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Breakfast consumption patterns and obesity risk among students in New Haven Public Schools

Sisi Wang

MPH Thesis

ABSTRACT

Objectives. We examined breakfast consumption patterns in a longitudinal sample of fifth to seventh grade students and the relationship between the different consumption patterns and weight status over time.

Methods. 1,534 fifth to seventh grade students from 12 randomly selected public schools in New Haven, Connecticut, completed school-based student surveys and physical measures during 2011 to 2013. We also identified students that participated in Breakfast in the Classroom (BIC) program.

Results. Using latent transition analysis, we identified four qualitatively different patterns of breakfast consumption: *frequent skippers or infrequent eaters*, *non-skipping mixed eaters*, *regular home eaters*, and *regular school or double breakfast eaters*. No evidence of association was found between double breakfast eaters and higher weight status, and there was no association between participating in BIC program and students' body mass index. However, we found a 3-fold increased risk of overweight or obese in skippers compared with regular school or double breakfast eaters.

Conclusion. Our findings support the current efforts to promote participation in school breakfast program. Regular breakfast consumption may have weight-gain prevention effect.

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INTRODUCTION

The School Breakfast Program is a federally funded meal program that is designed to provide a nutritious meal to children in public and nonprofit private schools and residential child care institutions. There is consistent evidence that eating breakfast is associated with improved cognitive performance, nutritional adequacy, and bone and cardiovascular health.[1-6] However, the relationship between participating in the school breakfast program and body weight is unclear. There is research suggesting that eating breakfast in general is linked with healthier body weight, [7-10] and children who skip breakfast are more likely to be overweight and obese.[1,10-13] While other work has shown that offering children breakfast at school leads to higher rates of breakfast consumption, participation in the school breakfast program has not been shown to have a significant association with body weight.[14,15]

Currently, there are national advocacy efforts to promote higher levels of participation in school breakfast; specifically, to make it easier for low-income communities to be eligible for universal breakfast,[16] and to offer universal Breakfast in the Classroom program.[17] One concern about promoting school breakfast policies is that it may inadvertently increase the likelihood of consuming a "double breakfast." The USDA School Breakfast Pilot Study found that 20% of the students in six school districts ate two or more breakfasts. Further, within that group, 46% ate what was defined as a "substantive breakfast" at home in addition to the school breakfast they consumed.[18] In light of the epidemic of childhood obesity, it is important to make sure that efforts to promote school breakfast do not lead to excess overall caloric consumption by at-risk children due to serving them a second breakfast at school.

In the present study, we aim to (1) explore breakfast consumption patterns and its predictors in a longitudinal sample of fifth to seventh grade students; (2) explore the relationship

between baseline breakfast consumption patterns and weight status over time; and (3) explore the role of the Breakfast in the Classroom program on breakfast consumption and weight outcomes.

METHODS

Study Participants

Participants for this study were drawn from 12 K-8 (kindergarten through eighth grade) schools that were randomly selected from a total of 27 schools in New Haven, Connecticut, a medium-sized urban school district. All 12 schools agreed to participate. We studied students who were enrolled in fifth grade in 2011-12 school year over a period of three years. Students who opted out of the study or missed the data collection visit at fifth grade were still eligible to participate at the following year, along with any transferred students in the participating schools. There were a total of 684, 701, and 694 students enrolled in fifth, sixth and seventh grades of the 12 selected public schools in 2011, 2012, and 2013 respectively. Of these, 584 (85.4%) students in fifth grade, 602 (85.9%) students in sixth grade, and 539 (77.7%) students in seventh grade with informed consent (assent and parental consent) completed both the student survey and physical measurements. We excluded students that provided data for only one of the three study years (N=191). Our final analytic sample included a total of 513 fifth grade, 553 sixth grade, and 468 seventh grade students. We compared the characteristics of students in the final analytic sample and students with missing data or provided data for only one of the three study years. Compared with the final analytic sample, at baseline, those that were excluded had a lower proportion of Hispanics (46.8% vs. 32.3%) and a higher proportion of students that participated in Breakfast in the Classroom program (22.7% vs. 40.6%). There was no significant difference in sex, age, weight status, and breakfast consumption between the two samples.

Measures

Following informed consent, student data were collected through three sources: student surveys, physical measurements, and the school district's administrative database. Yale Institutional Review Board approval and informed consent (student assent and parental consent) were obtained prior to each year's data collection.

Student surveys

Student surveys assessed student breakfast consumption patterns. Trained research staff read all survey questions and responses aloud while the students entered responses on their own desktop computers via a Survey Monkey online survey (Surveymonkey.com, LLC; Palo Alto, CA). To describe breakfast consumption patterns, students were asked to answer (a) the typical number of days in a week they eat breakfast, and (b) the location where they ate breakfast the previous school day, with the choices of **home**, **school**, **both home and school** or **I didn't eat breakfast**.

Physical measurements

Trained research staff obtained student physical measurements using the World Health Organization Expanded STEPS protocol.[19] Height was measured using a standardized stadiometer (Charder Electronic Co., Ltd., Taichung City, Taiwan) to the nearest half-centimeter, and weight was measured using an electronic flat scale (Seca Co, Hamburg, Germany) to the nearest tenth of a pound. All physical measurements were linked via school-assigned identification numbers to protect students' privacy. The measured heights and weights were then used to calculate Body Mass Index (BMI) (kg/m^2) for each student. The Centers for Disease Control and Prevention (CDC) categorization of sex-and age-specific BMI percentile was used in the study.

Administrative data

Student sex, race/ethnicity, and grade level were obtained from school district records. Eligibility for free or reduced school breakfast program at baseline was included in the analysis as a proxy for family socioeconomic status. In addition, researchers recorded the classes that participated in Breakfast in the Classroom during data collection visits to the school each year. These variables were treated as covariates in the analyses.

Statistical analysis

Initial analyses to assess the distribution of the data, missing values and outliers, frequency distribution, and the central tendency of the variables were conducted. Descriptive statistics were calculated for breakfast consumption, BMI, demographics and other student covariates. T-tests and the Chi-square tests were used to assess the bivariate associations between continuous and categorical variables respectively.

We used latent transition analysis (LTA) to identify unobserved breakfast consumption patterns underlying the observed data, and to estimate the transition probabilities of moving into or out of a given latent status membership. LTA is an extension of latent class analysis that allows longitudinal change of latent class membership over time. All LTA analyses were performed by using SAS software, version 9.2 (SAS Institute, Inc., Cary, North Carolina), and the procedure PROC LTA, version 1.3.1 Beta (The Methodology Center, Penn State).

Two categorical variables from the two questions in the student surveys were used as indicators (referred to as items in LTA models) of breakfast consumption. We first conducted LTA to identify the best baseline breakfast consumption latent statuses membership, and the transition probability from one status to the other, without including grouping variables or covariates. Models with different numbers of latent statuses were compared. Akiake Information Criterion (AIC)[20], Bayesian Information Criterion (BIC)[21], likelihood ratio G^2 statistic[22], model

parsimony and interpretability criteria were considered when selecting the best model for the study. The interpretability criteria entails that the ability to distinguish different classes based on their item response probabilities, no class should be retained if it has near-zero probability, and finally a meaningful description of each class should be achievable. In addition, sex and race/ethnicity were incorporated as grouping variables to explore the sex or racial/ethnic differences in breakfast consumption patterns at baseline.

LTA allowed estimation of several parameters. More specifically, we estimated breakfast consumption latent status membership probabilities at baseline (delta), and item-response probabilities conditional on time and latent status membership (rho), which reflect the likelihood of reporting a particular observed item of breakfast consumption at each time point given the latent status membership. Furthermore, transition probabilities were calculated to determine the probabilities of transition from one breakfast consumption latent status to another over time (tau). Finally, we estimated coefficients of logistic regression (beta) by including covariates in the model to identify potential predictors of breakfast consumption class membership status at baseline and class membership transition over time. In all models, maximum likelihood method of estimation was used employing an expectation maximization (EM) algorithm.

Generalized Estimating Equations (GEE) models for categorical variables were used to predict BMI trajectory over time with regard to the latent statuses membership, and to also look into the role of Breakfast in the Classroom program on breakfast consumption. BMI values were collapsed into a binary variable: overweight/obese (yes/no), and student characteristics and other covariates were also incorporated into the model.

RESULTS

Descriptive characteristics of the sample

At baseline, the study sample included 46% boys and was racially and ethnically diverse: 17% non-Hispanic white, 36% non-Hispanic black, 47% Hispanic, and 1% other race/ethnicity. There were no substantial changes in demographics across the years. Approximately 83% of the sample at baseline was eligible for free or reduced school breakfast program. Based on the sex-and-age adjusted BMI cutoff percentile, 53% of the children in the sample were overweight or obese at baseline, and there was no significant change over time (p=0.221) (Table 1).

Patterns of breakfast consumption

Using the fit indices and model interpretability criteria, a four-class model was selected in this study. Although the G^2 difference (37.31) between the model with four classes and the model with five classes was significant (p=0.03, df=23), after taking consideration of the AIC values and model interpretability, we selected the more parsimonious model with 4 classes (Table 2). For each latent status, the item-response probabilities, the overall prevalence of the status at each time point, and the transition probabilities are shown in Table 3. Based on the values of the item-response probabilities in each latent status, the following interpretational labels were given to the four statuses: *frequent skippers or infrequent eaters, non-skipping mixed eaters, regular home eaters,* and *regular school or double breakfast eaters.* These groups are referred to as *skippers*, *mixed*, *regular home*, and *regular school*. Those in the *skippers* status reported eating breakfast only 0 to 3 days a week (98%), and had the highest probability of not eating breakfast when asked about yesterday's consumption (84%). The status of *mixed* eaters was characterized by low probability of skipping breakfast (0% reported not eating breakfast at all) and notable heterogeneity within the class for breakfast location, although a higher preference for eating at home (53%). The *regular home* eaters were characterized by a 97.5% probability of eating breakfast 6-7 days a week, mostly at home (92%). Finally, students in the

regular school were similar to the *regular home* eaters in their high probability of having regular breakfast everyday (98%), but, distinctively, they had the highest probabilities of participating in the school breakfast program (52%) and being double breakfast eaters (45%).

At baseline, the most prevalent status was the *regular home* eaters (39.5%), followed by the *mixed* eaters (37.7%); the *skippers* latent status was the least prevalent (8%). However, the proportion of children in the *skippers* group progressively increased over time, with 19% of the students in this group by seventh grade. Similarly, the percentage of *regular home* eaters decreased dramatically to 23% in sixth grade and 28% in seventh grade.

The transition probability matrix reflects the likelihood of a transition from one status to a different status at different time points. For instance, *mixed* eaters in fifth grade had about 63% probability of being in the same status again in sixth grade, and a 17% chance of transitioning to the *skippers* status. Interestingly, the highest probability of transitioning to the *skippers* status was among children in the *mixed* eaters group, individuals that were neither skippers nor regular eaters at the time. This suggests that the *mixed* eaters group has the highest risk of becoming *skippers* over time. Similarly, *skippers* who changed statuses were most likely to transition to *mixed* eaters, and very unlikely to become *regular school* breakfast eaters over the study period. Overall, there was a higher probability for changes in status membership from fifth to sixth grade compared with sixth to seventh grade.

When examining the latent status prevalence by sex and race/ethnicity, some patterns emerged (Table 4). While the proportion of children who were *skippers* increased with time, the increase was greater for females than males (fifth grade: 7.1% female vs. 9.5% male; sixth grade: 18.0% female vs. 8.2% male; seventh grade: 28.1% female vs. 11.6% male). However, there were more male than female *regular school* eaters at every time point. The results also suggest

differences among the racial/ethnic groups. Compared with non-Hispanic whites, non-Hispanic blacks and Hispanics were more likely to be *regular school* eaters at every time point. In addition, as might be expected, they were less likely to be in the *regular home* group at every time point. The probabilities of being in the *skippers* or *mixed* eaters status were comparable between non-Hispanic whites and Hispanics, while non-Hispanic blacks had a higher probability of being *mixed* eaters.

Predictors of Breakfast Consumption Pattern

In the unadjusted LTA analysis (Table 5), at baseline, those who were males, eligible for free or reduced meals, and enrolled in schools that participated in Breakfast in the Classroom program were less likely to be *skippers* or *regular home* eaters compared with *regular school* eaters. In contrast, non-Hispanic whites and those who were overweight or obese were more likely to be *skippers*, *mixed eaters,* and *regular home* eaters compared with *regular school* eaters.

In the multivariable model, characteristics that remained independently associated with the different breakfast consumption patterns are shown in Table 6. The status for *regular school* was selected as the reference group, and an odds ratio (OR) larger than 1 indicated an increased risk of membership in a latent status compared with the reference. Significant racial/ethnic differences in breakfast patterns at baseline were identified ($P < 0.0001$). Compared with Hispanics or Non-Hispanic blacks, Non-Hispanic whites were roughly 3 times more likely to be *mixed* eaters, 11 times more likely to be *regular home* eaters, and more than 8 times likely to belong in the *skippers* latent status relative to the *regular school* status even after adjusting for other covariates. Similarly, children with overweight or obese BMI status were 4.4, 2.9, and 7.8

times more likely than healthy weight children to be *skippers*, *mixed* eaters, and *regular home* eaters, respectively (P=0.001).

To better understand the role of breakfast in the classroom program on breakfast consumption, we conducted a longitudinal analysis examining the relationship between breakfast consumption and participation in Breakfast in the Classroom program. After adjusting for year, clustering of students within school, and race, students in Breakfast in the Classroom program were less likely to be *skippers* compared with *regular school* eaters (OR: 0.39, 95% CI: 0.19, 0.82).

Association of the Latent Classes with Weight Status

Weight category was not proportionally distributed across the four latent breakfast statuses (Figure 1). Among fifth grade students that were in the *skippers* status, 71.1% of students were overweight or obese (15.8% and 55.3%, respectively). The proportion of overweight or obese did not change over time. By seventh grade, 72.6% of students in this class were overweight or obese (23.1% and 49.5%, respectively). On the other hand, substantially larger proportion of children classified as *regular school* eaters were identified as healthy weight (52.4% in grade 5, 52.2% in grade 6, and 67.3% in grade 7).

In the repeated measurement GEE analysis, accounting for the clustering of students within schools and the repeated measurements on the same student, and adjusting for the effect of year and race/ethnicity, a significant association between the latent class membership and weight category was revealed (p=0.005). Students in the *skippers* group were three times more likely to be overweight or obese compared with the *regular school eaters* (OR: 3.00, 95% CI: 1.39, 6.51). A grade effect was also observed in our study, such that the odds of being obese or overweight in 6^{th} and 7^{th} graders were 1.59, and 1.24 times the odds in the 5^{th} graders

respectively. In addition, Hispanics and non-Hispanic blacks also had higher risks of obesity compared with non-Hispanic whites (Figure 2).

Because our fourth latent status included both regular school eaters and double breakfast eaters, to confirm our findings, we used the students' response to the question "location of breakfast consumption yesterday" to categorize them into double breakfast eaters (yes/no), and further examined the association between weight category and double breakfast eaters. After adjusting for other covariates and clustering effect, we found a negative relationship between double breakfast eaters and overweight or obese weight status (OR: 0.45, 95% CI: 0.32, 0.64).

DISCUSSION

Overall, our findings help to support the current efforts to promote participation in the school breakfast program. Four qualitatively different patterns of breakfast consumption among elementary school students were identified in our study: *frequent skippers or infrequent eaters, non-skipping mixed eaters, regular home eaters,* and *regular school or double breakfast eaters.* Prevalence of these patterns varied by sex, race/ethnicity, and weight status. Our study found the *regular school or double breakfast* status was not associated with students' BMI over time. This contributes to the scant evidence that school breakfast program will not lead to higher risk of obesity despite the possibility of consuming a second breakfast. To our knowledge, this is the first longitudinal study to explore patterns of breakfast consumption, including double breakfast, and obesity risk in the US, using a representative sample of elementary school students in New Haven, Connecticut. In addition, we demonstrated that complex analytic approaches such as LTA could be successfully used to understand different response patterns and to help identify specific risk groups that should be targeted by obesity prevention strategies.

Findings from this study have important implications to the current efforts to promote school breakfast, such as through Breakfast in the Classroom program. Specifically, we found students participated in Breakfast in the Classroom program were less likely to be breakfast skippers compared with those in schools that offered the traditional school breakfast program. There has been concern on the impacts of promoting school breakfast, as it can lead to double breakfast consumption and potential risks to obesity. Despite only 15% of the students were *regular school or double breakfast eaters*; we found no evidence between this group of students and higher weight status after adjusting for other covariates. In fact, there was no association between participating in Breakfast in the Classroom program and students' BMI. This study is the first to explicitly connect double breakfast and children's weight status over time. Studies have shown that children from lower-income households have a higher risk of obesity.[23-27] Since schools with Breakfast in the Classroom program are more likely to have higher numbers of free or reduced breakfast eaters and thus higher obesity risk; the absence of such relationship in our study further underscores that promoting school breakfast participation would not contribute to childhood obesity.

Among elementary school children, breakfast skipping increased over time and was more common in female students. Similar pattern was found in previous studies conducted in the US and in other countries.[28-30] We found being overweight or obese predicts the breakfast consumption patterns. More specifically, overweight or obese had eight times the odds of being *skippers* than *regular school* eaters. This suggests that not having regular breakfast might be used as a weight-control method among these students. In addition, being *skippers* were also associated with higher BMI status. This is in line with findings from many cross-sectional studies that examined breakfast skipping and weight status.[1,12,13,31-35] The bi-directional

association between BMI and the *skippers* latent status might explain the increased prevalence of overweight or obese children in this group.

Few studies have tracked weight change and different breakfast consumption patterns longitudinally,[10,36] and no studies have previously compared the risk of being overweight or obese in breakfast skippers versus double breakfast eaters. In our study, a 3-fold increased risk of overweight or obese was identified in skippers or infrequent eaters compared with regular school breakfast eaters and even double breakfast eaters. This suggests the possibility that regular breakfast consumption may have weight-gain prevention effect, and associates with favorable weight status. In a study with many low-income children (83% of the students were eligible for free or reduced breakfast), breakfast skippers and infrequent eaters were most at-risk for being overweight or obese over time. It is likely that consuming a greater proportion of calories earlier in the day, such as from eating two breakfasts is compensated with fewer calories consumption from lunch, dinner or snacks. Additional research is needed to examine the total energy intake of children in the double breakfast group compared with the other breakfast consumption groups.

Given *skippers* had the highest risk of being overweight or obese over time, *mixed* eaters, in particular, deserve further discussion. Our transition probabilities suggested that this latent status had the highest risk of becoming *skippers or infrequent eaters* over time. Although this group of students ate breakfast, they have not yet formed regular breakfast eating habits. Therefore, even though this breakfast consumption pattern did not result in higher BMI, children in this status are at an elevated risk of obesity in near future, as they tend to slip into the *skippers* group over time. This result supports the use of LTA to detect behavior change. From a preventative point of view, this is the class for primary prevention. To prevent childhood obesity, students in this group will likely to benefit from interventions that will help them to establish

healthy behaviors, such as regular breakfast consumption habits and a more balanced diet overall.

Finally, in our study sample, the percentages of children who were overweight or obese during our study years (2011-2013) were alarming. In the US, around 34% of 6-11 years old were either overweight or obese in 2011-2012.[37] However, in our study, we found half of the children in this age group were overweight or obese at baseline, and the rate remained constant over time (53.3% in 2011, 54.8% in 2012, and 50.2% in 2013). Accompanying the higher-than-average rates of being overweight or obese, more than half of the students in our sample were not meeting the CDC's physical activity guidelines and reported only consuming 0 to 2 items of fruits or vegetables (including 100% juice) when asked about yesterday's consumption. These sobering findings suggest childhood obesity is a serious issue in the New Haven community and may have profound impacts on children's academic performance and health in adulthood. A number of existing initiatives in the community have focused on school as an important setting to address and reduce childhood overweight and obesity.[38,39] However, the impacts of these initiatives need to be rigorously assessed, and future interventions to reverse the obesity trend can consider incorporating strategies that promote regular healthy breakfast consumption.

This study has some limitations. We did not collect plate-waste data that could be linked with individual double breakfast eaters. Therefore, it is likely that some students did not eat two full breakfasts, but were identified as double breakfast eaters. Further research could consider collecting individual plate-waste data on double breakfast eaters to better understand this consumption pattern. Additionally, breakfast data collected for this study were self-reported by students and are subject to reporting error. We were unable to assess students' breakfast caloric intake, which should be measured and explored in future studies. Finally, our findings may only

represent the children in New Haven, Connecticut; results need to be replicated with other samples in future research.

In summary, as rates of breakfast skipping increase with age, the impact of having regular breakfast consumption in school-aged children may be significant. Our findings provide evidence for policy-makers and health professionals to use school as a venue to promote regular breakfast consumption. Using LTA, we were able to identify different patterns, changes, and predictors of breakfast consumption, and their associations with weight status over time. Understanding the different consumption patterns can provide insights into how we might develop effective strategies to reduce childhood obesity, as well as target children who are at greater risk of developing it.

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Figure Legends

Figure 1 Weight status distribution of the four latent statuses

Figure 2 Factors associated with overweight or obese. Variables with significant association with overweight or obese are shown along the vertical axis. The strength of the association is shown along the horizontal axis with the vertical dashed line indicating an odds ratio of 1 (no association). Each square represents the point estimate of the effect of the variable in the model, while the line represents the 95% confidence interval.

Table 1. Description of Sample

Characteristic	Grade 5 N (%)	Grade 6 N (%)	Grade 7 N (%)	P for trend
Indicators of Latent Classes				
Breakfast Frequency				<.0001
0 day/week	14 (2.8)	30 (5.4)	28 (6.1)	
1-3 days/week	72 (14.1)	94 (17.0)	101 (22.0)	
4-5 days/week	78 (15.3)	89 (16.1)	78 (17.0)	
6-7 days/week	346 (67.8)	339 (61.4)	253 (55.0)	
Yesterday's Breakfast Location				.045
Did not eat	59 (11.6)	97 (17.6)	107 (23.1)	
Home	302 (59.5)	252 (45.7)	216 (46.7)	
School	85 (16.7)	138 (25.1)	86 (18.6)	
Both home and school	62 (12.2)	64 (11.6)	54 (11.7)	
Covariates				
Sex				.575
Male	236 (46.0)	248 (44.9)	207 (44.2)	
Female	277 (54.0)	305 (55.2)	261 (55.8)	
Race/Ethnicity				.473
Non-Hispanic white	88 (17.2)	99 (17.9)	81 (17.4)	
Non-Hispanic black	182 (35.5)	195 (35.3)	153 (32.8)	
Hispanic	239 (46.6)	255 (46.1)	229 (49.1)	
Other	4 (0.8)	4 (0.7)	3 (0.6)	
Eligibility for Breakfast Program				---

Free/Reduced	415 (82.8)	---	---	
Full	86 (17.2)	---	---	
Participate in Breakfast in the Classroom Program				<.0001
No	397 (77.4)	350 (63.3)	393 (92.3)	
Yes	116 (22.6)	203 (36.7)	33 (7.8)	
Body Mass Index				.221
Underweight	10 (2.0)	9 (1.6)	9 (1.9)	
Healthy weight	227 (44.8)	241 (43.6)	224 (47.9)	
Overweight	108 (21.3)	119 (21.5)	105 (22.4)	
Obese	162 (32.0)	284 (33.3)	130 (27.8)	

Note: Dashes indicate missing information.

Table 2. Latent Class Model Fit Indices

Classes	Likelihood-Ratio G^2	Degree of Freedoms	AIC	BIC
2	1057.16	4078	1091.16	1165.33
3	985.46	4063	1049.46	1189.07
4	**894.22**	**4044**	**996.22**	**1218.74**
5	856.91	4021	1004.91	1327.78

Note: Bold font indicates the selected model.

Table 3. Class Item-Response Probabilities, Prevalence of Latent Statuses, and Transition Probabilities

	Frequent skippers or infrequent eaters	Non-skipping mixed eaters	Regular home eaters	Regular school or double breakfast eaters
Item-Response Probabilities:				
Breakfast Frequency				
0 day/week	.338	.000	.000	.009
1-3 days/week	.639	.213	.002	.010
4-5 days/week	.024	.373	.022	.000
6-7 days/week	.000	.415	.975	.981
Yesterday's Breakfast Location				
Did not eat	.835	.132	.001	.017
Home	.100	.530	.921	.009
School	.064	.253	.029	.523
Both home and school	.001	.086	.040	.451
Prevalence of Statuses at:				
Grade 5	.080	.377	.395	.148
Grade 6	.134	.431	.233	.202
Grade 7	.193	.411	.281	.116
Transitions from Grade 5 (rows) to Grade 6 (columns):				
Frequent skippers or	.456	.449	.095	.000

infrequent eaters				
Non-skipping mixed eaters	.169	.634	.009	.188
Regular home eaters	.086	.238	.486	.190
Regular school or double breakfast eaters	.000	.418	.204	.377
Transitions from Grade 6 (rows) to Grade 7 (columns):				
Frequent skippers or infrequent eaters	.747	.214	.039	.000
Non-skipping mixed eaters	.162	.785	.000	.052
Regular home eaters	.040	.000	.960	.000
Regular school or double breakfast eaters	.069	.216	.254	.461

Table 4. Prevalence of Latent Statuses by Sex and Race/Ethnicity

	Frequent skippers or infrequent eaters	Non-skipping mixed eaters	Regular home eaters	Regular school or double breakfast eaters
Male				
Grade 5	.095	.259	.359	.286
Grade 6	.082	.379	.230	.309
Grade 7	.116	.293	.314	.278
Female				
Grade 5	.071	.436	.366	.128
Grade 6	.180	.406	.198	.216
Grade 7	.281	.308	.260	.151
Non-Hispanic white				
Grade 5	.094	.207	.524	.175
Grade 6	.138	.316	.398	.149
Grade 7	.207	.323	.365	.105
Non-Hispanic black				
Grade 5	.096	.381	.296	.228
Grade 6	.096	.421	.176	.308
Grade 7	.105	.498	.219	.205
Hispanic				
Grade 5	.064	.375	.333	.229
Grade 6	.155	.378	.159	.307
Grade 7	.254	.304	.238	.179

Table 5. Unadjusted Odds Ratio for Predictors of Class Membership at Grade 5

Covariates	Non-skipping mixed eaters	Regular home eaters	Skippers or infrequent eaters	Regular school or double breakfast eaters	P-value
Male	0.23	0.39	0.47	---	.006
Non-Hispanic white	1.20	4.64	4.00	---	.001
Eligible for free or reduced meals	1.44	0.38	0.84	---	.002
Participate in Breakfast in the Classroom Program	0.22	0.38	0.32	---	.050
Overweight/obese	2.86	2.36	5.95	---	.006

Note: Dashes indicate the reference class.

Table 6. Adjusted Odds Ratios for Predictors of Class Membership at Grade 5

Covariates	Frequent skippers or infrequent eaters	Non-skipping mixed eaters	Regular home eaters	Regular school or double breakfast eaters	P-value
Male	0.60	0.23	0.56	---	.013
Non-Hispanic white	7.59	2.70	10.76	---	<.0001
Participate in Breakfast in the Classroom Program	0.37	0.29	0.57	---	.078
Overweight/obese	7.82	4.40	2.92	---	.001

Note: Dashes indicate the reference class.

Figure 1

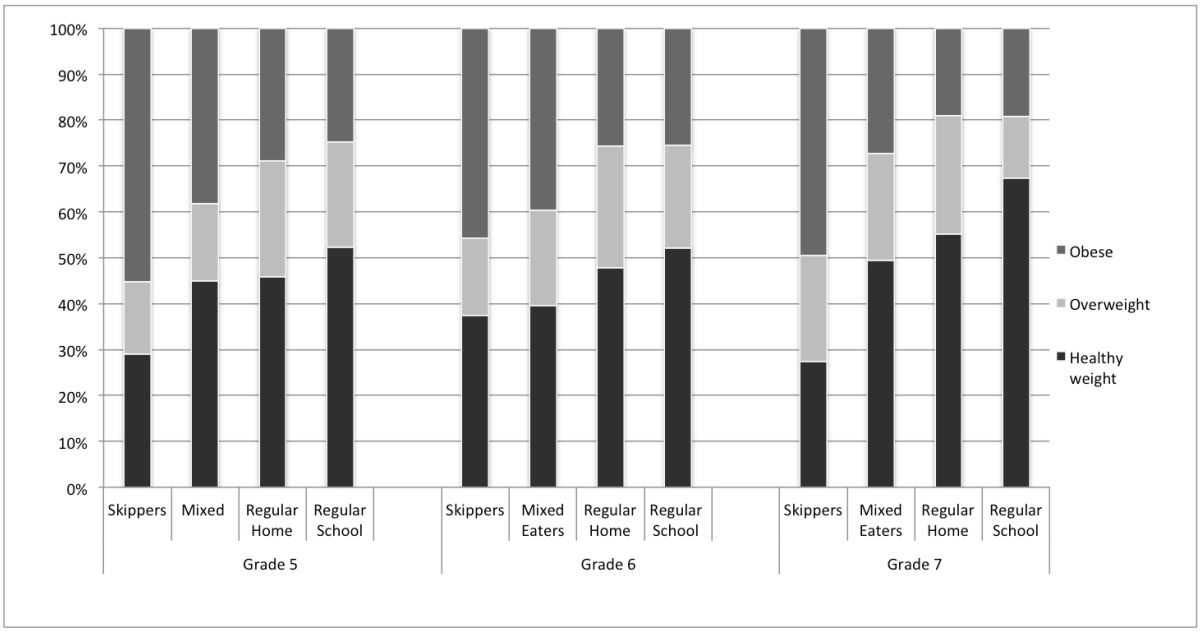
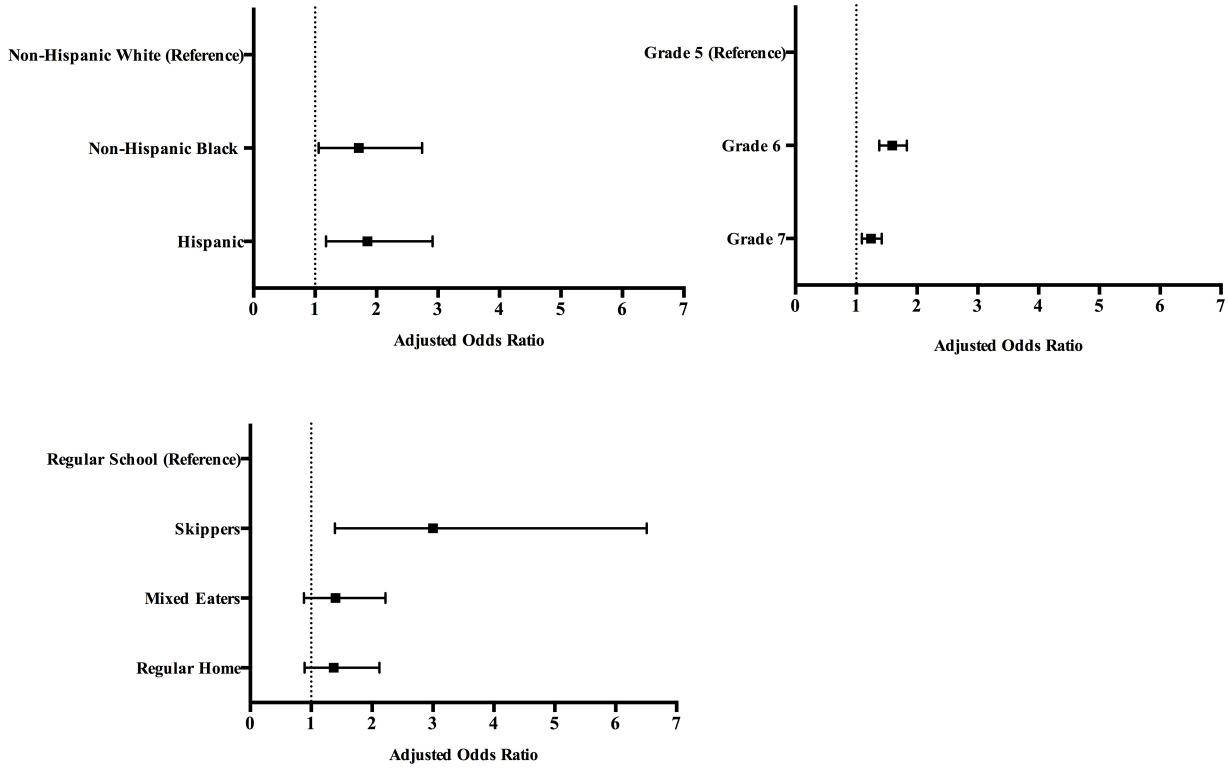

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Skippers
Mixed
Regular Home
Regular School
Grade 5
Skippers
Mixed Eaters
Regular Home
Regular School
Grade 6
Skippers
Mixed Eaters
Regular Home
Regular School
Grade 7
Obese
Overweight
Healthy weight

Figure 2


Non-Hispanic White (Reference)
Non-Hispanic Black
Hispanic
0 1 2 3 4 5 6 7
Adjusted Odds Ratio
Grade 5 (Reference)
Grade 6
Grade 7
0 1 2 3 4 5 6 7
Adjusted Odds Ratio
Regular School (Reference)
Skippers
Mixed Eaters
Regular Home
0 1 2 3 4 5 6 7
Adjusted Odds Ratio