The effectiveness of health literacy program to reduce alcohol use among medical students in Hubei province, China

Meihua Yin

A Thesis Submitted in Partial Fulfillment of Requirements for
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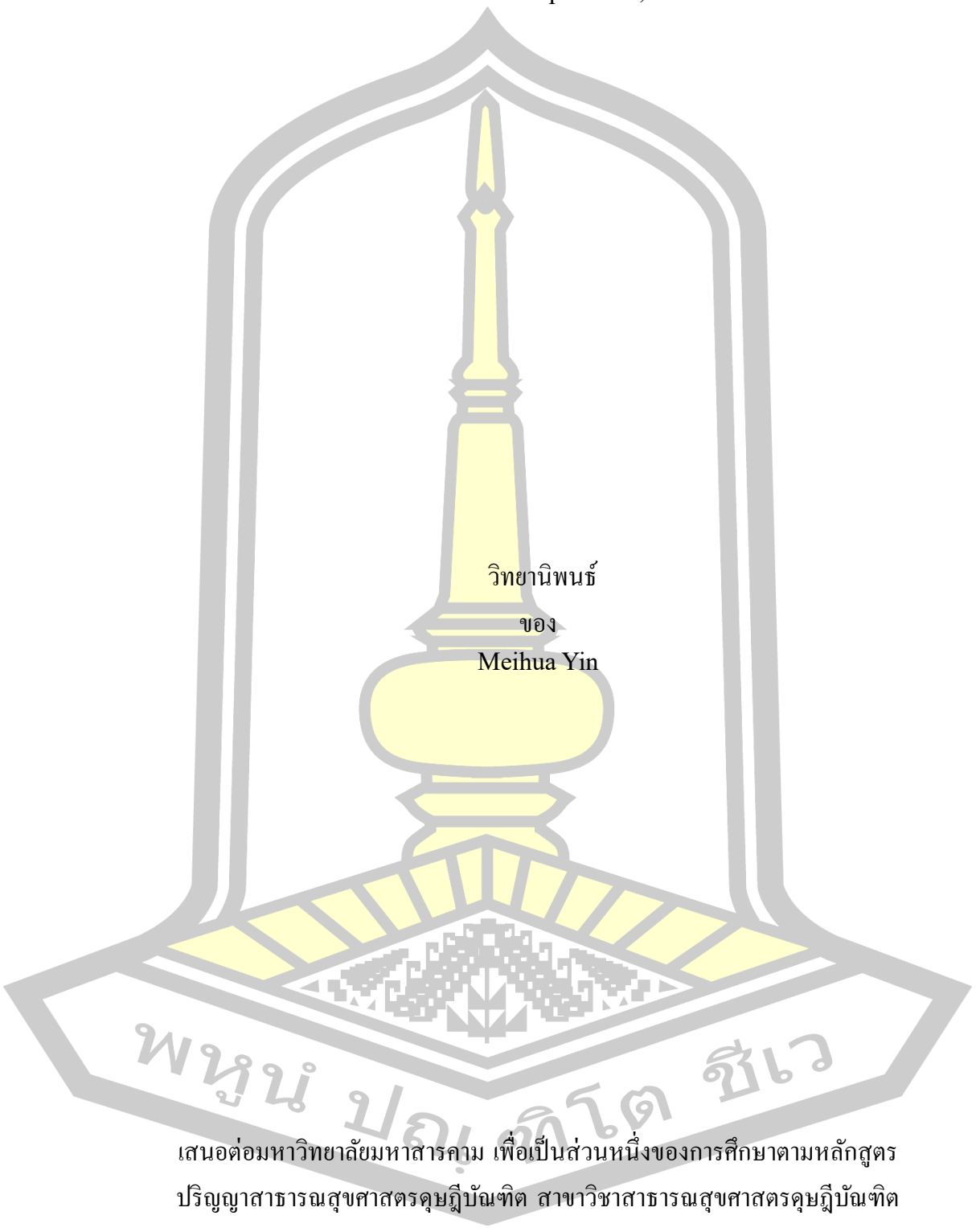

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ABSTRACT

Alcohol use has been identified as the health behavior most strongly associated with substance dependence and an increased risk of chronic disease in adulthood. Also, in China, alcohol consumption among medical students is a serious public health problem. Health literacy (HL) plays an important role in health-risk behaviors such as alcohol drinking. Individuals who have inadequate HL are a barrier to reducing the risk of alcohol and might lead to alcohol dependence, poor treatment outcomes, and relapsing. This mixed-methods research was separated into two phases. In phase 1, we aimed to assess the health literacy level and explore factors related to alcohol use among medical students in vocational colleges, the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effect of alcohol use, utilizing a cross-sectional design. In the quantitative method, the sample consisted of 1146 medical students and 15 key informants (e.g., medical students with a habit of drinking alcohol, education specialists, health promotion specialists, and mental health specialists). In phase 2, we aimed to develop and evaluate the effectiveness of the health literacy program to reduce alcohol use among medical students in vocational colleges. This phase employed a cluster-randomized controlled trial design with 104 first-year medical students. The data were collected using questionnaires. The quantitative data was analyzed using frequency, percentage, mean, standard deviation, multivariate logistic regression, chi-square tests, chi-square test for trend, and an independent sample t-test. For qualitative data, we used content analysis with the MAXQDA 2020 software.

The results in phase 1 showed that the three-level factors of a socio-ecological model, such as individual-level variables (all six dimensions of health literacy, low total health literacy, male, monthly household income >5000 CNY, smoking, high PAEs), interpersonal-level variables (family member alcohol use, peer alcohol use), and community-level variables (easy access to alcohol), were related to alcohol use among medical students. A qualitative study showed that the current laws and regulations prohibiting adolescents' access to alcohol are inadequate and that strengthening supervision and changing medical students' attitudes toward alcohol consumption are two important strategies. Besides, the suggestions of alcohol use reduction intervention, such as individual and family level: improving medical

students' health literacy, increasing internal drive, and proper guidance from guardians. The school level: strict enforcement of school rules prohibiting alcohol consumption, more meaningful activities to publicize the dangers of alcohol consumption, and enhanced peer education. The social level: strengthen the regulation of alcohol sellers. The national level: Introduce laws and regulations to prohibit youth from drinking alcohol. Additionally, alcohol is harmful to medical students, including occupational hazards, academic hazards, and hazards to body organs, family hazards, psychological hazards, and social hazards. In phase 2, the results revealed that we developed the health literacy program (HLP) based on Nutbeam's theory with experts in the health education, public health, or health promotion sectors, which consists of six sessions with a total of six activities. The intervention group was given 6 weeks of HLP and regular health education, while the control group was given only 6 weeks of regular health education. After the intervention, the total health literacy score and the scores of the six dimensions of the intervention group were higher than those of the control group and showed significant differences ($P<0.05$); the number of hazardous drinkers and the number of harmful drinkers in the intervention group were reduced compared with those in the control group and showed significant differences ($P<0.05$).

In conclusion, this study showed that inadequate HL plays an important role in increasing alcohol use among medical students, and HLP can be effective in improving medical students' health literacy to change their drinking behavior. Thus, this study suggests that HLP should be cited in the classroom of college student health education to change their drinking behaviors and maybe expand the intervention population to reach a wider range of people with drinking behaviors.

Keyword : Health Literacy, Health Literacy Program, Alcohol use, Medical students, China, Drinking

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INTRODUCTION

1.1 Background

Alcohol consumption has been identified as the main culprit linked to substance dependence (e.g., alcohol or nicotine dependence) and an increased risk of chronic disease in adulthood (Fleary et al., 2018). In 2016, the World Health Organization estimated that there are 2.4 billion people drinkers worldwide, which is one third of the world's population. On a global scale, alcohol abuse is responsible for more than 3 million deaths, or 5 percent of the world's total (World Health Organization, 2018). Alcohol abuse accounts for more than 5 percent of the global disease burden and it is one of the most common mental disorders in the world (World Health Organization, 2018). World Health Organization reported that in 2016, 8.6 percent of men and 1.7 percent of women worldwide had alcohol use disorder and approximately 26.5 % of youth are currently consuming alcohol (World Health Organization, 2018).

In China, alcohol abuse is a major public health problem and has become a threat to national health. In the 2015-2017 report of Chinese Center for Disease Control and Prevention revealed that the prevalence of adult drinkers was 43.7%. Also the prevalence of adult drinker in urban areas is higher than that in rural areas (urban area was 46.5% and rural area was 40.8%, respectively). In addition, the alcohol consumption rate of males was 64.5% and 23.1% for females (Pu et al., 2021). Furthermore, WHO pointed out that the per capita alcohol consumption in China has increased to 76% in 2016 (World Health Organization Report 2018). Currently, there are about 44.3 million college students in China, of which about 15.910 million are enrolled in higher education (college). Due to the wide variety of ways to pursue a college education in China, the age range of students with general college and undergraduate degrees is about 17 to 24 years old, and Chinese universities do not impose an age limit on students who want to pursue a college education, as long as they pass a selective college entrance examination. The opportunity to pursue a tertiary education is open to all successful applicants. Researcher Qiannan Sun of the School of Public Health at Southeast University conducted a study of factors linked to alcohol use among medical students enrolled in Jiangsu Province, and the results

revealed the drinking rate among medical students at 44.59% and the prevalence of alcohol abuse was 8.25% (Sun et al., 2021).

Alcohol consumption is on the rise in China and the disease burden caused by alcohol consumption is not decreasing. In 2016, the disease burden caused by alcohol consumption surged by 17.94 percent compared with 1990 (WHO, 2018). Alcohol consumption is responsible for 44.56% of cirrhosis, 28.8% of esophageal cancer, 27.65% of nasopharyngeal cancer, 27.45% of epilepsy and 25.13% of liver cancer in China (Huang et al., 2020). Adolescent alcohol consumption can cause personal health problems such as gastritis, gastric bleeding, alcoholism, liver disease, growth and growth retardation. Furthermore, alcohol can damage brain cells and it is important to note that during substitution, it can affect the development of brain nerves leading to inefficient learning, declined academic performance, and even absenteeism in adolescents who are drinkers. Some studies have revealed that alcohol use affects the growth of bone cells, and long-term alcohol exposure can lead to osteoporosis, bone fractures, and even affect the physical development of our youth (Luciana et al., 2013; Taylor et al., 2019). From the perspective of growth and development, adolescent alcohol consumption can lead to physical disorders, plus psychological problems (Huang et al., 2016). To clarify the effects of alcohol on adolescent cerebral development, Australian expert Briana Lees and her team completed a series of systematic evaluations and Mata analyses, and discovered alcohol consumption during adolescence affects healthy brain development, ultimately leading to a range of cognitive, emotional and social dysfunctions, in tandem with the researchers' longitudinal studies, revealing that adolescent alcohol abuse and the potential negative effects of heavy alcohol consumption on memory, learning, visuospatial function, executive function, reading ability, and impulsivity. It confirmed that alcohol can have significant negative effects on adolescent brain development, resulting in learning disabilities, violent behavior, and psychological problems (e.g., anxiety, depression, depressed mood, etc.) (Lees et al., 2019; Lees et al., 2020). As a result, there is an urgency to devise a plan to manage and reduce alcohol consumption among adolescents.

Alcohol use is influenced by personal characteristics, interpersonal factors, and community (Yangyuen et al., 2020; Galea et al., 2004). Previous studies in social

epidemiology have revealed that several factors associated with alcohol use, including gender, age, monthly household income, family and peer alcohol use, health literacy, social norms surrounding alcohol use, and the ease of accessing alcohol outlets, play important roles in determining alcohol-related outcomes (Yangyuen et al.,2020; Yangyuen, et al.,2021; Galea et al.,2004; Chisolm et al, 2014). To reduce alcohol use, one of the most effective methods is to promote health literacy as it has an impact on the effects of preventive programs and addiction treatment outcomes (Rolova et al.,2021; Melchior et al.,2008) and showed a significant role in the promotion of healthy behavior, and modification of attitude toward health care (Muhanga and Malungo, 2017). In addition, an adequate level of health literacy might contribute to improved health outcomes and decrease high-risk substance use such as alcohol use (Rolova et al.,2021; Rolova et al.,2020).

Health literacy (HL) is defined as the ability of individuals to access and understand basic health information and services to make the right decisions to maintain and promote their health (Publicity Department of National Health Commission of the People's Republic of China, 2014). Therefore, Nutbeam's theory of health literacy can be used to promote health awareness among the population. The six skills involved in the theory provide theoretical support for the implementation of measures to improve health literacy. In 2019, the National Health Commission issued the "Healthy China Action Plan (2019-2030)". The file pointed out that “improving the health literacy is essential for enhancing the health of the entire population. It is important to strengthen health promotion and education programs based on the characteristics of different groups of people. This helps to ensure health knowledge, behavior, and skills become universal qualities and abilities of the entire nation. Ultimately, our goal is to ensure everyone has access to health literacy.” (State Council China，2019). The Chinese government implemented urgent programs to improve the health literacy of the population. Therefore, promoting health literacy is important for the improvement of people’s health outcomes and behavior. In addition, the literature has suggested that health literacy (HL) is an important predictor of health outcome, and health risk behaviors such as smoking, alcohol drinking, and substance use (Muhanga and Malungo, 2017; Fleary et al., 2018). It indicates that individuals with lower health literacy may be more susceptible to substance use

and/or dependence like alcohol use (Rolova et al.,2020). For adolescents' alcohol use, limited HL may lead to alcohol dependence, poor treatment outcomes, and relapsing (Rundle-Thiele, 2013; Muhanga and Malungo, 2017). Due to inadequate HL, there is limited ability to access, understand, interpret, and evaluate substance-related information and have low self-management knowledge to make appropriate decisions to prevent or avoid consuming alcohol, (Rundle-Thiele, 2013; Yangyuen, et al.,2021). Thus, the level of health literacy has a direct impact on adolescents alcohol use, improving their health literacy can fundamentally solve the problem and reduce alcohol use. Presently, domestic and international studies are mainly based on prevailing surveys and mainly use theories and models of health literacy to investigate the poor behavioral habits of the population and related influencing factors. In China, there is a gap in using health literacy models to reduce alcohol use among adolescents. Some interventions have been developed to improve health literacy of specialist nursing students, including special lectures video-viewing, micro-communication groups, and peer education (Wang et al.,2020). Taiwanese researcher Lin, utilized health literacy to create a program that could successfully decrease illicit drug use among Taiwanese high school students. Results of the study indicated that health literacy in drug abuse programs can effectively increase the influence of health literacy and subjective behavioral norms among adolescents (Lin et al., 2021). Rolova, a Czech researcher, used a mixed methods approach to explore the health literacy of alcohol-dependent patients undergoing inpatient addiction treatment, and the results revealed that a mixed methods approach is preferable to a single approach because the phenomenon can be explored from multiple perspectives. The combination and integration of quantitative and qualitative methods could identify participants' health literacy and differences in health-related competencies between individuals with adequate and those with poor health literacy (Rolova et al., 2020). There is growing evidence that interventions with a clear theoretical foundation are more effective than those that lack one; some strategies with multiple theories and concepts are more effective, and applying theories of health literacy to develop health literacy program interventions is more effective in reducing alcohol use among adolescents. Developed interventions based on Nutbeam D's health literacy theory are one of the effective ways to improve health literacy among medical students, mainly because the theory

provides guidelines and evaluation criteria for practice in the six dimensions of cognitive skills, access skills, communication skills, self-management skills, media skills, and decision-making skills (Nutbeam, 2008). Gordon et al.'s study confirms that a health literacy intervention program is effective in reducing the number of adolescents' alcohol use, primarily by changing knowledge, perceptions, attitudes, and behavioral intentions to motivate them to accept healthy messages (Gordon et al., 2015; Gordon et al., 2016; Gordon et al., 2017); Wolf et al.'s study demonstrated that improving cognitive skills was effective in achieving self-care and predicting health (Wolf et al., 2012); and Rundle-Thiele et al.'s study demonstrated that health literacy interventions improved adolescents' ability to access, comprehend, interpret, and evaluate alcohol-related information and have more self-management knowledge to make appropriate decisions to prevent or abstain from alcohol (Rundle-Thiele et al., 2013). Therefore, health literacy interventions are an important tool for reducing adolescent drinking.

Adolescent alcohol use is a significant public health concern in Wuhan, Hubei Province. In 2016, Xingguang Chen conducted a study on the addiction habits of adolescent in five Chinese cities. Results showed that Wuhan's youth drinking rate was 23.2 % (Chen et al.,2016). A search on relevant domestic and international data did not reveal alcohol use among medical students in Hubei Province, but in Jiangsu province, sources revealed that the drinking rate among medical students has not changed essentially in 15 years (42.1% in 2006 and 44.59% in 2021) (Liu et al.,2012; Sun et al.,2021), and researcher Yushu Li conducted a study of health risk behaviors among 3,216 medical students from four universities in Tianjin. The results of the study showed a surprisingly high alcohol consumption rate of 52.18% (Li et al.,2015).

Bad habits are linked to personal health. So far, research on the health literacy of Wuhan adolescents is scarce. However, researcher Nana Liu's study on the current situation of health literacy of higher vocational students and the analysis of influencing factors revealed that the overall level of health literacy of higher vocational students was 20.5% (Liu et al., 2022), while researcher Xiaopeng Yang's survey on the health literacy of higher vocational students in Xinjiang found that the level of their health literacy was 17.30% (Yang et al., 2022), as well as researcher Guoliang Liu's survey results on the level of health literacy of higher vocational

medical students in Henan Province found that their level of health literacy was 35.0% (Liu et al., 2020). According to a study by Chinese scholar Xi Chen, the health literacy rate of junior high school students in Wuhan is 14.35% (Chen et al., 2021). The above data indicate that the health literacy status of students in different regions of China is not optimistic. However, to date, little is known about health literacy in substance use among medical students. Thus, investigating the effects of HL on alcohol use and assessing the effectiveness of HL program may help reduce the risk of alcohol use.

1.2 Research question

What should the patterns of the health literacy program to reduce alcohol use among medical students?

1.3 Research objectives

(1) To determine factors related to alcohol use among medical students in vocational colleges based on the social-ecological model.

(2) To assess the health literacy level among medical students in vocational colleges.

(3) To explore the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effect of alcohol use on medical students.

(4) To develop interventions to reduce alcohol use among medical students in vocational colleges based on the health literacy program model.

(5) To evaluate the effectiveness of the health literacy program to reduce alcohol use among medical students in vocational colleges.

1.4 Research hypothesis

Based on the research phase of this study, we aim to demonstrate the relationship between factors related to alcohol use among medical students and assess the effectiveness of the health literacy program to reduce alcohol use among medical students. We generated the research hypotheses as follows:

(1) Alcohol use behavior would be related to individual, interpersonal, and community factors based on the social-ecological model.

(2) After the intervention, the total HL score and the six dimensions scores of the intervention group were higher than the scores of the control group.

(3) After intervention, the proportions of alcohol use behaviors in the intervention group were lower than those in the control group.

1.5 The importance of research

This study is focused on determining the related factors of alcohol use among medical students in higher vocational colleges in Hubei Province of China, through a social-ecological model with a factor on the interplay among individual, interpersonal, and community variables. Then, we applied the significant variables and health literacy to develop a health literacy program to reduce alcohol use among medical students. That may be useful to improve their health literacy and could help reduce the risk of alcohol use.

1.6 Scope of research

1.6.1 Scope of contents

The study design in this research is a mixed-methods design, including two phases as follows: In phase 1, we integrated both quantitative and qualitative methods into the study. In the quantitative method, we focus on determining factors related to alcohol use (these factors include individual variables, interpersonal variables, and community variables according to the socio-ecological model) and assess the health literacy of substance use in adolescents. Also, we used qualitative methods to explore the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effect of alcohol use among medical students in vocational colleges. In phase 2, we focus on evaluating the effectiveness of health literacy programs to reduce alcohol use. Also, we will develop the health literacy program with experts in the fields of public health, health education, and adolescent psychology.

1.6.2 Scope of population

In phase 1, we integrated both quantitative and qualitative methods in a study.

1) The quantitative method, we focused on the assessment of the health literacy of medical students and determine factors related to alcohol use. The population in

this phase is medical students including freshmen, sophomores, or juniors who are aged between 17-24 years old. The sample size is 1,146 medical students from four vocational colleges in Hubei province.

2) In the qualitative method, we focused on exploring the social norms of alcohol use, the experiences of making a decision to stop or reduce alcohol consumption, and the effects of alcohol use on medical students. The main participants include 9 representatives of medical students who drink, 2 education specialists, 2 health promotion specialists, and 2 mental health specialists.

In phase 2, this research focused on the development of an intervention program by using a health literacy model to evaluate the effectiveness of this program. For this study, we asked for a sample of 104 freshmen medical students from a particular school. The age range of the participants is between 17 to 20 years old. The sample is divided into 2 groups – an experimental group of 52 medical students and a control group of 52 medical students.

1.6.3 Scope of research setting

In phase 1, this research was conducted in four colleges and universities in Hubei province such as 1) Jingzhou Institute of Technology, 2) Huanggang Polytechnic College, 3) Wuhan College of Foreign Languages and Foreign Affairs, and 4) Hubei College of Chinese Medicine.

In phase 2, this research was conducted in Jingzhou Institute of Technology for the treatment group and in Hubei College of Chinese Medicine for the control group.

1.6.4 Scope of study period

In Phase 1, the research was conducted from October 2022 to May 2023.

In Phase 2, this research was conducted From June 2023 to January 2024.

October-December 2022, begin to form the research team and the researcher begins to attend ethics training online and obtains a certificate of competency; January-April 2023, conceptualize the framework and details of the study; May 2023, after passing ethics at Mahasarakham University, collect phase 1 data; June-July 2023, implement phase 2 of the intervention and collect phase II data; August 2023, organize and analyze phase I data, complete and submit the first manuscript; September 2023-January 2024, organize and analyze phase II data, complete and submit the second manuscript.

1.7 Operational definition

(1) The Socio-ecological model refers to the social-ecological model conceptualizing health broadly and focusing on multiple factors that might affect health. It has 5 levels: individual; interpersonal; institution and organization; community; public policy. In this study, we simulated the socio-ecological model as 3 levels including individual; interpersonal; and community levels.

(2) Health literacy refers to an individual's ability to acquire and understand health information and uses it to maintain and promote their health. In this study, health literacy refers to the degree to which individuals can obtain, process, understand, and use alcohol-related information to make decisions to prevent and avoid the risk of alcohol use. According to Nutbeam's concept, that includes (1) access to skill (2) cognitive skills (3) communication skills (4) self-management skills (5) decision skills and (6) media literacy skills and focuses on functional health literacy. In this study, health literacy was assessed by the Alcohol Health Literacy Scale, adapted by Ponrachom, which reflects an individual's capacity to change their alcohol use behavior. This summed rating scale comprised 36 items across the following 6 dimensions, such as: 1) cognitive skill 2) access skill 3) communication skill 4) self-management skill 5) media literacy skill, and 6) decision skill. The total scores were calculated with a summary of the scores of all items (ranging from 30 to 150).

(3) Alcohol use: It was defined when the respondents were asked whether or not they had ever used alcohol in the past 12 months and assessed hazardous drinking by The Alcohol Use Disorders Identification Test (AUDIT). This scale comprised ten items regarding alcohol consumption, drinking behavior, and consequences of drinking. The total scores ranged from 0 to 40 (Cronbach's α 0.86 for the total scale), and the risk level with scores of 0–7 was regarded as low-risk, 8–15 as hazardous use, 16–19 as harmful use, and 20 or above as alcohol dependence.

(4) Alcohol expectancy: Alcohol expectancies refer to the persons beliefs about behavior, cognition, moods, and emotions that occur to oneself when drinking. AEs were assessed by a self-reported questionnaire adapted from Ham reflecting the expectations of ~~a~~ positive and negative effects of alcohol consumption. A scoring questionnaire ranging from 1 (disagree) to 4 (agree) consisted of 15 items (8 items for

positive alcohol expectancies [PAEs] and 7 items for negative alcohol expectancies [NAEs]). The total scores were defined by totaling the scores across all items of each dimension; for PAE, range 8–32 and for NAE, range 7–28).

(5) Social norms of alcohol use refer to common standards of acceptable behavior by groups and the perceptions of approval of drinking behavior and alcohol harmful effects.

(6) Access to alcohol outlet refer to the individual ability is in an environment where access to alcohol is. In this study, the respondents were asking, "It is easy to buy alcohol in your community if you want to". This variable was categorized as a dichotomous variable (Y/N).

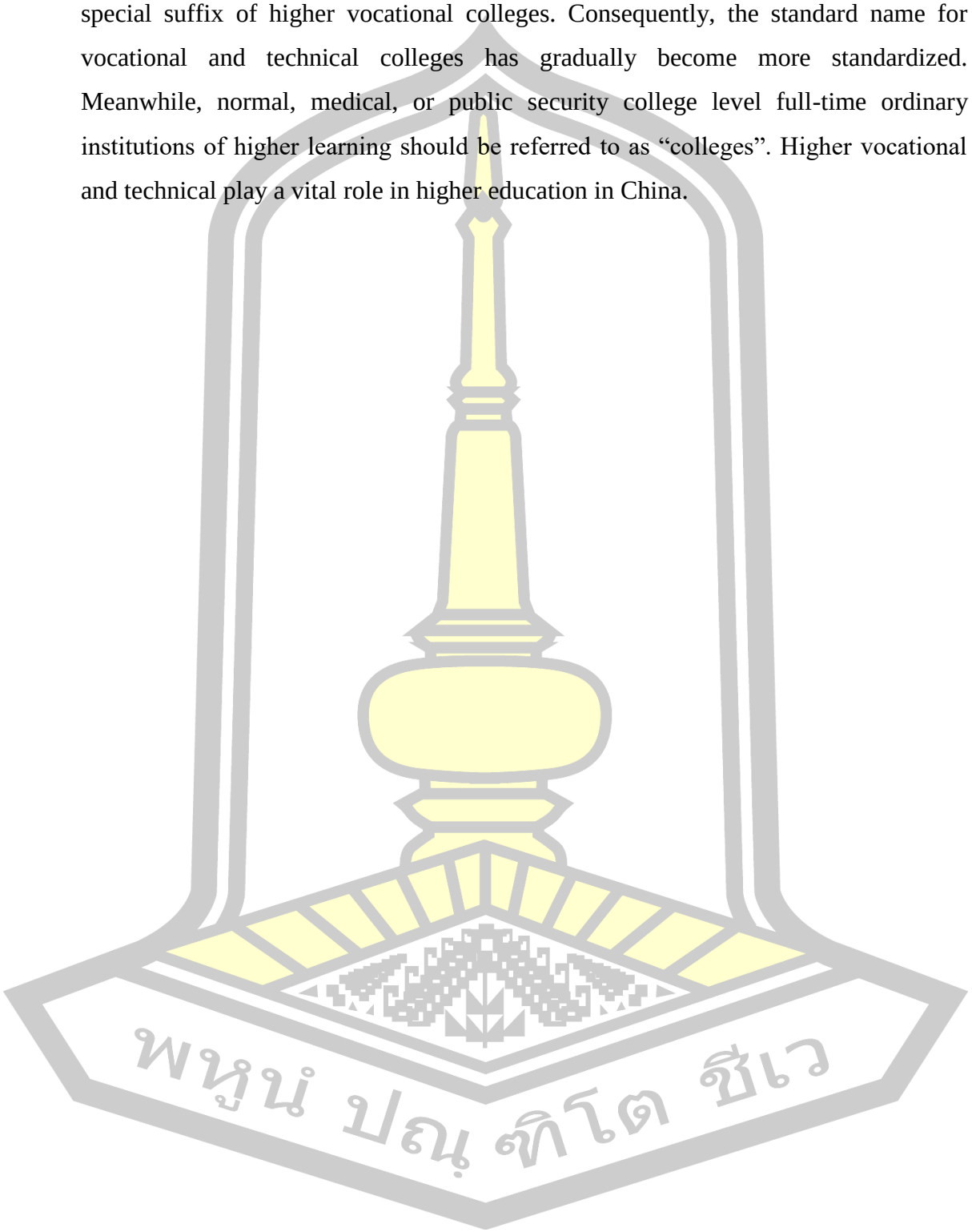
(7) The health literacy program: It is the health literacy program for reducing alcohol use among medical students which applies the health literacy theory of Nutbeam D, includes 6 dimensions such as: (1) access skill, (2) cognitive skill, (3) communication skill (4) self-management skill, (5) decision skill, and (6) media literacy skill.

(8) The effectiveness of health literacy program to reduce alcohol use refers to the successor achieving results of programs to improve health literacy of medical students for reducing their alcohol use. In this study, we measure the effectiveness of health literacy programs by using health literacy scores and alcohol use behavior that are evaluated by the AUDIT scale.

(9) Medical students: The students who study in medical schools that according to China's restrictions on the application of medical majors in higher education institutions, the main specialties currently offered is: clinical medicine, pharmacy, dentistry, nursing, midwifery, medical cosmetology and pharmaceutical marketing, etc. Students are between the ages of 17 and 24, and all take the general college entrance examination or skill entrance examination before admission. For example, medical students study in four senior vocational schools in Hubei Province: 1) Jing zhou Institute of Technology, 2) Huang gang Polytechnic College, 3) Wuhan, College of Foreign Languages and Foreign Affairs, and 4) Hubei College of Chinese Medicine.

(10) Higher vocational and technical college: Since the end of the last century, the Ministry of Education has regulated that higher vocational and technical colleges should not be classified full-time ordinary institutions of higher learning at the same

level as medical or public security colleges. Instead, they should be recognized as a special suffix of higher vocational colleges. Consequently, the standard name for vocational and technical colleges has gradually become more standardized. Meanwhile, normal, medical, or public security college level full-time ordinary institutions of higher learning should be referred to as “colleges”. Higher vocational and technical play a vital role in higher education in China.



CHAPTER 2
LITERATURE REVIEW

The study is entitled: “The Effectiveness of Health Literacy Program to reduce alcohol use among medical students in Hubei Province, China”. This study aims to determine factors linked to alcohol use, assess health literacy and evaluate the effectiveness of the health literacy program in reducing alcohol use among medical students. The researcher reviewed literatures, concept, theories, and relevant research studies as follows:

2.1 The situation of adolescent alcohol use in China

2.2 The alcohol-related knowledge

2.3 The effects of alcohol use on adolescents

2.4 AUDIT scale

2.5 Socio-ecological theory

2.6 The factors related to alcohol use

2.7 Health literacy theory

2.8 Relevant researches

2.9 Conceptual framework of the study

2.1 The situation of adolescent alcohol use in China

The burden of disease caused by alcohol is a public issue of great importance globally, with adolescent alcohol use being a major global public health concern. In a 2016 report by the World Health Organization, it was presented that adolescent drinking in China has reached 41.2% (World Health Organization, 2016). China is a vast country, covering 9.6 million square kilometers and a population of 1.4 billion people. This variation is attributed to a range of factors. Studies by Chinese scholars show that drinking in the west is higher than in the east, there are more drinkers in rural areas than in urban areas. Further analysis of drinking students revealed 76.56% consumed beer, 17.42% consumed fruit wine, and 4.57% consumed white wine, and girls tended to drink more beer and fruit wine than boys (Xie et al., 2008). In recent years, more and more studies have shown that there is a shrinking gap between girls and boys in terms of drinking patterns, frequency and quantity of alcohol

consumption (Shang et al., 2013). Chinese adolescents are the pillars of hope of the society, and a healthy body is the cornerstone for contributing to the motherland and poor drinking habits can destroy their physical health and psychological well-being. Therefore, it is of paramount importance to scrutinize the drinking problem of adolescents.

A recent study on adolescent drinking in various Chinese provinces over the past 2 decades revealed the following findings: adolescent drinking rates in Henan Province are 30.1% (Li et al., 2018), 46.1% in parts of Xinjiang (Zhang et al., 2016), 44.59% in Jiangsu Province (Sun et al., 2021), and 52.18% in Tianjin, a municipality in China (Li et al., 2015). Adolescent drinking rate in Tianjin, a municipality under the direct jurisdiction of China's central government, was 52.18% (Li et al., 2015). The situation of adolescent drinking in Hubei province is also not promising, as in 2016, Xingguang Chen conducted a study on the addiction habits of adolescents in five Chinese cities, and the results showed that the rate of adolescent drinking in Wuhan, Hubei province was 23.2% (Chen et al., 2016).

Summarizing the above, it is found that adolescent drinking has become a serious social problem in China that deserves the attention of the Chinese government and people.

2.2 The alcohol-related knowledge

The World Health Organization defines alcohol as "Alcohol as a liquid with ethanol and ready for consumption, and is the most predominant beverage". Ancient China was an agricultural society; the people produced and consumed plenty of alcohol. As alcohol was in abundant supply back then, it became closely related to the lives of the Chinese. Wine is an integral part of Chinese poems, text and cultural history. In general, for most Chinese, drinking symbolizes a happy or successful event and is seen as friendship. However, in recent years, there aren't many medical research papers pointing out the bad effects of drinking and identifying the dangers of alcohol abuse. In contrast, there are still many alcohol advertisements with scenes of holiday singing and dancing on many television stations and in newspapers. Under the long-term influence of this drinking culture, most Chinese are biased toward alcohol consumption, which is the most effective bridge to connect with family, relatives,

friends, colleagues or business. This is the current state of alcohol consumption among the Chinese population. However, alcohol was defined as a Class II drug in the United States in the Controlled Substances Act of 1970, and Class II drugs are defined as "having a high potential for abuse and significant dependence liability" (Rogers et al., 1987). Dr. Douglas Talbot has stated, "With all the scientific and pharmacological limitations that exist today to protect society, alcohol should be designated as a Schedule II drug, available only by prescription from a licensed physician with a narcotic drug registration number." For adolescents, alcohol is undoubtedly a dangerous drug with potentially life-threatening consequences. In his book, "The Disease Concept of Alcoholism," Keller explains that "alcoholism is a behavioral disorder that leaves the affected person "devastatingly" physically or emotionally disabled, and the alcoholic is a pathological person." The American Medical Association has considered alcoholism to be a disease since 1993. Alcohol has been the most common substance of abuse among adolescents, most of whom prefer beer, fruit wines, and some alcoholic beverages, and a small percentage of whom choose the stronger alcoholic liquors. To effectively detect alcohol use in the population, the World Health Organization defines alcohol use by asking respondents if they have used alcohol in the past 12 months and assessing hazardous drinking through the Alcohol Use Disorders Identification Test (AUDIT) (Fleming et al., 1991). Harmful drinking is defined as a person who drinks alcohol that results in adverse events (psychological or physical harm). Binge drinking is defined as a person drinking heavily over a short period to become intoxicated. Alcoholism, also known as alcoholic use disorder, refers to consuming large amounts of alcohol over an extended period, resulting in physical or mental health problems. Reducing alcohol consumption becomes very difficult for the affected person. Alcohol misuse, on the other hand, involves the consumption of alcohol that puts a person at an increased risk of adverse health and social consequences. Despite the existence of health risks, most countries have a permissive attitude towards alcohol use, viewing it as a readily available substance, even for young people.

Historical factors have determined differences in perceptions of drinking behavior in different countries. Different perceptions produce different social attitudes.

Chinese adolescents are the future of their country, and changing their attitudes towards alcohol consumption is fundamental to promoting their health.

2.3 The effects of alcohol use on adolescents

From a global perspective, the harm alcohol brings to society is far-reaching. The effects are particularly severe for adolescents; bad behaviors developed during adolescence carry over into adulthood. Reports have confirmed that alcohol consumption in adolescents not only affects academic performance, but also impairs mental health and physical health, (Jaisoorya et al., 2016; Charlet et al., 2016) and, more seriously, causes sexual activity due to heavy drinking behavior, resulting in unprotected sex and genital herpes infection (Gazibara et al., 2021). Therefore, to change this bad behavior at the root, it is necessary first to recognize the seriousness of the harmful effects of alcohol consumption, then to intervene in a multi-pronged way, and finally strengthen regulation and punishment.

2.3.1 Physical health

Alcohol not only stunts growth and development but also damages important organs, such as the brain, stomach, liver, heart, pancreas, and kidneys. Drinking large amounts of alcohol can depress the central nervous system, and under the effects of alcohol, you may become intoxicated, be incohesive in speech, stagger when walking. In serious cases, it can also cause breathing difficulties, suffocation, and other more serious consequences. Alcohol consumption can also irritate the stomach mucosa, resulting in bloating, abdominal pain, nausea and vomiting, and may even induce gastritis and gastric ulcers. The main organ of alcohol metabolism is the liver, and alcohol can also dilate blood vessel and increase blood flow to the kidneys. While alcohol also has a diuretic effect, if the kidneys can’t properly regulate the flow of body fluids, resulting in the disorderly distribution of sodium, potassium, and chloride ions, it will cause electrolyte imbalance. The organs of young people are not well developed, so it is more likely to damage the liver and kidney functions. Excessive alcohol consumption can also cause weakness of the heart muscles, resulting in irregular blood flow. Excessive alcohol consumption can disrupt the function of the pancreas, making it secrete too much enzymes, which accumulate in excess in the pancreas and induce pancreatitis. Overall, the damage of alcohol to the body of

adolescents is enormous, and the main damage is to the most important organs of the human body, which can seriously affect the quality of life in light cases, or cause death in heavy cases.

2.3.2 Psychological health

Adolescence is a crucial period for both physical and psychological development. However, alcohol has a harmful effect on the cerebral cortex, resulting in impaired thinking and attention. Furthermore, alcohol stimulation can make adolescents unstable and unpredictable. Adolescents often have poor self-control, more prone to act recklessly after drinking, prone to certain psychological disorders, such as anxiety and depression. Therefore, it is essential to reinforce the ban on alcohol consumption among adolescents to promote their psychological well-being.

2.3.3 Learning problems

Adolescence is an important time for the formation of study habits and the accumulation of knowledge. Due to the inhibitory effect of alcohol on the cerebral cortex, adolescents are often it is easy to make people inattentive and drowsy, which affects their studies. Adolescents who drink are also more likely to develop bad habits like laziness, disheveled, no social responsibility, perpetual lying. All these would aggravate their academic performance.

2.3.4 Sexually active

The depressing effect of alcohol on the human nervous system. Gives the brain a sense of euphoria talkative, and sexually active, making it highly likely that unsafe sexual behavior will occur in such an environment. Chinese talk about sex more subtly, and there is little research on adolescent sexual behavior after drinking, but studies by foreign scholars (Sharma et al., 2020) have greatly confirmed a positive correlation between alcohol consumption and adolescent sexual behavior. With the growing number of sexually transmitted diseases, abstinence from alcohol for adolescents is also one of the effective ways to reduce sexually transmitted diseases.

2.3.5 Social Problems

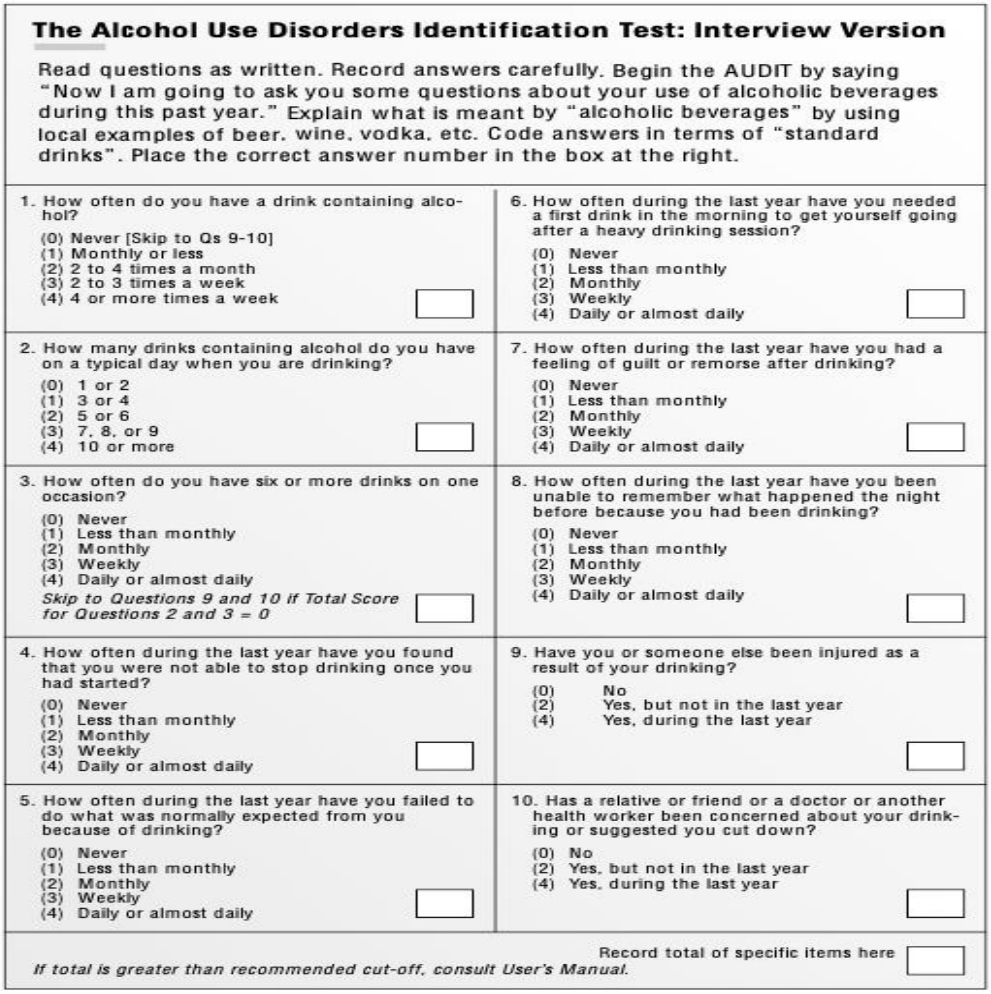
Adolescent alcohol use not only damages their physical and psychological health, but also causes serious social problems. Adolescent alcohol use can lead to an increased risk of death, accidents, murder and suicide, and may also be stimulated by alcohol to become manic and delirious and to engage in provocations, fights and even

homicides (Wahl et al., 2013). Some studies have shown that adolescents are more likely to engage in poor behavioral and criminal behaviors, such as smoking and drug use, during alcohol consumption. Therefore, the social impact of adolescent drinking is extremely bad, and tough measures should be taken to prohibit adolescent drinking to maintain a stable and cohesive society.

Alcohol can cause extremely serious harm to adolescents, such as damage to physical and mental health, jeopardizing schooling, contributing to the occurrence of sexual offenses, and causing irreversible social harm. For this reason, there is an urgent need to find effective ways to reduce alcohol consumption among adolescents.

2.4 AUDIT scale

Alcohol Use Disorders Identification Test (AUDIT), referred to as the AUDIT scale, was developed and recommended by the World Health Organization in 1982 in collaboration with multinational research. The scale is simple, quick, sensitive, and suitable for primary care and non-psychiatric personnel, and can effectively assess alcohol consumption, drinking behavior, and alcohol-related problems, and is currently the only scale used to screen for hazardous and harmful drinking, and has been tested suitable for a wide range of populations and ethnicities, the following scales have been developed by the World Health Organization.



The Alcohol Use Disorders Identification Test: Interview Version

Read questions as written. Record answers carefully. Begin the AUDIT by saying "Now I am going to ask you some questions about your use of alcoholic beverages during this past year." Explain what is meant by "alcoholic beverages" by using local examples of beer, wine, vodka, etc. Code answers in terms of "standard drinks". Place the correct answer number in the box at the right.

1. How often do you have a drink containing alcohol?
(0) Never [Skip to Qs 9-10]
(1) Monthly or less
(2) 2 to 4 times a month
(3) 2 to 3 times a week
(4) 4 or more times a week

2. How many drinks containing alcohol do you have on a typical day when you are drinking?
(0) 1 or 2
(1) 3 or 4
(2) 5 or 6
(3) 7, 8, or 9
(4) 10 or more

3. How often do you have six or more drinks on one occasion?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily
Skip to Questions 9 and 10 if Total Score for Questions 2 and 3 = 0

4. How often during the last year have you found that you were not able to stop drinking once you had started?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

5. How often during the last year have you failed to do what was normally expected from you because of drinking?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

7. How often during the last year have you had a feeling of guilt or remorse after drinking?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

8. How often during the last year have you been unable to remember what happened the night before because you had been drinking?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

9. Have you or someone else been injured as a result of your drinking?
(0) No
(2) Yes, but not in the last year
(4) Yes, during the last year

10. Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut down?
(0) No
(2) Yes, but not in the last year
(4) Yes, during the last year

Record total of specific items here

If total is greater than recommended cut-off, consult User's Manual.

Figure 1 Alcohol Use Disorders Identification Test (WHO)

The AUDIT scale is a semi-deterministic scale consisting of 10 items, items 1-3 on the amount and frequency of alcohol consumption, items 4-6 on alcohol dependence, and items 7-10 on alcohol-induced related problems. AUDIT scores address a variety of outcomes caused by alcohol, including attitudes toward drinking, the tendency to be dependent or not, adverse consequences of drinking, and the reasons for drinking. The reliability and validity of the scale are good, and several studies have shown high sensitivity and specificity with a total AUDIT score of 8.

The reliability and validity of the AUDIT scale have been well established in various countries and ethnic groups, and in 1999, Bing Li et al. introduced it at the Institute of Mental Health, Peking University (Li et al., 2003), forming the Chinese version of the AUDIT scale that is now widely used in China, and field tests were

conducted in 2000. In 2000, we conducted a field test and confirmed that the AUDIT has high reliability, acceptability and usefulness in China and other countries. At the same time, to test the cultural adaptability of the Chinese version of the AUDIT scale, the AUDIT was translated according to the language and dialect characteristics of the survey subjects before testing, including Cantonese, Minnan, Taiwanese tribal languages, and Tibetan, etc., to make it easier for the study subjects to understand and answer. After several tests, the Chinese version of the AUDIT scale has been widely used in studies related to alcohol use disorders in China. In the applied studies of the Chinese version of the AUDIT in China, the survey subjects included students, patients, healthcare workers, residents, and workers in special workplaces (Zhang et al.,2015). Since different types of alcoholic beverages contain different concentrations of alcohol, the concept of "a standard cup" was introduced in the scale to homogenize the amount of alcohol consumed by different people. The volume unit of the English version of the AUDIT scale is ounces, which is not in line with the Chinese unit. Before applying it, the researchers localized the concept of "a standard cup" by replacing the English version of "a standard cup" with a specific volume of alcohol, baijiu, beer, red wine or self-made barley wine, which is more in line with local beverages. This is also more in line with our drinking culture and customs. The following is the Chinese version of the AUDIT scale and the standard cup that has been used in China for 20 years.

One 750ml bottle of wine =9 standard glasses

1 standard = 10 grams of pure alcohol

One 750ml bottle of wine =9 standard glasses

1 beer = 2 standard glasses

1 500ml bottle of rice wine (rice wine) =6 standard cups

50 g 52 proof white wine = 2 standard glasses

50 g 45 proof white wine = 1.8 standard glasses

50 g 38 proof white wine = 1.5 standard glasses

Grams of alcohol consumed = milliliters of alcohol consumed × strength of alcohol ×0.8

The AUDIT scale, a collaborative study conducted by WHO in six countries, showed that the sensitivity of the scale in distinguishing harmful and normal drinking

was 80%-90% with an average specificity of 80% at a cut-off score of 8, indicating that the sensitivity of the scale was better at a cut-off score of 8, and therefore 8 was used as the cut-off score for screening for hazardous and harmful drinking (Claussen et al., 1993). However, when some Chinese experts tested the reliability of the scale, the results confirmed that when the cut-off score was 7, the sensitivity for screening hazardous and harmful drinking was 99.7%, the specificity was 90%, and the sensitivity was greater than the specificity, and the detection of hazardous and harmful drinkers was better than when the cut-off score was 8. A study by Chinese scholar Bing Li in 2003 showed that a cut-off value of 7 had a detection rate of 99.5% for somatic impairment, 98.6% for social problems, and 98.5% for psychiatric impairment in all surveyed populations, so the researchers concluded that a cut-off of 7 was more appropriate for the Chinese population (Li et al., 2003).

Based on the review of AUDIT, it was finally determined that the scale translated by Chinese scholar Bing Li was chosen to measure medical students in Hubei Province, which has good reliability and validity and is suitable for strategy different populations in China.

2.5 Socio-ecological theory

The socio-ecological model was first proposed by German-American psychologist Kurt Lewing in the 1930s, applying the principles of "ecological psychology" to describe the influence of the external environment on human beings, and was developed by Roger Bake in the 1960s, broadening it to include the social and physical environment. In the 1980s, more and more scholars tried to explain individual behavior through social and environmental scenarios, the most representative of which is the ecosystem theory proposed by the famous developmental psychologist Bronfenbrenner, who believes individuals are influenced by internal and external factors in the process of development, and proposes four dimensions that influence behavior: micro, meso, appearance and macro (Bronfenbrenner et al., 1977), the core of this system is the individual, including the individual's physical and psychological characteristics; the microsystem refers to the social factors that can have the most direct influence on the individual, such as family, friends, school, etc.; the mesosystem refers to the interaction of the factors in the

microsystem; the appearance system refers to those factors that directly affect the other important factors in the microsystem The macrosystem refers to the outer layer of the appearance system, which includes the values, attitudes, customs, and laws of a particular culture. At the same time, Bronfenbrenner considers all environments, such as family, economy, society, and politics, as part of the human development process, and emphasizes that people and their environment interact with each other, and the core of his theory is the "processes-person-context-time" (PPCT) model. (Bronfenbrenner et al., 1994).

Researcher Sudhinaraset applied the renowned developmental psychologist Bronfenbrenner's social-ecological framework to explain the effects of alcohol use (Sudhinaraset et al., 2016). Individual factors that influence alcohol use are nested within family, work, and school environments, which are then nested within the larger community. Macro-level factors, such as exposure to advertising, may influence attitudes and norms in family and peer networks, ultimately influencing individual attitudes and behaviors. As shown in the figure below.

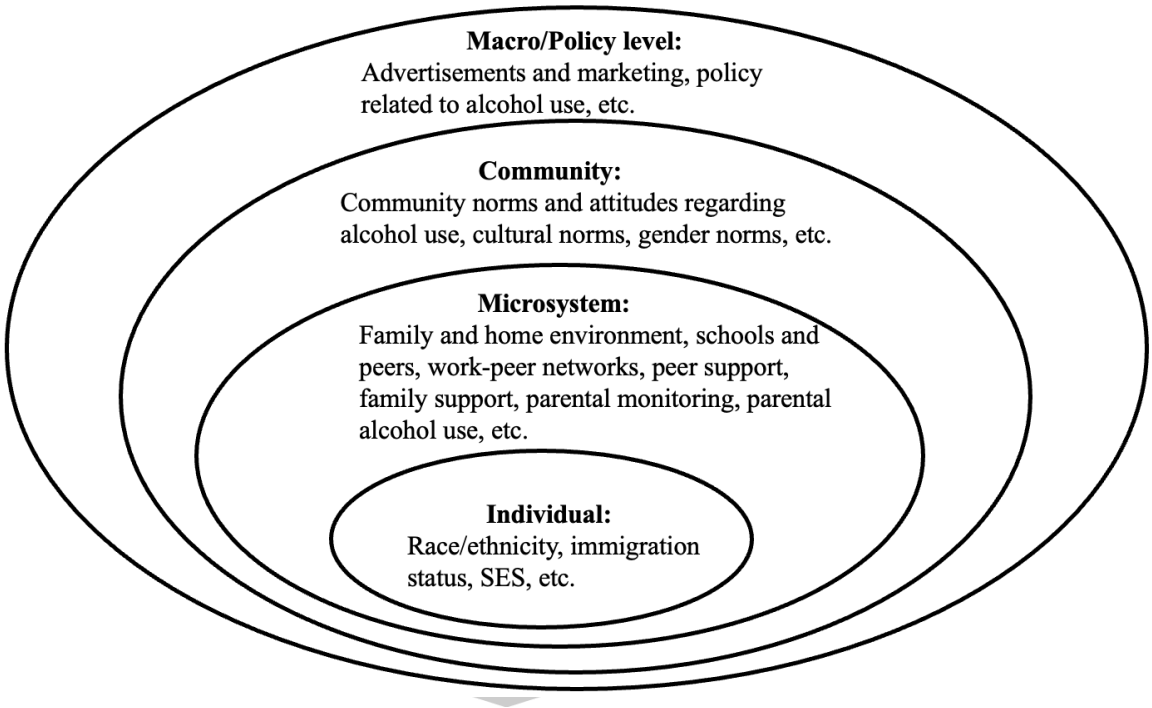


Figure 2 Social-ecological Framework (Bronfenbrenner)

Mcleroy's socio-ecological model of health behavior is based on the socio-ecological theory, which integrates individual and social factors while emphasizing the importance of the joint role of environment and policy. Mcleroy's socio-ecological theory allows for a detailed and explicit exploration of multiple levels of influence, which is the core concept of the model, and allows for an understanding of the complex and interacting influences on health behavior and the ability to influence or change each level to develop more rational and comprehensive interventions. The social-ecological model is a theory that emphasizes on integrated interventions, evolving from independent variables to correlational influences among factors. The model includes four core principles: 1) health behavior is influenced by multiple levels and dimensions; 2) factors at different levels interact with each other; 3) the ecological model changes according to the specific context of health behavior; and 4) joint and multi-level interventions are the most effective way to change behavior.

Researcher Alghzawi conducted a theoretical review and evaluation of adolescent drinking in the United States using the social-ecological model (Alghzawi et al., 2021). The core concept of SEM is that behavior has multiple levels of influence, usually including the intrapersonal level (biological, psychological), the interpersonal level (social, cultural), the organizational level, the community level, and the policy level. As shown in the figure: Socio-Ecological Model: A Framework for Prevention.

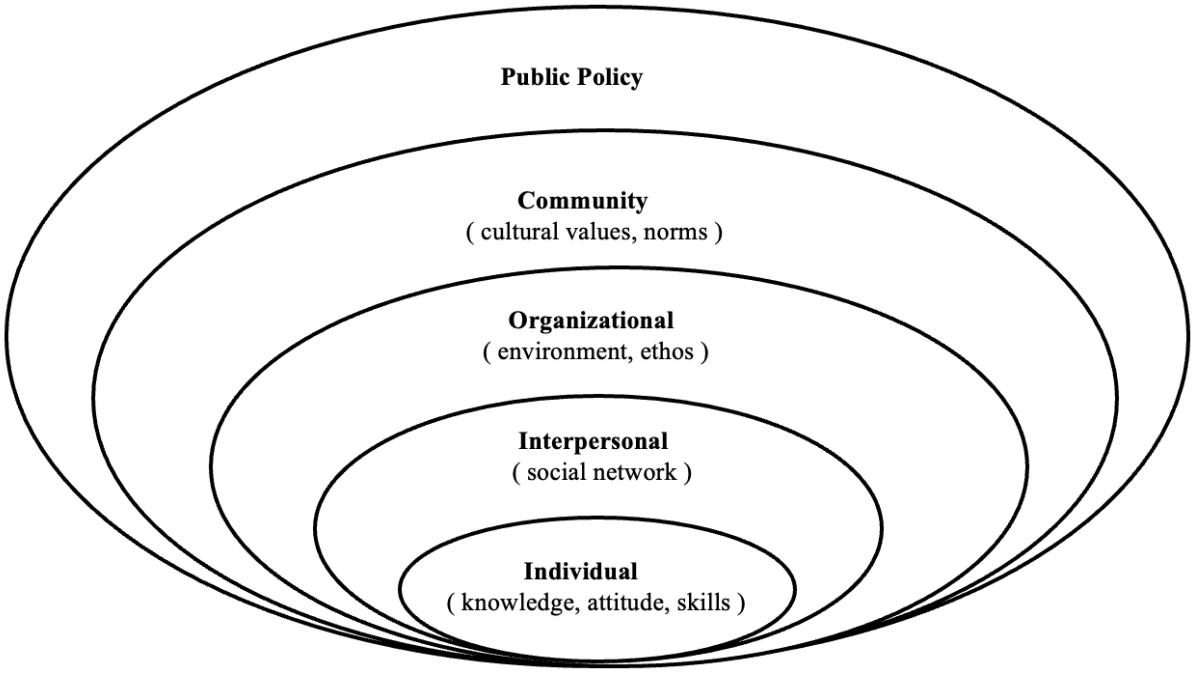


Figure 3 Socio-Ecological Model: A Framework for Prevention (Alghzawi)

When applying the socio-ecological model to determine the factors associated with adolescent drinking, the variables were identified at three levels: individual level, interpersonal level, and community level. Factors that are closely related to the individual level include age, gender, economic status (e.g., monthly household income and education), alcohol expectancies, and health literacy, these factors closely related to the interpersonal level include family and peer alcohol use, and there are less studies on the community level, as mentioned in the study by scholar Ssewanyana, the proximity of adolescents' homes to places where local alcohol is brewed and sold, as well as the packaging of alcohol, the size of the units sold, and the appearance of the product are considered important community factors. In adolescents' lives, they also often follow their parents to social events such as weddings and funerals at the homes of relatives and friends, and the symbolic significance of drinking at these gatherings can also exacerbate the occurrence of their drinking. The inadequacy of the legal regulatory system is also an extremely important community factor (Ssewanyana et al., 2020).

In summary, the socio-ecological model was chosen to maximize the identification of factors associated with adolescent drinking. At the same time, a mature model is a prerequisite for the study to be carried out successfully.

2.6 The factors related to alcohol use

The economic take-off and the rapid rise of the Internet and the advent of the era of big data prompted adolescents to have more exposure to alcohol; however, adolescence is a critical period for individuals to learn about health, develop healthy practices and improve health literacy, and develop effective interventions to reduce adolescent drinking. A review of relevant domestic and international literature reveals that the factors associated with adolescent drinking, according to the socio-ecological model can be divided into three major categories.

2.6.1 Individual factors

1) Age and gender: age and gender have some slight differences on adolescent alcohol use. In a survey conducted by Geelsl, a Dutch foreign scholar (Geelsl et al.,2012), it was revealed that boys drink more frequently and in quantities than girls when they are older than 16 years old. The findings of this study are generally consistent with those of Yangyuen, a Thai addiction researcher (Yangyuen et al.,2021), and the latest survey found that the number of boys who drank at risk was higher than that of females, and since age was used as the cutoff, the findings discovered that the age of girls was the same for boys who drank at risk. They are two different papers, with studies 10 years apart and geographically far apart, but the findings are consistent enough to suggest that drinking behavior among adolescents increases gradually with age and that boys are more likely to engage in drinking behavior than girls.

2）Monthly household income: The monthly household income directly affects the level of household consumption, and the higher the monthly household income, the more money is supplied to adolescents for discretionary use, as confirmed by the findings of the Thai researcher Yangyuen (Yangyuen et al., 2021), when the monthly household income was ≥ 8,000 baht, the number of adolescents with either hazardous or low-risk drinking was higher than those with monthly income < 8,000baht Thai households. Several researchers in China have shown that household income is

positively associated with adolescent drinking, and higher household income is associated with higher rates of adolescent drinking (Chen et al., 2017; Lei et al., 2018. The relationship between household income and alcohol consumption is clearly illustrated by the Ormond study from Ireland, whose findings suggest that alcohol consumption affects household income, while the household income of drinkers is higher than that of non-drinkers (Ormond et al.,2016). This suggests, on the other hand, an endogenous relationship between household income and alcohol consumption. Thus, it can also confirm that adolescents' alcohol consumption is inextricably linked to the monthly income of the family.

3) Alcohol expectancies: The alcohol-related outcome expectancies are defined as beliefs about the effects of alcohol on behavior, cognition, moods, and emotions (Leigh et al., 1989). At an age when experiences with alcohol are less advanced, these beliefs play a particularly important role. Alcohol-related outcome expectancy research emphasizes the importance of implicit cognitive or memory activation and extrapolated expectations in understanding alcohol use. Through the results of Urban's study (Urban et al., 2008), alcohol prevention programs should target high stimulation-seeking adolescents, with particular emphasis on preventing the development of positive expectations and motivation to drink. Also based on the results of the study, effective interventions must be developed to divert young people's attention from–drinking and increase energetic, alternative compatible and attractive activities Starting from the opposite direction and already achieving good results; another prevention approach is to delay alcohol experimentation in high stimulation seekers by limiting the availability of alcohol in the places most frequented by stimulation-seeking adolescents. Researcher Van's study (Van et al., 2011) also discovered that alcohol anticipation was positively associated with drinking behavior, and those who had positive expectations about the effects of alcohol use were likely to drink because of the enhancement. This finding is similar to Rhew's study (Rhew et al., 2021), which showed, among other things, that adolescents who drank with peers exhibited more positive alcohol expectations than those who drank alone. Thus, sociologists and epidemiologists have concluded from the same study that alcohol expectancy is one of the important causes of adolescent drinking.

4) Health literacy: Health literacy is a protective film that improves health awareness, prevents chronic diseases, and eliminates the use of addictive substances. Health literacy is a measure of an individual's ability to read, understand, and act on medical instructions. The results of the Iranian researcher Javadzade, who assessed health literacy among older adults, showed that health literacy among older adults in Iran is severely under-represented and the development of health literacy interventions is imperative (Javadzade et al., 2012). In a systematic review by the American researcher Fleary (Fleary et al., 2011), it was confirmed that there is a meaningful relationship between health literacy and adolescent health behaviors and that the integration of developmental theory in the research design is essential to determine the relationship between adolescent health literacy and health behaviors and to identify areas of intervention. The generalization and intervention of health literacy may improve adolescent health behaviors because it provides tools to translate knowledge into behavior and enables adolescents to make healthy decisions in their current lives and across the lifespan. Manganello recommends the Institute of Medicine (IOM) report Health Literacy and the Ecological Model as a probabilistic framework (Manganello et al. 2008), based on the framework to develop effective policies to improve the knowledge and skills of adolescent health literacy and to gradually address the public health problem of adolescent addictive substance use worldwide.

5) Smoking: Alcohol consumption among adolescents is often accompanied by smoking. 70%-80% of reports of adolescent malpractice indicate that smoking and alcohol consumption are inextricably linked (Mcclure et al., 2020). Studies in Taiwan have shown that adolescent smoking increases the likelihood of alcohol consumption by 54.9% and that smoking and alcohol consumption increase the risk of related diseases, such as respiratory disease, cardiovascular disease, and cancer (Lee et al.,2021). Meanwhile, foreign scholars have compared the alcohol use of Asian adolescents in Colombia with that of Korean adolescents and found that the greatest risk factor for alcohol use among adolescents in both places is the same: smoking behavior (Joung et al.,2020).

2.6.2 Interpersonal factors

1) Parents' drinking behavior: Parents are the first teachers of adolescents and play a crucial role, and their drinking behavior will directly influence adolescents' drinking behavior. A study by Smit, a foreign scholar, demonstrated that both fathers' and mothers' drinking behaviors were associated with adolescents' drinking behaviors and that fathers' drinking behaviors were somewhat greater for adolescents, which may be related to the fact that fathers drink more often than mothers and therefore have a greater influence (Smit et al., 2020). However, the opposite result was found in a study by Chinese scholar Ye Huang, whose results showed that there was no statistically significant difference in drinking rates among the three groups of adolescents whose parents were supportive, neutral, and opposed to drinking (Huang et al.,2014), and this result may be related to the national situation in China, where in some areas parents are away from their children all the time because they have to leave home to make a living and children are mainly raised by grandparents and thus the influence of parents on adolescent drinking behavior is not significant. Therefore, whether parental drinking behavior can influence adolescents needs to be judged according to different countries, different regions, and different social environments.

2) Parental education level and family income: low parental education is a risk factor for adolescent drinking, and a study by Cheah, a Malaysian scholar, found that adolescents with highly educated fathers had lower drinking behavior than those with less educated fathers, meaning that parental education was negatively associated with adolescent drinking behavior (Cheah et al.,2019). Parental education is positively correlated with family income; higher parental education leads to higher family income and more money at the disposal of children, which also makes them more likely to be exposed to alcohol.

3) Family patterns: A good family atmosphere can provide adolescents with more love, care, concern, and warmth, while poor family patterns bring greater life stress and lack of emotion to adolescents, leading to their lack of security; which is why they are more prone to drinking when they encounter bad things. Italian scientists Innamorati's research findings revealed that parents with marital conflict or divorce, adolescents from families with immature ways of facing and dealing with stress were more likely to choose alcohol as a way of coping with stress (Innamorati et al.,2015).

This is consistent with the findings of Chinese researcher Quanfeng Chen, who confirmed a significant positive association between parental marital conflict and adolescent drinking behavior, and this relationship was more prominent among middle school girls (Chen et al.,2019). Therefore, family stability and parental love are important guarantees for healthy adolescent growth.

4) Peer behavior: the vast majority of adolescence is spent with peers and the influence of peers is significant for them, thus making it easy for adolescent homogeneity to occur. The homogeneity phenomenon of adolescent delinquent behavior was confirmed by Ye Huang's study, whose findings showed that the difference in peers' attitudes toward drinking had a statistically significant effect on adolescent drinking behavior (Huang et al.,2014), and that the mutual influence of peers is high, a conclusion that can also be argued by the social learning theory of Bandura, a famous American psychologist, in which the imitation and role modeling of peers have a behavior.

2.6.3 Community factors

1) Social norms of alcohol use: Regulating behavior is an important measure to reduce adolescent drinking and also serves as a basis for developing policies and measures to reduce drinking. The findings of several foreign research scholars (Perkins et al., 2002; Neighbors et al., 2007; Cox et al., 2010), confirm that personal norms of behavior, campus norms of behavior, and social norms of behavior are important ways to reduce adolescent drinking. Studies have shown that adolescents with strong self-control tend to drink more than others, and the underlying reason for this phenomenon is that many adolescents are unaware of the dangers of drinking alcohol and use it as a way to relieve stress when they have little access to alcohol due to various constraints in their normal school life. For the regulation of campus behavior, on the one hand, school discipline and rules should be established, and on the other hand, the dangers of alcohol should be well publicized so that they are less exposed to alcohol. The regulation of social behavior must rely on national laws, the introduction of a strict ban on the sale of alcoholic beverages to minors, and the promotion of the dangers of alcohol consumption through digital media and the Internet to reduce youth drinking.

2) Access to alcohol outlets: Adolescents' access to alcohol is one of the major causes of their drinking and alcohol abuse, and there is no such literature in China to support this finding, mainly because there are no laws in place to prohibit adolescents from purchasing alcohol and alcoholic beverages, and only some formal businesses have reminder labels on their counters, which leads to alcohol being readily available to adolescents in China. From the literature, it was found that U.S. laws prohibit youth under the age of 21 from purchasing alcohol, but from Morrison's findings (Morrison et al., 2019), despite U.S. laws prohibiting alcohol purchases by those under 21, adolescents who live in the vicinity of a liquor dealership tend to consume more alcohol. The study found that bars near home and off-site outlets near home were positively associated with obtaining alcohol from peers under 21 years of age, and conversely, obtaining alcohol from peers under 21 years of age was positively associated with alcohol consumption. Therefore, interventions that reduce adolescents' access to alcohol through peers younger than 21 years of age may reduce adolescent alcohol consumption. In a study of adolescent drinking in Tanzania (Ibitoye et al., 2019), it was similarly found that the proximity of outlets and alcohol advertising to adolescents increased adolescent drinking. Thus, dense alcohol outlets, alcohol advertising, and poor enforcement of minimum drinking age laws all contribute to underage drinking.

Through previous studies, it was found that the individual level (gender, monthly family income, alcohol expectations, health literacy, smoking), the interpersonal level (parental factors, peer factors), and the community level (social norms of alcohol consumption, easy access to alcohol) of the socio-ecological model were strongly associated with adolescent alcohol consumption, and in the next step, we applied the model to the study to identify the correlates of alcohol use among the medical students in Hubei Province.

2.7 Health literacy Theory

In 1974, Simonds first introduced the term "health literacy" in his article "Health Education as Social Policy" (Simonds et al., 1974), which argued that individuals need to have certain competencies to meet the complex demands of health care in modern society. In 1999, the American Medical Association (AMA) defined health

literacy as "the set of interacting abilities to perform basic reading and numeracy in a medical setting" (AMA, 1999). In 2004, the Institute of Medicine (IOM) defined health literacy as an individual's ability to access, understand, and process basic information or services and to make sound and relevant health decisions. The currently accepted definition of health literacy is the WHO definition: the process by which people obtain, understand, and adopt health information and services, and use them to make sound judgments and decisions to promote their health. This definition reveals two important elements of health literacy: interaction and critique, and further broadens the content of health communication and health education, and emphasizes self-directed learning that leads to the promotion of individual, family, and community health (Nutbeam et al., 2008).

Health literacy research did not receive much attention in the first two decades, and in the 1990s, studies found large associations between health literacy and treatment adherence, self-management skills, and disease-related knowledge.

The Health Literacy Model is a model that translates the definition of health literacy into a model that can be operationalized, mainly to guide health literacy research and practice, but also to provide a theoretical basis for the measurement of abstract concepts of health literacy. At present, very few studies have explored health literacy models, and their research is divided into two main areas: health literacy from a clinical perspective and health literacy from a population health perspective.

Health literacy in clinical practice focuses on measuring whether individuals have sufficient skills and competencies to deal with medically relevant health behaviors; health literacy from a population health perspective focuses on promoting individual participation in health care decisions, changing the health care system, and ultimately promoting the health of society. Currently, most concepts of health literacy focus on the clinical perspective and are designed to measure the knowledge or skills needed to perform health-related activities. Baker has categorized health literacy into written materials and verbal-related literacy (Baker et al., 2006); Spreos' study identified four competencies in the probabilistic model of health literacy: reading and numeracy, comprehension, decision making with information, and health service orientation (Spreos et al., 2005); Lee's model of health literacy includes the following dimensions: knowledge of diseases and self-care, risky health behaviors, preventive

care, and physician visits and treatment adherence (Lee et al., 2004). In contrast, researchers Wolf and Paashe-Orlow both decomposed the health literacy model into listening, verbal fluency, memory duration, and navigational skills (Paashe-Orlow et al., 2007). Although the models developed by the five scholars vary greatly, a common element of their research is a focus on patient cognition, skills, and abilities.

The health literacy model from a population health perspective expands the dimensions of health literacy to a broader range of competencies, based on the knowledge and skills that individuals need to acquire in a public health perspective called functional health literacy. In addition to interactive health literacy and critical health literacy, the three levels of the health literacy model represent different levels of knowledge and skills from top to bottom, and give individuals more decision-making autonomy. According to authors Nutbeam D, the health literacy dimension including:

1) Access skill: access to health information and health services means using the ability to select dates and know how to find information. According to practice, view the dates from multiple sources until the dates are reliable.

2) Cognitive skill: refers to the correct knowledge and understanding of practice guidelines.

3) Communication skill: They refer to the ability to communicate through speech and writing, including the ability to communicate and persuade others. Plus, understanding and receiving information about practice.

4) Self-management skill: refers to the ability to have goals, plans, and implement plans, and to review them at the same time. Follow the goal to correct your behavior.

5) Decision skill: They refer to the ability to define to select and reject/avoid or select operational methods by using logic. Or to analyze the interests to refuse/avoid and take the right action.

6) Media literacy skill: They refer to the date reliability verification ability provided by the media can be quickly released. To compare how to choose the media to avoid potential risks to the health of yourself and others, as well as to assess information. Guide the community and society.

Health literacy measurement tools have been developed since 1991 and there are more than 50 of them. Depending on the measurement method, there are 2 main categories: objective measurement tools and self-assessment tools. The representative objective health literacy instruments include Rapid Estimate of Adult Literacy in Medicine (REALM) (Davis et al., 1991), Test of Functional Health Literacy in Adults (TOFHLA) (Parker et al., 1995), Newest Vital Sign (NVS) (Parker et al., 1995), and the Newest Vital Sign (NVS). Parker et al., 1995, Newest Vital Sign (NVS) (Weiss et al., 2005). Subjective health literacy measurement tools include: Set of brief screening questions (SBSQ) (Chew et al., 2004); Health Literacy Management Scale (HeLMS) (Jordan et al., 2013); All Aspects (Chinn et al., 2013); Health Literacy Scale-Europe (HLS-EU) (Heide et al., 2015); and All Aspects of Health Literacy (AAHLS) (Chinn et al., 2013).

China's Health Literacy Research Starts Late Compared to Developed Countries. Only in 2005, the Chinese Center for Disease and Control and the Center for Health Research and Development proposed that health literacy includes three dimensions: understanding scientific concepts of health; understanding the social impact of health, and mastery of basic health knowledge. Domestic research on health literacy measurement tools can be broadly divided into two types: locally developed and foreign scales. For example, the "Health Literacy of Chinese Citizens", which was developed by the former Ministry of Health and other multidisciplinary experts in health education, consists of three main aspects: basic knowledge and concepts (25 items), healthy lifestyle (24 items), and basic skills (7 items), based on which the health literacy questionnaire is designed. The health literacy questionnaire was designed on this basis. Based on the health literacy evaluation system developed by the China Health Education Center, Chinese scholar Bie combined health-related behaviors and constructed a health literacy evaluation index system for public health emergencies in three dimensions: knowledge, behavior, and functionality (Bie et al., 2013). Other health literacy measurement tools are mainly translations of existing foreign tools, for example, Chinese translation of foreign tools include: the study by Haolin Sun et al. translated the foreign HeLMS scale (Sun et al., 2013).

The health literacy program developed in this study based on Nutbeam D Health Literacy Theory consists of six dimensions: cognitive skills, acquisition skills,

communication skills, self-management skills, media skills and decision-making skills. The health literacy program can effectively improve the health literacy of the population. Scholar Grigg et al. (2018) used health literacy theory to develop health promotion pamphlets that led to a more significant improvement in alcohol cognitive skills among the study participants (Grigg et al.,2018). While researcher Katena used health literacy theory to develop an intervention for hypertensive patients in order to explore the changes in health literacy on blood pressure after lifestyle changes (Katena et al. 2023). Scholar Lubman et al., (2016), on the other hand, utilized health literacy theory and used structured phone calls to deliver health literacy as an intervention to reduce alcohol use (Lubman et al., 2016). Interventions developed by different researchers using the same health literacy theory were effective in addressing the health problems of the population.

In summary, there has been a "health literacy boom" in recent years. Whether it is the development of health literacy scales, the testing of the validity of health literacy scales and the development of effective interventions based on health literacy theories, or systematic evaluations and literature reviews on health literacy. In conclusion, health literacy theory and health literacy interventions are the most effective means of improving the health of populations.

2.8 Relevant researches

There are countless studies on adolescent substance abuse around the world, but the most popular ones are on adolescent smoking and alcohol consumption, and they are of great significance for the study of adolescent delinquent habits, with alcohol consumption definitely ranking first among the various delinquent habits of adolescents, making this study of great significance.

At present, the vast majority of research on socio-ecological models is applied to the field of psychology, and very little is involved in the field. Scholars have mainly gone on to analyze the causes of adverse events or subjects based on the social-ecological model, and Jacobs, a Nigerian researcher, in his literature review, found that many Nigerian scholars use this model to analyze the internal causes of adolescent drinking, while at other levels it is lacking (Jacobs et al., 2020). This would also be a good direction for future research. To fill this gap, the socio-

ecological model was used as a theoretical basis to summarize previous studies and it was discovered that the causes of adolescent drinking are mainly at three levels: individual level, interpersonal level, and community level; the main factors at the individual level include: gender (Geelsl et al., 2011), age (Yangyuen et al., 2021), monthly household income (Ormond et al.,2016), smoking behavior (Mcclure et al.,2020; Lee et al.,2021; Joung et al.,2020), expectations of alcohol (Van et al.,2011; Rhew et al.,2021), Health literacy (Javadzade et al., 2012). The main factors at the interpersonal level include: parental drinking behavior (Smit et al., 2020; Huan et al.,2014), parental education and family income (Cheah et al.,2019), family patterns (Chen et al.,2019), and peer behavior (Huan et al.,2014). Community level: Social norms of alcohol use (Wesley et al.,2002; Neighbors et al.,2007; Cox et al.,201. Access to alcohol outlets (Morrison et al., 2019).

The significance of identifying the causes of adolescent alcohol use is for coming up with targeted and effective interventions with the ultimate goal of reducing adolescent alcohol use. Researcher Sansom's review of 603 literature then noted that poorer health literacy was associated with poor health outcomes (Sansom et al., 2016). According to Yangyuen, a Thai scholar, health literacy is better able to reduce smoking and drinking behaviors among adolescents (Yangyuen et al., 2021). In general, health literacy is inextricably linked to adolescent behaviors (Chisolm et al., 2014), and their research confirmed that improving adolescent health literacy is effective in reducing their alcohol expectancies and thus adolescent drinking behavior, a finding consistent with Austrian expert Brandt (Brandt et al., 2019). Health literacy was associated with all indicators of adolescent smoking and drinking, and the easier it was for adolescents to "understand, evaluate" and "apply" health-related information, the less frequent they smoked and drank and the less they drank. The Danish scholar Konig applied health literacy theory to a study of alcohol abuse among university students (Konig et al., 2018), and his findings suggest that the approach to addressing alcohol use among Danish adolescents must be multifactorial, with the primary focus on supporting students in learning health knowledge and skills related to alcohol use. The Czech expert Rolova, whose study population was young people (Rolova et al., 2021), showed significant effects of economic factors, self-perceived health indicators, and shared injection among participants with addictive substance

use. Increasing health literacy can help improve health outcomes and reduce behaviors associated with high-risk substance use among people in addiction treatment. In an investigation of Swedish men's addictive substance use using health literacy (Dermota et al., 2013), expert Dermota discovered that increasing their health literacy reduced their use of addictive substances. In contrast, Liu, a Chinese researcher, used the health literacy model to analyze older adults (Liu et al., 2015; Liu et al., 2018), and the results confirmed that health literacy was significantly related to health-related behaviors in older adults, and another result showed that improving health literacy in older adults increased health-related behaviors in older adults. Only by finding ways to effectively improve health literacy can we address the root of the problem so that we can promote the health of populations around the world comprehensively, from point to point.

The study of addictive substance use in adolescents is a constant theme for public health experts around the world. Based on a literature review, it was found that health literacy is also a hot topic of global research. Similarly, improving the health literacy of the whole population is also the goal of China in the next decade.

2.9 Conceptual framework of the study

The three problems to be solved in this study are:

1. According to the three levels of the socio-ecological model, to determine the reasons for drinking among Chinese vocational medical students:

2. The health literacy scale was used to evaluate the health literacy level of Chinese vocational medical students.

3. According to the health literacy model proposed by Nutbeam, interventions were formulated from six aspects, hypotheses were put forward, and the effectiveness of interventions was verified.

Finally, the main purpose of this study is "evaluation of the effectiveness of health literacy programs to reduce alcohol use among medical students in Hubei Province, China", hoping that the results of this study can be generalized and that the awareness of health promotion and health promotion can be raised in China, a country that does not pay much attention to the public health field. The researcher can summarize for conceptual framework as follows:

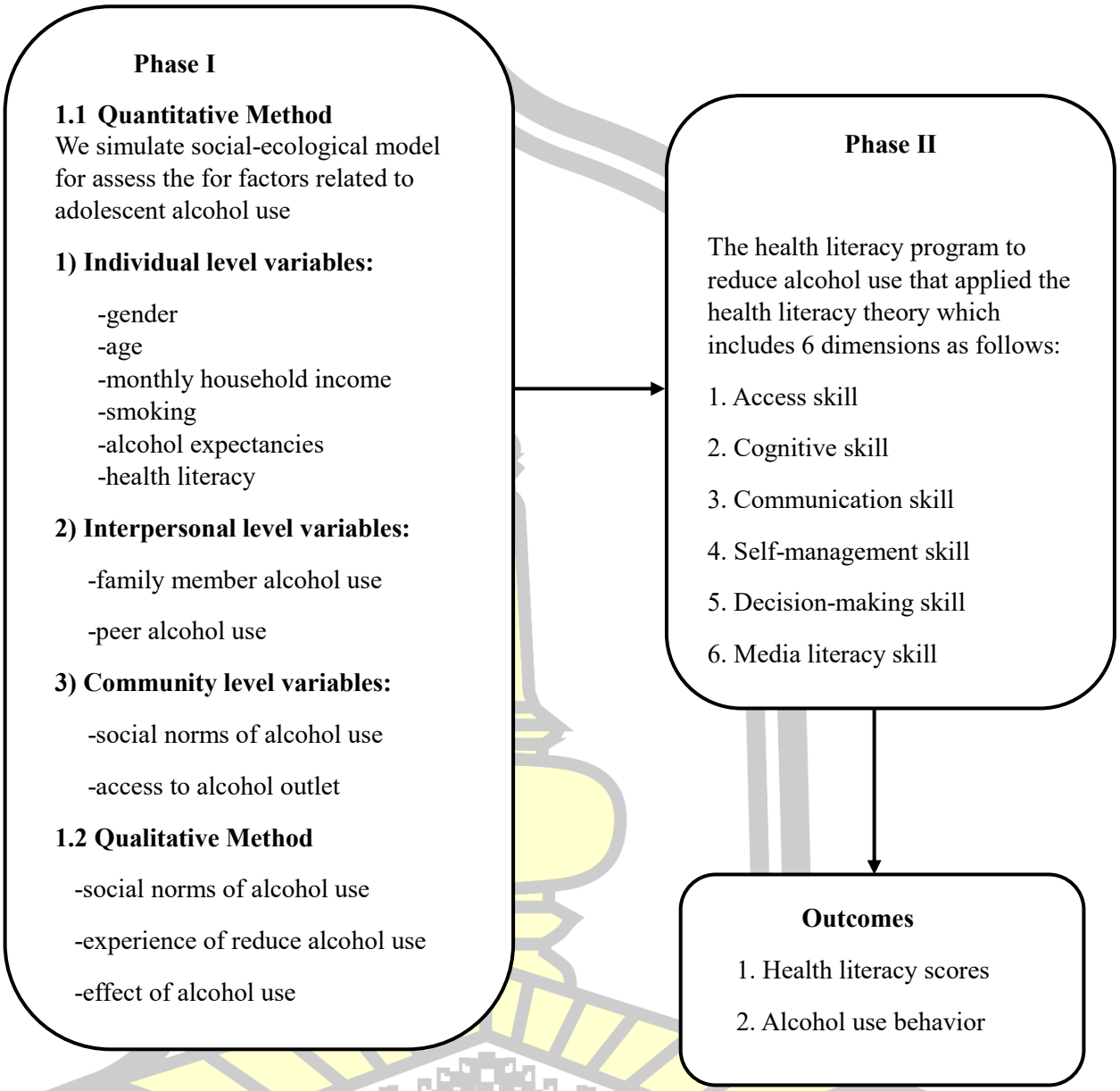


Figure 4 Conceptual Framework

CHAPTER 3
METHODLOGY

This was a mixed-methods study that was divided into two phases. In phase I, we integrated both quantitative and qualitative methods in a study to determine factors related to alcohol use, assess the health literacy level, explore the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effects of alcohol use among medical students in vocational colleges. In phase II, a cluster randomized controlled trial was used to evaluate the effectiveness of health literacy programs to reduce alcohol use among medical students in vocational colleges, which simulated the health literacy model. The study procedure for each phase is as follows:

3.1 In phase I, we integrate both quantitative and qualitative methods in the study.

3.1.1 Study design

3.1.1.1 Using the quantitative method as the cross-sectional study to determine the factors related to alcohol use and assess the health literacy level among medical students. Also, we stimulated a socio-ecological model in which a multi-level framework was used to understand the interaction between individuals and environmental factors in which they are embedded for us to focus on the interplay among individual, interpersonal, and community-level variables.

3.1.1.2 The qualitative method: we used a qualitative method such as an in-depth interview of key participants to explore the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effect of alcohol use on medical students.

3.1.2 Study population and samples

3.1.2.1 The Quantitative Method

Study population

The study population in this phase is composed of medical students from four higher vocational colleges in Hubei Province, China.

Sample

The sample size estimation was calculated using Daniel's (Daniel et al.,1999) formula as follows:

$$n' = \frac{N{Z\alpha/_2}^2 P\ （1-P）}{d^2(N-1) + {Z\alpha/_2}^2 P\ （1-P）}$$

n'=Sample size

N=Number of population（N=30000）

Z= confidence intervals (set as 95% CI, Z=1.96)

P= proportion of adolescents alcohol use in Hubei（P=0.4992）

d= precision values （d=0.03）

When

$$n' = \frac{(\mathbf{30000})(1.96)^2 0.4992(1-0.4992)}{(\mathbf{0.03})^2(\mathbf{30000-1}) + (\mathbf{1.96})^2(\mathbf{0.4992})(\mathbf{1-0.4992})}$$

n'=1030.50~1031

The formula to calculate the dropout rate as 10%.

$$N_1 = {n/}_{1-d}$$

d= dropout rate (d=0.1)

n= Number of population (n=1031)

N1 =Sample size

When

N1=1031/1-0.1

N1=1145.55~1146

Therefore, the total sample size of the medical students was 1,146 cases.

Inclusion criteria

1. The criteria included vocational medical students who were freshman, sophomores, or juniors (clinical practice students who ages range from 17 to 24 years)

2. Can use smart phone and have the WeChat app on the phone

3. Able to read and understand Chinese Mandarin independently

4. Willing participants

Exclusion criteria

1. Students who refused to answer the questionnaire
2. Students who provided incomplete responses

Sampling

In this study, the researcher selected the samples from each college according to the proportion to size, as shown in Table 1. In each college, students who met the eligible criteria were selected using a stratified sampling method. First, the researcher divided subjects into sub-groups by college years (strata), including freshmen, sophomores, and juniors. Secondly, the researcher made the sampling frame for each strata, which included a list of all students who were willing to offer samples. Thirdly, the researcher selected the sample from each strata. The data collection was continued without interruption until the required number of samples for each college was reached.

Table 1 The proportion to size of sample in each college

College	Number of students	Number of Sample
1. Hubei College of Chinese Medicine	12,000	458
2.Huanggang Polytechnic College	9,000	344
3. Jingzhou Institute of Technology	7,000	264
4. Wuhan College of Foreign Languages and Foreign Affairs	2,000	80
Total	**30,000**	**1,146**

3.1.2.1 The qualitative method

The target groups included main participants who could give information about the social norms of alcohol use, experiences of stopping or reducing alcohol consumption, and the effects of alcohol use on medical students, such as representative medical students who drink (n = 9), education specialists (n = 2), health promotion specialists (n = 2), and mental health specialists (n = 2).

Inclusion criteria

1. Adolescent psychiatrist who are doctors in hospitals that has the experience in their work at least 3 years.

2. Expert of health promotion and health literacy are expert person who has experience in adolescent alcohol use research or adolescent health literacy research or related field.

3. Medical students who are current drinker or binge drinker.

4. Willing participants.

Exclusion criteria

1. The participants who do not live in the research setting when conducting the research.

2. The participants who opted out of the research.

3. The participants who fell ill suddenly.

3.1.3 Phase I research instrument

3.1.3.1 Quantitative instruments

The self-administered questionnaire was developed based on the literature review and consisted of the following 5 parts:

Part I —Demographic characteristics

This part consisted of individual-level variables including gender, age, monthly household income, smoking, and alcohol expectancies. The interpersonal-level variables included family and peer alcohol use. The community-level variables included social norm of alcohol use and access to alcohol outlet.

Part II— AUDIT Scale

We used the AUDIT scale (Fleming et al., 1991), the most-widely used scale in China, which was introduced and translated into Chinese in 1999 by Bing Li et al. at the Institute of Mental Health, Peking University (Li et al., 1999). The scale consists of 10 questions, questions 1-3 assessed drinking behavior, Questions 4 – 6 assesses dependence, and Questions 7 – 10 assesses consequences or problems related to drinking. The total score of the scale is 40 points, with a score of 0–7 as low-risk, 8–15 as hazardous use, 16–19 as harmful use, and 20 or above as alcohol dependence. This scale has good internal consistency (Cronbach's α was 0.85).

Part III—Health Literacy Scale

Health literacy was assessed by the Alcohol Health Literacy, adapted by Ponrachom and Boonchuaythanasit (Ponrachom et al.,2018), reflecting an individual's capacity to alter alcohol use behavior. This summed up the rating scale, comprising 36 items across the following six dimensions such as (1) cognitive skills, (2) access skills, (3) communication skills, (4) self-management skills, (5) media literacy skills, and (6) decision skills. The total scores were calculated with a summary of the scores of all items (ranging from 30 to 150) (Cronbach's α was 0.83). We used the median to categorize the scale scores, and determined the median of the total scale score at 87; a total score below 87 was categorized as low health literacy and a total score of greater than or equal to 87 was categorized as high health literacy. The question information of each dimension as follow as:

Part 1: The part on cognitive skills consisted of 6 items with multiple-choice question type. The participants were given 4 choices; a correct answer earned 1 point while an incorrect answer would get 0. The total score ranged from 0 to 6. The cognitive scale scores were also categorized using the median, calculated to be 2 for the total scale score. A total score of less than 2 was categorized as low cognitive skills and a total score of greater than or equal to 2 was categorized as high cognitive skills.

Part 2: This part included four dimensions such as access skills, communication skills, self-management skills, and media literacy skills. Each dimension comprised of 6 items, yielding a total of 24 items. The items were rated on a 5-point Likert scale (5=always, 4=often, 3=sometimes, 2=rarely, 1=never). The total scores were calculated by summing the scores of all items of each dimension, access skills score ranged 1-6, communication skills score ranged 1-6, self-management skills score ranged 1-6, and decision skills score ranged 1-6. The total scores were calculated by summing the scores of all items of each dimension, access skill score range 6-30, communication skill score range 6-30, self-management skill score range 6-30, and decision skill score range 6-30. We used median scores for categorizing the access skills, communication skills, self-management skills, and media literacy skills as follow as:

The median total score for access skills was 17, a total score below 17 was categorized as low access skills and a total score of greater than or equal to 17 was categorized as high access skills.

The median total score for communication skills was 16, a total score below16 was categorized as low communication skills and a total score of greater than or equal to 16 was categorized as high communication skills.

The median total score for self-management skills was 16, a total score below 16 was categorized as low self-management skills and a total score of greater than or equal to 16 was categorized as high self-management skills.

The median total score for media literacy skills was 17, a total score below 17 was categorized as low media literacy skills and a total score of greater than or equal to 17 was categorized as high media literacy skills.

Part 3: The decision skills part consisted of 6 items. It is a simulation of decision-making to express alcohol use behavior with a multiple-choice question type that allowed respondents to answer on 4 choices ranging from 1-4. The total score ranges from 6 to 24. Finally, again, we used the median to categorize the decision skill scores, and calculated that the median of the total decision skill scale scores was 20, so that a total score of less than 20 was categorized as a low cognitive skill and a total score of greater than or equal to 20 was categorized as a high cognitive skill.

Part IV— Alcohol expectancy

Alcohol use expectancies refer to the personal beliefs on behavior, cognition, moods, and emotions that occur to oneself when drinking. AEs, measured by a self-reported questionnaire adapted from Ham et al., (Ham et al., 2005) reflect the expectations of positive and negative effects of alcohol consumption. The scores of the questionnaire ranged from 1 (disagree) to 4 (agree), and consisted of 15 items (8 items for positive alcohol expectancies [PAEs] and 7 items for negative alcohol expectancies [NAEs]). The total scores were determined by summing up the scores of all the items in each dimension (for PAE, range 8–32 and for NAE, range 7–28) (Cronbach's α was 0.85 and 0.83, respectively). The positive alcohol expectancies scale was categorized using the median, calculated at 9 for all positive alcohol expectancies scale. A total score of greater than or equal to 9 was categorized as a

high positive alcohol expectancy, while a score of less than 9 was categorized as a low positive alcohol expectancy. Similarly, the median was used to categorize the negative alcohol expectancies scale, and the median of the total scores on the negative alcohol expectancies scale was calculated to be 10, so that a total score greater than or equal to 10 was categorized as high negative alcohol expectancies and a score of less than 10 was categorized as low positive alcohol expectancies.

Part V—Social norm of alcohol use and access to alcohol use

We administered the social norms of alcohol use scale that were developed by Songklang and Yangyuen (Songklang et al.,2019) that involved social values on the harmful effects of alcohol. The scale consisted of 9 questions, all of which had 5 answer categories (5=strongly agree." 4=agree", "3=uncertain", "2=disagree", and "1=strongly disagree"). The total scores were calculated by summing up the scores of all items (ranging from 9 to 45), with higher scores indicating greater perceived alcohol harmful effects (Cronbach's α was 0.87). Finally, we used the median score to classify the social norms of alcohol use, which was calculated to be 31 for all total scores on the social norms of alcohol use scale, so that a total score greater than or equal to 31 is characterized as having a good social norm of alcohol use and a total score less than 31 is characterized as having a lack of social norms of alcohol use. Access to alcohol use was defined as the respondents asking, "It is easy to buy alcohol in your community if you want to". This variable was categorized as a dichotomous variable (Y/N).

3.1.3.2 Qualitative instruments

The researcher prepared the guidelines for the questions with in-depth interviews on the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effects of alcohol use on medical students. Some guidelines question are as follows:

1. What is your attitude toward medical students who drink?

2. In your opinion, what are the effects of alcohol use on medical students?

3. In your opinion, how do the social norms of alcohol use affect adolescent drinking?

4. In your opinion, what are the effective strategies that can be used to reduce alcohol use among medical students?

5. In your experience, how do we stop or reduce alcohol consumption? How do we cope with alcohol problems?

3.1.4 The evaluation of research instruments quality in phase I

Content validity: The questionnaire is checked for deficiencies by the expert who expertise in related field of your thesis about 3 persons including:

1.Name: Shaosong Yao; Field: Health Education Specialist, Associate Professor.

2.Name: Yan Liang; Field: Public Health Promotion Specialist, Associate Professor.

3.Name: Chaohan Liu; Field: Health Promotion Specialist, Assistant Professor.

Then, the researcher re-corrected it and check for complete before implement. The content validity of measurement will be used the Index of Item Objective Congruence (IOC). The range of the index score for an item is -1 to 1. Accordingly, an expert evaluates each item by giving a rating of 1 for clearly measuring objective, -1 for not clearly measuring, or 0 for the unclear objective. After the experts rate the items, the results are calculated to create the indices of IOC for each item on each objective. If the index of the IOC is between 0.5 and 1.00, it suggests that the item is acceptable, but if IOC falls below 0.5, it means that the item is not fitting and must be removed or reviewed (Kareema and Zubairi, 2022). The results showed that the IOC of each part of questionnaires as follow as:

1. Part I —Demographic characteristics, IOC was 0.70-1.00
2. Part II— AUDIT Scale, IOC was 0.80-1.00
3. Part III—Health Literacy Scale, IOC was 0.70-1.00
4. Part IV— Alcohol expectancy, IOC for PAE was 0.70-1.00 and for NAE was 0.60-1.00
5. Part V—Social norm of alcohol use and access to alcohol use, IOC was 0.70-1.00 and 0.60-1.00, respectively

Reliability: A pilot study will be conducted randomly among 30 medical students who study in college similar to our setting as Yangtze University. The

Cronbach's alpha coefficient will be used to measure the internal consistency of the questionnaire. High Cronbach's alpha values indicate that response values for each participant across a set of questions are consistent. The acceptable value of alpha is 0.70 or above (Tavakol and Dennick, 2011). The Cronbach's alpha coefficient was calculated for the different parts of it and obtained the results as follow as:

1. Part II— AUDIT Scale, Cronbach's α was 0.85
2. Part III—Health Literacy Scale, Cronbach's α was 0.83
3. Part IV— Alcohol expectancy, Cronbach's α for PAE was 0.85 and for NAE was 0.83
4. Part V—Social norm of alcohol use and access to alcohol use, Cronbach's α was 0.87 and 0.82, respectively

3.1.5 Data collection in phase I

3.1.5.1 Quantitative data collection

The research team consisted of 6 members, and the tool used for data collection was "Questionnaire Star", software with powerful features to design questionnaires, collect questionnaires, and perform simple data statistics. This method of implementation was as follows: first, the entries of the collection scale or survey were uploaded into Questionnaire Star. Next, the entries were edited to form a usable questionnaire, and finally, the completed questionnaire was produced with a QR code, which was given to the subjects, who filled it out. The data was collected in two steps.

Step 1: Before distributing the questionnaires, the 6 panel members were trained, and informed of the consent, precautions, and handling of unexpected situations before the questionnaires were filled out, and four members were selected to distribute the questionnaires.

Step 2: For the collected questionnaires, two other members were asked to check the completeness of the questionnaires, and if any questionable questionnaires were found, a third person was asked to come together for consultation and finalization.

3.1.5.2 Qualitative data collection

This part of the study was conducted by two researchers using the phenomenological approach of qualitative research, and the method of data collection was the in-depth interview method, which is an open-ended, unguided, and

unprompted interview conducted in a natural context. The interviewees introduced themselves and were informed of the purpose of the study, and the interview began after the interviewees gave informed consent and signed the consent form. Each interview lasted 30 to 45 minutes, and the entire interview was recorded and converted to text in a timely manner at the end of the interview. The data was processed and analyzed using Colaizzi's 7-step analysis method. It was also analyzed with the software MAXQDA 2020 (MAXQDA Standard 2020 (Release 20.0.7) Copyright © 1995-2020 VERBI GmbH Berlin)

3.1.6 Data analysis in phase I

In the quantitative data analysis, the IBM's SPSS version 25.0 (IBM Corp., Armonk, NY, USA) (Property of IBM Corp.© Copyright IBM Corporation and its licensors 1989,2017) was used to analyze the data. Descriptive statistics were utilized to describe the demographic characteristics variables. A number of cases and percentages were applied to describe other categorical variables like gender, age, smoking, monthly household income alcohol expectancies, family and peers alcohol use, social norm of alcohol use and access to alcohol outlet. The Multivariable Logistic Regression Analysis was used to determine the association among all the demographic characteristics, alcohol expectancy, the social norms of alcohol use, access to alcohol use, health literacy, and alcohol use. The statistically significant level was set as $P < 0.05$.

In qualitative data analysis, the data was analyzed by using Colaizzi's 7-step analysis method with the software MAXQDA 2020 (MAXQDA Standard 2020 (Release 20.0.7) Copyright © 1995-2020 VERBI GmbH Berlin).

3.2 In phase II, the evaluation of the effectiveness of health literacy program to reduce alcohol use among medical students.

3.2.1 Study design

The cluster-randomized controlled trial was used to evaluate the effectiveness of health literacy programs to reduce alcohol use among medical students. In this phase, the researcher developed the intervention program by applying the health literacy model (HL), in which the model of an individual's ability to acquire and understand

health information and using it to maintain and promote their health. The researcher focused on functional health literacy with 6 dimensions including: (1) access skills, (2) cognitive skills, (3) communication skills, (4) self-management skills, (5) decision skills, and (6) Media literacy skills.

3.2.2 Study population and samples

Study population

The study population in this phase was the freshman college students in the Jingzhou Institute of Technology and Hubei College of Chinese Medicine.

Sample

The sample size was estimated by using the formula as follows: (Hayes et al.,1999):

$$n = \frac{\left(Z\alpha/_2 + Z_\beta\right)^2 \text{【}\pi_0\text{（}1-\pi_0\text{）}+\pi_1(1-\pi_1)\text{】}}{\text{（}\pi_0-\pi_1\text{）}^2}$$

n=Sample size

α=0.05, β=0.2（$Z_{\alpha/2}$=1.96, Z_β=0.84）

π_0= Pre-intervention drinking rates（0.4667）

π_1= rates after the intervention（0.20）

When

$$n = \frac{(1.96+0.84)^2 \text{【}0.4667\ (1-0.4667)+0.20(1-0.20)\text{】}}{(0.4667-0.20)^2}$$

n= 45.07 ~46

We calculate for non-response or dropout as 10% as follows:

$$N_1 = {}^{n}/_{1-d}$$

d= dropout rate (d=0.10)

n= Size of the population (n=46)

N1 = Adjusted sample size

When

N1=46/1-0.1

N1= 51.11~52

Therefore, the total sample size is 104 students (experimental group with 52 students and control group with 52 students).

Inclusion criteria

1. Vocational medical students who are freshman medical students with ages ranging from 17 to 20 years old and studying in Jingzhou Institute of Technology or Hubei College of Chinese Medicine.

2. Students who consume alcohol (Note: The students who are in the experimental and control groups have the same range of AUDIT scores and were asked about their drinking behavior in the past month)

3. Able to use smart phone and have the Wechat app on the phone

4. Able to read and understand Chinese Mandarin independently

5. Have no congenital diseases that obstruct activities

6. Willing to participate

Exclusion criteria

1. Student who refused to answer the questionnaire

2. Student who provided an incomplete response

3. Student who could not participate in all activities on time.

Sampling

The sampling method will be used in Phase II as follows:

1. In the first stage, the researcher will select the colleges that has similar numbers of students and who are willing to participate in this study by using cluster random sampling. The experimental group is the Jingzhou Institute of Technology and the Hubei College of Chinese Medicine is the control group.

2. In the second stage, the researcher will prepare the sampling frame of each college, which includes a list of all students who met the eligibility criteria.

3. In the third stage, the students will be selected for participation by using simple random sampling.

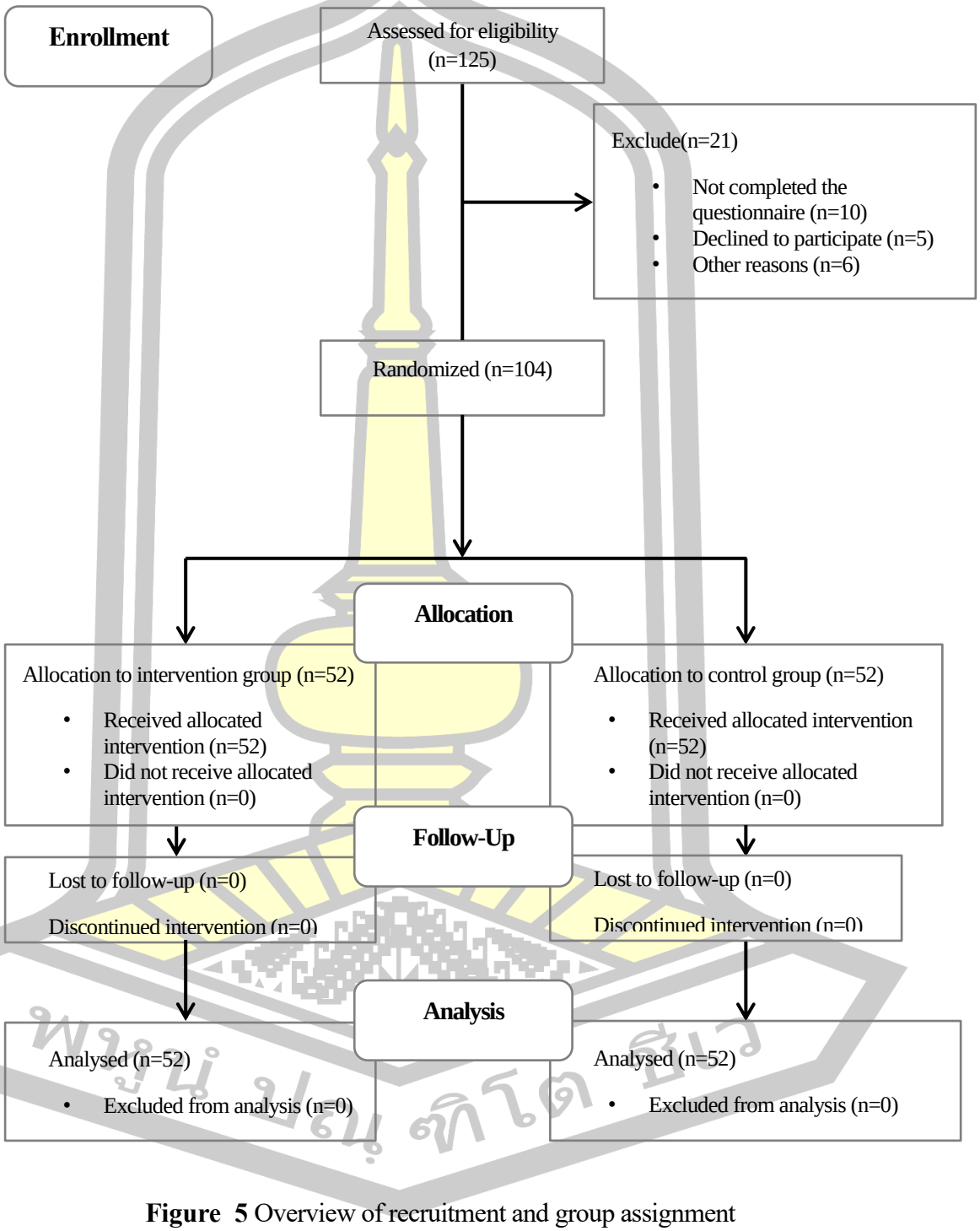


Figure 5 Overview of recruitment and group assignment

3.2.3 Research instruments in phase II

The research instruments in this phase consist of 2 parts as follows:

Part 1- The self-administered questionnaire, which will be used in Phase I that consists of demographic characteristics, health literacy, AUDIT score, alcohol expectancy, social norm of alcohol use, and access to alcohol outlet.

Part 2- The health literacy program

The researcher developed the health literacy program to reduce alcohol use with experts in the fields of health education or public health. This program development applied the health literacy theory of Nutbeam D, which included six dimensions: (1) access skills; (2) cognitive skills; (3) communication skills; (4) self-management skills; (5) decision skills; and (6) media literacy skills.

3.2.4 The intervention development

After a literature review and discussion with the specialists in health education, health behavior, and health promotion, we developed a health literacy program to reduce alcohol use based on the health literacy theory of Nutbeam D. The health literacy program was developed as follows:

Step 1: Team members drafted activity themes for the health literacy program interventions around the themes of "alcohol use" and "health literacy" and determined the number of activity themes to be six, with each activity taking four hours.

Step 2: Using the six skills of Nutbeam D.'s Health Literacy Theory as the cornerstone, the objectives of each health literacy program were determined.

Step 3: Each thematic activity consists of the development of the six skills. Also, the six skills of health literacy are practiced through the process of group discussion and assignments.

The total duration of an activity is 4 hours, and the tasks and time distribution of the activity are as follows: the health expert announces the beginning of the activity and issues the tasks (15 min), the students complete the tasks in groups (150 min), the students report and present their results (60 min), and the expert summarizes and announces the end of the activity (15 min).The intervention developer proposes that the core means of implementation of the health literacy program intervention is to "improve health literacy in six skills with each activity," which focuses on the active thinking, active learning, and changes in drinking behaviors of the medical students during the activity. Therefore, the medical students were divided into small groups of

6-7 students, and then the group discussion was used in each activity based on the activity theme. The process of the activity within the group was as follows: The group leader received the task from the public health specialist; the group leader assigned the task to the group members; the students then completed the task individually and discussed it within the group. One hour before the end of the activity, the group members worked together to create the reporting materials and selected one student to report and present the results (each group of students took turns reporting).The medical students can choose the form they are good at to show their results of each activity, such as exhibition boards, oral presentations, PPT presentations, drama performance reports, publicity brochures, and so on.

Step 4: Designing the connection between each activity and the objectives of the six dimensions of health literacy skills.

Each activity needs to achieve the objectives for all six dimensions of health literacy skills. When using various media platforms to retrieve useful information, not only the access skills will be improved, but also the media skills will be trained, so picking up useful information will not only improve the decision-making skills but also the cognitive skills. Extracting the knowledge to be shared after group discussion will not only improve communication skills but also decision-making skills. Finally, when experiencing the results of the transformation process, it may lead to cautioning themselves to eliminate and reduce the consumption of alcohol; that is one of the self-management skills. Therefore, in each activity, including the sub-activities for improving the six skills, they complement and depend on each other. Ultimately, the overall improvement in health literacy was improved.

3.2.4.1 Drafting of a health literacy program intervention

Based on the results of the first phase of the study, it is clear that low health literacy, gender, monthly family income >5000RMB, positive alcohol expectations, alcohol consumption by family members and peer drinking, and easy access to alcohol are important causes of alcohol consumption among medical students, and then based on the results of the qualitative study, improving health literacy is the main method to effectively reduce alcohol consumption among adolescents. Based on the above results and according to the health literacy theory, we drafted the health literacy intervention program. The first is the theme of the program, the second is the time of

the program, the second is the practice process, and the last is the evaluation criteria. The aim is that the improvement of the 6 skills of health literacy is carried out throughout each thematic activity.

3.2.4.2 Discussion of a health literacy program intervention with the experts

Six health literacy experts were invited to discuss the health literacy activity plan, which centered on the theme, objectives, activity details, activity methods, materials and duration of each activity. The theme centered on "alcohol use" and "health literacy"; the objectives centered on the enhancement of the 6 skills of health literacy; the details of the activities included: setting tasks - issuing tasks - completing tasks - reporting tasks; the method of the activities was mainly based on group discussion; and the method of the activities was mainly based on group discussion. -Reporting on the task; the method of activity is mainly based on group discussion, the materials should be closely related to the objectives of each activity, and the duration of each activity is 4 hours. After the debriefing by the facilitator, each part was discussed one by one with the 6 experts until all experts agreed on each item in its entirety.

3.2.4.3 Revising the health literacy program intervention

For poorly designed health literacy activities, after discussion, changes were made on the spot, and after the changes were made, discussions were held again until the content was finalized after all approved by a show of hands (a show of hands if you agree). For the activities that were presented as needing revision, each expert needed to express his or her opinion on the revision and give the basis for it. After discussion and reviewing the literature to find the best evidence, the entire activities of the health literacy intervention program were finalized.

3.2.4.4 Verifying the health literacy program intervention

After the first 2 rounds of discussion on the health literacy intervention, the 6 experts were again asked to comment, and the discussion still centered on the theme, objectives, details of the activity, methodology of the activity, materials, and duration of each activity. Each expert commented on and agreed with each item. After all experts agreed, we finalized the health literacy intervention.

3.2.4.5 The characteristics of final intervention

Intervention

The health literacy program consists of six sessions with a total of six activities. The intervention team attended six health literacy program activities, each of which began with a public health specialist initiating the activity. One activity was delivered per week, so the total duration of intervention implementation is six weeks. Our program runs from June 4 - July 9, 2023, every Sunday from 2:00 - 6:00 p.m. The dates for each program are June 4, June 11, June 18, June 25, July 2, and July 9 (summer vacation in China is usually around July 15).

The public health specialist implemented the intervention based on the activity theme, with an intervention time of 4 hours per activity. The tasks were delivered in small groups of 6-7 students each. The group discussion started when they received the task assignments. Each student received a different task under the arrangement of the group leader and would complete the task individually first before discussing within the group. One student was selected to report and present the results 1 hour before the end of the activity (for each theme activity, the student must report the results that differ from the previous one). At the end of each session, the public health specialist summarizes the contents. The themes for all activities are as follows:

1. The theme of the first event was alcohol knowledge. Its aim is to summarize the data collected, making trade-offs and checking multiple sources to choose the best evidence to improve the students' understanding of alcohol.

2. The theme of the second event was drinking harm. Its aim is to summarize the dangers of alcohol in all areas, asking the medical students not only to internalize their knowledge but also to share what they have learned with their relatives, classmates, and friends around them, and to take more practical actions to help others and take up the mission of medical students.

3. The theme of the third event was the current state of drinking in China. Its aim is to let medical students know about the current situation of alcohol consumption in China and the wrong concept of drinking. As medical students, we are the guardians of future health, and we have the responsibility and obligation to do something meaningful to change the current situation of alcohol consumption in China.

4. The theme of the fourth event was health literacy. Its aim is to make medical students aware of plans to improve health literacy in China and the importance of health literacy to the health of the Chinese population.

5. The theme of the fifth event was to avoid and reduce alcohol consumption. Its aim is to make medical students understand that the most important way to avoid and reduce alcohol consumption is to improve their health literacy and intrinsic motivation by guiding students' behavior.

6. The theme of the sixth event was to change adolescent drinking attitudes. Its aim is to change the understanding and attitude of medical students towards drinking so that they know that they are the guardians of people's health, the disseminators of healthy behaviors, and the defenders of their own health.

3.2.5 The regular health education

Control group

The students who were allocated to the control group did not receive any of the health literacy program components. Instead, they continued with their regular health education from their college, which was offered by the teacher, and did not focus on reducing alcohol use. The characteristics of the regular health education is the themes of the activities are mainly from the documents issued by the Hubei Provincial Department of Education. The activities are mainly carried out in the form of class meetings, which are completed by counselors or class leaders in the form of health education at weekly class meetings. Students don't have to do any preparation themselves, they just need to attend the weekly class meeting on time, and they don't need to have any report after the meeting.

3.2.6 Study procedure

Before the beginning of the health literacy program intervention, baseline characteristics and outcome measurements were completed by both groups. Then, the health literacy program was delivered to the intervention group for six weeks of six sessions. Then, outcome measurements were conducted in both groups after intervention completion. The data collection procedure was the same for both the intervention and control groups.

3.2.7 Data collection in phase II

The primary outcome was the change in health literacy score from baseline to after the intervention. The secondary outcome was changes in alcohol use behavior. A web-based online survey will be conducted. First, the questionnaire will be uploaded to Wenjuanxing (https://www.wjx.cn/), an online questionnaire system, and a link and QR code will be created by Wenjuanxing. Before implementing the program, the questionnaire link and QR code will be forwarded to participants through the Wechat app. Survey participation is voluntary, and each participant logs in with a special social media account and IP address, allowing the participants to respond to the survey questionnaire only once. Informed consent will be obtained from the participants before they start the survey. The system will remind respondents of missing responses before submission, and only fully completed questionnaires will be submitted. The survey takes about 15 to 25 minutes to complete. After the implementation of the intervention, the same survey would be sent to the participant again.

3.2.8 Data analysis in phase II

Raw data was numerically coded and entered in Excel version 2013 (Microsoft, 2021). It was carefully examined for entry errors and missing values; any questionnaire with missing data would be excluded from analysis. Descriptive statistics were used to analyze the participants' characteristics and outcomes. The frequency and percentage of categorical variables and the mean and standard deviation (SD) of normally distributed continuous variables. For the comparison of baseline characteristics of participants between intervention and control groups, Chi-square tests were used for categorical variables and independent sample t-tests were used for normally distributed continuous variables. We compared the outcome measurement before and after intervention within groups; the paired sample t-test was used for normally distributed continuous variables, and the Chi square test was used for categorical variables. Besides, to compare the change in outcomes between the intervention and control groups before and after intervention, Chi-square tests were used to evaluate the change in alcohol use behavior, and independent sample t-tests were used to evaluate the changes in health literacy scores. Statistical significance will be set at P <0.05.

3.3 Ethical approval

This study will be approved by the Ethics Committee for Research Involving Human Subjectd, Mahasarakan University in Thailand (Ethics number: 164-053/2566. The participants will be informed of the study objectives and procedures, and their participation is voluntary. They will be informed of their rights to decline to participate or withdraw at any time without penalty. In order to maintain ethical principles and the privacy of the participants, all responses will be collected and analyzed without identifiers.

CHAPTER 4
RESULTS

This is a mixed-methods study of the effectiveness of health literacy programs to reduce alcohol use among medical students in Hubei Province, China. The study is divided into two phases. In Phase 1, the researcher utilized quantitative and qualitative methods, and in Phase 2, a cluster-randomized controlled trial was used to evaluate the effectiveness of health literacy programs to reduce alcohol use. The results of this study were as follows:

Phase 1: Quantitative and qualitative results

1. Quantitative results

1.1 The demographic characteristics, alcohol use behavior, and health literacy levels.

1.2 Factors associated with alcohol use among medical students in the social-ecological model

1.2.1 Bivariate model

1.2.2 Multivariate model

1.3 The hypothesis testing of phase I.

2. Qualitative results

2.1 The social normal of alcohol use

2.2 The experiences of stopping or reducing alcohol consumption.

2.3 The effect of alcohol use on medical students.

Phase 2: The development and evaluation the effectiveness of health literacy programs to reduce alcohol use:

1. The development of a health literacy program to reduce alcohol use.
2. The evaluation the effectiveness of a health literacy program to reduce alcohol use.

2.1 The comparison of baseline characteristics and alcohol use behavior between intervention and control groups.

2.2 The comparison of health literacy scores between intervention and control groups at baseline.

2.3 The comparison of health literacy scores and alcohol use behavior within intervention groups at before and after intervention.

2.4 The comparison of health literacy scores and alcohol use behavior within control groups at before and after intervention.

2.5 The comparison of health literacy scores between intervention and control groups before and after intervention.

2.6 The comparison of alcohol use behavior between intervention and control groups before and after intervention.

2.7 The hypothesis testing of phase II.

4.1 Phase 1: Quantitative and qualitative results.

4.1.1 Quantitative results

4.1.1.1 The demographic characteristics, alcohol use behavior, and health literacy levels.

The majority of medical students were female (51.8%), the median age was 19 years. Approximately 45.3% of medical students use alcohol, about 11.5% were hazardous drinkers, and 33.8% were low-risk drinkers. More than one third (38.5%) had a monthly household income of 3001–5000 CNY, and more than half reported that their family member (59.3%) and peer (51.7%) were drinking. Most medical students reported high levels of PAEs (50.1%) or NAEs (54.7%). The overall health literacy levels showed that about 49.3% of them had a low level of health literacy. When divided by alcohol use behavior, about 94.7% of hazardous drinkers and 72.9% of low-risk drinkers had a low level of health literacy (Table 2).

Table 2 Distribution of individual, interpersonal, and community-level variables by alcohol use.

Variables	Total (n=1146)	Hazardous (n=132)	Low-risk (n=387)	No drinking (n=627)	*p*-value[#]
	n (%)	n (%)	n (%)	n (%)	
Individual-level					
Health literacy					
Cognitive skill					0.027*
Low	326(28.4)	49(37.1)	171(44.2)	106(16.9)	
High	820(71.6)	83(62.9)	216(55.8)	521(83.1)	
Access skill					0.002*
Low	498(43.5)	99(75.0)	231(59.7)	168(26.8)	
High	648(56.5)	33(25.0)	156(40.3)	459(73.2)	
Communication skill					0.001*
Low	554(48.3)	109(82.6)	248(64.1)	197(31.4)	
High	592(51.7)	23(17.4)	139(35.9)	430(68.6)	
Self-management skill					0.004*
Low	560(48.9)	120(90.9)	257(66.4)	183(29.2)	
High	586(51.1)	12(9.1)	130(33.6)	444(70.8)	
Media skill					0.015*
Low	572(49.9)	122(92.4)	256(66.1)	194(30.9)	
High	574(50.1)	10(7.6)	131(33.9)	433(69.1)	
Decision skill					0.003*
Low	515(44.9)	83(62.9)	226(58.4)	206(32.9)	
High	631(55.1)	49(37.1)	161(41.6)	421(67.1)	
Total health literacy					0.018*
Low	565(49.3)	125(94.7)	282(72.9)	158(25.2)	
High	581(50.7)	7(5.3)	105(27.1)	469(74.8)	
Age(y)					0.004*
≤19	714(62.3)	93(70.5)	255(65.9)	366(58.4)	
<19	432(37.7)	39(29.5)	132(34.1)	261(41.6)	
Gender					0.009*
Male	552(48.2)	79(59.8)	201(51.9)	272(43.4)	
Female	594(51.8)	53(40.2)	186(48.1)	355(56.6)	
Monthly household income (CNY)					0.108
<1000	179(15.6)	23(17.4)	59(15.2)	97(15.5)	
1000-3000	349(30.5)	26(19.7)	114(29.5)	209(33.3)	
3001-5000	441(38.5)	43(32.6)	135(34.9)	263(41.9)	
>5000	177(15.4)	40(30.3)	79(20.4)	58(9.3)	
Smoking					0.001*
Yes	283(24.7)	58(43.9)	124(32.0)	101(16.1)	
No	863(75.3)	74(56.1)	263(68.0)	526(83.9)	
Positive alcohol expectancies					0.012*
High	574(50.1)	85(64.4)	240(62.0)	249(39.7)	
Low	572(49.9)	47(35.6)	147(38.0)	378(63.3)	
Negative alcohol expectancies					0.361
High	627(54.7)	81(61.4)	219(56.6)	327(52.2)	
Low	519(45.3)	51(38.6)	168(43.4)	300(47.8)	

as number (%); CNY, Chinese Yuan; [#] *p*-value for chi-square test.
* Statistically significant ($p<0.05$)

Note: Values are presented

Table 2 Distribution of individual, interpersonal, and community-level variables by alcohol use (cont.).

Variables	Total (n=1146)	Hazardous (n=132)	Low-risk (n=387)	No drinking (n=627)	*p*-value[#]
	n (%)	n (%)	n (%)	n (%)	
Interpersonal-level					
Family member alcohol use					0.001*
Yes	680(59.3)	99(75.0)	260(67.2)	321(51.2)	
No	466(40.7)	33(25.0)	127(32.8)	306(48.8)	
Peer alcohol use					0.005*
Yes	593(51.7)	85(64.4)	244(63.0)	264(42.1)	
No	553(48.3)	47(35.6)	143(37.0)	363(57.9)	
Community-level					
Social norm of alcohol use					0.179
High	609(53.1)	55(41.7)	180(46.5)	374(59.6)	
Low	537(46.9)	77(58.3)	207(53.5)	253(40.4)	
Easy access to alcohol					0.013*
Yes	814(71.0)	108(81.8)	300(77.5)	406(64.8)	
No	332(29.0)	24(18.2)	87(22.5)	221(35.2)	

Note: Values are presented as number (%); [#] *p*-value for chi-square test.
* Statistically significant ($p<0.05$)

4.1.2 Factors associated with alcohol use among medical students under the social-ecological model.

4.1.2.1 Bivariate model

Bivariate Models: In both the low-risk and hazardous levels of the drinking category, the lower levels of health literacy and all six dimensions of health literacy were associated with an increase in alcohol use. Male medical students, aged 19 years and above, smoked, had a monthly household income of more than 5000 CNY, with family members and peers who drink, had a high level of PAEs or social norms of alcohol use, and with easy access to alcohol were more likely to be alcohol users. However, there was no significant association between monthly household income less than 5000 CNY, NAEs, and alcohol use (Tables 2 and 3)

4.1.2.2 Multivariate model

Multivariable Models: In multinomial logistic analyses, the findings were almost similar for both hazardous and low-risk drinking categories. Model 1 showed that greater use of alcohol by males, and smokers was associated with lower levels of total health literacy and the six dimensions of health literacy, monthly household

income greater than 5000 CNY, and a higher level of PAEs. In model 2, interpersonal-level factors were added to model 1, family member use and peer alcohol use were significantly related to drinking. In model 3, community-level factors were added to the model. Results revealed a similar association between the individual and interpersonal-level variables and alcohol use in model 2. Similarly, total health literacy and the six dimensions of health literacy remained significantly associated with alcohol use after controlling for other predictors. Additionally, students who had easy access to alcohol were more likely to use it (Tables 3 and 4).

Table 3 Odds ratios and 95 %confidence intervals from multinomial logistic regression for low-risk drinking .

Variables	Bivariate		Model 1		Model 2		Model 3	
	Unadjusted OR (95%CI)	*P* value	Adjusted OR (95%CI)	*P* value	Adjusted OR (95%CI)	*P* value	Adjusted OR (95%CI)	*P* value
Individual-level								
Health literacy								
Low cognitive skill (ref: High)	3.89(2.91,5.19)	<0.001	3.31(2.32,4.74)	<0.001	3.48(2.42,5.02)	<0.001	3.50(2.41,5.07)	<0.001
Low access skill (ref: High)	4.04(3.09,5.29)	<0.001	2.07(1.45,2.97)	<0.001	2.08(1.44,3.00)	<0.001	2.11(1.46,3.05)	<0.001
Low communication skill (ref: High)	3.89(2.98,5.08)	<0.001	1.81(1.27,2.58)	0.001	1.74(1.21,2.49)	0.002	1.72(1.20,2.47)	0.003
Low self-management skill (ref: High)	4.76(3.65,6.29)	<0.001	1.89(1.27,2.81)	0.002	1.79(1.19,2.67)	0.005	1.73(1.15,2.59)	0.008
Low media skill (ref: High)	4.36(3.32,5.71)	<0.001	1.48(1.00,2.19)	0.048	1.54(1.03,2.28)	0.032	1.50(1.01,2.23)	0.043
Low decision skill (ref: High)	2.86(2.20,3.72)	<0.001	2.32(1.65,3.24)	<0.001	2.19(1.55,3.08)	<0.001	2.12(1.49,3.00)	<0.001
Low total health literacy (ref: High)	7.97(5.98,10.62)	<0.001	1.73(1.07,2.80)	0.024	1.76(1.08,2.86)	0.021	1.79(1.10,2.91)	0.019
Age≤19 (y) (ref: <19)	1.37(1.05, 1.79)	0.017	1.22(0.88,1.70)	0.228	1.18(0.84,1.65)	0.333	1.16(0.83,1.63)	0.368
Male (ref: Female)	1.41(1.09,1.81)	0.008	1.58(1.15,2.18)	0.005	1.65(1.19,2.29)	0.003	1.63(1.17,2.27)	0.003
Monthly household income (CNY)								
1000-3000	0.89(0.60,1.33)	0.590	1.23(0.75,2.00)	0.409	1.30(0.79,2.14)	0.300	1.26(0.76,2.09)	0.357
3001-5000	(0.57,1.23)0.84	0.387	(0.67,1.75)1.08	0.740	(0.71,1.90)1.16	0.531	(0.69,1.85)1.13	0.619
>5000 (ref: <1000CNY)	(1.40,3.57)2.23	0.001	2.41(1.34,4.35)	0.003	(1.38,4.63)2.53	0.003	2.46(1.33,4.52)	0.004
Smoking (ref: No)	2.45(1.81,3.32)	<0.001	1.75(1.18,2.58)	0.005	1.73(1.17,2.55)	0.006	1.70(1.14,2.52)	0.008
High PAEs (ref: Low)	2.47(1.91,3.21)	<0.001	2.98(2.09,4.26)	<0.001	2.82(1.96,4.05)	<0.001	2.84(1.98,4.09)	<0.001
High NAEs (ref: Low)	1.19(0.92,1.54)	0.169	0.80(0.56,1.14)	0.233	0.77(0.54,1.10)	0.153	0.77(0.53,1.10)	0.158
Interpersonal-level								
Family member alcohol use (ref: No)	1.95(1.49,2.54)	<0.001			1.49(1.07,2.08)	0.016	1.47(1.05,2.05)	0.022
Peer alcohol use (ref: No)	2.34(1.80,3.04)	<0.001			1.96(1.41,2.73)	<0.001	1.95(1.40,2.72)	<0.001
Community-level								
High social norm of alcohol use (ref: Low)	0.58(0.45,0.76)	<0.001					0.91(0.65,1.26)	0.584
Easy access to alcohol (ref: No)	1.87(1.40,2.50)	<0.001					1.70(1.18,2.45)	0.004

OR, odds ratio; aOR, adjusted OR; CI, confidence interval; ref, reference group; CNY, Chinese Yuan.

Table 4 Odds ratios and 95 %confidence intervals from multinomial logistic regression for hazardous drinking.

Variables	Bivariate		Model 1		Model 2		Model 3	
	Unadjusted OR (95%CI)	*P* value	Adjusted OR (95%CI)	*P* value	Adjusted OR (95%CI)	*P* value	Adjusted OR (95%CI)	*P* value
Individual-level								
Health literacy								
Low cognitive skill (ref: High)	2.90(1.92,4.37)	<0.001	2.01(1.20,3.35)	0.007	2.08(1.24,3.50)	0.006	2.07(1.22,3.51)	0.006
Low access skill (ref: High)	5.19(4.32,7.62)	<0.001	2.48(1.43,4.28)	0.001	2.43(1.40,4.24)	0.002	2.40(1.37,4.19)	0.002
Low communication skill (ref: High)	4.34(3.39,6.72)	<0.001	2.36(1.32,4.24)	0.004	2.24(1.24,4.04)	0.007	2.21(1.22,4.00)	0.009
Low self-management skill (ref: High)	5.26(4.07,6.50)	<0.001	4.47(2.14,9.32)	<0.001	4.17(1.99,8.75)	<0.001	4.01(1.91,8.44)	<0.001
Low media skill (ref: High)	4.72(3.98,5.73)	<0.001	4.67(2.15,10.12)	<0.001	4.84(2.23,10.52)	<0.001	4.68(2.15,10.17)	<0.001
Low decision skill (ref: High)	3.46(2.34,5.11)	<0.001	2.51(1.53,4.11)	<0.001	2.35(1.42,3.89)	0.001	2.25(1.35,3.74)	0.002
Low total health literacy (ref: High)	7.81(5.97,10.78)	<0.001	3.22(1.19,8.66)	0.021	3.32(1.23,8.99)	0.018	3.48(1.28,9.45)	0.014
Age≤19 (y) (ref: <19)	1.70(1.13, 2.55)	0.010	1.49(0.90,2.46)	0.117	1.47(0.88,2.45)	0.133	1.48(0.88,2.47)	0.131
Male (ref: Female)	1.94(1.32,2.85)	0.001	2.24(1.39,3.61)	0.001	2.35(1.45,3.81)	0.001	2.61(1.17,5.81)	0.018
Monthly household income (CNY)								
1000-3000	0.52(0.28,0.96)	0.038	0.74(0.35,1.56)	0.435	0.79(0.37,1.68)	0.544	0.76(0.36,1.63)	0.495
3001-5000	(0.39,1.20)0.69	0.191	(0.43,1.75)0.87	0.710	(0.46,1.91)0.94	0.878	(0.45,1.87)0.92	0.826
>5000 (ref: <1000CNY)	(1.58,5.33)2.90	0.001	(1.23,5.84)2.68	0.013	(1.21,5.96)2.69	0.014	(1.17,5.81)2.61	0.018
Smoking (ref: No)	4.08(2.72,6.11)	<0.001	2.39(1.42,4.03)	0.001	2.37(1.40,4.01)	0.001	2.30(1.35,3.91)	0.002
High PAEs (ref: Low)	2.74(1.85,4.05)	<0.001	3.03(1.79,5.12)	<0.001	2.81(1.65,4.78)	<0.001	2.81(1.65,4.80)	<0.001
High NAEs (ref: Low)	1.45(0.99,2.13)	0.055	0.93(0.56,1.56)	0.803	0.91(0.54,1.52)	0.720	0.91(0.54,1.53)	0.726
Interpersonal-level								
Family member alcohol use (ref: No)	2.86(1.87,4.37)	<0.001			1.87(1.11,3.16)	0.018	1.88(1.11,3.19)	0.019
Peer alcohol use (ref: No)	2.48(1.68,3.67)	<0.001			1.81(1.10,2.97)	0.018	1.79(1.09,2.95)	0.021
Community-level								
High social norm of alcohol use (ref: Low)	0.48(0.33,0.70)	<0.001					0.85(0.52,1.38)	0.519
Easy access to alcohol (ref: No)	2.45(1.52,3.92)	<0.001					2.09(1.17,3.74)	0.012

OR, odds ratio; aOR, adjusted OR; CI, confidence interval; ref, reference group; CNY, Chinese Yuan.

4.1.2.3 The hypothesis testing of phase I.

We hypothesized that alcohol use behavior would be related to individual, interpersonal, and community factors based on the social-ecological model. Our results supported this hypothesis which showed that the three-level factors of a socio-ecological model such as individual–level variables (all six dimensions of health literacy, low total health literacy, male, monthly household income>5000CNY, smoking, High PAEs), interpersonal-level variables (family member alcohol use, peer alcohol use) and community-level variables (easy access to alcohol) were related to alcohol use among medical students

4.1.3 Qualitative results

Based on the theoretical framework of the qualitative study, an outline of the interviews was created, codes were determined, and the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effects of alcohol use on medical students were analyzed.

A sample group of 15 participants was created for the qualitative study, including 9 medical students with drinking habits, 2 education specialists, 2 health promotion specialists, and 2 mental health specialists. Data was coded and analyzed using the qualitative research tool Maxqda2020, with primary codes for the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effects of alcohol use on medical students.

4.1.3.1 The social norms of alcohol use

Secondary coding of the social norms on alcohol consumption: inadequate supervision in schools; feeble laws and regulations prohibiting young people from accessing alcohol; public media platforms (Weibo, Douyin, Kuai shou, etc.) only prompt and do not prohibit the broadcast of these videos; lack of social supervision of distilleries and alcohol distributors; increasing social supervision and changing the mindsets of medical students are two of the most important strategies to reduce consumption by medical students (Figure 6).

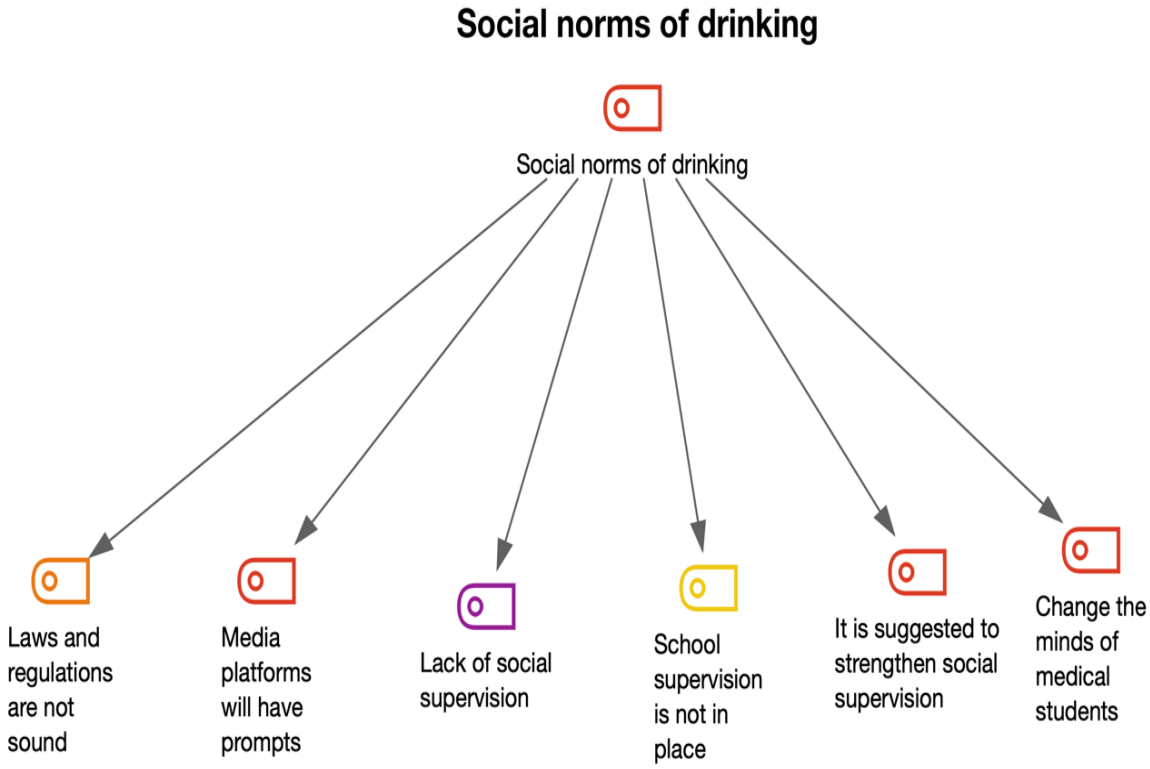


Figure 6 Visualization of social norms of alcohol consumption among medical students

4.1.3.2 The experiences of stopping or reducing alcohol consumption

Secondary coding of ways on the experiences of stopping or reducing alcohol consumption: At the individual and family levels, the first step is to increase one's self-health literacy and self-awareness with a sense of purpose as a medical student, thereby increasing one's own internal motivation. Parents need to be good role models and guide their children well, helping them to develop the right outlook and values in life. Secondly, scientific methods can be used to divert the attention of medical students from taking alcohol. At school, rules against alcohol consumption should be implemented, and more activities should be organized to prohibit alcohol consumption. Teachers should also provide proper guidance on this topic. Secondly, there is a need to strengthen peer education and raise self-awareness among medical students. At the social level, increase social awareness of the dangers of alcohol consumption and use negative examples to raise awareness of the dangers of alcohol consumption among young people. To increase regulation of alcohol sellers at the

national level, the government must implement and execute state laws and regulations to prohibit the consumption of alcohol among young people and increase funding to earmark the control of alcohol consumption among students (Figure 7).

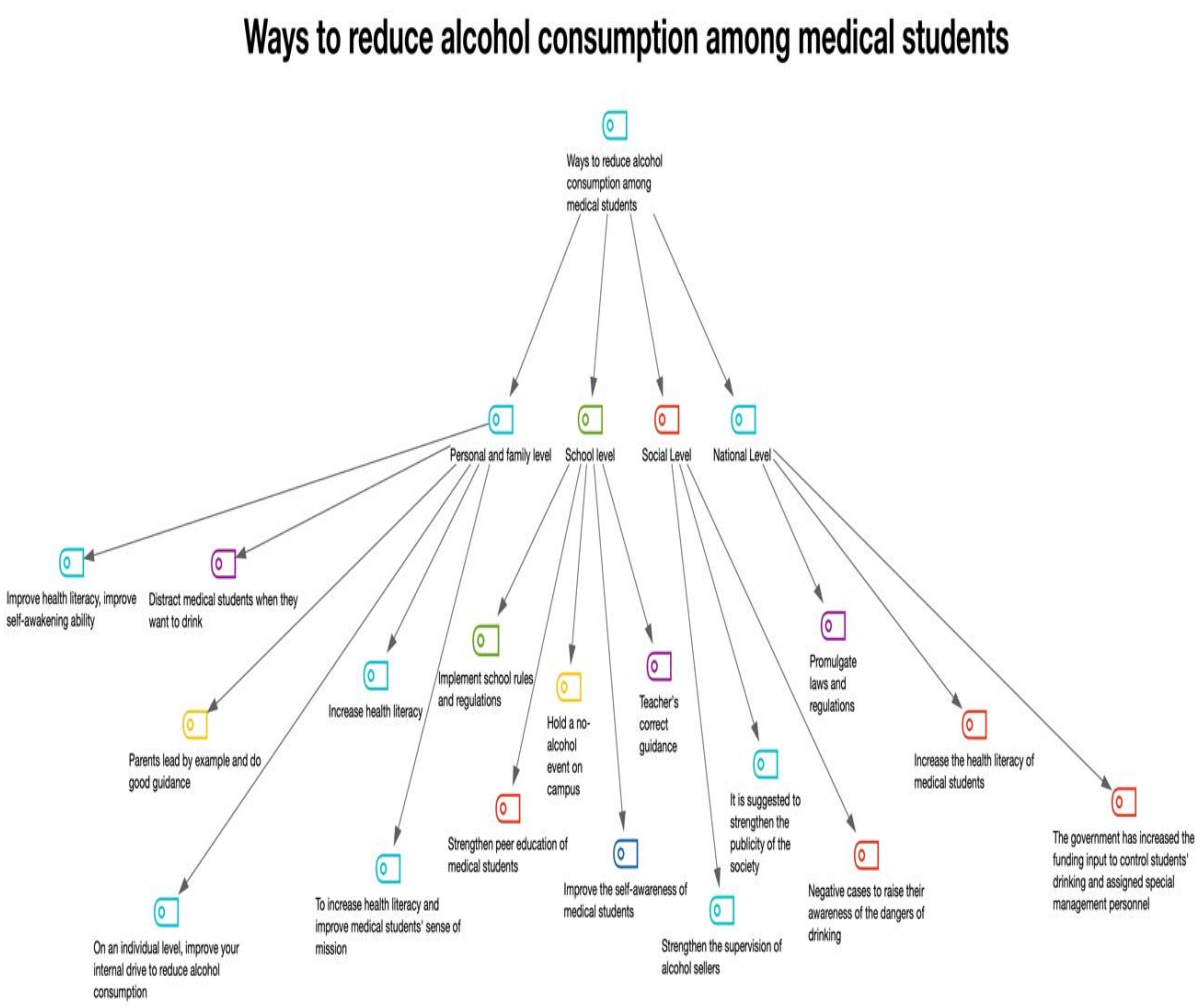


Figure 7 Visualization of reduced drinking patterns among medical students

4.1.3.3 The effects of alcohol use on medical students

Secondary codes for the effects of alcohol use on medical students: experts' attitudes toward medical students' drinking, the harmful effects of their drinking, and characteristics of these medical students who drink. The results of the analysis showed that all experts had negative attitudes toward medical students' drinking, but medical students who loved to drink had positive attitudes toward their own behavior but said they would drink only after work or study. The main risks of alcohol consumption among medical students include social (drunken fights and attacks, intentional injuries, etc.), academic (failing exams, delayed graduation, etc.), family

(increasing financial pressure on the family), career (increasing alcohol affects the nervous system, which may lead to muscle trembling), psychological (increasing alcohol addiction causes them to develop a sense of shame), and physical (damaging the liver, stomach, brain, and heart, etc.). More details are in Figure 4 below. The sample group consisted of 15 participants in the qualitative study, including 9 medical students with drinking habits, 2 education specialists, 2 health promotion specialists, and 2 mental health specialists. The data were coded and analyzed using the qualitative research tool Maxqda2020, with primary codes: reasons for medical students' drinking, social norms of drinking, and ways to reduce medical students' drinking (Figure 8).

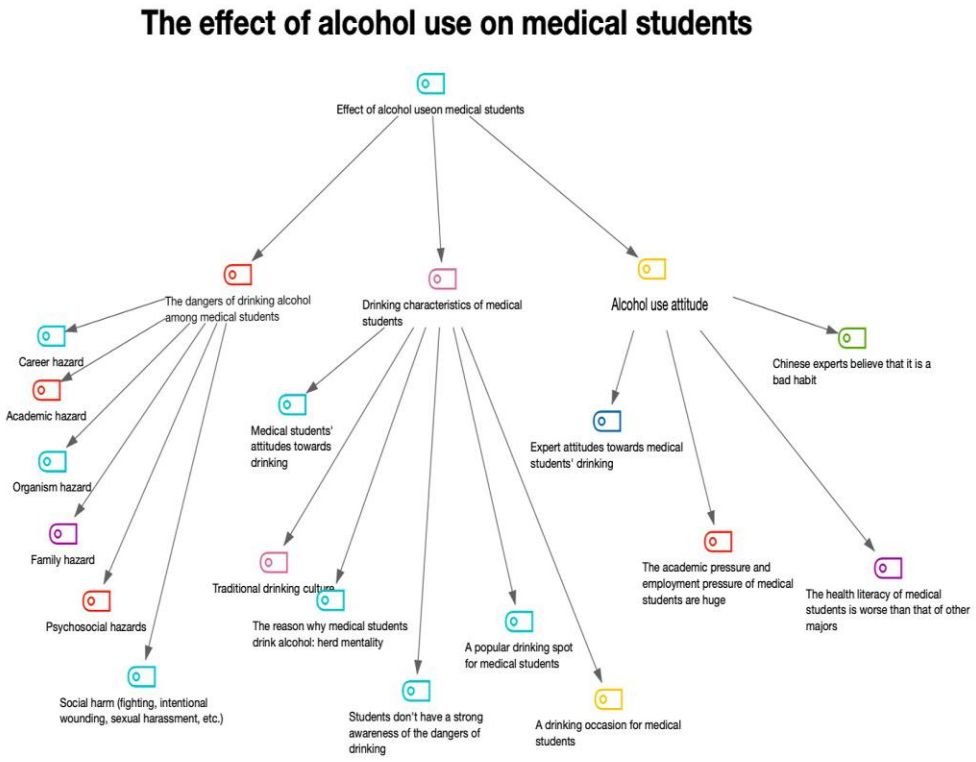


Figure 8 Visualization of the effect of alcohol use on medical students

4.2 Phase 2: The development and evaluation of a health literacy program to reduce alcohol use

4.2.1 The development of a health literacy program to reduce alcohol use

4.2.1.1 The intervention development process

Constructing the intervention program mainly includes the following steps: setting up a subject group, forming a draft of the intervention program, organizing an expert meeting to validate the intervention program, and forming the intervention program.

Setting up a subject group: the researcher invited six experts from health education, public health or health promotion departments to form a subject group for the health literacy intervention.

Formation of the draft intervention program: Before the start of this study, members of the group read a large amount of domestic and international literature on health literacy interventions, studied successful cases of health literacy improvement in domestic and international populations, and carefully studied the purpose, content, and evaluation criteria of the theoretical model of health literacy of the Nutbeam D scholars in order to draw up a draft of the health literacy interventions. The intervention centered on training medical students in six skills to improve their health literacy in order to reduce and eliminate alcohol consumption, with medical students as the main participants and public health experts leading the activities. Six activities were organized around the theme of alcohol use and health literacy. Each event entailed the achievement of all six dimensions of health literacy skills. All six activities were repeated and practiced so that medical students would memorize them.

Organizing an expert meeting to validate the intervention program: using the method of expert meeting to validate the intervention program, the moderator arranged the content of the meeting before the beginning of the meeting, which included: introduction of the background of the study, the purpose of the study and the general information questionnaire of the experts (mainly including age, education, title, position, years of working experience, field and area of specialization); the text of the health literacy intervention program; and the content of evidence of health literacy interventions used by other researchers.

Shaping the intervention program: Three meetings were held to finalize the intervention for the health literacy program. The three meetings were as follows: In

the first meeting, the facilitator briefed the six health literacy experts on the health literacy interventions that had been drafted and discussed the health literacy program of activities with the six health literacy experts, with the discussion focusing on the theme, objectives, details of the activities, methods of the activities, materials and duration of each activity. After the facilitator's report, the six experts expressed their opinions on the theme, objectives, activity details, activity methods, materials and duration of the activities. After the meeting, the facilitator reorganized the program of health literacy interventions based on the experts' opinions. The second meeting was held one week later, in which the facilitator reported on the organized health literacy intervention plan, and the six experts again expressed their opinions on the theme, objectives, details of the activities, activity methods, materials and duration of the activities, and resolved the disagreements through discussion and a vote by show of hands. A third meeting was held after another week, and the facilitator again reported on the content of the revised health literacy intervention program. Each expert had to comment and vote by show of hands on all elements of each activity, and the health literacy intervention was finalized.

4.2.1.2 The final intervention characteristics

The main features of the health literacy program (HLP) to reduce alcohol use intervention are presented, and Table 5 below focuses on the objectives of the HLP activities, the details of the activities, the main point presented, and the activity timings. Table 6 focuses on the core objectives of HLP and usual education activities.

In the intervention group, the medical students received an HLP intervention that was divided into two parts: the first part was a 6-week themed class meeting, and the second part was a health literacy intervention developed based on Nutbeam's theory.

The health literacy program (HLP) consists of six sessions with a total of six activities. One activity was delivered per week, with an intervention time of 4 hours per activity. The activity sessions were as follows: The public health specialist assigned the tasks to the participants. The medical students will complete the tasks through group discussion in small groups; after that, they will report and present the results in small groups. Then, the public health specialist gave a final summary.

The time allocated for the activity was as follows: the public health expert introduced the theme of the activity and assigned the task (15 min); the task was completed in small groups (150 min); the results were reported and presented in

small groups (60 min); and the public health expert summarized and declared the end of the activity (15 min). The recruited drinking medical students were randomly divided into 8 groups (4 groups of 6 students and 4 groups of 7 students).

The process of the activity was as follows: the public health expert assigned the task according to the theme of each activity; the leader of the group assigned the task to group members; then, the students completed the task individually and had discussions within the group.

In each group, the group members worked together to make the materials for the report for 1 hour before the end of the activity; one student in each group was selected to report and present the results (each student in the group had to take turns in the report); and the public health expert made a final summary.

In the control group, the medical students received regular health education based on the weekly theme class meetings developed by the school, the content of which was based on the documents issued by the Provincial Department of Education of Hubei Province, which called for the enhancement of all the qualities of the students and the cultivation of qualified successors to the modernization of socialism. All activities and pictures are in the appendix at the end.

Table 5 The summary of health literacy program to reduce alcohol use.

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
1	**alcohol knowledge**	**Cognitive dimension:** To improve knowledge about alcohol. **Access dimension:** To search for and gain access to information about alcohol. **Communication dimension:** To improve communication skills to provide information about alcohol to others. **Self-management dimension:** To manage ourselves to avoid drinking alcohol. **Media literacy dimension:** To analyze data on alcohol reported in the media. **Decision dimension:** To utilize the information received to make decisions about avoiding alcohol.	**Cognitive skills:** medical students find out the history of alcohol, its classification, its practical uses, its physical and chemical properties, and the whole spectrum of analysis. **Access skills:** Initially, use books, the internet, and close drinking friends to get information about the dangers of alcohol. Conduct relevant research and ask questions of friends around you who drink. **Communication skills:** For the information retrieved, the students, led by their group leaders, actively discussed the information, sifted through the poor and false information, discussed the useful information, and chose to use the creation of boards and slides to pass on the useful information and share with the group. **Self-management skills:** Students identified ways to manage drinking as: distracting or finding alternatives to carry out avoidance of alcohol; showing that they don't drink at friends' workplaces; attending classmates' parties; and reducing the fluke of having just one drink. **Media literacy skills:** medical students had finished making their slides and drawing their handbills. From their reports, it was clear that most of them had internalized their	Presentations, case studies, panel discussions, sitcom performances, oral presentations, board papers, comedy, brochures.	Paper, Pens, Chalkboard, Whiteboard, Computer, Ipad, Phone.	**4 hours** 1. Introduction the theme of the activity and assigned the task (15 min) 2. completed the task in small groups (150 min) 3. reporte and present in small groups (60 min) 4. Summarized and declared the end of the activity (15 min)

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
			knowledge of alcohol and also spoke about alcohol awareness. **Decision skills:** medical student found that they could use the Alcohol Metabolism Capacity Predictor to measure their maximum drinking capacity and thus drink in moderation.			
2	**Drinking harm**	**Cognitive dimension:** To increase our awareness of the harm of drinking. **Access dimension:** To search for and gain access to information on the harm of drinking. **Communication dimension:** To effectively use communication skills to provide information on the harms of drinking to people around us. **Self-management dimension:** To manage ourselves to avoid drinking alcohol. **Media literacy dimension:** To analyze the data on the harms of drinking that we have retrieved. **Decision dimension:** To use the information about the	**Cognitive skills:** Excessive alcohol consumption is also harmful to the human body and can greatly damage the digestive system, cause oesophageal cancer, damage the liver, increase the incidence of cardiovascular disease, and increase the burden on our body functions. **Access skills:** retrieve information on the dangers of alcohol from Baidu, literature reading, internet videos, descriptions from experts studying substance addiction, and Bailiff's publicity pieces, and then combine them with your own perceptions to summarize the information on the dangers of alcohol. **Communication skills:** Led by the group leader, students work together to analyze the information we have all collected and discuss the validity and accuracy of the information. During the discussion, students express their own opinions and select information to share with experts and other students. **Self-management skills:** As for self-	Presentations, case studies, panel discussions, sitcom performances, oral presentations, board papers, comedy, brochures.	Paper, Pens, Chalkboard, Whiteboard, Computer, Ipad, Phone.	**4 hours** 1. Introduction the theme of the activity and assigned the task (15 min) 2. completed the task in small groups (150 min) 3. reporte and present in small groups (60 min) 4. Summarized and

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
		harm of drinking that we found to warn ourselves not to drink alcohol.	management, one group said: distract yourself, find more meaningful things to do, attend group therapy and alcoholic meetings, use "group inertia" to discipline yourself, and develop good behavior habits. All the students agreed. **Media literacy skills:** The medical student had finished making slides and drawing handbills. The students were shown the dangers of alcohol consumption in a vivid way with accurate data, beautiful handbills, and interesting slides, as well as a realistic version of the "Emergency Department Story" to remind all students to stop drinking. **Decision skills:** real-life examples are harsh, but they are the best way to learn from them, and individual groups felt that it is only when we experience the social dangers of excessive drinking, such as fights and brawls when emotions are out of control, excessive financial pressure causing family discord, and fatal damage to various body systems. Vivid examples are the only way to better warn yourself against alcohol consumption.			declared the end of the activity (15 min)
3	**Current state of drinking in China**	**Cognitive dimension:** To raise awareness on the dangers of alcohol consumption. **Access dimension:** To search and access data on	**Cognitive skills:** Tracing the history of China, one of the first brewing countries in the world, drinking has become a habit, influenced by traditional customs and culture. The real data vividly imagines the current situation of alcohol use among the Chinese	Presentations, case studies, panel discussions, sitcom performances,	Paper, Pens, Chalkboard, Whiteboard, Computer, Ipad, Phone.	**4 hours** 1. Introduction the theme of the activity and

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
		the current drinking situation of the general public. **Communication dimension:** To effectively use communication skills and real data to provide information on the current situation of alcohol consumption to people around us. **Self-management dimension:** To stop ourselves from drinking. **Media literacy dimension:** To analyze the data found on drinking in China. **Decision-making dimension:** To utilize the information found on the current drinking situation in China to keep ourselves away from alcohol.	population. **Access skills:** Students use the search tools at hand (computers, mobile phones, tablets), the online media commonly used by Chinese people (Weibo, Zhihu, Jitterbug, etc.), domestic and international research search websites (Zhiwang, Vipshop, Wanfang, Pubmed, Scopus, SpringerLink, etc.), and the official platforms of the CDC and WHO, with the help of the above search tools, to obtain data on the current status of alcohol consumption in China. **Communication skills**: Led by the group leader, the students had a heated discussion about the content of the drawing board and the content of the slide presentation around this thematic activity. Group 1 students' discussion resulted in reporting on the current status of alcohol consumption among Chinese youths; Group 2 chose to report on the current status of alcohol consumption in different regions of China; Group 3 chose the topic of the current status of alcohol consumption among Chinese university students; In addition to this, the students discussed their drinking habits and drinking cultures in their home countries. **Self-management skills:** What are some effective ways to reduce and eliminate one's drinking? The students presented several	oral presentations, board papers, comedy, brochures.		assigned the task (15 min) 2. completed the task in small groups (150 min) 3. reporte and present in small groups (60 min) 4. Summarized and declared the end of the activity (15 min)

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
			scientific methods, such as cognitive therapy, aversion therapy, family therapy, etc., with the ultimate goal of restraining and stopping drinking. In addition to these scientific methods, there are also ways to stop drinking in our lives by eating right, exercising in moderation, telling ourselves to stop smoking and drinking, and being optimistic at all times; and, of course, by correcting our thinking, shifting our focus, and staying away from the drinking scene. **Media literacy skills:** For each of the theme activities, students were required to retrieve information, draw a beautiful board, and create a slide show to report on the knowledge and skills gained during the day. **Decision skills:** Medical students concluded that family discord, domestic violence, and financial pressure mostly exist in the families of drinkers, and the proportion of dangerous things happening among drinkers is much higher than normal (e.g., car accidents, fights, provocations, addictive substances). Alcoholics are also more likely to suffer from a variety of illnesses as they get older. In conclusion, the majority of medical students indicate that they do not drink alcohol.			
4	**Health Literacy**	**Cognitive dimension:** To improve our health literacy. **Access dimension:** To	**Cognitive skills:** Health literacy is currently a hot topic of research for public health experts in China, and therefore more	Presentations, case studies, panel	Paper, Pens, Chalkboard, Whiteboard,	**4 hours** 1. Introduction

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
		search and explore the relationship between health literacy and alcohol use in the Chinese general public. **Communication dimension:** To effectively use communication skills to enhance the health literacy of the general public. **Self-management dimension:** To improve our own health literacy while avoiding alcohol. **Media literacy dimension:** To analyze the data retrieved on the relationship between health literacy and alcohol consumption in the general public. **Decision-making dimension:** To utilize the knowledge and skills found in health literacy to reduce alcohol consumption.	information can be retrieved. Students summarize the information retrieved and select the knowledge points that need to be mastered and reported on, for example: the definition of health literacy, the areas and populations of health literacy research in China, the level of health literacy in Chinese populations, etc. In the process of finding and summarizing, students gained a good understanding of health literacy. **Access skills:** Previously, students used to search for information using Baidu, Google, Wikipedia, Zhihu, Weibo, Pubmed, Scopus, Bing, etc. This activity seemed to find a more practical tool: the China Statistical Yearbook (a classification and compilation of all data produced and consumed by Chinese people over the year) and the CDC's This activity seemed to be a more useful tool than the "China Statistical Yearbook" (a breakdown and summary of all data on Chinese production and consumption over the year) and the CDC data (including national, provincial, city, and county disease control centers). As more activities are conducted, students' ability to retrieve valid information grows. **Communication skills**: Each group had a heated discussion on what effective communication skills to use to improve the	discussions, sitcom performances, oral presentations, board papers, comedy, brochures.	Computer, Ipad, Phone.	the theme of the activity and assigned the task (15 min) 2. completed the task in small groups (150 min) 3. reporte and present in small groups (60 min) 4. Summarized and declared the end of the activity (15 min)

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
			health literacy of the population. The students in Group 3 thought that the improvement of health literacy could not be changed overnight and that it should start with children so that basic medical knowledge and health-related knowledge can be used throughout education, making it a kind of general education. In addition to this, the exciting discussions gave each student a deep understanding of the improvement of health literacy in the Chinese population as one of the pathways to improving the health of the population. **Self-management skills:** For the question of how to manage oneself to improve one's health literacy in life while trying not to drink alcohol, the students gave four effective paths of implementation: 1. expand health education models to improve the quality of health education; 2. strengthen information processing skills to promote health skills mastery; 3. expand health education paths to strengthen health cultivation links; 4. emphasize family health education to improve health literacy levels. **Media literacy skills:** For each thematic activity, students are required to retrieve information, draw beautiful boards, and create slides to report on the knowledge and skills they have gained today. We found that			

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
			they were getting better at retrieving information; their ability to discuss, analyze, summarize, and synthesize was gradually improving; and their slides were becoming more and more informative. **Decision skills:** Everyone concluded that the factors affecting adolescent health literacy mainly include: 1. social factors (cognitive problems caused by culture and media and the pressure of social competition); 2. family factors (parents have a great influence on their children's growth and development and on their character and quality); 3. school The school factor (psychological maladjustment caused by changes in the environment and roles). Finally, the students themselves have come up with solutions: 1. develop a positive outlook on health; 2. develop healthy habits of learning and living behaviour; 3. attend more meaningful health talks; 4. strengthen their own ability to learn about health.			
5	**To avoid and reduce drinking alcohol**	**Cognitive dimension:** To increase our awareness of the dangers of drinking. **Access dimension:** To search for information on avoiding and curbing alcohol consumption. **Communication dimension:** To effectively	**Cognitive skills:** Drinking alcohol has become an integral part of contemporary life, and long-term alcohol use can lead to high blood lipids, the formation of alcoholic hepatitis, and even cirrhosis of the liver, etc. These are all the pieces of information that students retrieved on the dangers of drinking alcohol themselves. After summarizing the results, raising awareness of the dangers of	Presentations, case studies, panel discussions, sitcom performances, oral presentations, board papers,	Paper, Pens, Chalkboard, Whiteboard, Computer, Ipad, Phone.	**4 hours** 1. Introduction the theme of the activity and assigned the task (15 min)

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
		use communication skills to provide information on avoiding and curbing alcohol consumption to people around us. **Self-management dimension:** To manage to avoid alcohol. **Media literacy dimension:** To analyze the information we have retrieved about avoiding and reducing alcohol consumption. **Decision-making dimension:** To use the information found to avoid and curb alcohol consumption.	alcohol consumption can be divided into three categories: dangers to bodily functions, dangers to public safety, and dangers to the family. The summary results showed that everyone was familiar with the dangers of alcohol use. **Access skills:** After the experience gained from previous searches, students have become skilled at using literature reading, censuses, books, and newspapers to quickly access the information they want. Some students have also collected ways to avoid and reduce alcohol use through e-reading, radio stations, and health promotion brochures. **Communication skills**: Each group member discussed passionately and expressed their opinions individually. Some groups chose to use educational videos, news reports on drinking and fighting, and short videos on the dangers of drinking to warn everyone. Others thought it was important to show that they were firm about not drinking when having dinner with friends or leaders or to use drinks instead of alcohol. If you are a hobby drinker, you can use distraction methods to avoid or reduce your drinking. **Self-management skills:** For how to manage yourself, try not to drink alcohol in your life. Students suggested the following: 1. Attend	comedy, brochures.		2. completed the task in small groups (150 min) 3. reporte and present in small groups (60 min) 4. Summarized and declared the end of the activity (15 min)

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
			fewer parties, especially alcoholic beverages. 2. Improve lifestyle habits and health literacy. 3. Develop other hobbies and interests as distractions. 4. Join relevant sobriety groups and be supervised by others. 5. Use medication to aid sobriety. **Media literacy skills:** Students categorized the information they had searched for and made themselves aware of the dangers of alcohol use. Information about reducing alcohol use is differentiated and compared. This will lead to a summary of ways to reduce alcohol use and the benefits of doing so in their lives. The information was then incorporated into a slide show and a poster. After a few activities cumulatively, it was clear that the students' media literacy skills and general abilities were enhanced. **Decision skills:** Students share a summary of information, such as the dangers of alcohol use. The pros and cons were clearly identified, as drinking in excess can cause physical discomfort and can lead to accidents, fights, domestic violence, and other risk factors. After weighing the pros and cons, the students advocated, "Stop drinking; start with me."			
6	**Change adolescent**	**Cognitive dimension:** To increase awareness for	**Cognitive skills:** The improvement of cognitive skills depends on students'	Presentations, case studies,	Paper, Pens, Chalkboard,	**4 hours** 1.

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
	drinking attitudes	adolescents on the dangers of drinking. **Accessing dimension:** To search for and access information on adolescent drinking attitudes. **Communication dimension:** To effectively use communication skills to provide adolescents with information about the harms of drinking. **Self-management dimension:** To aid adolescents in minimizing alcohol consumption in their lives. **Media literacy dimension:** To analyze adolescents' attitudes toward drinking. **Decision-making dimension:** To get adolescents to change their drinking attitudes, based on the information they have retrieved about the dangers of drinking.	awareness of the dangers of alcohol consumption, which can lead to dullness, memory loss, mental distraction, mood swings, and in serious cases, criminality. Cognitive skills therefore need to be improved by students seeing and hearing more and experiencing more, with changes in perception determining changes in attitude. **Access skills:** After a period of training, the students were able to use literature reading, censuses, books, newspapers, e-readers, radio stations, health promotion brochures, reports from the transport and education sectors to gather the information they wanted, etc. The students in Group 4 suggested that they could use a questionnaire on adolescent drinking behaviour and attitudes to drinking, a questionnaire on parents' drinking behaviour and parents' attitudes to their children's drinking behaviour Attitudes to Drinking Questionnaire, Peer Drinking Behaviour and Attitudes to Drinking Questionnaire, General Self-Efficacy Questionnaire and Social Maladjustment Questionnaire as research tools to solve problems through a scientific research approach. **Communication skills**: Members of each group discussed vigorously and expressed their views individually. Some groups felt that effective communication skills could be	panel discussions, sitcom performances, oral presentations, board papers, comedy, brochures.	Whiteboard, Computer, Ipad, Phone.	Introduction the theme of the activity and assigned the task (15 min) 2. completed the task in small groups (150 min) 3. reporte and present in small groups (60 min) 4. Summarized and declared the end of the activity (15 min)

Sessions	Themes	The Objectives of six dimension of HL	Activity Details and Main Points	Method of Activity	Matrials	Duration
			used to reduce youth drinking, including exploring reasons, expressing themselves reasonably and learning to say no. **Self-management skills:** How to manage young people to try not to drink alcohol in their lives. Some of the students suggested the following: 1. focus on controlling young people's drinking behaviour; 2. strengthen young people's awareness of the need to refuse alcohol; 3. develop a wider range of interests for young people; 4. create a better educational environment for young people. Some students in the group indicated that they could use scientific methods such as cognitive therapy, family therapy, aversion therapy and interest therapy. **Media literacy skills:** It was evident that everyone had improved in their media literacy with their proficiency in using various search tools, summarizing their knowledge, selecting the content of their boards, creating beautiful PowerPoint presentations, and showing confidence in their presentations. **Decision skills:** The students used the information they retrieved to draw boards and create slides; each board and PowerPoint was a testimony to their growth. The trajectory of the campaign is a record of their changing attitudes toward drinking.			

Table 6 The comparison betweent health literacy program to reduce alcohol use and regular health education.

Sessions	Health literacy program in the intervention group	Regular health education in control group
1	**Themes：alcohol knowledge** **Purpose：** This theme is to summarize the data collected, make trade-offs, and check multiple sources to choose the best evidence to improve the students' understanding of alcohol.	**Themes：** Safety comes first in education **Purpose：** Safety education for college students includes fire prevention, drowning prevention, burglary prevention, fraud prevention, and traffic accident prevention. This theme is to enhance the safety awareness and precautionary awareness of medical students and to build up a sense of safety for life in the future.
2	**Themes：Drinking harm** **Purpose：** This theme is to summarize the dangers of alcohol in all areas, asking the medical students not only to internalize their knowledge but also to share what they have learned with their relatives, classmates, and friends around them, and to take more practical actions to help others and take up the mission of medical students.	**Themes：** Blossoming in the name of love **Purpose：** Focusing on college students' mental health. This theme is to focus on the cultivation of mental health and improve the stress resistance of medical students. A strong mental ability is the basis for becoming an excellent medical worker.
3	**Themes：Current state of drinking in China** **Purpose：** The theme is to let medical students know the current situation of alcohol consumption in China and the wrong concept of drinking. As medical students, we are the guardians of future health, and we have the responsibility and obligation to do something meaningful to change the current situation of alcohol consumption in China.	**Themes：** Mastering Habits, Not Waiting **Purpose：** Cultivating good learning and behavioral habits. This theme is to cultivate the character of diligence and hard work and to inherit the spirit of dedication of our forefathers to protect the health of the present and future generations.
4	**Themes：Health Literacy** **Purpose：** The theme is to let medical students know the plan to improve health literacy in China. In the document "Health China Action Plan (2019-2030)," the country has put forward 15 major actions, including health literacy actions. The "14th Five-Year	**Themes：** Avoiding Addiction to Mobile Phones **Purpose：** Eliminating addiction to mobile phones. The theme aims to reduce their bad behaviors; cell phone addiction has gradually become a social problem. Thus, cultivating such good habits should begin atthe school.

Sessions	Health literacy program in the intervention group	Regular health education in control group
	Plan for National Health" proposes to "carry out in-depth publicity and popularization of health knowledge and improve residents' health literacy." Medical students should understand the importance of health literacy for the health of the Chinese population.	
5	**Themes：To avoid and reduce drinking alcohol** **Purpose：** The theme is to make medical students understand that the most important way to avoid and reduce alcohol consumption is to improve their health literacy and intrinsic motivation by guiding students' behavior.	**Themes：** Let Youth Shine in Labor **Purpose：** Respect labor, respect knowledge, respect talent, and respect innovation. This theme is to cultivate the spirit of hard work and endurance among medical students and to interpret the identity of the medical profession with perseverance and good moral character.
6	**Themes：** Change adolescent drinking attitudes **Purpose：** The theme is to change the understanding and attitude of medical students towards drinking so that they know that they are the guardians of people's health, the disseminators of healthy behaviors, and the defenders of their own health. At the same time, there are three core points to keep in mind: first, to recognize that young people are the future of the country and that their health affects its destiny; second, improving health literacy is one of the most effective measures to reduce young people's drinking. Third, in a rapidly developing society, language health education is difficult to achieve; only multi-dimensional health education can stimulate people's interest in learning.	**Themes：** Civilization Accompanies, Healthy Walking **Purpose：** Create a healthy learning environment and pursue a healthy campus life. This theme is to require medical students to pay attention to their words and deeds because the peer effect helps to establish a good campus environment, and a good campus environment can be added to increase the learning atmosphere. The result of the chain reaction is to promote the school to cultivate more quality students for society. To produce more quality healthcare workers for society.

4.2.2 The evaluation of health literacy programs to reduce alcohol use

4.2.2.1 The comparison of baseline characteristics and alcohol use behavior between intervention and control groups.

The 104 medical students were enrolled at baseline and participated until the end of the intervention. Most of the medical students were female (53.8%), aged greater than or equal to 18 years (76%), and approximately 47.1% had a monthly household income in the range of 3001–5000 CNY. The majority of them had family members (76%) and peers (64.4%) who drank alcohol, as well as easy access to alcohol (86.5%). Moreover, the mean (S.D.) of PAEs, NAEs, and social norms of alcohol use scores were 23.08 (3.75), 17.26 (5.41), and 22.05 (5.19), respectively. In terms of the comparison of the baseline demographic characteristics, there were no significant differences (p>0.05) between the intervention and control groups. More details are in Table 7.

Table 7 Baseline characteristics and alcohol use behavior between intervention and control groups at baseline

Baseline characteristics	**Total**	**Intervention (n=52)**	**Control (n=52)**	***p*-value**
	n (%) or M±SD	**n (%) or M±SD**	**n (%) or M±SD**	
Individual-level				
Age				0.496#
≥18	79(76.0)	38(73.1)	41(78.8)	
<18	25(24.0)	14(26.9)	11(21.2)	
Gender				0.697#
Male	56(53.8)	29(55.8)	27(51.9)	
Female	48(46.2)	23(44.2)	25(48.1)	
monthly household income (CNY)				0.495#
<1000	7(6.7)	5(9.6)	2(3.8)	
1000-3000	14(13.5)	7(13.5)	7(13.5)	
3001-5000	49(47.1)	23(44.2)	26(50.0)	
>5000	34(32.7)	17(32.7)	17(32.7)	
Smoking				0.496#
Yes	79(76.0)	41(78.8)	38(73.1)	
No	25(24.0)	11(21.2)	14(26.9)	
Positive alcohol expectancies	23.08±3.75	23.02± 3.82	23.13± 3.70	0.876*
Negative alcohol expectancies	17.26±5.41	17.79± 3.85	16.73± 6.62	0.322*

Note: Values are presented as number (%) and M±SD (Mean ±Standard deviation);
CNY, Chinese Yuan; **P*-value for independent sample t-test; #*p*-value for chi-square test;
Statistically significant level as p<0.05

Table 7 Baseline characteristics and alcohol use behavior between intervention and control groups at baseline (cont.)

Baseline characteristics	Total	Intervention (n=52)	Control (n=52)	*p*-value
	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD	
Interpersonal-level				
family member alcohol use				0.496#
Yes	79(76.0)	38(73.1)	41(78.8)	
No	25(24.0)	14(26.9)	11(21.2)	
peer alcohol use				0.543#
Yes	67(64.4)	35(67.3)	32(61.5)	
No	37(35.6)	17(32.7)	20(38.5)	
Community-level				
Social norm of alcohol use	22.05±5.19	22.10± 4.56	22.00± 5.80	0.925*
Access to alcohol use				0.570#
Yes	90(86.5)	46(88.5)	44(84.6)	
No	14(13.5)	6(11.5)	8(15.4)	
alcohol use behavior				
AUDIT				0.918#
Harmful	15(14.4)	7(13.5)	8 (15.4)	
Hazardous	52(50.0)	27(51.9)	25 (48.1)	
Low-risk	37(35.6)	18(34.6)	19 (36.5)	

Note: Values are presented as number (%) and M±SD (Mean ±Standard deviation);
CNY, Chinese Yuan; **P*-value for independent sample t-test; #*p*-value for chi-square test;
Statistically significant level as $p<0.05$

4.2.2.2 The comparison of health literacy scores between intervention and control groups at baseline

At baseline (before intervention) the comparison of total health literacy and all six dimension scores between the intervention and control groups. We performed the independent t-test to determine the differences and found that there was not a statistically significant difference ($p>0.05$). Therefore, the baselines of total health literacy and all six dimension scores in the intervention and control groups were not different. More details are in Table 8.

Table 8 Health literacy scores between intervention and control groups at baseline

Health literacy	Total	Intervention (n=52)	Control (n=52)	*p*-value [#]
	M±SD	M±SD	M±SD	
Cognitive skill	2.35± 1.34	2.40± 1.37	2.29± 1.31	0.663
Access skill	12.19±3.07	11.77±2.81	12.62± 3.28	0.162
Communication skill	10.98± 2.85	10.85± 2.94	11.12± 2.79	0.633
Self-management skill	11.44± 3.14	10.92± 2.44	11.96± 3.67	0.093
Media skill	12.07± 2.77	11.87± 2.70	12.27± 2.78	0.454
Decision skill	11.37± 2.72	11.29± 2.81	11.46± 2.66	0.748
Total health literacy	60.40± 7.56	59.10± 7.12	61.71± 7.83	0.078

Note: Values are presented as M±SD (Mean ±Standard deviation); [#]*p*-value for independent t-test; Statistically significant level as $p<0.05$

4.2.2.3 The comparison of health literacy scores and alcohol use behavior within intervention groups at before and after intervention.

The comparison of the health literacy scores within the intervention groups before and after intervention by using the paired samples t-test indicated that the total health literacy and all six dimension scores after intervention were significantly higher than those before intervention ($p<0.05$). In addition, we performed the Chi square test for trend to determine the difference in alcohol use behavior before and after intervention, and it showed a significant difference ($p<0.05$). Moreover, the number of cases of harmful alcohol use and hazardous alcohol use decreased after the intervention. Therefore, there was a significant difference in the within-group comparison of health literacy scores and alcohol use behavior in the intervention group. More details are in Table 9.

Table 9 Comparison of health literacy scores and alcohol use behavior within intervention groups at before and after intervention.

Outcomes	Before intervention	After intervention	*p*-value
	M±SD	M±SD	
Health literacy scores			
Cognitive skill	2.40± 1.37	3.12± 1.04	0.004 #
Access skill	11.77±2.81	13.83±2.58	<0.001 #
Communication skill	10.85± 2.94	12.56± 2.60	0.001 #
Self-management skill	10.92± 2.44	12.29± 2.14	0.003 #
Media skill	11.87± 2.70	13.63± 2.33	<0.001 #
Decision skill	11.29± 2.81	14.98± 2.65	<0.001 #
Total health literacy	59.10± 7.12	70.40± 7.06	<0.001 #
	n (%)	n (%)	
Alcohol use behavior			<0.001*
Harmful	7(13.5)	0(0.0)	
Hazardous	27(51.9)	15(28.8)	
Low-risk	18(34.6)	32(61.5)	
No drinking	0(0.0)	5(9.6)	

Note: Values are presented as number (%) and M±SD (Mean ±Standard deviation);
P-value for paired sample t-test; **p*-value for Chi square test for trend;
Statistically significant level as $p<0.05$

4.2.2.4 The comparison of health literacy scores and alcohol use behavior within control groups at before and after intervention.

The comparison of the health literacy scores within the control groups before and after intervention by using the paired samples t-test revealed that the total health literacy and all six dimension scores showed no significant difference ($p>0.05$). Besides, we performed the Chi square test for trend to determine the difference in alcohol use behavior before and after intervention, and it showed the difference is not statistically significant ($p>0.05$). Therefore, there was no difference in the within-group comparison of health literacy scores and alcohol use behavior in the control groups. More details are in Table 10.

Table 10 Comparison of health literacy scores and alcohol use behavior within control groups at before and after intervention.

Outcomes	Before intervention	After intervention	*p*-value
	M±SD	M±SD	
Health literacy scores			
Cognitive skill	2.29± 1.31	2.48± 1.18	0.378#
Access skill	12.62± 3.28	12.75± 2.72	0.844#
Communication skill	11.12± 2.79	10.54± 2.80	0.288#
Self-management skill	11.96± 3.67	11.29± 2.26	0.218#
Media skill	12.27± 2.78	11.92± 2.41	0.494#
Decision skill	11.46± 2.66	11.75± 2.67	0.573#
Total health literacy	61.71± 7.83	60.73± 6.45	0.450#
	n (%)	n (%)	
Alcohol use behavior			0.406*
Harmful	8(15.4)	8(15.4)	
Hazardous	25(48.1)	34(65.4)	
Low-risk	19(36.5)	7(13.5)	
No drinking	0(0.0)	3(5.8)	

Note: Values are presented as number (%) and M±SD (Mean ±Standard deviation);
P-value for paired sample t-test； **p*-value for Chi square test for trend;
Statistically significant level as $p<0.05$

4.2.2.5 The comparison of health literacy scores between intervention and control groups before and after intervention

The comparison of total health literacy and all six dimension scores between the intervention and control groups before and after intervention was done using the independent t-test. Before intervention, the results showed that there was no significant difference ($p>0.05$). However, after the intervention group received a 6-week health literacy program and the control group received regular health education, the results demonstrated that the health literacy and all six dimension scores of the intervention group were significantly higher than the scores of the control group ($p<0.05$). More details are in Table 11.

Table 11 Comparison of health literacy scores between intervention and control groups at before and after intervention

Health literacy	Before intervention		*p*-value[#]	After intervention		*p*-value[#]
	Intervention (n=52) (M±SD)	Control (n=52) (M±SD)		Intervention (n=52) (M±SD)	Control (n=52) (M±SD)	
Cognitive skill	2.40± 1.37	2.29± 1.31	0.663	3.12± 1.04	2.48± 1.18	0.004
Access skill	11.77±2.81	12.62± 3.28	0.162	13.83±2.58	12.75± 2.72	0.041
Communication skill	10.85± 2.94	11.12± 2.79	0.633	12.56± 2.60	10.54± 2.80	<0.001
Self-management skill	10.92± 2.44	11.96± 3.67	0.093	12.29± 2.14	11.29± 2.26	0.023
Media skill	11.87± 2.70	12.27± 2.78	0.454	13.63± 2.33	11.92± 2.41	<0.001
Decision skill	11.29± 2.81	11.46± 2.66	0.748	14.98± 2.65	11.75± 2.67	<0.001
Total health literacy	59.10± 7.12	61.71± 7.83	0.078	70.40± 7.06	60.73± 6.45	<0.001

Note: Values are presented as M±SD (Mean ±Standard deviation); [#]*p*-value for independent t-test; Statistically significant level as $p<0.05$

4.2.2.6 The comparison of alcohol use behavior between intervention and control groups before and after intervention

The comparison of alcohol use behavior between the intervention and control groups before and after intervention was done using the chi square test. Before intervention, the results showed that there was no significant difference ($p>0.05$). When the intervention group received a 6-week health literacy program and the control group received regular health education, the results indicated a significant difference in alcohol use behavior ($p<0.05$). Additionally, we found that the number of students who used harmful and hazardous alcohol in the intervention group decreased when compared with the control group. More details are in Table 12.

Table 12 Comparison of alcohol use behavior between intervention and control groups

Alcohol use behavior	Before intervention		*p*-value *	After intervention		*p*-value *
	Intervention (n=52)	Control (n=52)		Intervention (n=52)	Control (n=52)	
	n (%)	n (%)		n (%)	n (%)	
Alcohol use behavior			0.918			<0.001
Harmful	7 (13.5)	8 (15.4)		0 (0.0)	8 (15.4)	
Hazardous	27 (51.9)	25 (48.1)		15 (28.8)	34 (65.4)	
Low-risk	18 (34.6)	19 (36.5)		32 (61.5)	7 (13.5)	
No drinking	0 (0.0)	0 (0.0)		5 (9.6)	3 (5.8)	

Note: Values are presented as number (%); **p*-value for chi square test; statistically significant level as $p<0.05$

4.2.2.7 The hypothesis testing of phase II.

We hypothesized that after intervention, the total HL score and the six dimensions scores of the intervention group were higher than the scores of the control group. Our results supported this hypothesis, which revealed that after intervention, the health literacy and all six dimension scores of the intervention group were significantly higher than the scores of the control group ($p<0.05$).

Moreover, we also hypothesized that after intervention, the proportions of alcohol use behaviors in the intervention group were lower than those in the control group. Our results supported this hypothesis, which demonstrated a significant difference in alcohol use behavior ($p<0.05$), especially when the proportion of subjects who used harmful and hazardous alcohol in the intervention group decreased when compared with the control group.

In conclusion, the results of our study confirmed the research hypotheses. The results indicate that the health literacy program enhances medical students' cognitive skill, access skill, communication skill, media skill, and decision skill. The improvement of health-related skills of medical students led to the improvement of health literacy, and the improvement of health literacy led to the conscious reduction of drinking behavior among medical students. Thus the health literacy program was effective in improving total HL and all six dimensions as well as reducing alcohol use behaviors.

CHAPTER 5
CONCLUSION, DISCUSSION, AND RECOMMENDATION

This chapter presents aspects of the conclusions, discussion of the findings, and recommendations for practice and further research as follows:

5.1 Conclusions the results

5.1.1 Conclusions the results of Phase I

The results of the quantitative study were as follows: (1) The drinking rate of medical students in Hubei higher vocational colleges and universities was 45.3%, of which the rate of hazardous drinking was 11.5%. (2) Alcohol health literacy among medical students in Hubei's higher vocational colleges and universities was low, accounting for about 49.3%. (3) Factors associated with alcohol consumption among medical students in Hubei's higher vocational colleges were: low health literacy (including low levels of total HL and all six dimensions of HL such as cognitive skill, access skill, communication skill, self-management skill, media literacy skill, and decision skill), gender, monthly family income, smoking, positive alcohol expectations, family members' drinking, peer drinking, and easy access to alcohol.

The results of the qualitative study are as follows: (1) For social norms on alcohol consumption, the study found that the current laws and regulations prohibiting adolescents' access to alcohol are inadequate and that strengthening supervision and changing medical students' attitudes toward alcohol consumption are two important strategies. (2) Measures to effectively reduce alcohol consumption among medical students: Individual and family level: improving medical students' health literacy, increasing internal drive, and proper guidance from guardians. At the school level: strict enforcement of school rules prohibiting alcohol consumption; more meaningful activities to publicize the dangers of alcohol consumption; and enhanced peer education. At the social level, strengthen the regulation of alcohol sellers. National level: Introduce laws and regulations to prohibit youth from drinking alcohol. (3) Alcohol is harmful to medical students, including occupational hazards, academic hazards, and hazards to body organs, family hazards, psychological hazards, and social hazards.

5.1.2 Characteristics of the intervention (The health literacy program)

The interventions were developed based on Nutbeam D's theoretical model of health literacy and its six dimensions of skills to improve medical students' health literacy with six activities through the process of group discussion and assignments. One activity was delivered per week, with an intervention time of 4 hours per activity. The activity sessions were as follows: The public health specialist assigned the tasks to the participants (15 min.). The medical students will complete the tasks through group discussion in small groups (150 min.); after that, they will report and present the results in small groups (60 min). Then, the public health specialist gave a final summary (15 min). The concepts of intervention development in each dimension of HL as follows:

The development of cognitive skills focuses on the process of cognitive change, starting with self-awareness. In terms of the development of access skills, it is to increase the initiative of medical students to internalize the knowledge that alcohol consumption is harmful to health by retrieving knowledge on their own. Besides, communication skills focus on developing medical students' ability to communicate and share, and peer education can be more effective in achieving the goal. Also, the self-management skills are designed to cultivate the self-management ability of medical students, and good self-management ability can prevent their drinking behaviors from occurring. Moreover, self-management skills are designed to cultivate the self-management ability of medical students, and good self-management ability can prevent the occurrence of their own drinking behaviors. Media skills enhancement promotes oneself to be more sober in a diversified world and have more control over one's own behaviors. Finally, decision-making ability cultivation is designed to enable medical students to make the right decision after they have a comprehensive understanding of the harmful effects of alcohol consumption on their health.

5.1.3 Conclusions the results of Phase II

The findings of the second phase of the randomized controlled trial:

(1) The comparison of baseline characteristics and alcohol use behavior between intervention and control groups.

The findings showed that there was no statistically significant difference (P>0.05) in terms of alcohol use behavior, health literacy scores, individual level (e.g., gender,

age, monthly household income, smoking, and alcohol expectancies), interpersonal level (e.g., family and peer alcohol use), and community level variables (e.g., social norm of alcohol use and access to alcohol outlet).

(2) The comparison of health literacy scores and alcohol use behavior within groups before and after intervention.

The results revealed that in the intervention group, the total health literacy and all six dimension scores after intervention were significantly higher than those before intervention ($P<0.05$), while the number of cases of harmful alcohol use and hazardous alcohol use was significantly decreased ($P<0.05$). Conversely, in the control group, it was not found.

(3) The comparison of health literacy scores and alcohol use behavior between intervention and control groups before and after intervention.

The results showed that after the intervention, the total health literacy score and the scores of the six dimensions of the intervention group increased significantly compared to the control group ($P<0.05$), and the number of drinkers in the intervention group decreased significantly compared with the control group ($P<0.05$).

Therefore, the health literacy program based on Nutbeam D's health literacy theory was effective in improving health literacy and reducing alcohol consumption among medical students.

5.2 Discussion

5.2.1 Discussion of the findings of Phase I of the study

This study showed that medical students with low health literacy were more likely to drink alcohol, and the results of this study are consistent with those of Yangyuen et al. , who reported that adolescents with inadequate health literacy were more likely to consume alcohol (Yangyuen et al., 2021). One explanation is that this phenomenon occurs due to the great academic and employment pressures that medical students are currently facing and the tedium of medical knowledge that makes them willing to choose easy access to alcohol for a brief period of pleasure (Bryl et al., 2020). Also, the study by Rolova et al. demonstrated a strong link between low health literacy and alcohol consumption, which implies that when in a situation of low health literacy, people often tend to have insufficient access to, understanding of, and

assessment of knowledge related to the harms of alcohol, as well as the motivation and ability to self-manage, and are prone to alcohol consumption behaviors under such circumstances (Rolova et al., 2020).

In addition, the results revealed that other social-ecological factors related to alcohol use, such as smoking behavior was also closely related to the occurrence of drinking behavior (Nowak et al., 2018), a finding consistent with that of Motschman et al. (Motschman et al., 2021). This may be because smoking is often used as a means of social interaction, often taking a cigarette from the other party before a conversation and then moving on to the second stage of deepening the relationship through drinking as both parties become more familiar with it, a psychological motivation that, if not strictly controlled by social norms, can inadvertently lead to a negative social culture. Our study also found that easy access to alcohol was an important reason for their drinking (Morrison et al., 2019, Ibitoye et al., 2019, Sudhinaraset et al., 2016). One reason is that there is a lack of proper guidance and strict supervision in the family, school, and society; the other is because of the government's weak regulation of the marketplace, which leads to arbitrary purchases in supermarkets, retail stores, bars, and so on. With the lack of regulation on both buyers and sellers, obtaining alcohol becomes easier and drinking behavior increases (Stockwell et al., 2021). Morovers, behavioral modeling by parents and peers plays a key role. Parents' drinking behaviors are passed on to their children in their daily lives, which can lead children to believe that drinking is a normal and healthy behavior. Peers also influence adolescents' receptivity to health information, including alcohol-related information and health decisions, through peer pressures and lifestyle practices in their age groups (Smit et al., 2020, Huang et al., 2014, Studer et al., 2014). Thus, it may be difficult for them to raise their own health awareness and perception of the risks of drinking (Yangyuen et al., 2020). However, this finding is inconsistent with Freisler et al. (Freisthler et al., 2020), which states that under the strict regulatory system in the United States, most parents do not drink alcohol in front of their children and that parents choose meaningful activities to increase their adolescents' health information and reduce their risk of exposure to alcohol.

Furthermore, this study showed that alcohol consumption was strongly associated with individuals' expectations of alcohol (Van et al., 2011, Rhew et al.,

2021). Positive alcohol expectations were positively associated with alcohol consumption among medical students, whereas negative alcohol expectations were negatively associated with alcohol consumption, a finding that is inconsistent with Chisolm et al. (Chisolm et al., 2014). One possible examination is that individuals decide whether to drink alcohol based on their expected positive and negative consequences with alcohol consumption, and that medical students with positive alcohol expectations may enjoy the euphoric feeling presented by their alcohol-paralyzed brain, a feeling that may cause them to slowly develop an alcohol addiction and depend on alcohol for a moment of pleasure; thus, positive outcome expectations are thought to promote alcohol use, while negative outcome expectations are thought to have the opposite effect (Waddell et al., 2023). In addition, alcohol expectations can be obtained by observing parental or peer drinking behaviors and learning attitudes toward drinking, which have the most direct impact on adolescents.

We also found that males are the main group of people who experience hazardous and low-risk drinking, which may still be inextricably linked to traditional Chinese culture. Males have been influenced by traditional Chinese culture and environment during their growth and development, and this finding is consistent with Ghoreishi et al. (Ghoreishi et al., 2017) showed that males have more freedom in terms of their family and social relationships. As a result, they have more access to alcohol. In addition, alcohol use is strongly linked to family economic status (Yangyuen et al., 2021, Chen et al., 2016, Ormond et al., 2016). The amount of family income is related to the status of the pocket money that the adolescents can dispose of as they please, so adolescents with high family income will have more pocket money at their disposal to the extent that they can get alcohol quickly when they want to get it.

5.2.2 Discussion of the interventions

The health literacy program based on Nutbeam D's health literacy theory consist of six dimension such as cognitive skills, access skills, communication skills, self-management skills, media skills, and decision-making skills. The intervention is characterized by the development of activity themes and objectives centered on the two core themes of "alcohol use" and "health literacy," and medical students are trained in the six health literacy skills through the completion of tasks, with the core

of the intervention focusing on the cultivation of active learning and active training. The core of the program is to cultivate active learning and active training among medical students. This health literacy program is different from other health literacy interventions. For example, in the study of Grigg et al. (2018), a randomized controlled trial of alcohol intervention and breast cancer, a health promotion pamphlet was used to provide four minutes of information on alcohol and three minutes of information on nutrition as a health literacy intervention, and the results of the study showed that women in the intervention group also showed greater improvement in alcohol cognitive skills. Scholar Grigg's intervention was simpler in that the interviewees were only required to be passive recipients of health-related knowledge and did not need to actively learn it on their own (Grigg et al., 2018). Similarly, Lubman et al. (2016) utilized structured telephone delivery as an intervention to reduce alcohol use, which is also a passive learning process. Also, the study of Katena et al. (2023) in Zimbabwe used health literacy to develop an intervention for hypertensive and diabetic patients to explore the impact of health literacy on patients' lifestyle changes, whose intervention consisted of face-to-face educational sessions and supportive visits to the patients, an intervention that also required only passive acceptance by the study participants.

The health literacy intervention program in this study is mainly implemented through group discussion. In terms of group discussion, it is one of the common methods used in medical research. Stein et al. (1990) used the group discussion method to explore the effect of case teaching in clinical pharmacology, also Piamjariyakul et al. (2018) used group discussion to explore the relationship between patients with heart failure and depressive symptoms, and Ferreira et al. (2023) utilized group discussion in the educational support of children with autism.

The above research using the group discussion method to carry out research can be a good solution to the problem. The reason may be similar to the peer effect, that is, the interaction between peers is very influential. This conclusion can also be confirmed by the famous American psychologist Bandura's social learning theory, which states that peer imitation and role modeling have a kind of behavior. Therefore, the health literacy intervention program developed based on group discussion as a research methodology is feasible. Previous studies have found that the majority of

researchers prefer to use telephone, video, and pamphlets in developing health literacy intervention programs (Grigg et al., 2018; Lumman et al., 2016; Katena et al., 2023), which are more convenient but less controllable than group discussions.

Based on the above literature, it was found that the health literacy program in this study is as feasible and effective as compared to other health literacy programs. After completing six interventions of the health literacy program, the cognitive skills, acquisition skills, communication skills, self-management skills, media skills, and decision-making skills of the medical students were improved to a greater extent. Thus, allowing the study participants to train their health literacy skills through active learning leads to improved health literacy.

5.2.3 Discussion of the findings of Phase II of the study

The findings of this study showed that HLP is effective in improving health literacy among medical students. Consistent with the findings of previous studies (Lin et al., 2021), revealed that the HLP was effective in preventing drug use behavior, including alcohol use, among junior high school students. One explanation is that the HLP can increase health knowledge and change students' attitudes, active normative behaviors, and ability to control perceived behaviors. More studies have also confirmed the importance of cognitive skills in HLP (Wolf et al., 2012), as increased cognitive skills are effective in predicting an individual's self-care and ability to achieve desired health. In addition, the enhancement of media skills in HLP can not only change adolescents' attitudes and intentions toward risky health behaviors (Vahedi et al., 2018) but also improve access for medical students. Besides, the research of Bittlingmayer et al. (2020) showed that the importance of media skills in HLP can improve population health. Furthermore, communication skills in HLP can have a significant impact on health behaviors and health outcomes (Tavakoly et al., 2020; Ishikawa et al., 2010), and one explanation for this is the need for effective communication exchanges between health knowledge and health behaviors in populations. Moreover, the study of Nakayama et al. (2022) indicated that the relationship between information access skills and decision-making skills in health literacy, where effective information is the cornerstone of proper decision-making, plays a crucial role in the improvement of health literacy.

Furthermore, HLP is effective in reducing alcohol use behavior. This is consistent with previous research, which stated that HLP was effective for decreasing alcohol use (Gordon et al., 2016). A possible explanation is that the components of HLP, including cognitive skills and access skills, can improve adolescents' ability to access, understand, interpret, and evaluate alcohol-related information and have more self-management knowledge to make an appropriate decision for preventing or abstaining from drinking alcohol (Rundle-Thiele et al., 2013). Another reason is that HLP is an important way to address individuals' alcohol-related knowledge, perceptions, attitudes, and behavioral intentions that might affect their receipt of health information (e.g., alcohol use) and health decisions (Gordon et al., 2015; Gordon et al., 2017; Okan et al., 2020). Therefore, adolescents with adequate HL may be able to access and receive accurate information of alcohol-related harms and may have increased health awareness and know-how to deal with the risk of drinking, which may lead them to avoid or reduce drinking (Okan et al., 2020; Fleary et.al., 2018). In addition, the HLP enables medical students to independently absorb more health-related knowledge and know the harms of alcohol consumption to themselves and society (Fried et al., 2012). In particular, healthcare providers' knowledge of alcohol-related harms plays a significant role in the general population's trust in the risks and effects of drinking (Sinclair et al., 2019; Kaper et al., 2019). Thus, the knowledge of alcohol-related topics among medical students indicates a favorable outlook for their future actions as health service providers in reducing alcohol consumption programs (Fried et al., 2012; Kaper et al., 2019).

5.3 Strengths and limitations of the study

5.3.1 The phase I of the strengths and limitations

The phase I study has some limitations. First, because of the cross-sectional design, it is not possible to infer temporal and causal relationships. Second, although we used a social-ecological model, there are two dimensions that we did not cover: institutions and public policies because they are currently lacking clarity, so this can be the focus of future research. Third, the data were collected by self- report, which can be implicated in social desirability bias. To minimize self-report bias, validated and standardized instruments were used. Fourth, our subjects were medical students

who may have different experiences of alcohol use from other adolescents who were non-medical students and non-academic youth and were in communities; thus, caution must be used when generalizing the results to other groups. For example, the study by Chi et al (Chi et al., 2022) reported that the alcohol consumption of adolescents aged 18–20 years who resided in six Chinese cities is 31.8%, and the study by Chen et al showed that the drinking rate of medical students is 64.1%, and that of non-medical students is 73.2% (Chen et al., 2010). Despite these limitations, our study has a compensatory strength that allows for large sample sizes and controls for a wide range of covariates. The results provided evidence of risk factors for alcohol use, and low HL is an important contributor to alcohol use among medical students.

5.3.2 The phase II of the strengths and limitations

This study has some limitations. First, bias may have occurred because the sample was limited to medical students from two universities in Hubei Province, with no medical students from other provinces participating. Thus, generalizability to medical students in other settings might be limited but may reflect the situation of HL and alcohol use problems in a college-based context. Therefore, further studies may include medical student participants from colleges or universities in different provinces. Second, our study was conducted among a specific population of medical college students, who may have different experiences of alcohol use and HL levels from other adolescents who were non-medical students; thus, caution must be used when generalizing the results to other groups. Despite these limitations, our study had compensatory strength, which was one of the first to develop the themes and content of activities to reduce alcohol use among medical students in Hubei Province based on the six health literacy skills of Nutbeam's theoretical model and validated the effectiveness of the HLP in reducing alcohol use among medical students.

5.4 Recommendations

5.4.1 Recommendations for results

1. In the first phase of our study, our research showed that for the three levels of the socio-ecological model factors are suggested as follows, individual level factors: all six dimensions of HL, low total HL, male, family monthly income > 5000 yuan RMB, smoking and high PAEs are the important causes of alcohol consumption in

medical students, so first of all, we need to strengthen the improvement of health literacy, strengthen the society for male medical students supervision of male medical students, parents reducing the supply of pocket money to medical students, increasing anti-smoking publicity programs and raising the awareness of the harms of alcohol, and eliminating positive alcohol expectations. At the interpersonal level, parents' positive guidance on the dangers of alcohol should be strengthened and peer education should be enhanced. For the community level, only strong social regulation can cut off access to alcohol.

2. In phase II of the study, our research showed that a health literacy intervention program based on Nutbeam D's health literacy theory can be effective in improving medical students' health literacy to change their drinking behavior. Therefore, this study suggests that HLP should be cited in the classroom of college student health education to benefit more college students.

5.4.2 Suggestions for future research

1. First, on the basis of individual, interpersonal, and community variables, organizational and public policy variables were added to form a complete socio-ecological model; second, the study sample was expanded to include medical students from other provinces. Finally, a comprehensive analysis of alcohol health literacy among all medical students in China should be conducted.

2. The HL theory plays an important role in improving individuals' abilities to access, understand, interpret, and evaluate health-related information. Thus, health providers may apply the HL theory to designing interventions to address other health behavior problems, such as deviant behavior and substance abuse.

3. The HLP to reduce alcohol consumption in this study was applied using group discussion methods, active learning, or active training as a core of activities, which may be different from other health literacy programs such as the online education health literacy program, e-health literacy, and social media messages. Thus, the comparison of the effectiveness of each method should be done further research.

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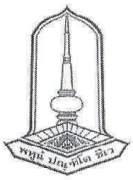
Appendix



คณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคาม

เอกสารรับรองโครงการวิจัย

เลขที่การรับรอง : 164-053/2566

ชื่อโครงการวิจัย (ภาษาไทย) -

ชื่อโครงการวิจัย (ภาษาอังกฤษ) The effectiveness of health literacy program to reduce alcohol use among medical students in Hubei province , China.

ผู้วิจัย : Miss. Meihua Yin และ ผู้ช่วยศาสตราจารย์ ดร.สุณีรัตน์ ยั่งยืน
หน่วยงานที่รับผิดชอบ : คณะสาธารณสุขศาสตร์
สถานที่ทำการวิจัย : มณฑลหูเป่ย์ ประเทศจีน

ประเภทการพิจารณาแบบ : แบบเร่งรัด

วันที่รับรอง : 3 พฤษภาคม 2566 **วันหมดอายุ** : 2 พฤษภาคม 2567

ข้อเสนอการวิจัยนี้ ได้รับการพิจารณาและให้ความเห็นชอบจากคณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคามแล้ว และอนุมัติในด้านจริยธรรมให้ดำเนินการศึกษาวิจัยเรื่องข้างต้นได้ บนพื้นฐานของโครงร่างงานวิจัยที่คณะกรรมการฯ ได้รับและพิจารณา เมื่อเสร็จสิ้นโครงการแล้วให้ผู้วิจัยส่งแบบฟอร์มการปิดโครงการและรายงานผลการดำเนินงานมายังคณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคาม หรือหากมีการเปลี่ยนแปลงใดๆ ในโครงการวิจัย ผู้วิจัยจักต้องยื่นขอรับการพิจารณาใหม่

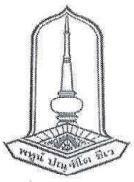
(ผู้ช่วยศาสตราจารย์ เภสัชกรหญิงราตรี สว่างจิตร)
ประธานคณะกรรมการจริยธรรมการวิจัยในคน
มหาวิทยาลัยมหาสารคาม

ทั้งนี้ การรับรองนี้มีเงื่อนไขดังที่ระบุไว้ด้านหลังทุกข้อ (ดูด้านหลังของเอกสารรับรองโครงการวิจัย)

นักวิจัยทุกท่านที่ผ่านการรับรองจริยธรรมการวิจัยต้องปฏิบัติดังต่อไปนี้

1. ดำเนินการวิจัยตามที่ระบุไว้ในโครงการวิจัยอย่างเคร่งครัด
2. ใช้เอกสารแนะนำอาสาสมัคร ใบยินยอม (และเอกสารเชิญเข้าร่วมวิจัยหรือใบโฆษณาถ้ามี) แบบสัมภาษณ์ และหรือ แบบสอบถาม เฉพาะที่มีตราประทับของคณะกรรมการจริยธรรมในคน มหาวิทยาลัยมหาสารคามเท่านั้น และส่งสำเนาเอกสารดังกล่าวที่ใช้กับผู้เข้าร่วมวิจัยจริงรายแรกมาที่คณะกรรมการจริยธรรมการวิจัยในคน เพื่อเก็บไว้เป็นหลักฐาน
3. รายงานเหตุการณ์ไม่พึงประสงค์ร้ายแรงที่เกิดขึ้นหรือการเปลี่ยนแปลงกิจกรรมวิจัยใดๆ ต่อคณะกรรมการจริยธรรมการวิจัยในคน มหาวิทยาลัยมหาสารคาม ภายในระยะเวลา 5 วันทำการ
4. ส่งรายงานความก้าวหน้าต่อคณะกรรมการจริยธรรมการวิจัยในคน ตามเวลาที่กำหนดหรือเมื่อได้รับการร้องขอ
5. หากการวิจัยไม่สามารถดำเนินการเสร็จสิ้นภายในกำหนด ผู้วิจัยต้องยื่นขออนุมัติใหม่ก่อน อย่างน้อย 60 วัน
6. หากการวิจัยเสร็จสมบูรณ์ผู้วิจัยต้องแจ้งปิดโครงการตามแบบฟอร์มของคณะกรรมการจริยธรรมในคน มหาวิทยาลัยมหาสารคาม

* รายชื่อของคณะกรรมการจริยธรรมการวิจัยในคน (ชื่อและตำแหน่ง) ที่เข้าร่วมประชุม ณ วันที่พิจารณารับรองโครงการวิจัย (หากร้องขอล่วงหน้า)



MAHASARAKHAM UNIVERSITY ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS

Certificate of Approval

Approval number: 164-053/2023

Title : The effectiveness of health literacy program to reduce alcohol use among medical students in Hubei province , China.

Principal Investigator : Miss. Meihua Yin and Asst. Prof. Suneerat Yaugyuen

Responsible Department : Faculty of Public Health

Research site : Hubei province, China

Review Method : Expedited Review

Date of Manufacture : 3 May 2023 **expire :** 2 May 2024

This research application has been reviewed and approved by the Ethics Committee for Research Involving Human Subjects, Mahasarakham University, Thailand. Approval is dependent on local ethical approval having been received. Any subsequent changes to the consent form must be re-submitted to the Committee.

Ratree S.

(Asst. Prof. Ratree Sawangjit)

Chairman

Approval is granted subject to the following conditions: (see back of this Certificate)

All approved investigators must comply with the following conditions:

1. Strictly conduct the research as required by the protocol;
2. Use only the information sheet, consent form (and recruitment materials, if any), interview outlines and/or questionnaires bearing the Institutional Review Board's seal of approval ; and return one copy of such documents of the first subject recruited to the Institutional Review Board (IRB) for the record (if applicable);
3. Report to the Institutional Review Board any serious adverse event or any changes in the research activity within five working days;
4. Provide reports to the Institutional Review Board concerning the progress of the research upon the specified period of time or when requested;
5. If the study cannot be finished within the expire date of the approval certificate, the investigator is obliged to reapply for approval at least two month before the date of expiration.
6. All the above approved documents are expired on the same date of the previously approved protocol (Protocol Number.....)

* A list of the Institutional Review Board members (names and positions) present at the meeting of Institutional Review Board on the date of approval of this study has been attached (per requested). All approved documents will be forwarded to the principal investigator.

053/66

ECMSU01-06.03

Informed Consent Form

(For Participants aged 18 years and older)

Name-Surname (Mr./Mrs./Ms.).....Age.....(years)

Address: House No. .....Village No.....Sub-district.....

District.....Province.....

I read the research subject information sheet and obtain the description of this study by Ms. Meihua Yin about the voluntary of "The effectiveness of health literacy program to reduce alcohol use among medical students in Hubei province, China". These information including the rational and purpose of the study and list all procedures that I have to act and be treated, list the benefits that I will receive from the research and risks that may occur from participating in the research, also the guidelines for prevention and correction in case of danger by reading/listening to the description of the message from research subject information sheet for questionnaire. Moreover, I have also received an explanation and response from the research project leader already.

As well as an assurance from the researcher that my data will be kept confidential, will not be anonymous, and the results will presented in an overview or summary to academic benefit

" The participation in this study, I participate voluntarily" and I am free to withdraw at any time, without giving a reason and without cost, and no affect to my learning, now or in the future.

I have read and I understand the provided information from research subject information sheet and informed consent form. I voluntarily agree to take part in this study and give my signature already.

Sign..... Participant

(.....)

Date.....

Sign..... Witness (In case of reading the explanation to the volunteers)

(.....)

Date.....

Sign..... Investigator/ person taking the consent

(.....)

Date.....

ECMSU01-06.02

Informed Consent Form

(For Participants aged less than 18 years)

Name-Surname (Mr./Mrs./Ms.).....Age.....(years)
as a parent/legal guardian of (your child's name-surname).....
Age.....(years)

I give permission to my child as mentioned above to participate in the research entitle of "The effectiveness of health literacy program to reduce alcohol use among medical students in Hubei province, China".

I and my child obtain the description of this study by Ms. Meihua Yin about the voluntary of "The effectiveness of health literacy program to reduce alcohol use among medical students in Hubei province, China". These information including the rational and purpose of the study and list all procedures that I have to act and be treated, list the benefits that I and my child will receive from the research and risks that may occur from participating in the research, also the guidelines for prevention and correction in case of danger by reading/listening to the description of the message from research subject information sheet for questionnaire. Moreover, I and my child have also received an explanation and response from the research project leader already.

As well as an assurance from the researcher that my child's data will be kept confidential, will not be anonymous, and the results will presented in an overview or summary to academic benefit.

I have voluntarily to give permission to my child to participate in this research under the criteria of research subject information sheet. Thus, I have permitted my child to join this research and my child decided to participation in this study is voluntary. In phase 1 of this research, my child has to answer the questionnaire of health literacy and associated factors of alcohol use among medical students in vocational colleges. This self-administered questionnaire comprise of 5 parts with 82 items, the duration of response approximately 30-45 minutes or in phase 2, my child has to join the activities of this phase for 6 weeks, but my child has the right to withdraw from this phase at any time without prior notice.

I and my child has the right and free to withdraw at any time, without giving a reason and without cost, and no affect to me and my child learning, now or in the future.

I have been guaranteed from the researcher and team that they will treat to my child according to the information of research subject information sheet and other relevant information. The data will be kept and not publicly disclosed on an individual person. All data will be identified only by a code, with personal details kept in a locked file or secure computer with access only by the immediate research team. The results will only present in terms of overall and these data will be destroyed at the end of the study.

If I and my child have any suspicions of the research process. I can contact Ms. Meihua Yin, Faculty of Public Health, Mahasarakham University. Tel. (mobile phone): (+86) 15507157380, E-mail: 490079361@qq.com. That is available 24 hours a day.

I and my child understand the provided information from research subject information sheet and informed consent form. I and my child voluntarily agree to take part in this study and give my signature already.

Sign..... Participant

(.....)

Date.....

Sign..... Parent / legal guardian

(.....)

Date.....

Sign..... Investigator/ person taking the consent

(.....)

Date.....

ECMSU01-05.02 Update 2021

Research Subject Information Sheet for Questionnaire

(For Participants aged less than 18 years)

Dear, All parental of participants

My name is Ms. Meihua Yin, the doctoral degree student of Doctor of Public Health program, Faculty of Public Health, Mahasarakham University. I am conducting the research entitle: " The effectiveness of health literacy program to reduce alcohol use among medical students in Hubei province, China". The research objective consist of 5 items such as 1) To determine factors related to alcohol use among medical students in vocational colleges based on social-ecological model, 2) To explore the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effect of alcohol use on medical students, 3) To assess the health literacy level among medical students in vocational colleges, 4) To develop intervention to reduce alcohol use among medical students in vocational colleges based on health literacy program model, and 5) To evaluate the effectiveness of health literacy program to reduce alcohol use among medical students in vocational colleges. This research divide into 2 phases, in phase 1, we integrate both of quantitative and qualitative method in a study. In quantitative method as the cross-sectional study will be used to determine factors related to alcohol use and assess the health literacy of substance use in adolescents. Also, we will use qualitative method to explore the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effect of alcohol use among medical students in vocational colleges. The samples of quantitative method are 1146 medical students from four vocational colleges in Hubei province. The target group of qualitative method are key informants including 5-10 representatives of medical students who drinking, 2 faculty members of medical programs in higher education, 2 adolescent psychiatrists, 2 health promotion and 2 health literacy specialists. In phase 2, this research focuses on the development of intervention program by using health literacy model and evaluate the effectively of this program. The sample size is 104 students, which divide into 2 groups such as experimental group is 52 medical students, and control group is 52 medical students. The benefits you will receive from this research such as 1) health literacy projects will be promoted to improve the health literacy of Chinese adolescents and 2) provide a good intervention method for improving adolescent personnel health. However, the participants may not get the benefit directly from participating in this research project but the information obtained will be useful for the Center for Disease Control in China, the educational institutes or other health facilities for guidance to improve adolescent health literacy and alcohol use behavior.

If you decided to give permission to your child participate in this research. In phase 1 of this research, I would like your child to answer the questionnaire of health literacy and associated factors of alcohol use among medical students in vocational colleges. This self-administered questionnaire

comprise of 5 parts with 82 items, the duration of response approximately 30-45 minutes. When your child is finished answer all of item, please send it back to the researcher team. Please take time to answer the questionnaire carefully or ask the researcher if there is anything that is not clear or if your child has any question. Also, in phase 2 of this research, If you decided to give permission to your child participate in phase 2, your child have to join the activities of this phase for 6 weeks, but your child has the right to withdraw from this phase at any time without prior notice.

If your child feels uncomfortable or undesired with some questions, your child has the right to refuse to answer questions. Also, your child has the right to withdraw from this program at any time without prior notice. In additional, the refusal or withdrawal from this project will involve no affect your child learning, now or in the future.

The data will be kept and not publicly disclosed on an individual person. All data will be identified only by a code, with personal details kept in a locked file or secure computer with access only by the immediate research team. The results will only present in terms of overall and these data will be destroyed at the end of the study. In this research, your child does not receive compensation and will not be charged anything.

If you and your child have any questions about the research, or if you and your child would like more information, please contact Ms. Meihua Yin, Faculty of Public Health, Mahasarakham University. Tel. (mobile phone): (+86) 15507157380, E-mail: 490079361@qq.com.

If you and your child are not treated as described or want to know your and your child's rights while participating in this research. You can contact the Review Ethics Broads of Mahasarakham University, Division of research facilitation and dissemination, Mahasarakham University. Tel. 0 4 3 - 754416 (internal number 1755)

Best Regards,

.....

( )

Researcher

ECMSU01-05.03 Update 2021

Research Subject Information Sheet for Questionnaire

(For Participants aged 18 years and older)

Dear, All Participants

My name is Ms. Meihua Yin, the doctoral degree student of Doctor of Public Health Program, Faculty of Public Health, Mahasarakham University. I am conducting the research entitle: " The effectiveness of health literacy program to reduce alcohol use among medical students in Hubei province, China". The research objective consist of 5 items such as 1) To determine factors related to alcohol use among medical students in vocational colleges based on social-ecological model, 2) To explore the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effect of alcohol use on medical students, 3) To assess the health literacy level among medical students in vocational colleges, 4) To develop intervention to reduce alcohol use among medical students in vocational colleges based on health literacy program model, and 5) To evaluate the effectiveness of health literacy program to reduce alcohol use among medical students in vocational colleges. This research divide into 2 phases, in phase 1, we integrate both of quantitative and qualitative method in a study. In quantitative method as the cross-sectional study will be used to determine factors related to alcohol use and assess the health literacy of substance use in adolescents. Also, we will use qualitative method to explore the social norms of alcohol use, the experiences of stopping or reducing alcohol consumption, and the effect of alcohol use among medical students in vocational colleges. The samples of quantitative method are 1146 medical students from four vocational colleges in Hubei province. The target group of qualitative method are key informants including 5-10 representatives of medical students who drinking, 2 faculty members of medical programs in higher education, 2 adolescent psychiatrists, 2 health promotion and 2 health literacy specialists. In phase 2, this research focuses on the development of intervention program by using health literacy model and evaluate the effectively of this program. The sample size is 104 students, which divide into 2 groups such as experimental group is 52 medical students, and control group is 52 medical students. The benefits you will receive from this research such as 1) health literacy projects will be promoted to improve the health literacy of Chinese adolescents and 2) provide a good intervention method for improving adolescent personnel health. However, the participants may not get the benefit directly from participating in this research project but the information obtained will be useful for the Center for Disease Control in China, the educational institutes or other health facilities for guidance to improve adolescent health literacy and alcohol use behavior.

Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you decided to participate in phase 1 of this research, I would like you to answer the questionnaire of health literacy and associated factors of alcohol use among medical students in vocational colleges. This self-administered questionnaire comprise of 5 parts with 82 items, the

duration of response approximately 30-45 minutes. When you are finished answer all of item, please send it back to the researcher team. Please take time to answer the questionnaire carefully or ask the researcher if there is anything that is not clear or if you have any question. Also, for participants in phase 2 of this research, if you decided to participate in phase 2, you have to join the activities of this phase for 6 weeks, but you have the right to withdraw from this phase at any time without prior notice.

If you feel uncomfortable or undesired with some questions, you have the right to refuse to answer questions. Also, you have the right to withdraw from this program at any time without prior notice. In additional, the refusal or withdrawal from this project will involve no affect your learning, now or in the future.

The data will be kept and not publicly disclosed on an individual person. All data will be identified only by a code, with personal details kept in a locked file or secure computer with access only by the immediate research team. The results will only present in terms of overall and these data will be destroyed at the end of the study. In this research, you do not receive compensation and will not be charged anything.

If you have any questions about the research, or if you would like more information, please contact Ms. Meihua Yin, Faculty of Public Health, Mahasarakham University. Tel. (mobile phone): (+86) 15507157380, E-mail: 490079361@qq.com.

If you are not treated as described or want to know your rights while participating in this research. You can contact the Review Ethics Broads of Mahasarakham University, Division of research facilitation and dissemination, Mahasarakham University. Tel. 043-754416 (internal number 1755)

Best Regards,

.....

( )

Researcher

Appendix

Part I –Demographic characteristics and social factors

Individual level variables:	1. gender	a. Female b. Male
	2. age	Please fill in the line_____
	3. ethnic	a. han nationality b. If you are an ethnic minority, Please fill in the line_____
	4. monthly household income	a. <1000RMB b. 1000-3000RMB c. 3000-5000RMB d.>5000RBM
	5. education	a. Freshman b. sophomore c. junior
	6. smoking	a.yes b. no
	7. alcohol expectancies	
	8. health literacy	
Interpersonal level variables :	1.family member alcohol use	a. mother drinking b. father drinking c. Parents drink alcohol
	2. peer alcohol use	a. Classmate drinking b. Friends drinking
community level variables :	1. social norms of alcohol use	
	2. access to alcohol outlet	a. Through the supermarket near my home and school b. The bar c. Wine exhibition and sales activities

Part II– AUDIT Scale

	Questions	0	1	2	3	4	Score Totals
1	How often do you have a drink containing alcohol?	never	Monthly or less	2 to 4 times a month	2 to 3 times a week	4 or more times a week	
2	How many standard drinks containing alcohol do you have on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 to 9	10 or more	
3	How often do you have 5 or more drinks in one occasion?	never	Less than monthly	Monthly	Weekly	Daily or almost daily	
4	How often during the last year have you found that you were not able to stop drinking once you started?	never	Less than monthly	Monthly	Weekly	Daily or almost daily	
5	How often in the last year have you failed to do what was normally expected of you because of drinking?	never	Less than monthly	Monthly	Weekly	Daily or almost daily	
6	How often during the last year have you needed a first drink in the morning to get yourself going ager a heavy drinking session?	never	Less than monthly	Monthly	Weekly	Daily or almost daily	
7	How often during the last year have you had a feeling of guilt or remorse after drinking?	never	Less than monthly	Monthly	Weekly	Daily or almost daily	
8	How often during the last year have you been unable to remember what happened the night before because of	never	Less than monthly	Monthly	Weekly	Daily or almost daily	

	your drinking?						
9	Have you or someone else been injured because of your drinking?	no		Yes, but not in last year		Yes, during the last year	
10	Has a relative, friend, doctor or other health care worker been concerned about your drinking or suggested you cut down?	no		Yes, but not in last year		Yes, during the last year	
Total							

Part III–The Alcohol Health Literacy Questionnaire

Part 1: The cognitive skill part (Please read carefully and choose the correct answer)

1. The organ most likely to be damaged by alcohol consumption is (b)

a. kidney

b. liver

c. Spleen

d. Heart

2. Excessive alcohol consumption does not lead to the following conditions (d)

a. Risk of hypertension, stroke

b. Multiple nutrient deficiencies

c. Accidents

d. Insomnia

3. The most common cause of death in acute alcohol intoxication is (c)

a. Coma

b. Convulsions

c. Aspiration and asphyxia

d. Shock

4. blood alcohol concentration of how many doses will make people die (a)

a.0.7%

b.0.8%

c.0.9%

d.10%

5. Can pregnant women, children and teenagers drink alcohol? (a)

a. They should not drink alcohol

b. You can drink more

c. Can drink in small amounts

d. You can drink occasionally

6. The reason for the redness of the face after drinking alcohol is the lack of which of the following enzymes (d)

a. Protease

b. Lipase

c. Amylase

d. acetaldehyde dehydrogenase

Part 2: This part including of 4 dimensions such as access skill, communication skill, self-management skill, and media literacy skill. (Questions 3, 6, 7, 10, 17, 18, 20, 22 are negative questions, please reverse your score)

Sentence	Opinion Level				
	Always 5	Often 4	Sometime 3	Rarely 2	Never 1
Access skill (no.1-6)					
1. When you need information about reduce or abstinence of alcohol use. You can use the device to search for that information.					
2. When you need information about reduce or abstinence of alcohol use. You can ask someone who knows until you get the correct information.					
3. You have a problem with finding information about reduce or abstinence of alcohol use from different sources.					
4. You select information about reduce or abstinence of alcohol use by searching or asking from many sources.					
5. You select information about reduce or abstinence of alcohol use until believing that the information is reliable					
6. You have a problem of selecting information about					

reduce or stop alcohol use to get the information reliable.					
Communication skill (no.7-12)					
7. You don't quite understand when listening to advice on reduce or abstinence of alcohol use from other people.					
8. You can ask for help or advice from others to help you reduce or quit alcohol use.					
9. You talk openly to a friend about your alcohol use problems to help you reduce or abstinence of alcohol use.					
10. You do not understand when you read the document on the problem of alcohol use for reducing or abstinence of drinking					
11. You can speak, read or write information about reduce or abstinence of alcohol use, so that others can understand					
12. You know how to convince others to accept information about reduce or abstinence of alcohol use.					
Self-management skill (no.13-18)					
13. You observe yourself about the amount of alcohol that you drink for setting goals for reduce or abstinence of alcohol use.					
14. You set a goal to be able to reduce demand of alcohol use.					
15. You plan to evaluate your					

emotions and feelings for not lead to alcohol use.					
16. You review your own drinking to reduce or abstain of alcohol use as intended.					
17. You cannot control yourself to follow a plan to refuse alcohol use from the persuasion of a friend or senior.					
18. You cannot plan to reduce or abstain of alcohol use as intended					
Media literacy skill (no.19-24)					
19. When you see an advertisement for alcoholic beverages that promotes love for friends or unity in the group. You analyze and assess the possible of such information before believing such advertisements.					
20. You believe social media advertising for alcoholic beverages that promotes social responsibility and public mind.					
21. When you see a friend, senior, or other person posting or sharing information about solicit alcohol. You analyze the advantages and disadvantages before choose to receive information.					
22. When you see an advertisement for alcoholic beverages that promote for sale or give premium gift. You decide for buy it.					

23. You analyzed information about alcoholic beverages from the social media advertising by rationally before you decide to refuse drinking.					
24. You analyzed information about alcohol harm from the media obtaining before you decide to refuse drinking.					

Part 3: The decision skill part consists of 6 items.

1. If a senior invites you to drinking after you have completed study. What will you do?
a. I will accept the invitation because of drinking a little shouldn't be a problem.
b. I will accept the invitation because of I don't want to have problems with seniors.
c. I will refuse the invitation, then tell that I will go together later.
d. I will refuse the invitation, then tell that I might not be able to wake up to go to college.

2. When you go to a party at a friend's house, then your friend implores you to drinking. How will you decide?
a. I will refuse to drink and asked to go back to the dorm because tomorrow we have early classes.
b. I will refuse to drink and asked to sit and eat with appetizers as a friend instead because if I drunk, I can't go home.
c. I will accept and drink a little to maintain a relationship with friends
d. I will accept and drink because if I refuse, my friends will be dissatisfied. Also, if drunk with friends, it's safe.

3. If your seniors persuades you to drinking and threatened that if you did not drink, they would end the relationship. What will you do?
a. I will drink heavily with seniors to show my respect.
b. I will drink a little bit with seniors because if seniors are drunk then I will take them to home or dorm.
c. I will not drink with seniors. I will sit as a friend because I will be driver for led them back to home or dorm.
d. I will not drink with seniors because of I am medical student who must be role models in health care.

4. If your friend invites you to drink for solving his/her broken heart problem. What will you do?
a. I will invite my friends for drinks at my dorm instead because if we get drunk, we can go to sleep.
b. I will invite my friends for drinks at pub or bar for make he/she get fun and does not drowning in sadness.
c. I will refuse to drink with my friend. I will induce he/she for searching new girlfriend/ boyfriend.
d. I will refuse to drink with my friend. I will invite friends to do other activities to make them forget the sad moments.

5. If you are bored or stressed. You think that drinking can help you solve that problem. What will you do?
a. I will go outside and find a place to drinking for relax
b. I will go outside for buy alcoholic beverages. Then, I will drink at my dorm because if I get drunk, I can go to sleep.
c. I decide I do not drink. I will hang out with my friend.
d. I decide I do not drink. I would call my best friend to relieve stress.

6. When you want to drink to forget about your stress or distress. What will you do?
a. I decide I do not drink. I would invite my friends go out for a drive to forget the stress or suffering at that time.
b. I decide I do not drink. I would vent my stress or distress to a close friend to solve the problem.
c. I'm going to call my friends who like drinking and ask he/she how should I do because I'm stressed.
d. I will buy alcoholic beverages to drink to forget my stress or suffering.

The scoring of each item

item	scoring
1,3,4,5	a=1 b=2 c=3 d=4
2,6	a=4 b=3 c=2 d=1

Part IV– Alcohol expectancy

	Questions	1	2	3	4	Score Totals
1	After a few drinks of alcohol, I would be more likely to enjoy sex more.	Disagree	Slightly Disagree	Slightly Agree	Agree	
2	After a few drinks of alcohol, I would be more likely to be courageous.	Disagree	Slightly Disagree	Slightly Agree	Agree	
3	After a few drinks of alcohol, I would be more likely to feel calm.	Disagree	Slightly Disagree	Slightly Agree	Agree	
4	After a few drinks of alcohol, I would be more likely to be a better lover.	Disagree	Slightly Disagree	Slightly Agree	Agree	
5	After a few drinks of alcohol, I would be more likely to act sociable.	Disagree	Slightly Disagree	Slightly Agree	Agree	
6	After a few drinks of alcohol, I would be more likely to talk to people more easily.	Disagree	Slightly Disagree	Slightly Agree	Agree	
7	After a few drinks of alcohol, I would be more likely to feel peaceful.	Disagree	Slightly Disagree	Slightly Agree	Agree	
8	After a few drinks of alcohol, I would be more likely to be brave and daring.	Disagree	Slightly Disagree	Slightly Agree	Agree	
9	After a few drinks of alcohol, I would be more likely to take risks.	Disagree	Slightly Disagree	Slightly Agree	Agree	
10	After a few drinks of alcohol, I would be more likely to feel dizzy.	Disagree	Slightly Disagree	Slightly Agree	Agree	
11	After a few drinks of alcohol, I would be more likely to feel moody.	Disagree	Slightly Disagree	Slightly Agree	Agree	
12	After a few drinks of alcohol, I would be more likely to clumsy.	Disagree	Slightly Disagree	Slightly Agree	Agree	
13	After a few drinks of alcohol, I would be more likely to be loud, boisterous, or noisy.	Disagree	Slightly Disagree	Slightly Agree	Agree	
14	After a few drinks of alcohol, I would be more likely to act	Disagree	Slightly Disagree	Slightly Agree	Agree	

	aggressively.					
15	After a few drinks of alcohol, I would be more likely to feel guilty.	Disagree	Slightly Disagree	Slightly Agree	Agree	
Total						

Part V–Social norm of alcohol use Questionnaire

Questions	strongly disagree	disagree	uncertain	agree	strongly agree
	1	2	3	4	5
1. Chinese people drink alcohol as part of the lifestyle of Chinese society.					
2. Alcoholism is the root cause of crime.					
3 Alcohol causes arguments.					
4. Alcohol abuse is the main culprit in traffic accidents.					
5. Alcohol abuse is a cause of health problems.					
6. Is alcoholism the cause of poverty, or is it the cause of poverty?					
7. Alcoholism is immoral.					
8. Alcohol abuse can lead to sexual harassment.					
9. Alcohol abuse can harm your learning.					

Health Literacy Program

Introduction

Alcohol is one of the most addictive substances that Chinese adolescents are likely to come into contact with, and due to the lack of self-control and social supervision, the rate of adolescent alcohol consumption has been at a high level. Alcohol consumption among medical students has also become a major concern of the society. Medical students are the guardians of the health of the future population and the forerunners in maintaining their own health. Improving the health literacy of medical students is a necessary way to achieve health for all. Interventions to improve health literacy among medical students, developed based on Nutbeam D's health literacy model, are an important pathway for exploring effective methods.

The authors hope that this handbook will help to reduce problematic drinking and improve health literacy among medical students.

Content

Activity 1: Alcohol knowledge

An intervention based on Nutbeam D's health literacy model was developed to improve students' health literacy and thus their drinking behavior. The Health Literacy Model consists of six main competencies: 1) Acquisition Skills 2) Cognitive Skills 3) Communication Skills 4) Self-Management Skills 5) Decision-Making Skills and 6) Media Literacy Skills. The following is a description of how the activities were carried out and how the intervention was implemented:

Activity Objectives

Cognitive dimension: To improve knowledge about alcohol.

Access dimension: To search for and gain access to information about alcohol.

Communication dimension: To improve communication skills to provide information about alcohol to others.

Self-management dimension: To manage ourselves to avoid drinking alcohol.

Media literacy dimension: To analyze data on alcohol reported in the media.

Decision dimension: To utilize the information received to make decisions about avoiding alcohol.

Implementation process

Cognitive skills: Medical students find out the history of alcohol, its classification, its practical uses, its physical and chemical properties, and the whole spectrum of analysis.

Access skills: Initially, use books, the internet, and close drinking friends to get information about the dangers of alcohol. Conduct relevant research and ask questions of friends around you who drink.

Communication skills: For the information retrieved, the students, led by their group leaders, actively discussed the information, sifted through the poor and false information, discussed the useful information, and chose to use the creation of boards and slides to pass on the useful information and share with the group.

Self-management skills: Students identified ways to manage drinking as: distracting or finding alternatives to carry out avoidance of alcohol; showing that they don't drink at friends' workplaces; attending classmates' parties; and reducing the fluke of having just one drink.

Media literacy skills: Medical students had finished making their slides and drawing their handbills. From their reports, it was clear that most of them had internalized their knowledge of alcohol and also spoke about alcohol awareness.

Decision skills: Medical student found that they could use the Alcohol Metabolism Capacity Predictor to measure their maximum drinking capacity and thus drink in moderation.

Activity 2: Drinking harm

Based on the experience of the first event, which went well, the facilitator introduced the second event on the theme: "The dangers of alcohol consumption".

Activity Objectives

Cognitive dimension: To increase our awareness of the harm of drinking.

Access dimension: To search for and gain access to information on the harm of drinking.

Communication dimension: To effectively use communication skills to provide information on the harms of drinking to people around us.

Self-management dimension: To manage ourselves to avoid drinking alcohol.

Media literacy dimension: To analyze the data on the harms of drinking that we have retrieved.

Decision dimension： To use the information about the harm of drinking that we found to warn ourselves not to drink alcohol.

Implementation process

Cognitive skills: Excessive alcohol consumption is also harmful to the human body and can greatly damage the digestive system, cause oesophageal cancer, damage the liver, increase the incidence of cardiovascular disease, and increase the burden on our body functions.

Access skills: retrieve information on the dangers of alcohol from Baidu, literature reading, internet videos, descriptions from experts studying substance addiction, and Bailiff's publicity pieces, and then combine them with your own perceptions to summarize the information on the dangers of alcohol.

Communication skills: Led by the group leader, students work together to analyze the information we have all collected and discuss the validity and accuracy of the information. During the discussion, students express their own opinions and select information to share with experts and other students.

Self-management skills: As for self-management, one group said: distract yourself, find more meaningful things to do, attend group therapy and alcoholic meetings, use "group inertia" to discipline yourself, and develop good behavior habits. All the students agreed.

Media literacy skills: The medical student had finished making slides and drawing handbills. The students were shown the dangers of alcohol consumption in a vivid way with accurate data, beautiful handbills, and interesting slides, as well as a realistic version of the "Emergency Department Story" to remind all students to stop drinking.

Decision skills: real-life examples are harsh, but they are the best way to learn from them, and individual groups felt that it is only when we experience the social dangers of excessive drinking, such as fights and brawls when emotions are out of control, excessive financial pressure causing family discord, and fatal damage to various body systems. Vivid examples are the only way to better warn yourself against alcohol consumption.

Activity 3: Current state of drinking in China

China is an ancient civilization with a long history and a long drinking culture. Since ancient times, drinking has become a way for Chinese people to socialize, gather, celebrate and express their emotions. Exploring the Chinese wine culture can be traced back to the Shang Dynasty period, more than 3,000 years ago. In ancient times, wine was regarded as a sacred object and was commonly used in rituals and religious ceremonies. With modernization, China's drinking culture has been quietly changing. Today, alcohol consumption is a major public health issue and has become a threat to the nation's health. The Chinese Center for Disease Control and Prevention (CDC) reports that chronic diseases with a high prevalence in the population (e.g., diabetes, hypertension, coronary heart disease, etc.) are significantly related to alcohol consumption. In order to ensure your health and fulfill your responsibility and mission as a medical student, eliminating alcohol consumption starts with me.

Activity Objectives

Cognitive dimension: To raise awareness on the dangers of alcohol consumption.

Access dimension: To search and access data on the current drinking situation of the general public.

Communication dimension: To effectively use communication skills and real data to provide information on the current situation of alcohol consumption to people around us.

Self-management dimension: To stop ourselves from drinking.

Media literacy dimension: To analyze the data found on drinking in China.

Decision-making dimension: To utilize the information fouud on the current drinking situation in China to keep ourselves away from alcohol.

Implementation process

Cognitive skills: Tracing the history of China, one of the first brewing countries in the world, drinking has become a habit, influenced by traditional customs and culture. The real data vividly imagines the current situation of alcohol use among the Chinese population.

Access skills: Students use the search tools at hand (computers, mobile phones, tablets), the online media commonly used by Chinese people (Weibo, Zhihu, Jitterbug, etc.), domestic and international research search websites (Zhiwang, Vipshop, Wanfang, Pubmed, Scopus, SpringerLink, etc.), and the official platforms of the CDC and WHO, with the help of the above search tools, to obtain data on the current status of alcohol consumption in China.

Communication skills: Led by the group leader, the students had a heated discussion about the content of the drawing board and the content of the slide presentation around this thematic activity. Group 1 students' discussion resulted in reporting on the current status of alcohol consumption among Chinese youths; Group 2 chose to report on the current status of alcohol consumption in different regions of China; Group 3 chose the topic of the current status of alcohol consumption among Chinese university students; In addition to this, the students discussed their drinking habits and drinking cultures in their home countries.

Self-management skills: What are some effective ways to reduce and eliminate one's drinking? The students presented several scientific methods, such as cognitive therapy, aversion therapy, family therapy, etc., with the ultimate goal of restraining and stopping drinking. In addition to these scientific methods, there are also ways to stop drinking in our lives by eating right, exercising in moderation, telling ourselves to stop smoking and drinking, and being optimistic at all times; and, of course, by correcting our thinking, shifting our focus, and staying away from the drinking scene.

Media literacy skills: For each of the theme activities, students were required to retrieve information, draw a beautiful board, and create a slide show to report on the knowledge and skills gained during the day.

Decision skills: Medical students concluded that family discord, domestic violence, and financial pressure mostly exist in the families of drinkers, and the proportion of dangerous things happening among drinkers is much higher than normal (e.g., car accidents, fights, provocations, addictive substances). Alcoholics are also more likely to suffer from a variety of illnesses as they get older. In conclusion, the majority of medical students indicate that they do not drink alcohol.

Activity 4: Health Literacy

Health literacy is the ability of an individual to access and understand health information and to use it to maintain and promote his or her own health; it is also a protective film for health awareness, prevention of chronic diseases and elimination of the use of addictive substances; at the same time, health literacy is a measure of an individual's ability to read, comprehend, and act in accordance with medical instructions; and likewise one of the most important tools used by public health experts to study how to improve the health of populations.

Activity Objectives

Cognitive dimension: To improve our health literacy.

Access dimension: To search and explore the relationship between health literacy and alcohol use in the Chinese general public.

Communication dimension: To effectively use communication skills to enhance the health literacy of the general public.

Self-management dimension: To improve our own health literacy while avoiding alcohol.

Media literacy dimension: To analyze the data retrieved on the relationship between health literacy and alcohol consumption in the general public.

Decision-making dimension: To utilize the knowledge and skills found in health literacy to reduce alcohol consumption.

Implementation process

Cognitive skills: Health literacy is currently a hot topic of research for public health experts in China, and therefore more information can be retrieved. Students summarize the information retrieved and select the knowledge points that need to be mastered and reported on, for example: the definition of health literacy, the areas and populations of health literacy research in China, the level of health literacy in Chinese populations, etc. In the process of finding and summarizing, students gained a good understanding of health literacy.

Access skills: Previously, students used to search for information using Baidu, Google, Wikipedia, Zhihu, Weibo, Pubmed, Scopus, Bing, etc. This activity seemed to find a more practical tool: the China Statistical Yearbook (a classification and compilation of all data produced and consumed by Chinese people over the year) and the CDC's This activity seemed to be a more useful tool than the "China Statistical Yearbook" (a breakdown and summary of all data on Chinese production and consumption over the year) and the CDC data (including national, provincial, city, and county disease control centers). As more activities are conducted, students' ability to retrieve valid information grows.

Communication skills: Each group had a heated discussion on what effective communication skills to use to improve the health literacy of the population. The students in Group 3 thought that the improvement of health literacy could not be changed overnight and that it should start with children so that basic medical knowledge and health-related knowledge can be used throughout education, making it a kind of general education. In addition to this, the exciting discussions gave each student a deep understanding of the improvement of health literacy in the Chinese population as one of the pathways to improving the health of the population.

Self-management skills: For the question of how to manage oneself to improve one's health literacy in life while trying not to drink alcohol, the students gave four effective paths of implementation: 1. expand health education models to improve the quality of health education; 2. strengthen information processing skills to promote health skills mastery; 3. expand health education paths to strengthen health cultivation links; 4. emphasize family health education to improve health literacy levels.

Media literacy skills: For each thematic activity, students are required to retrieve information, draw beautiful boards, and create slides to report on the knowledge and skills they have gained today. We found that they were getting better at retrieving information; their ability to discuss, analyze, summarize, and synthesize was gradually improving; and their slides were becoming more and more informative.

In the Action for a Healthy China (2019-2030) plan, 15 major actions are proposed, including actions to popularize health knowledge. The 14th Five-Year Plan for National Health puts forward the following: "Carry out in-depth publicity and popularization of health knowledge, and improve the health literacy of the population." At present, some residents still lack the knowledge and skills to maintain health, unhealthy lifestyle is quite common, and there is still much room for improvement in the level of health literacy. We are medical students, is the future of the population health maintainers and practitioners, I hope you can remember the theme, in the future of learning, life and work, always pass the health knowledge, for the realization of a healthy China to dedicate their own strength.

Activity 5: To avoid and reduce drinking

After having a comprehensive and deep understanding of alcohol consumption and knowing the knowledge and skills related to health literacy, the theme of today's activity was determined: avoidance and reduction of alcohol consumption.

Activity Objectives

Cognitive dimension: To increase our awareness of the dangers of drinking.

Access dimension: To search for information on avoiding and curbing alcohol consumption.

Communication dimension: To effectively use communication skills to provide information on avoiding and curbing alcohol consumption to people around us.

Self-management dimension: To manage to avoid alcohol.

Media literacy dimension: To analyze the information we have retrieved about avoiding and reducing alcohol consumption.

Decision-making dimension: To use the information found to avoid and curb alcohol consumption.

Implementation process

Cognitive skills: Drinking alcohol has become an integral part of contemporary life, and long-term alcohol use can lead to high blood lipids, the formation of alcoholic hepatitis, and even cirrhosis of the liver, etc. These are all the pieces of information that students retrieved on the dangers of drinking alcohol themselves. After summarizing the results, raising awareness of the dangers of alcohol consumption can be divided into three categories: dangers to bodily functions, dangers to public safety, and dangers to the family. The summary results showed that everyone was familiar with the dangers of alcohol use.

Access skills: After the experience gained from previous searches, students have become skilled at using literature reading, censuses, books, and newspapers to quickly access the information they want. Some students have also collected ways to avoid

and reduce alcohol use through e-reading, radio stations, and health promotion brochures.

Communication skills: Each group member discussed passionately and expressed their opinions individually. Some groups chose to use educational videos, news reports on drinking and fighting, and short videos on the dangers of drinking to warn everyone. Others thought it was important to show that they were firm about not drinking when having dinner with friends or leaders or to use drinks instead of alcohol. If you are a hobby drinker, you can use distraction methods to avoid or reduce your drinking.

Self-management skills: For how to manage yourself, try not to drink alcohol in your life. Students suggested the following: 1. Attend fewer parties, especially alcoholic beverages. 2. Improve lifestyle habits and health literacy. 3. Develop other hobbies and interests as distractions. 4. Join relevant sobriety groups and be supervised by others. 5. Use medication to aid sobriety.

Media literacy skills: Students categorized the information they had searched for and made themselves aware of the dangers of alcohol use. Information about reducing alcohol use is differentiated and compared. This will lead to a summary of ways to reduce alcohol use and the benefits of doing so in their lives. The information was then incorporated into a slide show and a poster. After a few activities cumulatively, it was clear that the students' media literacy skills and general abilities were enhanced.

Decision skills: Students share a summary of information, such as the dangers of alcohol use. The pros and cons were clearly identified, as drinking in excess can cause physical discomfort and can lead to accidents, fights, domestic violence, and other risk factors. After weighing the pros and cons, the students advocated, "Stop drinking; start with me."

The deepest impression of this activity is that the students' perception has changed. Compared with the first thematic activity "What is Alcohol", the attitude towards drinking was supportive during the debriefing, and many of the students summarized it

with an old Chinese saying: "Drinking a lot will hurt your body, while drinking a little will make you feel good! Many students summarized it with an old Chinese saying: "Drinking a lot hurts the body, drinking a little makes the heart happy. Nowadays, the attitude towards drinking has changed dramatically, and everyone has issued the slogan "Stop drinking, start from me". The most important way to avoid and reduce alcohol consumption is to enhance students' health literacy and internal drive through thought-guided behavior.

Activity 6: Change adolescent drinking attitudes

After completing the "Alcohol Awareness", "The Harms of Drinking", "Current Drinking Situation in China", "Health Literacy", and "Reducing and Avoiding Alcohol", we concluded that attitudes toward alcohol use are key to adolescents' decision to drink. After completing "Alcohol Awareness", "Harms of Drinking", "Current Situation of Drinking in China", "Health Literacy", and "Reducing and Avoiding Alcohol", we concluded that attitudes towards drinking are the key to adolescents' decision on whether or not to drink, and that attitudes towards alcohol use are dependent on the students' knowledge of alcohol use, the knowledge of the harms of alcohol use, and the students' health literacy level. This will not only test the results of the previous five programs, but also let us know the attitudes of teenagers towards drinking through the students' reports, so our last theme is "Teenagers' Attitudes towards Drinking".

Activity Objectives

Cognitive dimension: To increase awareness for adolescents on the dangers of drinking.

Accessing dimension: To search for and access information on adolescent drinking attitudes.

Communication dimension: To effectively use communication skills to provide adolescents with information about the harms of drinking.

Self-management dimension: To aid adolescents in minimizing alcohol consumption in their lives.

Media literacy dimension: To analyze adolescents' attitudes toward drinking.

Decision-making dimension: To get adolescents to change their drinking attitudes, based on the information they have retrieved about the dangers of drinking.

Implementation process

Cognitive skills: The improvement of cognitive skills depends on students' awareness of the dangers of alcohol consumption, which can lead to dullness, memory loss, mental distraction, mood swings, and in serious cases, criminality. Cognitive skills therefore need to be improved by students seeing and hearing more and experiencing more, with changes in perception determining changes in attitude.

Access skills: After a period of training, the students were able to use literature reading, censuses, books, newspapers, e-readers, radio stations, health promotion brochures, reports from the transport and education sectors to gather the information they wanted, etc. The students in Group 4 suggested that they could use a questionnaire on adolescent drinking behaviour and attitudes to drinking, a questionnaire on parents' drinking behaviour and parents' attitudes to their children's drinking behaviour Attitudes to Drinking Questionnaire, Peer Drinking Behaviour and Attitudes to Drinking Questionnaire, General Self-Efficacy Questionnaire and Social Maladjustment Questionnaire as research tools to solve problems through a scientific research approach.

Communication skills: Members of each group discussed vigorously and expressed their views individually. Some groups felt that effective communication skills could be used to reduce youth drinking, including exploring reasons, expressing themselves reasonably and learning to say no.

Self-management skills: How to manage young people to try not to drink alcohol in their lives. Some of the students suggested the following: 1. focus on controlling young people's drinking behaviour; 2. strengthen young people's awareness of the need to refuse alcohol; 3. develop a wider range of interests for young people; 4. create a better educational environment for young people. Some students in the group indicated that they could use scientific methods such as cognitive therapy, family therapy, aversion therapy and interest therapy.

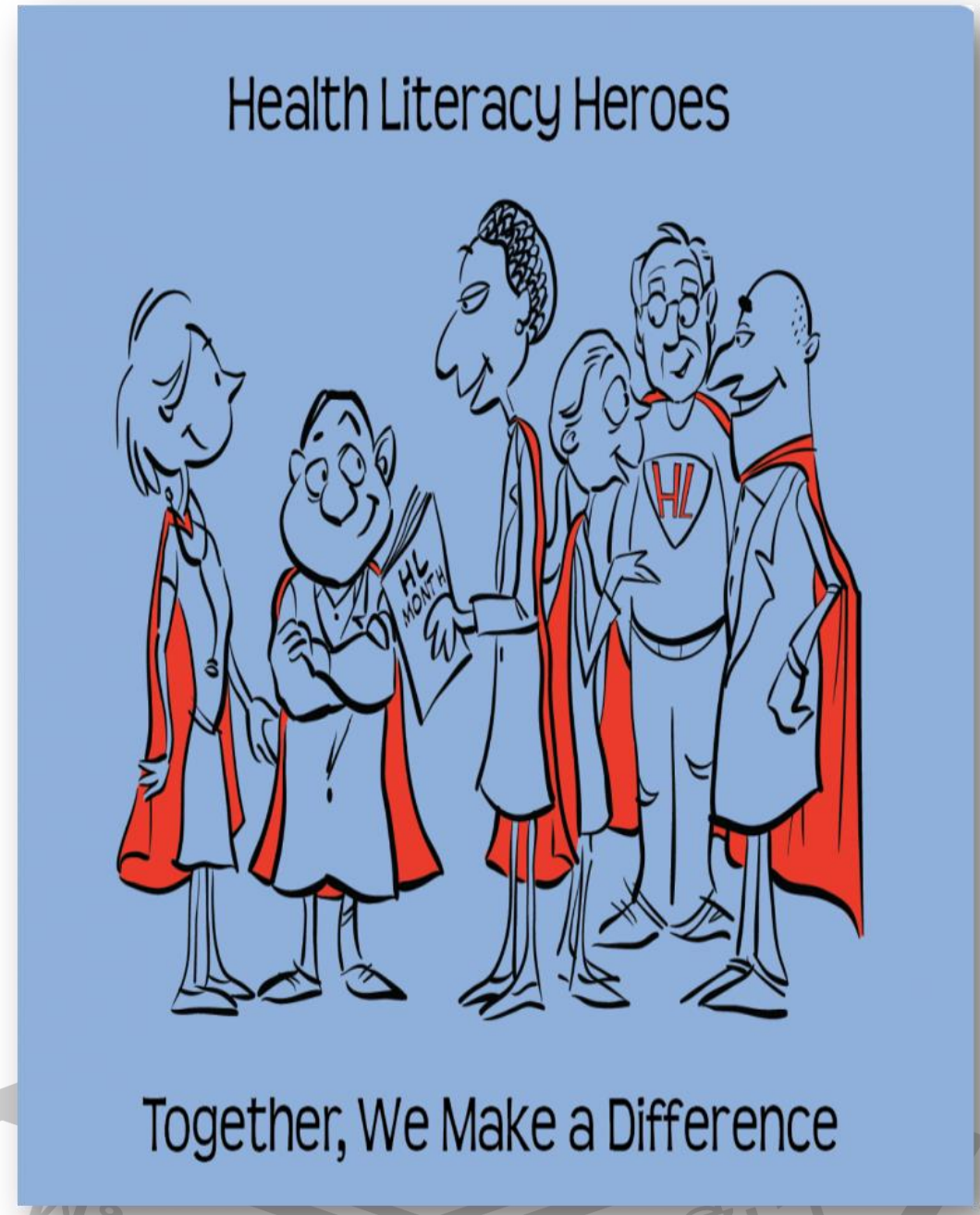
Media literacy skills: It was evident that everyone had improved in their media literacy with their proficiency in using various search tools, summarizing their knowledge, selecting the content of their boards, creating beautiful PowerPoint presentations, and showing confidence in their presentations.

Decision skills: The students used the information they retrieved to draw boards and create slides; each board and PowerPoint was a testimony to their growth. The trajectory of the campaign is a record of their changing attitudes toward drinking.

The 6-week campaign came to an end so quietly. For the medical students, the biggest gain was the change of drinking-related knowledge and attitude towards drinking; they are the guardians of the people's health, the disseminators of healthy behaviors, and the maintainers of their own health. For those responsible for the implementation of this activity, there are three main gains: first, realizing that young people are the future of the country and their health is related to the destiny of the country; second, improving health literacy is one of the effective measures to reduce alcohol consumption among young people; and third, in the fast-developing society, it is difficult to achieve the purpose of verbal health promotion, and multidimensional and multifaceted health education can only stimulate the interest of learning.







Be the hero of your own heart !!!!

Regular health education

Theme 1: "Safety comes first in education" (safety education for university students - fire prevention, drowning prevention, burglary prevention, fraud prevention, traffic safety);

Purpose: To provide safety education for university students, including fire prevention, drowning prevention, burglary prevention, fraud prevention, and traffic accident prevention.

This topic aims to enhance medical students' awareness of safety and prevention, and to build awareness of life safety in the future.

Theme 2: "In the Name of Love, Bloom to the Sun" (Concern for the Mental Health of University Students);

Purpose: To pay attention to the mental health of college students.

This theme aims to pay attention to the cultivation of medical students' mental health and improve their ability to resist stress. Strong mental ability is the foundation for becoming an excellent medical worker.

Theme 3: "Mastering Habits, Not Waiting" (Developing Good Learning and Behavioral Habits);

Purpose: To develop good learning and behavioral habits.

The purpose of this theme is to cultivate the character of hard work, to inherit the dedication of our ancestors and to protect the health of present and future generations.

Theme 4: "Addicted to cell phones, down to picking up the pieces" (eliminating cell phone addiction);

Purpose: Eliminate cell phone addiction.

This theme aims to reduce their bad behavior; cell phone addiction has gradually become a social problem. Therefore, the development of such good habits should start in school.

Theme 5: "Let Youth Shine in Labor" (Respect for Labor, Respect for Knowledge, Respect for Talent, Respect for Innovation);

Purpose: Respect for labor, respect for knowledge, respect for talent, and respect for innovation.

This theme aims to cultivate the spirit of hard work and endurance among medical students, and to interpret the identity of the medical profession with perseverance and good character.

Theme 6: "Civilization and Health" (Create a healthy learning environment and pursue a healthy campus life).

Purpose: To create a healthy learning environment and pursue a healthy campus life.

The purpose of this theme is to ask medical students to pay attention to what they say and do, because the peer effect helps to establish a good campus environment, and a good campus environment can increase the learning atmosphere. The result of this positive reaction is that the school will be able to train more quality students for the society and more quality health care workers for the society.

BIOGRAPHY

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Research output	1. Yin Meihua. The application of informatization means in the teaching design of intramuscular injection practical training class. Modern Vocational Education 2018; 11: 1. 2. Yin Meihua,Ao Xin.Research and practice progress of positive intention therapy in clinical medical and nursing care. Contemporary Nurses 2020; 27(5): 5. 3. Yin M, Yangyuen S, Somdee T. The relation of social-ecological factors and health literacy to medical students' alcohol use behavior in Hubei province, China. J Res Health Sci. 2023; 23(4): e00599.