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ORIGINAL ARTICLE

Psychological Symptoms as Mediators in the Association between Discrimination and Health among South Asian Americans

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Objective: To examine psychological symptoms (symptoms of depression, anger, anxiety) as potential mediators between discrimination and health outcomes among South Asian Americans. We hypothesized that psychological symptoms would be significant mediators in the pathways between discrimination and health.

Research design and methods: The Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study examines risk factors for heart disease among South Asian Americans using self-reported and medical data collected from participants in the San Francisco Bay Area and Chicago regions of the US (N = 1,164). For this study we assessed the associations among the everyday discrimination scale, symptoms of depression, anxiety, and anger, and health outcomes using structural equation modeling.

Results: We found significant positive associations between discrimination and symptoms of depression (ß 0.69, $P < 0.0001$), anger (ß 0.38, $P < 0.0001$), and anxiety (ß 0.64, $P < 0.0001$). Exposure to discrimination had a direct negative association with high-density lipoproteins (HDL) level (ß −0.37, $P = 0.01$). Indirect associations between discrimination and health outcomes were seen via depression (tobacco use: ß 1.08, $P = 0.007$), via anger (triglyceride level: 11.88, $P = 0.03$; alcohol consumption: ß 1.66, $P = 0.002$; calories consumed per day: ß 108.04, $P = 0.02$), and via anxiety (tobacco use: ß −1.05, $P = 0.004$; alcohol consumption: ß −1.88, $P = 0.03$).

Conclusion: Our hypothesis was partially confirmed with proximate health indicators (tobacco use, alcohol consumption, caloric intake) and triglyceride levels. These results suggest that psychological symptoms mediate the association between discrimination and adverse health risk behaviors among South Asian Americans.

Key Words: depression ▪ anxiety ▪ anger ▪ health risk behaviors ▪ chronic diseases

Racial discrimination, which are negative beliefs, attitudes, actions, or behaviors against a person because of their actual or perceived race/ethnicity, has been found to be associated with poor mental and physical health outcomes for ethnic minority groups in the US.[1,2] Although much of the research has been conducted among African Americans, previous research has also delineated the effects of racial discrimination on poor health outcomes among Asian Americans, Hispanic, Indigenous, Muslim, and Arab-American populations.[3–13] However, few studies have focused on subgroups of ethnic minorities, such as South Asian Americans (SAAs).[14,15]

South Asian Americans account for nearly 30% of the US Asian population and are growing and include individuals from the South Asian sub-continent (India, Bangladesh, Pakistan, Sri Lanka, and Nepal). Apart from discrimination due to phenotypic appearance, SAAs can experience discrimination because of culture, religion, and immigration status.[14,16–18] SAAs have faced a long history of xenophobia and racism in the US at the interpersonal, community, and structural levels. Examples of structural discrimination include denial of US citizenship to early South Asian immigrants, policies prohibiting immigrants from Asian countries, and miscegenation laws that outlawed interracial marriages.[19–21] SAAs continue to

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POPULAR SCIENTIFIC SUMMARY

- Discrimination is associated with poor health outcomes, a relation which has yet to be fully examined among South Asian Americans, who face various forms of discrimination (e.g. racism, xenophobia, Islamophobia) in the US.
- This study assessed associations among self-reported discrimination, symptoms of depression, anxiety, and anger, and health outcomes using structural equation modeling.
- We found significant positive associations between discrimination and symptoms of depression, anxiety, anger, and indirect associations with tobacco use, alcohol consumption.

face xenophobia and racism, along with Islamophobia, as the second largest ethnic group of Muslim Americans.[22,23] Islamophobia or anti-Muslim discrimination has resulted in increased government surveillance and profiling of Muslims, including restrictions on immigrants from Muslim-majority countries, as enacted through the Patriot Act, National Security Entry-Exit Registration System, and Muslim travel ban.[24–27] Interpersonal and community examples of discrimination against SAAs include hate crimes ranging from physical and verbal assaults to vandalism and attacks on temples and mosques.[18,28] Although SAAs have faced discrimination for decades in the US, they have been labeled as 'model minorities' along with other Asian American groups, based on aggregate educational and income data, despite disaggregated data showing varying degrees of socioeconomic success.[29] This labeling of SAAs as 'model minorities' has contributed to funding agencies and researchers overlooking the diversity of experiences and health disparities within this population.[30]

Research on Asian Indians has found that perceived discrimination is linked with poor health behaviors, including tobacco use and alcohol consumption, as well as health outcomes such as depression, anxiety, poor nutrition, higher body mass index (BMI), hypertension, and higher cholesterol.[15,31,32] Previous research has also indicated an association between mental health and chronic conditions in that harmful coping behaviors (poor dietary habits, low physical activity, tobacco use, and alcohol consumption) can be symptoms of depression.

Link and Phelan's conceptualization of stigma is a useful model for explaining the association between discrimination and poor health.[33] Stigma pertains to negative perceptions of a particular group contributing to discriminatory acts against the group, which in turn have health implications for the impacted group. Link and Phelan assert that proximate or immediate effects of discrimination include psychological distress and increased health risk behaviors, such as tobacco use and alcohol consumption. Chronic exposure to discrimination may lead to distal health risks such as hypertension, poor mental health, and other health outcomes that develop over time.[33] The literature on mental health indicates that individuals diagnosed with depression or anxiety may turn to harmful coping mechanisms, such as increased alcohol consumption or tobacco use, and poor dietary habits.[34] Symptoms of depression may include sadness and loss of interest in activities, which may contribute to decreased physical activity.[35] Given the interrelated paths among discrimination, and psychological and medical disorders, exposure to discrimination may have direct and indirect associations with psychological symptoms and medical outcomes.

Therefore, given the association between mental health and other health outcomes, this investigation sought to examine psychological symptoms as potential mediators in the path between discrimination and health outcomes, using data from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) Study. Link and Phelan's framework informed the current study in the selection of proximate and distal effects of discrimination as outcome measures.

METHODS

Data from the MASALA Study were analyzed for this investigation (N = 1,164). The objective of the MASALA Study is to identify risk factors for heart disease among SAAs (Indian, Bangladeshi, Pakistani, Nepali, and Sri Lankan), as SAAs have high rates of cardiovascular conditions, such as heart attacks and strokes. MASALA data were collected in two waves, from 2010 to 2013 (Wave 1) and 2017 to 2018 (Wave 2), at study sites in the San Francisco Bay Area, California (n = 613) and Chicago, Illinois (n = 551) regions. The second wave was implemented to recruit additional participants from diverse backgrounds. Data from Waves 1 and 2 of the study were examined in this analysis. A detailed explanation of recruitment strategies employed in the MASALA study was published in previous manuscripts.[36,37] Direct mailings, follow-up phone calls, and community outreach were used to recruit study participants. Participation was restricted to SAAs aged 40–84 years, who met specific medical criteria (i.e. no previous history of cardiovascular disease).[36]

Participant eligibility was determined in a pre-visit phone call and those deemed eligible were requested to fast for 12 h prior to their clinic visit. Written consent was obtained prior to the clinical exam. Institutional Review Board approval was obtained from the University of California, San Francisco and Northwestern University. The current analysis was approved by the Institutional Review Board at the University of Maryland, College Park.

Measures

Independent variable

Discrimination. Perceived discrimination was examined as an independent variable and assessed using the Everyday Discrimination scale, which has a total of nine items that ask about mistreatment a participant may have experienced. Examples of items included 'people act as if you are dishonest', and 'you are threatened or harassed'.[38] Items were answered using a 6-point Likert scale (range: 'Never' – 0 to 'Almost every day' – 6). This response option allows for participants to account for lifetime exposure to perceived discrimination. Item responses were averaged for the analysis and principal component analysis results yielded a one-component scale. The reliability of this instrument was 0.88 with this sample (McDonald's omega estimate).

Mediator variables

Depressive symptoms. Symptoms of depression were measured using the 20-item Center for Epidemiologic Studies Depression Scale (CESD), which asks about the frequency of symptoms in the past week. Examples of instrument items included 'I felt I was just about as good as other people', and 'I had crying spells'.[39] Items were answered using a 4-point Likert scale (range: 'rarely or none of the time' – 0 to 'most or all of the time' – 3). Scale items were assessed as a factor in the analyses and confirmatory factor analysis results indicated moderate fit (Root Mean Square Error of Approximation [RMSEA] 0.05, CFI 0.82, Standardized Root Mean Square Residual [SRMR] 0.05). The CESD had a reliability of 0.77, using McDonald's omega estimate, with this sample.

Anger. Emotions related to anger were assessed using the 10-item Spielberger Trait Anger Scale. Examples of scale items included 'I have a fiery temper', and 'When I get mad, I say nasty things'.[40] Items were answered using a 4-point response scale (range: 'almost never' – 0 to 'almost always' – 3). This instrument was assessed as a factor in the analyses and results from the confirmatory factor analysis indicated poor fit (RMSEA 0.07, CFI 0.88, SRMR 0.05). The McDonald's omega estimate for this instrument was 0.82.

Anxiety. Feelings of anxiety were measured using the 10-item Spielberger Trait Anxiety Scale. Examples of items in this scale included 'Feel nervous and reckless' and 'Satisfied with myself'.[41] The response scale for items ranged from 'almost never' – 0 to 'almost always' – 3. The instrument was assessed as a factor in the analyses and confirmatory factor analysis results yielded poor fit estimates (RMSEA 0.09, CFI 0.79, SRMR 0.06). The reliability of this scale was 0.59 (McDonald's omega estimate).

Outcome variables

A mix of self-reported data and clinical risk factors measured at the baseline exam were examined as dependent variables. Each variable was assessed individually in the analysis and described below.

Blood glucose. A series of tests were conducted to measure dysglycemia in participants. A HbA1c test was used to measure glycated hemoglobin, and elevated levels of HbA1c may indicate that a patient has prediabetes or diabetes. Among those who were not on any diabetes medicines, an oral glucose tolerance test was also conducted to measure glucose and insulin levels, and evaluate for diabetes. This included a fasting glucose test to determine glucose levels at baseline, and was followed by a glucose test at 2 h after ingestion of a 75-g glucose drink to assess how a patient's body manages the sugar levels.

Cholesterol. A panel of tests were undertaken to assess the lipid profile of participants. These tests included total cholesterol, triglyceride, low-density lipoproteins (LDL), and high-density lipoproteins (HDL) levels, which were taken after a 12 h fast.

Coronary artery calcium. A coronary artery calcium (CAC) score was assessed for each participant as a marker of atherosclerosis in each participant's coronary arteries.

Anthropometry. Body mass index and waist circumference (cm) were measured. The BMI was calculated based on participants' height and weight. Two measures of BMI were created: a continuous measure of BMI and a categorical measure of BMI (<25 kg/m^2, 25–29.9 kg/m^2, ≥ 30 kg/m^2). Waist was measured at the level of the umbilicus.

Blood pressure. Participants received a blood pressure assessment during their visit. For this analysis, the measure for diastolic and systolic blood pressure were used, which were obtained using an automated blood pressure monitor, using the average of the second and third seated blood pressure readings.

Diet. Trained bilingual research staff administered a 165-item food frequency questionnaire that was validated in South Asians in Canada to obtain dietary data. This dietary data included average daily calorie intake (kcal per day), daily servings of meat and vegetables, and consumption of sugar sweetened beverages (e.g. soft drinks, fruit juices).[41] Participants were asked the frequency of servings (daily, weekly, monthly, annually) for each food item and typical serving size (small, medium, large). Scores were calculated by summing responses for each food group.

Physical activity. Physical activity was assessed using two measures: hours per day engaging in vigorous physical activity (range: 1–5+) and days per week engaging in vigorous physical activity (range: 0–7).[42]

Alcohol consumption. Participants were asked about the typical number of alcoholic beverages consumed each week (continuous) and if they drink more than one drink a week (yes or no).

Tobacco use. Tobacco use was assessed using two measures: annual tobacco pack consumption (continuous) and number of years a participant has smoked (continuous).

Cardiovascular health. The overall cardiovascular health of participants was assessed using the American Heart Association Life's Simple 7 criteria (LS7), which includes diet, physical activity, BMI, smoking status, blood pressure, total cholesterol, and fasting glucose concentrations (score range: 0 to 14) (38). A score was assigned for each metric, depending on if the metric level was ideal (10–14), intermediate (8–9), or poor (0–7).[43]

Covariate variables

Covariates included age (continuous), sex (male or female), country of birth (US or outside of US), years living in the US for non-US born participants (<10, 10<20, 20<30, 30<40, >40 years), education level (<High School degree, <Bachelor's degree, Bachelor's degree, >Bachelor's degree), income (<$40K, $40K<$75K, $75K<$100K, >$100K), and health insurance status (yes or no).

Statistical analysis

First, descriptive statistics were conducted to describe the socio-demographic traits of participants and health indicator ranges in the sample. Next, confirmatory factor analysis and reliability estimates were calculated to assess the validity and reliability of instruments. Finally, structural equation modeling was used to determine associations among the study variables (Fig. 1), with each outcome assessed individually in the model. Direct and indirect paths in the model were assessed simultaneously. The covariates included in each model were age, sex, country of birth, education level, income, and health insurance status, which were included simultaneously with the model variables. MLR maximum likelihood is a feature in Mplus used for the analysis because it is robust to non-normality. Model fit was assessed using the following fit indices and thresholds: RMSEA (≤ 0.06), SRMR (≤ 0.08), and Comparative Fit Index (≥ 0.95).[44] Data were analyzed in SAS University, JASP 10.2, and Mplus 8.

RESULTS

The socio-demographic traits of the sample are presented in Table 1. The average age of participants was 56.7 years, and the sample was almost evenly split in terms of sex (male: 52.2%, female: 47.7%). The majority of participants were born outside of the US (98.2%) and had some form of health insurance (91.6%).

The averages, medians, interquartile ranges, and standard deviations for model variables are detailed in Table 2.

Results from the structural equation model analysis are detailed in Table 3. As with previous analyses of MASALA data, a positive direct association was seen between discrimination and psychological symptoms: CESD (range: ß 0.18–0.69, $P < 0.0001$), Anxiety (range: ß 0.21–0.64, $P < 0.0001$), and Anger (range: ß 0.15–0.38, $P < 0.0001$). As discriminatory incidents increased, so did symptoms of depression, anxiety, and anger. The direct paths between discrimination and health outcomes were not significant in the majority of models with the exception of HDL levels (ß −0.37, $P = 0.01$).

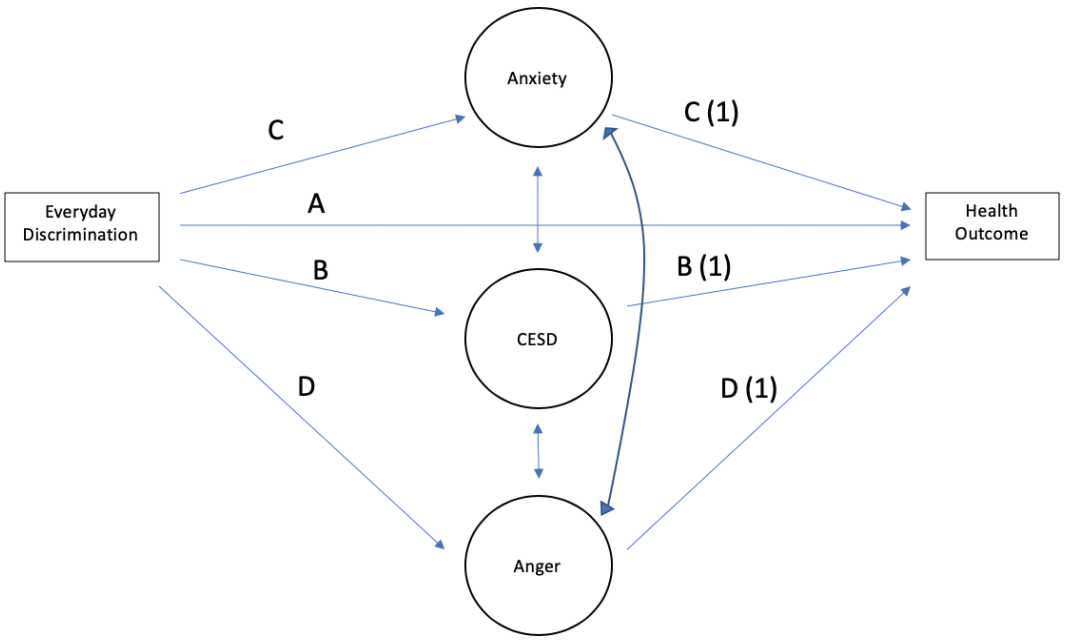

Figure 1. Study model.

Table 1. Demographic characteristics of the MASALA study population, (N = 1,164).

Age, years		Faith *N* (%)	
Mean	56.7	Hindu	796 (63.4)
Standard Dev.	9.4	Muslim	109 (9.4)
Range	39–83	Sikh	79 (6.8)
		Jain	77 (6.6)
Sex *N* (%)		None	64 (5.5)
Male	608 (52.2)	Christian	46 (3.9)
Female	556 (47.8)	Buddhist	12 (1.0)
		Zoroastrian	4 (0.3)
Country of birth *N* (%)			
US	21 (1.8)	**Health Insurance *N* (%)**	
non-US	1,143 (98.2)	Yes	1,067 (91.7)
		No	97 (8.3)
Years in the US *N* (%)			
<10	84 (7.4)		
10–19	272 (23.8)		
20–29	308 (27.0)		
30–39	311 (27.2)		
40+	167 (14.6)		
Education *N* (%)			
Less than High School	90 (7.7)		
Less than Bachelor's Degree	68 (5.8)		
Bachelor's Degree	355 (30.5)		
Graduate Degree	651 (55.9)		
Family Income *N* (%)			
<$40K	175 (15.5)		
$40K < $75K	151 (13.4)		
$75K < $100K	112 (9.9)		
>$100K	688 (61.1)		

We found significant indirect associations via psychological symptoms. Discrimination had an indirect positive association via depressive symptoms with tobacco use (tobacco pack: ß 1.08, P = 0.007). Conversely, discrimination had an indirect negative association via anxiety with alcoholic drinks per week (ß −1.88, P = 0.03) and tobacco use (tobacco pack: ß −1.05, P = 0.004). Significant indirect associations were found via anger with daily caloric intake (ß 108.03, P = 0.02), alcoholic drinks per week (ß 1.66, P = 0.002), and triglyceride levels (ß 11.88, P = 0.03).

DISCUSSION

Our results confirmed previous findings that perceived discrimination is associated with an increase in symptoms of psychological symptoms (depression, anger, and anxiety) among SAAs.[15,32] Discrimination was only directly associated with one health outcome – HDL levels. Our findings demonstrated that discrimination had indirect associations via psychological symptoms with proximate health indicators. The positive indirect associations via depression and anger with proximate outcomes (alcohol consumption, tobacco use, caloric intake) align with previous research showing that these psychological symptoms are linked to health risk behaviors.[45] Discrimination was associated with an increase in triglyceride levels via anger, which is supported by previous research on the association between stress and cholesterol levels.[31] The negative indirect associations via anxiety with alcohol consumption and tobacco use were not expected given the clinical literature on anxiety, and may be due to other factors, such as beneficial coping mechanisms.[46]

Our findings have clinical implications to note. Although discrimination was not found to be directly associated with distal health outcomes, discrimination was found to be associated with and mediated by symptoms of depression, anger, and anxiety. Therefore, asking about discrimination should be considered as part of the clinical care of SAAs to determine how care could be improved or adapted. For example, integration of primary care and

Table 2. MASALA health measures, (*N* = 1,164).

	Median	Interquartile range	Mean	Standard deviation
Discrimination	0.55	0.77	0.64	0.68
HbA1c, %	5.8	0.60	6.1	0.9
2-h post-challenge glucose, mg/dL	124	52	135	53
Fasting glucose, mg/dL	97	21	103	27
Total cholesterol, mg/dL	185	50	187	38
Triglycerides, mg/dL	118	70	131	68
LDL, mg/dL	109	44	111	32
HDL, mg/dL	48	18	50	14
CAC score	25	173	167	343
BMI, kg/m^2	25.7	4.9	26.2	4.0
Waist circumference, cm	92.9	13.3	93.6	10.3
Diastolic blood pressure, mmHg	74	14	74	10
Systolic blood pressure, mmHg	124	21	126	16
Vegetable intake (servings/day)	0.14	0.19	0.26	0.28
Meat intake (servings/day)	0.15	0.38	0.33	0.44
Sweet beverages	9.7	1.7	8.44	2.62
Total calories, kcal/day	1,630	665	1,685	505
Alcohol drinks per week	1.0	3	2.4	4.1
Tobacco pack-years	0	0	1.6	5.8
Smoking, years	0	0	3.5	9.5
Exercise (Days)	0	0	0.7	1.56
Exercise (Hours)	0	0	0.31	0.8
Life's simple 7 score	9	3	8.68	2.11
LS7 categories *N* (%)				
Poor (0–7)	320 (27.5)			
Intermediate (8–9)	399 (34.3)			
Ideal (10–14)	407 (34.9)			
BMI categories *N* (%)				
<25	419 (35.9)			
25–29.9	546 (46.9)			
≥30	198 (17.0)			
Alcohol (+1 drink per week) *N* (%)				
Yes	370 (31.8)			
No	794 (68.2)			

BMI, body mass index; LDL, low-density lipoproteins; HDL, high-density lipoproteins; CAC, coronary artery calcium.

mental health services or referrals to other health promotion services (e.g. tobacco cessation, nutritionist) should be considered in the care of SAAs to address health risk behaviors and prevent future adverse health outcomes. Existing research suggests underreporting of mental health conditions and low mental health service utilization among SAAs, which is an area for further clinical follow-up to ensure timely diagnosis and treatment.[47] Additionally, instruments for assessing symptoms of depression and anxiety may not work well with SAAs, as previous studies have shown psychosomatic symptoms are common among SAAs, which are typically not assessed in these instruments.[48,49]

These findings have implications for future research on health disparities among SAAs and the role of discrimination in these health disparities. Given the diversity of SAAs – by nativity status, generational differences, caste, skin color, and religion – researchers should examine how these factors shape discriminatory experiences and resulting health outcomes. For example, Muslims and Sikhs are more likely to face Islamophobia in comparison to other SAAs, and may be at increased risk for poor health as a result.[50] Although we were unable to ascertain the role of religious identity due to small sample sizes, future research should explore the moderating effects of religious identity on discrimination

Table 3. **Unstandardized (standardized) direct and indirect effects** of discrimination, (*N* = 1,164).**

Outcome A	*P*	CESD B	*P*	via CESD B (1)	*P*	Anxiety C	*P*	via Anxiety C (1)	*P*	Anger D	*P*	via Anger D (1)	*P*	RMSEA	CFI	SRMR
HbA1c																
0.07 (0.05)	0.05	0.69 (0.42)	<0.0001	0.006 (0.008)	0.91	0.64 (0.39)	<0.0001	−0.01 (−0.02)	0.81	0.38 (0.25)	<0.0001	0.02 (0.03)	0.47	0.03	0.83	0.04
2 h Glucose																
−0.96 (−0.01)	0.73	0.69 (0.42)	<0.0001	0.69 (0.01)	0.87	0.64 (0.39)	<0.0001	−1.79 (−0.03)	0.71	0.38 (0.25)	<0.0001	−0.42 (−0.009)	0.85	0.03	0.83	0.04
Fasting Glucose																
1.13 (0.02)	0.29	0.18 (0.42)	<0.0001	5.88 (0.06)	0.40	0.21 (0.39)	<0.0001	−7.66 (−0.10)	0.22	0.15 (0.25)	<0.0001	3.96 (0.06)	0.17	0.03	0.83	0.04
Total Cholesterol																
−1.48 (−0.02)	0.42	0.18 (0.42)	<0.0001	13.35 (0.10)	0.18	0.21 (0.39)	<0.0001	−8.17 (−0.08)	0.30	0.15 (0.25)	<0.0001	1.84 (0.02)	0.58	0.03	0.84	0.04
Triglycerides																
−0.37 (−0.004)	0.89	0.18 (0.42)	<0.0001	25.83 (0.12)	0.09	0.21 (0.39)	<0.0001	−24.69 (−0.14)	0.06	0.15 (0.25)	<0.0001	11.88 (0.08)	0.03	0.03	0.83	0.04
LDL																
−0.054 (−0.01)	0.72	0.18 (0.42)	<0.0001	8.37 (0.07)	0.33	0.21 (0.39)	<0.0001	−5.22 (−0.06)	0.45	0.15 (0.25)	<0.0001	2.12 (0.02)	0.47	0.03	0.83	0.04
HDL																
−1.37 (−0.07)	0.01	0.38 (0.25)	<0.0001	−0.74 (−0.05)	0.57	0.21 (0.29)	<0.0001	2.70 (0.10)	0.30	0.15 (0.23)	<0.0001	−1.90 (−0.06)	0.06	0.04	0.77	0.16
CAC score																
−17.66 (−0.03)	0.45	0.18 (0.42)	<0.0001	74.39 (0.06)	0.61	0.21 (0.39)	<0.0001	123.45 (0.13)	0.34	0.15 (0.25)	<0.0001	−22.72 (−0.02)	0.60	0.03	0.83	0.04
BMI																
−0.002 (0.000)	0.99	0.18 (0.42)	<0.0001	0.98 (0.07)	0.28	0.21 (0.39)	<0.0001	−0.53 (−0.04)	0.50	0.15 (0.25)	<0.0001	0.16 (0.01)	0.66	0.03	0.83	0.04
BMI (categorical)																
0.006 (0.006)	0.85	0.18 (0.42)	<0.0001	0.15 (0.06)	0.35	0.21 (0.39)	<0.0001	−0.05 (−0.03)	0.69	0.15 (0.25)	<0.0001	0.02 (0.01)	0.74	0.03	0.83	0.04
Waistline (cm)																
−0.43 (−0.02)	0.37	0.18 (0.42)	<0.0001	1.89 (0.05)	0.39	0.21 (0.39)	<0.0001	0.36 (0.01)	0.85	0.15 (0.25)	<0.0001	0.51 (0.02)	0.56	0.03	0.83	0.04
Diastolic BP																
−0.53 (−0.03)	0.25	0.18 (0.42)	<0.0001	1.10 (0.03)	0.62	0.21 (0.39)	<0.0001	−2.27 (−0.08)	0.24	0.15 (0.25)	<0.0001	1.33 (0.05)	0.09	0.03	0.84	0.04
Systolic BP																
−0.79 (−0.03)	0.29	0.69 (0.42)	<0.0001	0.94 (0.06)	0.30	0.64 (0.39)	<0.0001	−1.58 (−0.11)	0.12	0.38 (0.25)	<0.0001	0.79 (0.05)	0.13	0.03	0.84	0.04
Vegetable intake																
0.01 (0.03)	0.18	0.18 (0.42)	<0.0001	−0.006 (−0.006)	0.93	0.21 (0.39)	<0.0001	−0.07 (−0.09)	0.20	0.15 (0.25)	<0.0001	0.01 (0.01)	0.62	0.03	0.83	0.04
Meat intake																
−0.003 (−0.004)	0.93	0.18 (0.42)	<0.0001	0.30 (0.20)	0.06	0.21 (0.39)	<0.0001	−0.18 (−0.15)	0.12	0.15 (0.25)	<0.0001	0.03 (0.03)	0.57	0.03	0.83	0.04
Sweet Beverages																
−0.20 (−0.05)	0.48	0.69 (0.42)	<0.0001	0.36 (0.15)	0.27	0.64 (0.39)	<0.0001	−0.46 (−0.19)	0.25	0.38 (0.25)	<0.0001	0.06 (0.02)	0.77	0.03	0.83	0.04

Continued

Table 3. (Continued)

Outcome A	*P*	CESD B	*P*	via CESD B (1)	*P*	Anxiety C	*P*	via Anxiety C (1)	*P*	Anger D	*P*	via Anger D (1)	*P*	RMSEA	CFI	SRMR
Calories Per Day																
50.02 (0.06)	0.07	0.18 (0.42)	<0.0001	173.49 (0.10)	0.20	0.21 (0.39)	<0.0001	−177.37 (−0.13)	0.12	0.15 (0.25)	<0.0001	108.04 (0.09)	0.02	0.03	0.83	0.04
Drinks Per Week																
−0.19 (−0.03)	0.46	0.18 (0.42)	<0.0001	1.32 (0.09)	0.20	0.21 (0.39)	<0.0001	−1.88 (−0.16)	0.03	0.15 (0.25)	<0.0001	1.66 (0.17)	0.00	0.03	0.83	0.04
Alcohol																
0.02 (0.006)	0.87	0.18 (0.42)	<0.0001	0.60 (0.06)	0.36	0.21 (0.39)	<0.0001	−0.69 (−0.09)	0.23	0.15 (0.25)	<0.0001	0.39 (0.06)	0.11	0.03	0.83	0.04
Tobacco Pack																
−0.14 (−0.01)	0.65	0.69 (0.42)	<0.0001	1.08 (0.20)	0.007	0.64 (0.39)	<0.0001	−1.05 (−0.20)	0.004	0.38 (0.25)	<0.0001	0.09 (0.01)	0.66	0.03	0.84	0.04
Smoke (year)																
−0.59 (−0.04)	0.14	0.18 (0.42)	<0.0001	4.18 (0.13)	0.07	0.21 (0.39)	<0.0001	−1.73 (−0.06)	0.37	0.15 (0.25)	<.00001	0.36 (0.01)	0.64	0.03	0.84	0.04
Exercise (days)																
−0.003 (−0.001)	0.96	0.69 (0.42)	<0.0001	0.09 (0.06)	0.32	0.64 (0.39)	<0.0001	−0.11 (−0.08)	0.26	0.38 (0.25)	<0.0001	0.004 (0.003)	0.94	0.03	0.83	0.04
Exercise (hours)																
0.07 (0.06)	0.07	0.18 (0.42)	<0.0001	0.12 (0.04)	0.47	0.21 (0.39)	<0.0001	−0.21 (−0.09)	0.15	0.15 (0.25)	<0.0001	0.009 (0.005)	0.89	0.03	0.83	0.04
LS7 (continuous)																
0.02 (0.009)	0.77	0.18 (0.42)	<0.0001	−0.67 (−0.09)	0.17	0.21 (0.39)	<0.0001	0.38 (0.06)	0.37	0.15 (0.25)	<0.0001	−0.25 (−0.05)	0.20	0.03	0.83	0.04
LS7 (categorical)																
−0.01 (−0.009)	0.75	0.18 (0.42)	<0.0001	−0.28 (−0.10)	0.13	0.21 (0.39)	<0.0001	0.21 (0.09)	0.21	0.15 (0.25)	<0.0001	−0.09 (−0.04)	0.20	0.03	0.83	0.04

** The table details the unstandardized ß (standardized ß) for each model path. The column headings (A, B, C, etc.) correspond with labeled model paths in Fig. 1. Covariates included in each model were age, sex, country of birth, education level, family income, and health insurance status.

CESD, Center for Epidemiological Studies Depression; RMSEA, Root Mean Square Error of Approximation; CFI, Comparative Fit Index; SRMR, Standardized Root Mean Residual

Model fit parameters were moderate overall, with excellent RMSEA (≤0.06) and SRMR (≤0.08) estimates, and poor CFI (<0.95) estimates.[44] Modifications were made to improve model fit, which are detailed in Table 4.

Table 4. Model modifications.

	RMSEA	CFI	SRMR
No modifications	0.04	0.79	0.04
CESD items			
'Had crying spells' with 'Felt sad'	0.04	0.80	0.04
'Was happy' with 'Felt hopeful about the future'			
'Enjoyed life' with 'Was happy'	0.04	0.81	0.04
'Felt that people disliked me' with 'People were unfriendly'	0.04	0.82	0.04
Anxiety items			
'Satisfied with myself' with 'Feel secure'	0.04	0.82	0.04
Anger items			
'Feel infuriated good job/poor evaluation' with 'It makes me furious when I'm criticized'	0.03	0.83	0.04
CESD and anxiety items			
'Feel like a failure' with 'Thought my life had been a failure'	0.03	0.83	0.04

Legend:

CESD, Center for Epidemiological Studies Depression; RMSEA, Root Mean Square Error of Approximation; CFI, Comparative Fit Index; SRMR, Standardized Root Mean Residual

and harmful coping behaviors. Other moderating effects to consider include socioeconomic status and community support, as SAAs of a high economic and educational status may be insulated from discrimination because of their home and work environments, whereas SAAs of a lower socioeconomic status may have increased exposure to discrimination. Previous research has suggested that community support (e.g. family, friends, faith groups) and coping styles may be a buffer against discrimination.[14] Future studies should consider how the absence or abundance of these sources of support affect the impact of discrimination.

Strengths and limitations

This analysis has some strengths to note. First, this study contributes to the sparse literature available on subgroups of Asians, particularly SAAs. Few studies have explored the effects of discrimination and role of mediators between discrimination and proximate and distal health outcomes. Additionally, we used clinical data that was available from the participants in MASALA. Lastly, we used symptoms of psychological symptoms as mediators, which reflect participants' current psychological state, rather than a self-reported mental health diagnosis.

There are limitations to note. First, this was a cross-sectional study. As such, we are unable to establish temporality between symptoms of psychological symptoms and outcome measures. Future studies should incorporate a longitudinal design to ascertain temporality of the variables. Additionally, the Everyday Discrimination scale does not measure structural forms of discrimination, which as noted earlier is salient to the SAA experience. Furthermore, this scale may not fully capture interpersonal forms of discrimination that SAAs encounter. Another limitation is the absence of tobacco questions regarding smokeless forms of tobacco, which is commonly used among SAAs.[51] Finally, generalizability of the study is limited. We were unable to perform subgroup analysis by country of birth to parse out differences by type of SAA, as there was not enough representation from certain communities of the South Asians diaspora (e.g. Bangladeshis, Pakistanis), with Indian Americans being largely represented in MASALA. While the prevalence of diabetes, obesity, and cardiovascular disease may differ by native South Asians (as well as regions of the South Asian subcontinent), few studies have explored health outcomes by subgroups of South Asians.[52–54] Additionally, educational attainment and socioeconomic status were unequally represented and may affect study results. Given the high educational attainment and household income of the participants in this study, future studies should include a more representative sample, with SAAs living in different areas of the US, with a wide range of socioeconomic backgrounds.

CONCLUSION

These findings advance our understanding of the health implications of discrimination, and associations between psychological symptoms and adverse medical outcomes in an understudied health disparities population. SAAs are often categorized as 'model minorities', a divisive and harmful label, which has contributed to the paucity of research on SAAs' experiences of discrimination and health. Reducing health disparities among SAAs will require greater inclusion and better understanding of how discrimination may lead to differences in health risks and outcomes in diverse groups.

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