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Novel Strategies in the Prevention and Treatment of Childhood Obesity:
The Importance of Lifestyle Counseling and Psychological Resiliency

A Thesis Submitted to the
Yale University School of Medicine
In Partial Fulfillment of the Requirements for the
Degree of Doctor of Medicine

by

Stacey Kallem

2013

NOVEL STRATEGIES IN THE PREVENTION AND TREATMENT OF CHILDHOOD OBESITY: THE IMPORTANCE OF LIFESTYLE COUNSELING AND PSYCHOLOGICAL RESILIENCY

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Efforts to prevent and treat childhood obesity have had only modest results. Novel strategies are needed. The aims and hypotheses of this thesis are to: 1) Document the self-reported receipt of lifestyle counseling from physicians and other health care providers by BMI status. We hypothesize that despite recommendations for universal lifestyle counseling, few children will be counseled by their health care providers, though children who are obese will report receiving the most counseling. 2) Test the hypothesis that psychological resiliency (i.e., “shift and persist”) protects low socioeconomic status children from obesity. Physical assessments and health surveys were collected from two school-based samples of children (N = 959 and N = 1,523). Multivariate logistic regression and multivariate linear regression were used to address aims one and two respectively. For lifestyle counseling, nearly one-quarter of healthy weight children received no counseling. Overweight children received counseling at rates similar to their healthy weight peers, while obese children were more likely to be counseled. As expected, among children low in resiliency, lower socioeconomic status was associated with significantly higher BMI z-scores ($p < .05$). However, among children high in resiliency, there was no association of socioeconomic status with BMI z-score ($p = .16$), suggesting that resiliency may be protective. Future research should to explore how best to leverage interventions we already know to be effective in fighting childhood obesity, such as lifestyle counseling, and also investigate novel means of approaching childhood obesity, including promoting psychological resiliency.

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Chapter 1: Overview of the Childhood Obesity Epidemic

Since the 1980s, the prevalence of childhood obesity in the United States has nearly tripled.¹ Though the most recent data from the National Health and Nutrition Examination Survey, a representative sample of the US population, demonstrates a plateau in childhood obesity over the past decade, nearly one-third of US children ages 2-19 are still considered overweight (body mass index [BMI] \geq 85th and $<$ 95th percentile) or obese (BMI \geq 95th percentile).² Additionally, there are racial/ethnic and socioeconomic disparities in childhood obesity with even higher prevalence of obesity and overweight among Black and Latino children² and those of low socioeconomic status (SES).³⁻⁶

The high prevalence of childhood obesity is of great public health concern since childhood obesity is associated with significant morbidity in both the short and long-term. The health complications of obesity during childhood are numerous and include hypertension, dyslipidemia, insulin resistance, type 2 diabetes, fatty liver disease, polycystic ovary syndrome, and obstructive sleep apnea.^{7,8} Furthermore, overweight and obese children tend to become obese adults⁹ which is associated with premature mortality and adult morbidity.^{10,11} Due to the medical complications of childhood obesity, researchers predict that this may be the first generation of children to have a lower life expectancy than their parents.¹²

Obesity during childhood is also associated with both psychological comorbidities and social challenges. Overweight and obese children are more likely to have low self-esteem,^{13,14} depressive symptoms,^{15,16} and body dissatisfaction.¹⁵ Additionally, childhood overweight and obesity is associated with weight-based stigma and teasing.¹⁷⁻¹⁹

In addition to the health and psychological sequelae of childhood obesity, the epidemic also places a substantial economic burden on an already strained US healthcare system. An estimated additional \$2.9 billion is spent annually on outpatient and emergency room visits and prescription drugs for overweight and obese children^{20,21} with an additional \$236.7 million spent annually on childhood obesity-associated hospitalizations.²² Furthermore, since many obese children become obese adults,⁹ the childhood obesity epidemic will have long-term economic ramifications as these children reach adulthood and suffer from obesity-related morbidity and mortality. Based on current rates of adolescent obesity, researchers forecast that from 2030-2050, there will be an additional \$254 billion of obesity-related costs from both direct medical costs and loss of productivity.²³

Due to the severe health and economic costs of childhood obesity, curtailing the epidemic has been elevated to a national priority. First Lady Michelle Obama has made solving obesity within a generation her main policy initiative through the *Let's Move!* campaign.²⁴ Additionally, in Healthy People 2020, many of the goals relate to childhood overweight and obesity and include reducing the proportion of children and adolescents who are obese by ten percent by the year 2020.²⁵ The Institute of Medicine has also

recognized the importance of addressing the obesity epidemic and in May 2012 released recommendations on how best to accelerate progress in obesity prevention.²⁶ Despite this strong national push to end the childhood obesity epidemic, current strategies for the prevention and treatment of childhood obesity have only begun to have modest success and data is limited on which particular interventions are most effective.

The most comprehensive recent review of the effectiveness of childhood obesity prevention interventions comes from the Cochrane Collaboration in 2011.²⁷ This review examined 55 different studies that aimed to prevent childhood obesity and included a meta-analysis of the 37 studies with BMI as an outcome measure. The authors concluded that overall, these interventions were effective in modestly reducing adiposity in children (standardized mean difference in adiposity of -0.15kg/m^2). Some of the strategies used in effective interventions included implementing school curriculum on healthy lifestyles, increasing physical activity during the school day, improving the quality of food at schools, and improving parent support for physical activity and healthy diets. However, there was a high level of unexplained heterogeneity between the studies, and it was not possible to isolate which specific components of interventions were effective thus making it difficult to develop generalizable recommendations.

In order to forestall the childhood obesity epidemic, it is important not only to prevent the development of obesity in healthy weight children but also to develop effective treatments for children who are already obese. Three recent review articles on the treatment of obesity in children all demonstrated that lifestyle interventions focusing on

physical activity, diet, and behavioral strategies have been effective in reducing adiposity (BMI changes from -1.25kg/m^2 to -3.3kg/m^2).²⁸⁻³⁰ Successful interventions have been implemented in diverse settings such as primary care clinics, specialty care clinics, schools, and communities. However, as with the research on the prevention of childhood obesity, researchers were unable to isolate which specific intervention components were most effective. Along with lifestyle interventions, the pharmacologic agent *orlistat* was used successfully for weight reduction in obese adolescents;^{29,30} however this agent had more potential adverse effects than using lifestyle interventions alone.

Though it is promising that some prevention and treatment strategies have demonstrated modest success, with nearly one-third of US children still overweight or obese, the childhood obesity epidemic is far from solved. Continued improvement in the epidemic will require both leveraging interventions already known to be effective while also thinking creatively about alternative means of intervention. The broad, overarching aims of this thesis are to do just that by assessing how well a specific childhood obesity recommendation has been implemented and explore a novel strategy that can be used in prevention of childhood obesity.

Specifically, the aims of this thesis are to:

- 1) Document the self-reported receipt of counseling about weight, nutrition, and physical activity by BMI status in a high-risk cohort of predominantly minority and low-income children (see Chapter 2).
- 2) Test the hypothesis that psychological resiliency (i.e. “shift-and-persist”) protects low socioeconomic status children from overweight and obesity (see

Chapter 3).

The present author conducted her thesis research while a fellow at CARE: Community Alliance for Research and Engagement, a community health non-profit housed in Yale's School of Public Health. During the academic year 2011-2012, she trained and supervised community data collectors, developed research hypotheses, performed data analyses, and was the primary author of the resultant manuscripts.

Chapter 2: BMI and Lifestyle Counseling^a

One of the settings in which the childhood obesity epidemic can be addressed is at the primary care office. According to recommendations from an Expert Committee convened by the American Medical Association, the Centers for Disease Control and Prevention, and Health Resources and Services Administration,³¹ clinicians should screen children annually for overweight and obesity and then provide targeted counseling based on BMI status. These recommendations emphasize universal assessment and health counseling with the goals of prevention in healthy weight children and treatment in overweight and obese children. Importantly, it is recommended that all children receive counseling on healthy lifestyles, with more intensive counseling for those who are overweight or obese.³²

Previous studies have shown clinician documentation of weight status and obesity diagnosis to be suboptimal. A recent study using data from the National Ambulatory Medical Care Survey and the National Hospital Medical Care Survey, found that only 18% of children (ages 2 to 18) who met the diagnostic criteria for obesity (BMI \geq 95th percentile) actually had a documented diagnosis of obesity. Not only was obesity underdiagnosed, but it was also undertreated with only half of obese children receiving any sort of counseling on weight reduction, diet, or exercise.³³ However, this study is limited in that it only examined children with the diagnosis of obesity and overlooked the

^a Kallem S, Carroll-Scott A, Gildstad-Hayden K, Peters SM, McCaslin C, Ickovics JR. Children's Report of Lifestyle Counseling Differs by BMI Status. *Childhood Obesity*. In press.

clinically important diagnosis of overweight. Similarly, a chart review of a Medicaid population found that only 12% of youth (ages 13-16) considered overweight or obese (BMI \geq 85th percentile) had their weight status documented and only 7% had documented physical activity or nutrition counseling.³⁴ However, this study did not differentiate between overweight and obese youth.

Both obese and overweight children were included and distinguished in studies from the National Health and Nutrition Examination Survey (NHANES). Among adolescents (ages 16-19) classified as obese, only 37% to 51% reported ever being informed by a clinician that they were obese; teens classified as overweight reported being informed of their weight status at rates as low as 17%.^{35,36} However, NHANES did not assess whether the adolescents then received appropriate counseling about nutrition and physical activity and did not assess whether healthy weight adolescents received preventive counseling. A recent study examining lifestyle counseling among all BMI categories found that obese adolescents (ages 12-17) received diet and exercise screening more frequently than their overweight peers, with rates declining between 2003 and 2007.³⁷ Similarly, another study found that youth (ages 10-18) with BMIs \geq 85th percentile were more likely to report receiving lifestyle counseling; however, this study did not distinguish between overweight and obese youth.³⁸ Both of these studies were limited by the use of self-reported height and weight to calculate BMI.

Aims and Hypotheses:

The primary aim of this study is to document the self-reported receipt of counseling about weight, nutrition, and physical activity by BMI status in a high-risk cohort of predominantly minority and low-income children. We hypothesize that, consistent with prior literature, the overall rates of counseling will be low with less than half of those surveyed reporting counseling on each lifestyle factor. Furthermore, we hypothesize that contrary to recommendations for universal healthy lifestyle counseling, obese children will report receiving the most counseling, followed by overweight and then healthy weight children.

This study adds to the literature by examining counseling rates among younger children (ages 9-13), an age group in which lifestyle counseling has not yet been examined. This is a crucial age for physical activity counseling since childhood levels of physical activity are a strong predictor of physical activity in adolescence³⁹ and during the transition from childhood to adolescence, physical activity levels tend to decline.⁴⁰⁻⁴² Additionally, this is an age in which children are beginning to have independence and influence on their food choices and food preparation.⁴³⁻⁴⁵ With this increasing autonomy over their consumption, it is important that the children themselves receive and recall nutrition counseling in order for it to be effective.

Additionally, this study is strengthened by including children in all weight categories, using objective measures of height and weight to calculate BMI, and examining factors beyond BMI (i.e. site of care provider, race/ethnicity, gender, comorbid conditions, age, SES) that may be associated with lifestyle counseling.

Methods:

Data were collected as part of Community Interventions for Health, a comprehensive community-based study designed to prevent chronic disease by addressing individual and environmental chronic disease risk factors.⁴⁶ New Haven CT is an affiliated study site and CARE: Community Alliance for Research and Engagement at the Yale School of Public Health is the sponsoring research organization. All procedures were approved by the Yale University Human Subjects Committee and the local Board of Education. Parental consent and child assent were obtained for all participants in English or Spanish.

Study Participants

Participants included 1,226 5th and 6th grade students from 12 kindergarten through eighth grade (K-8) schools randomly selected from a total of 27 K-8 schools in New Haven. To be eligible, students had to be in a homeroom classroom where the sole language of instruction was English. This study sample represents 88% of all eligible children. Two percent were excluded because of parental opt-out, and 10% were absent during data collection. The analytic sample for this paper included 959 students (78%). Students were excluded if they did not have survey data (n=132) or physical measures (n=65), if they were missing data for any explanatory variables (n=21) or all of the outcome variables (n=20). Students were also excluded if they were underweight (BMI <5th percentile, n=29) since expected weight, nutrition, and physical activity counseling would be substantively different from counseling aimed at overweight and obese children who are the focus of this paper.

Data Collection and Measurement

Protocol. Data were collected during the academic year 2010-2011. Physical measurements were obtained by trained community data collectors during regularly scheduled physical education classes. Measurements were taken privately and recorded with only school-assigned identification numbers to enable data linkage. Measurements were taken based on the World Health Organization Expanded STEPS protocol.⁴⁷ A standardized stadiometer (Charder Electronic Co., LTD, Taichung City, Taiwan) and digital scale (Seca Corp., Hamburg, Germany) were used to measure height and weight respectively. Student health surveys were administered via desktop computer during regularly scheduled computer classes. In order to take into account subjects' differing levels of literacy, trained research staff read all questions and responses aloud while students read along and entered responses online (SurveyMonkey.com, LLC; Palo Alto, CA). Surveys took approximately thirty minutes to administer, and a backpack was given as compensation to each child who participated.

Measures

Lifestyle counseling. Lifestyle counseling was assessed during the survey by yes or no questions which asked, "Has a doctor or nurse ever talked to you about any of the following: –your weight? –healthier eating? –doing more exercise or physical activity?"

Physical Assessments. Body mass index (BMI) was calculated based on measured height and weight, and age and gender adjusted percentiles were determined for each student.⁴⁸ Following standard protocols, healthy weight was defined as $BMI \geq 5^{\text{th}}$

percentile and $<85^{\text{th}}$, overweight was defined as BMI $\geq 85^{\text{th}}$ percentile and $<95^{\text{th}}$ percentile, obese was defined as BMI $\geq 95^{\text{th}}$ percentile.³¹

Socioeconomic status. Data from school district records on students' qualification for the free and reduced-price school lunch program was used as the indicator of socioeconomic status. Low socioeconomic status (SES) was defined as eligibility for free or reduced-price lunch, while higher SES was defined as being ineligible for these programs.

Site of care provider. Students were asked "where do you go most often when you get sick" and chose from responses of "emergency room, my doctor, school health clinic, and don't know/not sure."

Comorbidities. Students were asked "has a doctor or nurse ever told you that you have –diabetes –asthma?"

Statistical analysis:

Descriptive statistics were calculated for demographic variables, BMI status, and other confounding variables (type of care provider and comorbidities of asthma and diabetes). Multivariate logistic regression analyses were performed to test associations of the outcome variables (whether the student reported being counseled on weight, diet, or exercise) with BMI category after adjusting for potential confounders including race/ethnicity, gender, SES, age, site of care provider, and the comorbidities of diabetes and asthma. Separate logistic regression models were run for each outcome variable using PROC SURVEYLOGISTIC in SAS to account for clustering by school due to the school-stratified sampling design. The Wald chi-square statistic was used to test if

regression coefficients significantly differed from zero. Model assumptions and fit were diagnosed with fit, residual and influence statistics. Statistical significance was set at 0.05. Statistical analyses were performed using SAS 9.2 (SAS Institute Inc., Cary, NC)

Results:

Description of Study Participants

The final sample included 959 children ages 9 to 13 years (Table 1). There was a high prevalence of overweight (19.3%) and an even higher prevalence of obesity (29.9%), together accounting for nearly one-half of the entire sample. Reflecting school district demographics, Black and Hispanic minorities were well represented, making up over 80% of the sample. All other represented races/ethnicities, white (n= 128), Asian (n=14) and American Indian (n=1) were combined into a single category in these analyses. Seventy percent of the children qualified for free lunch, with another 12.6% qualifying for a reduced price lunch, together serving as a proxy for low socioeconomic status. Most children (68.8%) reported receiving medical care at a personal physician's office. Asthma was self-reported by 22.8% of study participants, and diabetes was self-reported by 2.6% of study participants.

Logistic Regression Analysis

Nearly one-quarter of healthy weight children reporting receiving no lifestyle counseling at all and only 34.1% reported being counseled on all three topics. Within each topic, the percent of healthy weight children reporting counseling ranged from approximately 55 to 60%. Despite clinical indication, overweight children were no more likely than their healthy weight peers to report receiving weight and nutrition counseling (Table 2),

though they were more likely to report counseling on physical activity (OR = 1.62, 95% CI 1.05-2.48). As expected, obese children were significantly more likely to report receiving counseling on weight (OR= 2.21, 95% CI 1.65-2.97, nutrition (OR= 2.52, 95% CI 1.73-3.67) and physical activity (OR= 1.96, 95% CI 1.27-3.04), compared to healthy weight children even after controlling for race, gender, SES, age, site of care provider, and the comorbidities of diabetes and asthma. However, 23.9% of obese children did not report receiving any counseling about their weight and 8.7% reported not receiving lifestyle counseling on any topic.

Girls were 30-50% more likely to report receiving counseling than boys for all three lifestyle topics. Having a lower socioeconomic status, as defined by eligibility for free or reduced price lunch, significantly increased the odds of reporting being counseled on weight and physical activity, with no significant association for nutrition counseling. Hispanic children were roughly two to three times as likely to report each type of counseling compared to the reference category of whites and others. Black children were roughly twice as likely as whites/others to report nutrition and physical activity counseling, and 1.38 times as likely to report weight counseling. As expected, lifestyle counseling was higher among children with comorbidities with asthmatics more likely to report receiving weight counseling (OR = 1.36, 95% CI 1.17-1.66) and diabetics more likely to report receiving nutrition (OR = 3.65, 95% CI 1.03-12.96) and physical activity counseling (OR = 2.12, 95% CI 1.18-3.79). No association was found between site of care provider with any of the three lifestyle counseling outcomes, and thus results are not shown.

Discussion:

This is among the first studies to examine the report of lifestyle counseling across BMI categories in children. Our results show that despite recommendations for universal preventive health messages,³¹ children across all BMI categories reported that they did not receive lifestyle counseling. Nearly one-half of the children in our study were overweight or obese, which is substantially higher than the national prevalence of childhood overweight and obesity.² This high prevalence of overweight and obesity is consistent with the demographics of our study cohort in which students were predominantly racial/ethnic minorities and of low SES since both of these factors are associated with higher rates of obesity.²⁻⁶

Despite clinical indication for more intensive lifestyle counseling, overweight students were no more likely than their healthy weight peers to report receiving weight and nutrition counseling. This finding is consistent with prior work that demonstrated this pattern of counseling in adolescents.³⁸ We did find that overweight children were more likely than healthy weight children to report being counseled about physical activity; however, this difference may be driven by the low rate (55.4%) of physical activity counseling among healthy weight children as compared to their counseling on the other lifestyle factors. Taken together, this evidence suggests that many overweight children are not receiving appropriate, targeted lifestyle counseling.

In our study, obese children were more likely than healthy weight children to report being counseled. Although rates of counseling on weight in this sample demonstrates

improvement from prior studies in which one-third to one-half of obese children were not counseled about their weight,³⁴⁻³⁶ our rates were still suboptimal with nearly one-quarter of obese children reporting never having discussed their weight with a clinician. The potential benefits of effectively treating childhood obesity are substantial. Recent evidence indicates that if an overweight or obese child achieves healthy weight as an adult, they have no increased cardiovascular risk compared to adults who had been healthy weight throughout childhood.⁴⁹ Moreover, if we do not address childhood obesity, this generation of children is expected to have a shorter life expectancy than their parents.¹²

There are two overall possible explanations for why the children in our study are not reporting receiving the recommended lifestyle counseling: either the counseling is occurring but children are not remembering and reporting it or clinicians are not counseling all children. Several possible reasons exist for why children may not remember and report counseling that they have received. First, many overweight and obese children considerably underestimate their own weight status and this misperception is greater when exposed to more obese family members and classmates.⁵⁰ Since our study population had such a high prevalence of overweight and obesity (nearly 50% compared to the national prevalence of 32%²), they may misperceive their own weight status and therefore may not attend to and remember discussions about their weight because they do not view it as a health problem. Additionally, even if clinicians are counseling all children, they may spend more time and provide more memorable counseling to obese children for whom such lifestyle counseling might be viewed as

more important. Therefore, that obese children report receiving more counseling might reflect the intensity and dose of the counseling received rather than whether or not counseling occurred at all. Future studies should examine what aspects of counseling are most memorable to children.

Alternatively, clinicians may not be providing all children with the necessary lifestyle counseling. Despite recommendations to assess children's weight status annually by calculating BMI percentiles,^{31,32} in several recent surveys of physician practices, at least one-half of physicians did not calculate BMI percentiles.⁵¹⁻⁵⁵ Instead physicians were more likely to plot children's height and weight on a growth chart and visually assess patients for weight concerns. Given the high prevalence of childhood overweight and obesity in the US, it may be that the appearance of an overweight or obese child has become normalized and by relying on visual assessment, clinicians are not diagnosing all overweight and obese children. Without first recognizing which children are overweight or obese, clinicians may not then be providing appropriate lifestyle counseling. This theory is supported by a study which found that children with extreme obesity, who provide clinicians with the greatest visual cues, were more likely to receive weight reduction counseling than children of other weight categories.⁵⁶ Calculating BMI percentiles is therefore an essential first step in screening for overweight and obesity in order to ensure that children are diagnosed and then receive appropriate counseling. One method of facilitating calculating BMI percentiles is the adoption of electronic medical records that automatically calculate BMI percentiles. The use of such medical records has been found to increase the diagnosis and counseling of overweight children.⁵⁷

Childhood overweight and obesity are more prevalent among racial/ethnic minorities,² however, evidence on whether lifestyle counseling differences by race/ethnicity remains limited and inconclusive. In a study of preventive obesity counseling in healthy weight children, non-Hispanic patients received more counseling than Hispanics.⁵⁸ In contrast, in a study of the diagnosis of childhood obesity in outpatient visits, obesity was more likely to be diagnosed in non-white patients.³³ In the current study, Hispanics and blacks were more likely than whites to report receiving counseling, even after controlling for BMI status. The geographic area in this study has a high prevalence of racial and ethnic minorities, so it is possible that these clinicians are more skilled in counseling about lifestyle factors in a way that is particularly salient and memorable to minority children. Alternatively, clinicians in our geographic area may be particularly attuned to the racial/ethnic differences in obesity risk and therefore more likely to counsel all racial/ethnic minorities on lifestyle factors, regardless of the weight of the patient.

Lastly, we document sex differences, with girls more likely to report being counseled than boys regardless of BMI. Again, this may either be due to girls being counseled at similar rates and intensity as boys but remembering and reporting it more frequently or that clinicians are in fact counseling girls more frequently. Specifically, since overweight and obese girls are more likely to report body dissatisfaction than boys of the same weight category,^{59,60} it is possible that there is a recall bias and that with their own focus on body weight, girls may be more likely to attend to and recall conversations with clinicians about weight. Alternatively, sex differences may be the result of a clinician

bias in counseling, reflecting social norms about the acceptability of overweight among girls versus boys. Though it is of utmost importance that clinicians counsel overweight and obese girls, clinicians should be sensitive in such discussions since weight stigma is already more prevalent in girls than boys.⁶¹

This study has several limitations. First, our survey asked whether the child had ever talked to a clinician about weight, nutrition, or physical activity. We have no information on quantity or quality of counseling or when or how often the counseling occurred. We also do not have records of whether the children in our study had well-child clinician visits in the past year, where preventive counseling would be expected to occur.

Differences in these factors may have influenced whether or not the children remembered being counseled. Our study was also cross-sectional and so we do not have information on whether counseling affected children's behavior over time.

It can also be argued that use of child self-report of counseling as opposed to clinician documentation is a limitation as we cannot differentiate whether counseling did not occur or if children are not recalling the counseling they received. However, research has shown good reliability in children's self-report on health questionnaires starting as young as age eight.⁶² Additionally, we believe that child self-report is an important method to assess counseling effectiveness, because it reflects whether the counseling was salient and memorable to the child. However, it is also possible that at this age group, clinicians may speak in private to the parents of the child, which would not be captured by our measures. Nevertheless, in an age group with significant influence regarding their health

behaviors, whether a child is made aware of clinician's concerns and suggestions for lifestyle changes is key to behavior change. Due to necessary data restrictions from the school district, the only measure of the child's family income is eligibility for the national school lunch program. Lastly, due to logistical challenges in ensuring a private space for examination by trained personnel, we were unable to do Tanner Staging to assess pubertal status.

In contrast, this study has several strengths. Importantly, we used objective measures of children's weights and heights to calculate BMI, and included all BMI risk categories. We were also able to link important health survey information to physical measures to understand whether, and how, BMI is associated with receipt of counseling. Unlike prior studies which mostly focused on adolescents, our participants were young (ages 9-13) and predominantly composed of racial minorities who are particularly at risk for overweight and obesity

In sum, though lifestyle counseling is recommended for children of all BMI statuses, many children report not receiving counseling. Despite clinical indication for more intensive counseling, overweight children report similar lifestyle counseling rates as their healthy weight peers. Furthermore, a substantial proportion of obese children report not receiving lifestyle counseling. Future research should examine why students are reporting not being counseled to see if they are indeed not being counseled, or if the counseling they are receiving is not effective. Also, future research could explore what makes counseling more salient to different sub-populations.

Chapter 3: Shift-and-Persist as a Protective Factor^b

Childhood overweight and obesity are more common in those of low socioeconomic status (SES).³⁻⁶ This may be attributed to the fact that children from low-SES and disadvantaged backgrounds are more likely to live in “obesogenic environments” that promote sedentary lifestyles and consumption of energy-dense foods.⁶³ For example, those living in obesogenic environments tend to lack access to safe outdoor recreational facilities and full supermarkets that sell a variety of foods (as opposed to small grocery stores).^{63,64} Additionally, living in a low-SES environment is associated with experiencing more psychosocial stressors, for example crowding and violence,⁶⁵ which are in turn linked to the development of childhood obesity.⁶⁶

Despite its elevation as a national priority, interventions aimed at preventing and treating childhood obesity have had only modest success.^{7,27,64,67} Many of the strategies to prevent and treat childhood obesity have focused on elucidating behavioral risk factors for becoming overweight/obese (e.g. screen time, sugar-sweetened beverage consumption, sedentary behavior)⁷ and implementing interventions to reduce these risks.²⁷ A complementary or alternative approach may be to leverage protective factors some children inherently possess that allow them to maintain a healthy weight despite living in low-SES, obesogenic environments.

^b Kallem S, Carroll-Scott A, Rosenthal L, Chen E, Peters SM, McCaslin C, Ickovics JR. Shift-and-Persist: A Protective Factor for Elevated BMI among Low Socioeconomic Status Children. *Obesity*. In press.

Chen and colleagues have documented one such protective psychological factor, “shift-and-persist,” in their exploration of protective factors among low-SES individuals.⁶⁸⁻⁷⁰ They posit that low-SES individuals who are able to develop an approach to life that prioritizes *shifting*, accepting stress and adapting the self through reappraisals, in combination with *persisting*, sustaining meaning and optimism about the future, may be protected from some of the negative health effects of low SES and therefore are likely to have better health outcomes than low-SES individuals who do not have these strategies.

In a study of over 100 children diagnosed with asthma, engaging in more shift-and-persist strategies was associated with better asthma outcomes for low-SES children. Among low-SES children with asthma, those who reported engaging in more shift-and-persist strategies had fewer baseline biological markers of inflammation and less asthma impairment (reduced rescue inhaler use and fewer school absences) at six months, compared to low-SES children who did not report engaging in shift-and-persist strategies. Furthermore, the asthma profiles of low-SES children who were high in shift-and-persist resembled those of high-SES children, indicating that these resilience strategies were able to buffer the negative effects of low SES on asthma.⁶⁸

Chen and colleagues found a similar protective health effect of shift-and-persist strategies for low-SES individuals in a study of allostatic load and socioeconomic status.⁶⁹

Allostatic load refers to the physiologic wear and tear that results from exposure to chronic stressors.⁷¹ Using a national sample of 1207 adults, Chen and colleagues found that among adults from a low-SES background, those who reported the highest levels of

shift-and-persist strategies had the lowest allostatic load scores.⁶⁹ In contrast, there was no benefit of shift-and-persist among adults who came from high childhood socioeconomic backgrounds.

Chen and Miller proposed that shift-and-persist strategies are protective for health because they alter stress-physiology pathways. That is, shift-and-persist strategies mitigate perceptions of stress, thereby reducing acute activation of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (SNS).⁷⁰ Over time, diminished stress reactivity leads to reductions in longer term pathogenic processes, such as systemic inflammation, high blood pressure, and insulin resistance. Shift-and-persist strategies may be particularly adaptive in low socioeconomic status contexts where limited resources may make alternative approaches, such as proactive efforts to eliminate stressors, challenging and frustrating. Since chronic activation of the HPA axis has been linked with dysregulation of metabolism and the development of obesity,^{66,70,72} shift-and-persist strategies that decrease the stress response may also protect against obesity.

Aims and Hypotheses:

The objective of the present study was to test whether shift-and-persist strategies are protective against the association between low-SES and overweight and obesity among children. We hypothesized that low-SES (measured by eligibility for free or reduced-price lunch) would be associated with higher BMI z-scores for children low in shift-and-persist strategies, but would have no association with BMI-z scores for children high in shift-in-persist strategies.

Methods:Study Participants

Data came from a study conducted by CARE – Community Alliance for Research and Engagement at the Yale School of Public Health in partnership with the Rudd Center on Food Policy and Obesity, and the New Haven Public Schools.⁴⁶ Participants included 1,655 students from grades 5, 7 and 8 from twelve kindergarten through grade 8 (K-8) schools that were randomly selected from the 27 K-8 schools in the district. For the 5th grade cohort, baseline data was collected as part of a larger longitudinal study and for the 7th and 8th grade cohort, follow-up data was collected as part of a separate study. All data collection methods and procedures were identical in the two cohorts of students.

Participants represent 85.5% of all eligible children. Those not included were either absent from school during study administration (6.8%) or had parents who requested that they not participate (7.7%). The analytic sample for this study included 1,523 students. Students were excluded if they were missing measures of height and weight (n=4), or missing sociodemographic data from school records (n=128). All procedures were approved by the Yale University Human Subjects Committee and the Board of Education. Parental consent and child assent were obtained for all participants in English or Spanish.

Data Collection and Measurement

Protocol. Data was collected during the 2011-2012 academic year. Physical measurements were obtained by trained community data collectors and were based on the World Health Organization Expanded STEPS protocol.⁴⁷ Measurements were taken privately during regularly scheduled physical education classes and recorded with only

school-assigned identification numbers to enable data linkage. A standardized stadiometer (Charder Electronic Co., LTD, Taichung City, Taiwan) and digital scale (Seca Corp., Hamburg, Germany) were used to measure height and weight respectively. Student surveys were administered online (SurveyMonkey.com, LLC; Palo Alto, CA) via desktop computers during regularly scheduled computer classes. To take into account participants' differing levels of literacy, trained research staff read all questions and responses aloud to the class while students read the survey and entered responses on their computer. Survey administration took approximately 30 minutes, and a water bottle was given to each child who participated as compensation.

Measures:

Primary Outcome: Physical Assessments. Body mass index (BMI) was calculated using height and weight. Age- and gender-adjusted BMI z-scores were determined for each student based on guidelines established by the Centers for Disease Control and Prevention.⁴⁸

Primary Independent Variables: Shift and Persist Strategies. Given limitations in survey duration to comply with the time available during a classroom period, a shortened five-item version of the shift-and-persist measurement^{68,69} was used. The three “shift” items were selected from the Responses to Stress questionnaire,⁷³ a validated measure of coping for use in children ages 11-18. Items were taken from the subscales of cognitive restructuring (“I think about the things I can learn from a situation, or about some thing good that can come from it”), positive thinking (“I tell myself that everything will be all right”), and emotion regulation (“I do something to calm myself down”). Two “persist”

questions were used: one from the Resilience Inventory⁷⁴, a validated measure for children that taps optimism (“I think that things will get better in the future”), and one from the Purpose in Life Scale⁷⁵, a version of the commonly used Purpose in Life Test that has been validated in adolescents (“I feel my life has a sense of purpose”). Responses were on a four-point Likert-type scale (responses ranging from “not at all” to “a lot”). Responses to the shift-and-persist measures were summed to create a total shift-and-persist score ranging from zero to twenty. Higher scores indicate reporting the use of more shift-and-persist strategies.

Socioeconomic status. Data from school district records on students’ qualification for the free and reduced-price school lunch program was used as the indicator of socioeconomic status. Low SES was defined as eligibility for free or reduced-price lunch, while higher SES was defined as being ineligible for these programs.

Control Variables:

Healthy and unhealthy eating. Students were asked questions regarding whether they ate certain foods yesterday. We summed responses to three healthy food items (fruit, vegetables, salad) into an additive “healthy eating index” ranging from 0 to 3, with three representing the healthiest eating. Similarly, we summed responses to five unhealthy food items (french fries, fried chicken, candy, ice cream, sweets) into an additive “unhealthy eating index” ranging from 0 to 5, with five representing the unhealthiest eating.

Physical activity. Based on CDC physical activity recommendations that children exercise for at least 60 minutes a day, students reported the number of days in the past week that they did physical activity for 60 minutes or more.^{76,77}

Statistical analysis

Descriptive statistics were calculated for all study variables. To test *a priori* hypotheses regarding the potential differential association of SES with BMI by level of shift-and-persist, multiple linear regression analyses were conducted. BMI z-score was the primary outcome. Primary independent variables included the main effect of shift-and-persist strategies, the main effect of SES, and the interaction between shift-and-persist and SES. Including the interaction term allowed us to test the hypothesis that low-SES would be associated with higher BMI z-scores for those low in shift-and-persist strategies, but not those high in shift-and-persist strategies. Tests of interactions were conducted according to the recommendations of Aiken and West⁷⁸, whereby variables are first centered and then the interaction is calculated as the product of the two variables. The model adjusted for sex, race/ethnicity, healthy and unhealthy eating indices and physical activity. The latter two measures of diet and physical activity behaviors were included as additional covariates in order to determine whether the relationship between shift and persist and BMI z-scores existed even after accounting for variations in health behaviors. Statistical analyses were performed using SPSS Version 20.0.0.

Results:

Description of Study Participants

The final sample included 1,523 children ages 9 to 15 years (Table 3). Reflecting school district demographics, Black and Latino students were well represented, making up over 85% of the sample. There was a high prevalence of overweight (20.2%) and an even

higher prevalence of obesity (27.4%), together accounting for nearly one-half of the entire sample.

Linear Regression Analysis

Table 4 presents the results of the multiple regression analysis for BMI z-score. After adjusting for sex, race/ethnicity, healthy and unhealthy eating indices and physical activity, there were no statistically significant main effects for either SES or shift-and-persist strategies on BMI z-score. There was, however, a significant interaction of SES with the shift-and-persist score ($p < .05$). We then conducted follow-up regression analyses with all the same controls, examining the association between SES and BMI z-scores for those high and low in shift-and-persist strategies separately (split at the mean score). In these analyses, low SES was significantly associated with higher BMI z-score among those low in shift-and-persist strategies ($\beta = .09$, $p = .036$), but not for those high in shift-and-persist strategies ($\beta = -.05$, $p = .158$). Figure 1 depicts this interaction graphically.

Discussion:

Results confirmed our hypothesis that low-SES children with psychological resilience, as defined by reporting more frequent shift-and-persist strategies, were protected against the association of low-SES with higher BMI. Low SES was significantly associated with higher BMI z-scores among children reporting lower shift-and-persist strategies.

However low SES had no association with BMI z-scores among those who had higher shift-and-persist strategies. As proposed by Chen et al⁷⁰, shifting (working to reinterpret stressors in a more positive light) and persisting (maintaining optimism about the future)

may be protective against the negative health impact of low-SES settings where, on average, individuals experience more frequent uncontrollable stressors.⁷⁹ Findings are consistent with prior research on shift-and-persist strategies by Chen et al which found that shift-and-persist strategies were protective against severity of asthma in low-SES children⁶⁸ and allostatic load in low-SES adults.⁶⁹ This study is the first to show such a relationship between shift-and-persist strategies and body mass index.

We hypothesize that shift-and-persist strategies influence BMI by enabling children to be less reactive to stressors, which in turn decreases the activation of their hypothalamic-pituitary-adrenal axis and sympathetic nervous system. Since chronic activation of the HPA axis and SNS has been linked to the accumulation of visceral fat, insulin resistance, and dysregulation of metabolism, decreasing their activation will be beneficial in preventing the development of many chronic diseases, including obesity.^{70,72} The strategies of shift-and-persist may be particularly adaptive in low-SES settings where limited resources may prevent children from taking active steps to eliminate stressors. Instead, strategies such as shift-and-persist, which involve reframing one's perception of stressors, may be more beneficial. Alternatively, shift-and-persist may affect BMI by decreasing perception of stress and therefore reducing children's stress-eating.

Our work has important implications for efforts to reduce the prevalence of overweight and obesity among children of low socioeconomic status. We identified psychological qualities of resilience that seem to protect children from the adverse impact of low-SES on BMI. It is important to determine whether shift-and-persist strategies can be learned.

If so, they may be taught to low-SES children to protect them against weight gain and other negative health outcomes. The beneficial effects of shift-and-persist strategies may be helpful to children of all weight categories because children's risk of most co-morbidities of overweight and obesity increase continuously with BMI z-score even if they are considered to be at a healthy weight.⁸⁰ Interventions that promote psychological resiliency have been successful in diverse settings, including improving academic achievement in low-performing students,⁸¹ preventing depression,^{82,83} and enhancing the coping skills of victims of bullying.⁸⁴ Future studies should examine if such interventions are effective in the prevention of overweight and obesity among low-SES children.

There are several limitations of the present study. Our measure of SES was whether students qualified for free or reduced price lunch. Although this measure is often used in the education literature, it has also come under criticism as a restricted way to assess family socioeconomic status.⁸⁵ Unfortunately, the school district collects only limited family demographic information and young children could not reasonably be expected to accurately answer questions regarding parent's educational attainment or income. Second, our study was cross-sectional in design; therefore, we cannot determine whether the relationship between shift-and-persist and BMI among low-SES children was causative.

In contrast, this study was strengthened by its large sample size and the objective measure of body mass index. Furthermore, we take a novel approach of examining a

protective rather than risk factor for obesity among low-SES children, and this factor may be amenable to future intervention.

In sum, shift-and-persist strategies protect children from the negative association of low socioeconomic status with higher BMI. Interventions aimed at promoting psychological resilience and shift-and-persist strategies in low-SES children represent a novel approach that should be added to the arsenal of interventions used to prevent childhood overweight and obesity.

Chapter 4: Conclusions

The rapid growth in childhood obesity may result in today's youth being the first generation in modern times not to outlive their parents.¹² Successful interventions for childhood obesity are essential in order to prevent this from occurring. Though some interventions have begun to have modest success in the prevention and treatment of childhood obesity, there is still much work to be done in order to reverse the epidemic.

First, we need to strengthen and make universal interventions already known to be effective in preventing and treating childhood obesity. For example, from the present research we learn that many children do not report receiving the recommended lifestyle counseling. Despite clinical indication for more intensive counseling, overweight children report similar lifestyle counseling rates as their healthy weight peers.

Furthermore, a substantial proportion of obese children report not receiving lifestyle counseling. This lack of universal counseling is a missed opportunity in the prevention and treatment of childhood obesity.

A first-line intervention that can help capture this missed opportunity is the adoption of electronic medical records that automatically calculate BMI percentile and alert the clinician if the child is overweight or obese. Additionally, future research should explore what aspects of lifestyle counseling are most effective and memorable to children.

Lastly, work needs to be done to identify and eliminate the barriers that prevent clinicians from providing effective counseling.

Additionally, we need to be creative and think beyond the traditional interventions that primarily target reducing risk factors for developing obesity. These approaches should be complemented by strategies that harness the protective factors that some children inherently possess that allow them to remain at healthy weights despite living in obesogenic environments.

For example, from the present research we learned that for children low in psychological resiliency, there was the expected association between low socioeconomic status and high BMI. However, among children high in psychological resiliency, there was no association between their SES and BMI. Together, these findings indicate that resiliency may be protective against the harmful association between SES and BMI. Though not traditionally viewed as an obesity prevention initiative, teaching psychological resiliency should be added to the armament of obesity prevention interventions.

The potential benefits of teaching resiliency may extend beyond addressing the childhood obesity epidemic since promoting resiliency has been shown to be helpful in diverse settings including academic achievement, depression, and bullying. Future research should address if an intervention that improves resiliency will also improve weight status. Additionally, future research should explore other possible protective factors of the subset of children who are able to maintain healthy weight despite living in obesogenic environments. Such protective factors can then guide further interventions.

Tackling the childhood obesity epidemic is admittedly a daunting task. However, the Herculean nature of the challenge should not be used as justification for inaction.

Through extending interventions that have proven successful while also exploring novel interventions that build upon protective factors reversing the childhood obesity epidemic may be possible. As clinicians, we are on the frontline of this epidemic and must not shy away from the challenge of childhood obesity.

Table 1: Characteristics of study sample (n=959)

Characteristic	n (%) [*]
Age	
9 years	1 (0.1)
10 years	319 (33.3)
11 years	460 (48.0)
12 years	162 (16.9)
13 years	17 (1.8)
Gender	
Female	515 (53.7)
Male	444 (46.3)
Race	
Hispanic	424 (44.2)
Black	392 (40.9)
White/other ^{**}	143 (14.9)
School Lunch Eligibility	
Free lunch	679 (70.8)
Reduced price lunch	121 (12.6)
Full price	159 (16.6)
BMI Status	
Healthy weight (5% \geq BMI < 85%)	487 (50.8)
Overweight (85% \geq BMI \leq 95%)	185 (19.3)
Obese (BMI > 95%)	287 (29.9)
Site of care	
Personal physician's office	660 (68.8)
Emergency room	124 (12.9)
School health clinic	47 (4.9)
Unknown	128 (13.4)
Asthma	
Yes	219 (22.8)
No	740 (77.2)
Diabetes	
Yes	25 (2.6)
No	934 (97.4)

^{*}Percentages may not add to 100% due to rounding

^{**}Other includes Asians (n= 14) and American Indian (n=1)

Table 2: Associations Between Lifestyle Counseling with BMI Status and Demographic Variables

	Weight Counseling (n=946)			Nutrition Counseling (n=956)			Physical Activity Counseling (n=946)			
	% counseled	Adjusted OR [†] (95% CI)		% counseled	Adjusted OR [†] (95%CI)		% counseled	Adjusted OR [†] (95% CI)		
BMI Status										
Healthy weight (5% ≥ BMI <85%)	57.8	—		60.8	—		55.4	—		
Overweight (85% ≥ BMI < 95%)	61.8	1.16 (0.85, 1.59)		66.2	1.20 (0.90, 1.60)		65.9	1.62 (1.05, 2.48)*		
Obese (BMI ≥ 95%)	76.1	2.21 (1.65, 2.97)***		79.4	2.52 (1.73, 3.67)***		71.3	1.96 (1.27, 3.04)**		
Race										
White	49.7	—		49.6	—		39.6	—		
Black	63.3	1.38 (1.06, 1.79)*		65.4	1.80 (1.12, 2.90)*		63.8	2.12 (1.44, 3.12)***		
Hispanic	70.0	1.84 (1.24, 2.71)**		75.2	2.94 (1.48, 5.82)**		68.3	2.57 (1.68, 3.93)***		
Gender										
Male	61.6	—		64.0	—		60.0	—		
Female	66.2	1.40 (1.07, 1.84)*		70.4	1.59 (1.20, 2.10)**		64.0	1.38 (1.02, 1.86)*		
Lunch Eligibility										
Full Price	52.3	—		61.1	—		43.1	—		
Free or Reduced	66.5	1.58 (1.108, 2.30)*		68.7	1.03 (0.67, 1.57)		65.9	2.15 (1.23, 3.76)**		
Asthma										
No	62.0	—		66.4	—		60.9	—		
Yes	71.4	1.36 (1.17, 1.66)**		71.0	0.98 (0.72, 1.34)		66.5	1.11 (0.66, 1.85)		
Diabetes										
No	63.7	—		66.9	—		61.7	—		
Yes	81.8	2.39 (0.93, 6.09)		87.5	3.65 (1.03, 12.96)*		78.3	2.12 (1.18, 3.79)*		
Likelihood Ratio Test of Global Null Hypothesis										
		χ ²	df	p-value	χ ²	df	p-value	χ ²	df	p-value
		60.23	12	<.0001	80.52	12	<.0001	77.30	12	<.0001

[†] Also adjusted for age and site of care provider

* p < 0.05 , ** p < 0.01, *** p < 0.001 based upon Wald Chi-Square statistic

OR= odds ratio, CI= confidence interval

Table 3: Characteristics of study sample (n= 1523)

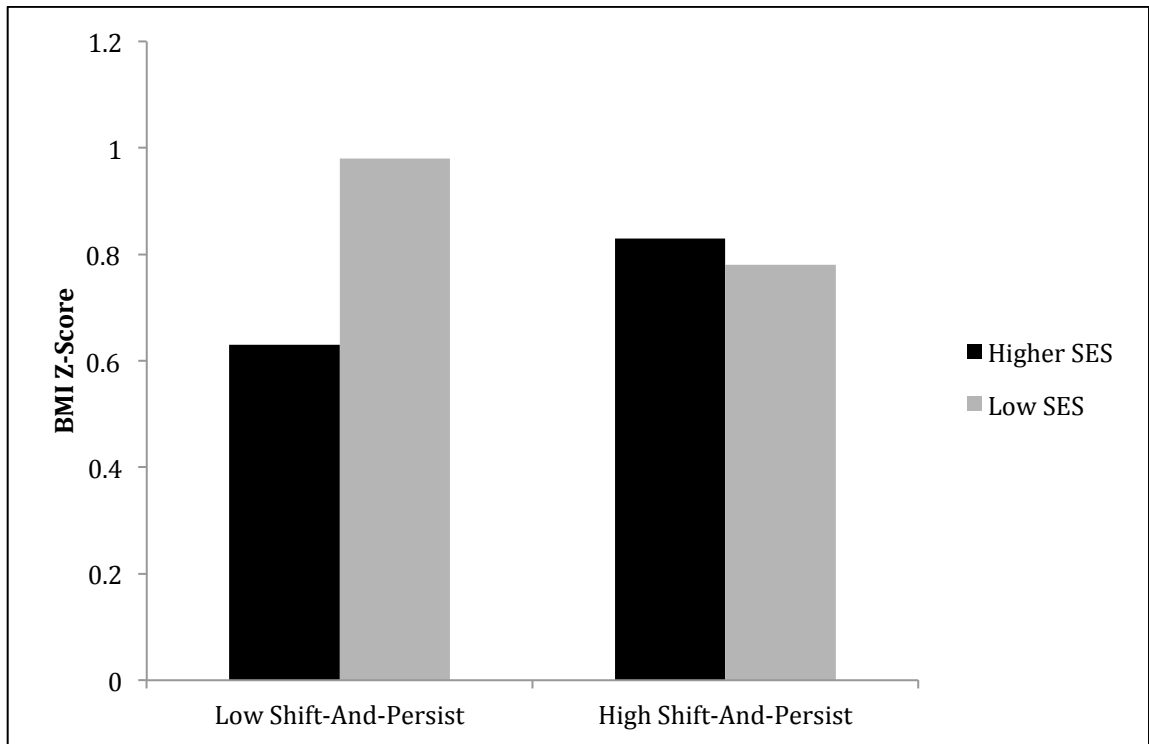
Characteristic	N (%)	Mean ± SD
Age		12.4 ± 1.3
Gender		
Female	819 (53.8%)	
Male	704 (46.2%)	
BMI Status		
Healthy weight (<85% BMI)	798 (52.4%)	
Overweight (85% ≥ BMI ≤95%)	307 (20.2%)	
Obese (BMI > 95%)	418 (27.4%)	
BMI unadjusted		22.6 ± 5.6
Race/ethnicity		
Hispanic	728 (47.8%)	
Black	583 (38.3%)	
White/other	212 (13.9%)	
Socioeconomic Status		
Low SES (free/reduced lunch)	1335 (87.7%)	
Higher SES (ineligible)	188 (12.3%)	
Shift-and-Persist Score		14.97 ± 3.13

Table 4: Multiple Regression Analysis Predicting BMI Z-score

Predictor	β	P-value
SES	.01	.78
Shift-and-persist score	.09	.23
SES x shift-and-persist score	-.15	.03

Note: adjusted for sex, race/ethnicity, health and unhealthy eating scales, and physical activity. SES = socioeconomic status (1 = qualifies for free/reduced price lunch, 0 = ineligible for free/reduced price lunch)

Figure 1: Mean BMI Z-scores by SES and Level of Shift-and-Persist.



Shift-and-persist level was split at the mean. Low SES was significantly associated with higher BMI z-score for those low in shift-and-persist, but not for those high in shift-and-persist.

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