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Predicting Health Literacy Among English-as-a-Second-Language Older Chinese Immigrant Women to Canada: Comprehension of Colon Cancer Prevention Information

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Abstract Inadequate health literacy has been identified as a barrier to the utilization of health-care services, including cancer screening. This study examined predictors of health literacy among 106 older Chinese immigrant women to Canada and how colon cancer information presented in their first versus second language affected health literacy skill. Only 38.7% of the women had adequate health literacy based on Short Test of Functional Health Literacy for Adults, and 54.3% had adequate comprehension of the colon cancer information. Comprehension of the cancer information was significantly lower among women who received the information in English compared with those who received the information in Chinese. Age, acculturation, self-reported proficiency reading English, and education were significant predictors of health literacy but varied depending on the measure of health literacy used and language of the information. Presentation of cancer prevention information in one's first rather than second language improves health literacy but does not eliminate comprehension difficulties for older ESL Chinese immigrants.

Keywords Health literacy · Cancer prevention · Comprehension · Immigrants · Acculturation

Introduction

Colon cancer incidence and mortality rates in Canada are among the highest worldwide [1]. If detected early, colon cancer is highly curable and biennial FOBT screening followed by a colonoscopy after positive results significantly reduces mortality [2, 3]. Despite this, screening rates are consistently low in Canada; in 2008, an estimated 60% of Canadians aged 50 and older reported never to have screened for colon cancer [4]. Even lower rates occur among many immigrant groups in North America [5, 6], including Chinese-Americans who have been shown to be less likely to undergo colon cancer screening than the general population [7, 8].

Limited literacy is associated with less knowledge about cancer-related health services and more negative attitudes [9, 10]. Health literacy, an important determinant of health, is "the cognitive and social skills, which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health" [11]. The Canadian Council on Learning emphasizes the broad reach of health literacy which "includes whether individuals can read and act upon written health information, as well as whether they possess the speaking skills to communicate their health needs to physicians and the listening skills to understand and act on the instructions they receive" [12]. Although conceptualized as being made up of many components (e.g., empowerment and self-efficacy), comprehension is fundamental for health literacy.

Seniors and immigrants in Canada are disproportionately affected by low health literacy [13]. Printed health education materials are widely used to increase awareness and knowledge, and are often a core component of cancer education campaigns. However, there is little known about the comprehension of these materials by diverse audiences. The Chinese community comprises the second largest ethnic group in Canada, and Chinese is the third most

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commonly spoken language [14]. The primary objectives of this exploratory study were to examine basic health literacy among older Chinese immigrant women in Canada, predicators of health literacy, and how colon cancer prevention information presented in one's first versus second language affects health literacy.

Materials and Methods

Participants and Procedures

A convenience sample of 110 women was recruited from two Southern Ontario communities from October 2009 to February 2010. Participants were required to (1) be 50 years or older, (2) have immigrated to Canada, (3) have Cantonese or Mandarin as their first language and English-as-a-second-language (ESL), and (4) be able to read in English. After excluding women who had been previously diagnosed with cancer or who were visitors, the final sample size was 106. Participants were recruited from organizations and venues that provide recreation and entertainment to Chinese older adults. The research was approved by the university ethics review board, and informed consent was obtained.

Eligible women attended a 90-min testing session and completed questionnaires to assess demographic characteristics, acculturation, and health literacy. Following the administration of the questionnaires, the women read a short (two-page) consumer colon cancer information sheet in English or Chinese available from the Cancer Care Ontario (CCO) website [15]. Prior to the start, women were randomly assigned to receive this information in English or Chinese. Sixteen women who were randomized to the English language group refused to read the CCO sheet in English and were given the information in Chinese. Separate analyses including and excluding these women were conducted.

Immediately after reading the information page, participants completed a standard Cloze test [16] to assess comprehension. This comprehension task was given in the same language in which the information was provided (English or Chinese). A trilingual (English, Mandarin, and Cantonese) research assistant/translator was present at all testing sessions. Each participant received an honorarium of $30 in appreciation of her time.

Measures

Health Literacy Measures

The Short Test of Functional Health Literacy for Adults (S-TOFHLA) [17], a 7-min (timed) 36-item test, measures an individual's ability to read and understand health-care-related passages with a modified Cloze procedure (every fifth to seventh word was omitted and replaced with a blank space). The reader selects a word to fit into the blank spaces from four multiple-choice options. S-TOFHLA is scored on a scale of 0 to 36, with scores >22 as adequate, 17–22 as marginal, and <17 as inadequate health literacy. The S-TOFHLA has high internal consistency (Cronbach's alpha=0.97) and correlates well with the full TOFHLA (R^2=0.91).

A second assessment of health literacy (comprehension) was developed based on the CCO colon cancer information page. Using a standard Cloze procedure, every sixth word was deleted for the English and Chinese versions and replaced with a blank line [16]. Participants completed the passage by inserting what they believed to be the deleted word. The standard Cloze test is a reliable measure of patient comprehension [16, 18]. Participants correctly answering >60% Cloze units (i.e., missing words) have adequate comprehension, those answering 40%–59% have marginal comprehension (text is challenging), and those answering <40% Cloze units have inadequate comprehension (great difficulty with comprehension of text) [16].

Acculturation

Acculturation was measured using the Suinn–Lew Asian Self-Identity Acculturation Scale [19]. This 21-item questionnaire includes items about language, identity, friendships, general and geographic background, and attitudes. Responses were assessed on a five-point Likert scale, and an average acculturation score was derived where scores ranged from 1 (low acculturation, greater Asian identification) to 5 (high acculturation, greater Western identification). The Cronbach's alpha (0.91) is high [19].

Statistical Analysis

Data were analyzed using SPSS software (Version 17.0; SPSS Inc., Chicago, IL, USA). Descriptive and correlation analyses were conducted for demographic, acculturation, and health literacy measures. Independent sample *t* tests identified differences in comprehension by language of the information. Multiple regression analysis was used to identify variables that were significantly associated with health literacy. Scores on the English and Chinese Cloze tests and the S-TOFHLA were the dependent variables. Predictor variables included acculturation, years of residency in Canada, age, self-reported proficiency reading English, income, and education. Analyses of health literacy using the Chinese language Cloze scores were carried out separately including and excluding the 16 women who could not be

randomized. A p value of 0.05 or less was considered significant.

Results

Sample Characteristics

Table 1 shows selected demographic characteristics of the participants. The women ranged in age from 50 to 81 years, with a mean (±SD) age of 63.2±8.2. Most were married (76.4%), retired (62.3%), and well educated (67.9% completed post-secondary education in China).

Table 1 Selected characteristics of participants (n=106)

Characteristic	Percent
Marital status	
Married	76.4
Divorced	11.3
Widowed	8.5
Single	3.8
Occupation	
Employed	17.0
Unemployed	5.7
Homemaker	14.2
Retired	62.3
Other	1.0
Education	
12 years or less	32.1
Post-secondary	67.9
Income level[a]	
<$20,000	51.9
>$20,000	40.6
Missing	7.5
Language	
Mandarin	37.7
Cantonese	59.4
Both	2.8
Self-reported health	
Excellent or very good	31.2
Good	39.6
Fair	25.5
Poor	3.8
Self-reported English proficiency (speaking)	
High	13.2
Moderate	49.1
Low	37.7
Self-reported English proficiency (reading)	
High	14.2
Moderate	52.8
Low	33.0

[a] $20,000 was selected based on national low-income cut-offs for a two-adult family in 2006 [37]

Acculturation

Participant acculturation scores were low, ranging from 1 to 4.2, with a mean score of 2.2±0.5 (maximum score of 5). Length of residency in Canada varied markedly from 1 to 51 years (average 24.9±14.3 years).

Health Literacy Profiles

Scores on the S-TOFHLA were between 0 and 36, with a mean score of 18.1±10.6. Overall, 38.7% of participants had adequate, 17.0% had marginal, and 44.3% had inadequate health literacy. Scores on the colon cancer Cloze tests were low, ranging from 0 to 88 (mean 55.2±20.9). Just over 54% had adequate comprehension, whereas 22.9% had marginal and 22.9% had inadequate comprehension.

Differences in Health Literacy by Language of Information

Although health literacy as reflected in comprehension of the cancer information was generally low, a different picture emerges when broken out by language. Table 2 shows the percentage of women who had adequate, marginal or inadequate comprehension on the English compared with the Chinese language versions. Fifty percent of the women who completed the English language Cloze had inadequate comprehension, 34.2% had marginal comprehension, and 15.8% had adequate comprehension. In contrast, 7.5% of participants who completed the Chinese language Cloze test had inadequate comprehension, 16.4% had marginal comprehension, and 76.1% had adequate comprehension. Mean comprehension scores were significantly lower in the English (39.9±17.9) compared with the Chinese (63.9±17.2) language Cloze group (t=6.761, df=103, p<0.01).

Regression Modeling of Comprehension

Table 3 shows that health literacy, as measured by S-TOFHLA, was significantly predicted ($F_{4,101}$=35.258, p=0.0001) by acculturation, age, self-reported proficiency reading English, and education; these factors accounted for 56.6% of the variation in scores among the women. Table 3 also indicates that health literacy, reflected by scores on the colon cancer Cloze test, was significantly predicted by acculturation for the English version of the test ($F_{1,36}$=12.947, p=0.001) and by education for the Chinese version of the test ($F_{1,65}$=8.335, p=0.005 and $F_{1,49}$=6.878,

Table 2 Proportion of participants who had inadequate, marginal, or adequate comprehension of colon cancer information by language of test

	Cloze test group		
	English	Chinese (all)	Chinese (excluding non-randomized)
Inadequate comprehension (score<40%)	50.0	7.5	7.8
Marginal comprehension (score of 40–59%)	34.2	16.4	13.7
Adequate comprehension (score≥60%)	15.8	76.1	78.4
Mean score (SD)	39.91 (17.91)	63.85 (17.17)[a]	64.00 (17.80)[a]

[a] Score was significantly different than English Cloze, $p=0.0001$

$p=0.01$ for full sample and for sample excluding women who could not be randomized, respectively).

Discussion

The consequences of inadequate health literacy are extensive and include increased risk of hospitalization, poor adherence to medical regimens, and difficulty accessing health-care and prevention services. Older Chinese immigrant women had low health literacy scores on S-TOFHLA and poor comprehension of colon cancer prevention information. Only 39% had adequate health literacy on S-TOFHLA and only 54% had adequate comprehension of the cancer information.

These findings highlight the importance of language in health literacy skills among ESL immigrants. Women who received colon cancer information in their first language (Chinese) scored significantly higher on the health literacy test than those who received the same information in their second language (English). This finding is consistent with research showing language concordant medical encounters are associated with better comprehension by patients [20, 21]. Nevertheless, health literacy even for the women who received the information in Chinese was still not satisfactory (mean score of 64%). These results and the findings of others suggest that language concordance mitigates but does not eliminate comprehension barriers for adult ESL speakers [20, 22].

Table 3 Multiple regression modeling of health literacy among ESL Chinese immigrant women

Explanatory variable	S-TOFHLA	English Cloze	Chinese Cloze (all)	Chinese Cloze (excluding non-randomized)
	Beta; p value (95% CI)	Beta; p value (95% CI)	Beta; p value (95% CI)	Beta; p value (95% CI)
Constant	9.490	−4.130	57.071	56.300
	0.142	0.743	0.0001	0.0001
	(−3.219, 22.199)	(−29.477, 21.217)	(50.925, 63.218)	(48.732, 63.868)
Age	−0.215	–	–	–
	0.001			
	(−0.445, −0.109)			
Education	0.202	–	0.337	0.351
	0.003		0.005	0.012
	(1.599, 7.497)		(3.590, 19.703)	(2.961, 22.374)
Acculturation	0.438	0.514	–	–
	0.0001	0.001		
	(5.219, 11.974)	(7.787, 27.903)		
English proficiency (reading)	0.250	–	–	–
	0.005			
	(1.744, 9.457)		–	
Overall model				
F	35.258	12.947	8.335	6.878
df	105	37	66	50
R^2	0.566	0.244	0.100	0.105

One woman completed the S-TOFHLA but subsequently refused the Cloze comprehension test

Acculturation was a significant predictor for the two health literacy measures assessed in English (S-TOFHLA and English Cloze test). Acculturation refers to "the extent to which ethnic minorities retain their indigenous culture versus adopt the alternative host culture" [23]. Older ESL Chinese immigrant women with lower acculturation scores had lower health literacy and greater difficulty understanding the information presented. Given that acculturation is a proxy for language skill, this finding emphasizes the risk of inadequate health literacy among women with limited English language proficiency. Women who self-reported low proficiency reading English also had lower scores on S-TOFHLA. Nevertheless, the acculturation measure includes other factors such as identity and attitudes. Therefore, aspects of acculturation other than language, such as deeply held cultural beliefs, may affect health literacy skill among ESL immigrant women [24, 25].

Older age was associated with lower health literacy on S-TOFHLA. Many studies among native English speakers provide similar results [26, 27]. While declining cognitive abilities with age explain some of the loss in health literacy skills, Baker et al. found that cognitive abilities, visual acuity, and health status cannot fully account for the decline [28]. Even less is known about aging and health literacy skill in a second language. Decline may be worse in one's second language compared with first language [29].

Not surprisingly, Chinese language education predicted performance on the Chinese Cloze test. Chinese language education also predicted performance on S-TOFHLA, an English health literacy measure. Developing literacy in a second language is affected by literacy capabilities in the first language [30]. This may explain why more educated women had higher health literacy, even when tested in English.

The use of two different measures of health literacy provides an opportunity to consider the measurement of this complex concept. We expected that the factors important for predicting health literacy to be consistent across the two measures; however, this was not the case. There are a number of possible reasons for this inconsistency. First, the S-TOFHLA uses a multiple-choice cloze test in which participants are given four options to complete the passage, whereas the cancer prevention information was assessed using a standard cloze test in which no multiple-choice options were given. While both formats have comparable reliabilities [31] and correlate moderately well with one another [32], the impact of response type among adult ESL readers is unknown. Second, the health information contained in S-TOFHLA is more general whereas the Cloze test involved information specific to colon cancer prevention. Finally, there is the possibility that the small sample size in the English language Cloze test group did not allow for adequate power to detect significant predictors as the larger sample size for S-TOFHLA.

The primary strength of this exploratory study is that it offers an initial look at health literacy among older Chinese-Canadian immigrant women. There are also limitations. We used a convenience sample which is likely not representative of the larger Chinese-Canadian immigrant population. Not all women could be randomized due to refusal to complete the colon cancer comprehension test in English. We attempted to account for this by carrying out analyses with and without the 16 women. S-TOFHLA and Cloze tests are often used to assess health literacy but little is known about their validity in ESL populations. Participants may read and understand the information in English but lack written language skills to complete the Cloze test [33]. Chinese ESL learners often encounter difficulties acquiring English writing skills given the contrast between the Chinese ideographic and the Western alphabetic systems [34]. S-TOFHLA is not available in Chinese, and performance in English may reflect language abilities rather than health literacy skills. An individual may have high health literacy in their first language, but inferior English language proficiency which would result in a poor score on S-TOFHLA. Using a technique such as "teach-back" would clarify the issue of language versus comprehension. Finally, the S-TOFHLA is a health literacy instrument developed for US audiences, and many terms would not be familiar to Canadians.

Cancer Education Practice Implications

The provision of relevant and motivating cancer prevention information to vulnerable immigrant populations has the potential to reduce screening disparities, improve long-term outcomes, and ultimately reduce cancer burden [35]. Our findings suggest allocation of resources in Canada (and likely in the USA as well) into multi-language cancer education materials; however, our findings also emphasize the need to look beyond language translation alone and consider alternative methods to improve receipt and understanding of printed cancer education materials for diverse audiences. For instance, materials developed specifically for a target audience (e.g., Chinese-Americans) and which are culturally as well as language appropriate may be more effective than those which follow the one-size-fits-all approach (e.g., translation of generic English language written information into multiple languages). Such an approach has been successful for an innovative campaign designed to increase colon cancer screening among low-acculturated Chinese-Americans [36]. Finally, our findings highlight the need for cancer educators to consider that even if cancer information is presented in an English-as-a-Second Language patient's first language, comprehension may still be lacking especially among older, less educated, and less acculturated immigrants.

Conclusion

Given that print materials are often used to disseminate cancer prevention information, the low health literacy skills found among older Chinese immigrant women in this small study suggests cause for concern. Our results also indicate that printed health materials in one's first language rather than second language can have a significant positive impact on health literacy. Nonetheless, while translation improves comprehension, it does not eliminate health literacy difficulties. In addition to language, many factors affect health literacy among ESL immigrants including acculturation, age, and education. Providing language-appropriate materials may only be a first step in addressing low health literacy among ESL immigrants to North America.

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