

ECHO: A Pilot Health Literacy Intervention to Improve Hypertension Self-Care

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ABSTRACT

Background: Medication adherence and diet and weight control are essential contributors to blood pressure management. Low health literacy is also associated with poor health behaviors and outcomes among adults with hypertension. **Objective:** This study aims to pilot test the acceptability and feasibility of a brief health literacy intervention focused on hypertension self-care and to assess changes in self-care activities. **Methods:** We recruited patients with hypertension who were treated at a low-cost clinic. A 2-hour evidence-based class was delivered in Spanish and English, and a telephone follow-up survey was conducted 1 month later. Intervention content included health literacy activities, nutrition education, and medication use. Participants engaged in reading, writing, a group activity, and critical discussion. Health literacy was measured using the Newest Vital Sign and the Test of Functional Health Literacy in Adults. **Key Results:** The intervention was delivered to 52 English- (52%) and Spanish-speaking adults (48%) with a mean age of 52.3 years (*SD* 7.9). More than one-half had Stage 1 or 2 hypertension (54%), and 56% had inadequate health literacy. At 1-month follow-up, participants showed improvement on all self-care measures with significant mean differences ($p < .05$) on diet adherence and weight management activities. These improvements were largely among Hispanics and those with low health literacy. **Conclusions:** Results suggest that teaching targeted self-care skills in a brief health literacy intervention can be effective in improving self-care activities relating to diet and weight management among vulnerable populations. [*HLRP: Health Literacy Research and Practice*. 2019;3(4):e259-e267.]

Plain Language Summary: This study explored the effects of a 2-hour health education class on self-care behaviors. At the follow-up, participants reported better self-care behaviors. Effects were more pronounced among those with low health literacy, suggesting brief exposure to health education may improve high blood pressure in this population.

Recent changes in hypertension diagnosis guidelines have lowered the criteria for Stage 1 hypertension, resulting in 40% of the adult population in the United States having hypertension (Carey & Whelton, 2018). Prior to these guideline changes, approximately one-half of hypertension cases were uncontrolled (blood pressure [BP] $\geq 140/90$ mm Hg) due to ignorance of the condition

(Bakris, Sarafidis, Agarwal, & Ruilope, 2014), awareness but no treatment (Merai et al., 2016), and nonadherence to prescribed medications and self-care behaviors (Warren-Findlow & Seymour, 2011).

In the U.S., the primary therapy to manage high BP is antihypertensive medication. Rates of adherence to antihypertensive medication in the U.S. are often lower than

40% 1 year after treatment initiation and rates decline with extended treatment (Degli Esposti et al., 2004). Being uninsured or underinsured reduces the odds of using antihypertensive medication by 17% to 60% (Fang, Zhao, Wang, Ayala, & Loustalot, 2016). Obesity and weight management also have a significant relationship with hypertension. The risk of hypertension increases with every additional pound of body weight (Nguyen, Magno, Lane, Hinojosa, & Lane, 2008). Even small reductions in body weight can reduce hypertension risk and improve BP control among those who are already diagnosed (Bennett & Wolin, 2006). Weight management activities related to diet and physical activity can help prevent weight gain or contribute to weight loss.

Hypertension disproportionately affects vulnerable populations, such as racial and ethnic minorities and those with reduced access to health care. Fewer Hispanics experience hypertension in comparison to non-Hispanic White adults; however, the prevalence of uncontrolled hypertension among Hispanics is significantly higher—57% in Hispanic adults versus 48% among non-Hispanic Whites (National Center for Health Statistics, 2017). Hispanic adults with no health insurance have higher rates of undiagnosed and untreated hypertension as compared to Hispanic adults with insurance (Sorlie et al., 2014). These data suggest that without intervention Hispanic populations and people who are underinsured and uninsured will experience greater hypertension-related consequences as compared to non-Hispanic Whites with hypertension.

A barrier to hypertension self-management is health literacy, defined as an individual's ability to find and apply health-related information in to make appropriate health choices (Kindig, Panzer, & Nielsen-Bohlman, 2004).

There is no current consensus on how to measure health literacy. Multiple validated tools exist that assess one or more domains of health literacy and each establishes its own standards of what level of health literacy is considered sufficient or adequate (Altin, Finke, Kautz-Freimuth, & Stock, 2014). Two meta-analysis studies indicate a significant relationship between health literacy and chronic disease self-care behaviors including medication adherence (Zhang, Terry, & McHorney, 2014) and other lifestyle behaviors (Miller, 2016). Low health literacy has also been tied to obesity (Chari, Warsh, Ketterer, Hossain, & Sharif, 2014; James, Harville, Efunbumi, & Martin, 2015), which may reflect poor understanding of diet and active lifestyle recommendations, and/or decreased utilization of primary care services (Faruqi, Stocks, Spooner, El Haddad, & Harris, 2015). Only 12% of the U.S. population has sufficient health literacy (Kutner, Greenburg, Jin, & Paulsen, 2006), with lower rates among non-English speakers (Barton et al., 2014). Low health literacy rates among Hispanics range from 22.6% to 45.3% depending upon English language proficiency (Sentell & Braun, 2012).

Improving health literacy has been suggested as a possible intervention target to increase medication adherence (Zhang, Terry, & McHorney, 2014) as well as other hypertension self-care behaviors (Hutchison, Warren-Findlow, Dulin, Tapp, & Kuhn, 2014). This study reports on a pilot intervention designed to improve health literacy related to medication adherence and weight management activities among under- and uninsured primary care patients with hypertension. Our hypothesis is that intervention participants would report significant improvements on self-care behaviors that would result in reduced systolic and diastolic BP at the 30-day follow-up appointment.

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METHODS

Setting and Timeline

The pilot study was conducted in a low-cost health care clinic located in Charlotte, NC. Charlotte is located in Mecklenburg County, which is a majority-minority county (County Manager's Office, 2018). The clinic that supported the study provides preventive health services to more than 7,000 patients annually who are uninsured or underinsured. The clinic assisted with recruitment, provided classroom space, and abstracted participants' medication and BP data from medical records.

Ten classes were taught from February 2016 to February 2017. Class size ranged from 3 to 10 participants; 5 classes were taught in English and 5 in Spanish. The classes were taught by three trained research assistants with experience as health educators or providers. Two research assistants were fluent in Spanish, and additional support was provided by the research team.

CURRICULUM DEVELOPMENT

The third author (E.V.T.), a Certified Health Education Specialist, developed the intervention curriculum, named ECHO for Empowering Change in Health Outcomes. The curriculum was developed by assessing needs of the population through dialogue with clinic staff, examining empirical literature, and reviewing evidence-based curricula related to the topic. Topics were adapted from the National Diabetes Prevention Program (Centers for Disease Control and Prevention, 2017) and informed by literature describing health literacy and medication adherence interventions for diverse, urban-dwelling adults (Manias & Williams, 2010; Schoenthaler et al., 2015). The delivery structure was based on the Five-Step Health Literacy Model (El Paso Community College, n.d.), which engages participants in reading, writing, speaking, listening, and critical thinking through active learning techniques. **Table 1** describes the ECHO class content.

The curriculum was accompanied by a participant workbook, which included activity handouts and information related to the five core curriculum concepts. Participants wrote answers to medication and food label activities, problems they encountered with medication adherence and feasible solutions, and recorded their own health and medication information within the workbook; they also took the workbook with them after the intervention was completed. The workbook also featured four low-sodium recipes approved by the American Heart Association.

Participants

Eligible participants met the following inclusion criteria: (1) at least age 21 years; (2) spoke English or Spanish; (3) current patient at the study clinic; (4) had a diagnosis of hypertension for at least 1 year; and (5) prescribed at least one medication for hypertension. Exclusion criteria included pregnancy or inability to communicate in English or Spanish.

Clinic staff identified patients who met the inclusion criteria using medical record review. Eligible participants received a letter of invitation and flyer describing the study. Flyers were also posted at the study site. Advertisements invited participants to join the study and directed them to contact a study representative who then scheduled them for an available class. Two days prior to the class, participants received a reminder phone call.

Procedures

The ECHO intervention consisted of a single class that lasted for 2 hours. Participants attended a class with instructors and were provided materials based on their language preference. Participants received a \$25 gift card at the end of the intervention and \$20 for participating in the follow-up interview whether in-person or via telephone. All participants signed an informed consent document that was approved by the University of North Carolina at Charlotte Institutional Review Board.

Data Collection

Demographics, health status, health literacy, and self-care behaviors were assessed at baseline. Participant satisfaction data were collected immediately postintervention. Thirty-day follow-up data were originally intended to be assessed in-person to collect health literacy and BP measures. However, the response rate was low, and the remainder of the follow-up data was collected by phone, which precluded us from assessing changes in health literacy and BP. We did attempt to collect BPs from clinic medical records. We were only able to obtain BP measures for 18 participants. However, only three were within a 30- to 60-day, postintervention window; the remainder were 2 to 6 months after the intervention.

Measures

Demographic data assessed age, gender, race/ethnicity, and survey language. Health data included self-reports of overall physical health and emotional health with response options ranging from *excellent* to *poor/fair*. Consistent with prior studies (Zajacova & Dowd, 2011) responses were collapsed into *poor/fair* or *other*. Clinical health measures included body mass index measured with a digital floor



TABLE 1

Description of ECHO Intervention Using the Five-Step Model

Activity Type	Purpose	Sample Activities
Reading	Read, interpret, and apply health text	Read about hypertension, medication adherence, and self-care expectations
Writing	Develop writing ability related to blood pressure	Create health log, record medication information, develop and record feasible solutions to medication adherence problems
Group activity	Develop literacy and critical thinking skills	Analyze nutrition labels and recipes for sodium content; understand OTC and prescription medication labels
Critical discussion	Apply blood pressure and medication information	Apply learning to overcome barriers, solve problems, and develop support network
Application	Increase understanding of medication compliance and apply learning to own environment	Assess a nutrition label; refill a prescription at the pharmacy; use of a pill box and other visual cues
Wrap up	Reinforce key concepts	Interact with health care providers using Ask Me 3®

Note. ECHO = Empowering Change in Health Outcomes; OTC = over the counter.

scale and stadiometer, and BP taken immediately prior to the class. BP was taken manually using a stethoscope and gauge-type sphygmomanometer by nursing research team members. Results were recorded and reported to the participants.

Hypertension self-care behaviors were measured using a subset of the Hypertension Self-Care Activity Level Effects (H-SCALE), a brief self-report questionnaire that assesses hypertension self-care activities, including adhering to antihypertensive medication regimens, engaging in physical activity, following a healthy, low-salt and low-fat diet, and maintaining a healthy weight (Warren-Findlow, Coffman, & Karp, 2017; Warren-Findlow & Seymour, 2011). Prior research suggests that greater adherence to self-care activities measured by the H-SCALE was associated with lower systolic and diastolic BP (Warren-Findlow, Basalik, Dulin, Tapp, & Kuhn, 2013). Medication adherence was assessed with three items that inquire about the frequency, timing, and dosage of medication intake over the past 7 days. Diet was measured with a single item, physical activity with two items, and weight management consisted of 10 items. Item stems for medication adherence, diet, and physical activity were “How many of the past 7 days did you”? The response options ranged from 0 to 7 days, with higher scores indicating greater adherence. For the weight management scale, each item began with: “In order to lose weight or maintain my weight...,” with response options ranging from *strongly disagree* (1) to *strongly agree* (5). Higher scores indicate

greater adherence. Item responses were summed to obtain a score for each subscale domain. Adherence levels were based on previously established cut-points (Warren-Findlow & Seymour, 2011).

Health literacy was measured using the English and Spanish versions of the Newest Vital Sign (NVS) (Weiss et al., 2005). For the NVS, participants respond to six numeracy and prose questions related to a food label from an ice cream container. The NVS was scored by summing the total number of correct responses; a score less than 4 suggests inadequate health literacy. Numeracy was also assessed using two of the medication labels from the Test of Functional Health Literacy in Adults (TOFHLA) (Parker, Baker, Williams, & Nurss, 1995). Medication literacy was categorized as inadequate for scores of 6 or less of a possible 8.

A 4-item measure was used to assess barriers to medication adherence (Morisky, Green, & Levine, 1986). Scores range from 1 to 4 with higher numbers indicating greater barriers.

Data Analyses

All statistical analyses were conducted using SPSS Version 24. Percentages, means, and standard deviations describe participant characteristics at baseline. *T*-tests were used to examine differences between participants with follow-up data and those lost during the follow-up process. To examine changes between baseline and the 30-day follow-up adherence, we used the summed scores, which are continuous as opposed to the dichotomous format.



RESULTS

The participants ($N = 52$) were mostly female and older than age 50 years (range, 30-80), and most completed the survey and education materials in English (53.8%) (Table 2). One-half of the sample population was Hispanic, and 89% of the non-Hispanic participants were African American.

Of the 52 participants, approximately two-thirds had systolic BP above 130 mm Hg and/or diastolic BP above 80 mm Hg; 57.7% were obese. One-half rated their physical health as *poor/fair*, and one-fourth rated their emotional health as *poor/fair*.

Less than one-half of the population sample had adequate health literacy based on the NVS (44.2%), and 57.7% had adequate numeracy based on the TOFHLA medication labels. One-third reported more than one barrier to medication adherence.

Hispanics reported *poor/fair* physical health in greater numbers, but few reported *poor/fair* emotional health. Hispanic participants reported more barriers to medication adherence. These differences were not statistically significant. Fewer Hispanic participants were obese. Hispanics had lower rates of adequate health literacy both in terms of the NVS and the TOFHLA; differences in the TOFHLA were statistically significant.

Baseline hypertension self-care behaviors ranged from 33% adherence on eating a healthy diet to 52% adherence on medication regimens. Except for diet, hypertension self-care adherence levels were overall higher in Hispanics than in non-Hispanics. Two-thirds of Hispanics were adherent to medication regimens as compared to less than 40% of non-Hispanics. In the overall sample, adherence to hypertension self-care behaviors did not differ by participants' health literacy status based on NVS and TOFHLA scores (data not shown).

Follow-up data were obtained from 33 participants (63.5% response rate) using face-to-face or telephone interviews. Despite conducting the follow-up interviews in both languages, twice as many Spanish-speaking participants did not complete the second interview (66.7%) compared to English-speaking participants (32.3%). Those participants who were lost to the follow-up process reported significantly less tobacco exposure than those for whom we have follow-up data (mean score = .45 vs. mean score of 2.17). There were no differences in baseline BPs between participants we retained in the study and those lost during the follow-up process.

Comparing baseline and follow-up hypertension self-care scores (Table 3), participants reported significant improvements in diet adherence ($p < .01$) and weight management

behaviors ($p < .05$). Barriers to medication adherence decreased and medication adherence increased; however, these changes were not statistically significant. Although all outcomes were in the desired direction, reported shifts in behavior were not substantial enough to affect adherence levels from baseline to follow-up. Intervention effects were largely driven by Hispanics and those with low literacy at baseline. In subgroup analyses (Table 4), Hispanics had statistically significant improvements in diet ($p < .01$) and weight management behaviors ($p < .02$), whereas non-Hispanics had no significant changes. Those with low literacy, as assessed by the NVS, reported significant improvements in diet, and those with low literacy assessed by the TOFHLA had significant reductions in barriers to medication adherence. Participants with adequate literacy based on the TOFHLA reported significant increases in physical activity, which was not addressed in the intervention.

Postintervention surveys indicated that 96% of participants found the class useful (Table 5); 86% reported that it was useful to learn to read food labels. All Hispanic participants evaluated the class as useful. They reported that food label reading was more useful than non-Hispanic participants ($p < .01$). These data suggest that the intervention was acceptable.

DISCUSSION

This pilot study developed and implemented a brief, single-session health literacy intervention with the goal of improving medication adherence and weight management skills among primary care patients with hypertension. The intervention was tailored to the needs of adults who were chronically ill and underinsured. Materials and instruction were provided in Spanish and English to address the growing Hispanic population in the region.

The sample in this study was similar to prior studies conducted in the area. Hispanics in the current study were slightly older and reported higher levels of *poor/fair* physical health and lower levels of emotional health than a prior study conducted at a free clinic serving the Hispanic population (Warren-Findlow, Coffman, et al., 2017). However, hypertension self-care adherence levels among Hispanics in the current sample were substantially greater. The previous study included participants with and without hypertension, whereas the current study included only people diagnosed with hypertension, which may explain the differences in self-reported health status and adherence behaviors (Warren-Findlow, Coffman, et al., 2017). The non-Hispanics in the present study were similar to partici-



TABLE 2
Baseline Demographic and Health Characteristics for ECHO Participants

Characteristics	Total (N = 52)	Non-Hispanic (n = 27)	Hispanic (n = 25)
	% (n)		
Demographics			
Age (>50 years)	73.10 (38)	70.4 (19)	76 (19)
Female	59.60 (31)	51.90 (14)	68 (17)
Survey language: Spanish	46.20 (24)	3.70 (1)	92 (23)
Health			
Poor/fair self-rated physical health (N = 49)	53.10 (26)	44.40 (12)	63.60 (14)
Poor/fair self-rated emotional health (N = 48)	25 (12)	38.50 (10)	9.10 (2)
Obesity (BMI ≥30)	57.70 (30)	63.00 (17)	52 (13)
SBP (>130 mmHg)	61.50 (32)	63.00 (17)	60 (15)
DBP (>80 mmHg)	69.20 (36)	70.40 (19)	68 (17)
Barriers			
Adequate health literacy (NVS ≥4)	44.20 (23)	51.90 (14)	36 (9)
Adequate medication literacy (TOFHLA ≥6)	57.70 (30)	70.40 (19)	44 (11)
Barriers to medication adherence (score >1)	34.61 (18)	29.63 (8)	40 (10)
Self-care behaviors adherence			
Medication adherence (N = 50)	52 (26)	38.50 (10)	66.70 (16)
Diet adherence (N = 51)	33.33 (17)	34.60 (9)	32 (8)
Physical activity adherence (N = 35)	45.10 (23)	40.70 (11)	50 (12)
Weight management adherence (N = 48)	39.58 (19)	33.30 (8)	45.80 (11)

Note. BMI = body mass index; DBP = diastolic blood pressure; ECHO = Empowering Change in Health Outcomes; NVS = Newest Vital Sign; SBP = systolic blood pressure; TOFHLA = Test of Functional Health Literacy in Adults.

TABLE 3

Comparison of Baseline and 30-Day Follow-Up Hypertension Self-Care Scores

Scores	Baseline		Follow-Up		Significance
	N	Mean (SD)	Mean (SD)	Mean Difference	p Value (two-tailed)
Medication adherence	33	18.39 (4.41)	18.76 (4.27)	.36	.50
Diet adherence	35	4.23 (2.34)	5.40 (1.80)	1.17	.01
Physical activity adherence	35	6.86 (4.30)	8.37 (4.12)	1.51	.08
Weight management adherence	30	37.57 (7.46)	41.07 (6.04)	3.50	.05
Barriers to medication adherence	31	1.23 (1.09)	.90 (.87)	-0.32	.15

pants in a previous study conducted with a local primary care clinic that serves Medicaid and Medicare patients (Warren-Findlow et al., 2013); these two samples had virtually identical adherence scores for medication, physical activity, and weight management. Diet scores could not be compared as the diet subscale had been revised.

Intervention findings were mixed; overall significant improvements were seen in diet and weight management scores, providing partial support for our hypothesis. Changes in medication adherence scores did not achieve statistical significance suggesting that some barriers to medication adherence are not overcome with increased





TABLE 4

Changes in Hypertension Self-Care Scores by Key Baseline Subgroups

Scores	Hispanic	Non-Hispanic	NVS Adequate Literacy	NVS Inadequate Literacy	TOFHLA Adequate Literacy	TOFHLA Inadequate Literacy
Medication adherence	-0.77	1.10	-0.15	.70	1.20	0.92
Diet adherence	1.93*	0.67	1.00	1.29*	1.48	0.71
Physical activity adherence	1.07	1.81	1.00	1.86	2.71*	-0.29
Weight management adherence	9.27*	0.16	3.58	3.44	3.06	4.17
Barriers to medication adherence	-1.90	-0.21	-0.43	-1.28	-1.05	-0.69*

Note. NVS = Newest Vital Sign; TOFHLA = Test of Functional Health Literacy in Adults.

* $p < .05$.

TABLE 5

ECHO Intervention Satisfaction Scores

Satisfaction Items	Total	Non-Hispanic	Hispanic
How useful was: ^a	%		
The class overall	96	92	100
The health log activity	80	61	100
Learning to read food labels	86	73	100
Talking about solutions to barriers	92	85	100
Ask Me 3 [®] activity	86	72	100
Would recommend to others	79	78	80

Note. ECHO = Empowering Change in Health Outcomes.

^aResponses indicate participants who selected *quite* or *extremely*.

education (i.e., inadequate funds to afford prescriptions). As with previous literature, our intervention was most effective among the racial/ethnic group members in our sample (Miller, 2016). Similarly, our focus on people who are under-resourced financially is also consistent with having a greater effect on health literacy.

Subgroup analyses based on two measures of literacy levels indicated significant improvements on diet and medication barriers, suggesting that we may have improved literacy around issues of diet and medication adherence, which were our primary goals. Given the brevity of the intervention, difficulty in recruiting and retaining this vulnerable population, and the small sample size, we view these results as positive. The intervention may be most effective delivered to people with low health literacy.

STUDY LIMITATIONS

The study should be interpreted with several caveats. Our sample was small, which underpowers our statistical analysis and limits the generalizability of the findings. We were only able to assess diet with a single item. At the time of the intervention, the H-SCALE included a multi-item subscale (Dietary Approaches to Stop Hypertension–Quality [DASH-Q]) to assess diet but it was not available in Spanish. Future studies should include the more complete DASH-Q, which assesses adherence to the DASH diet and is available in English and Spanish (Warren-Findlow, Coffman, & Karp, 2017; Warren-Findlow, Reeve, & Racine, 2017). Although participants widely accepted the intervention, its sustainability in the low-cost clinic setting will be difficult due to financial and staffing challenges. We faced challenges recruiting and retaining Hispanic study participants for face-to-face follow-



up data collection, which limited our ability to assess changes in BP. Although we attempted to supplement our follow-up data with clinical medical records, our participants were infrequent users of clinic services. Thus, even medical record data were spotty. We should note that the Hispanic population in Charlotte, NC, is largely undocumented, and many citizens or legal residents within the community have undocumented relatives residing with them, thereby affecting their willingness to participate in research or be contacted (Calderón et al., 2006). Recruitment and retention of Hispanic populations may improve as the climate for immigration in the US stabilizes.

STUDY STRENGTHS

The study had multiple strengths. We used a trusted provider as the intervention setting, which supported study recruitment. Both clinical and health education professionals delivered the intervention, and research team members were bilingual. All self-report measures were validated, available in English and Spanish, and appropriate for the population. Self-report measures were supported with clinical outcomes. We used two separate literacy measures, which were specific to the outcomes of interest in terms of content and assessed different domains of health literacy. The intervention itself was brief yet incorporated multiple “best practice” elements of health education programming. Participant satisfaction scores indicated that the material and delivery were well-received.

CONCLUSION

Our results suggest that even a 2-hour health literacy intervention may have short term (30-day) behavioral effects on vulnerable people with hypertension. Future studies will require larger samples and increased duration of follow-up.

Based on the current findings, we recommend incorporating a variety of skills and teaching modalities to improve health literacy within the context of a single self-care behavior. The development of brief, single-behavior modules that can be delivered based on an initial assessment of baseline self-care activities may be more effective with vulnerable populations than longer more comprehensive interventions, given the complexity of their daily lives. The H-SCALE instrument was a useful tool to assess patients’ self-care activities.

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