Association Between Health Literacy and Medication Adherence among Hispanics With Hypertension

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Abstract

Background: Poor adherence to prescribed antihypertensive medication is a major contributor to disparities in effective blood pressure control among Hispanics. The purpose of this study was to investigate the association between health literacy level and adherence to antihypertensive medications among Hispanic adults, who self-reported hypertension, controlling for potential covariates of adherence and/or health literacy.

Methods: We conducted a cross-sectional survey of 1,355 Hispanic adults, primarily Dominicans, who self-reported hypertension. Antihypertensive medication adherence and health literacy were evaluated along with covariates including sociodemographic characteristics, depression, anxiety, and sleep disturbance. Linear regression models were created for health literacy, each covariate, and adherence. Factors found to be significantly associated with adherence in the individual regression models at a p-value of <0.20 were included in a hierarchical multiple linear regression model.

Results: Overall, the majority of participants had low adherence levels to antihypertensive medications (88.4%; n=1,026) and inadequate health literacy (84.9%; n=1,151). When controlling for age, sex, birth country, education level, recruitment location, depression, anxiety, and sleep disturbance, having adequate as compared to inadequate health literacy was associated with a higher adherence score (b=0.378, p=0.043). The full model explained 13.6% of the variance in

medication adherence (p-value <0.001), but the unique contribution of health literacy to the model was minimal (R^2 change=0.003).

Conclusions.—Tailored interventions considering health literacy are needed to support medication adherence in order to improve hypertension outcomes of Hispanics. Additional studies are needed to identify and prioritize factors in the development of targeted and effective adherence interventions for Hispanics with hypertension.

Keywords

medication adherence; hypertension; Dominicans; Hispanics; health literacy

Background

Hypertension (HTN) is a leading cause of cardiovascular disease (CVD) and preventable mortality affecting 75 million adults in the United States (US), and contributing to more than 360,000 deaths in 2013 [1]. CVD is the second leading cause of death for Hispanics, a group currently representing 17.8% of the US population [2] with an expected increase to 29% by 2060 [3], [4]. A significant contributor to CVD for Hispanics is hypertension [5], with overall low rates of poor control in comparison to white cohorts [6]. Additionally, racial ethnic disparities persist for both initial treatment and long-term management of HTN [7]. Poor adherence to prescribed antihypertensive medication is a major contributor to disparities in effective blood pressure control among racial ethnic minorities including Hispanic patients [8]. Yet there is a paucity of evidence addressing adherence behavior in the Hispanic population [9]. Moreover, the majority of studies reporting on cardiovascular disease for US Hispanics has primarily focused on Mexicans; however these data may not be relevant to other Hispanic ethnic groups [10] including Dominicans. Given the current demographic shift in the US and prevalence of CVD among the Hispanic population [4], there is a pressing need to better understand factors influencing medication adherence among ethnic minority Hispanic adults with HTN.

According to the 2017 guidelines for high blood pressure in adults by the American College of Cardiology [11], maintaining optimal blood pressure control and treatment with blood pressure lowering agents or antihypertensives is imperative. Adherence of 80% or better to prescribed antihypertensive medications is an essential component of maintaining optimal blood pressure control [12,13]. The World Health Organization defines adherence to long-term therapy as the extent to which a person's behavior corresponds with agreed recommendations from a health care provider [14]. In general, levels of adherence to medications for chronic illness including CVD are estimated to be at 50% [13,15] with half of patients discontinuing antihypertensive medications within one year of initiation [16].

Hispanics are less likely to be currently taking medications to control their blood pressure compared to non-Hispanic whites [17,18]. In fact, low levels of high medication adherence, defined as a score of eight on the Morrisky Adherence Scale have been reported in an urban, community dwelling cohort of US Hispanics, primarily of Dominican origin [19].

Patient adherence to antihypertensive treatment is influenced by a myriad of factors including sociodemographic characteristics (e.g., age, sex, education level, health insurance; [19,20], symptoms (e.g., depression, anxiety; [21,22], sleep [23]), and health literacy [24,25], Health literacy refers to an individual's skills to gain access to, understand, and use information in ways that promote and maintain his or her health [26]. A systematic review of 35 studies revealed that there is a significant and positive relationship between health literacy and medication adherence [27]. Despite the reported findings, these factors are understudied in urban, Dominican Hispanic populations.

Therefore, the purpose of this study was to investigate the association between health literacy level and adherence to antihypertensive medications among Hispanic adults, who self-reported HTN, controlling for potential covariates/confounders of adherence, including demographic characteristics (i.e., age, sex, birth country, marital status, health insurance, education level, and recruitment location), and symptoms of depression, anxiety, and sleep disturbance.

METHODS

This study is part of a larger parent project, the Washington Heights/Inwood Informatics Infrastructure for Comparative Effectiveness Research (WICER) study [28–31]. The overall goal of the WICER study was to build a community-focused data infrastructure focused on improving the health of a Hispanic immigrant community at risk for health disparities. The WICER study was approved by the Columbia University Medical Center's Institutional Review Board.

Setting and Participants

A convenience sample was recruited between 2012 and 2013 from two distinct community settings representing five zip codes (10031, 10032, 10033, 10034, and 10040) within the Washington Heights/Inwood communities of Northern Manhattan: 1) community households (HH) and 2) ambulatory care clinics (ACN) affiliated with New York Presbyterian Hospital. Eligible participants for the current analysis were 18 years or older, English or Spanish speaking, Hispanic, and self-reporting HTN.

Recruitment and Data Collection

Trained bilingual community health workers from the neighborhood recruited eligible participants. Multiple recruitment strategies were employed. The HH sample was recruited by probability sampling within the five target zip codes through ringing doorbells in the apartment buildings followed with snowball sampling. The ACN sample was recruited by inviting patients waiting for medical appointments in the ambulatory clinics to participate in the study. Participants completed the informed consent and the WICER Community Health Survey (CHS) in their preferred language (English or Spanish) using validated measures in either English and Spanish [32,33]. All participants completing the WICER CHS were compensated for their time and received a choice of two movie tickets, a $25.00 New York City transit metro-card, or a $25.00 food voucher to a local grocery store.

Community Health Survey (CHS)

The WICER CHS collected comprehensive sociocultural information including demographic and health information as well as anthropometric measures from participants. Approximate time for completion of the survey was 60 to 120 minutes. Measures for the analysis were selected based on published literature.

Measures

Sociodemographic characteristics.—Age, sex, birth country, marital status, health insurance, and education level were collected. Birth country was coded into three categories: (1) Dominican Republic, (2) United States, and (3) other countries. Marital status was dichotomized as partnered or not partnered. Not partnered individuals were those who indicated that they were widowed, single, separated, or divorced. Health insurance was dichotomized based on having Medicaid/Medicare or other. Education level was coded into three categories: completed (1) less than high school, (2) high school, and (3) some college or beyond.

Health literacy.—Health literacy was measured using the Newest Vital Sign (NVS), a rapid screening measure of adult health literacy in primary health care settings [34]. The NVS is a nutrition label and includes six questions, requiring three minutes for administration. Scores of 0–1 indicate high likelihood of limited literacy, scores of 2–3 suggest the possibility of limited literacy, and scores of 4 are consistent with adequate literacy [34]. Psychometric testing of the NVS demonstrates reliability for both the English (Cronbach's $\alpha > 0.76$) and Spanish (Cronbach's $\alpha = 0.69$) versions [34]. Scores were recoded into a dichotomous variable of not adequate literacy (score of 3) and adequate literacy (score of 4) level.

Symptom Status.—Depression was measured using the Patient-Reported Outcome Measurement Information System (PROMIS) Short Form v1.0 – Depression 4a [35]. The four-items ask, "In the past 7 days, I felt (1) worthless; (2) helpless; (3) depressed; and (4) hopeless" with responses of "never," "rarely", "sometimes," "often", or "always." Anxiety was measured with the PROMIS Short Form v1.0 – Emotional Distress-Anxiety 4a [35]. The four-items ask, "In the past 7 days, (1) I felt fearful; (2) I found it hard to focus on anything other than my anxiety, (3) my worries overwhelmed me, and (4) I felt uneasy" with responses of "never," "rarely", "sometimes," "often", or "always." Sleep was measured with the PROMIS Short Form v1.0 – Sleep Disturbance 4a [36]. The first item asks, "In the past 7 days, my sleep quality was" with responses of "very poor," "poor," "fair," "good," or "very good." The remaining three items ask, "In the past 7 days, (1) my sleep was refreshing, (2) I had a problem with my sleep, and (3) I had difficulty falling asleep" with responses "not at all," "a little bit," "somewhat," "quite a bit", or "very much." Reponses to the PROMIS measures for depression, anxiety, and sleep were summed and converted into a T-score metric with a mean of 50 (SD 10). Higher T-scores indicate more of the concept being measured (e.g., higher levels of anxiety).

Adherence.—Adherence to anti-hypertensive medications was measured with an eight-item self-report scale using the Morisky Medication Adherence Scale [37]. This adherence

measure is reliable (Cronbach's α=0.83) with good concurrent and predictive validity in low-income, minority patients with HTN, and is significantly associated with blood pressure control (p<0.05). The possible range of scores is 0 to 8. Scores of ≤5 indicate low adherence, scores of 6 to 7 indicate medium adherence, and scores of 8 indicate high adherence [37]. The total score was used as the dependent variable in the analysis.

Statistical Analysis

Data was imported into IBM SPSS Statistics, version 21 (Chicago, IL). Initially, we computed descriptive statistics (mean and standard deviation, median and range, frequency and percentage) to summarize demographic characteristics, adherence estimates, and health literacy scores. Data was assessed for normality. Bivariate correlations between each of the predictors and adherence were initially calculated. Unadjusted linear regression models with adherence as the outcomes were then created for each of the following predictor variables: health literacy, demographics (i.e., age, sex, birth country, marital status, health insurance, education level, recruitment locations), and symptoms (depression, anxiety, and sleep disturbance). Variables found to be significantly associated with adherence in the individual regression models at a p-value of <0.20 were then included in a hierarchical multiple linear regression model. The unique contribution of health literacy level in explaining the variance in medication adherence scores was evaluated in the final block of the hierarchical multiple linear regression model, adjusted for covariates/confounders meeting the <0.20 p-value cutoff.

RESULTS

A total of 1,355 participants were included. Participants had a mean age of 62 (SD 11.05). Seventy-six percent were females, 68% did not have a partner, 90% were born in the Dominican Republic, 68.3% have less than a high school education, and 86.3% have Medicaid/Medicare (Table 1). We found that 84.9 % (n=1,151) of participants had inadequate health literacy. Adherence scores as measured by the Morisky Medication Adherence Scale ranged from 0 to 8 with a mean score of 1.94 (SD=2.15).

Table 2 shows the association of health literacy level, as well as each of the included covariates with adherence. Adequate health literacy was associated with a higher adherence score, i.e., "better" adherence (b=0.572, p-value=0.002, R^2=0.008), as compared to inadequate health literacy levels. Age (p-value=0.003), sex (p-value=0.017), education level (p-value=0.002), birth country (p-value=0.070), recruitment location (p-value=0.007), anxiety (p-value <0.001), depression (p-value <0.001), and sleep disturbance (p-value <0.001) met the p-value <0.20 cutoff for inclusion in the full multiple linear regression model.

The full model was significant overall (p-value <0.001) with an R^2 of 0.136 (Table 3). In the comparison of adequate to inadequate health literacy levels, adequate health literacy was associated with a higher adherence score, i.e., "better" adherence (b=0.378, p=0.043), when controlling for age, sex, birth country, education level, recruitment location, anxiety, depression, and sleep disturbance. However, the unique contribution of health literacy level to the model consisting of the covariates/confounders alone was minimal, R^2 change=0.003.

In addition, we found that as age increases, adherence scores decrease (b=−0.015, p-value=0.013) and as anxiety (b=0.036, p-value= 0.001), depression (0.029, p-value=0.024), and sleep disturbance (b=0.058, p-value <0.001) increase, adherence scores increase. Male compared to female sex (b=0.354, p-value=0.015) and being recruited from ACN compared to HH (b=0.814, p-value <0.001) were associated with higher adherence scores. High school (b=−0.555, p-value=0.001) or some college education and beyond (b=−0.512, p-value=0.007) was associated with lower adherence scores, compared to having less than a high school education. Likewise, compared to being born in the Dominican Republic, being born in the United States (b=−0.031, p-value=0.935) or other countries (b=−0.383, p-value=0.115) was associated with lower adherence scores.

DISCUSSION

The findings from this study are among the first to describe the association between health literacy levels and HTN medication adherence among Hispanic adults, primarily Dominicans, who self-reported HTN, controlling for potential covariates of adherence and/or health literacy, including demographic characteristics, depression, anxiety, and sleep disturbance. Overall, the majority of participants had low adherence to antihypertensive medications (88.4%) and inadequate health literacy (84.9%). The results of this study demonstrate that when controlling for individually significant covariates, only 0.3% of the variation in medication adherence is explained by health literacy level as measured by the NVS. One possible explanation for this finding could be the lack of variability in health literacy levels among the study participants. Additionally, the NVS primarily assesses numeracy and requires mathematical skills to answer questions correctly [38] and results may have differed if another health literacy measure was used. However, the large number of participants in our study with inadequate health literacy is congruent with existing research that shows that racial ethnic minorities are far more likely to be at or below basic levels in health literacy skills [39]. Consistent with existing research, having adequate health literacy was associated with better adherence [27]. Consequently, more interventions are needed for low health literate populations in order to increase medication adherence. For example, researchers could develop tailored medication interventions that include aids to reinforce written information, personalize information, ease navigation and improve accessibility. A systematic review of 47 intervention studies revealed that such tailoring was both effective and strongly preferred by low health literate patients to help improve their medication adherence [40].

We also found that as age increases, adherence score decreases, indicating poor adherence to antihypertensive medications among Hispanic participants. This finding is contrary to research that has reported that younger age (e.g., aged 18–44 years [41]; < 60 [42]; <65 years [43])was associated with greater odds of non-adherence [41–43]. Declining cognitive status in older adults may contribute to poor adherence [44–47], but this was not explicitly measured in the WICER CHS.

Also inconsistent with existing research [19,20], we found that having completed high school or some college and beyond were associated with lower adherence scores compared to high school or less. Similarly, we found that as levels of anxiety, depression, and sleep

disturbance increased, adherence also increased. This finding is inconsistent with results of previous research studies [21–23,41], and may explained by the limited variability in adherence scores among study participants and symptom scores that were slightly below the mean for the PROMIS measures reference population.

Among this study sample, male sex and recruitment from an ambulatory care practice (i.e., ACN) were associated with better adherence. This finding is consistent with research that has demonstrated that males have higher levels of medication adherence than women, including those who are Hispanics and other ethnic groups with HTN and other chronic diseases [48–50]. In addition, it is possible that participants who were recruited from ACN have better adherence to antihypertensive medications because they may have more frequent contact with healthcare providers. Grigoryan, Pavlik, and Hyman (2012) found that higher adherence was seen in patients monitored by clinicians in the intervention clinics [51]. Despite such findings, there are clear disparities between women and men related to medication adherence. Tailored interventions to support medication adherence for each sex should be considered in order to improve medication adherence and ultimately health outcomes. It has been documented that barriers to antihypertensive medication adherence differ according to sex [52]. For instance, the presence of depressive symptoms and patients' dissatisfaction with communication with their health care provider were identified as barriers to adherence in women but not men [52]. Hence, interventions could address such barriers to increase medication adherence among women.

The strengths and weakness of the current study should be considered in the interpretation of the results. First, this study considered many important variables related to medication adherence. However, not all known covariates of adherence were assessed or included (e.g., income, social support, HTN beliefs and knowledge, and cognitive status, etc.). Future studies could investigate how such variables impact medication adherence among Hispanics. Second, our measures were self-reported and response bias may be present. However, all interviewers were trained to reduce bias. Third, there was limited variability in health literacy, and medication adherence measures. Despite these limitations, major strengths of the current study include the use of a relatively large sample size of Hispanic participants who were mainly Dominican, and the use of validated and conventional measures for health literacy and medication adherence [53].

CONCLUSION

This study is one of the first to examine the association between health literacy and antihypertensive medication adherence among a large sample of Hispanics, primarily Dominicans, who self-reported HTN. Higher health literacy was found to be associated with better adherence. However, both health literacy and self-reported antihypertensive medication adherence levels were low in the majority of study participants. In addition, being male and recruited from an ambulatory care practice were associated with better adherence. Hence, future intervention could be tailored to reflect sex differences and consider care settings to improve antihypertensive medication adherence among Hispanics. Moving forward, an important research priority is the need for studies designed to identify

and prioritize factors in the development of tailored and effective adherence interventions for Hispanics with HTN.

Acknowledgements

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Table 1

Sample demographic characteristics (N=1,355)

Variable	Count	Percent
Cohort		
Ambulatory Care Clinics(ACN)	1,112	82.1
Household (HH)	243	17.9
Sex		
Female	1,030	76
Male	325	24
Marital Status		
Partnered	433	32
Not Partnered	922	68
Birth Country		
United States	41	3
Dominican Republic	1,219	90
Other	88	6.5
Missing	7	0.5
Health Insurance		
Medicaid/Medicare	1,170	86.3
Other	168	12.4
Education		
Less than high school education	926	68.3
High School	235	17.3
Some college and beyond	189	13.9
Missing	5	0.4
Newest Vital Sign- limited literacy		
Yes	1,151	84.9
No	188	13.9
Missing	16	1.2
	Mean	**SD**
Age	62.27	11.05
Medication adherence sum	1.94	2.15
Anxiety	47.39	9.54
Depression	46.51	8.01
Sleep disturbance	49.94	4.98

Table 2.

Results for individual unadjusted linear regression model for medication adherence

	b	95% Confidence Interval of b (Lower, Upper)	R^2	P-Value
Health literacy			0.008	
Adequate literacy	0.572	(0.207, 0.938)		0.002*
Reference group: Not adequate literacy				
Cohort				
Ambulatory care clinics	0.444	(0.123, 0.766)	0.006	0.007*
Reference group: Community households				
Age	−0.017	(−0.029, −0.006)	0.007	0.003*
Sex				
Male	0.358	(0.002, 0.008)	0.005	0.017*
Reference group: Female				
Birth country			0.005	0.070
United States	0.258	(−0.510, 1.026)		0.510
Other countries	−0.543	(−1.032, −0.054)		0.030*
Reference group: Dominican Republic				
Marital status				
Partnered	−0.001	(−0.269, 0.267)	0.000	0.995
Reference group: Not partnered				
Health insurance			0.000	
Other insurance	0.000	(−0.001, 0.002)	0.000	0.708
Reference group: Medicaid/Medicare				
Education level			0.010	0.002
High school	−0.505	(−0.844, −0.165)		0.004*
Some college and beyond	−0.444	(−0.812, −0.076)		0.018*
Reference group: Less than high school				
Depression	0.070	(0.054, 0.085)	0.067	<0.001*
Anxiety	0.064	(0.051, 0.077)	0.077	<0.001*
Sleep disturbances	0.085	(0.060, 0.110)	0.037	<0.001*

Note:

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*
denotes predictors that met the p-value of < 0.20

Table 3

Summary of multiple linear regression analysis for variables predicting medication adherence (N=1,102)

Cohort	b	95% Confidence Interval of b		P-Value
		Lower bound	Upper bound	
Ambulatory care clinics	0.814	0.484	1.145	<0.001
Reference group: Community households				
Age	−0.015	−0.028	−0.003	0.013
Sex				
Male	0.354	0.069	0.639	0.015
Reference group: Female				
Birth country				
United States	−0.031	−0.787	0.724	0.935
Other countries	−0.383	−0.860	0.094	0.115
Reference group: Dominican Republic				
Education level				
High school	−0.555	−0.867	−0.204	0.001
Some college and beyond	−0.512	−0.886	−0.138	0.007
Reference group: Less than high school				
Anxiety	0.036	0.014	0.058	0.001
Depression	0.029	0.004	0.054	0.024
Sleep disturbances	0.058	0.032	0.085	<0.001
Health literacy				
Adequate literacy	0.378	0.013	0.743	0.043
Reference group: Not adequate literacy				

Note: Overall model R^2 = 0.136