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Low health literacy:

Implications for managing cardiac patients in practice

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Abstract

There are limited data on racial and ethnic disparities related to quality of life (QoL) and health literacy in adults with multiple cardiac conditions. This article evaluates the relationship between health literacy and QoL among patients with cardiac conditions in a multiethnic community in New York City.

Keywords

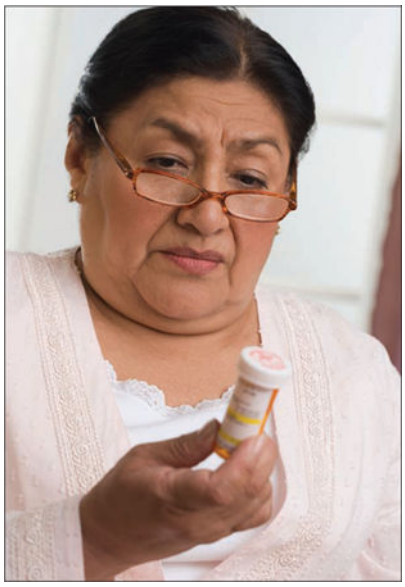
cardiac outpatient clinic; cardiac conditions; health literacy; health status disparities; minority health; quality of life

The U.S. population is aging, and with it so are adults with multiple chronic cardiac conditions. Minorities account for an increasing proportion of the U.S. population, especially in urban areas.[1] Hispanics are the fastest growing population in New York City.[2,3] Patients living with chronic comorbid conditions such as hypertension, diabetes mellitus, and hyperlipidemia require a high level of engagement with healthcare providers (HCPs), including NPs, to coordinate medications and manage appointments.

Health literacy is strongly associated with patients being able to engage in complex disease management and self-care.[4–7] Patients who are unable to successfully interpret health information have increased hospitalization rates, develop more diseases, and experience higher mortality.[4] These patients also use EDs for primary care more commonly than their

counterparts with higher health literacy scores.[8] The additional financial and social burdens placed on the healthcare system due to low health literacy make addressing this issue a priority.

Low health literacy is associated with patients who are older, have limited education, lower income, chronic conditions, and those who are non-native English speakers.[9–16] Approximately 80 million adults in the United States are estimated to have limited or low health literacy.[9] Although a number of studies have explored health literacy in the general U.S. population, very little is known about the state of health literacy in minority populations, including Hispanics.[10,11]



Assessment of racial and ethnic differences in patient health literacy is critical for tailoring educational programs for managing cardiac conditions and providing assistance to older, non-native English-speaking patients. This article evaluates the racial and ethnic differences in health literacy and coexisting self-reported quality of life (QoL) in an older adult, ethnically diverse, economically disadvantaged population with chronic comorbidities including, but not limited to, diabetes mellitus, hypertension, and hyperlipidemia.

Methods

Study design.

This was a single-center, cross-sectional study conducted in a population of older adults with multiple cardiac conditions. The study was approved by the authors' Institutional Review Board prior to patient enrollment. A convenience sample of 91 participants was recruited from a cardiac outpatient clinic run primarily by NPs at a large hospital system located in Washington Heights, New York. Because Hispanic individuals make up about 71% of the total Washington Heights population, this study focused on the findings from this group.[17]

As an inclusion criterion, all participants' medical records were screened to ensure that participants had two or more cardiac conditions. At the time of enrollment, eligibility criteria included willingness to share racial, economic, and education background information, as well as willingness to complete the health literacy and QoL questionnaires.

Participants were given the Mini-Mental State Examination, and those with a score of 24 (normal cognition) were deemed mentally competent to participate. Participants with a documented history of anxiety and/ or depression were excluded from the study. Relevant cardiac health information regarding chronic cardiac conditions and mental status was obtained and confirmed in the electronic health record.

Study procedure.

HCPs were asked if they would consider having their patients approached by the research team to consider voluntary participation in the study. After obtaining informed consent and Health Insurance Portability and Accountability Act documentation, a bilingual research coordinator interviewed the participants to collect demographics such as age, self-identified race and ethnicity, income level, and education level. The research coordinator then administered the Test of Functional Health Literacy in Adults (TOFHLA) that measures both reading comprehension and numeracy, the Short Assessment of Health Literacy (SAHL), and the Short-Form Health Survey (SF-36v2).

Study instruments

TOFHLA is a timed exam with known validity and reliability and has been used to collect health literacy data in multiple studies.[18–21] The TOFHLA has two sections: reading comprehension and numeracy. The reading comprehension portion asks patients to read health-related passages and fill in missing words. For each missing word, a list of four words is given to choose from.[21] Patients must select the response that is most appropriate to the passage. The reading comprehension portion has a total of 50 missing words that require responses. All responses were reviewed and scored by two independent research coordinators. Each correct answer is allotted one point, whereas incorrect responses receive no points.[21]

The numeracy section of the TOFHLA involves reading numerical information and using simple math skills. Participants are asked to answer 17 questions related to prescription labels, appointment cards, directions, and financial information.[21] Correct answers are allotted one point, and incorrect responses receive no credit. These items are then summed, and their total is multiplied by 2.941 to create scores that range from 0 to 50.[21] Reading comprehension items are summed (range: 0 to 50) and are then added to the scaled numeracy score.[21] In the study, patients receiving a score between 0 and 59 were determined to have inadequate health literacy. All participants were stopped at 10 minutes for this portion, and translation was available for Spanish-speaking study participants (see Health literacy tools and scores).

Based on several studies, it has been noted that those with inadequate health literacy are more often likely to misread or miscalculate medication prescriptions and appointment

information.[22–24] Those with marginal health literacy, while often able to understand simple instructions, can misinterpret instructions that are even slightly more involved (for example, do not take medication on an empty stomach). Finally, patients with adequate health literacy are often able to comprehend most instructions pertaining to their care but may be unable to understand financial details or information that involves certain calculations.[22–24]

SAHL.

The SAHL is an instrument consisting of comparable tests (available in both English and Spanish) with good reliability (0.80) and validity.[25] The SAHL-S, which is in the Spanish language for Spanish-speaking adults (correlation coefficient [r] = 0.88, $P < .05$), is highly correlated with other Spanish instruments of health literacy, including the Spanish Test of Functional Literacy in Adults (r = 0.62, $P < .05$).[25]

With the SAHL and SAHL-S, individuals being examined are presented with 18 test terms. For each term, a keyword with a related meaning and a distractor word are listed. The examinee is asked to choose which word is associated with the test term.[25] This is used to gauge the subject's comprehension as well as pronunciation (decoding) of health-related terms. Administration of the test takes about 2 to 3 minutes and requires minimal training.[25] Scores of 0 to 14 are classified as low health literacy; this correlates to a decreased ability to read and comprehend health-related information.[25,26]

SF-36v2.

QoL was measured using the SF-36v2 multi-item scale, which measures eight health concepts (four physical and four mental health domains) rated on a 3-point to 6-point Likert scale with documented validity and reliability when used in older White and minority populations.[27,28] The four physical domains (physical functioning, role-physical, body pain, general health) and four mental health domains (vitality, social functioning, role-emotional, and mental health) were determined along with the physical component summary and mental component summary scores. These measures were scaled to have a mean of 50 and a standard deviation (SD) of 10 in the general population.[27] This survey was also translated into Spanish.

Statistical analyses

Demographic and clinical data are reported as frequencies and percentages, and age is reported as mean and SD. Logistic regression analysis was used to determine the relationship between race/ethnicity and measures of health literacy with results reported as odds ratio and 95% confidence interval, with White participants as the comparison group.

Health literacy tools and scores[23,25]

Tool	Questions	Test score range	Scores for functional health literacy
TOFHLA	17	0–100	Inadequate: 0–59 Marginal: 60–74

Tool	Questions	Test score range	Scores for functional health literacy
			Adequate: 75–100
SAHL	18	0–18	Low: 0–14

Participant education level was included as a covariate in the statistical model to assess the potential confounding effect of this variable. Analysis of variance was performed using indicator variables to test for differences in QoL health domains and summary scores between race/ethnic groups, again with White participants as the comparison group. Analyses were performed using SAS 9.4. A critical *P*-value of .05 was used for significance in all analyses.

Results

Among the 91 participants, the mean age was 68 ± 12 years. The majority of participants (65%) were male, and the sample was racially and ethnically diverse (see Demographic and clinical characteristics of the study population). The Hispanic sample was primarily first-generation immigrants from the Dominican Republic. Most participants reported a low income, with 49% earning under $15,000 annually.

The majority of White participants (74%) had at least some college education, compared with 48% of Black participants and 15% of Hispanics ($P < .01$). Clinical characteristics of the participants included diabetes mellitus (46%), hyperlipidemia (64%), and hypertension (87%); 69% of participants had multiple cardiac risk factors, including 5% who were current smokers.

Based on the TOFHLA, 32% of participants had inadequate functional health literacy. Consistent with the TOFHLA results, 35% of participants had low health literacy according to the SAHL. Among White participants, 16% were classified as having inadequate functional health literacy, and 23% were classified as having low health literacy (see TOFHLA: Functional health literacy) and (SAHL: Short assessment of health literacy).

Inadequate health literacy measured by the TOFHLA was more common in Hispanic participants (41%) than White participants (16%; odds ratio = 3.62; 95% confidence interval = 1.15, 11.43; $P < .05$) as was low health literacy (SAHL; 46% versus 23%; odds ratio = 2.94; 95% confidence interval = 1.03, 8.41; $P < .05$). Overall, many of the participants enrolled in the study struggled to read and interpret health texts, even when administered in Spanish.

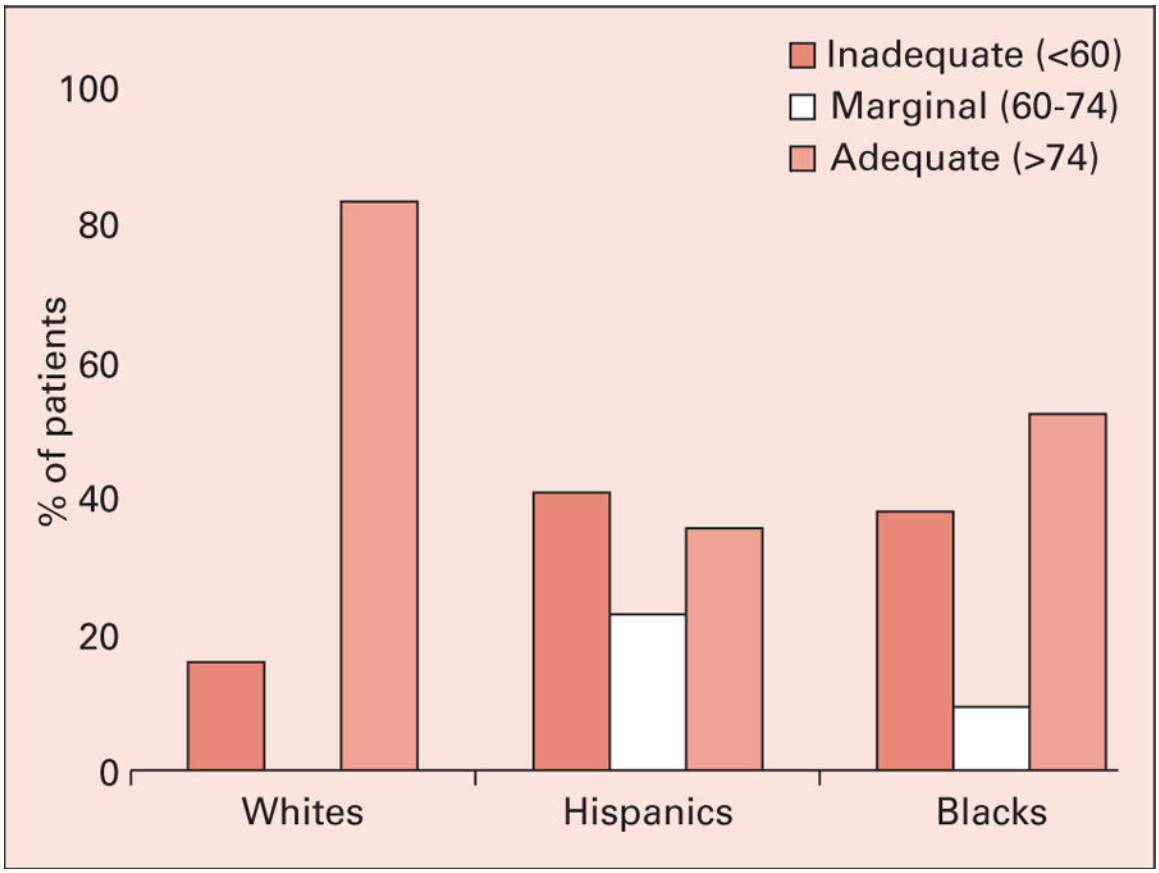
Demographic and clinical characteristics of the study population

	Total cohort N = 91	Blacks N = 21 (23%)	Hispanics N = 39 (43%)	Whites N = 31 (34%)
Age (years, mean ± SD)	68 ± 12	67 ± 13	68 ± 10	70 ± 15
Males	65%	43% *	69%	74%

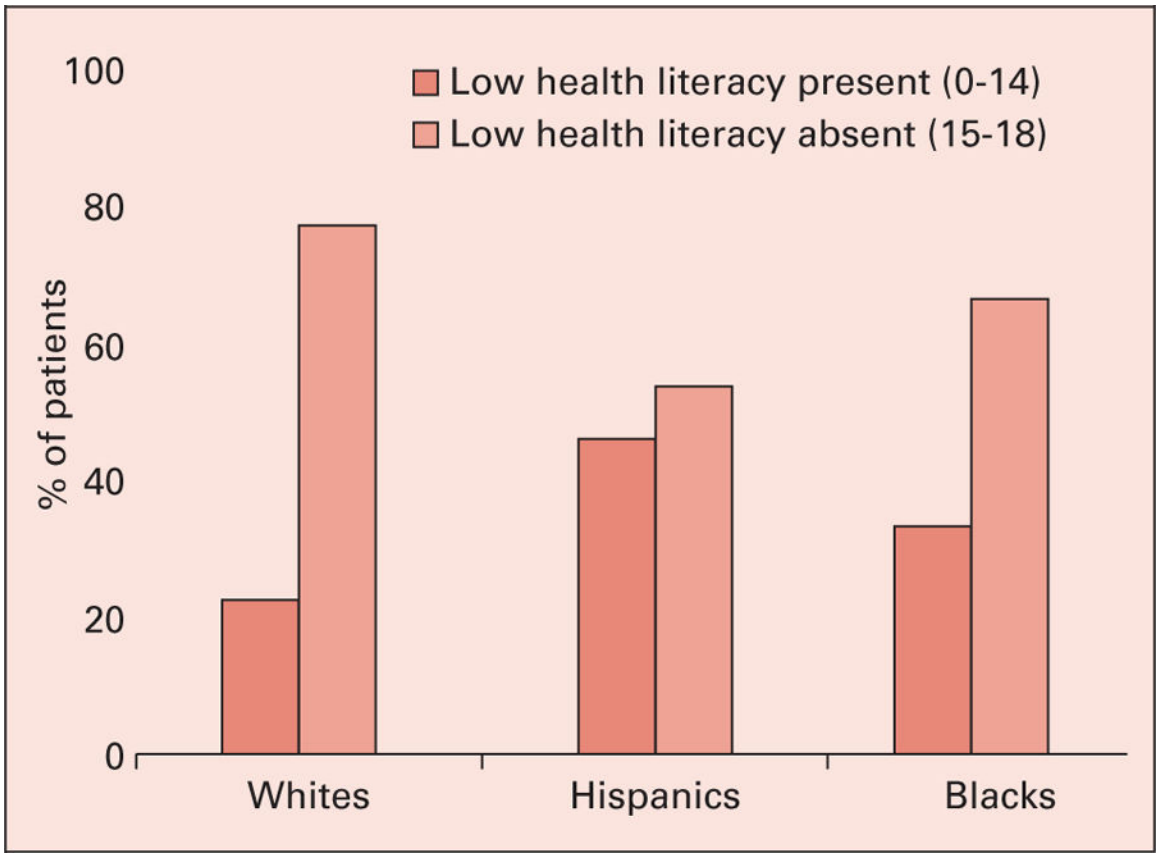
	Total cohort N = 91	Blacks N = 21 (23%)	Hispanics N = 39 (43%)	Whites N = 31 (34%)
College educated	43%	48%	15%**	74%
Income <$15,000	49%	48%*	74%**	17%
Diabetes	46%	48%	54%	35%
Hypertension	87%	90%	95%*	74%
Hyperlipidemia	64%	52%	69%	65%
Current smoker	5%	14%	3%	3%
Multiple risk factors (2 or more)	69%	67%	77%	61%

*$P < .05$ vs. White participants

**$P < .01$ vs. White participants



TOFHLA: Functional health literacy



SAHL: Short assessment of health literacy

Health literacy classifications were strongly related to education, with only 5% of those with at least some college education having inadequate functional health literacy versus 52% with a high school education or less (odds ratio = 0.050; 95% confidence interval = 0.011, 0.230; $P = .0001$). Hispanic participants were less likely than White participants to be college educated, and differences in literacy were no longer significant when education status was included in the statistical analysis (odds ratio = 0.91; 95% confidence interval = 0.22, 3.73).

Similar results were observed for assessments of low health literacy (15% versus 50%; odds ratio = 0.182; 95% confidence interval = 0.65, 0.507; $P = .0011$). When education was included as a covariate in the analysis, differences between Hispanic participants and White participants were no longer significant (odds ratio = 1.25, 95% confidence interval = 0.36, 4.33). The number of cardiac risk factors also correlated significantly with inadequate functional health literacy (r = 0.25, $P < .05$).

QoL measures of physical and mental health varied significantly among racial and ethnic groups (see QoL: Race and ethnicity factors). Physical well-being component summary scores were lower among Black participants (35, SD = 10) than among White participants (41, SD = 10), ($t = 2.21$, df = 88, $P < .05$). Physical component summary scores were also lower among Black participants (36, SD = 13 versus 45, SD = 9; $t = 2.97$, df = 88, $P < .01$). Hispanic participants had poorer mental component summary scores compared with White

participants (46, SD = 15 versus 54, SD = 12; $t = 2.30$, df = 88, $P < .05$), with lower scores in the social function (44, SD = 12 versus 50, SD = 10; $t = 2.29$, df = 88, $P < .05$) and in the role-emotional (34, SD = 22 versus 47, SD = 16; $t = 2.86$, df = 88, $P < .01$) domains.

QoL: Race and ethnicity factors

	Total cohort N = 91	Blacks N = 21	Hispanics N = 39	Whites N = 31
Component summary measures				
Physical component summary	39 ± 10	35 ± 10 *	40 ± 9	41 ± 10
Mental component summary	50 ± 14	50 ± 14	46 ± 15 *	54 ± 12
Health domain scales				
Physical function	40 ± 11	36 ± 13 **	38 ± 10 *	45 ± 9
Role-physical	35 ± 17	30 ± 15	36 ± 17	37 ± 17
Body pain	45 ± 11	44 ± 11	45 ± 13	47 ± 9
General health	42 ± 10	42 ± 9	42 ± 12	44 ± 9
Vitality	50 ± 12	45 ± 13	50 ± 13	52 ± 9
Social function	47 ± 12	47 ± 12	44 ± 12 *	50 ± 10
Role-emotional	39 ± 20	38 ± 19	34 ± 22 **	47 ± 16
Mental health	51 ± 10	52 ± 10	49 ±12	52 ± 9

* $P < .05$ versus. White participants

** $P < .01$ versus. White participants

Hispanic participants also scored lower than White participants in the physical functional domain (38, SD = 10; versus 45, SD = 10; $t = 2.60$, df = 88, $P < .01$). Scores obtained on the QoL were not related to health literacy or education, with the exception of the physical functional domain, where patients with at least some college education scored higher than those with a high school education or less (43, SD = 11 versus 38, SD = 10; $t = 2.51$, df = 89, $P < .05$).

Participants reporting annual income under $15,000 had poorer mental component summary scores compared with those earning more than $15,000 (45, SD = 16 versus 55, SD = 10; $t = 3.54$, df = 88, $P < .001$) as well as lower scores for the social function (43, SD = 13 versus 51, SD = 9; $t = 3.57$, df = 88, $P < .001$) and role-emotional domains (32, SD = 21 versus 47, SD = 16; $t = 4.06$, df = 88, $P < .001$).

Discussion

This study evaluated differences in health literacy and self-reported QoL in a primarily older, ethnically diverse, economically disadvantaged cardiac patients, most of whom had multiple cardiac conditions. The study results demonstrate differences in functional health literacy and QoL among minority groups. Older age and lower income level have also been correlated with poor functional health literacy and increased mortality in both urban and rural populations.[19]

The urban population in this study had a mean age of 68 years and was primarily low income, with 49% earning below $15,000 per year. In addition to having low literacy, the authors also found that Hispanic adults had the poorest health literacy and general knowledge of their coexisting cardiac conditions.

The results of this study are similar to a variety of recent studies evaluating health literacy in Hispanic populations.[18,20] Because the majority of these individuals were older and age is known to be correlated with decreased functional health literacy, it may be important for NPs to develop rapid methods of assessing healthcare comprehension during routine follow-up visits, especially for nonnative English speakers. This is critical to ensure that patients understand their healthcare treatments, can communicate with NPs and other HCPs, and have the basic skills to navigate the complexities of the changing healthcare system. In addition, NPs should be aware of the impact of a lack of health literacy on individuals being able to perform adequate self-care related to their cardiac health.

In the study, Hispanic patients were more likely than White patients to have inadequate or low health literacy, similar to Dunn-Navarra and colleagues' report on health literacy in an underserved urban community in New York City.[18] The researchers found that 36% of the Hispanic immigrant population had "inadequate" functional health literacy based on the shortened version of the TOFHLA.[18] Moreover, Bennett and colleagues found health literacy to be a mediator of differences in health outcomes between Hispanic, Black, and White participants.[29]

Additionally, Dunn-Navarra and colleagues found that older White adults had an average health literacy score within the defined basic functional level, which was significantly higher than Black and Hispanic older adults. These findings highlight a significant gap of knowledge that NPs must be aware of in the context of care in diverse populations and settings.

Similarly to Hispanics, Blacks were approximately 1.5 times more likely to report a fair or poor health status as compared with White respondents.[29] In this study, only 15% of Hispanics reported having at least some college education as compared with 48% of Blacks and 74% of Whites. This suggests the likelihood of educational level as an important factor influencing low health literacy scores among Hispanics.

The authors also found that poor functional health literacy was associated with the presence of multiple comorbid conditions, such as hypertension, diabetes mellitus, and hyperlipidemia, consistent with multiple reports on the association between health literacy and these conditions.[15,30,31] Interestingly, 87% of Hispanic participants in the study had a diagnosis of hypertension, showing the significant relationship between health literacy and chronic conditions; high prevalence of hypertension is associated with lower health literacy.[29,31]

Little information is available regarding the relationship between QoL and health literacy. There was no significant association between QoL and health literacy, but participants with less education had lower scores for the physical functional domain. Hispanic participants had poorer mental component summary scores compared with White participants; lower

scores were observed for the social function and the role-emotional domains. Hispanic participants had less education and also scored lower in the physical functional domain. These findings add to the limited body of knowledge of the relationship between QoL and health literacy in older, underserved minorities with coexisting chronic conditions. Further research is warranted.

Limitations

There were a number of study limitations to be noted. This was a single-center study using a convenient sampling method. In addition, there were potential issues related to instrumentation. Though some patients denied visual deficits prior to enrollment, some reported difficulty reading the administered questionnaire, even though the version with a larger font size was used.

Although the TOFHLA and SAHL provide a basic assessment of functional health literacy, they are not easily administered in the clinical setting. Patients in this study tended to dislike the feeling of being “tested,” which was often communicated to the research team. Further research is warranted to determine if existing instruments can be refined and validated for use in older adult minorities.

Finally, low health literacy, race/ethnicity, and education were each related to medication adherence in previous research that was conducted among Medicare enrollees with cardiac-related conditions.[32] The authors did not collect information on medication adherence, which would have been helpful to provide additional insight related to hypertension, diabetes, and hyperlipidemia self-management.

NP practice implications

These findings highlight a significant gap of knowledge that NPs must be aware of regarding care in diverse populations and settings. This raises the question of how NPs can develop and implement educational interventions that specifically target Hispanic patients by using visual aids and other approaches to improve cardiac knowledge and self-management. The next steps include:

- developing and testing interventions to support the improvement of health literacy and QoL in minority populations, particularly among Hispanic patients
- examining clinical interventions that target different health literacy levels among minorities and the impact on patient self-care, medication adherence, and cardiac outcomes
- evaluation of improving health literacy on health-related QoL over time among those with chronic conditions.

Conclusion

This study found that low income is associated with low functional health literacy in a population of older urban adults with cardiac diseases seen primarily by NPs. Low

functional health literacy, which impacts a patients' ability to comprehend their own healthcare and make important decisions regarding their health, was associated with the presence of multiple chronic conditions. Health literacy should be routinely assessed as the population continues to age and live with complex comorbid conditions. NPs need to incorporate health literacy into standard clinical care with rapid, easy-to-use tools.

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REFERENCES

1. Colby SL, Ortman JM. Projections of the size and composition of the U.S. population: 2014 to 2060 2015 https://census.gov/content/dam/Census/library/publications/2015/demo/p25-1143.pdf.
2. United States Department of Health and Human Services. Quick guide to health literacy 2013 https://health.gov/communication/literacy/quickguide/Quickguide.pdf.
3. Bergad LW. Center for Latin American, Caribbean & Latino Studies. The Latino Population of New York City 1990—2015 2016 http://clacls.gc.cuny.edu/files/2017/03/Latino-Data-Project-Report-65.-The-Latino-Population-of-New-York-City-1990-2015.-December-2016.pdf.
4. Aaby A, Friis K, Christensen B, Rowlands G, Maindal HT. Health literacy is associated with health behaviour and self-reported health: a large population-based study in individuals with cardiovascular disease. Eur J Prev Cardiol 2017;24(17):1880–1888. [PubMed: 28854822]
5. Matsuoka S, Tsuchihashi-Makaya M, Kayane T, et al. Health literacy is independently associated with self-care behavior in patients with heart failure. Patient Educ Couns 2016;99(6):1026–1032. [PubMed: 26830514]
6. Barton AJ, Allen PE, Boyle DK, Loan LA, Stichler JF, Parnell TA. Health literacy: essential for a culture of health. J Contin Educ Nurs 2018;49(2):73–78. [PubMed: 29381170]
7. Hahn EA, Burns JL, Jacobs EA, et al. Health literacy and patient-reported outcomes: a cross-sectional study of underserved English- and Spanish- speaking patients with type 2 diabetes. J Health Commun 2015;20(suppl 2):4–15.
8. Balakrishnan MP, Herndon JB, Zhang J, Payton T, Shuster J, Carden DL. The Association of Health Literacy with Preventable Emergency Department Visits: a cross-sectional study. Acad Emerg Med 2017;24(9):1042–1050. [PubMed: 28646519]
9. Prince LY, Schmidtke C, Beck JK, Hadden KB. An assessment of organizational health literacy practices at an academic health center. Qual Manag Health Care 2018;27(2):93–97. [PubMed: 29596270]
10. Schaffler J, Leung K, Tremblay S, et al. The effectiveness of self-management interventions for individuals with low health literacy and/or low income: a descriptive systematic review. J Gen Intern Med 2018;33(4):510–523. [PubMed: 29427178]
11. Nguyen TH, Park H, Han HR, et al. State of the science of health literacy measures: validity implications for minority populations. Patient Educ Couns 2015.
12. Rikard RV, Thompson MS, McKinney J, Beauchamp A. Examining health literacy disparities in the United States: a third look at the National Assessment of Adult Literacy (NAAL). BMC Public Health 2016;16:975. [PubMed: 27624540]
13. Ylitalo KR, Meyer MRU, Lanning BA, During C, Laschober R, Griggs JO. Simple screening tools to identify limited health literacy in a low-income patient population. Medicine (Baltimore) 2018;97(10):e0110. [PubMed: 29517689]
14. MacLeod S, Musich S, Gulyas S, et al. The impact of inadequate health literacy on patient satisfaction, healthcare utilization, and expenditures among older adults. Geriatr Nurs 2017;38(4):334–341. [PubMed: 28089217]
15. Soto Mas F, Jacobson HE. Advancing health literacy among Hispanic immigrants: the intersection between education and health. Health Promot Pract 2018.

16. Serper M, Patzer RE, Curtis LM, et al. Health literacy, cognitive ability, and functional health status among older adults. Health Serv Res 2014;49(4):1249–1267. [PubMed: 24476068]
17. King L, Hinterland K, Dragan KL, et al. Community Health Profiles 2015, Manhattan Community District 12: Washington Heights and Inwood 2015 www1.nyc.gov/assets/doh/downloads/pdf/data/2015chp-mn12.pdf.
18. Dunn-Navarra AM, Stockwell MS, Meyer D, Larson E. Parental health literacy, knowledge and beliefs regarding upper respiratory infections (URI) in an urban Latino immigrant population. J Urban Health 2012;89(5):848–860. [PubMed: 22707307]
19. Dracup K, Moser DK, Pelter MM, et al. Rural patients' knowledge about heart failure. J Cardiovasc Nurs 2014;29(5):423–428. [PubMed: 23839575]
20. Garcia CH, Espinoza SE, Lichtenstein M, Hazuda HP. Health literacy associations between Hispanic elderly patients and their caregivers. J Health Commun 2013;18(suppl 1):256–272. [PubMed: 24093360]
21. Parker RM, Baker DW, Williams MV, Nurss JR. The test of functional health literacy in adults: a new instrument for measuring patients' literacy skills. J Gen Intern Med 1995;10(10):537–541. [PubMed: 8576769]
22. Cutilli CC, Simko LC, Colbert AM, Bennett IM. Health literacy, health disparities, and sources of health information in U.S. older adults. Orthop Nurs 2018;37(1):54–65. [PubMed: 29369135]
23. Williams MV, Parker RM, Baker DW, et al. Inadequate functional health literacy among patients at two public hospitals. JAMA 1995;274(21):1677–1682. [PubMed: 7474271]
24. Gazmararian JA, Kripalani S, Miller MJ, Echt KV, Ren J, Rask K. Factors associated with medication refill adherence in cardiovascular-related diseases: a focus on health literacy. J Gen Intern Med 2006;21(12):1215–1221. [PubMed: 17105519]
25. Lee SY, Stucky BD, Lee JY, Rozier RG, Bender DE. Short assessment of health literacy-Spanish and English: a comparable test of health literacy for Spanish and English speakers. Health Serv Res 2010;45(4):1105–1120. [PubMed: 20500222]
26. Baker DW, Williams MV, Parker RM, Gazmararian JA, Nurss J. Development of a brief test to measure functional health literacy. Patient Educ Couns 1999;38(1):33–42. [PubMed: 14528569]
27. Ware JEKM, Bjorner JB, Turner-Bowker DM, Gandek B, Maruish ME. User's Manual for the SF-36v2 Health Survey 2nd ed. Lincoln, RI: QualityMetric Inc; 2007.
28. Peek MK, Ray L, Patel K, Stoebner-May D, Ottenbacher KJ. Reliability and validity of the SF-36 among older Mexican Americans. Gerontologist 2004;44(3):418–425. [PubMed: 15197296]
29. Bennett IM, Chen J, Soroui JS, White S. The contribution of health literacy to disparities in self-rated health status and preventive health behaviors in older adults. Ann Fam Med 2009;7(3):204–211. [PubMed: 19433837]
30. Gazmararian JA, Williams MV, Peel J, Baker DW. Health literacy and knowledge of chronic disease. Patient Educ Couns 2003;51(3):267–275. [PubMed: 14630383]
31. Cheng YL, Shu JH, Hsu HC, et al. High health literacy is associated with less obesity and lower Framingham risk score: sub-study of the VGH-HEALTHCARE trial. PLoS One 2018;13(3):e0194813. [PubMed: 29590183]
32. Gazmararian JA, Kripalani S, Miller MJ, Echt KV, Ren J, Rask K. Factors associated with medication refill adherence in cardiovascular-related diseases: a focus on health literacy. J Gen Intern Med 2006;21(12):1215–1221. [PubMed: 17105519]