Journals of Gerontology: MEDICAL SCIENCES
Cite journal as: J Gerontol A Biol Sci Med Sci. 2014 November;69A(S2):S54–S60
doi:10.1093/gerona/glu179

Levels of Health Literacy in a Community-Dwelling Population of Chinese Older Adults

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Background. Lower levels of health literacy have been associated with adverse health outcomes, especially for older adults. However, limited research has been conducted to understand health literacy levels among Chinese American older adults.

Methods. The PINE study is an epidemiological cohort of 3,159 community-dwelling Chinese older adults, 95% of whom do not speak or read English. Chinese older adults' health literacy levels were examined using the Chinese version of the Rapid Estimate of Adult Literacy in Medicine, Revised (REALM-R) test. Kruskal–Wallis test and chi-square statistics were used to identify significant differences by sociodemographic and self-reported health characteristics. Pearson and Spearman correlation coefficients were used to examine correlations between personal characteristics and health literacy level.

Results. The mean age among this sample of Chinese older adults was 72.8 years (*SD* = 8.3, range = 60–105) and the mean REALM-R test score was 6.9 [*SD* = 2.3, range (0–8)]. Health literacy was positively associated with education, marriage status, and number of people living with. Older age, being female, greater number of children, years in the United States, and preference for speaking Cantonese or Taishanese were negatively associated with health literacy. Health literary was not associated with self-reported health status or quality of life.

Conclusions. In this Chicago Chinese population, older adults had reasonable levels of health literacy in Chinese. Future longitudinal research is needed to understand risk/protective factors associated with health literacy level in Chinese older adults.

Key Words: Health Literacy—Chinese aging—Health disparity—PINE study.

Received May 7, 2014; Accepted August 27, 2014

Decision Editor: Stephen Kritchevsky, PhD

HEALTH literacy is commonly defined as "the degree to which individuals have the capacity to obtain, process, and understand basic health information needed to make appropriate health decisions and services needed to prevent or treat illness (1)". Health literacy has been accepted by researchers, health care professionals, and policy makers as a necessary area of study for reducing health disparities and improving health outcomes. Because of its importance in promoting better health services, health literacy was incorporated into multiple provisions of the Patient Protection and Affordable Care Act (ACA) (2). Additionally, the U.S. Department of Health and Human Services has issued a strategic plan to improve health literacy nationally (3).

Although researchers are still exploring how health literacy directly or indirectly impact health outcomes, many empirical studies have identified significant associations between inadequate health literacy and poor health outcomes. For example, low health literacy level is associated with reduced likelihood of understanding diagnoses, treatment (4), and prescription drug label instructions (5). Emergency Department patients with poor health literacy might be subject to increased risk of hospitalization (6). Evidence suggests that people with low health literacy tend to have reduced understanding regarding the necessities and benefits of using preventive care services, including cancer screening tests (7). In addition, the high prevalence of low health literacy has been found to be associated with certain deteriorating cognitive abilities, such as memory and verbal fluency, among the elderly (8).

Overall, approximately 14% of Americans have a "below basic" health literacy level, meaning they are only able to locate easily identifiable information and comprehend written instructions in simple documents, such as the date on a hospital appointment slip (9). It has been further suggested that low health literacy is particularly prevalent among certain populations—including people aged 65 and over, racial/ethnic minorities, recently arrived refugees and immigrants, people who did not complete high school, those living at or below the poverty line, and those whose native language is not English (3). Progress has been made in explaining why

health literacy disparities exist among these groups, but little is known about health literacy levels in the U.S. Chinese population.

The Chinese community constitutes the largest Asian American subgroup population while Asian Americans are the fastest growing ethnic group in the United States (10). Therefore, it is important to develop a better understanding of health literacy level of U.S. Chinese population, especially for Chinese older adults who might be more significantly impacted by low health literacy. To grow our knowledge of Chinese older adults' Chinese health literacy level, we examined over 3,000 Chinese older adults in the greater Chicago area. Chicago has one of the largest Chinese older adult populations and prior studies indicate that over 90% of Chinese older adults in Chicago do not speak or read English (11). Moreover, similar with Chinese older adults in other metropolitan areas, the majority of Chinese older adults in the greater Chicago area choose to live in ethnic enclaves, namely Chinatown neighborhoods and its surrounding areas where Chinese is used as the main language (12). Because Chinese older adults usually are able to obtain health care services and medical information from their primary care physicians and other health professionals who speak Chinese, Chinese instead of English is the language they usually use to seek care for their health needs. Therefore, our study focuses on Chinese older adults' health literacy in Chinese.

The objectives of this study are to: 1) examine health literacy level among community-dwelling Chinese older adults in the greater Chicago area and 2) examine the sociodemographic, family position, and health-related correlates of health literacy among this population.

Method

Population and Settings

The Population Study of Chinese Elderly in Chicago (PINE) is a population-based epidemiological study of Chinese older adults aged 60 and over in the Greater Chicago area. Briefly, the purpose of the PINE study is to collect community-level data of U.S. Chinese older adults to examine the key cultural determinants of health and well-being. The project was initiated by a synergistic community-academic collaboration among the Rush Institute for Healthy Aging, Northwestern University Medical Center, and many Greater Chicago area community-based social services agencies and organizations (11).

The PINE study implemented extensive culturally and linguistically appropriate community recruitment strategies guided by a community-based participatory research (CBPR) approach (13). Out of 3,542 eligible older adults who were approached, 3,159 agreed to participate in the study, yielding a response rate of 91.9%. Based on available data drawn from the U.S. Census 2010 and a random block census project, the PINE study is representative of the Chinese aging population in the Greater Chicago area (14). The study was approved by the Institutional Review Board of the Rush University Medical Center.

Measures

Sociodemographic characteristics.—Sociodemographic characteristics assessed include age, education, annual income, marital status, number of children, living arrangement, language preference, country of origin, years in the United States and years in the community. Overall health status was measured by asking participants, "In general, how would you rate your health?" on a 4-point scale. Quality of life was assessed by asking, "In general, how would you rate your quality of life?" on a 4-point scale. Health changes over the last year was measured with the question, "Compared to 1 year ago, how would you rate your now?" on a 3-point scale.

Health literacy.—We assessed health literacy using the Chinese version of the Rapid Estimate of Adult Literacy in Medicine, Revised (REALM-R) test. The REALM-R test is a proven word recognition assessment which can be completed in about 2 minutes (15). Study participants were asked to read 11 items written in Chinese: Fat, Flu, Pill, Osteoporosis, Allergic, Jaundice, Anemia, Fatigue, Directed, Colitis, and Constipation. Because three items, Fat, Flu, and Pill, were included to minimize study participants' anxiety, the test score for each study participant was determined by his or her reading of the remaining eight items: Osteoporosis, Allergic, Jaundice, Anemia, Fatigue, Directed, Colitis, and Constipation. Each correct reading received one point and the overall REALM-R test score ranged from 0 to 8. Test participants receiving a score of 6 or less were categorized as having a low literacy level; this score is considered the equivalent to a sixth grade reading level (15).

Data Analysis

Descriptive statistics were used to summarize sociodemographic characteristics, family composition, health related, and quality of life information of Chinese older adults. Kruskal–Wallis test and chi-square statistics were used to compare health literacy levels by sociodemographic characteristics. Pearson correlation coefficients and Spearman correlation coefficients were generated to identify whether sociodemographic, health, and life quality-related variables were associated with health literacy level. All statistical analyses were conducted using SAS, version 9.2 (SAS Institute Inc., Cary, NC).

Results

Sample Characteristics

Among the 3,159 participants surveyed, the mean age was 72.8 years (SD = 8.3) and approximately 60% of the participants were female. More than 80% of the participants

had less than 12 years of education and 95% had an annual income less than $15,000. About 30% Chinese older adults were separated, divorced or widowed. More than 20% of the elderly lived alone. Only 4% of the participants did not have children. About 93% of the participants came from China, 95% of our study participants reported that they could not read or speak English, and only 1% preferred speaking English.

Health Literacy Level

REALM-R tests (Chinese version) were completed by 3,125 Chinese older adults. Among the eight test items, only "Anemia" and "Allergic" were correctly recognized by over 90% of participants. Only one word, "Directed," had a recognition rate below 80% (Table 1). The mean overall score was 6.9 (SD = 2.3). Less than 20% of Chinese older adults had poor health literacy, obtaining an overall score of 6 or less (15). Although 7% of study participants scored 0, approximately 70% obtained a full score of 8 (Table 2).

Health literacy levels were significantly different across sociodemographic and immigration factors. Men tended to score higher on the REALM-R test than women (7.4 vs 6.5, $p < .001$). Chinese older adults who had stayed in the United States for less than 10 years had higher REALM-R scores than those who have been in the United States for 11–20 years, 21–30 years, and 31 years and over (7.2 vs 6.9 vs 6.6 vs 6.8, $p < .001$) (Table 3).

Correlation Between Sociodemographic, Health, and Life Quality-Related Factors and Health Literacy Level

Health literacy level was positively and significantly associated with education, marital status, and household size. Age, being female, number of children, length of staying in the United States and preference of speaking Cantonese and Taishanese were negatively associated with health literacy level. The most significant association was between education and health literacy ($r = .56$, $p < .001$). Income, country of origin, self-reported health status and quality of life were not significantly correlated with health literacy level (Table 4).

Table 1. Scoring of REALM-R

	Correct	Not Correct/Not Attempted
	N (%)	*N* (%)
Osteoporosis	2,629 (84.2)	495 (15.9)
Anemia	2,847 (91.1)	279 (8.9)
Colitis	2,786 (89.2)	339 (10.9)
Allergic	2,835 (90.7)	290 (9.3)
Fatigue	2,801 (89.6)	325 (10.4)
Constipation	2,682 (85.8)	443 (14.2)
Jaundice	2,538 (81.3)	585 (18.7)
Directed	2,386 (76.4)	739 (23.7)

Discussion

Within the context of the PINE study, we found that Chinese older women had lower health literacy levels than men and Chinese older adults' health literacy was negatively associated with their length of time spent in the U.S. Self-reported health status was not significantly associated with health literacy level. Overall, Chinese older adults' mean health literacy level score assessed by the Chinese version of REALM-R test was higher than the low health literacy threshold.

In contrast with a prior study finding that sex was not significantly associated with health literacy (16), we found that Chinese older men scored significantly higher than Chinese older women on the REALM-R test. One possible explanation may be related to Chinese traditional culture such that men generally have higher socioeconomic status and receive more educational opportunities than women, which is particularly true for older generations. Significant and positive associations between education and health literacy have been documented in the prior study (16), so it is possible that differences in education level among Chinese older men and women contributed to the significant association between sex and health literary level observed in our study. However, further studies are necessary to identify other explanations.

We found that number of years of residence in the United States was negatively associated with health literacy level among Chinese older adults. This negative association may be explained in a few ways. First, we found a significant positive association between age and the number of years in the United States, suggesting that those who have resided longer in the United States tended to be older. Because our study, as well as a prior study (16), has found that age was negatively associated with health literacy, age may very well be driving the association between years of residence in the United States and health literacy level. Another potential explanation is related to age and education. For Chinese older adults in our study, age was negatively associated with education. Thus, it is possible that older participants in our study, having received less education, would score lower on the REALM-R test. To validate this association, prospective, longitudinal multivariate analyses need to be conducted in the future when more data become available.

Our study showed that health literacy was not significantly associated with self-reported health status. Findings from prior studies (17–21) on the association between health literacy and self-reported health status have been mixed. In a population-based study in Taiwan (17), self-rated physical health was not associated with health literacy and the association between self-rated mental health and health literacy was also limited. However, several studies conducted in the United States (18–20) and one study conducted in Japan (21) found significant associations between health literacy and self-perceived general health, self-rated physical, or self-rated mental health.

Table 2. Levels of Health Literacy by REALM-R Cutoff Points

Test Score	Cumulative Number (Total = 3,125)	Cumulative Percent (Total = 100%)	Percent for Each Level	Original Scoring Key
0	222	7.1%	7.1%	
0–1	252	8.1%	1.0%	
0–2	284	9.1%	1.0%	
0–3	317	10.1%	1.0%	
0–4	372	11.9%	1.8%	
0–5	447	14.3%	2.4%	
0–6	620	19.8%	5.5%	At risk for poor health literacy
0–7	983	31.5%	11.7%	
0–8	3125	100.0%	68.5%	

Note: Mean (*SD*) = 6.9 (2.3).

This inconsistency may be related to differences in methods and instruments used to assess participants' perceived health information. In some studies showing an association between self-perceived health and health literacy, study participants were required to complete a set of specific and multi-aspect survey questions, such as the Medical Outcomes Study 36-Item Short-Form Health Survey. In contrast, our study and the Taiwan study asked study participants a more limited set of items. It is possible that our study participants and participants in the Taiwan study reported better perceived health due to cultural influences. For example, bearing hardship is considered a Chinese traditional cultural value and a national trait (22). Thus, Chinese in comparison with other ethnic groups may be more willing to tolerate misfortune, pain, unhappiness, and inconvenience in their lives. Therefore, even when they face some health issues, they may still believe that they have good health and rate their health status as good or very good. These relatively better perceived health status data in turn may make the significant association between perceived health and health literacy observed in other studies insignificant in our study and the Taiwan study.

Our study has shown that Chinese older adults scored relatively high in the Chinese version of REALM-R test. Moreover, less than 20% of Chinese older adults had REALM-R scores that indicated low levels of health literacy level and 70% of Chinese older adults responded correctly to all eight items in the test. In contrast, a health literacy systematic review conducted by Paasche-Orlow and colleagues found that the weighted prevalence of low health literacy rate was 26% for a combined study subject pool of 31,129 (16). However, the weighted average age was 42.9 in the meta-analysis. Given the negative association between age and health literacy, we can expect that the prevalence of low health literacy among subjects over 60 years would be even higher than 26%, which makes the low prevalence of poor health literacy among Chinese older adults more apparent.

Although Chinese older adults' health literacy level is relatively high based on the Chinese version of REALM-R test, it does not necessarily mean that Chinese older adults can function well in a Chinese language health care environment. The REALM-R test assesses an individual's ability to correctly recognize eight items, but it does not evaluate whether an individual knows the meaning of these eight items. In the Chinese version of the REALM-R test, each tested item consisted of a few written Chinese characters. Because a written Chinese character generally has one pronunciation but could have different meanings in different contexts, it is possible that some Chinese older adults recognized the written Chinese characters in the REALM-R test and correctly pronounced them, but did not know the correct meaning of the characters. Therefore, Chinese older adults' relatively high REALM-R scores may not indicate an adequate level of health literacy to understand health care-related information. This validity issue has also been noticed when some researchers attempted to create a version of the REALM test for Spanish speaking populations. Because Spanish is a language featuring more pronunciation rules than in English, people with low health literacy levels can also have high scores in Spanish adaptations of the REALM test (23).

Our study has several limitations that must be acknowledged. First, because sociodemographic characteristics of Chinese older adults may vary substantially by region, caution is necessary when applying our findings to Chinese populations in other regions of the United States and in other countries. Second, there is a possibility that we may overestimate the Chinese health literacy level among Chinese older adults. As we discussed above, that the Chinese version of REALM-R test may not accurately reflect Chinese older adults' ability to understand health information, their true health literacy level may be the same as or even lower than other population groups. Third, because the validity of the Chinese version of REALM-R test is unknown, additional research is necessary to better understand Chinese older adults' ability to understand health care-related information and communicate in Chinese health care environments. Other health literacy test instruments such as Chinese version of the short-form Test of Functional Health Literacy in Adults (c-s TOFHLA) (24) should be considered in future studies. Forth, because Chinese older adults living in the United

Table 3. Health Literacy Levels by Different Characteristics

Age	60–64 (*N* = 678)	65–69 (*N* = 636)	70–74 (*N* = 601)	75–79 (*N* = 553)	80+ (*N* = 657)	
Mean (*SD*)	7.3 (1.7)	7.3 (1.7)	7.3 (1.8)	6.6 (2.6)	5.9 (3.0)	
Chi-square						138.2
p value						<.001
Sex	Men (*N* = 1,324)	—				
Mean (*SD*)	7.4 (1.6)	6.5 (2.3)				
Chi-square						128.1
p value						<.001
Education	0–6 (*N* = 1,343)	7–12 (*N* = 1,101)	13+ (*N* = 663)			
Mean (*SD*)	5.7 (2.9)	7.7 (1.0)	7.9 (0.7)			
Chi-square						805.8
p value						<.001
Income	$0–$4,999 (*N* = 1,030)	$5,000–$9,999 (*N* = 1,598)	$10,000–$14,999 (*N* = 309)	$15,000–$19,999 (*N* = 68)	Over $20,000 (*N* = 87)	
Mean (*SD*)	7.0 (2.2)	6.6 (2.5)	7.3 (1.7)	7.5 (1.5)	7.8 (0.6)	
Chi-square						56.8
p value						<.001
Overall health status	Very good (*N* = 138)	Good (*N* = 1,089)	Fair (*N* = 1,310)	Poor (*N* = 588)		
Mean (*SD*)	7.3 (1.8)	6.9 (2.2)	7.0 (2.2)	6.6 (2.6)		
Chi-square						12.5
p value						.01
Quality of life	Very good (*N* = 216)	Good (*N* = 1,367)	Fair (*N* = 1,443)	Poor (*N* = 98)		
Mean (*SD*)	7.1 (2.0)	6.9 (2.3)	6.8 (2.3)	6.7 (2.6)		
Chi-square						5.5
p value						.13
Health status change over the past year	Improved (*N* = 275)	Same (*N* = 1,525)	Worsened (*N* = 1,323)			
Mean (*SD*)	7.0 (2.2)	6.9 (2.2)	6.8 (2.4)			
Chi-square						2.8
p value						.24
Years in the United States	0–10 (*N* = 831)	11–20 (*N* = 961)	21–30 (*N* = 759)	31+ (*N* = 560)		
Mean (*SD*)	7.2 (1.9)	6.9 (2.3)	6.6 (2.6)	6.8 (2.3)		
Chi-square						41.4
p value						<.001
Country of Origin	Mainland China (*N* = 2,902)	Hong Kong/Macau (*N* = 105)	Taiwan (*N* = 42)	Others (*N* = 76)		
Mean (*SD*)	6.9 (2.3)	7.5 (1.5)	7.1 (2.3)	6.1 (2.8)		
Chi-square						19.5
p value						<.001
Preferred language	Cantonese (*N* = 1,670)	Taishanese (*N* = 721)	Mandarin (*N* = 701)	English (*N* = 33)		
Mean (*SD*)	6.9 (2.2)	5.8 (2.9)	7.8 (1.1)	7.4 (1.3)		
Chi-square						381.8
p value						<.001

Table 4. Correlations Between Health Literacy Levels and Different Characteristics

	Age	Sex	Edu	Income	MS	Living	Children	Yrs in U.S.	Yrs in Com	Origin	LP-CT	OHS	QOL	HC	HL
Age	1.0														
Sex	0.01	1.0													
Edu	−0.12***	−0.21***	1.0												
Income	0.05**	0.00	0.01	1.0											
MS	−0.33***	−0.32***	0.22	−0.03	1.0										
Living	−0.35***	−0.07***	0.02	0.16***	0.24***	1.0									
Children	0.32***	0.09***	−0.38***	0.00	−0.13***	−0.07***	1.0								
Yrs in U.S.	0.35***	0.03	−0.10***	0.35***	−0.2***	−0.31***	0.15***	1.0							
Yrs in Com	0.23***	0.02	−0.11***	0.24***	−0.13***	−0.18***	0.10***	0.66***	1.0						
Origin	0.04*	−0.01	−0.08***	−0.20	0.05**	0.05**	0.04*	−0.2***	−0.15***	1.0					
LPCT	−0.02	−0.01	−0.56***	−0.03	−0.06***	0.06***	0.27***	0.18***	0.20***	0.06**	1.0				
OHS	−0.08***	−0.06**	0.06***	0.12***	0.05**	−0.00	−0.00	−0.01	0.05*	−0.03	−0.01	1.0			
QOL	0.06***	0.05**	0.09***	0.08***	0.03	−0.01	0.04*	0.00	−0.02	−0.04*	0.12***	0.32***	1.0		
HC	−0.11***	−0.03	0.02	0.05**	0.07***	0.01	−0.02	−0.04*	0.03	−0.00	−0.03	0.15***	0.15***	1.0	
HL	−0.18***	−0.20***	0.56***	0.00	0.22***	0.06***	−0.27***	−0.12***	−0.11***	0.00	−0.2***	0.03	0.03	0.02	1.0

Notes: Children = number of children; Edu = education; HC = health changes over last year; HL = health literacy; Living = living arrangement; LPCT = language preference of Cantonese and Taishanese; MS = marital status; OHS = overall health status; Origin = country of origin; QOL = quality of life; Yrs in com = years in the community; Yrs in U.S. = years in the United States.

*$p < .05$, **$p < .01$, ***$p < .001$.

States, especially those who do not live in ethnic enclaves where Chinese is used as the main language, may likely encounter health care information in English, it is necessary to also evaluate their English health literacy level. Fifth, the associations we observed for Chinese health literacy level may not hold when we evaluate their English health literacy level. For example, the negative association between year of residence in the United States and health literacy level may change. It is possible that the longer Chinese older adults live in the United States, the more they get familiarized with English. Hence, Chinese older adults living in the United States for a longer period of time may have a higher level of English health literacy. Finally, we did not screen study participants by visual function. Therefore, poor visual functioning may potentially impact REALM-R scores.

Nevertheless, this study has important implications for researchers, community organizations, health care providers, and policy makers. With over 90% of Chinese older adults have difficulty in reading English and one in five Chinese older adults at risk for low health literacy in Chinese, community organizations and policy makers may need to consider special trainings to improve health literacy levels among Chinese older adults in greater Chicago area. In particular, Chinese older adults with less than 6 years of education may benefit greatly from these trainings. In addition, because we found that health literacy levels among women were lower than men's, special attention may need to be paid to women. Moreover, health care providers may want to consider using different forms of communication, such as pictures (25) to convey health care information to Chinese older adults.

Conclusion

Our study indicates that health literacy level, as measured by the Chinese version of REALM-R test, is relatively high for Chinese older adults in the Greater Chicago area. Because the Chinese version of REALM-R test still needs to be fully validated, Chinese older adults' health literacy level reflected in our study may vary from their actual health literacy level. Future researches, including those conducted by different test tools, are needed to explore if Chinese older adults can truly function well in health care environments and understand health care and medical information in both Chinese and English. In addition, future longitudinal studies are needed to quantify the risk factors and consequences associated with lower health literacy among U.S. Chinese populations.

Funding

X.D. and M.A.S. were supported by National Institute on Aging grants (R01 AG042318, R01 MD006173, R01 CA163830, R34MH100443, R34MH100393, P20CA165588, R24MD001650, and RC4 AG039085), Paul B. Beeson Award in Aging, The Starr Foundation, American Federation for Aging Research, John A. Hartford Foundation and The Atlantic Philanthropies.

Acknowledgments

We are grateful to Community Advisory Board members for their continued effort in this project. Particular thanks are extended to Bernie Wong, Vivian Xu, Yicklun Mo with Chinese American Service League (CASL), Dr. David Lee with Illinois College of Optometry, David Wu with Pui Tak Center, Dr. Hong Liu with Midwest Asian Health Association, Dr. Margaret Dolan with John H. Stroger Jr. Hospital, Mary Jane Welch with Rush University Medical Center, Florence Lei with CASL Pine Tree Council, Julia Wong with CASL Senior Housing, Dr. Jing Zhang with Asian Human Services, Marta Pereya with Coalition of Limited English Speaking Elderly, Mona El-Shamaa with Asian Health Coalition.

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