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The Obesity Epidemic in Chinese American Youth?:

A Literature Review and Pilot Study

Robyn Greenfield Matloff, Angela C. Lee,
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Abstract

Despite nearly 14 million Asian Americans living in the United States and continued immigration, this increasingly substantial subpopulation has consistently been left out of national obesity studies. When included in national studies, Chinese-American children have been grouped together with other Asian Americans, Pacific Islanders or simply as "other," yielding significantly lower rates of overweight and obesity compared to non-Asians. There is a failure to recognize the ethnic diversity of Asian Americans as well as the effect of acculturation. Results from smaller studies of Chinese American youth suggest that they are adopting lifestyles less Chinese and more American and that their share of disease burden is growing. After stumbling upon the problem while collecting height and weight for an Asthma study we sought to review the literature as well as determine risk factors contributing to obesity in Boston's Chinatown. We screened 142 children from the waiting room of a community health center that serves primarily recent Chinese immigrants for height, weight and demographic profile. Body Mass Index was calculated and evaluated using CDC growth charts. Overall, 30.1 percent of children were above the 85th percentile for BMI, while 16.1 percent had BMI > 95th percentile. Using a forward stepwise binary logistic regression, we found being male and being born in the U.S. to be statistically significant for BMI > 85th percentile ($p=0.039$, $p=0.001$, respectively). Our results suggest that being overweight in this Chinese American immigrant population is associated with being born in the U.S. A change in public policy and framework for research are required to accurately assess the extent of overweight and obesity in Chi-

nese American children. In particular, large scale data should be stratified by age, sex, birthplace and measures of acculturation to identify those at risk and construct tailored interventions.

Introduction

In 2001, the U.S. Surgeon General declared a “call to action” to combat the obesity epidemic that continues to run rampant throughout the American people (U.S. Department of Health and Human Services, 2001). Despite the nearly 14 million Asian Americans already living in the United States (U.S Census Bureau, 2005) and the continued immigration of Asians to the U.S., little is known regarding obesity among Asian Americans. Due to under sampling and an inclusion of Asian Americans with various ethnic groups as “other” in the National Health and Nutrition Examination Study (NHANES III), no problem of obesity in Asian Americans could be clearly identified and thus leaves the issue largely ignored. Results of several later smaller scale studies have been more definitive and less reassuring. A study by Lauderdale *et al.* revealed the overall prevalence of overweight in Asian American males and females to be 57% and 38%, respectively. For males, this number is comparable to the 54% of US adults overweight nationally (Lauderdale, 2004).

In addition to being undersampled in U.S. studies, there is growing evidence from international studies suggesting that the Center for Disease Control (CDC) system of classifying obesity may underestimate prevalence in Asians. Physiologic differences exist in body composition between races and in particular between Asians and Caucasians from which the BMI classification system was largely based. At the same BMI Asians have a higher percentage of body fat (Lauderdale, 2000; Ko, 1999; Yong-Woo, 2001) and a higher prevalence of obesity-related disease beginning at low categories of BMI (Deurenberg-Yap, 2000; Samaha, 2007; Sung 2007) than their white or black counterparts. The prevalence of such conditions as type II diabetes mellitus and hypertension are high among Asians (Ko, 1999). Even with these physiologic differences, several small scale studies have shown obesity to be a significant problem among certain sub-sets of Asian American when stratified by country of origin or US versus foreign born (Chen & Kennedy, 2005; Davis, 2004; Crawford, 2001; Unger, 2004). With obesity related complications seen among Asian Americans of lower BMIs and obesity, by Western standards and potentially on the rise among

specific sub-sets of this population it reveals a population who may in fact be more at risk from the epidemic, yet studied less.

By attempting to encompass a multitude of subgroups that differ in language, culture and historical background, the term Asian American itself is inherently imprecise. In regards to recording health related data, this becomes an even greater problem. With subgroups differing in physiologic make up, dietary patterns, activity level and with even members of the same sub-group differing among themselves based on length lived in the United States; failure to disaggregate data poses a serious problem to the validity of obesity research (Lauderdale, 2000; Davis, 2004).

There is evidence that indicates that rates of overweight and obesity for immigrants rise with increased duration of residence in the United States. Data collected from a nationally representative sample of Latinos and Asian Americans in the United States found that there were statistically significant increases in BMI and obesity with successive generations of Chinese and "other Asian" subgroups". In this study, the estimates of obesity among Asian Americans were, on average, lower than for the US population as a whole. But importantly, disaggregation of the group "Asian American" unmasked dramatic increases of obesity in succeeding generations, and also among certain subgroups of Asians, such as Filipinos (Bates, 2008).

Perhaps victims of the so-called "healthy immigrant" hypothesis Asian Americans have traditionally been perceived as healthier than their non-Asian counterparts, thought to uphold their traditional health promoting lifestyles thereby rendering themselves immune to the effects of Western culture and its propensity towards an obesogenic lifestyle. Indeed, Asian Americans have lower rates of heart disease, high cholesterol and obesity, thereby suggesting a health promoting way of life (Lauderdale, 2000). In contrast, immigrants to the United States, including Chinese and other subsets of Asian Americans, have been reported to eat less fruits and vegetables and higher fat foods as they adapt US eating styles (Gordon-Larsen, et al., 2003; Satia et al., 2001, Duals, 2004). US born Asian Americans experience higher rates of coronary artery disease, diabetes mellitus, breast and colon cancer than those living in their country of origin (Davis, 2004). Even among foreign-born Asian-Americans it has been reported that the number of years spent in the US is related to the relative risk for being overweight or obese among foreign-born Asian Americans (Lauderdale, 2000).

Data from the 2000 National Health Interview Survey (NHIS) indicate that people who were foreign-born were less likely than persons born in the United States to be overweight and obese. The prevalence of obesity among foreign-born living in the United States for less than 1 year was 8%. However, the proportion of overweight and obese among foreign-born people increased with increased length of residence in the United States. The BMI distribution of foreign-born persons living in the United States for at least 15 years approached that of US-born respondents, with 41% at normal weight, 38% overweight, and 19% obese, compared with 41%, 35%, and 22% of the US-born, respectively (Goel, 2004).

As Asian immigrants to the United States adapt to Western culture their once health promoting way of life may be replaced by the obesogenic lifestyle of the US, priming them for its accompanying medical hardships. Though such themes likely repeat themselves among all sub-groups of Asian Americans, here we will focus upon Chinese Americans, and in particular their youth.

There is conflicting evidence about the state of overweight and obesity in Chinese Children. A cross sectional study of 262,738 children in 26 counties and cities in China found a 7.4% overall prevalence of overweight or obesity among children 3.5-6.5 years old (Liu, 2007). This prevalence is low compared to US populations of Asian Americans. Yet, a study of 6,863 Chinese adolescents revealed 10% of females and 17% of males were overweight (Xie, 2007). In this study, high levels of family income and education were significant risk factors for overweight. A one-year longitudinal study of 7-8 year old Chinese children found that a high baseline BMI, poor aerobic activity and high maternal BMI were significantly correlated with increased BMI at 12 months follow-up. As with US children, increased television viewing and computer time, and poorer aerobic capacity were identified as predictors for weight gain in children (Chen, 2007).

The prevalence of at risk for overweight and overweight among first generation Chinese American children has been reported to be between 11-16%, far below the 26% seen in first generation Hispanic American children (Tarantino in Chen, 2005; Crawford, 2001). However, second and third generation Chinese American children display rates of overweight and obesity between 27-35%, comparable to both the 25% prevalence seen in Hispanic American children and in US children overall (Wang 2001, Chen & Kennedy,

2005; Popkin, 1998). We report next BMI data from the sample we recruited in an asthma screening study (Greenfield et al., 2005) and use the analysis to point toward research needs.

Research Methods and Procedures

Participants

A convenience sample of 152 children ages five to eighteen was recruited as part of an asthma screening study (Greenfield, 2005) in the waiting room of the pediatrics department at South Cove Community Health Center, which serves primarily recent Chinese immigrants, in Boston, Massachusetts between June 16 to July 23, 2004. All children present on recruiting days were approached. We excluded those who were outside the specified age range or who already participated in the screen. Additionally, because of the use of spirometry, children with cough or fever were excluded.

Procedures and methods

The Tufts-New England Medical Center Institutional Review Board and the South Cove Community Health Center Board of Directors approved the study protocol. Consent was given orally at the time of entry into the study from parents of children less than eleven years of age and the child him/herself for years thereafter. Data collected were anonymous and de-identified. Families were provided with a written description of the study in their choice of English or Chinese.

Questionnaire

A bilingual English/Cantonese speaker orally administered a questionnaire to parents of children younger than 11 years old and orally to the child him/herself for those 11 years of age and older. Our rationale was that parents would be better able to report health information for young children while older children would be better reporters for their own health than would parents. Participants chose whether to take the questionnaire in English or Cantonese. The survey was originally written in English, then translated into traditional Chinese characters and then translated back into English. The questions from the questionnaire relevant to this analysis consisted of six questions of demographic nature. Participants were asked the child's age in years, sex, place of birth, and length of residence in the United

States. An additional question related to paternal and maternal education was asked as a measure of socio-economic status.

Height, Weight, and BMI Measurements

Standard, calibrated scales and stadiometers were used to determine height and weight. Two examiners were trained by clinic staff as to the use of the scales and stadiometers and were the only people to perform the measurements to improve consistency. The equipment was calibrated per the protocol in place by the clinic. Subjects were measured in light summer clothing, without shoes. Measurements were taken to the nearest inch and pound, respectively. Each child's age, sex and physical measurements were entered into the ndd Model 2000 EasyOne™ Frontline Spirometer Software (nnd Technologies, Andover, Massachusetts). Body Mass Index was generated by the software and recorded. Each child was then assigned to the following categories: underweight (<5th percentile), healthy weight (5-85th percentile), overweight (85th-95th percentile) or obese (>95th percentile) using the CDC BMI growth charts for boys and girls ages 2-20 (Ogden et al., 2002).

Statistical Analysis

Data were double entered into SPSS version 11.5 and cross-checked by reference to the hard copy for errors. Chi-square and binomial logistic regression were used to test for relationships between BMI categorization and demographic characteristics. Statistical significance was set at the $p \leq 0.05$ level.

Results

Participant demographics

Demographic characteristics of the study population are presented in Table 1 (n=152) as well as stratified by age as under eleven years old (n=58) and eleven years of age and over (n=94). The mean sample age was 12.2 (SD = 4.082) years. Children under eleven years of age differed from those eleven years of age and older in both birthplace and preferred language ($p < 0.001$). A higher percentage of children under eleven were born in the U.S. than older children (53.8 percent, 41.5 percent). It should be noted that the parent answered surveys for children under eleven while older children answered for themselves. Thus parents of children under eleven preferred Chinese (87.9 percent) while children 11 years of

age and over preferred English (61.7 percent). Based on language and place of birth, the sample had a high proportion of recent immigrants to the U.S. Overall, 30.1 percent of children were above the 85th percentile for BMI. The prevalence of BMI > 95th percentile was 16.1 percent (not shown).

Analysis

Table 2 presents frequencies, odds ratios (OR), and p-values for associations between language, sex, age and birthplace and the 85th percentile for BMI. In considering the entire study population: sex, age, and birthplace were associated with differences in BMI status. Females were less likely to be above the 85th percentile than males (21.9 percent vs. 38.6 percent, $p=0.030$). Being under the age of eleven was associated with greater likelihood of being above the 85th percentile (42.3 percent vs. 23.1 percent, $p=0.016$). A higher percentage of native-born children were above the 85th percentile than those who were foreign born (41.6 percent vs. 16.7 percent, $p=0.001$). No association was seen for the full sample population between paternal or maternal education (as a measure of socioeconomic status) and being above the 85th percentile though such categories contained substantial missing values (not shown).

Chi-square tests were used to examine the associations within each age category. For children less than eleven years of age, sex was not associated with being above the 85th percentile ($p=0.458$). Birthplace remained significant, with a higher percentage of U.S.-born children being above the 85th percentile than foreign-born (51.3 percent vs. 15.4 percent, $p=0.023$). In addition, for children less than 11, higher maternal education was associated with being above the 85th percentile (55.2 percent for a high school education or above vs. 23.8 percent for those who did not complete high school, $p=0.027$). For children eleven years and older no associations remained statistically significant.

Multivariate analysis

We considered preferred language, sex, birthplace, age and years living in the U.S. as possible predictors of risk for BMI above the 85th percentile in a forward stepwise binary logistic regression. Being male and being born in the U.S. were found to be statistically significant for BMI greater than the 85th percentile ($p=0.039$, $p=0.001$, respectively). Language chosen, length of time since im-

migrating to the US or being younger than 11 were not found to be associated with overweight or obese in the model.

Discussion

Limitations

Because this was a serendipitous finding in an asthma screening study we were limited by our methods of determining BMI. Rounding to the nearest inch and pound for height and weight, respectively, limited the precision of our BMI calculations. More importantly, as we were not approved to ask for date of birth, the true age of the child could only be determined within 6 months of actual age. We used the midyear value to determine the BMI percentile. In addition, we did not control for the effects of menarche on BMI, which would be expected to cloud results most notably in children over the age of eleven. As only Cantonese or English speakers were included and because this was a convenience sample of patients at a health center, who would be expected to be sicker and more recent immigrants than the general population of Chinese Americans, the generalizability of our results is questionable.

Interpretation

Our results are consistent with the hypothesis that the obesity epidemic has penetrated certain sub-groups of Asian Americans. Our results suggest a problem of overweight children in this primarily recent immigrant Chinese American population (30.1 percent). The prevalence of BMI greater than the 85th percentile that we found is comparable to the overall prevalence in the U.S. (25 percent) (Wang, 2001) and to the prevalence for Asian children in the New York City schools (30 percent) (Thorpe, 2004).

Reference BMI curves for children in Hong Kong are lower than those from the U.S. (Leung et al., 1998). We used CDC growth charts rather than international growth charts in order to compare our findings with other reports on weight categorizations of U.S. subgroups. This could therefore underestimate the true problem of overweight and obesity among this sample of Chinese American immigrants due to physiologic difference in body composition compared to those from which the CDC charts were developed.

It is tempting to suspect that Westernization is a contributor to the prevalence of overweight in our study population. However, the fact that birthplace, but not years lived in the U.S., was a pre-

dictor in the multivariate model is suggestive that some aspect of prenatal or very early infancy may be critical. It could in part relate to generation since immigration in the family as well. In contrast to findings in adults, Chen and Kennedy noted obesity among Chinese youth to be inversely proportional to maternal level of acculturation (Chen and Kennedy, 2005). With an increased level of acculturation, mothers would be expected to be less reliant on their children for communication and interaction within U.S. society, preventing the parental role reversal seen in less acculturated immigrant families (Unger, 2004). Traditional Chinese culture as well as this disturbance in familial hierarchy promote an environment in which children are given more freedom from parental control (Chen and Kennedy, 2005; Unger, 2004). While a more authoritative parenting style was associated with a higher level of maternal acculturation, on its own it was linked to a lower rate of overweight and obesity among Chinese children (Chen and Kennedy, 2005).

In addition to maternal acculturation and parenting style, U.S.-born children may live in homes that differ from foreign-born children in additional ways we did not measure. We did not find the same association between U.S. born and foreign born for children over eleven years of age. However, fewer older children were born in the U.S. compared to the younger children in our study, limiting our statistical power. The fact that we found greater overweight in male children may reflect a preference for male children in childhood feeding, but this too remains speculative (Wang and Lethbridge, 1991; Koh and Tan, 2000).

Future Studies

Additional studies designed to examine trends in overweight among Chinese children are needed. Aspects of the home environment including dietary preferences, amount of television/computer time and activity level as well as parenting style, levels of parental and child acculturation, male child preference are among the factors requiring further study. Additionally, we would argue that there is no a priori reason to assume that Chinese Americans are immune to the effects of Western culture. In fact, their health may be jeopardized when assumptions are made based mainly on lack of evidence or studies that fail to disaggregate data by ethnic subgroup and immigration status in our study population

Table 1. Demographics of the Study Sample Population

	< 11 years old (n=58)	≥ 11 years old (n=94)	Total (n=152)
Preferred Language			
Chinese	87.9% (51)*	38.3% (36)*	57.2% (87)
English	12.1% (7)	61.7% (58)	42.7% (65)
Sex			
Female	58.6% (34)	56.4% (53)	57.2% (87)
Male	41.4% (24)	43.6% (41)	42.7% (65)
Birthplace			
Native-born	74.1% (43)*	41.5% (39)*	53.9% (82)
Foreign-born	25.9% (15)	58.5% (55)	46.1% (70)
Parent Education ¹			
Father high school or less	34.5% (19)	42.6% (26)	38.8% (45)
Father more than high school	65.5% (36)	57.4% (35)	61.2% (71)
Mother high school or less	39.3% (22)	37.5% (24)	38.3% (46)
Mother more than high school	60.7% (34)	62.5% (40)	61.7% (74)

* p<.001
¹Note that our education question resulted in substantial missing data. For total father responses, (n=116); For total mother responses, (n=120).

Table 2: Odds Ratios for Bivariate Analyses

	<85 percentile (n=100)	≥ 85 percentile (n=43)	OR	p-value
Language				
English	63.5% (40)	36.5% (23)	0.58 (0.28-1.19)	0.136
Chinese	75.0% (60)	25.0% (20)		
Sex				
Female	78.1% (57)	21.9% (16)	0.45 (0.22-0.93)	0.030
Male	61.4% (43)	38.6% (27)		
Age				
<11 years old	57.7% (30)	42.3% (22)	0.41 (0.20-0.85)	0.016
≥ 11 years old	76.9% (70)	23.1% (21)		
Birthplace				
Native-born	58.4% (45)	41.6% (32)	3.56 (1.61-7.84)	0.001
Foreign-born	83.3% (55)	16.7% (11)		

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