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# Health literacy: a cross-disciplinary study in American undergraduate college students

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## Abstract

Our research aims to assess the health literacy of undergraduate college students. Past research on the health literacy of undergraduate students has revealed some gaps in the undergraduate health literacy. In this study, we employed the Newest Vital Sign Test to measure health literacy. We interviewed 235 undergraduate students from health majors (nursing and other health) and non-health majors. We hypothesised that due to the specificity of a health-related curriculum, nursing and other health-related majors would score higher in health literacy than non-health-related majors, and that nursing majors in particular would score higher than other health-related majors and non-health-related majors. We found support for our hypothesis, as nursing majors had a mean score of 3.57, while health and non-health majors had a mean score of 3.24 and 2.88 respectively when assessing their health literacy levels. We discuss our results with regard to the strategies for improving health literacy skills.

## Keywords

information literacy; health literacy; health education; nursing; US

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## 1. Introduction

Literacy is defined by the US Department of Education (Centers for Disease Control and Prevention 2015) as "understanding, evaluating, using, and engaging with written text to participate in the society, to achieve one's goals and to develop one's knowledge and potential". Likewise, the American Library Association (1989) defined information literacy (IL) as the ability of individuals to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information". An American college education certainly provides some advantages with regard to basic literacy, critical thinking and information filtering (Behrens 1994) and it is very likely that IL is correlated with the attainment of other adult competencies such as "literacy, numeracy, the capacity to work with others, communication skills, scientific literacy (or the use of technology), problem solving (sometimes called critical thinking), and information skills" (Catts 2012, p.6). In effect, an information literate person should know how to organise knowledge, and find and use information.

Garner (2006) stressed that IL should be more than just a library or education issue and be extended to areas such as health and well-being, as it is a crucial tool in developing health and well-being amongst people. She outlines various reasons for the importance of IL in health such as the ability for people to understand documents, charts, dosages etc., the ability to understand the

information needed for an individual's own health, and information about various diseases with the increase in migration and refugees. In a panel discussion on people, cultures, and health, participants raised the fact that "Health information is a unique axis for information literacy, as illnesses are often a powerful motivation for families to become information literate." (Thompson and Cody 2003, p.3).

Catts and Lau (2008) also reiterated this sentiment claiming that IL "needs to be considered not only in relation to education, but also in the broader context of work, civil society, and health and well-being" (p.9). There are two areas where IL for the purpose of health and well-being is of great importance, one of which is the access to current research and best practices for health professionals as it relates to the delivery of quality services and the quality of information shared between health professionals and researchers. The other area is the right of individuals to obtain information pertaining to their health and well-being to address any health concerns which may extend to health and well-being of the family and community too. Increased IL levels help people distinguish between health information that is credible versus health information provided by manufacturers and marketers. Nowadays many people seek health information via the internet and while they might be computer literate, the majority are not information literate. There is no assurance on the credibility or reliability of the information presented, thus it can be particularly harmful for an individual's health and well-being. Therefore, skills in IL of locating and evaluating quality of information are necessary (Catts and Lau 2008).

Though there might be many other indicators of adult competencies to provide us with an indication of an individual's IL (Catts 2012), in this study we look at health information literacy (HL) as the main indicator. From the perspective of health and well-being, HL involves the capability of an individual to obtain, interpret, and understand basic health information as well as to have the competencies to use health information in ways that are health enhancing. Selden et al. (2000) define HL as "the degree to which individuals obtain, process, and understand basic health information and services needed to make appropriate health decisions." HL requires that individuals read, comprehend, discuss, consult, negotiate, and use judgment to choose the right route to achieve and maintain health status. A sizeable proportion of Americans have been found to have difficulty with reading comprehension as text becomes more complex (Kindig et al. 2004), therefore it is perhaps not surprising that more than 43% of American adults have been reported to have HL skills that are basic or below basic (Greenberg and Jin 2007).

The US Department of Health and Human Services (USDHHS) Healthy People 2020 project discussed strategies to improve health outcomes by developing educational objectives and establishing leading healthcare indicators. One such objective was to improve the overall HL of Americans (USDHHS 2015). Low HL is associated with increased health disparities, including poor health outcomes, misuse and/or less use of healthcare services, and medical errors (Berkman et al. 2011; USDHHS 2009). In addition to increased rate of hospitalisations, limited HL can also result in less health knowledge, poor self-management skills, and lower use of preventive services (Serper et al. 2014). If HL is low, individuals may not only have difficulty evaluating needed healthcare information, but may also struggle in deciding the best choice for their situation, and in following through to achieve it. That means individuals must overcome the challenge of understanding health information and access, or acquire the tools to improve their health.

In the present study we examine how variability in exposure to healthcare-related information may create health information literacy disparities across undergraduate students when comparing across nursing, other health-related, and non-health-related majors.

## 2. Literature review

In recent years, there has been a growing interest in health information literacy. Ivanitskaya et al. (2012) demonstrated this progression by conducting an internet search for "health and information

and literacy” in PubMed. Their undertaking produced “364 documents published in 2000–2005, 865 documents published in 2005–2010, and 340 documents published in 2011 and the first 4 months of 2012” (p.227). Such an exponential growth indicates the need and interest to understand the knowledge generated in HL.

HL, age, income and education have been reported as significant determinants of health (Ownby et al. 2012). HL can limit a person’s ability to find health information, especially if they constitute vulnerable populations (Parker and Kreps 2005). Cognitive function in all age groups, and physical health and depression in older adults aged 55-74 years are found to be associated with HL (N=784) (Serper et al. 2014). Reducing the cognitive burden to understand information may help older adults to manage their health better (Wolf et al. 2012).

The impact of HL on the US economy is very significant as it is estimated that healthcare spending will be 19.3% of GDP by 2023, an increase from 17.2% in 2012. The out of pocket healthcare spending was USD 338.6 billion in 2013 and is expected to grow (Centers for Medicaid & Medicaid Services [no date]). Prescription drug expenses included USD 272.1 billion and are estimated to have a steep increase. HL measures have been found to be associated with lower total healthcare spending, specifically, lower emergency department and inpatient admission spending (Hardie et al. 2011; Schumacher et al. 2013). They also found better self-reports of the ability to read and learn about medical conditions associated with lower emergency department visits. Schumacher et al. (2013) found that patients with limited HL reported a preference for emergency care and perceived this as better service. Therefore improving HL is significant for better personal and national economics. It is also important to understand HL in the emerging workforce to understand their self-care ability, as well as their competency to impact the health and HL of the population. This will provide a measure of success or determine areas for improvement when it comes to preparing students setting out into the professional world.

The role of education in health inequality and poor health outcome has been the focus of a good deal of research (Hasnain-Wynia and Wolf 2010; Flecha et al. 2011). Education is reported to be a major determinant of health, associated with longer life expectancy, improved health, and quality of life (Office of the Surgeon General [no date]). Health promoting behaviours such as regular physical activity, not smoking, routine checkups, and following recommended screenings are also associated with education (Office of the Surgeon General [no date]). Education, language, and difficulty in communication may impact HL (Frankel 2008), thereby affecting the health of those with limited English proficiency. College graduates skilled to understand these dynamics can recognise and interpret the health behaviour of their clients.

HL has been measured in many ways (Harper 2014). Dimensions of HL may include (a) health numeracy: the skill to use and interpret mathematical calculations, and (b) health prose literacy: the skill needed to follow written instructions (Centers for Disease Control and Prevention 2015). An example of health numeracy is taking medication as prescribed, and an example of health prose literacy is the ability to follow written medical instructions. HL may also include communication and information seeking skills (Squiers et al. 2012).

HL in college students had been studied in the past. One study measured numeracy and reading comprehension of 399 junior and senior college students using the Test of Functional Health Literacy (TOFHLA) (Ickes and Cottrell 2010). Their results indicated that college students had adequate levels of HL and valued it, but many students still had problems with numeracy questions. A fairly recent study also used TOFHLA to survey 390 undergraduate students that were enrolled in general student’s health education course and classified 85.1% of the participants as health literate (Hansen et al. 2015). Further investigation into the demographics of the health literate participants indicated that they were significantly older and earned more college credits than non-health literate participants. The study also stated that participants’ basic health knowledge was mediocre as health literate participants only scored 48% on health knowledge. Mas

et al. (2014) examined HL in Latino/Hispanic college students and reported that 90% of participants had adequate HL on the six-point scale of the Newest Vital Sign test (NVS). Their results suggested that the literacy levels of Hispanic college students were similar to the general US population with an equivalent level of education. Further they found that age, sex, and citizenship status were not significant for HL, however the language used at home was found to be significant. It is interesting to note that the researchers used the six-point scale using NVS which may represent an inflated score which may mask the score of a difficult item. This may represent a score of five when in fact the last two questions are extremely simple.

In terms of accessing health information, Ivanitskaya et al. (2012) measured university students' proficiency in obtaining and evaluating health information as well as their understanding of plagiarism. Their study revealed that majority of students believed their research skills were good or excellent, however many students were unable to conduct advanced information searches and lacked the ability to judge the trustworthiness of health-related websites. Similarly, Stellefson et al. (2011) evaluated the college student's abilities to locate, use, and evaluate health information on the internet, labelled as eHealth literacy. They reported that college students were comfortable using the internet to obtain health information, however many students were still lacking in their eHealth literacy skills and recommended that college students would benefit from customised college-level courses that improve general eHealth information. The American Library Association (1989) noted that the quality of a college education is measured by the resources and the students' preparation to be independent and self-directed learners. Including librarians in curriculum development and launching courses with foundational IL skills will equip the students to be lifelong learners and users for IL.

Ivanitskaya et al. (2012) found that 55% of undergraduate students chose librarians over peers and professors as beneficial resources. Further, the majority of the students preferred to attain IL skills on their own through trial and error as they believed self-discipline was key in gaining competencies, thereby emphasising the support needed for individual self-study. Attitudes of medical librarians and healthcare professionals towards HL education fall into three dimensions: (1) optimism and support for HL being taught in clinical settings, (2) less optimism and support for HL being taught in classroom settings, and (3) optimism and support for HL education to help people privately interact with health information materials (Logan 2007). Medical librarians take continuing education courses and workshops in Evidence Based Practice (EBP) and work with clinical staff and students in schools of medicine, nursing, physical therapy, and physician's assistants (Schardt 2011). However, the number of librarians who have embraced these roles are scarce (McGowan 2012), therefore librarians can offer more effort into explaining library resources or accept the fact that other alternatives at lower cost and barriers are available (Blumenthal 2014). Blumenthal (2014) explains how people today are perfectly happy conducting a simple Google search for their needs, but librarians can critique the "accuracy, currency and bias of that information, but many customers with simple questions perceive those results accurate, current, and objective enough." (p.2) Librarians with IL expertise can help faculty staff (inter-professional collaboration) to design courses and provide instructions that leads to higher EBP skills in students (Boruff and Thomas 2011).

Enhancing HL is an essential step to ensure health and well-being of a nation. College students who are being prepared to enter the workforce are in the best position to acquire skills to search, and use credible information. Cross-disciplinary collaboration between faculty staff of all disciplines and librarians is key in instilling the foundation for best practice to develop these skills in students of all majors. As technology and globalisation advances, and knowledge proliferates quickly, information explosion is a present reality. The emerging professionals need to be well-equipped and competent to understand the growing complexities of health conditions and health information. Universities should not overlook this major responsibility vested in them. For this we must understand the current state of HL among college students.

### 3. Study purpose

The purpose of this study is to explore the HL of undergraduate students in a medium sized university in the North East United States, and to compare the HL of students in nursing, health, and non-health majors. The HL of the students may guide faculty staff to incorporate changes in curriculum of IL skill development programmes in order to equip the students for successful employment.

#### 3.1 Research questions

Our first question focused on participants' overall perception and confidence in their own health knowledge. We suspected that age and year in school would affect an undergraduate student's perception of their current health knowledge purely due to experience and exposure to the healthcare system. Interaction with others and a higher education environment can potentially contribute to better health knowledge. Second, we hypothesised that the overall HL of undergraduate students would be lower than the ideal of 100%, a perfect score, because the students are still in the education process. Third, comparing between majors, we wanted to determine if HL would be higher in nursing and health-related majors in comparison to non-health-related majors. By virtue of being in the College of Health Sciences, one may score higher in HL due to the courses undertaken and conversations or clinical exposure. Finally, between nursing and health-related majors, we predicted that nursing majors would score higher in HL.

#### 3.2 Measure of HL used

The Newest Vital Sign (NVS) (Figure 1, see 4.2 below) has been shown to be a valid tool in past research that measures literacy and numeracy skills (Mas et al. 2014; Weiss et al. 2005; Wolf et al. 2012). Pfizer Inc. recently made the tool freely available to medical and public health providers to assess the HL levels of their patients. It is fairly short, moderately accurate, and can identify individuals with limited reading skills. NVS is short and easy to use in clinical settings where we have limited time. NVS also covers all the domains of the conceptual model of HL described by Baker (2006). The first domain of the conceptual model is individual capacity which comprises of two inter-related components: reading fluency and prior knowledge. Reading fluency is the ability of the individual to mentally process written information and form new knowledge. Prior knowledge is the individual's vocabulary skills as well their conceptual knowledge of health and healthcare. The possession of these two abilities allows the individual to comprehend health information, and to deal with healthcare personnel and the healthcare system in a more effective manner. The second domain of the conceptual model is HL which is divided into health-related print literacy and health-related oral literacy. In this domain the ability to understand written health information and orally communicate about health is dependent on the individual's capacity. Individual capacity along with the oral and print literacy helps a person to respond to the information which may determine the outcome (Baker 2006).

A comparative review of various HL conceptual models by Squiers et al. (2012) describes that Baker's model (2006) identifies mediators and/or moderators that may influence health outcomes. Simultaneously, the model also emphasises the role of prior knowledge and attends to both conceptual knowledge and vocabulary. These components are important for our study because having prior knowledge can influence health information literacy levels when comparing health related versus non-health related students. Further, language can influence how people comprehend health information. However, one limitation of this model is that it does not identify any specific health outcomes (Squiers et al. 2012).

## 4. Methods

### 4.1 Participants

We interviewed 235 participants of which 152 were females and 83 were males. The mean age of the participants was 20.6 years. All participants were undergraduate college students and represented various academic majors. Representation of majors were as follows: 61% non-health majors, 30% health majors, and 9% nursing majors.

Health-related majors included: health, nutrition, and athletic majors such as Biology, Exercise Physiology, Nutrition and Dietetics, Respiratory Care, Pharmaceutical Professional Development, Pre-Med, Pre-OT Exercise Science, PT/PE, Public Health.

Non-health-related majors included: arts, sciences, education, and business majors such as Accounting, Astronomy, Chemistry, Communications, Computer Science, Criminal Justice, Economics, Finance, Graphic Design, History, Language (Russian, French, Spanish, English), Marketing, Math, Music, Philosophy, Physics, Political Science, Professional Studies, Psychology, Religious Studies, Social Work, Theater, Women's Studies.

With regards to their academic levels, 41% of participants were seniors, 28% were juniors, and 31% were sophomores and freshmen. The race distribution of the participants was as follows: 75% Caucasians, 13% African-Americans, 8% Hispanics, and 4% Asians.

### 4.2 Materials

Figure 1: The Newest Vital Sign: Ice cream label



The image shows a nutrition facts label for ice cream. The label is enclosed in a blue border. It includes the following information:

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

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

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

NVS employs the use of an ice cream nutrition label to determine HL (Figure 1) and can be administered in 3 minutes. The label takes into account prose literacy, numeracy, and document literacy. Based on the information provided on the nutrition label, individuals are asked four to six questions. Depending on the number of correct answers, medical and public health providers can determine the HL of a patient. Patients are given as much time as needed to answer the questions while looking at the label.

The following questions were asked of each participant:

1. If you eat the entire container, how many calories will you eat?
2. If you are allowed to eat 60 grams of carbohydrates as a snack, how much ice cream could you have?
3. Your doctor advises you to reduce the amount of saturated fat in your diet. You usually have 42 grams of saturated fat each day, which includes one serving of ice cream. If you stop eating ice cream, how many grams of saturated fat would you be consuming each day?
4. If you usually eat 2,500 calories in a day, what percentage of your daily value of calories will you be eating if you eat one serving?

Following the above four questions, the next two questions were asked following the statement: "Pretend that you are allergic to the following substances: penicillin, peanuts, latex gloves, and bee stings."

5. Is it safe for you to eat this ice cream?
6. (Ask only if the patient responds "no" to question 5): Why not?

In addition to the questions in the NVS tool, demographic data and data on Measure of Perception of Own Level of HL were collected. Participants were asked to rate themselves on the following question: My knowledge of health information is: (1=Very poor, 2=Poor, 3=Somewhat good, 4=Good, 5=Very good). This was self-reported by choosing the level of their knowledge of health information on this five-point scale.

### **4.3 Procedure**

The Institutional Review Board (IRB) of the university where the research was conducted approved the study. A student researcher was trained to conduct the interview and administer the NVS tool. The interviews were conducted on campus, but outside classrooms. Students on campus were approached at random and asked if they were graduate or undergraduate students. If they were undergraduate students, the study was briefly explained, and the interviewer requested participation which was voluntary. The consent form approved by the IRB was initialled by the student to indicate their willingness to participate. The participants' anonymity was preserved by not collecting any personal information. Consenting students were given the ice cream nutrition label and were asked 4-6 questions in the toolkit. Their responses were documented by the interviewer and the participant could refer to the ice cream label the entire time. The interviewer could repeat the questions if needed, but could not explain the questions. Because it was a one-on-one interview, their responses were not heard by anyone and cannot be matched with their identification. A sequencing number was given on the data collection packet. The packet contained the demographic data sheet and the responses to the questions based on the ice cream label. Completed sealed envelopes were stored in the Principal investigator's office.

### **4.4 Statistical analysis**

The data was entered on an Excel spreadsheet and was cleaned, coded, and uploaded to SPSS 22.0 for analysis. Correlations were run to check the relationship between actual HL levels and self-reported (perceived) HL levels. ANOVA was conducted to examine the differences in HL scores between non-health related, health related, and nursing majors. Scores were based on



whether respondents got the first four questions correct. We did not include responses to the last two questions because they were a follow-up question that was only administered if one of the first four questions was answered incorrectly. Therefore a perfect score would be 4 and the lowest possible score would be 0.

## 5. Results

Our first query focused on participants' overall perception and confidence in their own health knowledge. We suspected that age and year in school would affect an undergraduate student's perception of their current health knowledge purely due to experience and exposure to the healthcare system. We explored the overall perceptions of health knowledge and found that participants were fairly confident, as the overall mean was 3.60 (SD= 0.921). Fifty-three per cent of the participants perceived that their health knowledge was good or very good. As a function of age, health knowledge perception increased as one got older, the mean score of those aged 24 and younger (n=225) was Mean = 3.57 (SD= 0.924), whereas the mean score of those aged 25 and over (n=10) was Mean = 4.20 (SD= 0.632). Additionally, looking at year in school, we found that mean score of freshman and sophomores (n=74) was Mean = 3.38, (SD= 0.871), whereas the mean score of juniors and seniors (n=161) was Mean = 3.70 (SD= 0.929). These findings support our first hypothesis that age and year in function impacts overall perception of health knowledge.

Second, we hypothesised that the overall HL of undergraduate students would be lower than the ideal of 100% therefore we looked at the overall actual HL levels of participants. The total HL was in the acceptable range of 88% amongst all students. Forty-three per cent of the participants correctly answered the first four questions in the NVS tool. The number of correct responses was lowest on question three across all majors (Table 1). In terms of differences between male and female HL scores, a significant difference was found:  $t(233) = -2.836, p=.005$ . Statistically significant differences between group means as determined by One-way ANOVA. African-American students scored less on HL measures compared to other groups ( $F(3,231) = 4.477, p=.004$ ). The number of years in school was not associated with a significant difference in their actual NVS score. However, a noticeable difference in the actual NVS mean score was noticed as a function of age as the mean of those aged >24 was Mean = 3.70 (SD= 0.483) and those aged <24 was Mean = 3.03 (SD= 1.065).

NVS Question	Nursing (N=21)	Health majors (N=70)	Non-health majors (N=144)	Total (N=235)	Sig. (Chi-Sq.)
NVS Q1	100	89	88	89	0.232
NVS Q2	95	87	76	81	<b>0.029</b>
NVS Q3	71	69	61	64	0.436
NVS Q4	91	80	65	72	<b>0.008</b>

**Table 1. The Newest Vital Sign: responses (in %) to first four questions by all majors (N=235)**

Third, comparing between majors, we hypothesised that HL would be higher in nursing and health-related majors in comparison to non-health-related majors (Table 1). In order to determine if there were differences between nursing and health-related majors versus non-health-related majors we looked at the NVS mean scores. The mean score of nursing and health-related majors was Mean = 3.3 (SD= 0.9), whereas the mean score of non-health-related majors was Mean = 2.9 (SD= 1.1)  $t(233) = 3.099, p=.002$ . One-way ANOVA determined that there was a significant difference between nursing, health-related, and non-health-related majors ( $F(2, 232) = 5.628, p=.004$ ). A Tukey post-hoc test revealed that the mean difference between nursing and non-health-related majors was .683 ( $p=.014$ ), whereas the mean differences between nursing and health-related majors was .329 ( $p=.410$ ). Comparison of health and non-health-related majors was .354 ( $p.051$ ). These results indicate that there was a significant difference in the HL scores of nursing and non-health majors which could be attributed to the healthcare work experience of nursing students.

Finally, we hypothesised that between nursing and health-related majors, nursing majors would have higher HL. To test this hypothesis, we looked at the results of nursing majors independently. The mean score of the first four questions on the NVS tool was Mean = 3.57 (SD= .598) for nursing majors which was slightly higher than mean score of Mean = 3.24 (SD= .955) for health-related majors. The significance of the mean differences of both groups is .410 which is substantial enough to say that nursing majors performed better than health-related majors. However, only 9% (N=21) of the participants were nursing students which prohibits any generalisation about a superior HL for them.

## 6. Discussion

The data were coded to cluster health-related majors, and non-health majors. Other data points were also coded to ensure synergy with the SPSS software. Our results suggest that there was a difference in scores as a function of age and year in school, which may be attributed to the fact that as one gets older they are exposed to much more health information due to experience and necessity. The lack of confidence in their healthcare knowledge could be credited to their current reading fluency and vocabulary, as well as their existing conceptual knowledge of healthcare. Less exposure to the healthcare system and other environmental factors may make undergraduate students feel inadequate about their health knowledge.

We also predicted that the overall HL of undergraduate students would not be an ideal 100%. From the results, we see that the HL of undergraduate students is quite acceptable; however a little over a half of the participants thought their health knowledge was average, and less than half of the participants correctly answered all of the NVS tool questions. While the NVS score is still acceptable for undergraduate students, not achieving 100% could be due to the fact that students find difficulty in numeracy skills that is consistent with previous studies conducted on health information literacy with undergraduate students (Ickes and Cottrell 2010).

We also predicted that nursing and health related majors would score better on the NVS tool than non-health-related majors. Mean scores for nursing and health related majors were higher than for non-health-related majors. Nursing and health-related undergraduate students may have a better grasp over healthcare concepts, health-related terms, and possess work experience in the healthcare field. As theorised in our conceptual model, HL is an interaction between one's individual capacity and health-related literacy. Undergraduate students in health-related and nursing majors are more likely to come across health-related terms through study materials as well as comprehend meanings of such words thereby simultaneously improving their vocabulary. At the same time, attaining background knowledge by way of their major also adds to their ability in grasping health-related materials more efficiently. On the other hand, non-health-related majors would less likely be exposed to specific vocabulary and concepts related to healthcare, therefore their conceptual knowledge of healthcare would be lower, thereby affecting their ability to understand health-related print and oral information. Even though students in non-health majors

would have similar reading ability as those in health-related majors, the differences in scores can be explained by the difference in baseline knowledge of health vocabulary and concepts (Baker 2006).

Lastly, we expected undergraduate students in nursing majors to perform better than all other undergraduate majors. This was evident through our study where nursing major students reported slightly higher scores than other health majors grouped together. We believe that nursing majors would have better comprehension skills when it comes to healthcare concepts and the healthcare system in general. As outlined in the conceptual model, exposure to vocabulary and reading materials influence the comprehension of healthcare related materials. As one learns and improves their conceptual understanding of healthcare, they are better able to comprehend health information resulting in such individuals being able to understand written health information as well as orally communicate health information. In the model, Baker (2006) states that the complexity and difficulty of printed and spoken messages also affects an individual's ability to understand and communicate health information. Keeping this in mind, it would be expected for nursing majors to achieve a higher score on the NVS tool as they would be exposed to complex and difficult materials in their course materials enabling them to perform better. The fact that nursing students have higher HL scores may be a reflection of their overall high school GPA or ACT scores on entry to college. Nursing, a high demand competitive major, may attract higher calibre students and therefore that might have translated into higher HL scores.

## 6.1 Limitations

Even though we saw differences in scores as a function of age, our sample was still limited in age diversity. The tool itself is a simple procedure, however it may not measure details. Time to respond to the four questions on the tool was not limited, hence different individuals might have used varying amounts of time which might have influenced the results. Further, the questions could be repeated any number of times while the person refers to the ice cream label. Previous studies have used all of the six questions provided with the ice cream label. For our study we chose to include the first four questions only. Due to the simplicity of the last two questions, we believed it would inflate HL levels. Therefore, the results reported cannot be compared to other studies that have used the NVS tool.

Nursing is a competitive field, therefore students are known to enter universities with a higher GPA and may have been exposed to healthcare shadowing or volunteering experiences prior to entry in the programme. These experiences might have contributed to the higher score in the small percentage of participants from nursing major. Similar exposure might have affected the scores of other health majors as well.

## 6.2 Implications

HL has major implications for practice, education, and research. Health information is notoriously incomprehensible to ordinary people, and oral and written communication are equally challenging (Hess and Whelan 2009). For effectiveness, the information must be provided in a cultural context in simple vocabulary. Food labels should be simple enough to be understood by the reader for optimum health and dietary outcomes (Cha et al. 2014). In practice, there is a problem with the definition of HL as it ignores cultural differences and the needs of non-English language learners (Hill 2004). Improving HL may be a step to limit barriers for accessing and improving attitudes toward primary care services (Schumacher et al. 2013). In addition, research involving the health information literacy of different ethnic and cultural groups may guide future development of health information materials. Focused education to individuals and groups can improve HL. One should also foster policies that address health information literacy at all levels.

IL is essential for lifelong learning and students need to be able to filter information from large volumes of literature (Ku et al. 2007). Because IL enhances student skills with evaluating,

managing, and using information, it is now considered as a key outcome for college students (American Library Association 1989). IL helps students to keep an open mind of inquiry, helps interpret, integrate and apply the information in their field of learning (Jacobs 2008). The Association of College and Research Libraries (ACRL) designed a framework for IL for higher education which basically outlines concepts that can infuse IL into the higher education curriculum. It proposes a collaborative effort between librarians, faculty staff and students as each have a role in building IL skills. Starting a campus conversation on IL skills can be a starting point for addressing the importance of these skills for students and incorporating it as part of student learning outcomes. Further, providing resources and facilitating partnerships that can endorse the framework into the curriculum is required. Policies to enhance HL skills early in higher education can provide equal opportunity for every student to be exposed to such skills. This will be a good investment with good return on future higher HL and better health outcomes. In addition, policies to develop materials in simple language is critical for improved HL. Students with a higher IL can help identify the gaps and contribute to that endeavour.

## 7. Conclusion

The HL of undergraduate college students must be improved to maintain the health and well-being of individuals and families. In addition, HL can impact the financial status of families and nations. The young generation of students who graduate from universities must be well-equipped to have good numeracy and literacy skills so that they can guide others who seek their service. Is it the problem with the communication and math skills of individuals? Rudd stated it appropriately “We have the audacity to say people have low literacy skills when our material is poorly designed” (USDHHS 2009). We need to improve not only the presentation of health-related information, but educational curriculum around health information literacy as well.

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