

BODY MASS INDEX AS A FUNCTION OF LENGTH OF UNITED STATES RESIDENCY AMONG HAITIAN IMMIGRANT CHILDREN

Objectives: 1) To compare Body Mass Index (BMI) percentiles of Haitian-born children and US-born Haitian Children; 2) To assess the relationship between time in the United States and BMI percentiles for Haitian-born children; and 3) To compare BMI percentiles of Haitian-born and US-born Haitian children to other US pediatric populations included in the 2003–2004 National Health and Nutrition Examination Survey (NHANES) data.

Design: Retrospective medical chart review of demographic and anthropometric characteristics.

Setting: Center for Haitian Studies, a non-profit community based organization that provides health care and social services to the Haitian community.

Patients: The medical charts from 250 children ages 2–18 who received medical care at CHS between January 1, 2004 and July 30, 2006.

Main Outcome Measures: 1) Overweight ($\geq 85^{\text{th}}$ to $< 95^{\text{th}}$ BMI percentile) and 2) Obese ($\geq 95^{\text{th}}$ BMI percentile).

Results: Thirty percent of Haitian-born and 51% of US-born Haitian children were $\geq 85^{\text{th}}$ percentile for BMI. US-born children had higher BMI percentiles than Haitian-born children (81st percentile vs 68th percentile). Among Haitian-born children, BMI percentile increased by 3.7% for each year of US residency. When compared to NHANES data, Haitian-born children were less likely to be overweight than non-Hispanic Blacks, Mexican Americans, and non-Hispanic White children, or for all groups combined (14.9% vs 33.6%, 95% CI 9.8%–22.2%), but were as likely to be obese (14.9% vs 17.7%, 95% CI, 9.8%–22.2%).

Conclusions: Haitian-born children are currently experiencing a 3.7% BMI percentile increase for each year of US residency and are as likely to be overweight as other US minority children making them potentially at increased risk for health consequences associated with obesity. (*Ethn Dis.* 2010;20:22–28)

Key Words: Overweight, Body Mass Index, Children, Minority, Haitian

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INTRODUCTION

Haitian immigrants are one of the largest and fastest growing ethnic groups in Miami, Florida, and in other US metropolitan areas. Haitian immigrants, once referred to as Haitian Boat People¹ have been arriving in the United States since the 1950s, during which time many migrated to the northeastern United States and Canada. As economic conditions continued to deteriorate in Haiti, more immigrants arrived and stayed in South Florida.¹ Currently, nearly 45% of all Haitians in the United States reside in Florida, surpassing New York as the primary concentration of Haitian settlement.²

Haitian immigrant integration into the US socioeconomic mainstream is often slower and more difficult than that of other immigrant groups, given their double minority status of being Black and Creole-speaking. Given the complexity of this unique minority group, it is important to understand how they compare with other minority populations with regard to the possible development and etiology of cardiovascular disease risk, a topic largely unexplored until now especially among

children. As the number of Haitians immigrating to the United States continues to grow, it becomes increasingly important to understand how their health differs from native-born individuals, particularly among children given that nearly 30% of the US pediatric population aged 6–18 years are estimated to be overweight ($\geq 85^{\text{th}}$ to $< 95^{\text{th}}$ body mass index [BMI] percentile)³ and another 16% (15% of non-Hispanic Whites and 21% of non-Hispanic Blacks and Mexican Americans, specifically) are obese ($> 95^{\text{th}}$ BMI percentile).^{3,4} Childhood-onset overweight is associated with hypertension, dyslipidemia, hypertriglyceridemia and hyperinsulinemia, which are risk factors for both childhood and adult-onset metabolic syndrome, type 2 diabetes and cardiovascular disease (CVD).^{5–10}

While the majority of current studies on estimates of pediatric obesity prevalence report on large race/ethnic groups, namely non-Hispanic Blacks and Whites and Mexican Americans, few have focused on the subgroups within these major categories; yet, as of 2006, immigrants comprised more than 12% of the US population.¹¹ With the foreign-born proportion of the US population increasing, the health of the immigrant population becomes even more important for the nation's health as a whole.

A recent review of adult health literature showed a positive relationship between BMI and duration of residence in the United States indicating that acculturation is a powerful health determinant.¹² Currently, however, there are no obesity prevalence estimates available for either US-born Haitian children or Haitian-born children living in the United States. Therefore, the primary aims of this study were to: 1)

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...nearly 30% of the US pediatric population aged 6–18 years are estimated to be overweight³ and another 16% (15% of non-Hispanic Whites and 21% of non-Hispanic Blacks and Mexican Americans, specifically) are obese.^{3,4}

compare the BMI percentiles of Haitian-born children with those of US-born Haitian children; 2) assess the relationship between time in the United States and BMI percentiles for Haitian-born children; and 3) compare BMI percentiles of both Haitian- and US-born children to the national prevalence estimates during the same time period using the 2003–2004 National Health and Nutrition Examination Survey (NHANES) data. Our analysis provides an important first step in describing obesity prevalence estimates and potential cardiovascular risk among this population.

DESIGN AND METHODS

Design

Demographic and anthropometric characteristics were abstracted from the medical records of 250 Haitian children aged 2–18 years who were seen, between January 2004 and July 2006, at The Center for Haitian Studies (CHS), a non-profit community-based organization that provides health care and social services to the predominantly uninsured Haitian population of south Florida. The center treats 240 to 300 children each year and maintains records on more than 800 children. The 250 charts abstracted for this study were the first 250 charts filed alphabetically by the

center. Only children who were born in Haiti or who had a parent born in Haiti were included. All data used in this report represent the child's most recent visit to the clinic. Of 250 records reviewed, 200 had sufficient data for analysis. Of the 50 records excluded, 3 were excluded because the child was aged <2 years; 27 because the place of birth was either unknown or was not Haiti nor the United States; and 20 because either the height or weight information was missing. The Institutional Review Board at the University of Miami approved the study.

Main Outcome Variables

The primary outcome variable was body mass index calculated as weight/height² (kilograms/meter²). Age and sex-specific BMI percentiles were computed using the 2000 Centers for Disease Control growth charts for the United States.^{13,14}

Body mass index percentile is a commonly used and validated measurement of adiposity among children.¹⁴ Overweight was a value $\geq 85^{\text{th}}$ and $< 95^{\text{th}}$ percentile, and obese was defined as $\geq 95^{\text{th}}$ percentile.^{3,4} The 2003–2004 NHANES national pediatric population overweight and obesity prevalence estimates by age and ethnicity were used as a comparison group to examine how Haitian children compared to national estimates. The 2003–2004 sample was used because it was the closest in time compared to the local Miami data.

Demographic Variables

Available demographic information was abstracted from the medical charts and consisted of sex, date and place of birth of the children, and duration of residence in the United States for those born in Haiti.

Duration of US residence was calculated using the child's date of arrival in the United States and the visit date. However, if information pertaining to the month and day of immigration was not available we assumed the date of immi-

gration was July 1 of the year specified in the chart, the midpoint of the year. The age at immigration for each child was calculated by subtracting the child's birthdate from the date of immigration.

Statistical Methods

To address the primary aim of the study, children were categorized by place of birth (Haiti, $n=127$ or United States, $n=73$) and compared using analysis of variance (ANOVA) with BMI percentile as the dependent variable. For descriptive purposes and to test for possible interactions with place of birth, children were further categorized by sex and age (three-way ANOVA). To evaluate change in BMI percentile within Haitian-born children, BMI percentile was regressed on months of US residence. A logistic transformation (ie, logit) was used to make the distribution of BMI percentiles more symmetrical, equalize the variance in the residuals and provide for more accurate measures of central tendency.

Predicted logit BMI percentiles were then back-transformed by inverse logs to their original units. Prevalence estimates of overweight and obese and their 95% confidence intervals (CI) were calculated for our sample and compared to the estimates for multi-race or ethnic populations in the 2003–2004 NHANES dataset, an ongoing study designed to assess relationships between behavioral, nutritional and clinical variables.¹⁴

Because this study was an initial attempt to describe the anthropometric characteristics of Haitian children, and because the study sample was non-probabilistic, statistical testing was held to a minimum. When performed, results of statistical testing are given as exact P -values or as confidence intervals.

RESULTS

Characteristics of the Study Population

Of the 200 children included in this analysis, 62% were born in Haiti, and

Table 1. Demographic and anthropometric characteristics of 200 Haitian children living in Miami, Florida

Variable	Born in Haiti n (%)	Born in US n (%)
Total Sample	127 (62.0)	73 (38.0)
Sex		
Boys	60 (47.2)	37 (50.7)
Girls	67 (52.8)	36 (49.3)
Age*		
2–5 years	26 (20.5)	27 (37.0)
6–11 years	42 (33.1)	24 (32.9)
12–18 years	59 (46.5)	22 (30.1)
Mean age (SD), years	10.9±4.4	8.8±4.5
Range, years	2.2–17.6	2.1–16.9
BMI percentile†‡		
Underweight (<5%)	4 (3.1)	2 (2.7)
Normal weight (≥5-<85%)	85 (66.9)	34 (46.6)
At-Risk for overweight (≥85-<95%)	19 (15.0)	18 (24.7)
Overweight (≥95%)	19 (15.0)	19 (26.0)

* $\chi^2_{2df}=7.82, P=0.02.$

† $\chi^2_{3df}=8.60 P=0.04.$

‡ CDC classification.

38% were born in the United States (Table 1). The children were approximately evenly distributed between boys and girls regardless of their place of birth. The overall mean age of the study sample was 10.4 years (range 2–17.5 years). Approximately 40% of the entire sample was either overweight or obese. US-born Haitian children were more likely to be overweight or obese than Haitian-born children (51% vs 30%, respectively).

Body Mass Index Percentiles and Demographic Characteristics

Figure 1 presents the side-by-side box plots of the logit of BMI percentile by place of birth. Mean logit BMI percentiles (center lines of box plots) have been back re-expressed to BMI percentiles. On average, across all age and sex categories, BMI percentile was lower for Haitian-born children (68th percentile) than for US-born children (81st percentile) ($F [1,198]=5.02, P=0.02$) (Figure 1). Although Table 2 reports BMI percentile by sex and age, there was no statistically discernable sex-by-group or age-by-group interaction.

Body Mass Index and Immigration

Among Haitian-born children, duration of time in the United States accounted for 8% of the total variance in BMI percentile ($F[1,122]=10.89, P=.001$). Figure 2 (Panels A and B) presents the regression analysis. Panel A gives the scatter plot and least squares fit of the logit (ie log odds) of BMI

percentile and duration of time in the United States (months). Predicted logit BMI percentiles were transformed back to simple BMI percentiles and plotted against duration of time in the United States in months (Panel B). A least-squares line was fitted to the predicted BMI percentiles to summarize the mostly linear increase in BMI percentiles during the first decade of US residency. BMI percentile increased 3.7% for each year of US residency (Figure 2 Panel B). There was no relationship between age at immigration and BMI percentiles.

Prevalence of Overweight among Haitian Children compared to other Race and Ethnic Populations

To compare prevalence estimates between racial and ethnic populations, confidence intervals were placed around prevalence estimates from the Haitian-born immigrant children and then compared for inclusion in those intervals to the NHANES national estimates (Table 3). Haitian-born immigrant children are less likely to be overweight than the overall NHANES national estimate, and this finding holds true when comparing Haitian-born children

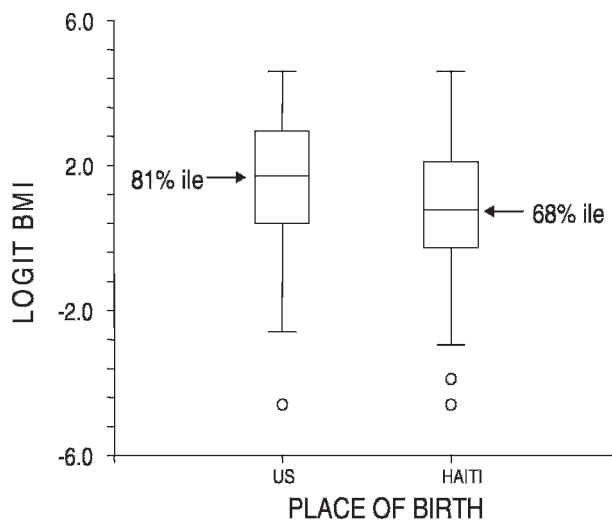


Fig 1. Side-by-side box plots of the logistic transformation of BMI by place of birth. Note: BMI % ile=InvLog_n(logit)/(1+InvLog_n(logit))

Table 2. Mean body mass index percentiles for Haitian- and US-born by sex and age

Variable	Born in Haiti (n=127)	Born in US (n=73)
	Mean BMI Percentile	Mean BMI Percentile
Sex		
Boys	59.7	71.2
Girls	64.9	73.3
Age		
2–5 years	56.9	69.4
6–11 years	65.3	74.4
12–18 years	62.8	68.0

to White non-Hispanic, Mexican Hispanic, and Black, non-Hispanic children. This relationship is present for children aged 6–11 years, and 12–18 years but not for those ages 2–5 years. With the exception of Mexican Hispanic children aged 2 to 5 years, Haitian-

born children are equally as likely to be obese as all of the other racial and ethnic groups combined, irrespective of age. The same analysis for the US-born Haitian children found no statistical differences in the prevalence estimates of either overweight or obese compared

to any of the racial or ethnic groups from the NHANES sample, irrespective of age.

DISCUSSION

This retrospective analysis of combined BMI and immigration status variables presents estimates of those who were overweight or obese among Haitian immigrant children. Haitian-born immigrant children have lower BMI percentiles than those of US-born Haitian children. Among the Haitian-born immigrants, 30% were either overweight or obese. Although this percentage is lower than the 50% of US-born Haitian children who were either overweight or obese, BMI percentiles increased 3.7% for each year of US residency. Compared to national estimates of other pediatric populations in the 2003–2004 NHANES survey, Haitian-born children were less likely to be overweight, but equally likely to be obese.

To a large degree our findings parallel patterns of weight change that are described in most studies of adult immigrant populations in the United States. These studies report that on entry to the United States, adult immigrants are healthier than US-born adults, but this advantage decreases with longer United States residency.^{12,15–24} Adjusted self-reported height and weight findings from the annual cross-sectional California Health Interview Survey showed that immigrant women were 10% less likely to be overweight than US-born women at the time of immigration, but that 90% of this difference closed within the first decade of United States residence. Immigrant men were approximately 16% less likely to be overweight than US-born men, and 50% of this gap closed within 15 years of United States residence.²⁵ This trend has been documented for immigrants migrating to Canada as well.^{26–28}

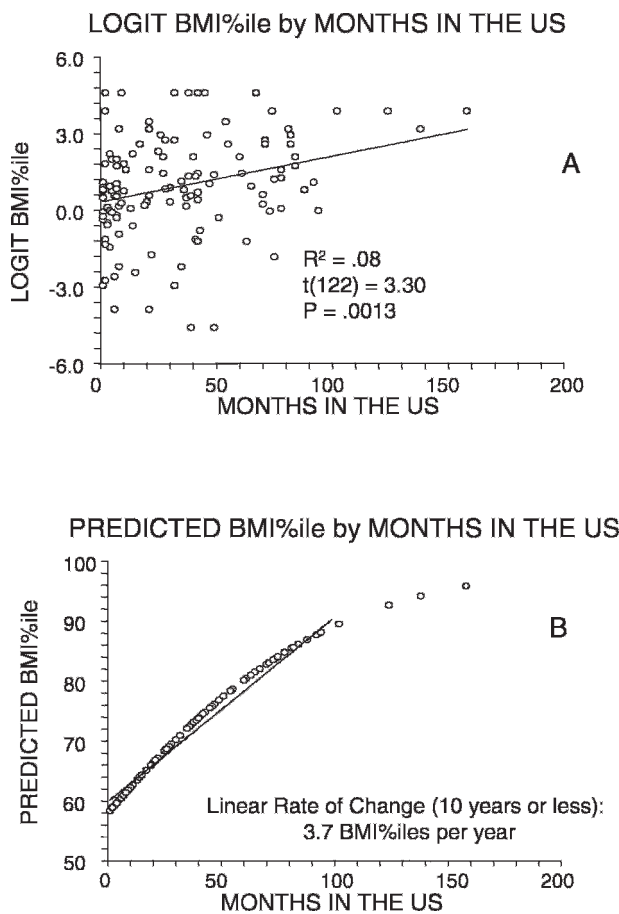


Fig 2. Observed logit (Panel A) and predicted BMI percentile (Panel B) by length of residence in the United States

Table 3. Prevalence of at-risk for overweight and overweight by age among Haitian-born children and children in the 2003–2004 National Health and Nutrition Examination Survey (NHANES). National estimates by age and ethnicity

Age group	NHANES Data 2003–2004 (n=3958)				Center for Haitian Studies, Miami (n=127)	
	Total % (2003–2004)	NHB* (%)	MA† (%)	NHW‡ (%)	Haitian-Born (%)	95% CI (Haitian-Born)
At-Risk for Overweight (≥85 th –<95 th BMI percentile)						
2–5 years	26.2	24.0	32.6	25.0	11.5	(4.2–29.1)
6–11 years	37.2	40.0	42.9	36.9	11.9	(5.3–25.1)
12–19 years	34.3	36.5	34.3	34.7	18.6	(0.8–30.4)
Overall	33.6	35.1	37.0	33.5	14.9	(9.8–22.2)
Overweight (≥95 th BMI percentile)						
2–5 years	13.9	13.0	19.2	11.5	3.8	(0.91–18.9)
6–11 years	18.8	22.0	22.5	17.7	19.0	(10.0–33.4)
12–18 years	17.4	21.8	16.3	17.3	16.9	(9.5–28.5)
Overall	17.7	20.0	19.2	16.3	14.9	(9.8–22.2)

* Non Hispanic Black.

† Mexican American.

‡ Non-Hispanic, White.

Numbers in **bold** indicate prevalence estimates of at-risk of overweight and overweight that are outside the confidence intervals calculated on the Miami Haitian-born children.

Our findings indicate that the rate with which children gain weight and acculturate is faster than adults. This rate was irrespective of their sex, age, or age at immigration. Analyses of data from NHANES II (1976–1980) and subsequent NHANES cohorts (1976–1980 and 2003–2004) revealed an average annual rate of increase of .5 in BMI percentile.²⁹ The difference in BMI percentile increases between our smaller cohort of immigrant children and a larger national cohort is likely a result of the lower prevalence rate of overweight at immigration, as well as the immediate availability of additional calories.

In a study of inner-city children in Montreal, Canada, O’Loughlin et al³⁰ found that 33.8% of Haitian boys were overweight. The authors suggested that immigrant families residing in Montreal for longer periods of time are more acculturated and that new lifestyle behaviors may result in detrimental effects on body weight. Our study also indicates the increasing prevalence of overweight among Haitian children with longer US residence time. Research on other pediatric and adolescent immigrant populations have revealed that acculturation brings detrimental chang-

es in lifestyle behaviors, such as diet, reduced physical activity, and increased smoking, drinking, and risky sexual behaviors.^{31,32} Our data suggest that the rapid rate of acculturation, diet and physical activity levels in particular, into American society may be a major influence of the speed with which the Haitian-born children gained weight.^{33–39}

Study Limitations

Because our data are specific to a Miami-based community health center, our findings may not be generalizable to the broader Haitian community. Our sample is not a true random probability

sample and therefore the confidence intervals used to describe possible sample errors are approximate. In addition, our relatively small sample size prohibits a more detailed analysis. Finally, because our data are cross-sectional in nature, we cannot assume a causal relationship between duration of US residence and increase in BMI percentile. However, our data do indicate a positive association between the two variables.

CONCLUSIONS

Haitian-born immigrants experience a sharp 3.7% upward trajectory in BMI percentile increase for each year of US residency indicating a need for obesity prevention efforts at a young age in this group. Our results show that Haitian-born children have lower BMI percentiles than do US-born Haitian children; however, their BMI percentiles increase the longer they live in the United States with the largest increase in BMI percentile occurring in the first 12 months of US residence. In addition, we found that our sample of Haitian-born children was less likely to be overweight than national estimates but equally as

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likely to be obese, indicating that the speed with which they gain weight may be critical for future cardiometabolic disease(s).

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