



Ethnicity, socioeconomic status, and overweight in Asian American adolescents

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ARTICLE INFO

Article history:

Received 22 December 2015

Received in revised form 28 April 2016

Accepted 6 June 2016

Available online 7 June 2016

Keywords:

adolescent overweight

health disparities

Asian American health

social determinants of health

ABSTRACT

Asian American children and adolescents are an under-investigated subpopulation in obesity research. This study aimed to identify specific profiles of Asian subgroups at high risk of adolescent overweight with special attention to Asian ethnicity, socioeconomic status (SES), and their interaction. Multiple logistic regression models were fitted using a sample of 1533 Asian American adolescents ages 12–17 from the 2007–2012 California Health Interview Survey (CHIS). In addition to Asian ethnicity and socioeconomic status (assessed by family income and parental education level), age, gender, nativity, and two lifestyle variables, fast food consumption and physical activity, were also controlled for in these models. Key predictors of overweight in Asian American adolescents included certain Asian ethnicities (Southeast Asian, Filipino, and mixed ethnicities), low family income (<300% of the Federal Poverty Level), and being male. Multiplicative interaction terms between low family income and two ethnicities, Southeast Asian and Vietnamese that had the lowest SES among Asian ethnic groups, were significantly associated with greatly elevated odds of being overweight (ORs = 12.90 and 6.67, respectively). These findings suggest that high risk of overweight in Asian American adolescents associated with low family incomes may be further elevated for those in low-income ethnic groups. Future research might investigate ethnic-group SES as a meaningful indicator of community-level socioeconomic disparities that influence the health of Asian Americans.

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1. Introduction

The prevalence of overweight and obesity has increased markedly in children and adolescents in the U.S. and worldwide during the last several decades (Wang and Lim, 2012). Research has linked childhood overweight and obesity to a host of health, behavioral, and psychological problems. They include: chronic health conditions such as cardiovascular disease, type 2 diabetes, and asthma (Daniels et al., 2005); developmental problems such as lower self-esteem, becoming victims or perpetrators of bullying or other disruptive behaviors, and performing poorly academically (Judge and Jahns, 2007; Storch et al., 2007; Strauss, 2000); and becoming overweight or obese adults and thus at high risk for associated adult health problems such as hypertension, dyslipidemia, type 2 diabetes, cardiovascular disease, and certain cancers (Dietz, 1998). Public policy and community interventions can shape children's obesity-related behaviors (Singh and Yu, 2012). To inform interventions, it is critically important to improve understanding of childhood overweight and its risk factors. Past research suggests that interventions targeted at high-risk subgroups—for example, one aimed to reduce weight in mostly Latino adolescents (Cloutier et al., 2015)—can be effective.

Asian American children and adolescents are an under-investigated subpopulation in obesity research. Key predictors of childhood obesity—such as low individual- and neighborhood-level socioeconomic status (SES) (Wang and Lim, 2012; Carroll-Scott et al., 2013; Singh et al., 2008), parental overweight (Rooney et al., 2011; Farajian et al., 2014), and lifestyle factors such as physical activity (Gutin et al., 2005; Trost et al., 2001), dietary patterns (An, 2011; Malik et al., 2013), and television viewing (Gable et al., 2007; Shankaran et al., 2011)—are well documented for U.S. children in general. However, there is limited evidence that those findings, mostly from studies using large, multi-racial samples, are generalizable to Asian Americans. For the most part, Asian Americans were not included in these studies and, when they were, their numbers were too small to meaningfully influence study results.

Asian Americans are highly diverse. Not only do they represent over 20 national origins in the U.S. alone (Zhou and Xiong, 2005), but there are also pronounced socioeconomic disparities across Asian American ethnic groups, with some ethnic groups (such as Asian Indian, Filipino, and Chinese, mostly large and more-established) having incomes and educational levels far exceeding national averages, while others (like the Hmong, Cambodian, and Vietnamese) having the lowest income and education levels in the U.S. (Cook et al., 2011). Prevalence of adult health conditions—for example, metabolic syndrome, cardiovascular diseases, and type 2 diabetes (Palaniappan et al., 2011; Wang et al.,

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2011; Staimez et al., 2013)—also varies across Asian ethnic groups. Given such diversity in multiple dimensions, all of which may have important implications for overweight in adolescence, efforts to identify subgroups of Asian Americans at high risk of childhood overweight are warranted to inform targeted interventions for those subgroups. Such efforts are largely lacking in the current literature.

In investigating key predictors of overweight in Asian American adolescents, the current study is intended to address this gap. Special attention was given to SES, Asian ethnicity, and their intersection in this study. The inverse relationship between SES and adolescent excess bodyweight in industrialized countries (including the U.S.) is relatively well-documented (Wang and Lim, 2012; Singh et al., 2008). However, little research has been reported on this relationship specifically for Asian Americans. To our knowledge, only two studies have examined this relationship, one using a Chinese American sample (Chen, 2009), the other an early adolescent Asian female sample (Schaefer et al., 2009).

Of note, there is scant ethnic-specific information about Asian American childhood obesity (Lu et al., 2015). The small body of current literature on Asian American childhood obesity has focused on individual-level predictors such as gender (Au et al., 2009; Popkin and Udry, 1998), U.S. nativity (Popkin and Udry, 1998), maternal or parental acculturation (Jain et al., 2012; Chen et al., 2011), and maternal education (Jain et al., 2012; Kasemsup and Reicks, 2006). Used in prior studies were mostly single-ethnic samples of two ethnic groups, Chinese (Au et al., 2009; Chen et al., 2011) and Hmong (Kasemsup and Reicks, 2006; Mulasi-Pokhriyal et al., 2012). A few other studies used ethnically-diverse samples including a few large ethnic groups such as Chinese, Japanese, Filipino, Asian Indian, and Korean (Popkin and Udry, 1998; Jain et al., 2012; Albrecht and Gordon-Larsen, 2013). Importantly, small Asian ethnic groups with lower SES were omitted in these samples, making it difficult to accurately assess the risk of childhood overweight that may be pronounced for them.

Furthermore, there is little understanding of the intersection between SES and Asian ethnicity that may significantly influence overweight in adolescence. It has been well-noted that SES and race are closely intertwined, with members of minority groups, on average, having lower SES (Stewart and Napoles-Springer, 2003; Chen et al., 2006). Because of the complex ways SES and race operate to affect health, it is important to elucidate how race and SES collectively influence health (Stewart and Napoles-Springer, 2003; Williams, 2002; Williams, 1999). In a similar vein, given the socioeconomic diversity among Asian American ethnic groups that may influence their health, it is worth exploring how Asian ethnicity intersects with SES.

Using a representative sample from the 2007–2012 California Health Interview Survey (CHIS) that includes Asian ethnic groups of diverse socioeconomic backgrounds, we address three research questions: 1) What Asian ethnic groups are at high risk of overweight or obesity in adolescence?; 2) Is low SES associated with overweight or obese for Asian American adolescents?; and 3) Do ethnicity and SES intersect to increase the risk of overweight or obesity for Asian American adolescents?

2. Materials and methods

2.1. Data

We used a sample of 1533 Asian American adolescents ages 12–17 from the California Health Interview Survey (CHIS) with data pooled from the 2007–2012 survey years. CHIS is the largest state health survey in the U.S., covering a broad range of social and environmental factors that may affect health. It is a survey of households conducted since 2001, using a county-based, stratified sampling design to represent California's non-institutionalized residents. CHIS has used a landline sample administered through a Computer-Assisted Telephone Interview system with random-digit dialing. Since 2007, CHIS has also

included a statewide cell phone sample. In addition to English and Spanish, CHIS is administered in four Asian languages: Cantonese, Mandarin, Korean, and Vietnamese.

2.2. Measures

Using the definitions recommended by the 2007 American Medical Association expert committee (Krebs et al., 2007; Barlow, 2007) and adopted by the Centers for Disease Control and Prevention (Ogden and Flegal, 2010), overweight is defined as a body mass index (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 adolescents ($n = 86$) in our Asian American sample, we created a variable combining both overweight and obesity, referred to hereafter as “overweight.”

Family income and parental education level were used to assess SES of the respondents. Following Braveman (Braveman et al., 2005), we examined parental income and education as separate indicators of individual-level SES to avoid the conceptual blurring of explanatory mechanisms for SES effects that occurs with use of a composite. Low family income is a dichotomous variable indicating an income less than 300% of the federal poverty level (FPL) versus higher income. In CHIS, open questions were used to ask about incomes in dollars. 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, a dichotomous variable of having a 4-year college or advanced degree versus a lower education level.

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 minutes or more. Fast food consumption was a dichotomous variable indicating any consumption of fast food in the past week, constructed using the response about the number of times of eating fast food.

Nativity status was assessed using a dichotomous variable indicating the adolescent was born in the U.S. versus overseas.

We used the self-reported Asian ethnicity variable constructed by CHIS, which includes seven categories: Chinese (including Taiwanese), Japanese, Korean, Filipino, South Asian (including Bangladeshi, Bhutanese, Goanese, Indian, Pakistani, and Sri Lankan), Vietnamese, and Southeast Asian other than Vietnamese (Burmese, Cambodian, Hmong, Indonesian, Laotian, Malaysian, and Thai) referred to hereafter as “Southeast Asian,” as well as Asian Americans of mixed ethnicity.

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 significantly differed by ethnicity. We then fitted a multiple logistic regression model to identify the predictors of overweight in adolescence. To test the hypothesis regarding the interaction between ethnicity and SES, we subsequently fitted another multivariate model including multiplicative interaction terms between them. To construct interaction terms, we chose family income (low versus high), rather than parental education, because of the former's significant association with overweight in our preliminary analysis and also because we deemed it more accurate than parental education assessed using a proxy. In addition to other demographic variables such as age, gender and nativity, two lifestyle variables—fast food consumption and physical activity—were also controlled for in our multivariate models.

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 (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 sample are provided in Table 1. Females (47%) were slightly underrepresented in our sample. Slightly over two-thirds (68%) were born in the U.S. About 44% of Asian American adolescents had family incomes less than 300% of the FPL, and about 57% had a parent or a guardian with a 4-year college or an advanced degree. 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 ethnic group (3%).

In a series of bivariate analyses to examine whether demographic characteristics differed across Asian ethnic groups (also in Table 1), we found a significant association between U.S. nativity and ethnicity ($p < 0.001$). The proportion of the adolescents born in the U.S. was the highest among Japanese Americans (85%), followed by Asian Americans of mixed ethnicity (84%), Southeast Asians (79%), and Chinese (69%). There was a significant association between family income and ethnicity as well ($p < 0.0001$), with the proportions of adolescents with low family incomes (*i.e.* less than 300% of the federal poverty level) being highest among Southeast Asians (75%) and Vietnamese (68%), and lowest among Chinese (32%), Asian Americans of mixed ethnicity (36%), and South Asians (39%). In a similar vein, South Asians had 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. The ethnic groups did not differ significantly in other demographic characteristics.

3.2. Predictors of Asian American adolescent overweight and obesity

In Model 1 (Table 2) intended to examine main effects of predictors, some Asian ethnicities were prominent predictors of Asian American adolescent overweight. Controlling for other covariates, Filipinos (OR = 4.87), Southeast Asians (OR = 4.61), and Asian Americans of mixed ethnicity (OR = 4.76) were over four times as likely to be overweight as Chinese (the reference group). Having a relatively low family income of less than 300% of the FPL was significantly associated with higher odds of being overweight (OR = 2.34). Parental education level was not significantly associated with odds of being overweight. Males (OR = 3.20) were over three times as likely to be overweight as females. Neither U.S. nativity nor lifestyle factors such as fast food consumption or physical inactivity were significantly associated with overweight in Asian American adolescents. In Model 2 that includes the interaction terms between ethnicity and income level (also in Table 2), the interaction terms with low income were significant for Southeast Asians (OR = 12.91) and Vietnamese (6.67), indicating

Table 2
Predictors of overweight in Asian Americans adolescents.

Characteristics	AOR (95% CI) Model 1 (N = 942)	AOR (95% CI) Model 2
Male ^a	3.21** (1.61–6.36)	3.39** (1.70–6.75)
Age	0.90 (0.76–1.08)	0.92 (0.77–1.09)
U.S. born ^b	0.53 (0.26–1.12)	0.54 (0.26–1.12)
Parental college ^c	1.45 (0.63–3.33)	1.33 (0.55–3.23)
Low-income ^d	2.34* (1.06–5.14)	0.75 (0.18–3.10)
Japanese ^e	0.82 (0.12–5.73)	0.65 (0.13–3.29)
Korean ^e	1.06 (0.35–3.23)	1.26 (0.30–5.31)
Filipino ^e	4.87** (1.57–15.17)	2.69 (0.71–10.13)
South Asian ^e	1.19 (0.40–3.57)	1.25 (0.45–3.50)
Vietnamese ^e	2.26 (0.74–6.87)	0.86* (0.23–3.16)
Southeast Asian ^e	4.61** (1.48–14.39)	1.09* (0.16–7.23)
Mixed Asian ethnicity ^e	4.79** (1.32–17.15)	4.10 (0.91–18.45)
Any fast food, past week ^f	0.95 (0.42–2.18)	0.88 (0.40–1.96)
# of days physical activity, past week	1.04 (0.92–1.16)	1.03 (0.90–1.17)
Japanese x low income	–	2.74 (0.03–289.32)
Korean x low income	–	1.33 (0.12–14.49)
Filipino x low income	–	5.98 (0.74–48.28)
South Asian x low income	–	1.35 (0.07–26.12)
Vietnamese x low income	–	6.67* (1.17–38.00)
Southeast Asian x low income	–	12.91* (1.14–146.74)
Mixed Asian ethnicity x low income	–	1.95 (0.38–9.84)
Constant	0.17 (0.01–2.56)	0.21 (0.001–0.60)

AOR: Adjusted odds ratio, CI: Confidence Interval.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

**** $p < 0.0001$.

^a With female as the reference category.

^b With foreign-born as the reference category.

^c With parent or guardian having less education than 4-year college degree as the reference category.

^d With family incomes $\geq 300\%$ of the Federal Poverty Level as the reference category.

^e With Chinese ethnicity as the reference category.

^f With no consumption of fast food as the reference category.

greatly elevated odds of being overweight for adolescents with low family incomes in these two ethnic groups.

4. Discussion

To summarize our key findings, Southeast Asian, Filipino, and mixed ethnicities were prominent predictors of overweight in Asian American adolescents. Low family income was significantly associated with overweight, suggesting its adverse effect on overweight in Asian American adolescents. Increased odds of overweight associated with low family income were pronounced for two ethnic groups, Vietnamese and Southeast Asian.

Table 1
Demographic characteristics of Asian American adolescents.

Characteristics	All	Chinese	Japanese	Korean	Filipino	South Asian	Vietnamese	Southeast Asian	Mixed ethnicity	p
Gender: female	717 (47%)	46%	55%	51%	48%	52%	53%	50%	49%	$p > 0.05$
Age (mean; standard error)	14.45 (0.04)	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. nativity	1047 (68%)	69%	85%	44%	66%	64%	66%	79%	84%	**
Parental education: 4-year college or advanced degree	871 (57%)	62%	66%	64%	64%	71%	27%	33%	58%	****
Low family income $< 300\%$ FPL ^a	668(44%)	32%	43%	47%	40%	39%	68%	75%	36%	****
Any fast food, past week	675 (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.

Our findings involving the specific Asian ethnicities associated with adolescent overweight are informative and contribute to the small body of literature on Asian American childhood obesity. To a certain degree, the high risk of overweight for Filipino adolescents is not surprising, given the high prevalence of obesity-related health conditions such as diabetes among their adult counterparts (Wang et al., 2011; Staimez et al., 2013). However, our findings identifying Southeast Asians, particularly those in the low-income group, as the subgroup at the highest risk of adolescent overweight are entirely new, and have a potential to significantly inform targeted future interventions.

The association between low family income and overweight in Asian American adolescents we found is consistent with past research using samples of U.S. children that linked low SES to childhood overweight (Murasko, 2011; Singh et al., 2010). The significantly elevated odds of being overweight in Southeast Asian and Vietnamese adolescents of low SES are worth noting. As shown in Table 1, Southeast Asians and Vietnamese had the lowest SES among Asian American ethnic groups in California, assessed both by income and education level. This is also the case nationally (U. S. Census Bureau, 2011–2013). Somewhat akin to the interaction between individual- and neighborhood- level disadvantage, characterized as the “double jeopardy” in prior research (Wen and Christakis, 2005), our findings suggest that the adverse effects of individual poverty that may increase the risk of overweight in adolescence may be further intensified for those who may also experience concentrated disadvantage on the ethnic group level. Socioeconomic resources of ethnic groups is documented to be integral to Asian immigrants' (and their off-spring's) survival and prosperity, as they often draw upon ethnic resources such as business or labor market information, subsidized loans, and ethnic customers and institutions to make a living (Light and Bonachich, 1988; Min and Yang, 2005; Park, 1997). Future research might investigate ethnic-group SES as a meaningful indicator of community-level socioeconomic disparities that influence the health of Asian Americans.

We do not have information about the specific mechanisms by which low family income, especially in low-SES ethnic groups, leads to overweight in Asian American adolescents. Mechanisms involving such a relationship 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 (Zarnowiecki et al., 2014; Ball and Crawford, 2006; Cohen et al., 2010). However, the nature and impact of these mechanisms with respect to populations with high proportions of immigrants—such as Asian Americans (about three fifths of whom are foreign born)—are poorly understood, warranting further investigation.

Though not a central focus of this study, our findings that mixed Asian ethnicity is a risk factor for adolescent obesity/overweight are also worth noting. They are in line with prior studies that show multi-ethnic Asian Americans at high risk of unhealthy behaviors such as alcohol and other substance use (Sakai et al., 2010; Wu et al., 2013). Our findings add to the evidence that points to the increased health risks facing multi-ethnic Asian Americans, which future research might explore further.

This study has several limitations, most of which concern the data used. First, since we used cross-sectional data from CHIS, caution is urged in inferring causal relationships. The absence of significant associations involving parental education level and adolescent overweight may be due in part to the potential classification bias involved in using a proxy, another limitation of the data used. We also acknowledge other potential biases. Due to social desirability bias in reporting incomes (Phillips and Clancy, 1972), incomes of low earners may have been overreported (Biemer et al., 1991; Bollinger, 1998). Similarly, the self-reported BMI measure used in CHIS may entail reporting and misclassification biases to the extent that BMI values were overestimated at the low end of the BMI scale and underestimated at the high end (Stommel and Schoenborn, 2009; Keith et al., 2011). The use of phone

surveys, documented to lower response rates than face-to-face methods (Bowling, 2005), may have entailed selection bias.

Lastly, the findings are generalizable only to Asian Americans in California since CHIS was administered exclusively in that state. Still, about 32% of Asians in the U.S. live in California, home to the largest Asian American population in the U.S. (U. S. Census Bureau, 2011–2013). Most of, if not all, Asian ethnic groups are 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. This study contributes to the literature in two main ways. First, in identifying the specific profiles of Asian American adolescents at high risk of overweight as a combination of their Asian ethnicity and SES, our findings enhance understanding of Asian American childhood obesity with a great potential to inform targeted interventions. Second, the interaction between low-income and Southeast Asian and Vietnamese ethnicities, pointing to the greatly-elevated risks of being overweight for low-income adolescents in Asian ethnic groups with the lowest SES, is highly innovative. These findings capture a new layer of disparities for Asian Americans that has not been noted in past literature, with implications for other populations with a high proportion of immigrants.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

Acknowledgement

This study was supported by a grant from the Robert Wood Johnson Foundation (Award 72376). The foundation had no involvement in study design, data analysis and interpretation of findings, or the decision to submit this manuscript for publication.

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