

ASSOCIATION BETWEEN HEALTH LITERACY, HEALTH
INFORMATION ACCESS, AND HEALTH CARE CHOICES IN
CHINA

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Abstract

Health literacy (HL) is influential in individual's decision concerning health care choices through critically obtaining, understanding, and using health-related information. It is taken as an essential factor for health protection and promotion.

This study intends to examine and understand the associations between HL, health information access, and health care choices when people feel ill, in order to guide individuals to safer decision making in using health services (regular checkup, use doctor service, change behavior) and avoiding unsafe choices (self-medication, ignoring symptoms).

A questionnaire survey was conducted in Hefei city, China. The sample consisted of 279 participants aged 18-60 years old. Findings show that HL is associated with socio-demographic variables being higher in younger aged, more educated, and with a better economic status. Also, controlling for these variables, findings show that people with higher critical literacy tend to use health checkup and are more likely to prefer books/brochures as information source; people who seek health information from magazines, radio, and books/brochures tend to use doctor service. These findings suggest there is room for individuals, professionals, and Government to improve public HL levels and the quality of multiple health information in order to foster health prevention and correction.

Keywords: Health literacy; health information access; health care choice; health prevention and correction.

JEL Classification: I10; I12

Resumo

A literacia em saúde (LS) influencia a decisão individual respeitante às escolhas de saúde através da aquisição, compreensão e uso crítico de informação relacionada com a saúde. É considerada um fator essencial para a proteção e promoção da saúde.

O presente estudo pretende examinar e compreender as associações entre a LS, o acesso a informação sobre saúde, e as escolhas de tratamento quando as pessoas se sentem doentes, para guiar os indivíduos na direção de melhores decisões na utilização de serviços de saúde (checkup regular, consulta médica, mudança comportamental) e evitar as escolhas inseguras (auto-medicação, ignorar os sintomas).

Foi realizado um inquérito por questionário na cidade de Hefei na China. A amostra compreende 279 participantes com idades compreendidas entre os 18 e os 60 anos. Os resultados mostram que a LS está associada a variáveis sociodemográficas sendo maior nos mais jovens, mais escolarizados e com melhor situação económica. Adicionalmente, controlando estas variáveis, os resultados mostram que as pessoas com maior literacia crítica tendem a recorrer mais a checkup e têm maior probabilidade de escolher livros enquanto fonte de informação. As pessoas que procuram informação com base em revistas, rádio e livros tendem a usar mais a consulta médica. Estes resultados sugerem margem para melhoria para os indivíduos, profissionais de saúde e autoridades para melhorar os níveis públicos de LS e a qualidade de múltiplas informações sobre saúde para promover a prevenção e tratamento de problemas de saúde.

Palavras-chave: Literacia em saúde, Acesso a fontes de informação; Escolhas de saúde; Prevenção e tratamento

Classificação JEL: I10; I12

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List of Abbreviations

AMA	American Medical Association
COPD	Chronic Obstructive Pulmonary Disease
HALS	Health Activity Literacy Scale
HISB	Health Information Seeking Behavior
HL	Health Literacy
HLS-14	The 14-item Health Literacy Scale
HLSI	Health Literacy Skills Instrument
MOH	Ministry of Health of the People's Republic of China
NAAL	Education's 2003 National Assessment of Adult Literacy
NHFPC	National Health and Family Planning Commission
OECD	Organization for Economic Cooperation and Development
OTC	Over-The-Counter
PIAAC	Programme for the International Assessment of Adult Competencies
REALM	Rapid Estimate of Adult Literacy in Medicine
REALM-R	The Rapid Estimate of Adult Literacy in Medicine
REALM-SF	Rapid Estimate of Adult Literacy in Medicine—Short Form
S-TOFHLA	Short Test of Functional Health Literacy in Adults
TOFHLA	Test of Functional Health Literacy in Adults
WHO	World Health Organization

1 Introduction

HL is generally defined as individual's ability to access, understand and apply health-related information to make decision of health care such as disease prevention and treatment (ABS, 2008; Freedman et al., 2009). As an emerging topic, HL is popular for guiding how to solve problems caused by inadequate literacy through health education or information, and for promoting public general health not only in the developed countries (e.g. The United States of America, Canada, European countries, Japan) (Sørensen et al., 2012), but also in developing countries (e.g. China) these years (Li, Jun-feng & Pei-sen, 2006). The term was first used in a 1974 paper entitled Health Education (Simonds, 1974). Later, American government started to pay attention to the HL area, in 1999 the American Medical Association (AMA) Council on Scientific Affairs appeal to federal and individual for funding researches on HL (DeWalt & Hink, 2009). Numeracy researches and policies occurred in this area including different definitions, models and measurements of HL that had been proposed (McCormack, et al., 2010), but also the relationship between HL and health outcomes were increasingly studied in USA (DeWalt & Hink, 2009). However, research of HL involving Asia especially China still remains in the primary stage.

In 2006, as predicted by Mathers and Loncar, the top four causes of death around the world by 2030 are expected to be ischaemic heart disease (13.4%), cerebrovascular disease (10.6%), HIV/AIDS (8.9%), and Chronic Obstructive Pulmonary Disease (COPD 7.8%). Likewise, by 2030 in the high-income countries, Lower-respiratory-tract cancers take the place of HIV/AIDS in the top three. This finding calls worldwide attention for chronic disease prevention and detection to avoid risk factors and to treat disease in the early stage. Some governments targeted the improvement in health domain by publishing health objectives for guiding and promoting public's HL such as Health People 2010 in USA (U.S. Dept of Health and Human Services, 2010), Goals and Targets for Australia's Health (2000) in Australia (Nutbeam, 1993).

In China, according to the data presented by The Ministry of Health of the People's Republic of China (MOH), prevalence of three major chronic diseases are hypertension (25.2%), COPD (9.9%) and diabetes (9.7%) (Report on Chinese Nutrition and Chronic Disease, 2015).

Chronic disease has been an emergent issue in the last years since it comprehends 70% of the expense burden in total disease and the mortality of chronic disease was up to 86.6% of the total mortality, which calls for action to promote civic health education, prevention and correction in the early stage, and use both checkup and doctor services (Plan for Chronic Disease Prevention in China 2017-2025, 2017). In the wake of development in economic, people have increasing needs for well living conditions, however, according to The China Human Development Report 1999, the economic growth negatively affects public health to some extent (UNDP, 2000). A huge change can be seen in people's life styles such as tobacco or alcohol consumption, physical inactivity, and over-nutrition which brought the increasing risk of chronic disease due to industrialization and urbanization (He et al., 2005; Report on Chinese nutrition and chronic disease, 2015; Yusuf et al., 2001).

Inadequate supply of quality health care services and resources in the market had failed to match the public demands for health. The opening to private initiatives medical care system seems to alleviate this problem, which provided us a wide selection to engage in health issues closely. However, it also brought potential problems such as the availability of some antibiotics being sold without prescription and the abuse of over-the-counter (OTC) drugs (Li, 2011; Li-yan, 2012; Xue-dong, 2008). In addition, the popularity of mass media also offers an easily accessible platform for individual to access both reliable and unreliable health information (Li-rong, Na & Qun, 2014; Ya-lang et al., 2016). Without mature regulation of health market, this unsupervised environment might mislead individual's health care choice such as taking unsafe behaviors and self-medication, choosing doubtful clinics. For example, in 2008 Ac Nielsen Survey Research Group indicated that 1/3 Chinese customers are likely to self-medicate when they have symptoms such as headache, upper respiratory tract infection, and indigestion (Jun, 2010). Meanwhile, the inequalities in HL lead to the impossibility to achieve national health care goals for preventing, detecting, and treating diseases. People with higher HL might have better performance in obtaining, distinguishing and utilizing health information critically for managing good health. Thus, improving individual's HL is a top priority. According to the Chinese residents monitoring of HL in 2012, the result indicated that general HL of Chinese stayed at a low level (Xue-qiong, Ying-hua & Li, 2014). Later on, National Health and Family Planning Commission (NHFPC) at the first time published an official document related to HL named Plan of National Health Literacy Promotion 2014-2020 for improving residents' HL (NHFPC, 2014). This guiding document implements the goal to improve individual's knowledge and skills by

holding some activities such as establish health problems announcement system; monitor and supervise information release platform; establish an online health information platform; and improve health publicity in communities (NHFPC, 2014).

Recent studies mainly concern HL's states and indicators among national Chinese residents especially measured by the Chinese version of Basic Knowledge and Skills (66 items) (Xue-qiong, Ying-hua & Li, 2014; Zhang & Kanbur, 2005), and the influence with primary disease prevention measured by health behaviors especially for students (Mei, Jun-ling & Jing-ming, 2015). Few researches explained the relationship between HL, health information access, and health care choices in China. Understanding the HL of Chinese adults is crucial since many findings are related to individual's HL in health information, prevention and promotion. This study aimed to fill this blank by understanding how HL impact on health care choices through access to health information. Considering the assignment of advocating healthy lifestyle and controlling the risky factors of chronic disease in the early stage by NHFPC, we assumed that when people feel illness symptoms, they chose amongst several options (e.g. behavior change, health checkup, go to doctor, self-medication, ignoring symptoms) either as corrective measure or for prevention purposes. Sometimes, such options are not only technically uninformed as they can even mask symptoms from a serious disease that could have been taken care easily if caught at early stage.

2 Literature review

2.1 The Origins of Conceptualization of Health Literacy

The concept of HL evolved from a history of defining and measuring the literacy in health setting. In the early history, the definitions of HL were immature, with the increasing attention to this term, more and more definitions of HL have emerged which had been generally explained by having literate related to one's health (Berkman et al., 2010). For a comprehensive understanding of this construct, we begin with reviewing the historical approaches to literacy, which suggests that the conceptualizations of HL are dependent on the development in economy and technology, as well as in health related services for individuals to have ability to utilize the multiplex information.

2.1.1 The Definition of Literacy

Literacy is an essential concept. Generally, literacy was defined as a complex set of the individuals' ability to read, write, compute, also have knowledge and potential to make decisions and solve problems to function in their communities proficiently (Alberto et al., 2007; CLQ, 2000; Kirsch et al., 1993). The demand for these abilities also vary with the improvement of technology and economy (Kickbusch, 2001) which favored a dynamic concept of literacy. In this line, Keefe and Copeland (2011) considered literacy as social phenomenon which is not limited to personal abilities but also required obligation to transfer information in the community.

According to National Assessment of Adult Literacy (Kutner, 2006), literacy was generally divided in two main constituents: task-based and skill-based. Task-based literacy is about the basic abilities in reading and writing, and skill-based literacy concern on the comprehensive skills to execute the tasks. However, as described by Nutbeam (2009) even with advanced literacy in both task-based and skill-based domains, people might failed to maintain a good performance when it comes to the unfamiliar background. According to Speros (2005), an individual only be literate under the health environment when required to understand the familiar health-related vocabulary or content. Based on this reviews, HL derives from literacy but distinctively specializes in the field of health content, and takes into account how people access, understand and utilize health information and health care in health issues and medical situations. Social skills and credentials such as reading, listening, analytic, decision-making, and numerical abilities are important as well to advocate for oneself, to act on health

information, and to negotiate and navigate within the health-care system. Consequently, to find a complete definition of HL, integrating personal literacy and health issues is necessary and indispensable for understanding.

2.1.2 The Definition of Health Literacy

Previous studies and recent papers have highlighted the growth of interest in HL, as well as the continuing debate about its definitions in terms of embracing the practices and policies to promote public and individual's health perspective (Nutbeam, 2008; Sørensen et al., 2012; Wills, 2009). The early definition described it as a capability to perform basic reading and numeracy skills in medical environment (Kirsch et al., 1993).

During the recent period of increasing interest in HL as an important component of health promotion, there are remarkable advancements in defining the concept of HL. Nutbeam (1998) at the first time defined the HL in the broadest sense, being proposed in the WHO health promotion glossary as personal abilities to obtain, understand and apply the information for being well status in health. Later in 2006 the increasing understanding of health factors, changing attitudes and incentive of health behavior, improving self-sufficiency about health-related goals were added to promoting and maintaining well health (Nutbeam & Bauman, 2006). This is in line with a more detailed definition by Australian Bureau of Statistics (2008: na) stating that HL involves the competence to “*understand and use health-related information relating to health issues such as drugs and alcohol, disease prevention and treatment, safety and accident prevention, first aid, emergencies, and staying healthy*”. Recently, after examining and combining previous definitions with professional research group, Sørensen et al. (2012: 3) yield a new comprehensive definition HL is “*linked to literacy and entails people's knowledge, motivation and competences to access, understand, appraise, and apply health information in order to make judgments and take decisions in everyday life concerning healthcare, disease prevention and health promotion to maintain or improve quality of life during the life course*”.

In conclusion, through the review of previous and recent definitions, Berkman et al. (2010) proposed that the definition of HL vary with personal health goals in a suitable and appropriate fit. Despite divergences between definitions, one can highlight that HL cumulative implies obtaining health related information, being able to understand it, being able to critically use it to protect health.

2.1.3 The Models of health literacy

HL is a ubiquitous concept around our daily life. According to the results summarized by Sørensen et al. (2012) providing the multidimensional conceptual model of HL and implying that there was a wide variation between different conceptual models, as well as the key components of HL range extensively.

The original model of Nutbeam distinguishes three level of HL: 1) functional literacy: elementary ability of reading and writing effectively in daily life; 2) communicative literacy: “*more advanced cognitive skills*” combined with social skills, to participant in different activities, to grasp important meaning from mass information during communicating process, in order to utilize information under certain condition; and 3) critical literacy: “*more advanced cognitive skills*” comprehend with social skills, are able to “*critically analyze information*”, and to apply this information to a healthy life (Nutbeam, 2000: 263-264). This model intends to offer positive outcome by representing levels of competences progressively for individual to gain knowledge of risks and health services, improving personal motivation, and resisting negative impact from social and economic sources, and for community to take part in public health programs, intercommunicate with social groups and plan these social and economic determinants of health (Nutbeam, 2000). Afterwards, though some contributions to this model expanded widely its components and consequences of HL, most of them (Manganello, 2008; Mancuso, 2008) can be described similarly to the prototypical one as functional, interactive, and critical HL (regarding components) as well as relating to the health cost, outcome, services, and behavior (regarding consequences).

2.2 The Measurement of Health Literacy

Before introducing the measurement of HL, there is an interesting debate about viewing HL as a static or dynamic concept. Some indicated that it is enough for an individual's HL level to be tested once because it would not change dramatically without specific education, while more objectors stated that individual's HL level can be improved with external and internal change in knowledge and skills dynamically, so in order to measure accurately, repeated estimation is necessary (Berkman et al., 2010; Zarcadoolas et al., 2005).

Many instruments have been used to measure HL in patients and there is still no consensus on how it should be measured since the concept of HL is not straightforward and different authors have their own reflection about it (e.g. Jordan, Osborne, & Buchbinder, 2011; Mancuso, 2009; Meaning & Model, 2006; Pleasant & McKinney, 2011).

According to the extant paper, the most commonly acceptable measures are the Rapid Estimate of Adult Literacy in Medicine (REALM) and the Test of Functional Health Literacy in Adults (TOFHLA), also the shorter versions of the REALM (REALM-R and REALM-SF) and TOFHLA (S-TOFHLA) have been widely used for time-saving (McCormack, Bann, Berkman, & Squiers, 2012). With only 66 words, REALM tests vision instead of the patients' understanding of the words. In addition, as the main tools for a number of extant studies testing HL, TOFHLA also has shortages focusing on the based skills like document literacy, numeracy and reading comprehension without considering the health surroundings (Mancuso, 2009). According to a review of American literacy assessment instruments conducted by Paasche-Orlow et al. (2005: 181), some suggestions of both assessments had been pointed out: 1) all the components of literacy should be considered into the measurement, including "*listening, speaking, writing*", but not limited in "*reading and numeracy*"; 2) Apart from these five components, the knowledge related to health is also essential to measure; 3) Considering "*vision and cognition*" is necessary to reflect the real HL in senior group. So it is insufficient to test the numeracy and reading skills solely by previous instruction as an assessment of the individual's HL.

However, except from REALM and TOFHLA, other existing comprehensive tests such as Education's 2003 National Assessment of Adult Literacy (NAAL) Survey, Health Literacy Skills Instrument (HLSI) and Health Activity Literacy Scale (HALS) are all conducted in the USA, there are few assessments for Asian. Studies in different societies and cultures may

provide additional insights in measuring HL. Based on Nutbeam's (2000) widely accepted theoretical model Ishikawa et al. (2008) developed the 14-item health literacy scale (HLS-14) for diabetic patients. Unlike previous studies that focused solely on functional broader concept of HL, HLS-14 includes three factors (i.e., functional literacy, communicative literacy, and critical literacy), and also proved to be easy to administer in a clinical setting. The instrument showed a good internal consistency ($\alpha = 0.84, 0.77$ and 0.65 respectively), and its three level structure almost measures the full spectrum of HL (van der Vaart, 2013). This instrument is advantageous due to its ease of use and comprehensibility of the items. This instruction is not without limitations. Although it has been used for measuring individuals' HL in public health contexts and received a good fit among Japanese in 2013 (Suka et al., 2013), some limitations were reported by a qualitative study in Holland such as: 1. several words were easily misunderstood; 2. some items were difficult for participants to understand; 3. the references of information vary differently between those three sub-scales (van der Vaart, 2013).

2.3 Socio-demographics

According to previous studies on the association between socio-demographics with HL, it is clear there are predisposing characteristics to individual HL, including age, education, and income (Andrus & Roth, 2002; Anker, Reinhart, & Feeley, 2011; Berkman et al., 2011; Dewalt et al., 2004; Dutta-Bergman, 2004; von Wagner et al., 2007). In terms of the results, most of the studies reported that advanced age, lower education level, and low income tended to correlate with lower HL, but no significant association is found with gender (Baker et al., 2007; Ishikawa et al., 2008; Paasche-Orlow et al., 2005).

Regarding to age, most of the studies on HL found that age is negatively related with HL level (Andrus & Roth, 2002; Baker et al., 2007). Explaining the association between age and HL requires us to focus on the connection between age and literacy, which might offer a clear understanding. Through reviewing the concept of HL, functional HL refers to the reading competence engaging in the area of health-relating information such as instructions of leaflets from hospitals or pharmacies. Some studies showed that senior group has a worse reading comprehension compared with younger group (Edmonds et al., 2009; Finucane et al., 2002; Katzir et al., 2006; Wagner et al., 1987).

The possible reasons for this relationship are the following:

Firstly, worse state of health in senior is a barrier to develop reading and cognitive competences (Goodpaster et al., 2006; Willis et al., 2006), especially some chronic disease which might occur adverse effect (Pizzamiglio et al., 1992). This may compromise their ability to access complex information at critical points (Schwarzer, 2008). Secondly, elders who lack of sufficient exercise show worse performance in cognitive ability (Aartsen et al., 2002; Weuve, 2004). Moreover, affected by the poor physical condition, elder people are less likely to read or learn than before leading to the degenerative backslide of their literacy (Yates & Patalano, 1999). Therefore, a well health status is an important intervention for remaining or increasing older people's reading competences and cognition.

From the original history of HL (Simonds, 1974), the term was described as health education, which showed an initiatory link between education and HL at the first time. As mentioned, more mature and comprehensive concept of HL has been defined as an individual's ability to have reading and numeracy skills to perform, as well as to obtain, process, and understand basic health information and services to practice in health-related setting with a key function matching the content of health information with individuals' literacy level (Schillinger et al., 2006). Therefore, it is important for us to know whether and how individuals' education level impact on improving their own literacy to deal with health issues. Studies stated that higher education attainment can be considered as an essential factor and basic requirement for grasping better literacy such as reading, numeracy, problem-solving, information gathering, and critical thinking in the area of health related environment (e.g., understanding health vocabulary well, communicating with professional, making sound health decisions, learning how to promote and prevent good health) (Barrow, 2004; DeWalt et al., 2004; Ratzan, 2001; Star & Hammer, 2008). However, some studies showed that individuals with similar educational background can differ substantially in their reading and numeracy skills (Kirsch et al., 1993; Kutner et al., 2007). Individuals with higher education degree might also show poor performance in literacy.

In conclusion, even though many existing researches explained how HL mediates the pathway between education and health outcome, it is accepted that less education is associated with low HL (van der Heide et al., 2013; Rudd, 2007) but in a way that the reverse (more education is associated with high HL) is not necessarily true.

Hypothesis1:

We thus believe there is enough evidence that HL is associated with socio-demographic variables (age, gender, education, and income) in such a way that younger people show higher Health Literacy Score (HLS) (H1a), Males and females show equal HLS (H1b), Education relates positively with HLS (H1c), and Income relates positively with HLS (H1d).

2.4 Health Care Choices

2.4.1 Health Behavior

Disease prevention was early classified in 1957 into primary prevention and secondary prevention (Gordon, 1983). Primary disease prevention is about take precaution against illness occurrence; while secondary prevention is to deter the progression of recognized symptoms from being serious (Gordon, 1983). As mentioned, since many health problems or diseases are directly or indirectly caused by risk health behaviors, like alcohol and tobacco use, reckless driving, physical inactivity, overeating, less checkup, and unprotected sexual behavior, the concept of disease prevention evolved to take healthy behavior for declining the incidence of chronic disease (Breslow, 1999). In 1979, an official US Public Health Service document highlighted the lifestyle as a key issue to enhance well-being. Ten years later, O'Donnell (1989: 5) put the focus precisely on promoting health by "*helping people change their lifestyle*" which required "*efforts to enhance awareness, change behavior, and create environments that support good health practices*". These approaches confer health behavior a central role in preventing disease and promoting good health which have also been supported in findings of numerous large previous and recent studies (Montaño & Kasprzyk, 2008).

As a key component of prevention and promotion, health behavior is composed of doing physical exercise and regular examination, controlling weight and balancing nutrition, avoiding smoking and drinking, using condom, doing regular checkup and so on (Schwarzer, 2008).

Early on, Kasl and Cobb (1966) defined three categories of health behavior: 1. Preventive health behavior; 2. Illness behavior; and 3. Sick-role behavior. Recently, preventive health behavior (defined as self-perception of being healthy and willing to maintain or promote good health) has been widely used to measure as health behavior in many empirical studies (e.g. Centola, 2011; Suka et al., 2015). Moreover, it is increasing interest in people's illness

behavior, explained by “*any activity undertaken by an individual who perceives himself/herself to be ill, to define the state of health, and to discover a suitable remedy*” (Kasl & Cobb, 1966: 246).

Numerous studies addressed the positive influence of HL on disease prevention and health promotion through changing and maintaining their health behavior (Scott et al. 2002; Suka et al., 2015). In turn, HL can be considered as an outcome of health promotion actions which provide health knowledge education for individuals to enhance their HL for navigating their health behavior (Baker, 2006; Nutbeam, 2008; Sørensen et al., 2012). Apart from HL, other factors such as cost, risks, availability, and effectiveness of the preventive measure might also impact on making decisions (Gordon, 1983). This study was followed by the concept of individual’s illness behavior in order to understand which key factors might affect their choice to take health lifestyle and prevent the occurrence of disease, which is scarce among recent studies.

2.4.2 Use of Health Services

The use of health services is defined as the process of taking regular health checkup or seeking professional health care with the purpose of preventing or treating health problems (Scheppers et al., 2006). Preventive care services encompass a variety of health care measures, including immunizations, health check-ups, and behavioral counseling, intended to prevent and early detection of diseases. Treatment services are always composed of doctor visit, hospitalization, dental visit and the services related to professional treatment (Scheppers et al., 2006).

Some studies stated that individual’s HL influenced the use of health care services that people with lower HL might take less preventive care measures such as vaccination and preventive medical check-ups and more likely to using the emergency room and hospitalization (Dewalt et al., 2004; Scott, 2002). Apart from literacy, need of correcting illness, predisposition, were also important in making choices to use health services (Andersen & Newman, 2005).

Within the behavioral model of utilization approach, many researchers also suggested that other factors like individual, environmental, and provider-related variables together influence individuals’ decision-making in identifying the reasons why people use or fail to use certain

services and types of health services (Andrea, Siegel & Teo, 2016; Phillips et al., 1998; Rosenstock, 2005; Vaidya, Partha, & Howe, 2011).

2.4.3 Self-Medication

Self-medication is defined as using non-prescription drugs without professional diagnose to treat self-identified illness or symptoms (Figueiras, Caamano & Gestal-Otero, 2000) and the self-use of an inappropriate medicine is called drug abuse (Kuain, 1988). Numerous studies have shown that inappropriate self-medication without medical instruction to use type or dosage correctly increases the risk of adverse drug events, drug resistance, potential drug interaction (Ajuoga et al., 2008; Awad & Eltayeb, 2007).

The most common problem of inappropriate uninformed drug use is antibiotic abuse which has attracted attention in both developed countries (e.g. Albarrán & Zapata, 2008; Berzanskyte et al., 2006; Grigoryan et al., 2006) and developing countries (e.g. Reynolds & McKee, 2009; Selvaraj, Kumar & Ramalingam, 2014). This attention is justified by antibiotic resistance, adverse effects issues and wastage of medical resources (Blaser, 2011; Goossens et al., 2005).

Although developed countries such as the United State of America and European countries have strict regulations on antibiotic use, such drugs are still available without prescription or consulting a physician in some areas which translates into underestimation of the true consumption in these regions (e.g. Figueiras, Caamano & Gestal-Otero, 2000; Grigoryan et al., 2006). The situation in developing countries motivates particular concern as self-medication poses serious public health threats caused by antibiotic resistance and adverse effects due to poor observation of prescription regulations in hospital and pharmacy (Harbarth & Samore, 2005).

In China, the problem of self-medication is an imperative issue. With the increasing economic growth and the investment in the public health market, China's health care system mainly transferred more control from State to the market based (Ho & Gostin, 2009). Hui & Ying (2014) stated that the self-reported rate of purchasing OTC drugs for cold is up to 89%. Apart from OTC drugs, there are still some available prescription drugs like antibiotics to be sold without professional prescriptions in pharmacy (Pan et al., 2012). According to Li-yan's report (2012), 58% residents purchased antibiotics frequently, 37% store antibiotics at home, and 31% self-used antibiotics to treat illness. Therefore, the potential impairments to

people's physical health will be far more serious if the rate of self-medication continues to grow without necessary professional guidance and normative management of medicine market.

Literature about self-medication shows it is explained by multiple factors which can also be described as external and internal factors. External factors include health care policy (e.g. health insurance and reimbursement policies, availability of over-the-counter drugs), social environment (e.g. the easy accessibility of local pharmacies and the influence by friends, family members or medicine providers; availability of drugs in mass media) and drug price (Figueiras, Caamano & Gestal-Otero, 2000; Grigoryan et al., 2006; Harbarth & Samore, 2005). These factors also impact on the internal factors such as public attitudes, beliefs and also knowledge of antibiotic use, self-medication and antibiotic resistance (Grigoryan, 2007; Wen et al., 2011). To some degree, self-medication might be beneficial for those patients only with professional health knowledge guidance and specific training due to its cost-efficiency and time-saving. But normally for the public at large, the disadvantages far exceed eventual efficiency gains as problems may be more extensive than just antibiotic resistance. In addition to these evident factors, there are still few studies shed light on direct impact of individuals' HL on their decisions to the utilization of self-medication.

2.4.4 Health Literacy and Health Care Choices

We are interested in the health behavior and health-care services utilization in response to symptoms for preventive, detective and corrective purposes when people perceive themselves as beginning to be ill based on their HL. Considering both preventive and corrective measures are essential for health care, individuals may ask for regular check-ups, avoid risky factors and have a healthy lifestyle to prevent their existing health problem from being worse, and also use go to doctor service to correct their illness. In turn, some people might use the dangerous measures as a supplement to fix problems when they are facing uncertain ill health, such as self-medication or simply ignoring symptoms with inadequate HL. So, in this study we consider that individual's health-care choices to use safe health services (regular check-ups and go to doctor) or unsafe health services (self-medication and ignore systems unless it is serious) are a key health issue that deserves to be researched.

Hypothesis 2

Therefore, we expect to find that HL positively relates with using safe health services (H2a: Behave change, regular check-ups, go to doctor) and conversely, that HL negatively relates with using unsafe health services (H2b: self-medication, ignore it).

2.5 Health Information Access

2.5.1 Health Information Need

Information need is a “*recognition that your knowledge is inadequate to satisfy a goal that you have*” (Mai, 2016: 6) and that may motivate thought and action. Concerning health-related information, people compare their current knowledge level against their health goals. The perception of a gap drives them to seek further health information through mass media to satisfy their needs of detailed information about health issues, such as illness symptoms, medicine or surgery information, prevention or treatment choices, type of health services (Turner, 2008; Wilson, 2000). A good example is provided by Rutten, et al. (2005) for oncological patients need of information, where the required information for such patients concerned disease-specific information, treatment-related, prognosis, rehabilitation, surveillance and health, coping, interpersonal/social, financial/legal, medical system and body image/ sexuality information.

According to Davis, Koutantji & Vincent (2008), the magnitude of individuals’ health information needs is related with how likely they are willing to seek information. However, some people (especially senior and male) are less willing to seek information and be active in managing their health situation, though they have a greater need for knowing health information (Leydon, Boulton, & Moynihan, 2000; Morrell, Mayhorn, & Echt, 2004) which might be explained as a gender related willingness of putting effort in extracting meaning from the information (Hibbard et al., 2007). Thus, health information is not a sufficient factor to explain actual health information seeking behavior.

2.5.2 Health Information Seeking Behavior

Taken as a purposeful effort to gain information in response to knowledge gap (Mai, 2016), information seeking often occurs when different kinds of sources are available (Brashers et

al., 2002). Studies have shown that lay-people increasingly choose to obtain information by themselves if they are facing uncertain health problems (Fox & Duggan, 2013).

The rapid improvement of mass media brought abundantly available and accessible health information sources. It provided people with easy opportunities to obtain, understand, and also use detailed information to address uncertain problems about their health issues and take care of own health (Fox & Fallows, 2003; Pang et al., 2014; Patrick, 2000). Thus, channel availability increases the number of lay-people motivated to fill their knowledge gaps in the area of health knowledge and gain a more comprehensive view about their health issues in order to better describe their symptom, understand content of professional consultation, make health decision critically, draw valid conclusion clearly (Suka et al., 2015). This is a significant change when compared with previous methods that mainly focused on getting health information from health professionals (e.g. physicians, nurses, and pharmacists) (Schloman, 2004; Shackley & Ryan, 1994).

Health information seeking behavior occurs through several sources of health information (e.g., newspapers, magazines, Internet, radio, television, books or brochures, family members/friends/co-workers, and health professionals). Recently, more and more studies have been placing the focus on individuals' health information seeking behavior via Internet (Fox, 2011; Korda & Itani, 2013). As the optimal channel breaking the time and space barriers of traditional media, Internet provides large number of accessible health information (Bernhardt et al., 2002; Cotten & Gupta, 2004; Fox & Duggan, 2013; Morahan-Martin, 2004), especially about weight control, physical activity, and healthy diet (Portnoy et al., 2008). According to Cline & Haynes (2001), the e-health seeking information activities can occur in three ways by searching directly for health information, participating in support groups, or consulting with health professionals via Internet. This constitutes an alternative opportunity that distinguishes Internet from other media as an engagement tool, especially for patients who might benefit from the helpful online support groups and doctors in terms of convenience, emotional support, and cost-effectiveness (Cotten & Gupta, 2004; Fox, 2011; Grandinetti, 2000; Koh, Brach, Harris, & Parchman, 2013; Kummervold et al., 2002; Oravec, 2000). However, e-health information seeking is a controversial topic. While it immediately disseminates abundant health-related information for users, it also poses six disadvantages: information overload, disorganization, searching difficulties, overly technical language, lack of user friendliness, and permanence (Cline & Haynes, 2001). Also, the

credibility of health information on the Internet has become an increasing issue due to a lack of regulation in websites operation (Metzger, 2007) and information presentation (Metzger, 2003). Moreover, ethical and legal issues about online consultation and online therapy have been pointed out as intractable topics (Kraus, Stricker & Speyer, 2010; Remley & Herlihy, 2001).

Apart from the online sources, newspapers, magazines, radio, television, books or brochures, are described as offline sources. Dutta-Bergma (2004) distinguished communication media into two types including: 1. Information-oriented media (such as newspapers, magazines, books or brochures) and 2. Entertainment-oriented media (such as television and radio). Accordingly, the first offers high credible information actively orient individuals to engage in searching health-related information; the second has less credible information without an archival quality, and mainly presents the risk caused by unhealthy behaviors (Kreps, Bonaguro & Query, 2003). Unlike print media, the oral sources seekers were considered as passive learners (Gunter, 1987).

In addition to mass media, interpersonal communication including family members/friends/co-workers and health professionals also give a crucial contribution to providing health information. Interpersonal communication mainly impact individual's health care behavior through changing their beliefs, attitudes, and values (Kreps, Bonaguro & Query, 2003). Through interpersonal communication, people are able to receive more relevant information easily from their groups or family members to support their choices (Kreps, Bonaguro, & Query, 2003).

Some evidences highlighted that health professionals are the most frequently and trustfully resources (Arora, 2003; Burns, Jones, Iverson, & Caputi, 2013), and likewise printed materials offered by professionals are taken as the most credible information (Dutta-Bergman, 2003). However, since the time to ask and discuss with physicians is limited, patients tend to seek disease-related questions in multiple resources before their consultation with doctors in order to prepare better communication with their doctor (Anderson, 2004; Gavgani, Qeisari, & Jafarabadi, 2013).

All in all, health information seeking behavior is now occurring via many channels from personal consultation with professionals up to entertainment-oriented venues which greatly vary as regards information quality and credibility. Some channels might be related to

positive outcomes while others might lead to detrimental results in the process of utilizing health-related information. Meanwhile, the requirement of quality control and reliability assessment was transferring from health professionals to individual seekers to judge and abstract health information critically, so it is important for individual to have adequate health-related competence in processing information.

2.5.3 Health Literacy and Health Information Access

As Feinberg & Frijters (2015: 4) described, HL is an interactive process “*matching the literacy content of health information with the literacy skill level of the individual*”, as well as taking an important role in understanding health information to guide their choices on health care (Manganello, 2008).

Taking into consideration the concept of HL as proposed by Nutbeam (2000), communicative literacy requires us the ability to access, understand and use health content from mass media, while critical literacy requires us to have ability to evaluate the accuracy, objectivity, and authority of information to exert better control of our own health (Metzger, 2007).

Several studies shed light on barriers of individuals to manage their health care (Berkman, et al., 2011) as the relationship between HL and information access behavior depends on the level of literacy. Hence, individuals who have low level literacy experience difficulties in accessing, understanding, communicating and distinguishing health information while being less likely go to hospital to consult a doctor. Hibbard et al. (2007) and Suka et al. (2015) pointed out that people with high HL tend to seek health-related information from multiple sources in order to make health care choices. In detail, people with low level literacy might be more likely to use oral sources (such as Radio, Television, Friends/Family/Co-Workers, Health Professionals) than printed sources (books/brochures, magazines, newspapers), since their limited literacy prevents them to clearly understand more complex and detailed content. In addition, Internet as the most commonly used source with easy accessibility is a great opportunity for those with low level literacy to receive and understand health information (Feinberg & Frijters, 2015).

Seeking health information is not always positive in helping individuals to make health care decisions. When it turns to the adverse sides, Tennant & Bethany (2015: 2) has pointed out that people with lower literacy skills might also “*unknowingly access health information that*

is inaccurate and potentially dangerous to their overall health”, which is especially a problem for the seniors.

In turn, during the health information seeking process, individuals might be re-educated about the health knowledge through involving in health issues deeply, and as a result their HL can be improved dynamically (Ratzan, 2001).

Hypothesis 3

Thus, we expect that more health literate individuals will show more use of possible health information sources such as newspapers, magazines, books; internet, radio, TV both individually (H3a) and as a whole, by crossing information among communication channels, to have higher use intensity (H3b).

2.6 Health Information Access and Health Care Choices

People tend to retrieve health information when they need to consider a variety of health care options (Pang, 2014), or when they lack a clear understanding about choices impact on their health (Hibbard & Peters, 2003).

Health information is an important warning sign or supplement in health care. By seeking or exchanging health information via mass media, information seekers are able to make appropriate health decisions to preventing health risks, using health services and adopting a positive lifestyle (Kreps, 1988; Kreps, Bonaguro, & Query, 2003; McCracken et al., 2006).

Through seeking health information, people are educated by improving their health knowledge, and have a deeper understanding about the negative and positive sides about the choice they are going to make. In addition, adequate information can enhance people’s confidence, as they would more likely prefer to ask health professionals with more reliable information (Shepperd, Charnock & Gann, 1999). Furthermore, more options can offer wider selections for people to sort out the better information depending on their own need.

Generally, it is evident that people can benefit a lot from abundant health information from multiple sources, however people can easily get lost in the mass information as well. Thus, it is simplistic to assert that more information is *per se* sufficient for individuals to make an appropriate decision.

Conversely, without standards or regulations for providing health information in different resources, some information could be misleading and even dangerous due to the lack of scientific reliable evidences (Cline & Haynes, 2001). Good quality information is the fundamental guarantee to support individuals' health service use and good health behavior (Coulter, Entwistle, & Gilbert, 1999; Shepperd, Charnock & Gann, 1999).

Based on the report by Fox & Ranie (2002), an increasing number of people use the Internet to acquire medical information more than doctor services. Without professional guidance and medical-related ability to judge the validity of information in mass media, some individuals might opt to use self-medication after reading the incorrect and even harmful information. And this vague information can also mislead patients to question and distrust their physicians (Lamp & Howard, 1999).

Obtaining enough health information is only the first step to make a decision. Further actions should be taken such as: a) critically analyzing the comprehensive information and b) identifying the appropriate and credible information (Hibbard et al., 2007), which requires higher HL especially critical literacy. Some studies pointed out that when people are given massive and complicated information, most of them prefer to take an easy way to reduce the cognitive burden, focusing on a single factor to make their decision solely with ignoring other factors (Hibbard & Peters, 2003). Thus, to be a wise chooser, individuals need to critically distinguish and sort out the utility and accuracy of information.

In conclusion, both external factors (e.g. information accessibility, information quality, information reliability, diversified channels, and regulations) and individual factors (e.g. cognition ability, extracting ability, critical thinking) play a crucial role in using health information to make a healthy choice (Wilson, 2000).

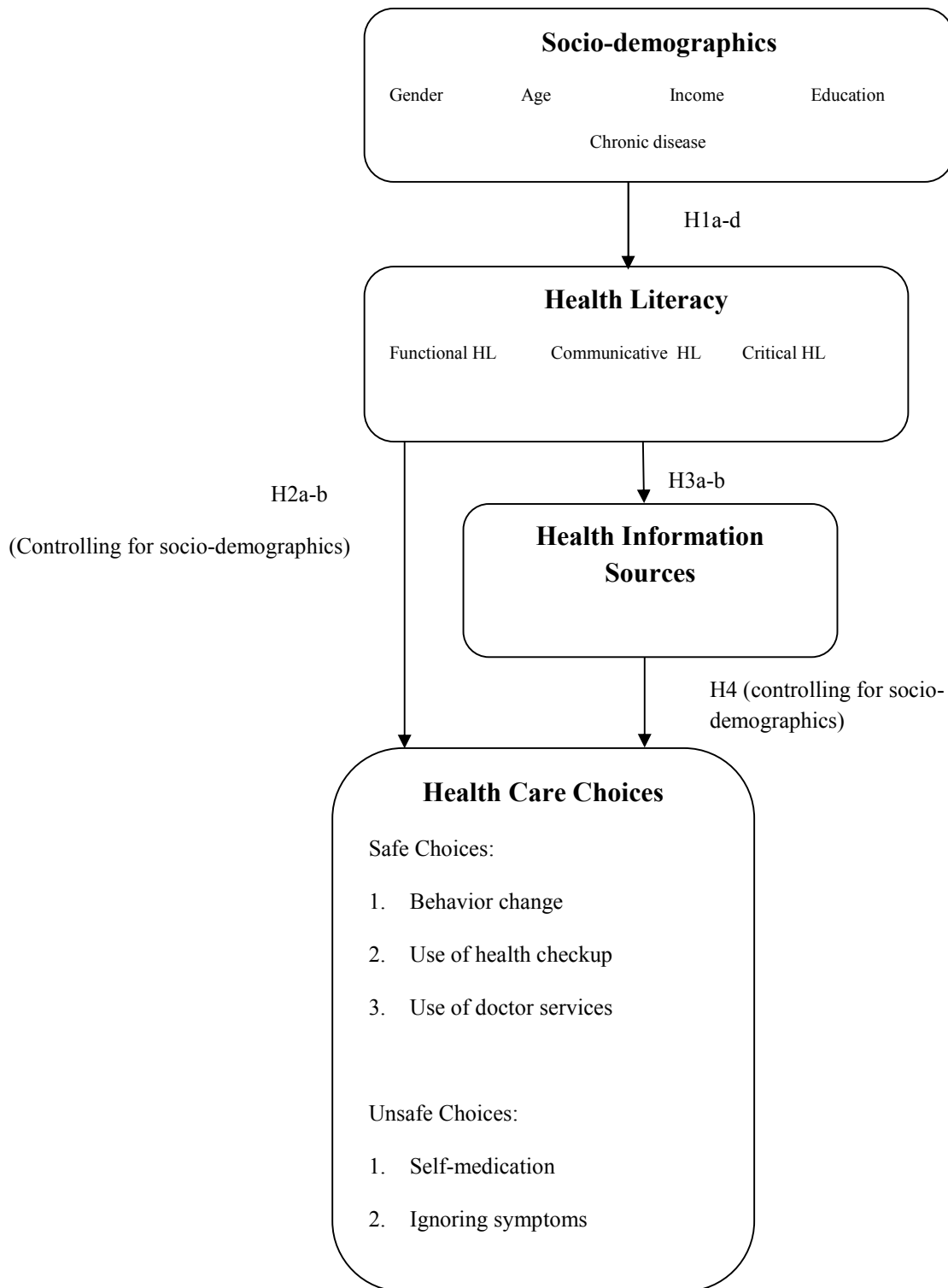
Generally, people with high level HL should have adequate skills to critically obtain, distinguish, understand, and use comprehensive information, in order to make appropriate health care choices, both for prevention and curative purposes.

Hypothesis 4

Thus, we expect that usage of health information from different sources or providers might affect individuals' decisions whether to take health behavior and health services or not (H4).

3 Research Model

Taking into consideration the literature review the full research model that integrates all hypotheses is depicted below.



H1a: Younger people show higher HLS

H1b: Males and females show equal HLS

H1c: Education relates positively with HLS

H1d: Income relates positively with HLS

H2a: The higher the HL the more safe using health services individuals show.

H2b: The higher the HL the less unsafe using health services individuals show.

H3a: HL is positively associated with intensity of information sources use.

H3b: HL is positively associated with average intensity usage of information sources overall

H4: Usage of different health related sources might positively influence people's decision of asking for the safe health services

4 Methodology

4.1 Data Analysis Strategy

The data analysis follows a two-step procedure, firstly we need to test the quality of the measures (validity and reliability) and only if they have enough quality can we proceed to the test of hypotheses.

The quality of measures comprehends validity issues to see whether a correlated 3-factor model of HLS-14 was fit to the data. A scale is valid if the factorial analysis finds a suitable number of factors as Nutbeam (2008) predicted in the original measure and this can be done by means of an exploratory or confirmatory factor analysis. The exploratory factor analysis is suitable when there is no *a priori* factor structure known. The confirmatory factor analysis is suitable when we have an *a priori* structure and allows us to compare the expected model with the true data from the respondents. If there is a good fit we should confirm that some goodness of fit indices meet the following criteria (Hair et al., 2010): $CMIN/DF < 3.0$, $p < .01$; $CFI > .90$; $RMSEA < .08$; $SRMR < .09$. PCFI, indicates parsimony, i.e. that the model is not excessively redundant, and there is no cutoff point. As one of method to test the internal consistency, Cronbach's alpha reflects the average correlation of items within the scale (Streiner & Norman, 2014) and be considered as a good measure when it achieved a criterion of 0.70-0.95 (Terwee et al., 2007).

A self-completion questionnaire survey was the tool to collect primary data in order to test the hypotheses, since using a questionnaire is a good way for collecting descriptive and explanatory data (Bryman, 2015). Additionally, self-completion questionnaire is cheaper and quicker to administer, prevents interviewer effects, and is of a greater convenience for respondents (Tobergte & Curtis, 2013).

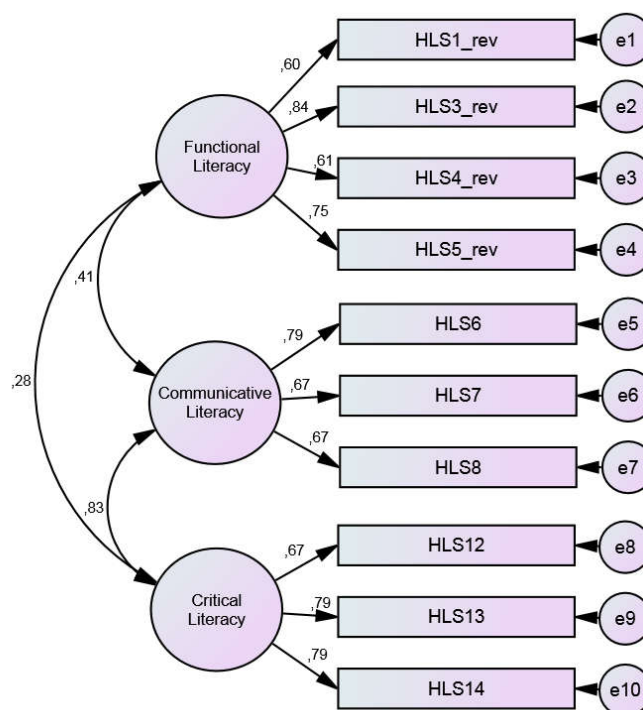
During our research, the survey was conducted between August and October 2016 by online survey. The online survey achieved a higher response rates than traditional paper-and-pencil or mailed surveys and might have an impact on the validity of the data analyses and results (Kiernan et al., 2005; McCabe, 2004;). Essentially we sent the questionnaire to approximately 350 people among 16-60 years old in Hefei city to monitor the opinions and their positioning on HISB and HLS-14 and received 279 valid responds.

4.2 Measures

Health Literacy: HL was measured with a 14-item scale from Nutbeam (2000) which covers three factors: (1) functional literacy; (2) communicative literacy; (3) critical literacy (Suka et al., 2013). The HLS-14 consists of 5 items for functional HL (e.g. “I find characters that I cannot read” or “The content is too difficult for me”), 5 items for communicative HL (e.g. “I collect information from various sources” or “I apply the obtained information to my daily life”), and 4 items for critical HL (e.g. “I consider whether the information is credible” or “I check whether the information is valid and reliable”). Respondents were requested to use a 5-point Likert scale (as in Suka et al., 2015) ranging from “strongly agree”(1) to “strongly disagree”(5).

The confirmatory factor analysis showed the original 3-factor model is not acceptable (CMIN/DF=3.431, $p < .001$, CFI=.866, PCFI=.704, RMSEA=.230, SRMR=.072). Therefore, we used Lagrange Multipliers and removed some items leading to a revised model with valid fit indices (CMIN/DF=2.149, $p < .001$, CFI=.963, PCFI=.685, RMSEA=.064, SRMR=.0547). Judging on Cronbach alpha, all factors showed good reliability (F1 functional literacy, 4 items, $\alpha = 0.784$; F2 Communicative literacy, 3 items, $\alpha = 0.739$; and F3 Critical literacy, 3 items, $\alpha = 0.784$).

Figure 1. Confirmatory factor analysis



Taking into consideration previous data treatment of this variable (e.g. Suka et al., 2015) as well as high Cronbach alpha (.820) we opted to additionally compute a global total score using the items preserved in the CFA.

Health Information Sources : Health information seeking behavior was established through the sources of health information used by the participants. We adapted the research questions from 2012 PIAAC (Programme for the International Assessment of Adult Competencies) which is an international survey implemented by the Organization for Economic Cooperation and Development (OECD). There are eight source variables including newspapers, magazines, Internet, radio, television, books or brochures, family members/friends/co-workers, and health professionals. For each source, participants were asked “How much information about health issues do you get from. . .” and responses should select one degree from “all the information I need”, “A lot”, “Some”, “A Little”, to “None at all” for each source.

The nature of this variable does not recommend the use of factorial analysis because it is not treated as a reflective construct but rather as a formative construct (Diamantopoulos & Winklhofer, 2001; Edwards & Bagozzi, 2000) due to its descriptive nature.

Health care choice: In this study, health care choice was created by measuring means of five items expressing distinct behaviors facing a suspected ill condition or symptoms. Namely: 1) Behavior change (I took healthy diet, did more exercise, and stopped drinking or smoking), 2) Regular checkup, 3) Go to doctor, 4) Self-diagnosis and self-medication, or 5) I ignore symptoms. From these three are recommendable (behavior change, meeting the doctor and doing regular checkup) and the remaining two are unsafe (ignore the symptoms, or self-medication/self-diagnosis). The respondent was to signal if each of the behavioral responses or not with a Yes/No format.

Socio-demographics: The socio-demographic variables are: Gender (1=Male, 2=Female). With regard to Age, age groups comprehended 18-28, 29-39, 40-50 and 51-60. Educational Attainment comprehended four groups which included BSc or higher education, vocational and technical education, high school education, and basic education based on self-reported data. And the income per month was categorized into five variables: <1000, 1000-3000, 3001-5000, 5001-7000,>7000. Medical insurance variables determined by yes or no. Geographic location was based on suburb area and rural area. For relationship status, we

created three options including single, in the relationship married or domestic partnership and divorced or widowed.

Considering the health focus of this study, we opted to measure the report on chronic diseases (yes/no) covering the most frequently occurring ones, namely: Hypertension, Diabetes, Chronic gastritis, Arthritis, Pharyngolaryngitis, Tuberculosis, Coronary heart disease, Thyroid disease, Hepatitis, Pelvic inflammatory disease, Breast cancer, or Epilepsy. Additionally we included “other” and “none”.

4.3 Sample

We collected 279 valid responses which were voluntarily completed corresponding to a response rate of 79% which indicated a very good level (Mangione, 1995). The sample is mostly female (57%) and also divided into four age groups where the majority of the sample falls in the 18-39 year-old range (63.8%) (Table1).

Table 1. Age distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-28	93	33.3	33.3	33.3
	29-39	85	30.5	30.5	63.8
	40-50	57	20.4	20.4	84.2
	51-60	44	15.8	15.8	100.0
	Total	279	100.0	100.0	

The sample respondents mostly have higher educational level (67%) comprehending both vocational and BSc or higher degrees (Tables 2).

Table 2. Education distribution

	Frequency	Percent	Valid Percent	Cumulative Percent
BSc or higher	113	40.5	40.5	40.5
Vocational	74	26.5	26.5	67.0
Valid High school	41	14.7	14.7	81.7
Basic	51	18.3	18.3	100.0
Total	279	100.0	100.0	

The sample's income per month lies mostly in the 1000-5000 yuan per month (Table 3) which should be taken as higher than average in the Chinese labor market.

Table 3. Monthly income

	Frequency	Percent	Valid Percent	Cumulative Percent
<1000	23	8.2	8.2	8.2
1000-3000	81	29.0	29.0	37.3
Valid 3001-5000	93	33.3	33.3	70.6
5001-7000	41	14.7	14.7	85.3
>7000	41	14.7	14.7	100.0
Total	279	100.0	100.0	

¥1000 ≈ €134 at time of data collection

The majority of the sample reports the rates of having public medical insurance (89.2%) and living in urban areas (86.4%) respectively.

The respondents report 54.5% respondents having no chronic disease, while the remaining of the sample reported having at least one chronic condition (Table 4).

Table 4. Chronic diseases

	Frequency		Frequency
Hypertension	6.8	Thyroid disease	2.2
Diabetes	4.3	Hepatitis	1.8
Chronic gastritis	14.7	Pelvic inflammatory disease	5.7
Arthritis	10.0	Breast cancer	0
Pharyngolaryngitis	11.8	Epilepsy	0
Tuberculosis	0	Other	7.5
Coronary heart disease	1.1	None	54.5

We computed an index that sums all of each chronic disease. It ranges from 0 to 13 and the overall sample reported the following frequencies (Table 5).

Table 5. Chronic disease index

	Frequency	Valid Percent	Cumulative Percent
No chronic disease	152	54.5	54.5
One disease	82	29.4	83.9
Two diseases	36	12.9	96.8
Three diseases	6	2.2	98.9
Four diseases	3	1.1	100.0
Total	279	100.0	

5. Results

Results will be presented by showing descriptive statistics before together with bivariate statistics followed by hypotheses testing.

5.1 Descriptives and Bivariate data analysis

Descriptive statistics report on response scale, minimum and maximum responses registered (scale range), as well as average and standard-deviation. For bivariate analysis we opted to use Spearman correlations are shown. For Gender, Medical insurance, status, geography and Chronic_Disease_Index, Phi and Cramer's V statistics are shown. In all cases nominal variables are crossed with interval variables, we opted not to use the Eta Directional measure but opted to conduct U Mann-Whitney tests to compare medians in dichotomic variables and X^2 Kruskal-Wallis in polyatomic variables (as Kolmogorov-Smirnov test indicate they were not normally distributed). Gender (1=Male, 2=Female). All descriptive and bivariate findings as reported below (Table 6).

Descriptive cover both the socio-demographics and subjective variables concerning HL. All variables show a full range of responses using the entire scale to the exception of Communicative Literacy which has the maximum value of 4.5 out of 5.

Table 6. Descriptives and bivariate statistics

	Scale	Min_Max	Average (sd)	1	2	3	4	5	6	7	8	9	10
1. Age_1	1-4	1-4	-	-									
2. Gender_1	1-2	1-2	-	.120	-								
3. Education	1-4	1-4	2.89 (1.13)	.323**	.210**	-							
4. Monthly income_1	1-5	1-5	2.99 (1.16)	.004	-.442**	.346**	-						
5. Medical_insurance_1	1-2	1-2	-	.183*	.068	-.125	.154	-					
6. Status_1	1-3	1-3	-	.616**	.052	-.217**	.042	.152*	-				
7. Geography_1	1-2	1-2	-	.038	.112	-.300**	.369**	.166**	.155*	-			
8. Chronic Disease Index	0-13	0-4	0.66 (0.86)	.308**	-.041	-.108	-.062	-.037	.198**	-.031	-		
9. Functional_Lit_1	1-5	1-5	3.09 (.89)	-.044	-1.207	.199**	.127*	-.628	.305	-3.001**	-.077	-	
10. Communicative_Lit_1	1-5	1-4.5	3.43 (.62)	-.097	-.086	.321**	.142*	-.453	3.703	-1.260	-.070	-.116	-
11. Critical_Literacy_1	1-5	1-5	3.80 (.79)	-.163**	-1.611	.385**	.237**	-.204	5.157	-2.865**	-.091	.130*	.459**

*p<.05; **p<.01.

Among HL dimensions, Critical Literacy shows the highest average (3.8) followed by communicative (3.43) and functional literacy which is at the midpoint of the scale (3.09).

Additionally, we believe it is important to understand how specific health literacy is distributed in the sample. Figure 2 to 4 show the distribution as frequencies.

Figure 2. Functional literacy distribution

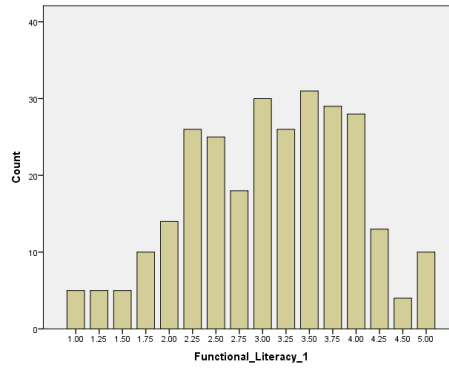


Figure 3. Communicative literacy distribution

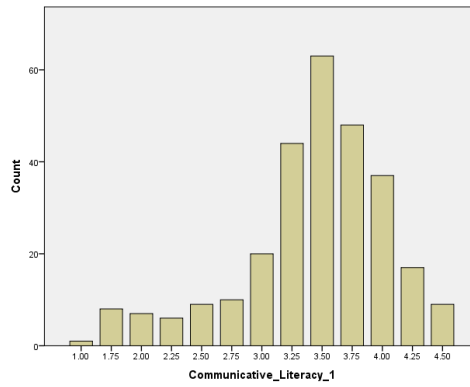


Figure 4. Critical literacy distribution

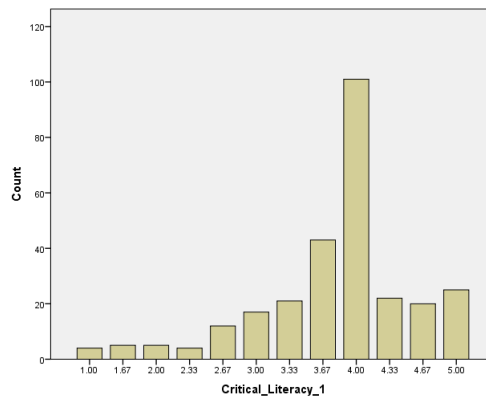
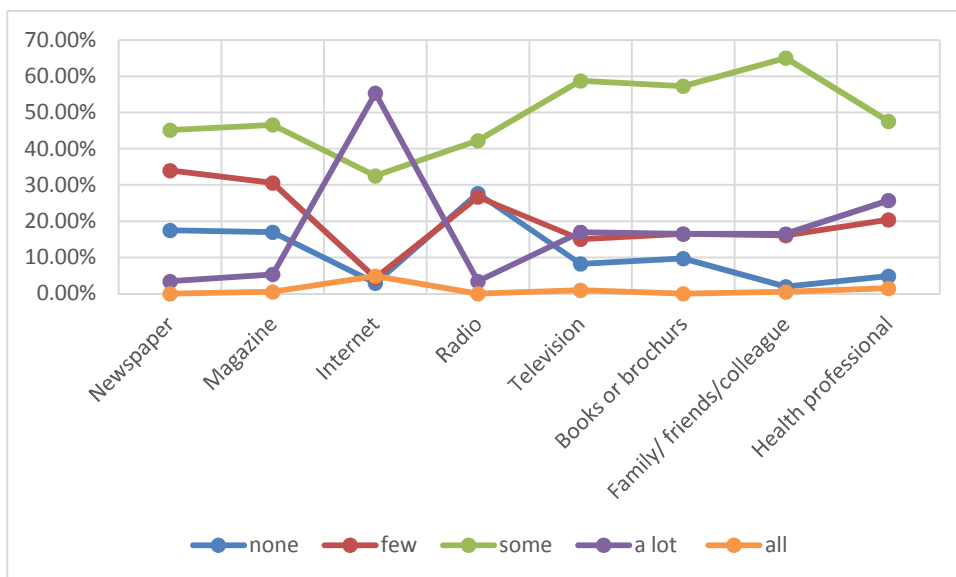
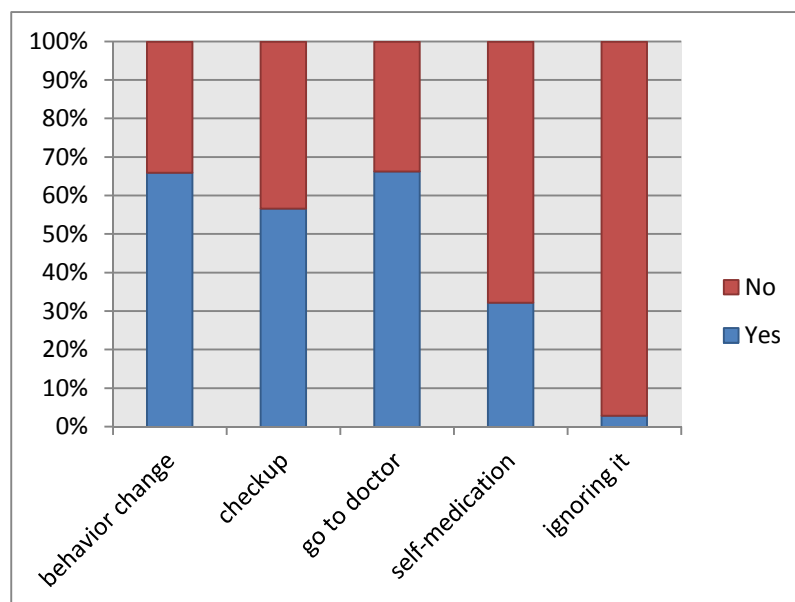


Figure 5. Intensity of health information use distribution



As shown in the figure 5, the most popular social media is Internet that 55.34% people got “a lot” of information from it. However, few of them access to health information from the tradition channels like newspaper, magazine and radio. Television, books, interpersonal communication remains a similar level with each other in self-reported “a lot”.

Figure 6. Distribution of health care choices



As can be seen from the distribution of health care choices (figure 6), respondents self-reported using behavior change (65.95%), regular checkup (56.63%), go to doctor services (66.31%), self-medication (32.26%), and ignoring symptoms (2.87%).

5.1.1 Hypothesis 1

The full exploration of the research model will start by testing how HL explained by socio-demographics and after that we shall test how HLS (and its factors) explains health care choices.

For any society concerned with preventing health social and economic costs it is important to create conditions to build HLS. Such sort of literacy reflects the phases through which society went and so it is expectable that some socio-demographic variables will relate with different levels of HL.

Therefore, we test the Hypothesis 1.

Taken into consideration that HL is a composite of three factors (functional, communicative, and critical literacy) we shall extend the hypotheses testing to each of these factors as corresponding sub-hypotheses.

Findings show that age relates negatively with HLS, with younger people showing higher Communicative literacy ($\beta = -.122$, $p < .05$) and Critical literacy ($\beta = -.158$, $p < .01$) but not with Functional literacy, thus partially supporting H1a.

Findings show that gender does not relate in a statistically significant ($p < .05$) way with any of the HLS variables, thus supporting H1b.

Findings show that education relates positively with HLS, with more educated people showing higher Functional literacy ($\beta = .241$, $p < .01$), and Communicative literacy ($\beta = .377$, $p < .01$) and Critical literacy ($\beta = .437$, $p < .01$) thus supporting H1c.

Findings show that incomes relates positively with HLS, with higher earners showing higher Functional literacy ($\beta = .140$, $p < .05$), and Communicative literacy ($\beta = .137$, $p < .05$) and Critical literacy ($\beta = .252$, $p < .01$) thus supporting H1d.

5.1.2 Hypothesis 2

H2a: The higher the HL the more safe using health services individuals show.

H2b: The higher the HL the less unsafe using health services individuals show.

To test H2a and H2b we have conducted logistic regression analysis for each of the choices. Technically, the cutoff value for each dependent variable has to be adjusted to its specific distribution and so the cutoff values for the variables were: behavior change (.341), checkup (.337), doctor (.677), self-medication (.434), and ignoring (.978).

We conducted a hierarchical logistic regression analysis to predict each health seeking behavior in the 279 respondents, controlling in the first step for age, gender, income, geographical residence area, and civil status.

For **CB1 (behavior change)** we found no significant predictors both among socio-demographics and HL variables. Omnibus tests of model coefficients returned a non-significant ($p > .05$) chi-square statistics for step, block and model with all predicted cases falling into the “positive change behavior” option. Although the majority of respondents reported changing their behavior (66%) there is no pattern associated with such behavioral option.

For **CB2 (regular check up)** we found a meaningful model. A test of the full model against a constant only model was statistically significant, indicating that HL reliably distinguish between people that do check-up from those that do not (Omnibus test $X^2=22.040$, 6 df, $p < .01$). From the table 8, the Nagelkerke R^2 (.102) indicates a relatively weak relation between predictors and actual behaviors. Hosmer-Lemeshow test (table8) indicates good fit of the model ($X^2=11.266$, 8 df, $p=.187$).

Table 7. Model Summary-health checkup

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	359.815 ^a	.076	.102

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 8. Hosmer and Lemeshow Test-health checkup

Step	Chi-square	df	Sig.
1	11.266	8	.187

Likewise, the ROC curve indicates the model classifies the group significantly better than by chance (Area=.58, sd=.034, $p < .05$). (Table9, Figure 7)

Table 9. Area Under the Curve-health checkup

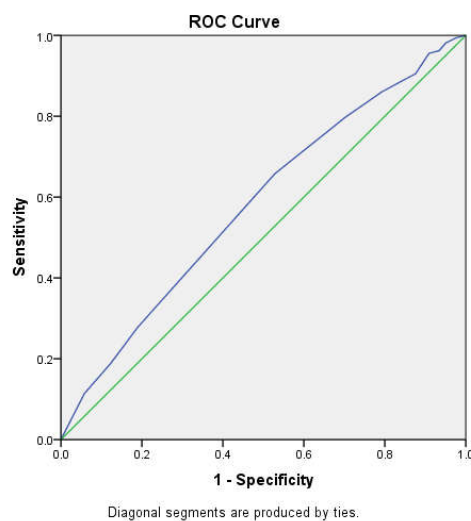
Area	Std. Error ^a	Asymptotic Sig. ^b	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.582	.034	.019	.515	.649

The test result variable(s): Critical_Literacy_1 has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

Figure 7. ROC Curve-health checkup



Prediction success overall was 65.2% (93.7% for checkup and 28.1% for non-checkup).

(Table10, 11)

Table 10. Classification-health checkup

	Observed	Predicted		
		Check-up		Percentage Correct
		No	Yes	
Step 1	No	34	87	28.1
	Yes	10	148	93.7
	Overall Percentage			65.2

a. The cut value is .434

Table 11. Classification-health checkup

	Observed	Predicted		
		Check-up		Percentage Correct
		No	Yes	
Step 1	No	Correct prediction	False positive (71.9%)	28.1
	Yes	False negative (6.3%)	Correct prediction	93.7
	Overall Percentage			65.2

a. The cut value is .434

The Wald criterion demonstrated that Gender, Education, and Critical literacy made all a significant contribution to prediction ($p < .05$). Exp(B) values indicate that females have higher odds ratio (.394) times as large as males of checkup which we tested with a chi-square ($X^2 = 7.148$, 1df, $p < .01$, Table 13). Likewise Education plays a role as more educated people have a higher odds ratio (1.344) of checkup. Concerning HL, findings show that when critical literacy is raised by one unit, the odds ratio is 1.53 as large and thus more literate respondents are more likely to checkup (Table 12, Table 13).

Table 12. Chi-Square Tests-health checkup

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.148 ^a	1	.008		
Continuity Correction ^b	6.510	1	.011		
Likelihood Ratio	7.154	1	.007		
Fisher's Exact Test				.010	.005
Linear-by-Linear Association	7.122	1	.008		
N of Valid Cases	279				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 52.04.

b. Computed only for a 2x2 table

Table 13. Variables in the Equation-health checkup

	B	S.E.	Wald	df	Sig.	Exp(B)
Gender(1)	-.932	.292	10.184	1	.001	.394
Insurance(1)	.737	.417	3.118	1	.077	2.089
EducationLevel_inv	.296	.143	4.295	1	.038	1.344
Age	.099	.128	.593	1	.441	1.104
Step 1 ^a Income	.018	.127	.020	1	.888	1.018
HLSF1_Functional_Lit	-.096	.154	.385	1	.535	.909
HLSF2_Communicative_Lit	-.340	.260	1.719	1	.190	.711
HLSF3_Critical_Lit	.425	.215	3.916	1	.048	1.530
Constant	-1.248	1.010	1.528	1	.216	.287

a. Variable(s) entered on step 1: HLSF1_Functional_Lit, HLSF2_Communicative_Lit, HLSF3_Critical_Lit.

Note: This regression was hierarchical in nature with the socio-demographic variables input as a first block followed by the HLS variables in the second block.

For **CB3 (go to doctor)** we found a meaningful model. A test of the full model against a constant only model was statistically significant, indicating that HL reliably distinguish between people that use doctor service from those that do not (Omnibus test $X^2=22.890$, 8 df, $p<.01$) Table 14 shows that the Nagelkerke R^2 (.109) indicating a relatively weak relation between predictors and actual behaviors although Hosmer-Lemeshow test indicates good fit of the model ($X^2=10.568$, 8 df, $p=.277$) (Table 15).

Table 14. Model Summary-go to doctor

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	333.656 ^a	.079	.109

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Table 15. Hosmer and Lemeshow Test-go to doctor

Step	Chi-square	df	Sig.
1	10.568	8	.277

Likewise, the ROC curves indicate the model classifies the group significantly better than by chance (for Education and Income levels, Area=.61, sd=.035, p<.01). (Table16, Figure 8)

Table 16. Area Under the Curve-go to doctor

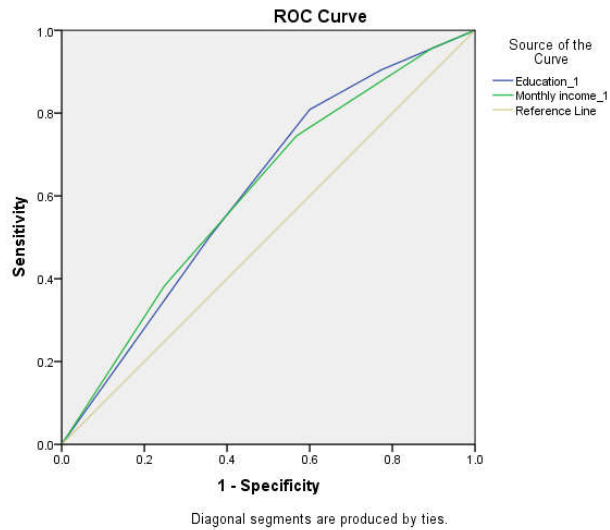
Test Result Variable(s)	Area	Std. Error ^a	Asymptotic Sig. ^b	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
Education_1	.613	.035	.002	.545	.680
Monthly income_1	.609	.035	.003	.540	.677

The test result variable(s): Education_1, Monthly income_1 has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

Figure 8. ROC Curve-go to doctor



Prediction success overall was 65.9% (99% for go-to-doctor and 1% for no go-to-doctor). (Table 17, 18)

Table 17. Classification-go to doctor

	Observed		Predicted		
			Go-to-doctor		Percentage Correct
			No	Yes	
Step 1	Go-to-doctor	No	1	93	1
		Yes	2	183	99
	Overall Percentage				65.9

a. The cut value is .337

Table 18. Classification-go to doctor

	Observed	Predicted		
		Go-to-doctor		Percentage Correct
		No	Yes	
Step 1	Go-to-doctor No	Correct prediction	False positive (98.9%)	1
	Go-to-doctor Yes	False negative (1%)	Correct prediction	99
Overall Percentage				65.9

a. The cut value is .337

The Wald criterion demonstrated that Education level and Income made significant contribution to prediction ($p < .05$). Exp(B) values indicate when education level is increased by one unit, the odds ratio is .729 and the less educative people are more likely to ask doctor for help ($B = -.316$). When income is raised by one unit, the odds ratio is .782 as large and thus higher income earners are less likely to use doctor services in case of suspected disease ($B = -.246$) (Table 19).

Table 19. Variables in the Equation-go to doctor

	B	S.E.	Wald	df	Sig.	Exp(B)
Education Level_inv	-.316	.143	4.882	1	.027	.729
Income	-.246	.119	4.254	1	.039	.782
Step 1 ^a						
HLSF1_Functional_Lit	-.063	.160	.156	1	.693	.939
HLSF2_Communicative_Lit	-.397	.279	2.032	1	.154	.672
HLSF3_Critical_Lit	.259	.227	1.302	1	.254	1.296
Constant	2.952	1.002	8.673	1	.003	19.149

a. Variable(s) entered on step 1: HLSF1_Functional_Lit, HLSF2_Communicative_Lit, HLSF3_Critical_Lit.

For **CB4 (self-medication)** as well as **CB5 (Ignoring symptoms)** we found no significant predictors both from socio-demographics and HL variables. Omnibus tests of model coefficients returned a non-significant ($p > .05$) chi-square statistics for step, block and model with all predicted cases falling into the “no self-medication” and “not ignoring symptoms” options. In the last case this is very simply to explain as 97.8% of respondents stated they would not ignore symptoms.

5.1.3 Hypothesis 3

How is the Health Information Sources associated with the Health literacy? Answering this question implies that respondents agreed to have conducted some health related information seeking in the last year, and so the sample was reduced to 206.

Therefore we hypothesize that:

H3a: HL is positively associated with intensity of information sources use.

We found chronic disease index to significantly predict newspaper usage ($\beta = .186$, $p < .01$, $R^2_{ad} = 2.6\%$), radio ($\beta = .207$, $p < .01$, $R^2_{ad} = 4.1\%$), consultation with family, colleagues and friends ($\beta = .232$, $p < .01$, $R^2_{ad} = 4.4\%$) and with professionals ($\beta = .224$, $p < .01$, $R^2_{ad} = 4.7\%$). After controlling for this index we tested socio-demographics (gender, age, education, income, geographical and insurance) possible predictive power. We found education was a significant predictor of some information source usage, namely newspapers ($\beta = .343$, $p < .01$, $R^2_{ad} = 11.7\%$), magazines ($\beta = .312$, $p < .01$, $R^2_{ad} = 11.4\%$), radio ($\beta = .297$, $p < .01$, $R^2_{ad} = 10.9\%$), and family, colleagues and friends ($\beta = .189$, $p < .01$, $R^2_{ad} = 8.9\%$). All other sources were not associated with any other socio-demographic variable.

On one hand, education seems to play a relevant role due to its transversal nature but on the other hand the explained variance is quite low. So, we shall continue with analyses including socio-demographics just for rigor sake although we are persuaded it does not play a strong explanative role in understanding the options for health information sources choice.

Concerning HL factors (functional, communicative, critical) we only found significant association for critical literacy (after controlling for socio-demographics) with books/brochures usage ($\beta = .245$, $p < .01$, $R^2_{ad} = 14\%$).

H3b: HL is positively associated with average intensity usage of information sources overall

Because general health state concerning chronic diseases might play an important role in health information sources use, we opted to control for this variable before any other. So, in a first step we entered chronic disease index, in the second step we entered the socio-demographics, and in the last step we entered the three literacy factors (functional, communicational, and critical).

Findings show that chronic disease index did significantly and positively associate with average use of information sources (beta=.277, $p < .01$, $R^2_{ad} = 7.2\%$) (Table 20). After controlling for this variable, only education showed positive significant association (beta=.418, $p < .01$, $R^2_{ad} = 19.5\%$) while no literacy type did significantly associate (Table 21).

Table 20. Model Summary-HL with average usage of whole information sources

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.277 ^a	.077	.072	.43702	.077	16.926	1	204	.000	1.069
2	.468 ^b	.219	.195	.40695	.142	7.252	5	199	.000	
3	.503 ^c	.253	.219	.40105	.034	2.965	3	196	.033	

a. Predictors: (Constant), Chronic_disease_index_1

b. Predictors: (Constant), Chronic_disease_index_1, Gender_1, Medical_insurance_1, Education_1, Age_1, Monthly income_1

c. Predictors: (Constant), Chronic_disease_index_1, Gender_1, Medical_insurance_1, Education_1, Age_1, Monthly income_1, Functional_Literacy_1, Communicative_Literacy_1, Critical_Literacy_1

d. Dependent Variable: average_ihsourse

Table 21. Coefficients-HL with average usage of whole information sources

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.671	.039		68.596	.000	
	Chronic_disease_index_1	.145	.035	.277	4.114	.000	1.000
	(Constant)	2.095	.234		8.941	.000	
	Chronic_disease_index_1	.155	.034	.296	4.516	.000	.915
	Age_1	.027	.030	.064	.908	.365	.802
2	Gender_1	.062	.066	.068	.942	.347	.764
	Monthly income_1	-.019	.029	-.048	-.643	.521	.701
	Medical_insurance_1	-.076	.104	-.046	-.732	.465	.984
	Education_1	.180	.031	.418	5.762	.000	.746
	(Constant)	1.525	.307		4.966	.000	
	Chronic_disease_index_1	.155	.034	.297	4.589	.000	.910
	Age_1	.022	.030	.051	.736	.462	.799
	Gender_1	.042	.066	.046	.645	.520	.753
3	Monthly income_1	-.029	.029	-.074	-1.001	.318	.690
	Medical_insurance_1	-.074	.103	-.045	-.720	.472	.977
	Education_1	.144	.033	.335	4.364	.000	.646
	Functional_Literacy_1	.059	.035	.112	1.670	.096	.852
	Communicative_Literacy_1	.087	.062	.098	1.401	.163	.783
	Critical_Literacy_1	.065	.051	.095	1.285	.200	.703

a. Dependent Variable: average_ihsource

5.1.4 Hypothesis 4

How is different health-related information sources impact on health care choices?

H4: Usage of health related sources might positively influence people’s decision of asking for the safe corrective measure

We conducted ANOVA comparing the average use of corrective behaviors between people that stated they used versus not-used each information source (table22).

Table 22. ANOVA-information usage and go to doctor

		Sum of Squares	df	Mean Square	F	Sig.
How often did you seek health-related information in the past year?	Between Groups	1.534	1	1.534	2.344	.127
	Within Groups	133.462	204	.654		
	Total	134.995	205			
How much information about health issues do you get from newspapers?	Between Groups	.540	1	.540	.835	.362
	Within Groups	131.989	204	.647		
	Total	132.529	205			
How much information about health issues do you get from magazines?	Between Groups	4.300	1	4.300	6.101	.014
	Within Groups	143.797	204	.705		
	Total	148.097	205			
How much information about health issues do you get from internet?	Between Groups	1.392	1	1.392	2.297	.131
	Within Groups	123.623	204	.606		
	Total	125.015	205			
How much information about health issues do you get from radio?	Between Groups	3.142	1	3.142	4.019	.046
	Within Groups	159.460	204	.782		
	Total	162.602	205			
How much information about health issues do you get from TV?	Between Groups	.967	1	.967	1.432	.233
	Within Groups	137.752	204	.675		
	Total	138.718	205			
How much information about health issues do you get from books/brochures?	Between Groups	4.129	1	4.129	6.188	.014
	Within Groups	136.104	204	.667		
	Total	140.233	205			
How much information about health issues do you get from family colleague friends?	Between Groups	.016	1	.016	.039	.844
	Within Groups	86.862	204	.426		
	Total	86.879	205			
How much information about health issues do you get from professionals?	Between Groups	2.904	1	2.904	4.113	.044
	Within Groups	144.052	204	.706		
	Total	146.956	205			

The only significant F statistics found concerns going to doctor when suspected of a disease. On the average respondents that stated they opt to visit a doctor when they suspect of a disease have 2.7 on reading magazines as an information source compared with 2.4 from those who don't [$F(1, 204) = 6.101, p < .05$]; they reported an average of 2.88 on listening to radio compared with 2.63 from those who don't [$F(1, 204) = 4.019, p < .05$]; also they reported an average of 2.3 on reading books/brochures compared with 2.01 from those who don't [$F(1, 204) = 6.188, p < .05$]. Additionally, they reported an average of 2.92 on asking professionals compared with 3.17 from those who don't [$F(1, 204) = 4.113, p < .05$].

6 Discussion

This study aimed to examine the association between HL, health information access, and health care choices in Chinese adults. By using path analysis with structural equation modeling, on a 279 sample of Chinese adults extracted from several random locations in Hefei city, we tested the possible relationships between these three factors. Measures used were all found to be valid and reliable, with minor changes in some cases to ensure adequate psychometric quality.

Our first hypothesis (H1a-d) for this study tested the relationship between socio-demographics and individual's HL. It was found that younger people show higher HL scores, higher communicative and critical literacy but not higher functional literacy. Additionally, there was no gender difference; people with higher educational level and economic status show higher general HL scores, as well as functional, communicative, and critical literacy. These findings corroborate former theory that proposes that younger, higher educated, and wealthier individuals tend to have higher HL, while no gender differences should be found (Paasche-Orlow et al., 2005; Baker et al., 2007). Thus, the hypothesis H1 is fully supported in this study as all sub-hypotheses were also supported. As stated in literature review, it is well known that elder people tend to show a decline in reading skills, cognitive abilities and also competencies to learn new knowledge (e.g. Edmonds et al., 2009), which are strongly related to individual's functional literacy. Due to this, we considered that age is an important proxy of all HL factors.

The second hypothesis stated individual's HL positively impact on using safe health care choices (behavior change, regular checkup, go to doctor services), and negatively in using unsafe health care choices (self-medication and ignoring symptoms). After controlling for socio-demographics, findings partially supported this hypothesis because no significant association was found with health behavior change, self-medication and ignoring to the exception of "critical literacy" for health checkup. However, in China, since many employees are supposed to take annual health examination provided by their enterprises as the welfare (Wei-xian & Xu-xi, 2011), the effect of HL on the intention to seek health checkup may therefore not be as obvious as found in former studies (Davis et al., 1996; Scott, 2002). In the "health checkup" behavior education level and gender were predictors and

likewise in the “go-to-doctor” behavior education level and income level were predictors. As the finding shown in (Nabalamba, & Millar, 2007), women are more likely to use health services more often than men do. Additionally, high educated people usually tend to use health checkup for prevention purpose (e.g. Phillips et al., 1998; Verhaert et al., 2008).

Findings for “go-to-doctor” do not corroborate previous findings that suggested that lower literate individuals were more likely to use doctor service including hospitalizations and emergency care (Berkman et al., 2011). Lacking education and wealth are main barriers to one’s health care (Lindau et al., 2001). Our findings support that people with less education attainment would more likely choose using doctor services, but shows the opposite concerning income earners as the wealthier are less likely to use doctor services compared to former study (Nabalamba, & Millar, 2007). In China, due to the uneven-distributed resources in health care system, people are inequitable to have quality public health resources (Xianguan et al., 2015). For example, doctors usually work more than 10 hours, see 22±21 patients in the outpatient department and 13±11 patients in the inpatient department per day (Wen, Tian-you & Xiu-ying, 2015), as a result the time of consulting physicians is limited and the quality of consultation as relatively low. Compared to low income group, high earners might to use more health preventive services instead of relying on the available information provided by physician (Hibbard, Slovic, & Jewett, 1997). In other words, using the doctor services for curative purposes might be considered as a time consuming activity for those high income group if one is able to avoid the illness. Lower educated people easily feel anxious about health symptoms or ill-feeling with inadequate health-related knowledge, leading them to heavily rely on health professionals especially doctors for correcting their health problems (Mackenbach, 1998).

The positive association between individual’s HL and health behavior has been clearly reported in some studies (Gazmararian et al., 2003; von Wagner et al., 2007). Additionally Mann, deRidder & Fujita (2013) reported that there are still several important factors, other than HL, such as motivation, self-efficacy and self-regulation influencing individual’s behavior change. This might be one possible reason why HL was not predicting people’s behavior change in this study because other possible factors may operate otherwise.

No significant association was found between the HL and using self-medication. One possible reason is that self-medication is influenced by complex and multiple factors which need to combine those external and internal factors, so HL might not be enough to predict

the result as expected. Moreover, since the lower HL people might select those better options on purpose for hiding their real level, it is possible to get non-significant findings.

The third hypothesis of this study is that HL is positively associated with intensity of information sources usage (each and overall). We provided evidence that critical literacy (after controlling for chronic disease and socio-demographics) is the single predictor for books/brochures usage ($\beta=.245$, $p<.01$, $R^2_{ad}=14\%$) which goes in lines with Dutta-Bergman (2003) statement that printed materials offered by professionals are more credited, hence implying critical judgment on its credibility. Apart from that, in the first step, we also computed the important index “chronic disease” to explain the positive impact on the average use of information sources ($\beta=.277$, $p<.01$, $R^2_{ad}=7.2\%$) and to predict the newspaper usage ($\beta=.186$, $p<.01$, $R^2_{ad}=2.6\%$), radio ($\beta=.207$, $p<.01$, $R^2_{ad}=4.1\%$), family, colleagues and friends ($\beta=.232$, $p<.01$, $R^2_{ad}=4.4\%$) and professionals ($\beta=.224$, $p<.01$, $R^2_{ad}=4.7\%$) respectively. After controlling for chronic disease, in the second step, we still found that education level was the only valid socio-demographic factor predicting the intensity of the overall information sources use ($\beta=.418$, $p<.01$, $R^2_{ad}=19.5\%$) and some information source usage, including newspapers ($\beta=.343$, $p<.01$, $R^2_{ad}=11.7\%$), magazines ($\beta=.312$, $p<.01$, $R^2_{ad}=11.4\%$), radio ($\beta=.297$, $p<.01$, $R^2_{ad}=10.9\%$), and family, colleagues and friends ($\beta=.189$, $p<.01$, $R^2_{ad}=8.9\%$). Thus, we believe that this hypothesis is supported only for the usage of the books/brochures from professional because people with higher critical literacy have adequate ability to distinguish good quality information from mass media sources, such as reliable scientific evidence-based books/brochures. Regarding to education, Feinberg et al. (2016) reported that those with a high school diploma were likely to use text-based sources while those without it were likely to seek health information from oral sources. In our sample, more educated respondents showed a stronger relation with magazines and radio, but the result might be overstated since few people reported obtaining “a lot” of health information from magazines (5.3%) or radio (3.4%). In addition, higher education people might have sound quality social circles, it is reasonable for them to ask for health opinions by communicating with their family, colleagues and friends. Internet is the most popular and optimal source to seek health information in recent studies strongly associated with individual’s education and HL (Feinberg et al., 2016), and is considered as providing “a lot” of useful health information to 55% seeker which is the highest ratio compared to other sources by self-report in our sample. However there is no significant association with Internet usage because of easy accessibility for people with

different educational background to use search engines like Baidu. Education level is not a requirement to use such search engines.

Our fourth hypothesis states usage of health information sources conditions people's decision of asking for the health care choices. Findings showed significant connections between some health information sources and choosing doctor service, but no statistically significant relationship between sources and any other choice was found. Compared with those who avoid using doctor services, people who opt to visit a doctor get more health-related information from magazines ($p < .05$), radio ($p < .05$), books/brochures ($p < .05$). However, there is an opposite trend showing that people who get more health-related information from professionals would opt less to visit a doctor in the hospital. Professionals may be taken as surrogate of doctors. As we mentioned, there is a sample bias concerning the usage of magazines and radio as the explained variance concerning judgment about individuals extracting a lot of information is quite low. In our view, books/brochures tend to provide more scientific based information as editors will not publish any book without a credible author source in medical domain (Hsu, 2002), which gives it an essential role in guiding people's options to visit a doctor when they feel ill. Besides, those who are able to access a lot of information from professionals easily, might be more flexible in making their decisions to go to doctor judging on their perception of how serious symptoms might be (Gavvani, Qeisari, & Jafarabadi, 2013). Suka et al. (2015) found that individuals with greater access to multiple sources are more likely to engage in preventive health measures, and have healthy lifestyle avoiding risk factors, but our finding failed to provide support for this view and the results might be underestimated because people are not aware of specific health information they obtained in those sources when they were facing the questions in limited time. Also, there is no new finding between information access and self-medication, even though there is a considerable proportion in the sample (32.3%) from our sample reported that those people would like to use self-medication in some cases. This is because it is difficult to measure individual's choice simply by the quantity of information, and we are unable to identify which information is credible or unauthentic from those multiple sources people obtained to take self-medication. And it is hard to detect the weak association between self-medication and some factors lacking of statistical power (Figueiras, Caamano & Gestal-Otero, 2000). So this hypothesis is only corroborated in using doctor service but rejected in other health care choices.

7 Conclusion

Overall findings suggest that Nutbeam's concept of HL can provide a useful springboard for the investigation of health information access and health preventive and corrective measures because the key finding shows that critical literacy made a contribution to predict the positive utilization of health checkup directly. It is interesting to find that the books provide the most reliable information solely indicated by individual's critical HL, which also may be the essential mediator in our study to lead people to opt to visit a doctor. Through obtaining, understanding, and using health information wisely from books/brochures with scientific evidence-based, people will be more critical when they are making their choices. For those people without adequate literacy to navigate the mass media sources, the unreliable, inaccurate and potentially dangerous information might mislead their decisions and eventually do harm to their health (Tennant et al., 2015). So, first of all, as can be seen in this sample, people's demand for health information are in a great level, 78.8% respondents had ever sought health-related information in the last year, and 22.3% among them reported that they often or always sought health information in the last year. But in fact, the environment of extant media in China is messy and lack of management leading to some problems such as lack of authoritative source, delay in updating data, availability of fake information and flooding advertisement, low legibility of content (Li-rong, Na & Qun, 2014). As a result, it is urgent for Government to conduct a sound management for health information provided media (especially the TV and Internet with a huge user base), and also asking for health providers to present high quality information and remove inaccurate or misleading information with self-supervision. In terms of HL, education level as an effective indicator of all three factors (functional, communicative, and critical), also plays an important role in health information access, and the safe health care choices directly. This suggests that Government needs to promote health education in the communities and provides more public official information channels to enhance people's HL. Last but not the least, the ratio of self-medication is up to 32.3%, and only 66.3% respondents considered that they would like to use doctor services when they feel ill, which call for action taken by authorities and individuals to pay strong attention to use health services appropriately. For the self-medication, though this study was unable to find out effective indicators, the sheer proportion of respondents assuming self-medication is a serious warning that has to be dealt with by improving the health care system and the quality of medicine manufacture especially

related to OTC management (Li, 2011). And health providers should feel obliged to offer high quality information and remove inaccurate or misleading information if not by ethical reasons, at least for practical ones, as law suits can easily trigger serious reputation and costs if someone feels harmed by the lack of information. So, the lack of a standard for health information management might lead to serious problem such as harmful self-medication not only for the individuals but also posing a public health threat such as the misuse of antibiotics.

In conclusion, findings suggest that governmental authorities have the opportunity to improve the medical environment in three perspectives: HL, health information, and health care system. Without investment in HL we believe that improvement in infrastructure, qualified professionals, or doctor/patient ratio is not fully achieved if HL is not treated as a key issue in building a strong society in order to guiding residents to critically use appropriate and efficient health services, and to take healthy lifestyle by access to multiple reliable sources for secondary preventing and correcting their ill symptoms. We believe that the costs of investing in HL are strongly overshadowed by those of not investing in it.

7.1 Limitation and Further Studies

This study has some limitations. Firstly, even though our sample has been selected without criteria that could compromise its random nature (within the territory), the distribution of our sample is not comprehensive enough which may explain some non-significant values. For example, lacking of the senior group over 60 years-old may have played an important role. This age group has often high ratio of chronic diseases and is probably the one in urgent need of health information. So, the results of this study might underestimate true effects. Thus, in further studies the sampling procedure must accommodate a substantial senior group. Secondly, changing behaviors might have misled responses because it comprehends an array of diverse behaviors (e.g. avoiding smoking and drinking, doing physical exercise and regular examinations) that were not presented separately. Thirdly, in terms of setting of the questionnaire, the 5-point Likert scale for measuring HL might not fit well among Chinese because they are more likely to select the middle point as their answer. In addition, it is subjective to reflect people's HL relied on self-report 14-item HLS which is prone to bias, lacking the objective instruments for testing individual's numeracy and basic health-

related knowledge. So regarding to this limitation, in a future study, the selection of the sample should be conducted by crossing more methods although HL instruments will be time-consuming. Besides, when measuring individual's health information seeking behavior by a single question "how many information about health-related issues do you get from...?", we may be adding too much measurement error to the response. Furthermore, in a future research, the frequency scale is more suitable for this study instead of "yes/no" when measuring the possible health care choices. Through this research findings suggest that while critical HL plays an important role in using information, it is not enough to enhance people's awareness to make appropriate choices with abundant knowledge and critical thinking when they are facing some uncertain illness. This invites to consider adding other personal factors to the model such as motivation, beliefs, self-efficacy (Berkman et al., 2011; Schwarzer, 2008; Wen, 2011). Despite those limitations, we believe this study makes a preliminary contribution to the research. Although our final model is accessible, we think that future research should concentrate on the reasons why people choose unsafe options instead of safe options and figure out a suggestion in prompting public health.

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Appendix

Health literacy, Health information access, and health care choices in China

This questionnaire is an academic research on the health care domain in China. The main topic is about your idea and literacy in health care. It will take approximately 20 minutes to finish. Please answer **all of the** questions to support for our researching. Thank you very much!

1. Have you had an experience of seeking health information in the past year?

yes no (skip to No.4)

2. How often did you seek health-related information in the past year?

always often sometimes rarely never

3. How much information about health issues do you get from those resources below?

(To which extent do you agree with the following factors? Please make a “√” signal)

	none at all	almost note	some	a lot	all the information I need
newspaper	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
magazines	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
internet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
radio	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
television	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
books or brochures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
family members/friends/co-workers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
health professional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

4. When you read instructions or leaflets from hospitals or pharmacies, how do you agree or disagree the following?

(To what extent do you agree or disagree? Please make a “√”)

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I find characters that I cannot read	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The print is too small for me(even though I wear glasses)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The content is too difficult for me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It takes a long time to read them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I need someone to help me read them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. If you are diagnosed as having and you have little information about the disease and its treatment,

how do you agree about the following? (To what extent do you agree or disagree? Please make a “√” signal)

	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I collect information from various sources	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I extract the information I want	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understand the obtained information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I tell my opinion about my illness to my doctor, family, or friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I apply the obtained information to my daily life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. If you are diagnosed as having a disease and you can obtain information about the disease and its treatment, how do you agree about the following? (To what extent do you agree or disagree? Please make a “√” signal)

	Strongly disagree	disagree	Not sure	Agree	Strongly agree
I consider whether the information is applicable to me	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I consider whether the information is credible	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I check whether the information is valid and reliable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I collect information to make my healthcare decisions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. Consider a situation in your past year, when you perceive ill-symptoms, what did you do? (multiple choices)

Avoid health risk factors and behaviors that might be harmful to my own health

(I took healthy diet, did more exercise, and stopped drinking or smoking)

self-diagnosis and self-medication

Use of health checkup

Use of doctor services

I ignore it

8. In general, how would you say your health is in the past year?

excellent very good good fail poor

9. Do you have any chronic diseases?

Hypertension Diabetes Chronic gastritis Arthritis Pharyngolaryngitis

Tuberculosis Coronary heart disease Thyroid disease Hepatitis

Pelvic inflammatory disease Breast cancer Epilepsy Others ___* None

10. Please state your education level

University or higher Junior college education or vocational education

High school education compulsory education or lower

11. Please state your age

18-28 29-39 40-50 51-60

12. Please state your gender

male female

13. Do you have medical insurance

yes no

14. Please state your geographic location

suburb area rural area

15. Please state your income per month

<1000 3001-5000 5001-7000 >7000

16. Please state your relationship status

single in a relationship married or domestic partnership divorced or widowed