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Disparities in self-management outcomes by limited English proficiency among adults with heart disease

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ARTICLE INFO	ABSTRACT
Keywords: Limited English proficiency Communication barrier Heart disease Self-management	There are significant disparities in cardiovascular health outcomes by limited English proficiency (LEP). Self-management plans (SMPs) are associated with better patient outcomes, however little is known about the association of LEP with having an SMP among adults with heart disease. This study examined this association using 2013–2016 California Health Interview Survey data. Among adults that received an SMP, we also examined whether they had a hard copy SMP (print or electronic vs. none), and whether they reported confidence in their ability to manage their heart disease. Our sample included a total of 9102 adults, including 1232 LEP and 7870 English proficient (EP) adults. LEP was associated with significantly lower odds of SMP receipt (Adjusted Odds Ratio [AOR] 0.46, 95% Confidence Interval [CI] 0.31 to 0.68). LEP and EP adults who received an SMP were similarly likely to have a hard copy SMP and report confidence in heart disease management. The finding that LEP adults were less likely than EP adults to receive an SMP may represent a missed opportunity to improve heart health outcomes for this group.

1. Introduction

Nearly 650,000 people die from heart disease each year in the United States (Centers for Disease Control and Prevention, 2020). Estimates suggest that heart conditions, including coronary artery disease, heart failure, and myocardial infarction, cost about $219 billion annually (Benjamin et al., 2019). Given high rates of morbidity and mortality, improving cardiovascular health is a federal government goal (Benjamin et al., 2019). While there have been some improvements over the past decade, several U.S. cardiovascular health objectives for 2020 have not improved or have even worsened (Arps et al., 2020). For example, among adults with hypertension, a leading risk factor for cardiovascular disease, there has been little improvement in the rate of physical activity (from 28% in 2010 to 31% in 2020) and the percent of people with a body mass index in the normal range actually declined (from 18% in 2008 to 14% in 2020) (Arps et al., 2020). Disparities in patient outcomes by race and ethnicity, limited English proficiency (LEP), socioeconomic status, and geography also persist (Graham, 2015; Lopez-Quintero et al., 2010).

While national efforts have aimed to address racial and ethnic disparities in heart health, there has been less focus on LEP as a barrier to receiving appropriate health care. A person who is LEP is defined as someone who speaks English less than "very well" (Schiaffino et al., 2014, 2016, 2020). Compared to English proficient (EP) patients, LEP adults with chronic conditions tend to be in worse health and experience higher hospital readmission rates (Rawal et al., 2019; Seman et al., 2020). Research shows that language spoken is an independent predictor of cardiovascular disease and health habits, such as smoking, even after controlling for race and ethnicity (Castro and Lorraine, 2009).

Patients with chronic conditions who have a self-management plan (SMP) tend to have better health outcomes and healthier behaviors (Bosworth et al., 2010; Huynh-Hohnbaum et al., 2015). An SMP is a set of provider-developed guidelines that assists patients in managing their conditions outside of the health care setting (National Institute for Health and Care Excellence, 2015). However, LEP patients are less likely to receive SMPs than their EP peers (Babey et al., 2009). Further, the effectiveness of self-management strategies depends on a patient's confidence in his ability to follow the plan (Bosworth et al., 2010). LEP patients may be less likely to have high confidence in their ability to manage their conditions, even if they receive an SMP (Chou et al., 2016; Sarkar et al., 2006).

While previous studies have examined the association of language

proficiency and other factors with having an SMP (Cabana et al., 2008; Cheng et al., 2007), there is little existing research that focuses on heart disease patients. This is a critical gap in the literature given heart health disparities for LEP relative to EP adults and evidence that SMPs can have a positive impact on heart disease patient outcomes. For example, having a plan can enhance a patient's knowledge and skills and encourage healthier behaviors (Jonkman et al., 2016). The objective of this study was to examine the association between LEP status and receipt of an SMP, the format of the SMP (hard copy vs. no hard copy), and patient confidence in self-managing a heart condition among adults with heart disease in California.

2. Data and methods

2.1. Data and outcome measures

Our analysis used the 2013–2016 California Health Interview Survey (CHIS). Before switching to a mixed mode survey and address-based sampling frame in 2019, the CHIS was a telephone survey that used a dual-frame random digit dial method and a multi-stage sample design to collect data on a wide range of health topics. California's 58 counties were grouped into 44 geographic sampling strata, including 14 sub-strata. Each year of the CHIS was designed to produce estimates representative of California as well as for most California counties and racial and ethnic groups and subgroups (California Health Interview Survey, 2016). We pooled multiple years of data to ensure the adequacy of the sample size for LEP participants with heart disease.

Our sample included adults ages 18 years and older who self-reported that they had ever been diagnosed with heart disease. All respondents had complete demographic information since the CHIS imputes missing values for nearly all of the survey's variables (California Health Interview Survey, 2016). The unweighted sample size was 9102 adults, including 1232 LEP and 7870 EP adults. Appendix Fig. S1 illustrates how our sample was selected. Respondents who reported speaking English less than "very well" were categorized as LEP, which is consistent with the U.S. Census Bureau's definition (United State Census Bureau, 2019).

Outcome measures included dichotomous indicators of: receipt of a heart disease SMP provided by a physician; having a hard copy of the SMP; and patient confidence in being able to manage and control heart disease. Only respondents who reported having an SMP were asked if they received a hard copy (print or electronic vs. none), and how confident they felt in their ability to manage their heart disease. Response options for the question about confidence included "very confident," "somewhat confident," "not too confident," and "not at all confident". The confidence outcome used in this analysis was equal to one for respondents who said they were "very confident" and zero otherwise.

The main independent variable of interest in these analyses was LEP status. However, our analysis also considered whether receiving a hard copy of the SMP was associated with confidence, and whether any association differed for LEP compared to EP individuals.

2.2. Statistical analysis

We first analyzed unadjusted weighted sample characteristics and outcome variables for the LEP and EP samples. Pearson's chi-squared tests were used to determine differences by LEP.

Weighted multivariable logit models were used to assess the association between the main independent variables and outcomes. All models controlled for sex, age (18–44, 45–64, 65–74, and 75 +), race/ethnicity (Hispanic/Latino, non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, non-Hispanic American Indian/Alaska Native, and non-Hispanic other race), education (high school diploma or less education, some college or Associate's degree, and four-year college or more education), family income as a percentage of the federal poverty level

Table 1
Sample characteristics by English proficiency, CHIS, 2013–2016.

Characteristics	Full sample	English Proficient	Limited English Proficient	P value
	Weighted percentage (%)	Weighted percentage (%)	Weighted percentage (%)	
All	100%	77.88%	22.12%	
Gender				
Male	54.27	55.10	51.37	0.30
Female	45.73	44.90	48.63	
Age				
18–44	12.15	9.57	21.19	<0.0001
45–64	33.40	32.26	37.43	
65–74	24.16	25.13	20.74	
75+	30.29	33.03	20.64	
Race/Ethnicity				
Non-Hispanic White	57.64	71.89	7.47	<0.0001
Hispanic/Latino	23.24	10.48	68.17	
Non-Hispanic African American	5.27	6.73	0.13	
Non-Hispanic American Indian, Alaska native	0.85	1.09	0.01	
Non-Hispanic Asian	10.61	6.81	23.99	
Other/more than 2 races	2.39	3.00	0.23	
Education				
No formal education/ grade1-12/HS diploma	42.87	33.69	75.23	<0.0001
Some college/ vocational school/AS/AA	24.87	29.36	9.06	
Bachelor/Master/ PhD	32.26	36.96	15.71	
Marital status				
Married/Living with a partner	59.03	59.19	58.45	0.85
Never married/ Widow, Separate, Divorce	40.97	40.81	41.55	
Insurance				
Employment based/Private insurance	23.21	24.15	19.91	<0.0001
Medicare [a]	56.55	60.40	43.00	
Medicaid and other public	15.20	12.86	23.44	
Uninsured	5.04	2.59	13.66	
Geography				
Rural	3.23	4.02	0.42	<0.0001
Metropolitan	96.77	95.97	99.58	
Poverty				<0.0001
200%+	58.35	68.29	23.37	
0–199%	41.65	31.71	76.63	

Notes: Estimates are unadjusted and weighted percents. [a] Medicare includes people who are covered by Medicare and a second form of insurance

(FPL) (0–199% and 200%+), marital status (married/living with partner; never married/widowed/divorced/ separated), metropolitan area status, and insurance status (private, Medicare, Medicaid/other public, and uninsured). These covariates were selected based on factors likely to be correlated with the self-management outcomes (Gonzalez-Zacarias et al., 2016; Mathew et al., 2012). We examined the pairwise correlation between the model controls to assess the extent of multicollinearity. When assessing whether associations differed for LEP relative to EP respondents, we estimated stratified models to allow for fully flexible
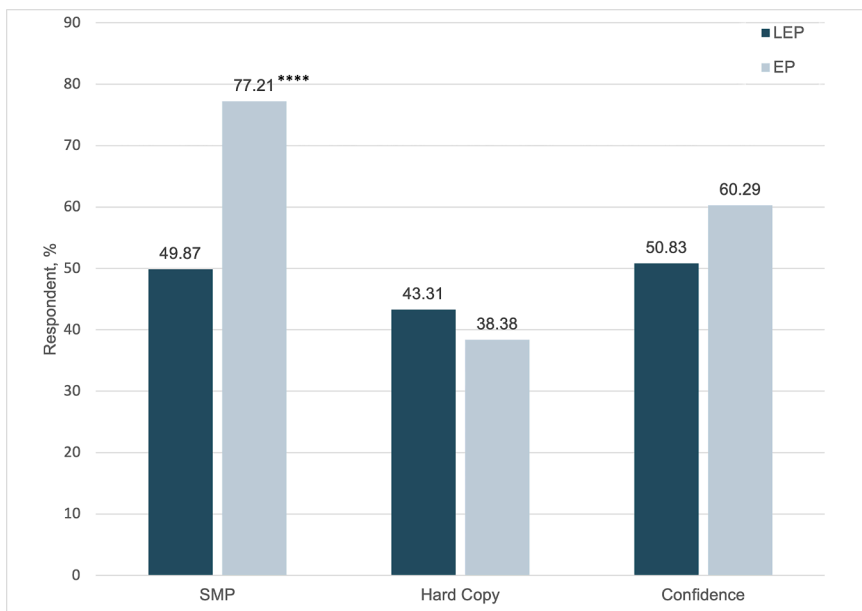
Fig. 1. Study outcomes by LEP status, (unadjusted and weighted %)Source: Authors' analysis of the 2013–2016 California Health Interview Survey. Notes: **** p < 0.0001. All estimates represent weighted percents for LEP and EP adults ever diagnosed with heart disease. "SMP'' is an indicator for receipt of a self-management plan. "Hard Copy" is an indicator for having a hard copy of a self-management plan, and "Confidence" is an indicator for reporting confidence in heart disease management. Both "Print" and "Confidence" only include observations where the respondent reported having a self-management plan.

differences by LEP.

All analyses accounted for the CHIS complex sampling design by calculating jackknife variance estimates using a series of replicate weights for multi-year population survey data (Lee et al., 2007). The use of survey weights also produces results representative of California's population for major population groups (California Health Interview Survey, 2016). Unless otherwise noted, results described in the text are adjusted odds ratios (AOR) and statistical significance is considered to be a two-sided P value of <0.05. All analyses were conducted using the Statistical Analysis System (SAS) University Edition, version 9.4. This analysis used publicly available, de-identified data and therefore was not human subjects research.

3. Results

Table 1 presents unadjusted weighted sample characteristics for the full sample and by LEP status. More than half of the sample (54%) was older than age 65. However, younger adults ages 18–44 were more likely to report being LEP (21%). About two-thirds of LEP adults were Hispanic/Latino and about one-quarter were non-Hispanic/Latino Asian. Medicare was the most common source of insurance coverage among both LEP (43%) and EP (60%) adults, but it was more prevalent among the EP sample. LEP adults were more likely to be uninsured compared to EP adults (14% vs. 3%). Weighted and unweighted sample sizes are shown in Appendix Table S1.

Fig. 1 presents unadjusted weighted percentages for each of the outcome variables for the LEP and EP samples. There was a nearly 30 percentage point difference in the likelihood of receiving an SMP for LEP relative to EP adults (50 vs. 77%, p < 0.0001). Among those who received a plan, a similar percentage of LEP and EP adults reported receiving a hard copy (43 vs. 38%, p = 0.27), and a somewhat lower percentage of LEP adults than EP adults reported confidence in managing their heart disease (51 vs. 60%, p = 0.07).

Table 2 presents weighted regression results for the association between LEP status and the self-management outcomes. LEP status was associated with approximately half the odds of having an SMP (Adjusted odds ratio [AOR] 0.46, 95% Confidence interval [CI] 0.31–0.68). Adults who were married or living with partners were more likely (AOR 1.43, 95% CI 1.09–1.89) and adults with incomes under 200% FPL were less likely (AOR 0.63, 95% CI 0.44–0.90) to report receiving an SMP. Estimates for the other respondent characteristics were not statistically

significant at conventional levels. Our analysis of pairwise correlations suggested that the model covariates were generally only weakly or moderately correlated (Appendix Table S2). We also present an unadjusted analysis of the association between LEP status and the self-management outcomes in Appendix Table S3. Results without adjusting for covariates were qualitatively similar to the adjusted results shown in Table 2.

Among adults that received an SMP, LEP status was not significantly associated with having a hard copy (AOR 1.22, 95% CI 0.77–1.93) or confidence in managing heart disease (AOR 0.82, 95% CI 0.46–1.48) (Table 2). Adults older than 75 were less likely to receive a copy (AOR 0.48, 95% CI 0.24–0.95), while adults ages 45–64 were less likely to report being confident (AOR 0.51, 95% CI 0.28–0.93). Adults with a higher educational level (Bachelor/Master/PhD) were also less likely to receive a copy of the SMP (AOR 0.68, 95% CI 0.48–0.96). Married adults were more likely to report being confident (AOR 1.38, 95% CI 1.03–1.85). None of the other controls were significantly associated with these outcomes. Appendix Tables S4 and S5 provide results for the self-management outcomes for LEP and EP adults, respectively, and Table S6 shows results for Hispanic and non-Hispanic Asian adults. Overall, these results are consistent with the full sample estimates.

Table 3 presents regression results for the association between receiving a hard copy of the SMP and patient confidence in managing heart disease. Results are presented for the full sample and separately for LEP and EP adults. Among the full sample, having a copy of the plan was associated with higher odds of patient confidence in managing their condition (AOR 1.30, 95% CI 1.01–1.67). This association was concentrated among LEP adults (AOR 3.13, 95% CI 1.52–6.50). The association for EP adults was not statistically significant (AOR 1.10, 95% CI 0.84–1.43).

4. Discussion

This study identified significant disparities in receiving an SMP by LEP among heart disease patients in California. Our analysis of unadjusted, weighted outcomes suggested that only about half of LEP adults with heart disease had received an SMP compared to more than three-quarters of their EP counterparts. The results of adjusted models confirmed this pattern.

While previous research has detected similar patterns for other health conditions (Babey et al., 2009), this research is among the first to

Table 2

Logistic regression estimates of characteristics associated with self-management plan variables, CHIS, 2013–2016.

Characteristics	Self-Management Plan (SMP) AOR (95% CI)	Hard Copy of SMP AOR (95% CI)	Confidence in self-managing heart disease AOR (95% CI)
English Proficiency			
English Proficient	Reference	Reference	Reference
Limited English Proficient	0.46 (0.31–0.68)*	1.22 (0.77–1.93)	0.82 (0.46–1.48)
Gender			
Female	Reference	Reference	Reference
Male	1.26 (0.98–1.62)	1.10 (0.85–1.43)	1.09 (0.87–1.36)
Age			
18–44	Reference	Reference	Reference
45–64	1.41 (0.85–2.35)	1.02 (0.60–1.72)	0.51 (0.28–0.93)*
65–74	1.89 (0.91–3.93)	0.64 (0.32–1.26)	0.72 (0.33–1.59)
75+	1.36 (0.70–2.64)	0.48 (0.24–0.96)*	0.79 (0.36–1.74)
Race/Ethnicity			
Non-Hispanic White	Reference	Reference	Reference
Hispanic/Latino	0.90 (0.56–1.46)	1.17 (0.72–1.89)	0.89 (0.54–1.47)
Non-Hispanic African American	1.31 (0.66–2.61)	1.77 (1.07–2.93)*	0.94 (0.58–1.53)
Non-Hispanic American Indian, Alaska native	0.61 (0.22–1.67)	1.67 (0.70–3.00)	1.44 (0.49–4.23)
Non-Hispanic Asian	0.78 (0.47–1.29)	1.47 (0.85–2.53)	0.59 (0.30–1.16)
Other/more than 2 races	1.13 (0.55–2.34)	1.20 (0.67–2.14)	1.11 (0.48–2.60)
Education			
No formal education/ grade1-12/HS diploma	Reference	Reference	Reference
Some college/vocational school/AS/AA	1.07 (0.77–1.49)	0.98 (0.72–1.34)	0.89 (0.68–1.16)
Bachelor/Master/PhD	0.96 (0.70–1.34)	0.68 (0.48–0.96)*	0.80 (0.57–1.14)
Marital status			
Never married/Widow, Separate, Divorce	Reference	Reference	Reference
Married/Living with a partner	1.43 (1.09–1.89)*	1.02 (0.78–1.35)	1.38 (1.03–1.85)*
Geography			
Rural	Reference	Reference	Reference
Metropolitan	0.70 (0.48–1.03)	1.08 (0.72–1.62)	0.98 (0.63–1.53)
Insurance			
Private insurance	Reference	Reference	Reference
Medicare (Centers for Disease Control and Prevention. Heart disease facts., 2020)	1.19 (0.70–2.03)	1.54 (0.92–2.59)	0.80 (0.43–1.45)
Medicaid + other public	0.98 (0.58–1.66)	1.20 (0.73–2.02)	0.90 (0.52–1.56)
Uninsured	0.60 (0.28–1.29)	1.01 (0.39–2.59)	0.83 (0.34–2.03)
Poverty			
200%+	Reference	Reference	Reference
0–199%	0.63 (0.44–0.90)*	0.94 (0.69–1.31)	1.02 (0.75–1.37)

Abbreviation: AOR, Adjusted odds ratio; CI, Confidence interval.

Notes: * p < 0.05.

All estimates come from weighted multivariable logistic regression models and account for the complex design of the CHIS using a set of replicate weights. Each column represents the results of a separate regression.

[a]Medicare includes people who are covered by Medicare and a second form of insurance.

Table 3

Logistic regression estimates of the association between receipt of a printed SMP and confidence in managing heart disease by limited English proficiency status, CHIS, 2013–2016.

Dependent variables	Confidence in managing heart disease AOR (95% CI)
Full Sample	1.30 (1.01–1.67)*
Limited English Proficient	3.13 (1.52–6.50)*
English Proficient	1.12 (0.85–1.47)

Abbreviation: AOR, Adjusted odds ratio; CI, Confidence interval.

Notes: * p < 0.05.

All estimates come from weighted logistic regression models and account for the complex design of the CHIS using a set of replicate weights. This analysis was restricted to adults who reported having a self-management plan. Each row represents a separate regression of confidence in managing heart disease on all of the control variables shown in Table 2. The first row shows results for the full sample, while the second and third rows limit the analysis to limited English proficient adults and English proficient adults, respectively.

document disparities by LEP among adults with cardiovascular disease. These disparities may have important implications since previous research has found that receiving an SMP is associated with better cardiovascular health outcomes (Clark et al., 1992; Lorig, 2003), including decreases in hospitalization rates and improvements in 12-month heart-failure-related quality of life (Jonkman et al., 2016). LEP adults also tend to have less education and are more likely to be uninsured than EP adults (Wilson et al., 2005), characteristics that are associated with worse heart health outcomes and greater opportunity for intervention (Berkman et al., 2011).

Several factors may influence whether receiving an SMP is an effective tool to manage heart disease. Patient adherence is critical to success (Robin DiMatteo et al., 2002), and adherence is difficult if not impossible if the patient does not understand the plan. Our results suggested that having a hard copy significantly increased confidence in an LEP adult's ability to manage their heart disease. However, we also found that LEP adults were *not* significantly more likely to receive a hard copy. These results deserve further attention as they may indicate a missed opportunity to improve equitable care delivery and reduce the burden experienced by LEP adults with chronic disease.

This study had several limitations. First, all outcomes were self-reported and may be subject to social desirability, recall error, and other biases (Rosenman et al., 2011). Second, while our regression models included a rich set of individual level controls, we were not able to account for all potential confounders and mediators, such as the use of interpreters. Accordingly, our study reports associations that are not necessarily indicative of a causal relationship. Third, our study used data from California and findings may not extend to other states. However, California represents over 30% of the LEP population in the United States (Proctor et al., 2018), making study of California valuable in assessing LEP-EP disparities. Fourth and relatedly, the CHIS was designed to produce representative, single year estimates for larger California counties and most racial and ethnic groups and subgroups, but may not be representative of some smaller subpopulations (California Health Interview Survey, 2016). However, we combined several years of data to ensure large sample sizes and statistically reliable estimates. Finally, assessment of ultimate heart health outcomes was outside of the scope of this study.

As the US population continues to age, chronic conditions including heart disease are becoming more prevalent (Benjamin et al., 2019). Self-management of disease is an important tool that may complement in-office medical treatments and may be even more critical as in-person care seeking has declined during the coronavirus pandemic (Banerjee et al., 2020). However, not all patients have access to these resources and written guidance is critical for patients that experience language barriers. Targeting disparities in access to health care, including a comprehensive self-management plan, may help to reduce disparities in

heart health outcomes and reduce the overall prevalence of disease.

CRediT authorship contribution statement

Phuong Nguyen: Conceptualization, Methodology, Investigation, Writing - original draft, Writing - review & editing. **Melody K Schiaffino:** Conceptualization, Methodology, Writing - review & editing, Supervision. **Brandy J Lipton:** Conceptualization, Methodology, Writing - original draft, Writing - review & editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2021.101407.

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