al., 2012; Rowe et al., 2016). In this study, where most of the participants' parents graduated from college and no one reported being eligible for free lunch, higher underage alcohol use, therefore, would be expected. Adolescents are more likely to drink if their parents have favorable attitudes towards alcohol and there is alcohol in the home (Yap et al., 2017). Parental attitudes and parental use of alcohol were not explored in this study but should be included in future research about age of initiation to alcohol and alcohol expectancies.

Peers and Underage Alcohol Use

Having friends who drink alcohol is a risk factor for underage alcohol use (Hawthorne, 1997; König et al., 2018). Adolescents tend to seek friends with a similar affinity for risky behaviors. During adolescence, being with friends activates the reward-seeking center in the brain. Therefore, adolescents prefer immediate rewards and take more risks when they are with their friends (Albert et al., 2013). In this study, although not statistically significant, more participants with adequate health literacy (63.3%, 19/30) reported having friends who drink than their peers with limited literacy possible (50.0%, 2/4) and limited literacy likely (50.0%, 1/2). Six participants (20.7%, 6/29) chose "unsure" to the question about having siblings who drink alcohol, so it was not possible to collapse responses to be dichotomous to look at statistical differences. Although not statistically significant, only participants with adequate health literacy reported having siblings who drink. Future research on health literacy can explore relationships between sibling, friend, and personal engagement in substance use including alcohol use.

Media, Alcohol Expectancies, and Underage Alcohol Use

Observing friends both in-person and via social media platforms, such as Facebook and Snapchat, influences adolescents' intentions and decisions to engage in alcohol use behaviors. The Internet exposes adolescents to unregulated alcohol advertising and social media posts that typically exclude negative consequences. Adolescents tend to think that these media messages are realistic (Moreno & Whitehill, 2013). Alcohol advertising and social media posts inform alcohol expectancies by targeting emotions that normalize alcohol use (Elmore et al., 2017).

Expectancy Theory describes relationships between behavior and anticipated consequences (Leonard & Blane, 1999). Positive alcohol expectancies, or the belief that drinking alcohol leads to favorable outcomes, are associated with earlier age of initiation to alcohol use and greater alcohol use. Negative alcohol expectancies are beliefs that drinking alcohol leads to unfavorable outcomes (Boyd et al., 2018). Consistent with Expectancy Theory, there is evidence that adults, especially adults over age 35, with negative alcohol expectancies show greater restraint (Leigh & Stacy, 2004). There is also evidence that some people perceive the consequences associated with risky drinking as positive, rather than negative. Moreover, risky drinkers have more negative expectancies than non-risky drinkers (Robertson et al., 2017). Because normal brain development predisposes adolescents to risky behaviors, they may perceive the outcomes associated with risky drinking as positive, rather than negative. In adolescents, there is some evidence that both positive and negative alcohol expectancies contribute to underage alcohol use (Chisolm et al., 2014; König et al., 2018). There is also some evidence that adolescents with higher health literacy may have more positive and negative alcohol expectancies, and they may be more susceptible to media messages possibly because

their peers with limited health literacy are less likely to understand the nuances of media messages that target adults (Chisolm et al., 2014).

In this study, it was not possible to collapse the responses to the alcohol expectancy questions to look for statistical differences between groups because 22.2% (8/36) chose "unsure" for positive alcohol expectancies and 16.7% (6/36) chose "unsure" for negative alcohol expectancies. Although not statistically significant, 30.0% (9/30) of the participants with adequate health literacy and 50% (2/4) of the participants with limited literacy possible had positive alcohol expectancies. No one with limited literacy likely had positive alcohol expectancies. When health literacy is dichotomized, positive alcohol expectancies are comparable between participants with adequate literacy (30%, 9/30) and their peers with limited literacy (33.3%, 2/6). Although not statistically significant, more participants with adequate literacy (56.7%, 17/30) had negative alcohol expectancies than their peers with limited literacy possible (25.0%, 1/4). No one with limited literacy likely had negative alcohol expectancies. When health literacy is dichotomized, more students with adequate literacy (56.7%, 17/30) had negative alcohol expectancies than students with limited literacy (16.7%, 1/6). Future research on health literacy can explore negative alcohol expectancies and underage alcohol use behaviors, especially age of initiation to alcohol use and amount of alcohol consumption.

Youth Risk Behavior Survey Comparison

Aside from driving under the influence of alcohol, students in this sample reported lower rates of alcohol use behaviors compared to the 2017 YRBS. In this study, fewer participants reported drinking prior to age 13 years and drinking at least one alcoholic beverage during their life compared with the 2017 YRBS. Since this data was collected during the COVID-19 pandemic while students were sheltering-at-home with their parents, findings about alcohol use

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behaviors in the past 30 days may not be comparable to the 2017 YRBS. Yet, some of the students in this sample reported drinking, binge drinking, riding with someone under the influence of alcohol, and driving under the influence of alcohol in the past 30 days. Fewer participants (25%, 1/4) reported that someone gave them alcohol compared to 43.5% of the participants in the 2017 YRBS (Kann et al., 2018). Future research on health literacy can explore underage alcohol use behaviors when students are not at home with their parents.

Health Literacy and Underage Alcohol Use

Neurodevelopmental changes allow adolescents to be comfortable with uncertainty, which can adversely affect their decision-making (Noël, 2014). Adolescents tend to overestimate the likelihood of harm associated with risky behaviors, but underestimate the likelihood of personal harm (Kail & Cavanuagh, 2016). Moreover, socioemotional arousal increases while adolescents are engaging in risky behaviors. Adolescents need to learn how to make appropriate choices during stressful situations (Modecki et al., 2017) and withstand internal and external pressures to engage in alcohol use (Bröder et al., 2017).

Self-selection of students from a higher SES attending a private high school may have contributed to the high health literacy in this sample. The site for this study participates in an alcohol and drug-use prevention program called the Red Ribbon Program. Participation in the Red Ribbon Program may have contributed to lower rates of underage alcohol use in this sample. Reports of lifetime and past 30-day alcohol use were comparable between students with adequate and limited health literacy. However, although not statistically significant, only participants with adequate literacy reported binge drinking and driving under the influence of alcohol. Intelligent adolescents know how to attain greater rewards from reward-seeking behaviors and will ignore potential risks if perceived rewards outweigh potential consequences (Harden et al., 2017). It is

possible that adolescents in this study who had adequate health literacy engaged in risky and unsafe alcohol use because they were rewarded for other risky behaviors and did not believe they would experience harmful consequences.

Limitations

There are several limitations to this study. Originally, the survey was to be administered in-person at the private high school with a waiver of parental consent. Study procedures were revised after in-seat instruction was cancelled due to the COVID-19 pandemic. In the revised study procedures, parents were asked to forward the survey link and password to their children. The response rate was low, and the online survey was completed by a small and homogeneous sample of primarily White students of higher SES. Students were encouraged to take the survey by themselves in a private setting. However, data were collected while there was an executive order requiring everyone to shelter-at-home. Because the survey was administered during the COVID-19 pandemic, it is unknown whether students reported on their behaviors in the past 30 days when they were at home without friends or on their typical behaviors before the COVID-19 pandemic. Lastly, categorical responses were collapsed, and analyses to identify relationships using statistical analyses for correlation were limited due to the small sample size. Nonetheless, this data adds evidence about the health literacy and alcohol use behaviors of students at one high school. It also provides insight into the alcohol use behaviors of this sample of high school students while they were at home with their parents during the COVID-19 pandemic.

Conclusion

Adolescents need the skills to make appropriate choices even when they are in stressful situations. Adolescents need to learn the skills to find, understand, and assess the credibility of health-related information so they can make healthy decisions while experiencing elevated levels

of socioemotional arousal. Healthcare providers, both in healthcare settings and schools, must talk with adolescents about lifestyle behaviors and reinforce their internal motivation to withstand peer pressure to engage in alcohol use.

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Table 1
Demographic Characteristics of Participants (N = 39)

Characteristics	n	%	Mean (SD)
Age (years)			15.97 (1.2)
13	1	2.6	
14	3	7.9	
15	9	23.7	
16	11	28.9	
17	11	28.9	
18	3	7.9	
Grade level			
Freshman	11	28.9	
Sophomore	12	31.6	
Junior	6	15.8	
Senior	9	23.7	
Missing	1	2.6	
Gender			
Male	11	28.2	
Female	28	71.8	
Race / ethnicity			
White	33	84.6	
Other	6	15.4	
Born in the United States			
No	1	2.6	
Yes	38	97.4	
Grades is school			
Mostly A's	24	61.5	
Mostly B's	13	33.3	
Mostly C's	2	5.1	
Mother's level of education			
Unknown	0	0.0	
Did not graduate from HS	0	0.0	
High school graduate	2	5.1	
Some education after HS	6	15.4	
College graduate	31	79.5	
Father's level of education			
Unknown	2	5.1	
Did not graduate from HS	1	2.6	
High school graduate	0	0.0	
Some education after HS	7	17.9	
College graduate	29	74.4	
Eligible for free lunch			
Yes	0	0.0	
No	28	71.8	
Unknown/Prefer not to answer	11	28.2	

Table 2

Health Literacy of Participants and Correct Responses on the Newest Vital Sign (N=39)

Newest Vital Sign (NVS)	N	%	Mean
Raw NVS Score			4.4 (1.8)
0	1	2.6	
1	3	7.7	
2	4	10.3	
3	1	2.6	
4	5	12.8	
5	12	30.8	
6	13	33.3	
Categorized NVS Score	Health Literacy of Sample		
0-1: Limited literacy likely	4	10.3	
2-3: Limited literacy possible	5	12.8	
4-6: Adequate literacy	30	76.9	
Dichotomized Categories of Health Literacy	Health Literacy of Sample		
0-3: Limited literacy likely/possible	9	23.2	
4-6: Adequate literacy	30	76.9	
NVS Questions and Answers	Correct Responses		
7. If you eat the entire container, how many calories will you eat? *Answer: 1,000.*	27	73.0	
8. 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.*	33	91.7	
9. 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.*	27	75.0	
10. If you usually eat 2,500 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving? *Answer: 10%.*	25	75.8	
11. Pretend that you are allergic to the following substances: penicillin, peanuts, latex gloves, and bee stings. Is it safe for you to eat this ice cream? *Answer: No.*	28	75.7	
12. Why not? *Answer: Because it has peanut oil.*	32	86.5	

Table 3

Detailed Raw Data of Participants' Health Literacy and Individual Traits

	Limited literacy likely		Limited literacy possible		Adequate literacy		Total	
	n	%	n	%	n	%	n	%
Age (years)								
13	0	0.0	0	0.0	1	3.4	1	2.6
14	0	0.0	1	20.0	2	6.9	3	7.9
15	2	50.0	2	40.0	5	17.2	9	23.7
16	0	0.0	0	0.0	11	37.9	11	28.9
17	2	50.0	2	40.0	7	24.1	11	28.9
18	0	0.0	0	0.0	3	10.3	3	7.9
Grade level								
Freshman	2	50.0	2	40.0	7	24.1	11	28.9
Sophomore	0	0.0	1	20.0	11	37.9	12	31.6
Junior	2	50.0	1	20.0	3	10.3	6	15.8
Senior	0	0.0	1	20.0	8	27.6	9	23.7
Gender								
Male	0	0.0	0	0.0	11	36.7	11	28.2
Female	4	100	5	100	19	63.3	28	71.8
Race / ethnicity								
White	3	75.0	4	80.0	26	86.7	33	84.6
Other	0	0.0	1	20.0	0	0.0	1	2.6
Hispanic/Latino	1	25.0	0	0.0	3	10.0	4	10.3
Unknown	0	0.0	0	0.0	1	3.3	1	2.6
Born in the United States								
No	0	0.0	1	20.0	0	0.0	1	2.6
Yes	4	100.0	4	80.0	30	100.0	38	97.4
Grades in school								
Mostly A's	3	75.0	2	40.0	19	63.3	24	61.5
Mostly B's	1	25.0	3	60.0	9	30.0	13	33.3
Mostly C's	0	0.0	0	0.0	2	6.7	2	5.1
Mother's level of education								
Unknown	0	0.0	0	0.0	0	0.0	0	0.0
Did not graduate from HS	0	0.0	0	0.0	0	0.0	0	0.0
High school graduate	0	0.0	0	0.0	2	6.7	2	5.1
Some education after HS	1	25.0	1	20.0	4	13.3	6	15.4
College graduate	3	75.0	4	80.0	24	80.0	31	79.5
Father's level of education								
Unknown	1	25.0	1	20.0	0	0.0	2	5.1
Did not graduate from HS	0	0.0	0	0.0	1	3.3	1	2.6
High school graduate	0	0.0	0	0.0	0	0.0	0	0.0
Some education after HS	1	25.0	1	20.0	5	16.7	7	17.9

College graduate	2	50.0	3	60.0	24	80.0	29	74.4
Eligible for free lunch								
Yes	0	0.0	0	0.0	0	0.0	0	0.0
No	2	50.0	3	60.0	23	76.7	28	71.8
Unknown	2	50.0	1	20.0	7	23.3	10	25.6
Prefer not to answer	0	0.0	1	20.0	0	0.0	1	2.6

Table 4

Differences in High School (HS) Students' Health Literacy Based on Individual Traits

	Limited HL		Adequate HL		
	N	%	N	%	p
Grade					1.00
Lowerclassmen	5	21.7	18	78.3	
Upperclassmen	4	26.7	11	73.3	
Gender*					.040
Male	0	0.0	11	100.0	
Female	9	32.1	19	67.9	
Race/Ethnicity					.607
White	7	21.2	26	78.8	
Other	2	33.3	4	66.7	
Born in the United States					.231
No	1	100.0	0	0.0	
Yes	8	21.1	30	78.9	
Grades in school					.711
Mostly A's	5	20.8	19	79.2	
Mostly B's or C's	4	26.7	11	73.3	
Eligible for free lunch					.238
No	5	17.9	23	82.1	
Unknown or prefer not to answer	4	36.4	7	63.6	
Mother's level of education					1.00
Did not graduate from college	2	25.0	6	75.0	
Graduated from college	7	22.6	24	77.4	
Father's level of education					.197
Did not graduate from college	4	40.0	6	60.0	
Graduated from college	5	17.2	24	82.8	

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Table 5

Detailed Raw Data of Participants' Health Literacy and Alcohol Use

	Limited literacy likely		Limited literacy possible		Adequate literacy		Total	
	n	%	n	%	n	%	n	%
Age when you had your first drink of alcohol (other than a few sips)								
Never	2	100.0	2	50.0	17	56.7	21	58.3
9 or 10 years old	0	0.0	0	0.0	1	3.3	1	2.8
11 or 12 years old	0	0.0	0	0.0	1	3.3	1	2.8
13 or 14 years old	0	0.0	1	25.0	5	16.7	6	16.7
15 or 16 years old	0	0.0	1	25.0	3	10.0	4	11.1
17 or older	0	0.0	0	0.0	3	10.0	3	8.3
During your life, number of days you had at least 1 drink of alcohol								
0 days	2	100.0	1	33.3	17	56.7	20	57.1
1 or 2 days	0	0.0	2	66.7	1	3.3	3	8.6
3 to 9 days	0	0.0	0	0.0	5	16.7	5	14.3
10 to 19 days	0	0.0	0	0.0	2	6.7	2	5.7
20 to 39 days	0	0.0	0	0.0	1	3.3	1	2.9
40 to 99 days	0	0.0	0	0.0	2	6.7	2	5.7
100 + days	0	0.0	0	0.0	2	6.7	2	5.7
During the past 30 days, the number of days you had at least 1 drink of alcohol								
0	2	100.0	2	66.7	23	82.1	27	81.8
1	0	0.0	0	0.0	1	3.6	1	3.0
2	0	0.0	0	0.0	0	0.0	0	0.0
3	0	0.0	1	33.3	0	0.0	1	3.0
4	0	0.0	0	0.0	0	0.0	0	0.0
5	0	0.0	0	0.0	1	3.6	1	3.0
6	0	0.0	0	0.0	0	0.0	0	0.0
7	0	0.0	0	0.0	1	3.6	1	3.0

8	0	0.0	0	0.0	2	7.2	2	6.1
During the past 30 days, the number of days you had 4 or more drinks of alcohol (female) or 5 or more drinks of alcohol within a couple of hours (male)								
0 days	2	100.0	3	100.0	25	89.3	30	90.9
2 days	0	0.0	0	0.0	1	3.6	1	3.0
3 to 5 days	0	0.0	0	0.0	1	3.6	1	3.0
6 to 9 days	0	0.0	0	0.0	1	3.6	1	3.0
During the past 30 days, the largest number of alcoholic drinks you had within a couple of hours								
None	2	100.0	4	100.0	24	82.8	30	85.7
1 or 2	0	0.0	0	0.0	1	3.4	1	2.9
3 drinks	0	0.0	0	0.0	1	3.4	1	2.9
5 drinks	0	0.0	0	0.0	2	6.9	2	5.7
6 or 7 drinks	0	0.0	0	0.0	1	3.4	1	2.9
During the past 30 days, the number of times you rode in a vehicle driven by someone who had been drinking alcohol								
0 times	2	100.0	4	100.0	23	82.1	29	85.3
1 time	0	0.0	0	0.0	4	14.3	4	11.8
2 or 3 times	0	0.0	0	0.0	1	3.6	1	2.9
During the past 30 days, the number of times you drove a vehicle when you had been drinking alcohol								
Did not drive a vehicle during the past 30 days	0	0.0	3	75.0	10	34.5	13	37.1
0 times	2	100.0	1	25.0	17	58.6	20	57.1
1 time	0	0.0	0	0.0	1	3.4	1	2.9
2 or 3 times	0	0.0	0	0.0	1	3.4	1	2.9
Used drugs or drank alcohol before last sexual intercourse								
Never had sexual intercourse	2	100.0	3	75.0	22	75.9	27	77.1
No	0	0.0	1	25.0	4	13.8	5	14.3
Yes	0	0.0	0	0.0	3	10.3	3	8.6
Drank alcohol before last sexual intercourse								
Never had sexual intercourse	2	100.0	3	75.0	24	82.8	29	82.9
No	0	0.0	1	25.0	4	13.8	5	14.3

Yes	0	0.0	0	0.0	1	3.4	1	2.9

Have older siblings drink alcoholic beverages or get drunk

No	0	0.0	2	50.0	7	29.2	9	31.0
Yes	0	0.0	0	0.0	14	58.3	14	48.3
Unsure	1	100.0	2	50.0	3	12.5	6	20.7

Have friends drink alcoholic beverages or get drunk

No	1	50.0	2	50.0	11	36.7	14	38.9
Yes	1	50.0	2	50.0	19	63.3	22	61.1

Have positive alcohol expectancies

No	1	50.0	1	25.0	15	50.0	17	47.2
Yes	0	0.0	2	50.0	9	30.0	11	30.6
Unsure	1	50.0	1	25.0	6	20.9	8	22.2

Have negative alcohol expectancies

No	2	100.0	1	25.0	9	30.0	12	33.3
Yes	0	0.0	1	25.0	17	56.7	18	50.0
Unsure	0	0.0	2	50.0	4	13.3	6	16.7

During the past 30 days, how you usually got the alcohol you drank

I did not drink alcohol during the past 30 days	2	100.0	4	100.0	24	85.7	30	88.2
I bought it in a store such as a liquor store, convenience store, supermarket, discount store, or gas station	0	0.0	0	0.0	1	3.6	1	2.9
I gave someone else money to buy it for me	0	0.0	0	0.0	1	3.6	1	2.9
Someone gave it to me	0	0.0	0	0.0	1	3.6	1	2.9
I took it from a store or family member	0	0.0	0	0.0	1	3.6	1	2.9

Table 6

Differences in High School Students' Alcohol Use Behaviors Based on Health Literacy

	Limited HL		Adequate HL		
	N	%	N	%	p
Drank at least one day during their lifetime					1.00
No	3	15.0	17	85.0	
Yes	2	13.3	13	86.7	
Drank at least one day in the past 30 days					1.00
No	4	14.8	23	85.2	
Yes	1	16.7	5	83.3	
Binge drank in the past 30 days					.600
No	5	16.7	25	83.3	
Yes	0	0.0	3	100.0	
Largest number of drinks in the past 30 days					1.00
0-3	6	18.8	26	81.3	
4 or more	0	0.0	3	100.0	
In the past 30 days, rode with someone who had been drinking					.559
No	6	20.7	23	79.3	
Yes	0	0.0	5	100.0	
In the past 30 days, drove when you had been drinking alcohol					1.00
No	6	18.2	27	81.8	
Yes	0	0.0	2	100.0	
Friends drink alcohol or get drunk					.658
No	3	21.4	11	78.6	
Yes	3	13.6	19	86.4	

CHAPTER V

DISCUSSION

Literacy in the context of health was identified as an important contributor to health outcomes in adults, and has been studied since 1958. Literacy provides some skills that are applicable to the context of health, but literacy does not predict health literacy (U.S. Department of Health and Human Services [HHS], Office of Disease Prevention and Health Promotion [ODPHP], 2010). Early studies of health literacy found that most adults did not understand "unfamiliar" health-related words, such as infection and virus (Bucklin Mohammed, 1964). Consequently, physicians and patients relied upon nurses to close the "communication gap" with plain and intelligible verbal communication (Petrello, 1976).

Adolescence is the ideal time for nurses to positively influence adolescents' health-related behaviors. Nurses can positively influence adolescents' health-related behaviors through advocacy, managing care, overseeing care, providing care, research, and volunteering (American Nurses Association, 2020). This chapter will include implications for education, policy, practice, and research. The Adolescent Health Literacy Framework by Manganello (2008) will guide discussion about how the healthcare system, the education system, and social media are potential targets for interventions to build health literacy skills and delay or decrease underage alcohol use. Potential interventions to build health literacy skills and potential interventions to delay and decrease underage alcohol use will be discussed separately.

Health Literacy

The National Health Education Standards (NHES) was the first organization to define health literacy (Joint Commission on National Health Education Standards, 1995). In 2020, the Healthy People 2030 Definitions Committee introduced distinct definitions for personal health

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literacy and organizational health literacy. 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" (ODPHP, 2020).

Health Literacy and Health Outcomes in Adults

Limited health literacy is found in adults from every age, educational, income, and race category (Rubin, 2016). Adults with limited health literacy are more likely to have poor health outcomes, such as chronic disease and disability, and higher health costs. Higher health costs are attributed to both the cost and lost wages associated with chronic disease and disability (HHS, ODPHP, 2010). The average per patient cost for adults with limited health literacy is roughly twice that of adults with adequate health literacy (Haun et al., 2015).

Health Literacy and Health Outcomes in Adolescents

Health literacy is now studied in adolescents because health-related behaviors are typically established during adolescence (Hubbard & Rainey, 2007; Okan et al., 2018). There is evidence that adolescents with limited health literacy have difficulty understanding health-related information (Needham et al., 2010; Shone et al., 2011), make inappropriate decisions (Dharmapuri et al., 2015; Park et al., 2017), and increasingly engage in substance use (Park et al., 2017). Consequently, adolescents with limited literacy are more likely to have poor health outcomes (Diehl, 2011).

Underage Alcohol Use

Underage alcohol use is a problem for adolescents that nurses need to address. Minors consume 11% of all alcohol sold in the United States even though the minimum legal age for alcohol is 21 years (Division of Population Health [DPH], National Center for Chronic Disease Prevention and Health Promotion [NCCDPHP], & Centers for Disease Control and Prevention

[CDC], 2020b). Alcohol use typically begins during early adolescence and increases steadily throughout high school (Windle & Zucker, 2010). Underage alcohol use alters brain structure and function, and contributes to impaired learning, memory, visuospatial navigation, attention, response inhibition, and goal attainment (Squeglia et al., 2014). It is associated with alcohol use disorders, risky behaviors, unintentional injury, violence, and death. Underage alcohol use contributes to roughly 119,000 emergency department visits and the death of more than 4,300 youth every year with associated costs reaching $24 billion (DPH, NCCDPHP, & CDC, 2020b).

Potential Contributions to Nursing Science

Nursing is a human science that focuses on the lived experiences of individuals, families, and communities (McEwen & Willis, 2011). The goal of nursing science is to build knowledge about how to optimize the ability of individuals, families, and communities to function (Butts & Rich, 2015). Little is known about how health literacy affects underage alcohol use. The two studies conducted in the United States exploring relationships between health literacy and underage alcohol use yielded conflicting results. In the first study, using the Rapid Estimate of Adolescent Literacy in Medicine (REALM-Teen), Chisolm et al. (2014) found that adolescents with adequate health literacy were more likely to report drinking alcohol, binge drinking, and problems as a result of drinking alcohol than those with limited health literacy (Chisolm et al., 2014). In the second study, Park et al. (2017) found an association between limited health literacy and increasing engagement in substance use over six months. After controlling for covariates, the relationship was significant when health literacy was measured with the KidsPoll but not significant when health literacy was measured with the REALM-Teen or the Newest Vital Sign (NVS). Although Park et al. (2017) collected data on alcohol use in the past 30 days,

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they were unable to benchmark their findings with the Youth Risk Behavior Survey (YRBS) since alcohol use, marijuana use, and tobacco use were aggregated into substance use.

Study Purpose

Limited health literacy and underage alcohol use are preventable public health problems that contribute to preventable disease burden and adverse health outcomes. The Framework for Studying Adolescent Health Literacy by Manganello (2008) is available to guide health literacy research in adolescents. The purpose of this research was to add evidence about relationships between high school students' health literacy and alcohol use. The three aims were to (a) describe the health literacy in a sample of high school students, (b) explore relationships between high school students' health literacy and individual traits, and (c) examine relationships between high school students' health literacy and alcohol use. Although it was not possible to statistically examine data for these relationships using correlations due to small sample size, the data were explored for differences in between groups based on individual traits and health literacy. This study contributes to nursing science because it is the only study using the NVS, currently the most comprehensive assessment of adolescents' health literacy, to explore relationships between health literacy and underage alcohol use. All the alcohol-related questions from the 2017 YRBS were included in this study to add evidence about underage alcohol use and behaviors while under the influence of alcohol. Moreover, responses were able to be compared with the 2017 YRBS. The generation of nursing knowledge is often influenced by social context (Butts & Rich, 2015). This study was underway when schools closed to in-seat instruction because of the COVID-19 pandemic, and provides insight into high school students' decisions about alcohol use while they were sheltering-at-home with their parents.

Summary of Study Results

Data were collected from 39 students (response rate = 5.3%, 39/737) attending a private high school in the Midwest. Most of the students in this sample were White, born in the United States, had college-educated parents, and had adequate health literacy (76.9%, 30/39). Gender was the only individual trait that showed differences between groups, with males more likely to have adequate health literacy. In males, math skills strengthen during high school and by 12th grade they have stronger math skills than females (National Center for Education Statistics, 2015). Because the NVS uses four numeracy questions and two reading questions to measure health literacy, this may explain why males had higher scores on the NVS than females in this study.

Many students (42.9%, 15/35) reported drinking, and 18.2% (6/33) reported drinking in the past 30 days. No significant differences in alcohol use were found between groups based on health literacy. Lifetime and current alcohol use were comparable between students with adequate and limited health literacy. Only participants with adequate health literacy reported drinking before age 13 years (15.4%, 2/13), drug or alcohol use (42.8%, 3/7) and alcohol use (20.0%, 1/5) before last sexual intercourse. Only participants with adequate health literacy reported binge drinking (10.3%, 3/29), riding with someone under the influence of alcohol (17.9%, 5/28), and driving under the influence of alcohol (10.5%, 2/19) in the past 30 days. Only participants with adequate health literacy reported having siblings who drink. More participants with adequate health literacy reported having friends (63.3%, 19/30) who drink than their peers with limited literacy (50%, 3/6).

Alcohol expectancies are personal beliefs about what will happen by drinking alcohol (König et al., 2018). Positive alcohol expectancies were assessed by asking participants if they

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thought they would feel relaxed, feel happy, feel more friendly and out-going, have a lot of fun, or forget their problems if they drank alcohol. Negative alcohol expectancies were assessed by asking participants if they thought they would get into trouble with the police, harm their health, not be able to stop drinking, get a hangover, do something they would regret, or feel sick if they drank alcohol. Although not statistically significant, positive alcohol expectancies were comparable between participants with adequate health literacy (9/30, 30%) and limited health literacy (33.3%, 2/6). More participants with adequate health literacy (56.7%, 17/30) had negative alcohol expectancies than their peers with limited health literacy (16.7%, 1/6).

Conceptual Framework

Theory offers a systematic approach to organizing nursing knowledge, collecting data, and validating intuition (McEwen & Willis, 2011). This study was guided by the Framework for Studying Adolescent Health Literacy by Manganello (2008). The Framework for Studying Adolescent Health Literacy proposes that individual traits predict one's health literacy and subsequent health outcomes. Families and friends as well as mass media, the education system, and the health system influence individual traits. Health literacy skills assist with obtaining, understanding, and assessing the credibility of health-related information. The education system directly influences literacy skills and has the potential to teach health literacy skills (Manganello, 2008).

Potential Targets for Interventions to Build Health Literacy Skills

The Affordable Care Act (ACA) is federal legislation that addresses crucial causes of preventable disease burden. The three major objectives of the ACA are to regulate the private health insurance industry, increase access to healthcare coverage, and control healthcare costs

(Somers & Mahadevan, 2010). Relevant to health literacy, the ACA mandates that explanation of benefits and coverage are written so they can be understood and used by the average enrollee (Grossman et al., 2010). Other legislation that relates to health literacy is the Plain Language Act of 2010. The Plain Language Act facilitates access to information and services by mandating that federal documents, such as healthcare coverage and explanations of benefits, are clear, concise, and well organized (Committee on Oversite and Government Reform, 2010). Nurses are uniquely situated to use legislation to optimize the ability of individuals, families, and communities to function. Nursing practice extends across a variety of settings, such as the healthcare system and the education system. Nurses need to advocate for national and local policies that optimize the ability of individuals, families, and communities to function.

Healthcare System

Health literacy impacts understanding and use of written and verbal health-related information. Healthcare providers tend to overestimate patients' health literacy level and underestimate patients' health information needs (Parnell, 2015). They also underutilize strategies known to improve consumer understanding of health-related information (Johnson, 2015). The Federal Plain Language Guidelines recommends knowing your audience (plainlanguage.gov, 2011). Most health-related materials are written at grade-levels higher than the average reading level of fifth grade. Product misunderstanding and misuse increases when health-related materials such as drug and nutrition labels are written above reading level (Somers & Mahadevan, 2010).

According to The Adolescent Health Literacy Framework by Manganello, the healthcare system is a potential point for intervention to improve health literacy. Three key elements of effective patient-centered communication are (a) avoid medical jargon, (b) use plain language,

and (c) encourage learners to repeat back information in their own words. Understanding and retention of health-related information increases when the learner has the opportunity for clarification. The interactive communication loop, also known as the teach-back method, is an effective method to identify what the learner understands (Parnell, 2015).

Learner focused education is most likely to influence behavior. Effective patient-centered communication considers the context of communication and integrates the learner's cultural beliefs, religious beliefs, education level, and literacy level. Communication that is tailored to the learner is most likely to increase understanding and retention of health-related information. To attain effective patient-centered communication, healthcare organizations and healthcare providers who care for adolescents need to identify and satisfy adolescents' needs (Parnell, 2015). Health-related materials need to be written for the intended audience, and at the fifth-grade reading level. Readability test tools, such as the Flesch Kincaid Grade Level and the SMOG Index, estimate grade reading level (Web FX, 2020). Healthcare providers need to identify their audience, and address their goals by writing as if they were speaking to an adolescent. Health-related materials need to be created and tailored to appeal to adolescent populations. Since pictures enhance understanding of health-related materials (Parnell, 2015), emojis, cartoons, and links to credible websites and mobile applications ("apps") can be incorporated into health-related materials to increase appeal and enhance understanding. Nurses need to advocate for national and local policies that support tailoring health-education materials to the intended audience.

During healthcare visits, nurses should review the grade reading level of health-related materials before giving them to adolescents. Ensuring that all education is focused on and tailored to the learner enhances the learner's understanding and retention (Parnell, 2015). To

ensure that education is tailored to the learner, healthcare providers need to assess health literacy in their adolescent patients. Evidence shows that screening tools facilitate patient-centered communication between adolescents and healthcare providers (Dalstrom et al., 2020). The NVS is a screening tool designed to quickly assess health literacy (Weiss et al., 2005), and should be used because it is the most comprehensive health literacy screening tool for adolescent populations. Nurses need to advocate for national and local policies that support screening patients for health literacy.

Media

Almost all adolescents have Internet access through which they are exposed to unregulated alcohol advertising, peer posts, and questionable health-related information. A nationwide study found that 99% of adolescents have Internet access via their own computer, tablet, or smartphone (Lauricella et al., 2018). Sixty-seven percent of adolescents use the Internet to look up health-related information including information about substance use, smoking, and sexual activity (Lauricella et al., 2018). Adolescents do not typically seek health-related information from a specific website. They typically use a search engine and select one of the top three websites or find health-related information through online advertisements. Even though they do not typically assess website credibility, 39% of adolescents report modifying their behavior based on their understanding of online health-related information (Jain & Bickham, 2015). According to The Adolescent Health Literacy Framework by Manganello (2008), media is a potential point for intervention to improve health literacy. Adolescents need to know how to find credible health-related information (Manganello, 2008). Online health-related information is not regulated because the Internet is not controlled by a central governing body (Jain & Bickham, 2015). To find credible health-related information, adolescents need to know how to

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discern credibility. In 2018, the National Library of Medicine published a tutorial and checklist about evaluating online health-related information. The four domains to assess for credibility are (a) provider, (b) funding, (c) quality, and (d) privacy. Assessing website credibility involves knowing who runs the website and why, who pays for the website and if the information is biased towards the sponsor, when and where the information comes from, and if personal information is being solicited (National Library of Medicine, 2018). During healthcare visits, healthcare providers can provide adolescents with the free resource *MedlinePlus Evaluating Internet Health Information: Checklist.*

Nurses need to advocate for national and local policies that support adolescents' ability to find credible health-related information. Since most adolescents have personal access to the Internet, technology could be used to improve their ability to find credible health-related information. Credible health-related websites could post or include a link to the *MedlinePlus Evaluating Internet Health Information: Checklist*. A mobile medical application ("app") version of the *MedlinePlus Evaluating Internet Health Information: Checklist* could be developed. For adolescents who use community resources to access the Internet, this checklist could be displayed by public computers.

Education System

The influence of the education system is second only to family. School is where most students make friends and where behavior norms are established and reinforced. To facilitate establishment and maintenance of healthy behavior norms, in 1995 the National Health Education Standards (NHES) published a framework to build health literacy skills in all primary and secondary school students. The NHES provide the framework, but the curriculum can be tailored to student body needs. Health education is effective when it is internalized and

personalized (Joint Committee on National Health Education Standards, 2007). Health education content can be incorporated into anatomy and physiology, biology, health, physical education, psychology, and sociology courses.

Effective health education builds health literacy skills including how to assess credibility of health-related information. In addition to teaching health information, effective health education forms beliefs that foster healthy behaviors, creates group norms that value a healthy lifestyle, and develops skills to establish and maintain healthy behaviors. It promotes healthy decisions by correcting misperceptions about peer and social norms. Personalizing information through experiential, interactive, and student-centered instructional strategies enhances student engagement (DPH & NCCDPHP, 2019).

The NHES outlines six principles for education systems to ensure that health education is accessible and equitable to all students. The six principles of access and equity are environment and climate, teaching, curriculum, assessment, technology, and learning. The school environment and climate must be safe and value healthy behaviors. Student-centered teaching facilitates student engagement so learning to understand and apply health-enhancing skills is meaningful. Effective curriculum addresses different learning styles to build communication, decision-making, and risk-assessment skills. Fair assessment of students' understanding and ability to apply health-enhancing skills measures student performance and informs curriculum. Technology is increasingly becoming a consumer health tool, and equitable access to technology is critical to building students' health literacy skills. Learning occurs when health-enhancing skills become healthy behaviors. During grades three through 12, students need a minimum of 80 hours of health education per academic year (Joint Committee on National Health Education Standards, 2007).

According to The Adolescent Health Literacy Framework by Manganello (2008), the education system is a potential point for intervention to improve health literacy. Nurses need to advocate for national and local policies that support effective health education. The NHES provide a framework that school faculty, administrators, and policy makers can use to allocate resources for effective health education (Joint Committee on National Health Education Standards, 2007). School faculty, administrators, and policy makers can advocate for effective health education that incorporates the NHES, the NHES six principles of access and equity, and continuing education for health educators. School policy makers can advocate for and allocate resources toward health education classroom space and class size that is equitable with other classes. School administrators can work with health educators to tailor health education to student body needs. School nurses can work with health educators to create health education curriculum that builds communication, decision-making, and risk-assessment skills. School nurses can teach health education content to classes or individual students to enhance their ability to understand and apply health-enhancing skills. Since most adolescents have personal access to the Internet, health educators can allocate resources to curriculum that improves students' ability to find and discern credibility of online health-related information. Health educators can incorporate the *MedlinePlus Evaluating Internet Health Information: Checklist* into curriculum and assessment.

Potential Points for Interventions to Delay or Decrease Underage Alcohol Use

Multiple federal and state laws have been enacted to prevent underage alcohol use. These laws vary by state. Minimum Legal Drinking Age laws identify the age when it is legal to purchase and publicly possess alcoholic beverages (DPH, NCCDPHP, & CDC, 2020a). The 1984 National Minimum Drinking Age Act withholds federal highway funding to states that

allow anyone under 21 years to purchase or publicly possess alcoholic beverages (www.govinfo.gov, 2019). Enactment varied across states (DPH, NCCDPHP, & CDC, 2020a). By 1988, every State met the federal funding requirements (www.govinfo.gov, 2019). Since 1991, high school students age of initiation to alcohol and current alcohol use trends have been monitored with the YRBS. Initiation to alcohol before 13 years is trending down from greater than 30% during the 1990s to 15% in 2019. Current alcohol use is also trending down from approximately 50% during the 1990s to just over 29% in 2019. And yet, in 2019 over 3% of high school students reported drinking 10 or more alcoholic beverages in a row in the past 30 days (Division of Adolescent and School Health, National Center for HIV/AIDS, Viral Hepatitis, STD, 2020). Binge drinking accounts for greater than 90% of underage alcohol consumption (DPH, NCCDPHP, & CDC, 2020a). Despite Minimum Legal Drinking Age laws, high school students are using alcohol in ways that are unhealthy and unsafe.

The Healthcare System

Screening for substance use is a preventative healthcare service. Medicaid and most health insurance plans sold on the Health Insurance Exchange Marketplace provide free preventive healthcare services for children when seen by a provider within the plan's network (U. S. Centers for Medicare & Medicaid Services [CMS], n.d.). Alcohol screening is backed by the Substance Abuse and Mental Health Services Administration and the U.S. Preventive Services Task Force (CDC, 2014). Healthcare providers are not required to screen adolescents for alcohol use, and fewer than half routinely screen adolescents for alcohol use (Geerligs et al., 2018), but screening adolescents for alcohol use should be promoted as best practice. Most healthcare providers use clinical judgement instead of a validated screening tool to assess adolescents' substance use behaviors, but clinical judgement typically fails to detect adolescents

who are engaging in alcohol use. Pediatricians who do not routinely use validated screening tools will miss nearly two-thirds of minors engaging in excessive alcohol use (Levy & Williams, 2016). Treatment for substance use disorders is an essential healthcare benefit and included in health insurance plans sold on the Marketplace. Coverage of treatment for substance use disorders varies between and within states. Some Marketplace health insurance plans have copayments, deductibles, and out-of-pocket costs (CMS, n.d.). Nurses need to advocate for national and local policies that support preventative healthcare services, use of a validated instrument to screen for underage alcohol use, and essential healthcare benefits including the treatment for substance use disorders.

Private conversation between adolescents and healthcare providers is supported by the American Academy of Pediatrics, the American Medical Association, the American College of Obstetricians and Gynecologists, the North American Society for Pediatric and Adolescent Gynecology, and the Society for Adolescent Health and Medicine (Burstein et al., 2016). With effective patient-centered communication, healthcare providers can identify and satisfy adolescents' needs (Parnell, 2015). Adolescents are more likely to disclose and discuss risk-taking behaviors during private conversations with their healthcare provider when their parents are not present (Dalstrom et al., 2020). Healthcare providers who focus and tailor education are most likely to influence adolescents' behaviors (Parnell, 2015). Adolescents who do not have the opportunity for private conversations with their healthcare providers are more likely to engage in risky behaviors (Fuentes et al., 2018). Nurses need to implement this recommendation for private conversations with adolescents in health care settings and advocate for national and local policies that support private conversation between adolescents and healthcare providers during preventative and emergent healthcare visits.

The healthcare system is a potential point for intervention to delay or decrease underage alcohol use. Healthcare providers need to privately assess adolescents' alcohol use with a validated screening tool during all healthcare visits. Screening tools can increase the number of potentially sensitive topics that adolescents discuss with their healthcare provider, and identify adolescents who use and misuse alcohol (Dalstrom et al., 2020; Levy & Williams, 2016). Since drinking patterns can change, adolescents should be screened at least once a year (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2019b). The Society for Adolescent Health and Medicine recommends either the Alcohol Use Disorders Identification Test (AUDIT) or the Alcohol Screening and Brief Intervention (Society for Adolescent Health and Medicine, 2020).

The Single Question Alcohol Screen identifies adolescents who have exceeded the daily limit, as established by the NIAAA. Anyone who answers more than zero to how many times in the past year have you had more than four (female) or five (male) drinks in a day should receive the full Alcohol Use Disorder Identification Test (AUDIT). The AUDIT and Single Question Alcohol Screen can be used in children as young as age nine years (CDC, 2014). The AUDIT, developed by the World Health Organization (WHO), is a validated 10-item screening tool designed to assess alcohol behaviors and alcohol-related problems (Saunders et al., 1993). The AUDIT is the gold standard screening tool to assess alcohol behaviors. The AUDIT, which takes just minutes to complete, can be administered orally, on paper, or on computer. Oral administration requires training and may generate less accurate results, but it is an option for those with limited literacy or vision. Adolescents who screen positive for alcohol use then receive a brief intervention. Those at severe risk will also be referred for treatment (CDC, 2014).

The Alcohol Screening and Brief Intervention is a two-question screening tool. The first question assesses frequency of alcohol use. For anyone who answers more than zero to how many times in the past year have you had a drink, nurses or other healthcare providers consult an estimated risk chart to see where age and frequency intersect. Estimated risk is used to identify brief interventions. The second question ascertains how much their friends drink. For adolescents who do not drink, healthcare providers briefly reinforce and discuss plans to stay alcohol-free. Healthcare providers reinforce healthy decisions and discuss reasons to stop using alcohol with adolescents at lower risk. For adolescents at moderate and highest risk, healthcare providers assess alcohol-related problems. Healthcare providers conduct brief motivational interviewing with anyone experiencing alcohol-related problems. Adolescents at highest risk may need to be referred for further evaluation and treatment (NIAAA, 2019b).

Brief interventions and motivational interviewing are designed to motivate adolescents to reduce or stop drinking. These interventions can be delivered by any trained member of the healthcare team in less than 15 minutes. Nurses and other healthcare providers are trained to listen for interest in changing behaviors, and ask permission prior to discussing significant concerns. Reflection, summarizing, and tailoring education increases understanding. Action plans are created cooperatively between healthcare providers and adolescents. A follow-up visit is beneficial for adolescents who received an intervention (NIAAA, 2019a).

Brief interventions are time-limited and designed to motivate individuals to change a specific health-related behavior. Patient-centered communication is used to motivate lower risk adolescents to reduce or stop drinking. After asking permission, nurses and other healthcare providers briefly provide advice and solicit feedback. Motivational interviewing uses patient-centered counseling to motivate moderate and highest risk adolescents to reduce or stop drinking.

Motivational interviewing is designed to elicit motivation to change a specific health-related behavior. Empathy, warmth, active listening, and reflection helps patients explore their beliefs, goals, perspectives, and values to identify how underage alcohol use could adversely impact their future (NIAAA, 2019).

In cases of imminent harm, healthcare providers and adolescents may need to discuss disclosing screening results with parents. Typically, adolescents appreciate collaborating with healthcare providers to disclose alcohol use with their parents, and experience relief once their parents are told. Parental support is often beneficial, particularly when adolescents are referred for further evaluation or treatment (Levy & Williams, 2016), such as family level intervention programs. Family level intervention programs can prevent risk-taking behaviors in adolescents. Family level intervention programs include the adolescent and at least one other family member, typically a parent. Family level interventions can be provided in-person or indirectly through printed information, a computer program, or the Internet. Traditional in-person family level interventions with booster sessions may be effective in reducing and preventing underage alcohol use (Kao et al., 2012). Nurses need to advocate for national and local policies that support brief interventions and motivational interviewing to ensure that they are incorporated into every adolescent practice.

Media

Social media shapes adolescents' alcohol expectancies and influences their health-related behaviors (Critchlow et al., 2019). Alcohol advertising increases underage alcohol use and misuse by transmitting positive messages of alcohol use minus the negative consequences (Committee on Substance Abuse, 2010; Moreno & Whitehill, 2013). Most adolescents have personal Internet access, and often view media alone or with friends. Their predisposition for

risky behaviors influences how they understand and use media messages, and how they engage with social networking sites such as Facebook, Twitter, or YouTube (Lauricella et al., 2018). Alcohol companies can upload content to pages on social networking sites where consumers can interact with the alcohol-brand content. Consumers promote and advertise alcohol-brand content when they add to the page or share alcohol-brand content on their own social media networking sites. Consumer interaction with alcohol-brand content on social networking sites is escalating and unregulated. It is unregulated because demographic information such as consumer age is proprietary to the social networking site and the page owner (Jernigan & Rushman, 2014). Consequently, despite age restrictions, adolescents are exposed to unregulated alcohol advertising (Jernigan & Rushman, 2014; Lauricella et al., 2018; Moreno & Whitehill, 2013). Consumer interaction with alcohol-brand content on social networking sites has a greater effect on alcohol consumption than traditional advertising. Adolescents who view or interact with alcohol advertising on social networking sites are more likely to have positive expectancies, and engage in underage alcohol use and misuse (Critchlow et al., 2019).

Monitoring social media networking sites is an intervention that has the potential to delay or decrease underage alcohol use. Nurses need to advocate for national and local policies that support monitoring minors' interactions with alcohol. Nationally, the United States Federal Trade Commission (FTC) could monitor how alcohol companies verify consumer age on social networking sites (Jernigan & Rushman, 2014). The FTC could also monitor how social media networking sites verify consumer age. Social media networking sites that fail to remove company generated and consumer-generated alcohol advertisements from minors' pages could be subject to fines. Locally, school systems can (a) block access to social media networking sites on school issued computers and (b) educate parents about monitoring social media activity.

Education System

According to Section 4108 of the Every Student Succeeds Act, Activities to Support Safe and Healthy Students, schools receiving federal funding must provide alcohol or other drug use prevention education. Operationalization is a state and local responsibility (U.S. Department of Education & Office of Elementary and Secondary Education, 2016). There is considerable variance in health education requirements and curriculum between states as well as between school districts within states. Health education programs that address behaviors that are amenable to change, such as alcohol and other drug-use prevention education programs, are backed by the American Cancer Society, the American Diabetes Association, and the American Heart Association (The American Cancer Society, the American Diabetes Association, the American Heart Association, 2008).

School-based alcohol prevention programs were initially informational and employed scare tactics; they were also ineffective (NIAAA, 2005). The four research-based characteristics of effective health education are (a) teaching health information, (b) forming values and beliefs that foster healthy behaviors, (c) creating group norms that value healthy lifestyles, and (d) developing skills to establish and maintain healthy lifestyles. Personalizing information through experiential, interactive, and student-centered instructional strategies enhances student engagement (DPH & NCCDPHP, 2019). Interactive health education programs are two to four times more effective than non-interactive programs. Discussing experiences, practicing behavior skills, and receiving feedback from peers helps create group norms and develop skills to establish and maintain healthy lifestyles (McBride, 2003). Effective school-based health education should begin prior to engagement in risky behaviors. Evidence supports annual interactive alcohol or other drug-use prevention education programs in grade school prior to

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initial exposure, in middle school during initial exposure, and in high school when underage

alcohol use increases (McBride, 2003; The American Cancer Society, the American Diabetes

Association, the American Heart Association, 2008).

The education system is a potential point for intervention to delay or decrease underage

alcohol use. Nurses need to advocate for policies and establish procedures and practices that

support alcohol-free schools. Numerous interventions have been designed to delay or decrease

underage alcohol use (Kao et al., 2012). School-based prevention intervention programs

designed to delay or decrease risk-taking behaviors can be effective (MacArthur et al., 2018).

Interactive health education programs with student-led discussions can teach facts and strategies

to resist peer pressure (Kail & Cavanuagh, 2016). Yet, health educators are only required to

attempt to increase students' knowledge about health topics and may not be afforded health

education professional development opportunities (Rasberry et al., 2017). Nurses need to

advocate for national and local policies that support the professional development of health

educators. Health educators can advocate for resources that support their professional

development. School policy makers and administrators can allocate resources that support the

professional development of health educators.

Effective alcohol or other drug-use prevention education programs are interactive and

conducted on an annual basis (Kail & Cavanuagh, 2016). Nurses need to advocate for national

and local policies that support effective alcohol or other drug-use prevention education

programs. School faculty, administrators, and policy makers can advocate for annual interactive

alcohol or other drug-use prevention education programs. School policy makers and

administrators can allocate resources for annual interactive alcohol or other drug-use prevention

education programs. School administrators can work with health educators to tailor health

education to student body needs. School nurses can collaborate with educators to create and support effective and interactive school-based health education curriculum. School nurses and health educators can introduce students to credible online websites, talk with students about lifestyle behaviors, and teach school faculty and parents how to identify students exhibiting warning signs of alcohol use and misuse. When necessary, school nurses can coordinate behavioral health services and monitor ongoing treatment.

Health Literacy and Underage Alcohol Use at the Study Site

The Framework for Studying Adolescent Health Literacy by Manganello proposes that individual traits, such as age, gender, race, social skills, cognitive skills, and physical abilities predict one's health literacy and subsequent health outcomes, including health behaviors, cost, and use of the health system. Families and friends, social media, the education system, and the health system also influence individual traits, health literacy, and health outcomes. This study explored relationships between health literacy and adolescents' health behavior of alcohol use and did not find a relationship. Self-selection of students from a higher socioeconomic status attending a private high school may have contributed to the high health literacy in this sample. Health literacy skills assist with obtaining, understanding, and assessing the credibility of health-related information. The site for this study participates in an alcohol and other drug-use prevention program called the Red Ribbon Program. Participation in the Red Ribbon Program may have contributed to the lower rates of underage alcohol use in this sample compared with the 2017 YRBS. The school uses the Red Ribbon Program to emphasize setting life goals and understanding how alcohol and other drugs adversely affect personal goals. If there is a relationship between health literacy skills and underage alcohol use, then interactive alcohol and other drug-use prevention education programs need to be conducted annually in all schools.

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Future Research

Future research is needed to explore relationships between health literacy and factors in The Framework for Studying Adolescent Health Literacy by Manganello (2008) that are associated with underage alcohol use. Conducting this study with the original methods may reach a larger and more heterogenous population. Repeating similar studies in additional high schools may allow researchers to sample a more heterogenous population and compare groups based on individual traits. This study identified high school students who began drinking alcohol prior to age 14 years. Conducting studies in middle schools also has the potential to understand health literacy and alcohol use in younger adolescents and identify targets for interventions to delay and decrease alcohol use.

Future research is needed to understand relationships between health literacy, underage alcohol use, and alcohol use by siblings and friends. In this study, although not statistically significant, only participants with adequate health literacy reported having siblings who drink alcohol. Also, more participants with adequate health literacy had friends who drink alcohol than their peers with limited literacy. The reward-seeking system is activated when adolescents are with their friends, which contributes to the appeal of immediate rewards and engagement in risky behaviors (McNeely & Blanchard, 2009; Shulman et al., 2016). Adolescents tend to overestimate the likelihood of harm associated with risky behaviors, but underestimate the likelihood of personal harm (Kail & Cavanuagh, 2016). It is possible that adolescents with lower health literacy may be less likely to understand how alcohol adversely affects personal goals, so health literacy must be considered when creating interventions to delay and decrease alcohol use.

Future research is needed to understand relationships between health literacy, negative alcohol expectancies, and underage alcohol use specifically age of initiation to alcohol use and

amount of alcohol consumption. Positive alcohol expectancies are associated with earlier age of initiation to alcohol use and greater alcohol use. In adults, there is evidence that negative alcohol expectancies are associated with greater restraint. But there is also evidence that some adults perceive the consequences associated with risky drinking as positive, rather than negative (Robertson et al., 2017). In adolescents, there is also some evidence that both positive and negative alcohol expectancies contribute to underage alcohol use (Chisolm et al., 2014; König et al., 2018). Chisolm et al. (2014) suggest that health literacy may moderate the relationship between expectancies and some alcohol behaviors. Expectancies are stronger predictors of alcohol use in adolescents with higher health literacy than in adolescents with lower health literacy because adolescents with lower health literacy may use more reactive decision-making. Health literacy must be considered when creating interventions based on alcohol expectancies (Chisolm et al., 2014). In this study, although not statistically significant, positive alcohol expectancies were comparable between participants with adequate literacy and limited literacy but more participants with adequate literacy had negative alcohol expectancies than their peers with limited literacy. Normal brain development predisposes adolescents to risky behaviors, and it is possible that adolescents may perceive the outcomes associated with risky drinking as positive, rather than negative.

Parental involvement is protective against alcohol use, and evidence suggests that family level interventions may reduce the amount of alcohol adolescents consume. Family level interventions are comparable to individual level interventions on the prevalence and frequency of underage alcohol use (Gilligan et al., 2019). Parental attitudes and parental use of alcohol were not explored in this study but should be included in future research about age of initiation to alcohol and alcohol expectancies.

Future research on health literacy can explore reading and numeracy skills to manage acute and chronic conditions. A quarter of the children in the United States are living with a chronic illness. Every year more than 13,000 children are diagnosed with cancer and another 13,000 are diagnosed with type I diabetes. Close to half of all chronically ill children are living with asthma (Compas et al., 2012). In this study, although not statistically significant, an average of 21.1% incorrectly answered the four math questions and an average of 18.9% incorrectly answered the two reading questions. Limited health literacy limits understanding of medication and dosing instructions (Shone et al., 2011), and can impact understanding and management of acute and chronic conditions. The ability to understand and manage acute and chronic conditions was not explored in this study but should be included in future research on health literacy.

Conclusion

Limited health literacy and underage alcohol use are preventable public health problems that contribute to preventable disease burden, adverse health outcomes, and high health costs. Health-related behaviors are typically established during adolescence, and adolescents increasingly make health-related decisions. Interventions to equip adolescents with health literacy skills has the potential to improve health outcomes and reduce health costs. Interventions to delay and decrease alcohol use also have the potential to improve health outcomes and reduce health costs. Interventions to prevent disease burden helps to optimize the ability of individuals, families, and communities to function.

The healthcare system, the education system, and social media are potential targets for interventions to increase health literacy in adolescents. These domains are also potential targets for interventions to delay or decrease underage alcohol use. Healthcare providers need to assess adolescents' health literacy so health education can be focused on and tailored to the learner.

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They also need to avoid medical jargon, use plain language, and ask adolescents to repeat back information in their own words. Healthcare providers need to privately assess alcohol use with a validated screening tool during all adolescent healthcare visits. They need to reinforce plans to stay alcohol-free with adolescents who do not drink. They need to conduct brief interventions or motivational interviewing with adolescents who drink alcohol.

Most adolescents have personal access to the Internet, and technology can be used to help them find credible health-related information. It is concerning that social media networking sites allow company generated and consumer-generated alcohol advertisements on minors' pages, and this practice needs attention. School systems can block access to social media networking sites on school issued computers, and can also educate parents about monitoring their children's social media activity. School faculty and administrators can implement effective health education that is tailored to student body needs, and implement annual interactive effective alcohol and other drug-use prevention education programs. School nurses can collaborate with educators to create and support effective and interactive school-based health education curriculum and introduce students to credible online websites. Nurses are uniquely situated to advocate for national and local policies that optimize the ability of individuals, families, and communities to function.

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<div align="center">**CURRICULUM VITAE**</div>

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Education

PhD University Name University of Wisconsin-Milwaukee, Nursing
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MSN Saint Anthony College of Nursing, Nursing: Clinical Nurse Leader
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BSN University of Wisconsin-Madison, Nursing
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Certifications

Clinical Nurse Leader (CNL)   2016

Honors and Awards

UW-Milwaukee Werley Doctoral Student Research Award   2019-2020

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                                                             2017-2018
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Honorable Mention Poster "A Survey of Doctoral Nursing Students: Activities to Facilitate
Professional Development" Sigma Theta Tau ETA Chapter, Milwaukee, WI.   2018

Honorable Mention Poster "Nursing's Metaparadigm: A Framework to Explore Adolescent
Health Literacy" Sigma Theta Tau ETA Chapter, Milwaukee, WI.   2017

"Improving Adherence to VTE Prophylaxis in an Acute Care Setting"
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Second Place PhD Student Poster Award "Innovative Use of Humor and Creativity During PhD
Nursing Student Virtual Social Sessions Amidst COVID-19 Pandemic" Sigma Theta Tau ETA
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Research Experience

OSF Saint Anthony Medical Center, Rockford, IL. Research Council Evidence Based Practice Internship, Dr. Colleen Klein. "Professionalism, individuality, and the identification of a nurse: A mixed methods study" that changed uniform policy in an ambulatory surgery unit.
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Teaching Experience

Saint Anthony College of Nursing, Rockford, IL., Adjunct Faculty, Nursing

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American Heart Association

- Basic Life Support (BLS) Instructor   1994-present
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Writing Experience

- OSF SAMC Professional Nursing Practice Manual   2012
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Publications

Journal Publications

- Dalstrom, Matthew, Parizek, Rebecca, & Doughty, Andrea. (2020). Nurse Practitioners and Adolescents: Productive Discussions About High-Risk Behaviors. *Journal for Nurse Practitioners*, *16*(2), 143–145. https://doi.org/10.1016/j.nurpra.2019.11.021

Journal Papers in Review

- Parizek, R.A., "Health literacy and underage alcohol use: A systematic review of international literature," submitted to: Journal of Adolescents on 6/30/2020

- Parizek, R.A., "Health literacy in US adolescents: A systematic review of the literature," submitted to: Health Education & Behavior on 8/14/2020

- Treisman, P., Kent, D., Sima, C., McMahon Bullis, M., Parizek, R.A., Snethen, J., "Writingcamp: Promoting dissertator writing productivity during the COVID-19 pandemic," submitted to: Nursing Education Perspectives on 9/8/2020

Presentations and Invited Lectures

Presentations

- Parizek, R.A., Kisch, T.E., "Magnet engagement"
  - OSF Saint Anthony Medical Center, Rockford, IL.   April 2019

- Parizek, R.A., Ligman-Schliem, M.A., "Do adolescents talk about sex and other risk-taking behaviors?"
  - 43rd Annual Midwest Nursing Research Society Research Conference, Kansas City, MO.   Mar. 2019

- Talsma, A., Roddy, L., Parizek, R.A., "Evaluation of the quality and outcomes reporting process of maternal child care for nursing leaders"
  - 20th Annual Building Bridges to Research-Based Nursing Practice Conference, Milwaukee, WI.   May 2018

- Parizek, R.A., Kakuta, M., Dermody, G., "Improving adherence to VTE prophylaxis in an acute care setting"
  - Sigma Theta Tau Eta Nu Chapter, Milwaukee, WI.   Jan. 2017

- Parizek, R.A., "Advancing nursing leadership through global collaboration"
  - OSF Saint Anthony Medical Center, Rockford, IL.   Sept. 2015

- Parizek, R.A., "Evidenced-based practice"
  - Japanese Red Cross Kyushu Int'l College of Nursing, Fukuoka, Japan   June 2015
  - Japan Nurses Association Kumamoto Chapter, Kumamoto, Japan   June 2015

- Parizek, R.A., "Nursing practice in the United States"
  - Kyoto University, Kyoto, Japan   June 2015
  - Japanese Red Cross Kyushu Int'l College of Nursing, Fukuoka, Japan June 2015
  - Kumamoto Health Science University, Kumamoto, Japan   June 2015

- Parizek, R.A., "The Joint Commission"
  - University of Tsukuba Hospital, Tsukuba, Japan   June 2015

Poster Presentations

- Parizek, R.A., "Health literacy and alcohol use behaviors in high school students"
  - Sigma Theta Tau Eta Nu Chapter, Milwaukee, WI.   Nov. 2020

- Treisman, P.E., Kent, D. C., Sima, C.D., McMahon Bullis, M. M., Parizek, R. A., & Snethen, J. A., "Writingcamp: Promoting dissertator writing productivity during the COVID-19 pandemic"
  - Sigma Theta Tau Eta Nu Chapter, Milwaukee, WI.   Nov. 2020

- McMahon Bullis, M. M., Peters, C. C., Gonzalez, C. M., Treisman, P. E., Kent, D. C., Rebecca A. Parizek, R.A., Graf, M. D., Hafez, S. A., & Snethen, J. A., "Innovative use of humor and creativity during PhD nursing student virtual social sessions amidst COVID-19 pandemic"
  - Sigma Theta Tau Eta Nu Chapter, Milwaukee, WI.   Nov. 2020

- Kent, D. C., Treisman, P. E., Parizek, R. A., McMahon Bullis, M. M., Gonzalez, C., Graf, M. D., Peters, C. C., Hafez, S. A., & Snethen, J. A., "Virtual socialization and scholarly discourse for PhD student professional development using reification"
  - Wisconsin League for Nursing 2020 Fall Virtual Conference   Nov. 2020

- Parizek, R.A., Ligman-Schliem, M.A., "Do adolescents talk about sex and other risk-taking behaviors?"
  - 43rd Annual Midwest Nursing Research Society Research Conference, Kansas City, MO.   Mar. 2019
  - 21st Annual Building Bridges to Research-Based Nursing Practice Conference, Milwaukee, WI.   May 2019

- Parizek, R.A., Hershberger, P.E., Roddy, L., Talsma, A., "A survey of doctoral nursing students: activities to facilitate professional development"
  - 20th Annual Building Bridges to Research-Based Nursing Practice Conference, Milwaukee, WI.   May 2018
  - Sigma Theta Tau Eta Nu Chapter, Milwaukee, WI.   Nov. 2018

- Parizek, R.A., "Nursing's metaparadigm: A framework to explore adolescent health literacy"
  - Sigma Theta Tau ETA Nu Chapter, Milwaukee, WI.   Nov. 2017

- Parizek, R.A., Kakuta, M., Dermody, G., "Improving adherence to VTE prophylaxis in an acute care setting"
  - Sigma Theta Tau Phi Omicron Chapter, Rockford, IL.   Nov. 2016
  - Sigma Theta Tau ETA Nu Chapter, Milwaukee, WI.   Nov. 2016

| — Nurses' Expo, Rockford, IL. | Mar. 2017 |
| — Sigma Theta Tau Phi Omicron Chapter, Rockford, IL. | April 2017 |

- Pohl, C., Parizek, R.A., Katsumata, A., "Float pool: Sink or swim"

| — OSF Research Symposium, Peoria, IL. | July 2016 |

- Parizek, R.A., Doughty, A., Richter, C., Klein, C., Lizer, S., "Professionalism, individuality, and the identification of a nurse"

— Nurses' Expo, Rockford, IL.	Mar. 2014
— OSF Magnet Celebration, Rockford, IL.	April 2015
— 22nd National Evidence-Based Practice Conference sponsored by University of Iowa Hospitals and Clinics, Coralville, IA.	April 2015

- Parizek, R. A., Kutsamata, A., "Preparing the novice patient for home"

— Nurses' Expo, Rockford, IL.	Mar. 2014
— OSF Saint Anthony Medical Center, Rockford, IL.	May 2014
— Sigma Theta Tau Phi Omicron Chapter, Rockford, IL.	Oct. 2014
— Japanese Red Cross Kyushu Int'l College of Nursing, Fukuoka, Japan	June 2015
— Kyoto University, Kyoto, Japan	June 2015

Workshops

"Evidence Based Practice," OSF Saint Anthony Medical Center, Rockford, IL.   2016

Professional Affiliations

| The American Association of Colleges of Nursing (AACN) | 2013-present |

| Sigma Theta Tau International Phi Omicron Chapter | 2014-present |

| UW-Milwaukee Doctoral Nursing Student Organization | 2016-present |

| Midwest Nursing Research Society | 2016-present |
| Student representative for UWM | 2017-present |

| Sigma Theta Tau International Eta Nu Chapter | 2019-present |

Professional Service

Poster Symposium Judge

- University of Illinois at Chicago Annual Research Day, Rockford, IL.

Judge for the Sister Mary Linus Nowak Research Award   2015

- University of Illinois at Chicago Annual Research Day, Rockford, IL.
  Judge for the Sister Mary Linus Nowak Research Award   2016

- University of Illinois at Chicago Annual Research Day, Rockford, IL.
  Judge for the Sister Mary Linus Nowak Research Award   2019

- Sigma Theta Tau International Eta Nu Chapter
  Judge for the Annual Poster Symposium   2019

Peer-Reviewed Articles

- Nursing Outlook   2020

Community Service

Saint Anthony College of Nursing, Rockford, IL.
- Graduate student representative for the Research Council
                                                              2013-2016

St. Peter Catholic School, S. Beloit, IL.
- Assistant basketball coach   2019-2020
- Annual AHA Heartsaver CPR instruction to students 2016-2020
- AHA Heartsaver CPR instruction to faculty   2018
- AHA First Aid instruction to Scout Troop #605   2020

Conferences

2008: Magnet Conference, Salt Lake City, UT.
2014: Nurses' Expo, Rockford, IL.
2014: Magnet Conference, Dallas, TX.
2014: National Evidence-Based Practice Conference, Coralville, IA.
2015: National Evidence-Based Practice Conference, Coralville, IA.
2016: OSF Research Symposium, Peoria, IL.
2017: MNRS, Minneapolis, MN.
2018: MNRS, Cleveland, OH.
2018: Building Bridges Nursing Research Conference, Milwaukee, WI.
2019: MNRS, Kansas City, MO.
2019: Building Bridges Nursing Research Conference, Milwaukee, WI.
2020: MNRS, virtual