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Emotional and physical reactions to perceived discrimination, language preference, and health-related quality of life among Latinos and Whites

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Abstract

Purpose To investigate whether emotional and physical reactions to perceived discrimination are associated with health-related quality of life (HRQOL) among whites and Latinos (by language preference) in Arizona.

Methods A cross-sectional analysis using the Arizona Behavioral Risk Factor Surveillance System (2012–2014) was restricted to non-Hispanic white and Latino (grouped by English- or Spanish-language preference) participants who completed the *Reactions to Race* optional module ($N = 14{,}623$). Four core items from the Centers for Disease Control and Prevention's Healthy Days Measures were included: self-rated health; physically unhealthy, mentally unhealthy; and functionally limited days. Poisson regression models estimated prevalence ratios and 95% confidence intervals (CIs) for poor self-rated health. Multinomial logistic models estimated odds ratios and 95% CI for poor mental, physical, and functionally limited days (defined as 14 + more days). Models were adjusted for sociodemographics, health behaviors, and multimorbidity.

Results Reports of emotional and physical reactions to perceived discrimination were highest among Spanish-language preference Latinos. Both Spanish- and English-language preference Latinos were more likely to report poor self-rated health in comparison to whites. In separate fully adjusted models, physical reactions were positively associated with each HRQOL measure. Emotional reactions were only associated with reporting 14 + mental unhealthy (aOR 3.16; 95% CI 1.82; 5.48) and functionally limited days (aOR 1.93; 95% CI 1.04, 3.58).

Conclusions Findings from this study suggest that physical and emotional reactions to perceived discrimination can manifest as diminished HRQOL. Consistent collection of population-based measures of perceived discrimination is warranted to track and monitor differential health vulnerability that affect Latinos.

Keywords Reactions to race · Discrimination · Latinos · Health-related quality of life · Language preference · Immigration

Introduction

Health-related quality of life (HRQOL) is a commonly used multi-dimensional measure of population health, which includes domains related to physical, mental, and functioning well-being [1, 2]. Despite the documented significant health advantages (e.g., lower all-cause mortality) [3], commonly referred to as the Latino health paradox, a growing number of studies have reported racial/ethnic disparities in HRQOL between Latinos and non-Hispanic whites (hereafter referred to as whites) [4–9]. These studies demonstrate that Latinos, in general, report diminished HRQOL relative to whites. While differences in HRQOL remain after adjusting for covariates such as socioeconomic status, exposure to psychosocial stressors (i.e., perceived racial discrimination) or factors related to acculturation (i.e., English-language

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proficiency) are not consistently included in studies that may further our understanding of the observed differences.

There is increased interest in perceived discrimination, the differential treatment accorded to members of non-dominant groups on the basis of personal characteristics (e.g., race/ethnicity), as a salient contributor to Latino health inequities [10–12]. Prior studies have linked perceived discrimination to adverse HRQOL among Latinos, suggesting that higher levels of perceived discrimination are associated with poorer self-rated health and greater likelihood of experiencing unhealthy mental and physical days [5, 13, 14]. Two of these studies utilized a single question to operationalize perceived discrimination due to race/ethnicity [7, 16]. One utilized the Everyday Discrimination Scale, which includes nine items that capture the frequency of routine incidents of discrimination [15]. Although these measures conceptualize discrimination as a distinct chronic psychosocial stressor [16, 17], they do not explicitly inquire about specific emotional or physical stress responses elicited from differential treatment. Perceived discrimination has been shown to trigger a cascade of physiological (i.e., cardiovascular reactivity) and psychological (i.e., depression) stress responses that lead to poorer physical and mental health outcomes [17–19]. Questions that assess symptom clusters of physical and emotional stress responses can potentially provide greater insight regarding the mechanistic pathways that underlie and magnify health risk.

The few studies that have examined the association between perceived discrimination and HRQOL among Latinos adjusted for linguistic acculturation. Linguistic acculturation, English-language use, preference, and/or proficiency, can impact the health of Latinos [20, 21]. Individuals who are linguistically acculturated have fewer language barriers that enable them to seamlessly navigate the health care system, communicate with service providers, and access health services and resources [22, 23]. While HRQOL has been shown to vary by linguistic acculturation, the results have been mixed. There is evidence to suggest that lower levels of English proficiency are associated with reporting more unhealthy and limited health days [4]. Other results support an association between favorable HRQOL and Spanish-language use [24]. These study differences may in part reflect adjustment of covariates, study population mix, and experiences of discrimination. However, there is a dearth of studies examining the relationship between HRQOL, perceived discrimination and language preference among Latinos.

An emerging body of work links anti-immigrant sociopolitical climates and policies to discrimination and adverse health outcomes among Latinos, regardless of immigration status [25–30]. For example, after the passage of the Arizona Senate's Supporting Our Law Enforcement and Safe Neighborhoods Act (S.B. 1070), the legislation that gives law enforcement officials the authority to determine the citizenship status of an individual upon reasonable suspicion [31], several studies demonstrated a deleterious impact on Latino health outcomes and lower health service utilization [27, 28, 32–34]. Further, there is compelling evidence documenting increased experiences of harassment, discrimination and racial profiling after the enactment of S.B. 1070 [25, 35, 36]. It has been suggested that language preference and language indicators (e.g., fluency, accuracy with grammar, and accent) may influence how an individual is perceived by others and may elicit discrimination [37]. For example, Spanish-language preference Latinos negotiate living in communities with anti-immigrant policies differently from English-language preference Latinos because of the heightened concern of experiencing discrimination and racial profiling [11, 12, 26, 38]. However, there has been limited attention to the broader sociopolitical landscape that may shape patterns of HRQOL among Latinos.

Data from the Arizona Behavioral Risk Factor Surveillance System (BRFSS) collected in 2012, 2013, and 2014 provide a unique opportunity to describe the distribution of emotional and physical reactions to perceived discrimination among whites and Latinos (by English- and Spanish-language preference). We hypothesize that Spanish-language preference Latinos will report experiencing greater emotional and physical reactions to perceived discrimination in comparison to English-language preference Latinos and whites. We also examine whether reactions to perceived discrimination are associated with poorer HRQOL among whites and Spanish- and English-language preference Latinos. We hypothesize that Spanish-language preference (SLP) Latinos reporting reactions to perceived discrimination will be associated with decreased HRQOL outcomes.

Method

Study population and sample

The Behavioral Risk Factor Surveillance System (BRFSS) is an annual, state-level, telephone survey of civilian non-institutionalized adults living in the United States conducted by the Centers for Disease Control and Prevention (CDC). The BRFSS is comprised of core sections, optional modules and state-added questions aimed at monitoring health-related risk behaviors, chronic health conditions and utilization of preventive health services. BRFSS study design survey methods, sample selection, and weighting procedure are described in detail elsewhere (http://www.cdc.gov/brfss). We pooled data from the 2012–2014 Arizona BRFSS. Response rates for the years included in the analysis were 41.4%, 39.5%, and 41.6% for 2012, 2013, and 2014 respectively, which are consistent with the reporting of BRFSS response rates at the national level [39–41]. The CDC

Institutional Review Board (IRB) reviewed and approved the protocol to administer the survey. This secondary analysis of publicly available and de-identified BRFSS data was considered exempt from human subjects review by the IRB at the University of South Carolina. This cross-sectional analysis was limited to Latinos and non-Hispanic whites (hereafter referred to as white) who completed the *Reactions to Race* optional module of the BRFSS. Respondents missing data on HRQOL outcomes ($N=129$) and relevant *Reactions to Race* optional module variables ($N=86$) were excluded from analyses, yielding a final sample of 14,623 participants.

Measures

Race/ethnicity and language preference

Race/ethnicity was constructed from two questions: "Are you Hispanic, Latino/a, or Spanish origin? (yes/no)" and "Which one of these groups would you say best represents your race? (White, Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, or Other [specify])". Individuals who self-identified as Hispanic/Latino were further divided into two subgroups—English-language preference (ELP) and Spanish-language preference (SLP)—based on language preference when completing the interview. Previous research has used language preference as a proxy for acculturation when detailed measures of acculturation (i.e., length of time in the US) are unavailable or limited [27].

Emotional and Physical Reactions to Perceived Discrimination

The *Reactions to Race* module is an optional module of the BRFSS. Initially piloted in 2002, this module consists of six-questions assessing socially assigned race, race consciousness, perceptions of differential treatment at work and when seeking healthcare, and reports of emotional or physical symptoms resulting from race-based treatment. Further detail about this optional module is explained elsewhere [42]. Reactions (emotional and physical) to perceived discrimination were assessed using two items from the *Reactions to Race* module. Emotional reactions were assessed with the question: "Within the past 30 days, have you felt emotionally upset, for example angry, sad or frustrated, as a result of how you were treated based on your race?" Physical reactions were assessed with the following question: "Within the past 30 days have you experienced any physical symptoms, for example, a headache, an upset stomach, tensing of your muscles, or a pounding of your heart, as a result of how you were treated based on your race?" (response categories: yes, no). Items from the *Reactions to Race module* have been widely used in population-based research on perceived discrimination and health in the United States, and have undergone extensive cognitive, field and pilot testing and demonstrated good internal consistency [43].

Outcome variables

Health-related quality of life (HRQOL) was measured using four items from the CDC's Healthy Days Measures (HRQOL-4) [44]. The CDC HRQOL-4 was developed to assess HRQOL by asking questions about self-rated general health and the number of recent days when a person was physically unhealthy, mentally unhealthy, or limited in usual activities [45]. The measure has been extensively used in state and national public health surveillance systems and public health programming and planning [45, 46]. The items used in the CDC HRQOL-4 have undergone cognitive testing and demonstrate high reliability, validity (i.e., criterion, content, construct and predictive), and responsiveness across different population subgroups for use in population-based studies [47–52]. CDC HRQOL-4 measures predict morbidity, mortality, and hospitalizations [2, 53].

To assess self-rated poor health, participants were asked: "Would you say that in general your health is excellent, very good, good, fair or poor?" Similar to prior research [5, 54–57], responses were dichotomized as: good ('excellent', 'very good', 'good') or poor ('fair', 'poor'). Self-rated poor mental health days was ascertained by asking: "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" The number of poor physical health days was ascertained by asking: "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?" To ascertain limitations in usual activities, respondents were asked: "During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?" Similar to prior research and as a result of the distribution of our data (a considerable number of study participants reported zero unhealthy days), responses to the unhealthy days questions were categorized as: 0 (no unhealthy days); 1–13 (infrequent unhealthy days); and ≥ 14 (frequent unhealthy days) [58, 59]. Fourteen or more unhealthy days represents a standard summary measure commonly used by prior studies and considered a meaningful cut point corresponding to mental distress, clinical depression and anxiety disorder [56, 60, 61]. Analogously, physically unhealthy days and functional limited days were categorized using the same cut points. Similar to prior studies, we did not combine the poor physical and mental unhealthy items to create a single summary score, given our interest in each individual item [62].

Covariates

Variables considered to be risk factors or potential confounders of the association between race/ethnicity-language preference, perceived discrimination, and HRQOL were included in the analyses [5, 63]. We adjusted for the following sociodemographic variables: age (assessed continuously); sex; educational attainment; annual household income; employment status, marital status, and health insurance status. Additionally, we included health behaviors (body mass index, leisure time physical activity, smoking status, and heavy drinking) and multimorbidity (total number of chronic conditions including myocardial infarction; coronary heart disease; stroke; asthma; skin cancer; other cancers; chronic obstructive pulmonary disease; arthritis; kidney disease; and diabetes). We controlled for the frequency with which respondents thought about their race (i.e., race consciousness). Respondents were asked, "How often do you think about your race? (never, once a year, once a month, once a week, once a day, once an hour, constantly)." Similar to other studies, responses were recoded into three categories: frequent (once a day, once an hour or constantly), moderate (once a month or once a week), and infrequent (once a year or never) [64, 65].

Analytic strategy

The distribution of covariates and HRQOL was assessed by race/ethnicity-language preference. Differences between the groups were examined using χ^2 (categorical variables) and analysis of variance (continuous variable). Poisson regression models were fit using Generalized Estimating Equations (GEE) to examine whether physical or emotional reactions to perceived discrimination were associated with poor self-rated health after adjusting for covariates. Prevalence ratios (PR) and 95% confidence intervals (CI) were estimated. Although log-binomial regression models are typically utilized to estimate prevalence ratios, when we attempted this method the models did not converge. Therefore Poisson regression models, which are considered sufficient alternatives in this situation so long as robust variance estimates are utilized, were employed [66, 67]. Multinomial logistic regression was used to fit models to examine the association between the reactions to perceived discrimination and associations with poor mental health, physical health, and functionally limited days. Odds ratios (OR) and 95% CIs were obtained. Models for each HRQOL indicator were constructed sequentially adjusting for: sociodemographic variables and survey year (Model 1); Model 1 + socioeconomic characteristics, health behaviors, multimorbidity, and race consciousness (Model 2); Model 2 + physical reactions (Model 3); Model 2 + emotional reactions (Model 4). We tested whether the association between race/ethnicity-language preference and the four HRQOL outcomes varied by sex by incorporating an interaction term in the fully adjusted model and did not find evidence of interaction. When comparing race/ethnicity-language preference groups, whites served as the referent group, similar to a prior study [27]. The referent group was defined as white because whites have the lowest rates of experiencing perceived discrimination, reporting self-rated health, and poor mental and physical health days. Models were weighted to account for the complex sampling design of the BRFSS. Data management and analysis were performed using SAS 9.4 (SAS Institute Inc., Cary, NC).

Results

The sample population consisted of 14,623 individuals of whom, 70.3% were white, 19.1% ELP Latinos, and 10.6% SLP Latinos (Table 1). Sociodemographic characteristics varied between the groups, where SLP Latinos were more to likely to have lower educational attainment, lower income, no health insurance, and more likely to report being married/partnered. Compared to whites (15.7%) and ELP Latinos (16.1%), SLP Latinos (40.8%) were more likely to report poor health ($p < 0.0001$). ELP Latinos (17.1%) were more likely to report 14 + poor mental health days in comparison to whites (10.1%) and SLP Latinos (11.7%; $p < 0.0045$). There were no significant differences between whites, ELP Latinos, and SLP Latinos for reporting frequent physical unhealthy or functionally limited days.

The distribution of emotional and physical reactions to perceived discrimination by race/ethnicity and language preference is presented (Fig. 1). The percentage of respondents reporting emotional reactions to perceived discrimination was highest among SLP Latinos (15.8%) in comparison to ELP Latinos (9.8%) and whites (3.7%). Experiencing a physical reaction to perceived discrimination was more commonly reported among SLP Latinos (8.3%) than ELP Latinos (5.9%; $p = 0.0153$) and whites (2.1%; $p < 0.0001$).

The adjusted prevalence ratios for self-rated poor health are presented (Table 2). In model 1 both ELP (aPR 1.71, 95% CI 1.54, 1.90) and SLP Latinos (aPR 2.94, 95% CI 2.38, 3.62) were more likely to report poor self-rated health in comparison to whites. After adjusting for sociodemographic factors, health behaviors, and multimorbidity, the estimates for both ELP Latinos (aPR 1.34; 95% CI 1.18, 1.51) and SLP Latinos (aPR 1.15, 95% CI 1.08, 1.22) were attenuated. The estimates for ELP and SLP Latinos (compared to whites) remained robust after additional adjustment for physical reactions, and emotional reactions. Experiencing a physical reaction to perceived discrimination (aPR 1.37, 95% CI 1.10, 1.69) was positively associated with poor self-rated health.

Table 1 Sociodemographic characteristics for the total sample and stratified by race/ethnicity and language preference, (weighted), Arizona Behavioral Risk Factor Surveillance System Survey, 2012–2014

	Total ($n = 14,623^b$)		White[a] ($n = 12,306^b$, 70.3%)		ELP Latino ($n = 1533^b$, 19.1%)		SLP Latino ($n = 784^b$, 10.6%)		*p* value
Age, mean (SE)	48.74 (0.29)		52.23 (0.31)		37.90 (0.65)		45.05 (0.84)		< 0.0001
Number of chronic conditions, mean (SE)	0.90 (0.02)		1.03 (0.02)		0.56 (0.04)		0.60 (0.07)		< 0.0001
	N^b	$\%^c$	N^b	$\%^c$	N^b	$\%^c$	N^b	$\%^c$	
Sex									0.0093
Male	5784	47.7	4921	47.2	627	53.2	236	41.1	
Female	8839	52.3	7385	52.8	906	46.8	548	58.9	
Education									< 0.0001
Did not graduate HS	1179	15.9	528	7.1	189	16.3	462	74.1	
Graduated HS	3596	24.9	2894	24.4	507	31.9	195	16.6	
Some college	4503	35.7	3922	39.3	502	37.9	79	7.6	
Graduated from college	5300	23.5	4926	29.3	331	14.0	43	1.6	
Income									< 0.0001
< $15,000	1467	12.4	1003	8.2	211	18.1	253	30.8	
$15,000– < $25,000	2369	20.1	1781	15.1	337	23.1	251	49.4	
$25,000– < $35,000	1455	11.3	1222	10.9	176	12.4	57	11.9	
$35,000– < $50,000	2053	15.0	1788	15.5	219	17.9	46	5.8	
≥ $50,000	5159	41.2	4728	50.2	405	28.5	26	2.1	
Employment status									< 0.0001
Employed	5640	50.1	4563	49.0	763	57.1	314	44.4	
Unemployed	1721	14.2	1322	12.2	243	18.4	156	19.9	
Homemaker/student	1415	14.4	1013	11.5	190	16.3	212	29.8	
Retired	5779	21.3	5355	27.2	329	8.3	95	5.9	
Marital status									< 0.0001
Married/partnered	8070	58.3	6813	60.2	746	41.8	511	75.5	
Divorced/widowed/separated	4864	21.2	4223	23.4	431	17.2	210	14.0	
Never married	1608	20.5	1199	16.4	348	41.1	61	10.5	
Health insurance									< 0.0001
Insured	13133	81.0	11406	88.3	1250	75.0	477	43.4	
Uninsured	1444	19.0	867	11.7	274	24.9	303	56.6	

Table 1 (continued)

	N^b	%[c]	N^b	%[c]	N^b	%[c]	N^b	%[c]	
BMI									< 0.0001
Underweight/normal weight	5219	37.9	4632	40.6	424	33.9	163	25.8	
Overweight	5080	35.1	4273	35.5	530	33.5	277	35.4	
Obese	3654	27.0	2912	23.9	517	32.9	225	38.8	
Leisure time physical activity									< 0.0001
Active	11137	76.7	9490	79.1	1114	75.7	533	62.7	
Not active	3451	23.3	2789	20.9	415	24.3	247	37.3	
Smoking status									< 0.0001
Current	1991	16.2	1684	16.7	226	15.3	81	14.2	
Former	4944	28.4	4431	31.7	356	21.4	157	19.0	
Never	7597	55.4	6109	51.5	945	63.3	543	66.8	
Alcoholic consumption									< 0.0001
Heavy drinker	776	5.4	710	5.9	57	4.3	9	0.05	
Not heavy drinker	13616	94.6	11413	94.1	1443	95.7	760	99.5	
Race consciousness									< 0.0001
Frequent	3460	29.0	2351	23.2	624	49.4	485	69.4	
Moderate	1825	12.6	1578	13.0	190	12.0	57	7.3	
Infrequent	8781	54.4	7934	63.8	656	38.6	191	23.3	
Self-rated health									< 0.0001
Poor	2878	18.5	2207	15.7	330	16.1	341	40.8	
Good	11718	81.5	10078	84.3	1201	83.9	439	59.2	
Poor mental health days									0.0045
None	10133	64.8	8669	66.4	993	60.4	471	61.8	
1–13	2862	23.5	2346	23.4	325	22.5	191	26.5	
≥ 14	1405	11.7	1125	10.1	196	17.1	84	11.7	
Poor physical health days									0.1716
None	8825	61.7	7483	61.9	908	60.5	434	60.9	
1–13	3383	24.9	2844	24.8	363	27.0	176	21.5	
≥ 14	2123	13.4	1759	13.2	231	12.5	133	17.6	
Limited health days									0.7209
None	4109	56.5	3392	56.2	468	57.9	249	57.6	
1–13	1989	27.2	1653	27.5	221	27.1	115	23.2	
≥ 14	1365	16.4	1148	16.3	142	15.0	75	19.2	

Table 1 (continued)

	N^b	%[c]	N^b	%[c]	N^b	%[c]	N^b	%[c]	
Survey year									0.8976
2012	5731	41.3	4760	41.6	631	40.7	340	41.1	
2013	3092	37.5	2609	37.5	349	36.5	134	38.6	
2014	5800	21.2	4937	20.9	553	22.8	310	20.3	

Numbers may not sum to total *n* due to missing data

SE standard error, *HS* high school, *BMI* body mass index, *ELP* English-language preference, *SLP* Spanish-language preference

[a]Non-Hispanic White

[b]Unweighted frequency

[c]Weighted percentage

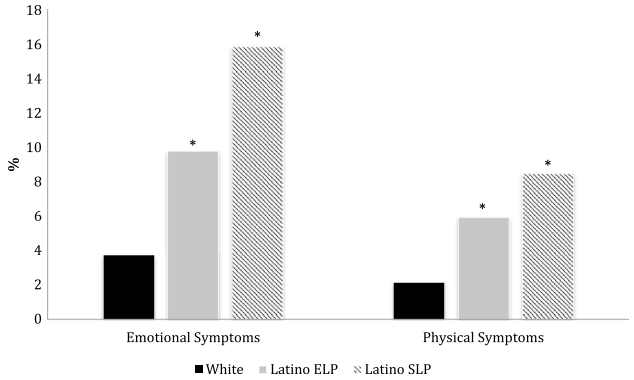

Fig. 1 Distribution of emotional and physical reactions to perceived discrimination by race/ethnicity and language preference: Arizona Behavioral Risk Factor Surveillance System Survey, 2012–2014. *$p < 0.0001$ for comparisons between Latino ELP or SLP and whites. *ELP* English-language preference, *SLP* Spanish-language preference

Results of multinomial logistic regression analyses for unhealthy days are provided (Table 3). Experiencing emotional reactions to perceived discrimination was associated with higher odds of reporting 1–13 poor mental health days (aOR 1.61, 95% CI 1.09, 2.37) and 14 + poor mental health days (aOR 3.26, 95% CI 2.08, 5.13). Those who reported experiencing physical reactions to perceived discrimination had higher odds of reporting 14 + poor mental health days (aOR 2.90, 95% CI 1.74, 4.85). Respondents who experienced physical reactions had higher odds of frequent poor physical health days (aOR 2.19, 95% CI 1.19, 4.01). Both physical (aOR 2.41, 95% CI 1.30, 4.48) and emotional (aOR 1.93, 95% CI 1.04, 3.58) reactions to perceived discrimination were associated with frequent functionally limited days.

Discussion

Our findings suggest that experiencing either an emotional or physical reaction to perceived discrimination was associated with lower HRQOL. When examining differences by race/ethnicity and language preference, the magnitude of this relationship varied based on the HRQOL measure assessed. The results suggest differential vulnerability only for poor self-rated health among SLP and ELP Latinos, when compared to whites.

Overall, Latinos, regardless of language preference, were more likely to report emotional or physical reactions to perceived discrimination in comparison to whites. This finding is consistent with prior studies demonstrating that members of stigmatized racial/ethnic groups, disproportionately experience and report higher frequencies of discrimination [68]. Experiencing an emotional or physical reaction to perceived discrimination was significantly higher among SLP Latinos in comparison to ELP Latinos. We expected that reporting

Table 2 Adjusted prevalence ratios for self-rated poor health, Arizona Behavioral Risk Factor Surveillance System; 2012–2014

	Model 1[a]		Model 2[b]		Model 3[b]		Model 4[b]	
	PR	95% CI	PR	95% CI	PR	95% CI	PR	95% CI
Race/ethnicity								
White[c]	1.00	–	1.00	–	1.00	–	1.00	–
ELP Latinos	1.71	1.54, 1.90	1.34	1.18, 1.51	1.32	1.17, 1.48	1.33	1.18, 1.51
SLP Latinos	2.94	2.38, 3.62	1.78	1.40, 2.27	1.74	1.37, 2.20	1.78	1.40,2.27
Physical reactions								
No					1.00	–		
Yes					1.37	1.10, 1.69		
Emotional reactions								
No							1.00	–
Yes							1.24	0.97, 1.60

[a]Adjusted for age, sex and survey year

[b]Adjusted for Model 1 + education, marital status, income, employment status, health insurance, race consciousness, smoking status, physical activity, BMI, alcohol consumption status, and chronic conditions

[c]Non-Hispanic White

physical and emotional reactions to perceived discrimination would differ by language preference group. These findings corroborate prior research demonstrating that speaking Spanish may lead to more direct experiences of discrimination (e.g., racial profiling, harassment) and social stigma [35, 69]. However, our results are contrary to one recent study showing ELP Latinos reporting a higher likelihood of physical symptoms from racial discrimination [70]. Differences in study findings between ELP and SLP Latinos may in part be a function of the local political climate related to immigration (i.e., residing in an area with exclusionary versus pro-immigration policies), which may have implications for exposure to discrimination [70]. Moreover, the former study did not include a sample of Latinos from border states such as Texas, New Mexico, California, or Arizona. Our study population was from Arizona, a border state with strict immigration laws. Almeida et al. showed that Latinos who lived in states with more anti-immigration policies reported greater discrimination [25]. The prejudice and fear experienced by individuals who are targeted by anti-immigration enforcement policies can be considered a type of psychosocial stressor and subsequently impact health behaviors, and psychological and physiological health outcomes [71]. Therefore, additional research of how federal, state, and local political environments circumscribe social interactions and vulnerabilities to poorer health outcomes may provide an important contribution to our understanding of Latino health [12].

We differentiated between the impact of emotional and physical reactions to perceived discrimination on HRQOL because of their representation of hypothesized physiological and psychological pathways that in turn lead to adverse health outcomes. There is some empirical evidence demonstrating that emotional and physical reactions to discrimination have different association with mental and physical health outcomes [14]. For example, Anderson and Finch demonstrated that physical reactions had a positive and stronger association with self-rated health in comparison to emotional reactions [14]. Similarly, in our study, we found that physical reactions to perceived discrimination had a more robust association with self-reported health in addition to poor physical health and poor functionally limited days in comparison to emotional reactions. However, emotional reactions had a stronger association with poor mental health days in comparison to physical reactions. Our data do not depict an association between emotional reactions and poor self-rated health or frequent poor physical unhealthy days. This may be partially explained by coping mechanisms used to alleviate the negative impact of experiencing a race-based stressor. Increasingly, race-based trauma interventions are being developed to address the emotional and physical reactions that are produced among those who endure discriminatory events [72]. It is possible that distinguishing between emotional and physical reactions may help tailor interventions to manage the health implications of stress. However, the association between physical and emotional reactions on HRQOL and other health outcomes in general, deserves more careful consideration given the potential to develop and implement race-based trauma interventions [72].

SLP and ELP Latinos were more likely to have poor self-rated health in comparison to whites; although, the larger magnitude among SLP Latinos may be explained by their increased vulnerability to experiencing physical and emotional perceived discrimination. Language preference associated differences in health have been observed, where SLP Latinos are more likely to have less access to healthcare and poorer health behaviors and outcomes [73, 74]. Our study findings are in part corroborated by prior research results

Table 3 Odds of reporting poor mental and physical health days: Arizona Behavioral Risk Factor Surveillance System; 2012–2014

	1–13 days								14 or more days							
	Model 1[a]		Model 2[b]		Model 3[b]		Model 4[b]		Model 1[a]		Model 2[b]		Model 3[b]		Model 4[b]	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Poor mental health days																
Race/ethnicity																
White[c]	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
ELP Latino	0.82	0.64, 1.03	0.74	0.57, 0.96	0.73	0.57, 0.95	0.73	0.56, 0.95	1.26	0.91, 1.72	0.94	0.65, 1.34	0.91	0.63, 1.31	0.90	0.63, 1.30
SLP Latino	1.24	0.84, 1.81	1.10	0.72, 1.71	1.08	0.70, 1.68	1.08	0.70, 1.68	1.34	0.76, 2.39	0.74	0.38, 1.43	0.67	0.35, 1.28	0.71	0.35, 1.41
Physical reactions																
No					1.00	–							1.00	–		
Yes					1.38	0.86, 2.22							2.90	1.74, 4.85		
Emotional reactions																
No							1.00	–							1.00	–
Yes							1.61	1.09, 2.37							3.26	2.08, 5.13
Poor physical health days																
Race/ethnicity																
White[c]	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
ELP Latino	1.01	0.80, 1.28	0.87	0.66, 1.13	0.86	0.66, 1.12	0.86	0.66, 1.12	1.06	0.78, 1.43	0.87	0.59, 1.28	0.85	0.58, 1.27	0.87	0.59, 1.28
SLP Latino	1.04	0.71, 1.53	0.74	0.48, 1.15	0.72	0.46, 1.13	0.73	0.47, 1.14	1.57	0.97, 2.54	1.07	0.56, 2.01	1.00	0.53, 1.19	1.05	0.56, 2.00
Physical reactions																
No					1.00	–							1.00	–		
Yes					1.54	0.91, 2.62							2.19	1.19, 4.01		
Emotional reactions																
No							1.00	–							1.00	–
Yes							1.37	0.93, 2.02							1.32	0.79, 2.21
Poor functional health days																
Race/ethnicity																
White[c]	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–	1.00	–
ELP Latino	0.80	0.59, 1.09	0.79	0.57, 1.11	0.79	0.56, 1.10	0.78	0.55, 1.09	0.97	0.65, 1.44	0.78	0.46, 1.31	0.76	0.45, 1.28	0.76	0.45, 1.28
SLP Latino	0.98	0.60, 1.60	1.15	0.64, 2.01	1.14	0.63, 2.06	1.15	0.64, 2.06	1.56	0.81, 3.00	0.99	0.46, 2.13	0.95	0.43, 2.07	0.99	0.46, 2.15
Physical reactions																
No					1.00	–							1.00	–		
Yes					1.22	0.68, 2.20							2.41	1.30, 4.48		
Emotional reactions																
No							1.00	–							1.00	–
Yes							1.61	1.00, 2.58							1.93	1.04, 3.58

ELP English-language preference, *SLP* Spanish-language preference

[a]Adjusted for age, sex and survey year

[b]Adjusted for Model 1 + education, marital status, income, employment status, health insurance, race consciousness, smoking status, physical activity, alcohol consumption status, BMI, chronic conditions

[c]Non-Hispanic Whites

exhibiting an association between poor self-rated health outcomes among SLP Latinos in comparison to ELP Latinos and whites [73]. Further, our work extends the results of Anderson and Finch, who used Arizona BRFSS data from 2009 to 2011, and evaluated the association between self-rated health before and after the passage of S.B. 1070 [27]. Anderson and Finch showed that SLP Latinos were more likely to report poorer self-rated health [27]. The authors explained the results by postulating SLP Latinos were at a higher risk for experiencing discrimination and police scrutiny under S.B. 1070 [27]; however, the variables capturing perceived discrimination were not available in BRFSS when their study was conducted. Our results show sustained poor self-rated health for SLP Latinos, even after the inclusion of race-based stressors as well as an association with ELP Latinos. The combination of physical reactions to perceived discrimination and language preference may have amplified the likelihood of reporting poor health.

We did not observe pronounced differences in the odds of reporting frequent mental and physical unhealthy or functionally limited days between whites, SLP, and ELP Latinos. This finding is in contrast to evidence from recent studies investigating state-level immigration policy and state-specific (Arizona) mental health among Latinos. For example, Latinos who resided in states with more exclusionary immigration policies had a slightly higher likelihood of reporting poor mental health days (1.03, 95% CI 1.01, 1.06) in comparison to whites [19]. This study did control for language preference among Latinos, which may impact the conclusion of the study. In another study, awareness of S.B. 1070 was associated with lower levels of psychological well-being among adolescents [75]. The differences in the results may be a function of coping strategies and resources used to buffer the emotional and psychological impact of discrimination [28]. For example, qualitative work by Ayon et al. revealed a heavy reliance upon informal social support of relatives and friends to provide emotional, moral, instrumental, and financial support following the passage of S.B. 1070 [76]. Such resources, which may have been available at the individual-, family-, and/or community-level, can potentially mitigate the harmful effects of discrimination among Latinos. However, more research is needed to characterize the types of resilience factors that are available and utilized by Latinos in the face of structural racism.

The conclusions drawn from our analyses should be considered in light of several limitations. Given the cross-sectional nature of this study, we are not able to draw causal inferences about physical and emotional reactions to perceived discrimination and HRQOL. Although we are couching these findings in the context of S.B. 1070, the reactions to race questions did not specify whether the perceived discrimination was directly connected to the immigration enforcement policy. We are aware of one instrument, the Race-Based Traumatic Stress Symptom Scale that assesses psychological reactions to a specific racist event [77]. However, to our knowledge, this instrument has not been used to appraise experiences related to S.B. 1070. Further, we are unable to evaluate the prevalence of reactions to perceived discrimination before or during the implementation period of the law to allow for direct comparisons because the data were not collected. The lack of availability of this data poses a challenge to understanding the full impact of immigration enforcement policies on health and well-being [78]. We rely on participants to self-report reactions to perceived discrimination, HRQOL measures, and covariates. For the reactions to perceived discrimination measures, there is a possibility for either under- or over-reporting of perceived discrimination because these reactions were assessed only within the past 30 days. Respondents may have forgotten an incident or may not have included an incident that occurred within the 30-day time frame. Differences in coping styles may have also influenced reactions to perceived discrimination. Further, it is also possible that some respondents may have had time to manage the stress associated with the perceived discrimination prior to being surveyed. Having previously coped with the experience, individuals may be more or less likely to report reactions to perceived discrimination. Detailed information on coping and appraisal strategies related to discrimination is not collected in the BRFSS. Also, country of origin and measures of acculturation such as citizenship status, length of residence in the US, or generation status were not available in the BRFSS. Future studies examining patterns of HRQOL among Latinos would be strengthened by disaggregating data to determine whether the association between language preference and HRQOL operates similarly or differently among specific subgroups of Latinos [79].

The comparison of self-rated health between Latinos and whites is somewhat controversial because of the translation and interpretation of the response category "fair" in English as "regular" in Spanish, which denotes a more positive meaning in Spanish [80–82]. Thus, categorizing 'fair' and 'poor' together, especially among Latinos who completed the survey in Spanish, may lead to a downward bias of the distribution of "poor" self-rated health and result in an underestimation of the observed association. In sensitivity analyses, we compared measuring self-rated health with 'fair' combined 'excellent/very good/good' versus categorized 'poor' and obtained similar results with negligible differences. The inferences in self-rated health should be viewed with caution given the awareness of this linguistic bias issue [80, 83]. As per suggestion of Bzostek et al., in addition to self-rated health, we examined the association of other self-assessments of health [81].

In spite of these limitations, this study has several strengths that fill a significant gap in the literature.

Arizona is one of a few states that has administered the optional *Reactions to Race module* for three consecutive years. We were able to use this population-based sample to separately examine the relationship between emotional and physical reactions to race and HRQOL. Also, we were able to examine language preference subgroup health differences among Latinos. Considering both physical and emotional responses to perceived discrimination may yield greater insight into understanding pathways between race-based stressors and health.

Examining emotional and physical reactions to perceived discrimination, in conjunction with measures of acculturation, can facilitate an understanding of poorer HRQOL and within-group differences in HRQOL. Expanded and consistent collection, tracking, and use of population-based measures of perceived discrimination and measures of acculturation to monitor differential health vulnerability among Latinos is warranted. This may be especially important in the context of exclusionary immigration policies. Increasingly studies in other states such as North Carolina [84] and Alabama [85] have also shown the negative impact of state-level immigration policies on Latino health and well-being. Appropriate consideration of linguistic acculturation, perceived discrimination, and policy climate may be important to aid public health practitioners to allocate resources and develop programs to improve HRQOL outcomes among Latinos.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

Ethical approval This article does not contain any studies with human participants performed by any of the authors.

Informed consent Informed consent was obtained from all individual participants included in the study.

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