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Associations of Asian Ethnicity and Parental Education with Overweight in Asian American Children and Adolescents: An Analysis of 2011–2016 National Health and Nutrition Examination Surveys

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Abstract
Objectives Asian Americans are highly diverse in cultural, socioeconomic, and health conditions. We aimed to identify socioeconomic and cultural profiles of subgroups of Asian American children at high risk of obesity or overweight to inform targeted interventions. *Methods* A sample of 841 Asian American children and adolescents ages 6–19 from the 2011–2016 National Health and Nutrition Examination Survey was used. Multivariable logistic regression modeling was conducted. Analyses were also stratified by age (6–11 vs. 12–19). Key variables of interest were Asian ethnicity (Chinese, Korean/Japanese, Filipino, South Asian, and Southeast Asian) and parental educational level. Models adjusted for age, gender, nativity status, parental nativity status, and health insurance coverage. *Results* Filipino (AOR 2.79; 95% CI 1.30–6.00), Japanese/Korean (AOR 2.55; 95% CI 1.21–5.38), Southeast Asian (AOR 2.54; 95% CI 1.63–3.94), and South Asian (AOR 2.10; 95% CI 1.01–4.36) children ages 6–19 had higher odds of being obese/overweight than Chinese. Filipino (AOR 3.24; 95% CI 1.11–9.49) and Southeast Asian (AOR 2.47; 95% CI 1.22–5.01) ethnicities were associated with higher risk of obesity/overweight in adolescents ages 12–19. Having a parent with a 4-year college or advanced degree was inversely associated with obesity/overweight in US-born Asian adolescents (AOR 0.34; 95% CI 0.14–0.78). *Conclusions for Practice* Asian American children and adolescents in some Asian ethnic subgroups may be at higher risk of obesity/overweight than in others. Higher parental education level appears to protect US-born Asian American adolescents from being obese/overweight. Multi-sectoral efforts are needed to better understand and address sociocultural processes that increase childhood obesity/overweight in high-risk Asian subgroups.

Keywords Pediatric obesity · Pediatric overweight · Asian American health · Immigrant status · Social determinants of health

Significance

This is the first study using a nationally-representative sample of Asian American children and adolescents with diverse ages and ethnic backgrounds to investigate key demographic and socioeconomic factors associated with obesity/overweight. In addition to identifying Asian ethnicities associated with overweight in adolescents, this study also found moderation by nativity status of the association between parental educational level and obesity/overweight in Asian American adolescents. Given the wide diversity of cultural and socioeconomic conditions and ethnic patterning of health problems among Asian Americans, this study lays the groundwork for future research and intervention to address childhood obesity in this population.

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Introduction

Available evidence points to the need for a rigorous investigation of Asian American childhood obesity and overweight. While the prevalence of obesity overall is lower among Asian American adults than in other racial groups, there is evidence that obesity is increasingly prevalent among Asian American adults. A recent study has found that Asian adults had a 102% increase in obesity rate in 2002–2012, far higher than a 35% increase in white adults (Yi et al. 2015). Also importantly, prevalence of metabolic syndrome is significantly higher among Asian adults than among white adults for every body mass index (BMI) category, to the extent that a World Health Organization expert consultation recommended lower BMI ranges for overweight and obesity in Asian populations (Palaniappan et al. 2011). Prevalence of obesity-related adult health conditions is particularly high in some Asian ethnic groups, with diabetes more prevalent among Asian Indians and Filipinos than among whites and other Asians (Staimez et al. 2013; Ye et al. 2009), and hypertension more prevalent among Filipinos than among whites and in other Asian groups (Ye et al. 2009).

As childhood obesity is a precursor of adult health problems (Dietz 1998), it is important to understand the true extent of childhood obesity and its risk factors that may differentially affect Asian subgroups. Intended to address this objective, the current study is the first-ever study that uses a nationally-representative sample of Asian American children and adolescents with diverse ages and ethnic backgrounds.

Three specific aims are addressed in this study. Given the ethnic patterning of health conditions among Asian Americans, the first aim is to identify Asian ethnic groups at high risk for childhood obesity or overweight. The second aim is to assess whether parental education as a marker of socioeconomic status (SES) is associated with childhood obesity or overweight. While there is a relatively large body of literature linking low SES to childhood obesity (Wang and Lim 2012), little research has been reported on this relationship for Asian Americans, particularly using nationally-representative data. The third aim is to investigate whether association between Asian ethnicity and parental education varies by nativity status. Immigrant status has been identified as an important social determinant of health for minority populations (Singh et al. 2013). Children's nativity status has been found to be an important contextual factor that moderates the effects of various ecological factors (such as school, family, and peers) on health and health risk behaviors (Prado et al. 2009). Identifying risk factors for obesity or overweight that may vary by children's nativity status will help inform the development of tailored interventions.

Methods

Data

We used a sample of 841 Asian American children and adolescents ages 6–19 drawn from the pooled 2011–2016 National Health and Nutrition Examination Survey (NHANES) data. Given our interest in Asian ethnicity as a risk factor for obesity/overweight, our sample included only those who indicated their specific Asian ethnicity. NHANES is a stratified multistage probability survey to monitor the health and nutritional status of the noninstitutionalized U.S. population. The survey has two parts: (1) an in-home interview for demographic and basic health information; and (2) a physical examination in a mobile examination center staffed by medical practitioners including physicians and technicians, as well as dietary and health interviewers. NHANES oversampled Asian Americans for the first time in the 2011–2012 survey and then in the 2013–2014 and 2015–2016 surveys as well, which yielded a relatively large Asian sample with diverse ethnic backgrounds that allowed rigorous analyses. Response rates were 69.5% in 2011–2012, 68.5% in 2013–2014, and 58.7% in 2015–2016 (Centers for Disease Control and Prevention 2017). Trained household interviewers administered NHANES questionnaires in the sample participant's home. One parent or guardian responded to the survey on behalf of their children ages up to 11. Adolescents ages 12 or older completed the questionnaire with the parent's or guardian's permission.

Measures

The definitions recommended by the 2007 American Medical Association expert committee and adopted by the Centers for Disease Prevention and Control (Ogden and Flegal 2010) define overweight as a BMI at or above the 85th percentile 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 sex. Because of the small number of obese children and adolescents (n = 80, 43 of whom were adolescents ages 12–19) in our Asian American sample, we combined overweight and obesity in our outcome variable, referred to hereafter as "overweight" for brevity of reporting. In NHANES, height and weight measures were obtained by a physical examination.

Parental education level, a dichotomous variable of having a 4-year college or advanced degree versus a lower education level, was considered as an indicator of SES. This decision was informed largely by our preliminary analysis, which found that parental education was significantly associated with overweight in childhood whereas family income was not. We did not use a composite of SES including both

family income and parental education to avoid the conceptual blurring of explanatory mechanisms for SES effects that occurs with use of such a composite (Braveman et al. 2005). In addition to being stable during adult life, educational level as a measure has the advantage of being available for both men and women whether they are in paid employment or not, having a high reliability and validity, and being simple to measure and use (Droomers et al. 1999).

Adolescent's nativity status was assessed by a dichotomous variable indicating being born in the US versus elsewhere. The birthplace of the household reference person (presumed parent or guardian), assessed using a dichotomous measure of 50 US states plus Washington DC versus elsewhere, was used as a proxy for parental nativity status.

We used the self-reported Asian ethnicity variable, which included five categories: Chinese (including Taiwanese), Japanese/Korean, Filipino, South Asian (including Bangladeshi, Bhutanese, Goanese, Indian, Pakistani, and Sri Lankan), and Southeast Asian (Burmese, Cambodian, Hmong, Indonesian, Laotian, Malaysian, Thai, Vietnamese). NHANES limited the use of data on Asian ethnicity only to these five categories.

Health insurance coverage was assessed by a dichotomous variable indicating having any type of coverage, private or public, versus no coverage.

Statistical Analysis

We first ran frequency distributions to understand the demographic characteristics of all Asian American children ages 6–19. Chi square tests were conducted to examine whether these characteristics differed by ethnicity. We performed multivariable logistic regression modeling to examine the associations of Asian ethnicity and parental educational level with overweight, controlling for age, gender, nativity status, parental nativity status, and health insurance coverage. We then included interaction terms between the child's nativity status and Asian ethnic categories, as well as parental college degree. Subsequently, these analyses were stratified by age (6–11 vs. 12–19). While the focus of the current study is on Asian Americans, we also conducted multivariable regression modeling using a US sample including non-Hispanic Whites, non-Hispanic Blacks, and Hispanics to examine whether similar patterns of associations between parental college degree and childhood/adolescent overweight were observed between Asian Americans and other racial/ethnic groups.

With the exception of the analysis to report the number of participants in each demographic subgroup, all analyses were conducted using the survey estimation procedure of STATA version 13 (Stata Corporation 2013). Sample weights that accounted for the differential probabilities of selection and nonresponse were incorporated into the estimation process.

This study was approved by an Institutional Review Board and conducted in accord with prevailing ethical principles. This study is based upon secondary analyses of existing data, not upon clinical study or patient data.

Results

Sample Characteristics

Demographic characteristics of Asian American children ages 6–19 in 2011–2016 NHANES are presented in Table 1. As our key findings were obtained using a subset of the sample consisting of adolescents ages 12–19, a detailed description of sample characteristics is provided only for this age group to avoid repetition and redundancy in reporting.

The majority of Asian American children were born in the US, but over four in five Asian American children had foreign-born parents. Over half of Asian American children had at least one parent/guardian with a 4-year college or advanced degree. Almost three in four Asian children had family incomes higher than the US median income. South Asians were the largest ethnic subgroup (29.2%) in our adolescent sample, followed by Chinese (24.5%), and Southeast Asians (22.4%); Japanese or Koreans were the smallest group (10.4%). Prevalence of overweight among Asian American adolescents was the highest among Filipinos (30.7%), followed by Southeast Asians (26.1%), and the lowest among Chinese (13.1%), although these differences were not statistically significant ($p > .05$).

In a series of weighted bivariate analyses to examine whether demographic characteristics differed across Asian ethnic subgroups (also in Table 1), we found significant differences in parental education levels ($p < .01$) and per capita incomes ($p < .5$), as well as the child's ($p < .001$) and parents' nativity status ($p < .0001$), across Asian ethnic groups. The proportion of having at least one parent with a 4-year college or advanced degree was the highest for Japanese or Korean American adolescents (68.3%), followed by South Asians (64.5%), and the lowest for Southeast Asians (29.5%). Japanese/Koreans (90.0% of whom had higher per capita income than the US median) were the highest income group, followed by Filipinos (80.5%); Chinese (63.9%) and Southeast Asians (65.4%) were the lowest income groups.

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In the model using the full Asian American children sample ages 6–19, Asian ethnicities were significantly

Table 1 Demographic characteristics of children and adolescents, NHANES 2011–2016

Characteristics	All Asian Ages 6–19 (n = 841)	Asian ages 12–19 (n = 473)	Chinese, 12–19 (n = 116)	Japanese/ Korean (n = 49)	Filipino (n = 64)	South Asian[c] (n = 138)	Southeast Asian[d] (n = 106)	p[a]	White (n = 987)	Black (n = 1031)	Hispanic (n = 1283)	p[b]
Gender: male	434 (51.7%)	239 (51.1%)	45.0%	46.3%	56.5%	55.3%	51.2%	p > .05	51.1%	50.3%	51.4%	p > .05
Age (mean: SE)[a]	12.46 (0.14)	15.38 (0.11)	15.48 (0.30)	15.31 (0.25)	15.49 (0.31)	15.37 (0.18)	15.22 (0.26)	p > .05	15.34 (0.08)	15.41 (0.12)	15.35 (0.08)	p > .05
U.S. nativity	575 (67.8%)	292 (61.0%)	56.1%	70.1%	55.7%	51.8%	78.0%	***	97.7%	96.6%	78.7%	****
Parental U.S. nativity	128 (16.2%)	80 (18.4%)	27.0%	37.6%	28.7%	2.3%	15.7%	****	93.6%	88.9%	37.1%	****
Parental education: 4-year college degree +	431 (57.2%)	214 (51.3%)	47.9%	68.3%	50.7%	64.5%	29.5%	**	42.2%	18.9%	12.4%	****
Per capita income > U.S. median	594 (72.2%)	336 (72.0%)	63.9%	90.0%	80.5%	73.6%	65.4%	*	77.9%	49.7%	44.2%	****
Health insurance coverage	792 (94.9%)	441 (93.5)	94.2%	82.8%	94.9%	95.3%	94.3%	p > .05	94.0%	91.9%	76.5%	****
Overweight or obese	177 (22.7%)	98 (21.9%)	13.1%	21.9%	30.7%	21.5%	26.1%	p > .05	33.1%	41.7%	44.3%	****

*p < .05; **p < .01; ***p < .001; ****p < .0001

[a]p values of chi-square and differences of means test results to test differences among Asian American ethnic subgroups

[b]p values of chi-square and differences of means test results to test differences among non-Hispanic whites, non-Hispanic blacks, Hispanics, and Asians

[c]South Asian category includes individuals of Bangladeshi, Bhutanese, Goanese, Indian, Pakistani, and Sri Lankan descents

[d]Southeast Asian category includes individuals of Burmese, Cambodian, Hmong, Indonesian, Laotian, Malaysian, Thai, and Vietnamese descents

associated with overweight (Table 2). Filipino (AOR 2.79; 95% CI 1.30–6.00), Japanese/Korean (AOR 2.55; 95% CI 1.21–5.38), Southeast Asian (AOR 2.54; 95% CI 1.63–3.94), and South Asian children (AOR 2.10; 95% CI 1.01–4.36) had higher odds of being overweight than Chinese, reference group. Being male was associated with higher odds of being overweight in this group (AOR 1.53; 95% CI 1.004–2.322). No significant association was found in models including interaction terms between child's nativity status and Asian ethnic categories, as well as parental college degree (results not shown for brevity of reporting).

In analyses stratified by age (also in Table 2), among adolescents ages 12–19, only Filipino (AOR 3.24; 95% CI 1.11–9.49) and Southeast Asian ethnicities (AOR 2.47; 95% CI 1.22–5.01) were significantly associated with childhood overweight. In the model using the same sample but including the interaction terms, the interaction term between parental college degree and the child's US nativity was inversely associated with overweight (AOR 0.34; 95% CI 0.14–0.78). No significant association was found in the main effect and interaction models for the younger age group 6–11 (results not shown). Significant inverse associations between parental college degree and adolescent overweight were found among Whites (AOR 0.66; 95% CI 0.44–0.99) and Hispanics (AOR 0.47; 95% CI 0.29–0.75), but not among Blacks, in the main effect models. No significant association was found in the interaction models for these racial/ethnic groups (results not shown).

Table 2 Associations of demographic and socioeconomic characteristics with overweight in children and adolescents

	Asian, 6–19 years (N = 721)	Asian, 12–19 years (n = 400)	Asian, 12–19 years (n = 400)	Non-Hispanic White, 12–19 years (n = 946)	Black, 12–19 years (n = 975)	Hispanic, 12–19 years (n = 1,211)
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Male	1.53 (1.004–2.322)*	1.44 (0.84–2.48)	1.39 (0.81–2.38)	0.94 (0.69–1.28)	0.64 (0.49–0.82)**	1.03 (0.81–1.30)
Age	1.00 (0.96–1.04)	0.99 (0.84–1.15)	0.98 (0.84–1.14)	1.01 (0.93–1.10)	0.97 (0.91–1.03)	0.99 (0.94–1.04)
Child US nativity[a]	1.13 (0.70–1.82)	1.69 (0.89–3.19)	4.42 (0.46–42.38)	2.62 (0.77–8.87)	1.07 (0.47–2.45)	1.64 (1.05–2.59)*
Parental US nativity[a]	0.93 (0.49–1.76)	1.21(0.54–2.73)	1.15 (0.48–2.72)	0.94 (0.48–1.83)	1.97 (1.10–3.54)*	1.17 (0.86–1.60)
Parental college/advanced degree[b]	0.65 (0.41–1.04)[†]	0.73 (0.38–1.39)	1.46 (0.55–3.86)	0.66 (0.44–0.99)*	1.02 (0.70–1.48)	0.47 (0.29–0.75)**
Health insurance coverage[c]	1.24 (0.51–3.03)	0.79 (0.25–2.42)	0.77 (0.24–2.53)	0.45 (0.45–1.57)	0.85 (0.51–1.43)	1.02 (0.71–1.47)
Japanese/Korean[d]	2.55 (1.21–5.38)*	2.02 (0.72–5.64)	2.64 (0.31–22.63)	–	–	–
Filipino[d]	2.79 (1.30-6.00)*	3.24 (1.11–9.49)*	4.31 (0.70-26.77)	–	–	–
South Asian[d]	2.10 (1.01–4.36)*	2.34 (0.82–6.65)	3.13 (0.48–20.47)	–	–	–
Southeast Asian[d]	2.54 (1.63–3.94)****	2.47 (1.22–5.01)*	5.64 (0.69–46.10)	–	–	–
Parental college degree + × US nativity	–	–	0.34 (0.14–0.78)*			
Japanese/Korean × US nativity	–	–	0.64 (0.03–12.84)	–	–	–
Filipino × US nativity	–	–	0.72 (0.08–6.95)	–	–	–
South Asian × US nativity	–	–	0.78 (0.06–10.44)	–	–	–
Southeast Asian × US nativity	–	–	0.33 (0.02–5.63)	–	–	–

[†]p < .01; *p < .05; **p < .01; ***p < .001; ****p < .0001

[a]Foreign nativity as reference category

[b]No college degree as reference category

[c]No insurance coverage as reference category

[d]Chinese as reference category

Conclusions for Practice

To summarize key findings of this study, Filipino and Southeast Asian ethnicities were associated with higher risks for overweight in adolescents, and having a parent with a 4-year college degree was associated with a reduced risk for overweight in US-born Asian adolescents. Similar associations suggesting protective effects of parental college degree from adolescent overweight were also observed in Whites and Hispanics, but not in Blacks.

Our findings pointing to the higher risk for overweight in Filipino and Southeast Asian adolescents are consistent with the findings from a recent study using a California sample (Cook et al. 2016). The high risk for overweight in Filipino adolescents we found is not surprising, given the higher prevalence of obesity-related health conditions such as diabetes and hypertension among their adult counterparts than among non-Hispanic Whites and in most other Asian ethnic subgroups (Staimez et al. 2013; Ye et al. 2009). Elevated risk of overweight for children of Filipino descent may indeed be a precursor of obesity-related adult health conditions. With the exceptions of mental health problems such as post-traumatic disorder, health conditions in Southeast Asians in the US have been understudied. In light of the documented adult chronic health conditions associated with childhood obesity such as hypertension, dyslipidemia, type 2 diabetes, cardiovascular disease, and certain cancers (Dietz 1998), our findings showing a higher risk of overweight for Southeast Asian adolescents point to the need for interventions targeted at Southeast Asian communities as well.

We do not have information about the specific mechanisms by which risk for childhood obesity/overweight is elevated in Filipino and Southeast Asian communities. Still, past research offers some clues in reporting obesogenic dietary practices in Filipino and Southeast Asian communities in the US. A California study, for example, found that Filipino children had the most obesogenic dietary practices among all Asian ethic groups (Guerrero et al. 2015). While highly-educated and acculturated Asian immigrants reported higher consumption of fruits and vegetables (Lv and Cason 2004), dietary patterns common among Filipino Americans are characterized by high intake of fat and sugar and low intake of fruits and vegetables regardless of their educational levels (Serafica et al. 2015).

Also, there is evidence that Southeast Asians, many of whom came to the US as refugees with scant financial resources and mostly just a few years of schooling, have limited knowledge in health, nutrition, and physical activity, and thus are ill-equipped to create salutogenic environments (Sakamoto and Woo 2007; Vue et al. 2011). Children are more acculturated in these communities and prefer fast and processed foods, with their food habits shaped by their peers and the media. With limited parental knowledge of American food items that are nutritious, easy to cook, and acceptable to their children, processed and convenience food items have become common in these communities because of time, busy lifestyles, and cost of fresh ingredients (Vue et al. 2011). Additionally, after experiencing prolonged food insecurity, refugee families often consume food in excess, to which community members attribute overweight (Vue et al. 2011). Specific mechanisms by which cultural practices and other social processes increase obesity risk in some Asian ethnic communities need to be better understood.

Our findings involving the inverse association between parental college/advanced degree and overweight in US-born Asian adolescents are consistent with past research linking low SES to childhood obesity in the US and globally (Wang and Lim 2012). SES influences living and working environments such as access to foods, exercise facilities, and health care services, which might significantly affect health status including overweight (Zhang and Wang 2004). 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; Weyers et al. 2010; Zarnowiecki et al. 2014). Individuals with a higher educational level, specifically, are likely to have greater understanding of benefits from health behaviors, greater financial resources, healthier neighborhood, and enhanced social networks, all of which are more conducive to health-promoting behaviors (Ball et al. 2006; Grzywacz and Marks 2001; Weyers et al. 2010; Zarnowiecki et al. 2014).

At the same time, our findings suggest that parental college degree may be protective from overweight only in US-born adolescents. Research shows that education does not have the same protective effects on racial/ethnic minorities as on Whites (Nguyen et al. 2014), with returns on education (and health benefits associated with them) varying across demographic groups (Williams 1996). College-educated foreign-born Asians tend to experience disproportionate challenges in securing an occupation commensurate with their credentials and a higher income associated with it (Zeng and Xie 2004), which may undermine their ability to create a health-promoting environment for their children (Drenowatz et al. 2010). Cultural norms may also come into play. Among others, immigrant parents (including those highly educated) may not prioritize physical activity and the psychosocial benefits it may confer due to cultural and normative influences that tend to value academic performance over physical activity (Singh et al. 2008). The nature and impact of these mechanisms on populations with high proportions of immigrants (such as Asian Americans) are

poorly understood. Further research elucidating such mechanisms would be informative.

Just as the BMI and body fat proportions vary among adults enough to justify different BMI cut-points for Asian Adults, Asian children also tend to have different body compositions than others such as Caucasians (Leung et al. 2000). Future research identifying appropriate BMI cut-points for Asian American children might help inform interventions tailored to their body compositions.

Addressing childhood obesity/overweight will require coordinated efforts across multiple sectors. It is critical to improve parenting education based in school, ethnic community, and healthcare settings to raise awareness of high prevalence of childhood obesity/overweight, as well as health and social problems associated with it, and to promote healthy living. Social capital within the ethnic community needs to be leveraged in culturally-appropriate ways to share information and advocate for environmental changes for healthy living, particularly in resource-poor ethnic communities at high-risk of childhood obesity/overweight. Given the critical role primary care providers can play in identifying obese/overweight children (for example, in measuring pediatric patients' heights and weights to assess growth), efforts to engage primary care providers (particularly those who practice in high-risk ethnic communities) in comprehensive assessments that include diet, active living, and child and family health history and in promotion of healthy lifestyle behaviors might be fruitful in addressing childhood obesity (Vine et al. 2013).

This study has several limitations, most of which concern the data used. First, since NHANES is of cross-sectional design, caution is urged in inferring causal relationships. Since NHANES limited use of data on Asian ethnicity to only five categories, further specific information about the subgroups aggregated into the same ethnic categories (e.g., South Asian, Southeast Asian) was unavailable. Additionally, while other ethnic traits (e.g., genetic traits and cultural practices) may explain Asian ethnic differences in overweight to a certain degree, due to little information about them in NHANES and in the current literature (Yi et al. 2015), they were not accounted for. The inclusion of multiple immigrant generations in the same foreign-nativity category in consideration of statistical power is also a limitation. Parental acculturation beyond nativity status, which may also influence childhood overweight and modify the effects of other risk factors, was not considered due to the absence of such information in NHANES. Additionally, physical activity and dietary patterns, which may help identify mechanisms that increase overweight, were underexplored in this study. NHANES physical activity variables were not useful because of the large numbers of missing cases on them. Some diet variables (i.e., consumption of fast food, pizza or frozen food, meals prepared away from home, and ready-to-eat foods), though explored, were not significantly associated with overweight in any age group, perhaps because they did not adequately capture overall dietary quality. As neither these variables nor 24-h dietary recall data were unavailable in NHANES 2015–2016, we did not include them in the final models to maximize statistical power. We also deemed extensive resource-intensive analysis of dietary recall data beyond the scope of the current study. Future research investigating such mechanisms and how they operate differently for diverse Asian American subgroups might be informative. Lastly, the odds ratios we estimated, though routinely reported in analyses of dichotomous outcomes and highly useful in adjusting for multiple confounding variables, tend to overestimate the strength of association when a common outcome is used (Davies et al. 1998; Katz 2006). Caution is urged in interpreting them.

Despite these limitations, the current study has a number of important strengths. This is the first study to investigate obesity/overweight in Asian American children and adolescents with diverse ages and ethnic backgrounds using a nationally-representative sample. The use of body measures obtained in a physical examination as the basis of BMI is another strength that addressed reporting and misclassification biases associated with self-reported body measures, which tend to overestimate BMI values at the low end of the BMI scale and underestimate those at the high end (Stommel and Schoenborn 2009). In enhancing understanding of key demographic and socioeconomic factors associated with obesity/overweight in Asian American children and adolescents, our findings have a great potential to inform future research and interventions.

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