Racial Discrimination and Health-Related Quality of Life: An Examination Among Asian American Immigrants

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Abstract

Objectives We aimed to examine the relationship between everyday and major racial discrimination with health-related quality of life (HRQOL), which consists of self-rated health, days of poor physical health, mental health, and activity limitation.

Design In a cross-sectional analytic sample of 524 foreign-born Asian adults, aged 18 years and older, we conducted multivariable logistic regression and multivariable negative binomial regression to examine associations between discrimination and HRQOL. Furthermore, potential effect modification was tested by gender, ethnicity, and social support.

Results Associations were found between everyday racial discrimination and days of poor physical health (incidence rate ratio, IRR = 1.05), mental health (IRR = 1.03), and activity limitation (IRR = 1.05). Stronger significant associations were observed between major racial discrimination and days of poor physical health (IRR = 1.21), mental health (IRR = 1.16), and activity limitation (IRR = 1.53), adjusting for all covariates. Racial discrimination was not associated with poor self-rated health. In addition, gender significantly modified the relationship between continuous racial discrimination and activity limitation days with associations of greater magnitude among men, while social support significantly modified the association between categorized major racial discrimination and physically unhealthy days. When stratified, the association was only significant among those with low social support (IRR = 3.04; 95% CI: 1.60, 5.79) as opposed to high social support.

Conclusions This study supports the association between racial discrimination and worse HRQOL among Asian Americans, which can inform future interventions, especially among men and those with low social support, aimed at improving the quality of life in this population.

Keywords Racial discrimination · Health-related quality of life · Asian Americans

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Introduction

The "model minority" stereotype has been pervasively used to inaccurately portray Asian Americans as having overcome structural barriers in society and attained academic and occupational success [1]. However, this depiction masks the realities that Asian Americans face and results in discriminatory experiences often being overlooked in the past within this population. Asian Americans have reported being threatened, harassed, and criticized due to their accent or speech, and treated with less respect in a variety of settings, including within the judicial, medical, education, housing, and employment systems [2, 3]. The continuation of racial discrimination in contemporary society as particularly observed during the current COVID-19 pandemic is a clear source of harm given its adverse consequences across a gamut of mental and physical health outcomes, including increased depression, stress, and anxiety as well as obesity, diabetes, and cardiovascular conditions [4–7].

A less examined outcome regarding racial discrimination among Asian Americans is health-related quality of life (HRQOL), which is a multi-dimensional construct that has been recognized as a valid indicator of health status and encompasses several factors such as physical functioning, psychological well-being, social functioning, role limitations, and health perceptions [8, 9]. Investigations into the factors that influence HRQOL are valuable for public health surveillance and policy development, as this metric can be used to evaluate disease burden, track population trends, and identify health disparities [10]. Based on the Biopsychosocial Model of Racism, social stressors, including racial discrimination, are known to be associated with greater risk for developing diseases by eliciting physiological, psychological, and behavioral responses, which in turn impact overall HRQOL [11, 12]. Racial discrimination is a prevalent social stressor among Asian Americans arising both in interpersonal interactions and institutional settings as illustrated by data from a Pew Research Center, which found that 56.7% of Asian respondents experienced discrimination [3, 13] and data from the National Latino and Asian American Study, which indicated that 56.1% of Asian Americans reported race as the main reason for their discriminatory experiences [14].

Among Asian Americans, self-reported discrimination has been found to be associated with numerous adverse health outcomes and behaviors, including depression, anxiety, psychological distress, and increased substance use, with most studies examining mental health [2, 6, 15]. Although racism has been found to be associated with worse HRQOL among African American and Latino American populations [16–19], this relationship has been less studied among Asians. The majority of existing studies on discrimination and HRQOL among Asians were conducted outside of the USA [20–23] and have limited generalizability due to study populations with specific conditions such as mental disorders [24] or restrictive eligibility criteria such as examining older adults 60 years and over [25]. In addition, there have been some mixed findings in this population, particularly pertaining to the association between discrimination and self-rated health, which is one common item used to measure HRQOL. Previous studies examining Asian Americans in the National Asian American Survey and California Health Interview Survey (CHIS) found that everyday and major forms of racial discrimination were associated with worse self-rated health [26, 27]. However, another study specifically examining older Korean American immigrants in Florida found no significant association between racial discrimination in medical settings and self-rated health [25].

The effects of racial discrimination on health can potentially vary by different factors. Previous literature suggests that different levels of discrimination may influence health in different ways by gender. In general, Asian men have previously reported greater discrimination as compared to women [28], but lower thresholds of discrimination can have potentially stronger adverse effects on mental and physical health among women than men [29]. Differences in coping with discrimination can also vary by gender with literature suggesting that Asian women may be more comfortable than men in disclosing their feelings and seeking advice from others about their experiences with racism [30]. Another factor that can influence the effects of discrimination is social support. Social support has been found to be protective in the relationship between discrimination and health [2, 7] and to mitigate psychological distress and depression associated with discrimination [31–33]. In a national study of Asian Americans, individuals with higher levels of social support were found to report fewer depressive symptoms even when having experienced higher levels of discrimination [7].

Considering the heterogeneity of Asian Americans, ethnicity may also influence perceptions of discrimination and its impact on health. In the present study, Chinese, Korean, and Vietnamese adults were examined, which are among the top five largest Asian ethnic groups in the USA [34]. These ethnic groups also have high proportions of limited English proficiency, specifically 48% of Vietnamese, 43% of Chinese, and 40% for Korean Americans, which may influence their experiences with racial discrimination pertaining to language and HRQOL [35, 36]. HRQOL has also been found to vary in these ethnic groups with Koreans having the worst self-rated health followed by Chinese and Vietnamese Americans [37]. Thus, examining potential differences by ethnicity and utilizing appropriate measures for this population are critical steps for developing a better understanding of how racial discrimination affects HRQOL in samples that allow for consideration of heterogeneous effects.

Furthermore, a general challenge in assessing the relationship between racial discrimination and health among Asian Americans is the lack of appropriate instruments to measure discrimination in this population [38]. Previous research suggests that the Asian American experience may qualitatively differ from those of other racial and ethnic groups and is strongly influenced by key components such as nativity and English proficiency [2]. These factors are often not captured by existing discrimination measures that were initially developed for mostly African Americans. The current study used measures for everyday and major racial discrimination that specifically captured discrimination due to language and immigrant status among other items. The objective of this study was to investigate the association between racial discrimination and HRQOL and to assess potential effect modification by gender, social support, and ethnicity. Based on previous literature, we hypothesized that racial discrimination would be significantly associated with HRQOL and have potentially stronger associations among men and those with less social support. For ethnicity, potential differences by strata were hypothesized but not specifically delineated.

Methods

Study Population and Data Collection

For this cross-sectional study, we conducted secondary data analysis to examine the association between self-reported racial discrimination and HRQOL among Asian American immigrants. The data were collected as part of a parent study that was funded by the National Institute of Health (NIH) to reduce liver cancer disparities in Asian Americans and approved by the Committee on Human Research of Johns Hopkins Bloomberg School of Public Health. From April 2013 to March 2014, participants were recruited through various channels including community-based organizations, faith-based organizations, and local health events among others, and included 600 foreign-born Asian American adults, aged 18 years and older. Among these participants, there were 201 Chinese, 198 Korean, and 201 Vietnamese adults. After participants provided written informed consent, they completed a self-administered questionnaire in their preferred language (i.e., English, Chinese, Korean, or Vietnamese). Further details regarding recruitment and data collection procedures have been previously published [39].

Measures

HRQOL was assessed using the 4-item Healthy Days Core Module developed by the Centers for Disease Control and Prevention [8, 10]. This measure includes items on self-rated health, physically unhealthy days, mentally unhealthy days, and activity limitation days. To assess self-rated health, participants were asked, "Would you say that in general your health is excellent, very good, good, fair or poor?" As done in previous studies, responses were dichotomized as "excellent/very good/good" and "fair/poor" [26, 40, 41]. Henceforth, the former will be referred to as "good" and the latter as "poor" self-rated health. For physically unhealthy days, participants were asked, "Now thinking about your physical health, which includes physical illness and injury, how many days during the past 30 days was your physical health not good?" A similar question was asked to assess mentally unhealthy days: "Now thinking about your mental health, which includes stress, depression, and problems with emotions, how many days during the past 30 days was your mental health not good?" For activity limitation days, participants were asked, "During the past 30 days, approximately how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?" Responses for these latter three items ranged from 0 to 30 days and were positively skewed.

Self-reported racial discrimination during participants' lifetime in the USA was assessed using two measures: an Everyday Racial Discrimination Scale (ERDS) and Major Racial Discrimination Scale (MRDS). ERDS is based on the Williams' Everyday Discrimination Scale [42] and consists of 7-items that capture the frequency of everyday racial discrimination experiences in the USA, including tailored items on whether participants were treated unfairly due to their accent or assumptions about their English ability and whether they have been treated badly because there are perceived as an immigrant. Responses were on a 6-point Likert scale ranging from never (0) to almost every day (5) (Cronbach's alpha = 0.94).

MRDS, which is based on a previous measure by Kessler et al. [43], includes 4 items. Participants were asked whether they have experienced any of the following lifetime events due to their race/ethnicity, English ability, or others' assumptions that they are an immigrant: not hired for a job, denied a promotion, or fired; prevented from moving into a neighborhood; received lower quality medical care; or unfairly denied education or discouraged by a teacher or advisor. Responses were on a 4-point Likert scale ranging from never (0) to three times or more (3).

Scores for ERDS and MRDS were calculated by summing items for each separately to examine everyday versus major systemic racial discrimination independently. The observed average across the available data was used to determine scores. Both scores were analyzed continuously and categorically based on categories used in a previous study [44]. ERDS scores were grouped into none (0), moderate (1 to 7), and high (8 or more), while MRDS scores were classified into none (0) and any (1 or more). Given the similarity in results and observed trends in the same direction, the results from the continuous treatment of racial discrimination are presented here.

Sociodemographic variables included age, gender, ethnicity, education, employment status, and marital status. Ethnicity included Chinese, Korean, or Vietnamese. Education was grouped into three categories: less than high school; high school/business or vocational school/some college; and college graduate/graduate school. Employment status was dichotomized as employed and not employed (i.e., student, unemployed, retired, and housewife). Moreover, marital status was collapsed into two categories: married/living with a partner and not married (i.e., separated/divorced/widowed/never married).

Regarding health behaviors, smoking status was categorized into never, former, and current based on participants' responses to two questions: (1) Have you smoked at least 100 cigarettes, or 5 packs, in your entire life and (2) Do you now smoke cigarettes everyday, some days, or not at all? Those who responded "no" to the first question were categorized as never smokers, those who responded "yes" to the first question but reported not currently smoking were categorized as former smokers, and those who responded "yes" to the first question and reported that they now smoke everyday or some

days were categorized as current smokers. In addition, alcohol use was categorized into none, moderate, and high using recommendations from the American Heart Association (AHA) that alcoholic beverages for men be limited to no more than 2 drinks per day and for women 1 drink per day [45, 46].

Finally, social support was measured using the 8-item Duke-UNC Functional Social Support Questionnaire, which includes items such as getting invitations to go out with others, receiving useful advice about important things in life, and having help when sick. Responses were on a 5-point Likert scale ranging from "much less than I would like" (1) to "as much as I would like" (5) (Cronbach's alpha = 0.94). Responses were summed and dichotomized based on the median (i.e., 1 to 30 and 31 or greater).

Statistical Analysis

Descriptive analyses were conducted to examine the distribution of all variables independently and by ethnicity. Differences in the categorical variables by ethnicity were assessed using chi-square tests, while Kruskal-Wallis tests were used for continuous variables (age, ERDS, MRDS, physically unhealthy days, mentally unhealthy days, and activity limitation days), which were determined to be non-normally distributed based on Shapiro-Wilk tests. To obtain the final analytic sample, we excluded 76 participants who were missing data for more than one racial discrimination item or covariates described in the methods section.

Following descriptive analysis, we performed logistic regression to examine the association between racial discrimination and self-rated health. To test the linearity assumption between continuous, independent variables and log odds for logistic regression, the Box-Tidwell test was employed by including each continuous variable as well as the cross-product of each variable and its natural logarithm to the regression models. All interaction terms were not significant supporting linearity. Negative binomial regression was conducted for physically unhealthy days, mentally unhealthy days, and activity limitation days due to over-dispersion (i.e., the observed variance was greater than the expected). A significant negative binomial dispersion parameter gave evidence in favor of the use of negative binomial models over Poisson models.

For model building, we examined associations before and after adjustment for each potential confounder with an estimate change of 10% or more indicating significant confounding. Based on this analysis and literature, multivariable regression was performed to assess the relationship between racial discrimination and HRQOL. A series of models were used to illustrate the effects of racial discrimination and confounders. Model 1 is the unadjusted model; Model 2 additionally adjusts for age, gender, and ethnicity; Model 3 further adjusts for socioeconomic status (i.e., education and employment status);

Model 4 additionally adjusts for marital status and social support; Model 5 additionally adjusts for health behaviors (i.e., smoking and alcohol consumption). Smoking and alcohol consumption may be considered as potential mediators or confounders, but we adjusted for these variables as potential confounders. As seen in Table 2 and Table 3, further adjustment of these variables did not change estimates.

Based on prior literature, potential effect modification by gender [47], ethnicity [26, 41], and social support [48] were individually examined by including the corresponding main effect and interaction terms in the models adjusting for all confounders. If the interaction was significant, stratified analysis was conducted. Variance inflation factors (VIF) were examined and found to be all less than 10, indicating no multicollinearity among independent variables. All statistical analysis for the current study was conducted using SAS 9.4 (SAS Institute, Cary, NC).

Results

The descriptive characteristics of participants in the total analytic sample and by ethnicity are presented in Table 1. Overall, the median age among participants was 48 years with 58% being women. Chinese, Korean, and Vietnamese participants each comprised roughly a third of the sample. About half of participants received a college education or higher and more than half were employed. During their lifetime in the USA, 60% of participants reported experiencing everyday racial discrimination, while 21% reported experiencing major discriminatory events. When examining descriptive characteristics by ethnic group, statistically significant differences were found for everyday racial discrimination, major racial discrimination, self-rated health, activity limitation days, education, employment status, smoking status, and alcohol consumption. More Korean participants (80%) reported everyday racial discrimination as compared to Chinese (58%) and Vietnamese participants (41%), while more Chinese participants reported major racial discrimination (29%) as compared to Korean (19%) and Vietnamese participants (16%). Three quarters of Chinese adults reported good self-rated health in comparison to 57% and 56% of Korean and Vietnamese adults, respectively. Better HRQOL was also reflected by fewer days of activity limitation among Chinese participants as compared to Korean and Vietnamese participants. As compared to the other ethnic groups, Chinese adults in our sample tended to be more educated, not employed, less likely to be a current smoker, and less likely to have high alcohol consumption.

Results from the logistic regression of racial discrimination and self-rated health are presented in Tables 2 and 3. The bivariate associations for both everyday (odds ratio, OR = 1.01; 95% CI: 0.97, 1.04) and major racial discrimination (OR = 1.09; 95% CI: 0.94, 1.27) suggested positive

Table 1 Descriptive characteristics of participants by ethnicity (N = 524)

	Total (N = 524)	Chinese (n = 184)	Korean (n = 176)	Vietnamese (n = 164)	p-value[a]
Age, median [Q1–Q3][b]	48 [40–56]	47 [37–57]	50 [43–57]	46 [41–55]	0.185
Gender, n (%)					0.848
Men	219 (41.8)	80 (43.5)	72 (40.9)	67 (40.9)	
Women	305 (58.2)	104 (56.5)	104 (59.1)	97 (59.2)	
Education, n (%)					<.001
Less than high school	69 (13.2)	11 (6.0)	13 (7.4)	45 (27.4)	
High school/some college	188 (35.9)	32 (17.4)	73 (41.5)	83 (50.6)	
College or higher	267 (51.0)	141 (76.6)	90 (51.1)	36 (22.0)	
Employment status, n (%)					0.008
Not employed	182 (34.7)	79 (42.9)	58 (33.0)	45 (27.4)	
Employed	342 (65.3)	105 (57.1)	118 (67.1)	119 (72.6)	
Marital status, n (%)					0.074
Not married	113 (21.6)	37 (20.1)	31 (17.6)	45 (27.4)	
Married	411 (78.4)	147 (79.9)	145 (82.4)	119 (72.6)	
Social support, n (%)					0.523
Low	244 (46.6)	87 (43.5)	87 (49.4)	77 (47.0)	
High	280 (53.4)	89 (56.5)	89 (50.6)	87 (53.1)	
Smoking status, n (%)					<.001
Never	435 (83)	164 (89.1)	131 (74.4)	140 (85.4)	
Former	37 (7.1)	13 (7.1)	24 (13.6)	0 (0)	
Current	52 (9.9)	7 (3.8)	21 (11.9)	24 (14.6)	
Alcohol consumption, n (%)					0.002
None	347 (66.2)	118 (64.1)	104 (59.1)	125 (76.2)	
Moderate	153 (29.2)	62 (33.7)	60 (34.1)	31 (18.9)	
High	24 (4.6)	4 (2.2)	12 (6.8)	8 (4.9)	
ERDS, median [Q1–Q3][b]	2 [0–6]	2 [0–6]	6 [1–10]	0 [0–2]	<.001
Categorical ERDS					
None	209 (39.9)	77 (41.9)	35 (19.9)	97 (59.1)	<0.001
Moderate	211 (40.3)	79 (42.9)	75 (42.6)	57 (34.8)	
High	104 (19.8)	28 (15.2)	66 (37.5)	10 (6.1)	
MRDS, median [Q1–Q3][b]	0 [0–0]	0 [0–1]	0 [0–0]	0 [0–0]	0.005
Categorical MRDS					
None	412 (78.6)	131 (71.2)	143 (81.2)	138 (84.2)	0.008
Any	112 (21.4)	53 (28.8)	33 (18.8)	26 (15.8)	
Self-rated health, n (%)					<.001
Good	330 (63.0)	138 (75.0)	101 (57.4)	91 (55.5)	
Poor	194 (37.0)	46 (25.0)	75 (42.6)	73 (44.5)	
Physically unhealthy days, median [Q1–Q3][b]	0 [0–3]	0 [0–3]	0 [0–5]	0 [0–4]	0.169
Mentally unhealthy day, median [Q1–Q3][b]	1 [0–5]	1 [0–5]	1.5 [0–7]	0 [0–5]	0.363
Activity limitation days, median [Q1–Q3][b]	0 [0–1]	0 [0–0]	0 [0–3]	0 [0–2]	<.001

Q1 = 25th percentile; Q3= 75th percentile; *ERDS*= everyday racial discrimination score, *MRDS*= major racial discrimination score

[a] The p-values for categorical variables are from chi-square and from the Kruskal-Wallis test for continuous variables

[b] Median and interquartile ranges are presented for non-normal continuous variables

relationships between racial discrimination and self-rated health but were not statistically significant. These associations were largely unchanged after adjusting for covariates. Overall, those with older age, women, being Korean, and a current smoker were associated with poorer self-rated health, while those with higher education, high social support, and moderate drinker practices had better self-rated health.

The negative binomial regression results for racial discrimination with physically unhealthy days, mentally unhealthy days, and activity limitation days are shown in Table 4. Everyday (incidence rate ratio, IRR = 1.04; 95% CI: 1.00, 1.07) and major racial discrimination (IRR = 1.17; 95% CI: 1.01, 1.34) were associated with physically unhealthy days in

the bivariate and multivariable analysis. Adjustment for covariates resulted in minimal change from the crude estimate for everyday racial discrimination and an overall increase in magnitude of the association for major racial discrimination. In the fully-adjusted models, the rate of physically unhealthy days increased by 5% for every unit increase in the ERDS (IRR = 1.05; 95% CI: 1.01, 1.09) and by 21% for every unit increase in MRDS (IRR = 1.21; 95% CI: 1.03, 1.41). The results for the negative binomial regression between racial discrimination and mentally unhealthy days were similar to those for physically unhealthy days. Everyday (IRR = 1.04; 95% CI: 1.01, 1.07) and major racial discrimination (IRR = 1.17; 1.04, 1.33) were also found to be associated with

Table 2 Logistic regression models for continuous everyday racial discrimination and poor self-rated health (N = 524)

Variable	Model 1[a] OR (95% CI)	Model 2[b] OR (95% CI)	Model 3[c] OR (95% CI)	Model 4[d] OR (95% CI)	Model 5[e] OR (95% CI)
ERDS	0.99 (0.96, 1.03)	0.99 (0.96, 1.03)	1.01 (0.97, 1.05)	1.00 (0.96, 1.04)	1.00 (0.96, 1.04)
Age		1.04 (1.02, 1.06)*	1.03 (1.02, 1.05)*	1.03 (1.01, 1.05)*	1.03 (1.01, 1.05)*
Gender					
Men		1.00	1.00	1.00	1.00
Women		1.95 (1.32, 2.87)*	1.89 (1.27, 2.81)*	1.99 (1.33, 2.99)*	1.96 (1.20, 3.20)*
Ethnicity					
Chinese		1.00	1.00	1.00	1.00
Korean		2.26 (1.40, 3.65)*	1.86 (1.12, 3.07)*	1.90 (1.15, 3.16)*	2.00 (1.18, 3.39)*
Vietnamese		2.40 (1.50, 3.86)*	1.42 (0.83, 2.43)	1.42 (0.82, 2.44)	1.28 (0.73, 2.22)
Education					
Less than high school			1.00	1.00	1.00
High school/some college			0.44 (0.24, 0.80)*	0.46 (0.25, 0.86)*	0.49 (0.27, 0.91)*
College or higher			0.22 (0.11, 0.41)*	0.23 (0.12, 0.45)*	0.27 (0.14, 0.52)*
Employment					
Not employed			1.00	1.00	1.00
Employed			1.12 (0.74, 1.70)	1.11 (0.73, 1.70)	1.11 (0.72, 1.70)
Marital status					
Not married				1.00	1.00
Married				1.07 (0.64, 1.78)	0.99 (0.59, 1.66)
Social support					
Low				1.00	1.00
High				0.64 (0.43, 0.96)*	0.65 (0.43, 0.98)*
Smoking					
Never					1.00
Former					0.79 (0.31, 2.01)
Current					2.55 (1.25, 5.23)*
Alcohol consumption					
None					1.00
Moderate					0.49 (0.29, 0.83)*
High					0.54 (0.20, 1.44)

ERDS= everyday racial discrimination score, OR= odds ratio, CI= confidence interval

[a] Model 1: Unadjusted model

[b] Model 2: Model 1+ age, gender, ethnicity

[c] Model 3: Model 2+ education, employment status

[d] Model 4: Model 3+ marital status, social support

[e] Model 5: Model 4+ smoking, alcohol consumption

* $p < 0.05$

† $p < 0.1$

mentally unhealthy days. After adjusting for covariates, ERDS became marginally associated with mentally unhealthy days (IRR = 1.03; 95% CI: 1.00, 1.07), while the rate of mentally unhealthy days was found to significantly increase by 16% for every unit increase in the MRDS score (IRR = 1.16; 95% CI: 1.02, 1.31). Likewise to mentally unhealthy days, the association between everyday discrimination and activity limitation days became marginal and the rate of

activity limitation days increased by 53% for every unit increase in MRDS (IRR = 1.53; 95% CI: 1.17, 2.00) in the fully-adjusted models.

There was no effect modification by gender, ethnicity, or social support in the associations between everyday and major racial discrimination with self-rated health, physically unhealthy days, and mentally unhealthy days. We tested effect modification by ethnicity to assess whether the association

Table 3 Logistic regression models for continuous major racial discrimination and poor self-rated health (N = 524)

Variable	Model 1[a] OR (95% CI)	Model 2[b] OR (95% CI)	Model 3[c] OR (95% CI)	Model 4[d] OR (95% CI)	Model 5[e] OR (95% CI)
MRDS	0.92 (0.79, 1.07)	0.97 (0.83, 1.14)	1.00 (0.85, 1.17)	0.97 (0.82, 1.15)	0.95 (0.81, 1.12)
Age		1.04 (1.02, 1.06)*	1.03 (1.02, 1.05)*	1.03 (1.01, 1.05)*	1.03 (1.01, 1.05)*
Gender					
Men		1.00	1.00	1.00	1.00
Women		1.95 (1.32, 2.86)*	1.89 (1.27, 2.82)*	1.99 (1.33, 2.98)*	1.95 (1.20, 3.19)*
Ethnicity					
Chinese		1.00	1.00	1.00	1.00
Korean		2.18 (1.37, 3.47)*	1.90 (1.17, 3.08)*	1.85 (1.14, 3.01)*	1.94 (1.17, 3.22)*
Vietnamese		2.41 (1.50, 3.87)*	1.41 (0.82, 2.41)	1.41 (0.82, 2.43)	1.27 (0.73, 2.20)
Education					
Less than high school			1.00	1.00	1.00
High school/some college			0.44 (0.24, 0.80)*	0.46 (0.25, 0.85)*	0.49 (0.27, 0.91)*
College or higher			0.22 (0.12, 0.42)*	0.23 (0.12, 0.44)*	0.27 (0.14, 0.52)*
Employment					
Not employed			1.00	1.00	1.00
Employed			1.13 (0.74, 1.71)	1.11 (0.73, 1.70)	1.11 (0.72, 1.70)
Marital status					
Not married				1.00	1.00
Married				1.06 (0.64, 1.76)	0.98 (0.58, 1.65)
Social support					
Low				1.00	1.00
High				0.64 (0.43, 0.95)*	0.65 (0.43, 0.96)*
Smoking					
Never					1.00
Former					0.79 (0.31, 1.99)
Current					2.59 (1.26, 5.31)*
Alcohol consumption					
None					1.00
Moderate					0.49 (0.29, 0.82)*
High					0.53 (0.20, 1.43)

MRDS= Major racial discrimination score, OR= odds ratio, CI= confidence interval

[a] Model 1: Unadjusted model

[bc] Model 2: Model 1+ age, gender, ethnicity

[c] Model 3: Model 2+ education, employment status

[d] Model 4: Model 3+ marital status, social support

[e] Model 5: Model 4+ smoking, alcohol consumption

* $p < 0.05$

† $p < 0.1$

between discrimination and HRQOL differs among Chinese, Korean, and Vietnamese participants, but ethnicity was not a significant effect modifier. However, there was significant interaction between everyday (p = 0.008) and major racial discrimination (p = 0.049) with gender in association with activity limitation days. The stratified results are presented in Table 5 and illustrated in Figs. 1 and 2. Everyday discrimination was significantly associated with greater activity limitation days among men (IRR = 1.16; 95% CI: 1.05, 1.27) but not women (IRR = 0.96; 95% CI: 0.88, 1.05). For major racial discrimination, there was a 2.20 times and 1.33 times greater rate for every unit increase in MRDS among men (IRR = 2.20; 95% CI: 1.39, 3.49) and women (IRR = 1.33; 95% CI: 1.00, 1.77), respectively.

All results described thus far were similar when ERDS and MRDS scores were treated as continuous and categorical.

Table 4 Negative binomial regression models of continuous racial discrimination scores and physically unhealthy days, mentally unhealthy days, and activity limitation days (N = 524)

Racial discrimination measure[a]	Model 1[b] IRR (95% CI)	Model 2[c] IRR (95% CI)	Model 3[d] IRR (95% CI)	Model 4[e] IRR (95% CI)	Model 5[f] IRR (95% CI)
Physically unhealthy days					
Everyday discrimination score	1.04 (1.00, 1.07)*	1.04 (1.00, 1.08)*	1.06 (1.02, 1.10)*	1.05 (1.01, 1.09)*	1.05 (1.01, 1.09)*
Major discrimination score	1.17 (1.01, 1.34)*	1.19 (1.03, 1.37)*	1.24 (1.07, 1.43)*	1.21 (1.05, 1.40)*	1.21 (1.03, 1.41)*
Mentally unhealthy days					
Everyday discrimination score	1.04 (1.01, 1.07)*	1.05 (1.01, 1.08)*	1.05 (1.01, 1.08)*	1.04 (1.00, 1.07)*	1.03 (1.00, 1.07)†
Major discrimination score	1.17 (1.04, 1.33)*	1.20 (1.06, 1.35)*	1.20 (1.06, 1.36)*	1.17 (1.03, 1.32)*	1.16 (1.02, 1.31)*
Activity limitation days					
Everyday discrimination score	1.05 (1.00, 1.11)†	1.06 (1.00, 1.12)*	1.06 (1.00, 1.13)*	1.04 (0.98, 1.10)	1.05 (0.99, 1.12)†
Major discrimination score	1.22 (0.97, 1.53)†	1.45 (1.13, 1.86)*	1.49 (1.16, 1.92)*	1.40 (1.10, 1.79)*	1.53 (1.17, 2.00)*

IRR= incidence rate ratio, *CI*= confidence interval

[a] Everyday and major racial discrimination scores were examined separately

[b] Model 1: Unadjusted model

[c] Model 2: Model 1+ age, gender, ethnicity

[d] Model 3: Model 2+ education, employment status

[e] Model 4: Model 3+ marital status, social support

[f] Model 5: Model 4+ smoking, alcohol consumption

* p < 0.05

† p < 0.1

However, unlike when treated as continuous, there was significant interaction between major racial discrimination and social support in association with physically unhealthy days when MRDS was categorized (p = 0.019). Results are presented in Table 6 and illustrated in Fig. 3. Discrimination measure scores were categorized based on a categorization scheme used in a previous study [44] and the distributions of the variables in the current study. Specifically, ERDS scores were categorized into none (0), moderate (1 to 7), and high (8 or more), while MRDS scores were categorized into none (0) and any (1 or more). Among those with low social support, participants who reported major racial discrimination were expected to have a 3.04 times greater rate of physically unhealthy days per month as opposed to those who did not adjusting for all covariates (IRR = 3.04; 95% CI: 1.60, 5.79). However, the association between major racial discrimination and physically unhealthy days was not significant among those with high social support (IRR = 0.91; 95% CI: 0.43, 1.92).

Discussion

The results of this study support the association between everyday and major racial discrimination and decreased HRQOL, with the exception of self-rated health, among Asian Americans. This study is one of the first among Asian Americans to examine the association between racial

discrimination measured in two ways (i.e., everyday and major) using questions that capture key components of the Asian American experience [2] as well as multiple items for HRQOL. Similar to our study, Gee et al. also found racial discrimination to be associated with decreased HRQOL among six Asian ethnic groups in the California Health Interview Survey (CHIS) (Chinese, Filipino, Japanese, Korean, South Asian, and Vietnamese) [26]. However, the current study contributes to the literature by using racial discrimination measures specifically tailored to Asian Americans to better assess their experiences with everyday and major racial discrimination and providing independent examinations of physically and mentally unhealthy days to better understand the impact of racial discrimination on different facets of health. These strengths of our assessments for racial discrimination and HRQOL enabled us to identify more granular relationships. For instance, we found that everyday and major racial discrimination are independently associated with physically unhealthy days, mentally unhealthy days, and activity limitation days.

Racial discrimination and self-rated health were not found to be significantly associated in this study. However, both everyday and major racial discrimination were significantly associated with physically unhealthy days, mentally unhealthy days, and activity limitation days. The findings for self-rated health differ from previous literature in this population [26, 27]. However, a key difference to note is that these previous studies included US-born Asian Americans in addition to

Table 5 Multivariable negative binomial regression of continuous racial discrimination scores and activity limitation days by gender (N = 524)

Racial discrimination measure[a]	Model 1[b] IRR (95% CI)	Model 2[c] IRR (95% CI)	Model 3[d] IRR (95% CI)	Model 4[e] IRR (95% CI)	Model 5[f] IRR (95% CI)
Men (n = 219)					
Everyday discrimination score	1.08 (1.00, 1.16)†	1.13 (1.04, 1.22)*	1.13 (1.04, 1.23)*	1.10 (1.02, 1.20)*	1.16 (1.05, 1.27)*
Major discrimination score	1.30 (0.91, 1.85)	2.00 (1.31, 3.04)*	2.05 (1.32, 3.17)*	1.76 (1.16, 2.66)*	2.20 (1.39, 3.49)*
Women (n = 305)					
Everyday discrimination score	1.03 (0.96, 1.12)	0.98 (0.90, 1.06)	0.98 (0.90, 1.07)	0.95 (0.87, 1.03)	0.96 (0.88, 1.05)
Major discrimination score	1.19 (0.89, 1.59)	1.28 (0.96, 1.69)†	1.34 (1.00, 1.78)*	1.33 (1.00, 1.76)†	1.33 (1.00, 1.77)*

IRR= incidence rate ratio, *CI*= confidence interval

[a] Everyday and major racial discrimination scores were examined separately

[b] Model 1: Unadjusted model

[c] Model 2: Model 1+ age, gender, ethnicity

[d] Model 3: Model 2+ education, employment status

[e] Model 4: Model 3+ marital status, social support

[f] Model 5: Model 4+ smoking, alcohol consumption

* $p < 0.05$

† $p < 0.1$

foreign-born Asian Americans, while the participants in this study were all foreign-born. Reporting of discrimination among Asian Americans varies depending on the measures used, types of discrimination assessed, and population characteristics. In previous studies, discrimination was found to range from 8% based on a single question to 75.4% based on a multi-item scale with US-born as opposed to foreign-born Asian Americans having a greater tendency to report discriminatory experiences [26, 49]. According to a nationally representative poll, US-born Asian Americans were more likely to report that they or a family member have experienced interpersonal discrimination because they are Asian [3]. One contributing factor may be that first-generation immigrants, especially those with limited English proficiency, report less discrimination because they have less interactions outside of their ethnic group. Similar to our findings, another study examining older Korean Americans with mostly limited English proficiency found that discrimination in medical settings was not associated with subjective perceptions of health [25].

Suppression was observed during model building with increases in the magnitude of the relationship between racial discrimination and HRQOL when including demographics,

Fig. 1 Continuous everyday racial discrimination and activity limitation days by gender (n = 524)
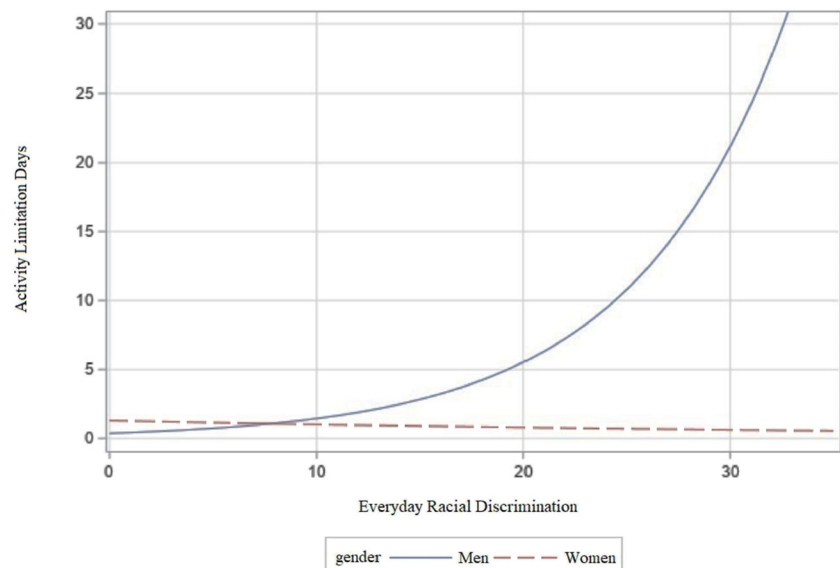
[a] Fit computed at age=47.2, ethnicity=Chinese, education=less than high school, employment=unemployed, marital status=not married, social support=low, smoke=never, alcohol=none

Fig. 2 Continuous major racial discrimination and activity limitation days by gender (n = 524)
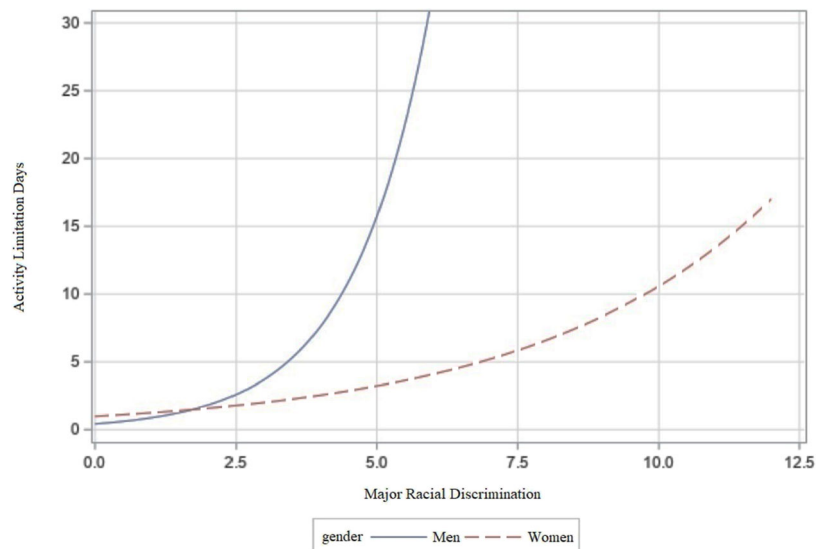
[a] Fit computed at age=47.2, ethnicity=Chinese, education=less than high school, employment=unemployed, marital status=not married, social support=low, smoke=never, alcohol=none

SES (i.e., education and employment), and sometimes health behaviors in the models. The addition of basic demographics (i.e., age, gender, and ethnicity) suggested suppression across everyday and major racial discrimination, especially in relation to physical health and activity limitation. In particular, the relationship between racial discrimination and HRQOL was in most cases strengthened after age, gender, and ethnicity were adjusted for. Based on the full models, older age was likely driving changes in the rate of physically unhealthy days and ethnicity impacted activity limitation. Relatively, Korean then Vietnamese Americans had greater rates of activity limitation days than Chinese Americans in this study. Suppression was also present when adjusting for socioeconomic factors (i.e., education and employment), particularly when examining physically unhealthy days, and when adjusting for health behaviors (i.e., smoking and alcohol consumption) when examining activity limitation days. The former was likely driven by education and the latter by smoking based on the full models. Also to note, excluded subjects and the final analytic model were similar in terms of age, gender, marital status, racial discrimination, and most HRQOL items (physically unhealthy days, mentally unhealthy days, and activity limitation days). However, some differences were observed by ethnicity, education, employment status, social support, smoking, alcohol, and self-rated health.

Previous studies among Asian Americans have found that the effects of racial discrimination on physical and mental health can be protected against by social support [50, 51].

Table 6 Multivariable negative binomial regression of categorical major discrimination scores and physically unhealthy days by social support (N = 524)

Racial discrimination measure	Model 1[a] IRR (95% CI)	Model 2[b] IRR (95% CI)	Model 3[c] IRR (95% CI)	Model 4[d] IRR (95% CI)	Model 5[e] IRR (95% CI)
Low social support (n = 244)					
Major racial discrimination	1.90 (1.10, 3.30)*	1.95 (1.13, 3.36)*	2.68 (1.51, 4.76)*	2.71 (1.51, 4.87)*	3.04 (1.60, 5.79)*
High social support (n = 280)					
Major racial discrimination	0.77 (0.38, 1.57)	0.88 (0.43, 1.81)	0.89 (0.43, 1.88)	0.92 (0.43, 1.94)	0.91 (0.43, 1.92)

IRR= incidence rate ratio, *CI*= confidence interval

[a] Model 1: Unadjusted model

[b] Model 2: Model 1+ age, gender, ethnicity

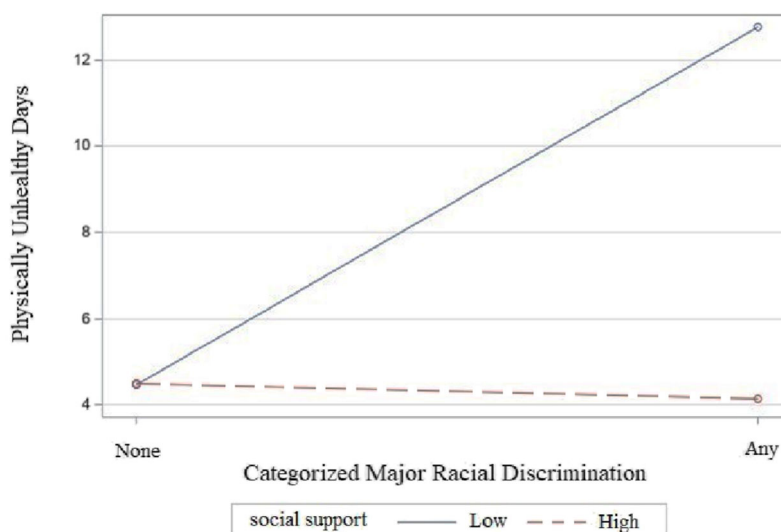[c] Model 3: Model 2+ education, employment status

[d] Model 4: Model 3+ marital status, social support

[e] Model 5: Model 4+ smoking, alcohol consumption

* p < 0.05

† p < 0.1

Fig. 3 Categorical major racial discrimination and physically unhealthy days by social support (n = 524)

[a] Fit computed at age=47.2, gender=men, ethnicity=Chinese, education=less than high school, employment=unemployed, marital status=not married, smoke=never, alcohol=none

For instance, among a national sample of Asian Americans, perceived emotional support from family for a serious problem was found to buffer the stress of high levels of everyday discrimination [31]. Similar to these previous studies, social support in this study was found to be a significant effect modifier in the relationship between major racial discrimination and physically unhealthy days when MRDS was categorized. Among those with low social support, participants who reported experiencing major racial discrimination had a 3.04 times greater rate of physically unhealthy days as compared to those who did not. However, the association was not significant among those with high social support. Social support has been well-documented in the literature as being a psychosocial factor that influences physical health with individuals reporting excellent physical health tending to have high social support [52]. Individuals with high social support had a protective effect, whereas those with low social support did not have this buffer. This significant effect from social support may be particularly relevant to Asian Americans due to traditional and cultural values of collectivism, which emphasizes positive social relationships [7]. Thus, targeting social support in future interventions may be beneficial in reducing the effects of racial discrimination on physical health.

Significant interactions were also found between racial discrimination and gender. Specifically, the associations between everyday and major racial discrimination and activity limitation days were found to be of greater magnitude among men than women. Previous studies among Asian adults have found that a higher threshold of discrimination for men affects mental and physical health status [29] but that men report higher levels of discrimination than women [28]. Literature has suggested that Asian women may have better coping mechanisms

in relation to discriminatory experiences and may be more open to sharing their feelings and soliciting advice from others [30]. These factors may contribute to the observed stronger associations between racial discrimination and having physical, mental, and/or emotional limitations in their daily lives among men. Racial discrimination may also impact HRQOL differently by gender through health behaviors. One previous study found that racial discrimination experienced earlier in life by men may be associated with less healthy eating behaviors and substance use, whereas exercise for women.

Study limitations to note include the use of a nonprobability sample, which may reduce the generalizability of the findings. In particular, this sample consisted of foreignborn Asian American adults only. Thus, a sample that includes US-born participants could have different findings. In addition, this study is cross sectional, which limits the ability to draw causal inferences. There is also the possibility of unmeasured confounding from social desirability as an example. Some research suggests that respondents may underreport personal experiences of discrimination consciously or unconsciously and may even disconnect themselves from negative discriminatory experiences as a coping mechanism, known as "repression" [53]. Repression was also not measured in the current study, which would have helped to capture individuals who may have heighted physiological responses but tend not to report racial discrimination. Furthermore, as with many self-reported outcomes, recall bias could have influenced participants' responses. For instance, we assessed HRQOL within the last month, which may make it challenging for some participants to accurately recall the exact number of days their physical or mental health was not good. This study also offers several strengths including the use of two tailored racial

discrimination measures to better capture the experiences of Asian Americans and examination of both everyday interpersonal racial discrimination as well as major racial discrimination experiences that are systemic in nature. Unlike previous studies, examining racial discrimination and HRQOL among Asian Americans, we also examined physically and mentally unhealthy days separately to assess potential differences.

The effects of racial discrimination on health are well established as detrimental to health [54]. However, the pathways and mechanisms through which these effects manifest and can be mitigated or exacerbated are complex. This study provides insight into some of these processes among Asian Americans through the association between racial discrimination and HRQOL, which once better understood can inform future interventions aimed at improving HRQOL in this population. Asian American men and those with low social support may be populations that would especially benefit from efforts to improve HRQOL.

Declarations

Ethics Approval The data were collected as part of a parent study that was approved by the Institutional Review Board (IRB) at the Johns Hopkins Bloomberg School of Public Health. All data were de-identified to ensure participant privacy and confidentiality.

Consent to Participate All participants were informed of voluntary participation in the study and provided written informed consent.

Consent for Publication Participants signed informed consent forms, which included publication.

Conflict of Interest The authors declare no competing interests.

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