Ethnic-group socioeconomic status as an indicator of community-level disadvantage: A study of overweight/obesity in Asian American adolescents

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ABSTRACT

Asian American children and adolescents are an under-investigated subpopulation in obesity research. Informed by a wide socioeconomic diversity among Asian American ethnic groups, this study explored ethnic-group socioeconomic status (SES) as an indicator of community-level disadvantage that may influence overweight/obesity in Asian American adolescents. We hypothesized that ethnic-group SES was inversely associated with overweight/obesity in Asian American adolescents. Multiple logistic regression models were fitted using a sample of 1525 Asian American adolescents ages 12—17 from pooled 2007—2012 California Health Interview Survey (CHIS) data. Age, gender, nativity, individual-level SES (income and education), and two lifestyle variables (fast food consumption and physical activity) were controlled for. We found that adolescents in high- or middle-level SES ethnic groups were far less likely to be overweight/obese than those in low-SES ethnic groups. Further, these relationships were more pronounced for foreign-born adolescents but not significant for U.S.-born adolescents. Ethnic-group SES may be a meaningful indicator of community-level socioeconomic disparities that influence the health of Asian Americans and, potentially, other populations with high proportions of immigrants of diverse socioeconomic and ethnic backgrounds.

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1. Introduction

With the understanding that individual-based explanations of ill health are insufficient, community contextual factors have received a great deal of research attention in recent decades. Neighborhoods with predominantly low-income and racial minority residents have been a key focus in this paradigm. Poverty and associated social and physical attributes in such neighborhoods have been linked to poor health outcomes including greater mortality, adverse mental health, greater incidence of chronic health issues, and adverse child health (Diez Roux and Mair, 2010; Pickett and Pearl, 2001).

While low neighborhood socioeconomic status (SES) has been well-established as a reliable indicator of community-level concentrated disadvantage, it has been underexplored in Asian American health research. In studies that have, it was not a significant predictor for Asian American health (Cook et al., 2015; Gee et al., 2007). Research focus on neighborhood effects on health for Asian Americans has shifted to co-ethnic concentration or density, i.e., residential concentration of a single racial or ethnic group (Becares et al., 2012). Informed mostly by Chinese- and Korean-American experiences, Asian ethnic neighborhoods are seen as positive educational and occupational environments that encourage upward mobility among residents (Zhou and Kim, 2006), serving as an appropriate case for investigating heterogeneity in neighborhood effects across contexts (Logan, 2011; Walton, 2012). However, as was the case for the larger body of literature on co-ethnic density (Becares et al., 2012), findings from Asian-specific research are mixed, with some reporting no significant association between co-ethnic density and health risk behavior such as

drinking (Cook et al., 2015), and other studies finding adverse (Hong et al., 2014) or positive effects of co-ethnic density on mental health (Mair et al., 2010). Co-ethnic density, therefore, is not yet established as a reliable significant community-level predictor of Asian American health.

Despite strong evidence in the health disparities paradigm linking socioeconomic disadvantages to health, there is limited understanding of disadvantage as it affects Asian Americans. Past research indicates that SES measures may not be equivalent across racial groups (Williams and Mohammed, 2009). It has been suggested that Asian American experiences may be qualitatively different from other U.S. racial groups, given that established markers of SES such as education and income, on the individual- or neighborhood-level, have not sufficiently assessed the effects of social position on Asian American health (de Castro et al., 2010; Gee et al., 2009). Alternative indicators of individual-level SES such as perceived economic opportunities and subjective SES have been identified as predictors of Asian American health (de Castro et al., 2010; Gong et al., 2012). However, little is known about community-level disadvantage that may uniquely influence Asian American health. This is a notable gap in the current literature.

To address this gap, we explore ethnic-group SES as an indicator of community-level disadvantage (or advantage) that may significantly affect Asian American health—specifically, overweight or obesity in adolescents. We operationalize this concept by the degrees to which Asian ethnic groups in the U.S. are exposed to community-level deprivation. This concept is informed by the wide socioeconomic diversity among Asian ethnic groups representing over 20 national origins in the U.S. alone (Zhou and Xiong, 2005). Some ethnic groups (such as Asian Indian, Japanese, and Chinese, mostly large and more-established in the U.S.) have incomes and educational levels that exceed national averages, while others (e.g., Hmong, Cambodian, and Vietnamese) have the lowest incomes and educational levels (United States Census Bureau, 2010—2014). Asian ethnic groups in the U.S. thus command a varying degree of resources, with some groups having a significant level of human or economic capital and others arriving as refugees with scant resources. The socioeconomic resources ethnic groups command are documented to be integral to the well-being of Asian immigrants, as they often draw upon ethnic resources such as business or labor market information, subsidized loans, and ethnic customers and institutions (Light and Bonacich, 1988; Zhou and Xiong, 2005). With about 60% of Asian Americans being foreign-born (United States Census Bureau, 2010—2014) and many of the rest being born into immigrant families, ethnic resources are likely to have important effects on their well-being.

The concept of ethnic-group SES is also grounded in the theory of segmented assimilation. This theory suggests that children of immigrants assimilate into different socioeconomic segments of American society with different sets of norms and behaviors, depending upon the economic, human, and social capital available to their parents and communities (Portes and Rumbaut, 2001). This theory also points to the importance of these resources in some ethnic groups that serve to insulate adolescents from health risk behaviors (Nagasawa et al., 2001; Zhou and Kim, 2006). Implied in this theory is the notion of socioeconomic disparities across Asian subgroups.

Ethnic group SES, therefore, concerns ethnic resources more-advantaged groups can draw upon from their specific ethnic communities. Conversely, it captures the additional hardships or barriers more-disadvantaged groups may experience from having limited resources, which may be associated with disproportionate burden of ill health. Somewhat akin to neighborhood SES, an established contextual predictor of health for disadvantaged populations, ethnic-group SES may be a meaningful indicator to capture community-level advantage (or disadvantage) for Asian Americans beyond the individual-level. Our investigation centering on ethnic-group SES has great potential to advance disparities research as it concerns the health of Asian Americans and, potentially, other populations with high proportions of immigrants of diverse socioeconomic and ethnic backgrounds.

Overweight or obesity in Asian American children warrants research attention. Childhood obesity, a current global issue, is linked to a host of health, behavioral, and psychological problems including: chronic health conditions such as Type 2 diabetes and asthma (Daniels et al., 2005), and developmental problems such as low self-esteem and poor academic performance (Judge and Jahns, 2007; Storch et al., 2007). Also, overweight children are more likely to be obese or overweight as adults and at high risk for associated adult health problems such as hypertension, Type 2 diabetes, and certain cancers (Dietz, 1998). Obesity is becoming more prevalent among Asian Americans, which increased 102% in 2002—2012, far higher than a 35% increase in whites, and Asians also tend to develop metabolic syndrome at lower body mass index (BMI) than other populations (Yi et al., 2015). As childhood obesity or overweight is a precursor of adult health problems, it is important to identify the profiles of Asian subgroups at high risk of childhood obesity to inform targeted interventions.

Asian American children and adolescents are an under-investigated subpopulation in obesity research. The small body of literature on Asian American childhood obesity, mostly using a single ethnic group sample (mostly Chinese, and to a lesser degree, Hmong) focused on individual-level predictors such as gender and U.S. nativity (Popkin and Udry, 1998), parental acculturation (Chen et al., 2011; Jain et al., 2012), and maternal education (Chen et al., 2011). There is little information about the specific profiles of the subgroups of Asian American children at high risk of obesity or overweight. To our knowledge, only one study (Cook et al., 2016) used a representative sample of diverse Asian ethnic groups to identify two Asian ethnicities (Filipino and Southeast Asian) that are associated with high risk of overweight in adolescents. This same study also found multiplicative interactions between ethnicity and individual-level SES; the odds of being overweight or obese were far higher than all other Asian adolescents for those in two ethnic groups with the lowest average per capita incomes (i.e. Southeast Asian and Vietnamese) and who also had low family incomes. These findings point to high risks of overweight or obesity for those in low-SES Asian ethnic groups.

Informed by these prior findings, we aimed to formally test the hypothesis that ethnic-group SES was inversely associated with overweight or obesity in Asian American adolescents. In doing so, we also drew upon past research that established low individual- and community-level SES as key predictors of childhood obesity (Carroll-Scott et al., 2013; Murasko, 2011; Singh et al., 2008). Our investigation of low ethnic-group SES as a predictor of overweight or obesity in Asian American adolescents explores this disparities thesis in the context of Asian ethnic communities, i.e., their wide socioeconomic diversity.

We also examined whether the association between ethnic-group SES and adolescent overweight or obesity varied by nativity status, as foreign-born adolescents may have closer ties to and are more influenced by their ethnic community than U.S.-born adolescents. Children's nativity status is an important contextual factor that moderates the effects of various ecological factors (e.g., school, family, and peers) on health behaviors (Gil et al., 2000; Prado et al., 2009).

2. Materials and methods

2.1. Data

A sample of 1525 Asian American adolescents ages 12—17 from pooled 2007—2012 California Health Interview Survey (CHIS) data was used. Utilizing a county-based, stratified sampling design, CHIS conducts a household survey that randomly selects adults, adolescents, and children. With the permission of the adult parents/guardians, adolescents were interviewed. CHIS uses a landline sample administered through a Computer-Assisted Telephone Interview system with random-digit dialing, and since 2007, a statewide cell phone sample as well. We used seven Asian ethnic categories from CHIS: Chinese (including Taiwanese), Japanese, Korean, Filipino, South Asian (including Bangladeshi, Bhutanese, Goanese, Indian, Pakistani, and Sri Lankan), Vietnamese, and Southeast Asian other than Vietnamese (including Burmese, Cambodian, Hmong, Indonesian, Laotian, Malaysian, and Thai) referred to hereafter as "Southeast Asian." In addition to English and Spanish, CHIS is administered in four Asian languages: Cantonese, Mandarin, Korean, and Vietnamese. Still, the vast majority (about 94%) of our adolescent sample responded to the survey in English.

Census tract data from the American Community Survey (ACS) (United States Census Bureau, 2010—2014) were used to construct an ethnic-group SES variable. ACS uses monthly samples to produce annually updated estimates for the same small areas (census tracts and block groups) formerly surveyed via the decennial census. We used the most recent 5-year estimates, more inclusive than 3-year estimates for geographic areas with 25,000 or people or 1-year estimates for larger areas (United States Census Bureau, 2014). Census tract data were used to characterize individuals and groups by the socioeconomic characteristics of their immediate residential area (Krieger, 2006).

2.2. Measures

Due to the lack of measures to assess ethnic group SES in the current literature, we used a proxy that captures the extent to which each Asian ethnic group on average is exposed to socioeconomic disadvantage (i.e., concentration of residents with low socioeconomic status in their residential areas). Exposure to socioeconomic disadvantage suggests that residents of the ethnic community may have less human and economic capital and other instrumental support to draw upon. Given that exposure is not limited to a single source, we distinguish between two community contextual measures—area-level disadvantage index (essentially capturing neighborhood disadvantage) and ethnic-group SES (capturing disadvantage associated with one's ethnic community). The latter, the primary focus of the current study, was constructed using the former.

The area-level disadvantage index is based on five indicators of area-level socioeconomic disadvantage linked with the respondent's address: proportion of persons aged 25 years or older who did not have a four-year college degree, proportion of males aged 16 years or older who were unemployed, proportion of persons with incomes below the federal poverty level, proportion of households that receive public assistance, and proportion of female-headed households. These indicators have been used in prior research to assess neighborhood disadvantage (Barber et al., 2016; Desmond and Kubrin, 2009; Sampson et al., 2008). While the proportion of persons without a high school diploma has been commonly used in neighborhood research, we opted to use the proportion of adults without a 4-year college degree, in light of high educational attainment by Asians in the U.S., over half of whom have 4-year college or advanced degrees (United States Census Bureau, 2010—2014). Using our sample, the Cronbach's alpha for this construct was 0.72. Pooling across all adolescent participants of Asian descent, we summed the standardized z-score for each disadvantage indicator to construct an area-level disadvantage index, with a higher index denoting a greater level of disadvantage.

For ethnic group SES, we then computed the mean of area-level disadvantage index scores for each ethnicity; using the tertiles of these mean scores, we constructed an ordinal ethnic-group SES variable with three categories representing high-, middle-, and low-level ethnic-group SES. Low-SES ethnic groups, therefore, are those that tend to reside in low-SES residential areas experiencing greater area-level disadvantage, and so on.

Using the definitions adopted by the Centers for Disease Control and Prevention (Ogden and Flegal, 2010), overweight is defined as a BMI at or above the 85th and below the 95th percentile and obesity as a BMI at or above the 95th percentile for children and teens of the same age and gender. Weight status in CHIS is based on height and measure reported by adolescent participants. Because of the small number of obese adolescents in our sample, we created a variable combining both overweight and obesity, referred to hereafter as "overweight/obesity."

Family income and parental education level were used to assess individual-level SES of the respondents. Following Braveman et al. (2005), we examined parental income and education separately since combining them into a composite would make it impossible to tease out the independent effect of each. Family income as a proportion of the federal poverty level (FPL) and educational level are both categorical variables in CHIS, which we recoded to create two dichotomous variables. Low family income indicates an income lower than 300% of the FPL *versus* higher income. Since information about parental education level was unavailable in CHIS, we used a proxy indicating the highest educational level for the adults in the family, having a 4-year college or advanced degree *versus* a lower education level. Nativity status was assessed using a dichotomous variable indicating that the adolescent was born in the U.S. *versus* abroad.

Physical activity was assessed using a continuous variable indicating the number of days in the past week when the respondent was physically active for 60 min or more. Fast food consumption was a dichotomous variable indicating any consumption of fast food in the past week.

2.3. Analysis

We first conducted a series of univariate and bivariate analyses to understand the demographic characteristics of all Asian American adolescents and to examine whether these characteristics and the prevalence of overweight/obesity varied across subgroups defined by income levels and ethnicity. We fitted a multiple logistic regression model to test the hypothesis that ethnic-group SES was inversely associated with overweight/obesity in Asian American adolescents, controlling for demographic variables and the two lifestyle variables. We then stratified this analysis by nativity status to examine whether the associations of ethnic-group SES with overweight/obesity varied by nativity status. Individual income and education were also adjusted in all of these models to assess independent effects of ethnic-group SES above and beyond those of individual SES.

With the exception of the univariate analysis performed to understand sample characteristics, all analyses were conducted using the survey estimation procedure of Stata version 13 (Stata Corporation, 2013), accommodating all design, non-response, and post-stratification adjustments. This study was approved by an Institutional Review Board.

3. Results

3.1. Sample characteristics

Demographic characteristics of Asian American adolescents in our CHIS sample are provided in Table 1. Slightly over two-thirds (68%) were born in the U.S. Over half of Asian American adolescents had family incomes of 300% of the FPL or higher (56%) and a parent or a guardian with a 4-year college or an advanced degree (57%). As for Asian ethnicity, Chinese was the largest ethnic group in the sample (27%), followed by Vietnamese (17%), Koreans (15%), and Filipinos (12%). Southeast Asians were the smallest group (3%).

In a series of bivariate analyses (also in Table 1), we found a significant association between family income and Asian ethnicity ($p < 0.0001$); the proportions of adolescents with relatively-high family incomes were higher among Chinese (68%) and South Asians (61%) than Southeast Asians (25%) and Vietnamese (32%). Parental educational level was also significantly associated with ethnicity, with South Asians having the highest proportion of the adults in the family with a 4-year college or advanced degree (71%), and Vietnamese (27%) and Southeast Asians (33%) the lowest.

3.2. Socioeconomic diversity among Asian American ethnic groups

Table 2 shows the diversity among Asian American ethnic groups in California as captured by our area-level disadvantage index scores. With lower scores denoting higher SES, South Asians had the highest ethnic-group SES, followed by Japanese. Southeast Asians had the lowest ethnic-group SES, followed by Vietnamese and Filipinos ($p < 0.05$).

3.3. Prevalence of overweight/obesity among Asian American subgroups

Relevant to our research question, the bivariate analyses (Table 3) provided overweight/obesity prevalence by Asian ethnicity to illuminate the profiles of ethnic groups included in this study. The proportion of Asian American adolescents who were overweight/obese was higher for those with low family incomes (24.7%) than their counterparts with higher incomes (13.4%) ($p < 0.01$). The proportion of Asian American adolescents who were overweight/obese was higher for those in the low-SES ethnic groups (29.0%) than the proportions for middle-level and high-level SES ethnic groups (11.6% and 12.8%, respectively). By ethnicity, prevalence of overweight/obesity was the lowest for Japanese (4.8%) and the highest for Filipino (26.3%) and Southeast Asians (25.5%).

3.4. Asian ethnicity and adolescent overweight/obesity

As Table 4 shows, area-level disadvantage was significantly associated with overweight/obesity for all Asian American adolescents (Model 1). In the model that included the ethnic-group SES variable (Model 2), both high- and middle-level ethnic-group SES were inversely associated with overweight/obesity, with the middle-level ethnic-group SES (AOR = 0.30) being slightly more protective from overweight/obesity than high ethnic-group SES (AOR = 0.33). These associations were far more pronounced in the foreign-born model (Model 4; AORs = 0.04 and 0.09) but were not significant in the U.S.-born model (Model 3).

Table 2
Socioeconomic disadvantage among Asian American ethnic groups in California.

Ethnicity	Mean of Area-Level Disadvantage Index Score
South Asian	−1.45
Japanese	−1.23
Chinese	−1.06
Korean	−0.73
Filipino	1.37
Vietnamese	2.17
Southeast Asian	3.15

$P < 0.05$.

Table 3
Prevalence of overweight/obesity in Asian American adolescents by family income and ethnicity.

	Overweight (%)	p
Family Income		
<300% of Federal Poverty level	24.7	**
≥300% of FPL	13.4	
Ethnic Group SES		
Low ethnic-group SES	29.0	***
Middle-level ethnic-group SES	11.6	
High ethnic-group SES	12.8	
Ethnicity		
Chinese	9.0	**
Japanese	4.8	
Korean	15.1	
Filipino	26.3	
South Asian	16.6	
Vietnamese	16.2	
Southeast Asian	25.5	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, ****$p < 0.0001$.

Table 1
Demographic characteristics of Asian American adolescents, CHIS.

Characteristics	All (N = 1525)	Chinese (n = 414)	Japanese (n = 61)	Korean (n = 227)	Filipino (n = 179)	South Asian[b] (n = 196)	Vietnamese (n = 257)	Southeast Asian[c] (n = 45)	Mixed ethnicity (n = 146)	p
Gender: Female	47%	46%	55%	51%	48%	52%	53%	50%	49%	p > 0.05
Age (Mean; Standard Error)	14.53 (0.06)	14.74 (0.11)	14.70 (0.35)	14.56 (0.16)	14.41 (0.14)	14.43 (0.14)	14.44 (0.16)	14.35 (0.36)	14.36 (0.25)	p > 0.05
U.S.-born	68%	69%	85%	44%	66%	64%	66%	79%	84%	**
Parental education: 4-year college or advanced degree	57%	62%	66%	64%	64%	71%	27%	33%	58%	****
Family income ≥ 300% FPL[a]	56%	68%	57%	53%	60%	61%	32%	25%	64%	****
Any fast food, past week	71%	69%	83%	68%	81%	67%	78%	86%	74%	p > 0.05
Days of physical activity, past week (Mean; Standard Error)	2.76 (0.06)	2.99 (0.16)	2.64 (0.28)	2.76 (0.23)	2.59 (0.18)	3.25 (0.26)	2.61 (0.19)	2.18 (0.55)	2.79 (0.29)	p > 0.05

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, ****$p < 0.0001$.
[a] FPL: Federal Poverty Level.
[b] South Asian category includes individuals of Bangladeshi, Bhutanese, Goanese, Indian, Pakistani, and Sri Lankan descents.
[c] Southeast Asian category includes individuals of Burmese, Cambodian, Hmong, Indonesian, Laotian, Malaysian, and Thai descents.

Table 4
Predictors of overweight/obesity in Asian American adolescents.

	Model 1 (All)			Model 2 (All)			Model 3 (U.S.-Born)			Model 4 (Foreign-born)		
	n = 1258			n = 1258			n = 976			n = 310		
	AOR		95% CI	AOR		95% CI	AOR		95% CI	AOR		95% CI
Male[a]	3.19	***	1.79, 5.69	3.32	***	1.88, 5.84	2.67	**	1.47, 4.87	10.58	**	2.48, 45.06
Age	0.90		0.78, 1.03	0.92		0.81, 1.05	0.89		0.75, 1.06	0.90		0.66, 1.23
US-born[b]	0.87		0.47, 1.60	0.69		0.36, 1.32	—		— —	—		— —
Parental college[c]	1.86		0.97, 3.58	1.71		0.86, 3.37	2.10		0.98, 4.47	1.43		0.32, 6.44
Family income <300% poverty level[d]	1.77		0.90, 3.45	2.24	**	1.26, 3.99	2.99	**	1.64, 5.44	1.17		0.36, 3.80
Area-level disadvantage index[e]	1.12	*	1.02, 1.22	—		— —	—		— —	—		— —
Middle-level ethnic-group SES[f]	—		— —	0.30	**	0.15, 0.60	0.60		0.31, 1.15	0.04	***	0.01, 0.20
High-level ethnic-group SES[f]	—		— —	0.33	*	0.14, 0.78	0.48		0.20, 1.14	0.09	*	0.01, 0.56
Any fast food in past week[g]	1.23		0.61, 2.49	1.13		0.57, 2.22	1.08		0.59, 1.98	1.75		0.35, 8.77
Days of physical activity in past week	0.99		0.90, 1.09	1.00		0.91, 1.10	1.02		0.91, 1.14	0.98		0.79, 1.20
Constant	0.29		0.03, 2.49	0.40		0.05, 2.98	0.32		0.02, 4.82	0.75		0.10, 55.58

Notes: Logistic regression models using weighted data. AOR = Adjusted odds ratios; CI=Confidence intervals.
*p < 0.05, **p < 0.01, ***p < 0.001.
[a] With female as the reference category.
[b] With foreign-born as the reference category.
[c] With parent or guardian having less than a college degree as the reference category.
[d] With family incomes of 300% or higher than the Federal Poverty Level as the reference category.
[e] Sum of z scores of five area-level disadvantage indicators: proportions of persons without a four-year college degree, unemployed males, persons under poverty level, households receiving public assistance, and female-headed households; higher score indicates a higher degree of disadvantage.
[f] With low ethnic-group SES as the reference category.
[g] With no fast food consumption as the reference category.

Low family income was significantly associated with obesity/overweight for all Asian American adolescents (AOR = 2.24) and for the U.S.-born (AOR = 2.99), but not for the foreign-born. Being male was a consistent predictor of overweight/obesity in all models. The two lifestyle factors (i.e., physical activity and fast food consumption) were not associated with overweight/obesity in any of these models.

4. Discussion

Our findings support our hypothesis that ethnic-group SES is inversely associated with overweight/obesity in Asian American adolescents. Adolescents in high- or middle-level SES ethnic groups were far less likely to be overweight or obese than those in low-SES ethnic groups. These relationships were more pronounced for foreign-born adolescents but not significant for the U.S.-born, suggesting that the effects of ethnic-group SES may attenuate as the socioeconomic or cultural ties with the ethnic community weaken.

The results reflecting increased odds of overweight/obesity for low-SES ethnic groups are consistent with past research linking low individual and neighborhood SES to childhood overweight/obesity in the U.S. and globally (Carroll-Scott et al., 2013; Murasko, 2011; Wang and Lim, 2012). Our findings also hint at low ethnic-group SES as an indicator of community-level disadvantage, providing a more nuanced understanding of socioeconomic disparities that may differentially influence the health of Asian Americans in diverse segments.

Our findings are consistent with segmented assimilation theory (Zhou and Xiong, 2005) that highlights diverse paths within the immigrant population, with children in resource-poor subgroups disproportionately experiencing adverse health and social outcomes. These findings also call into question the salutary health effects of co-ethnic density for Asian Americans, one reflecting the already-debunked model minority myth (Choi and Lahey, 2006), that this population commands greater cultural and socioeconomic resources enabling upward mobility (Zhou and Kim, 2006). Given the wide socioeconomic diversity among Asian Americans upon which our concept of ethnic-group SES is grounded, this premise should be reconsidered.

Though not the primary focus of this study, our findings on the inverse association between area-level disadvantage index scores and obesity/overweight in adolescents (Table 4) are worth noting. As this index is based upon items commonly used to assess neighborhood disadvantage, our findings are consistent with past neighborhood research that has demonstrated adverse health effects associated with neighborhood disadvantage. Given that past research examining neighborhood disadvantage on other health outcomes in Asian Americans such as drinking and other substance use did not yield significant effects (Cook et al., 2015; Gee et al., 2007), the relationship between neighborhood disadvantage and health for Asian Americans may depend on the specific health outcome. Our findings regarding the ethnic-group SES measure, constructed using the mean of disadvantage index scores for each ethnicity, suggest ethnic patterning of neighborhood disadvantage for Asian Americans in a way to reveal a higher degree of exposure to neighborhood disadvantage of some ethnic groups than others. To better understand multiple layers of disadvantage that may independently and synergistically affect Asian American health, future research might explore the complex interplay between neighborhood effects from where one lives and ethnic-group disadvantage from one's membership to an ethnic community.

Past research has duly noted the differences in health and social outcomes among Asian American ethnic groups, mostly among a few large ones—for example, reporting that Filipino youth are at higher risk for problem behaviors than Chinese and Korean American youth (Choi, 2008). However, current practices of descriptively comparing health outcomes across a small number of Asian ethnic groups, using ethnic categories as proxies for unspecified cultural and/or socioeconomic conditions that implicitly account for heterogeneous outcomes, are limiting so long as those conditions remain unspecified (Cook et al., 2015). To help specify those conditions, we tested a hypothesis that centered on socioeconomic conditions using a construct to characterize them in quantifiable terms.

Our finding that middle-level ethnic-group SES is more protective than high-level ethnic-group SES from overweight/obesity may be largely due to the relatively high prevalence of overweight/

obesity among South Asians (the ethnic group that collectively had the highest SES in our sample) compared to other Asian ethnic groups. In this respect, South Asians are a deviation from the overall inverse relationship between ethnic-group SES and overweight/obesity reported here. Traits other than ethnic-group SES may also explain the varying degree of obesity/overweight among Asian American ethnic groups, which we did not explore due to the lack of information in CHIS.

We consistently found elevated odds of obesity/overweight for low-SES ethnic groups, particularly for the foreign-born. Adolescents in the low-SES ethnic groups— Filipino, Southeast Asian, and Vietnamese—bear disproportionate burden of health and social problems including depression (Javier et al., 2007; Ying and Han, 2007), substance abuse (Javier et al., 2007; Lee and Kirkpatrick, 2005), gang violence (Choi, 2008), and chronic health conditions such as asthma and hypertension (Javier et al., 2007; Munger et al., 1991). Our findings on the high risk of overweight/obesity is only another layer of health disparities these low-SES ethnic groups already experience.

We do not have information about the specific mechanisms by which low ethnic-group SES is associated with adolescent overweight/obesity for Asian American adolescents. Mechanisms involving the relationship between low SES and childhood obesity are suggested in the current literature. For example, socioeconomic factors in childhood and adolescence may provide different environmental exposures that influence eating and physical activity, parental modeling, and home food availability and accessibility (Cohen et al., 2010; Zarnowiecki et al., 2014). The nature and impact of these mechanisms on Asian Americans are poorly understood.

Still, existing literature offers some clues. Obesogenic dietary practices in the low-SES ethnic groups such as Filipino and Southeast Asian have been noted (Franzen and Smith, 2009; Guerrero et al., 2015; Serafica et al., 2015; Wiecha et al., 2001). To a certain degree, this may be a reflection of the global trend towards consumption of energy-dense and processed foods and animal products, combined with reduction in physical activity in work and leisure (Novotny et al., 2009; Popkin, 2004; Satia, 2010). Conceptualized as 'nutrition transition' (Popkin, 2004; Satia, 2010) or 'dietary acculturation' (Satia, 2010; Satia et al., 2001), this trend has had detrimental effects on the diets of immigrants to place them at high risk for obesity-related chronic diseases (Satia, 2010; Satia et al., 2001). Among Asian Americans, dietary acculturation has been more apparent for youth and adolescents who report frequent consumption of sugary or junk food (Sastre and Haldeman, 2015; Story and Harris, 1989).

While unhealthy eating and other aspects of unhealthy lifestyle may thus be more or less universal (Kim et al., 2007), there are several reasons why they may be more prominent in low-SES ethnic groups. There is evidence that parents in low-SES Asian ethnic groups—especially Southeast Asians, many of whom came to the U.S. as refugees with scant resources and mostly just a few years of schooling (Sakamoto and Woo, 2007)—lack knowledge in health and nutrition and do not encourage physical activity (Sakamoto and Woo, 2007; Vue et al., 2011). Also, after experiencing prolonged food insecurity prior to immigration to the U.S., some of these groups tend to consume food in excess (Franzen and Smith, 2009; Unger et al., 2004). Combined with frequent consumption in the U.S. of festival foods (often high in carbohydrates, animal protein, sugar and fat) that were once eaten infrequently and on special occasions (Azar et al., 2013; Serafica et al., 2015; Story and Harris, 1988), overconsumption of energy-dense food may account for high prevalence of overweight/obesity among adolescents in low-SES ethnic groups.

In contrast, more salutogenic environments may have been created by higher-SES Asian ethnic groups. Overall, individuals with higher SES are likely to have greater nutritional knowledge (Ball et al., 2006; Turrell and Kavanagh, 2006) and to have the means to purchase more nutritious and less energy-dense food items that tend to cost more in the U.S. (Darmon et al., 2004; Drewnowski et al., 2004). Indeed, Asian immigrants of high SES have reported higher consumption of fruits and vegetables over time (Lv and Cason, 2004; Satia et al., 2001) or maintaining their high fruit and vegetable intake in the U.S. (Sukalakamala and Brittin, 2006).

To account for lifestyle factors that may be related to SES, we included physical activity and fast food consumption in our models, but neither of them was associated with overweight/obesity. This may be due in part to the inadequacy of these standard measures to capture the complexity of dietary patterns and physical activity in everyday lives. To inform targeted interventions, future research might explore whether food consumption and physical activity among Asian American are ethnically- and socioeconomically-patterned.

With our research question centering on the socioeconomic diversity *among* Asian ethnic groups, our ethnic-group construct does not take into account the socioeconomic diversity *within* each Asian ethnic group. We acknowledge the limited attention to the diversity within each ethnic group as a limitation. Here, findings of a prior study (Cook et al., 2016) are worth noting as they shed some light on this. Using interaction terms between low individual income and Asian ethnicities, this study found greatly-elevated odds of being overweight in Southeast Asian and Vietnamese adolescents (i.e. those in the low-SES ethnic groups) who also had low family incomes. Somewhat akin to the interaction between individual- and neighborhood level disadvantage, characterized as the "double jeopardy" in past research (Wen and Christakis, 2005), these findings suggest that the adverse effects of disadvantage on the ethnic group level on adolescent overweight/obesity may be further intensified for those who also experience individual-level poverty (Cook et al., 2016). Further research attention to these disadvantaged Asian subgroups is warranted to address health disparities disproportionately affecting them.

As noted above, we used a proxy for ethnic-group SES using items conventionally used to assess community- or neighborhood-level disadvantage due to the lack of measure in the current literature to assess ethnic resources. Developing such a measure might be the next step in improving understanding of disadvantage affecting Asian American health.

In addition to those already stated above, we also acknowledge other limitations, most of which concern the data used. Given the cross-sectional design of CHIS, we urge caution in inferring causal relationships. The self-reported BMI measure used in CHIS may entail reporting and misclassification biases in a way to overestimate BMI values at the low end of the BMI scale and underestimate those at the high end (Keith et al., 2011; Stommel and Schoenborn, 2009). Also, as CHIS requires parents'/guardians' permission for adolescents' participation, adolescents living with parents or guardians with limited English proficiency—who tend to have lower SES than English speakers (Wong and Wang, 2008)—may be less likely to participate in the survey, with the exceptions of Chinese, Vietnamese, and Koreans for which CHIS was administered bilingually. This is a limitation that may have biased study results. Lastly, since CHIS was administered exclusively in California, our findings are generalizable only to Asian Americans in that state. Still, California is home to the largest Asian American population in the U.S. where about 32% of Asians in the U.S. live (United States Census Bureau, 2010–2014), with most of, if not all, Asian ethnic groups represented in the state. Therefore, the findings from this study carry significant implications for most Asian American adolescents in the U.S.

5. Conclusions

This study has a number of important strengths. Weighted representativeness of the data is one of them. Though a proxy, the use of a quantitative measure to characterize the differences in SES across Asian ethnic groups allowed us to conceptualize a new layer of disparities for Asian Americans to enhance nuanced understanding of social determinants influencing their health, with great potential to advance disparities research as it concerns the health of Asian Americans (and other populations with high proportions of immigrants of diverse socioeconomic and ethnic backgrounds) and with implications well beyond adolescent overweight/obesity.

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