

Quantifying overweight and obesity among Alachua County adults and children

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Abstract

Alachua County's "Community Health Improvement Plan" (CHIP) establishes goals, strategies and objectives with the aim of improving access to primary and preventive care as well as promoting wellness. Objective CW1.1.1 aims to reduce the prevalence of obesity among middle-schoolers to 6% by December 2014. The data suggest (1) that the BRFSS data by which these goals were established significantly underestimated the prevalence of overweight and obesity among Alachua County youth, and (2) that this objective should be re-written to account for the most recent data as well as for disparities among students of different race and socioeconomic status. Objective CW1.1.2 aims to reduce the incidence of middle school children who do not get sufficient exercise to $\leq 20\%$ by December 2014. The data suggest (1) that the BRFSS data by which these goals were established needs to be updated. Objective CW1.2.1 aims to reduce the incidence of overweight and obesity among adults to $\leq 50\%$.

I. INTRODUCTION

Overweight and obesity among schoolchildren is a significant public health issue. Not only is childhood overweight causally correlated to obesity in adulthood, obesity entails short-term health problems for children such as asthma, increased risk of allergies, headaches, joint and muscle pain, and decreased quality of life.^{1,2} Obese youth have significantly worse indicators for mental health than their non-obese counterparts, are at greater risk for depression and perform worse academically.³

Furthermore, the estimated global prevalence of childhood obesity has nearly doubled in the last two decades, with the southern United States being most impacted by the current epi-

demic.⁴ Given these facts, the Alachua County Community Health Improvement Plan incorporates several objectives related to youth obesity under the strategic goal of "promoting wellness among all Alachua County residents."⁵ This paper aims to evaluate progress on Objective CW1.1.1, which states that "by December 31, 2014, the incidence of middle school children $\geq 95\%$ of BMI for age will be $\leq 6\%$." In order to do so, three questions are specifically addressed:

- What is the prevalence of obesity and overweight among Alachua County 6th-graders?
- How has this number changed over the last seven years?
- Which groups are most affected by the youth obesity epidemic?

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¹Dannemann, A., Ernert, A., Rucker, P., Bau, A. M., Martus, P., Krude, H., . . . Wiegand, S. (2011). Ethnicity and comorbidities in an overweight and obese multiethnic childhood cohort in Berlin. *Acta Paediatr*, 100(4), 578-584.

²Halfon, N., Larson, K., Slusser, W. (2013). Associations between obesity and comorbid mental health, developmental, and physical health conditions in a nationally representative sample of US children aged 10 to 17. *Acad Pediatr*, 13(1), 6-13.

³Pulgaron, E. R. (2013). Childhood obesity: a review of increased risk for physical and psychological comorbidities. *Clin Ther*, 35(1), A18-32.

⁴Wang, Y., Lobstein, T. (2006). Worldwide trends in childhood overweight and obesity. *Int J Pediatr Obes*, 1(1), 11-25

⁵Goal CW1 of the CHIP deals explicitly with "increasing the percentage of adults and children who are at a healthy weight." Available at: <http://www.floridahealth.gov/chdalachua/docs/alachuaCHIP.pdf>

We conclude that (1) youth obesity in Alachua County has been underestimated and that (2) significant disparities in obesity and overweight exist along racial and socioeconomic lines.

II. BACKGROUND

Alachua County is situated in North Central Florida and has a population of approximately 250,000 residents. It is a diverse county by race (70% white, 20% black), age (51.6% ages 15-44) and rurality (58% live in incorporated areas).⁶

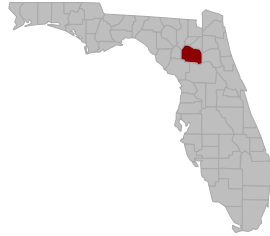


Figure 1: *Alachua County, Florida*

Using 2010 data from the BRFSS, Alachua appeared to be outperforming the rest of the State with only 8.2% of middle-schoolers with a BMI at or above the 95th percentile for age (compared to a Statewide prevalence of 11.7%).⁷ Furthermore, the prevalence of obesity in Alachua appeared to be trending downwards, having dropped more than 3% in two years. It was in this context that the goal of reducing middle school obesity to only 6% was established.

⁶<http://www.floridahealth.gov/chdalachua/docs/chp2012.pdf>

⁷Behavioral Risk Factor Surveillance Survey, 2010. Available through the Florida Department of Health at <http://www.floridacharts.com/charts/OtherIndicators/NonVitalIndRateOnlyDataViewer.aspx?cid=0503>

⁸Florida Statute 1003.22

⁹Flegal, KM; Cole, TJ (2013). Construction of LMS Parameters for the Centers for Disease Control and Prevention 2000 Growth Charts. National Health Statistics Reports (63). Available at: <http://www.cdc.gov/nchs/data/nhsr/nhsr063.pdf>

¹⁰Though some data were available on other middle-schoolers, 6th-grade is the year in which screenings were requiring, so 7th- and 8th-graders were excluded to avoid potential selection bias.

¹¹Full details available upon request.

III. METHODS

As per Florida State statute, schoolchildren are screened at schools for vision, hearing, scoliosis, height and weight.⁸ Using data from the School Board of Alachua County, collected by nurses during screenings, BMI and Z-scores for age were calculated according to the CDC's guidelines.⁹ Overweight is defined as greater than or equal to the 85th percentile for age (Z-score ≥ 1.036); obesity is defined as greater than or equal to the 95th percentile for age (Z-score ≥ 1.645).

Data were subset to include only 6th-graders.¹⁰ A degree of liberty was taken in correcting for misplaced decimals, though these corrections were made systematically.¹¹ As per CDC's guidelines, children with a Z score of less than -4 or greater than 5 were assumed to be data errors and excluded from analysis.

Race and socioeconomic strata-specific prevalence of obesity and overweight were calculated in addition to overall scores for each year from 2007 to 2013. Using logistic regression, unadjusted and adjusted odds ratios were calculated for obesity in 2013-14.

All students were categorized as one of six race groups:

1. White, non-hispanic
2. Black, non-hispanic
3. Hispanic
4. Asian or pacific islander
5. American Indian or Alaskan native
6. Multiracial

. Given small strata size, students of American Indian or Alaskan native origin were included

in the binary "non-white" category for analysis, but not race-specific odds ratios calculations.

Though BMI and BMI percentile for age had originally been recorded by nurses at the time of screening, both scores were recalculated for two reasons: (1) because a number of school-specific systematic errors existed in BMI calculations and (2) BMI percentile for age calculations relied on a visual curve (rather than the arithmetic Z-score formula).

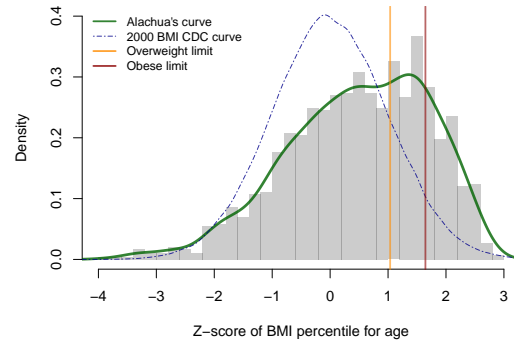


Figure 3: *Z-score distribution of Alachua County 6th-graders, 2013-14*

IV. RESULTS

I. Prevalence

At the time of screening in the 2013-14 school year, the prevalence of obesity among Alachua County 6th-graders was 18.14%. 37.74% of Alachua County 6th-graders were above the 85th percentile for age (the CDC cut-off for "overweight").

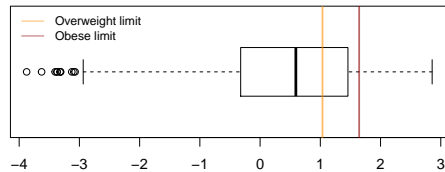


Figure 2: *Z-score distribution of Alachua County 6th-graders, 2013-14*

The distribution of BMI percentile for age among all 6th graders is markedly to the right of the CDC's theoretical bell curve. The median Z-score for BMI percentile for age was 0.59, equivalent to the CDC's 72nd percentile. Two thirds of 3rd graders were above the 50th percentile.

The prevalence of obesity is greatest in middle schools outside of central Gainesville.

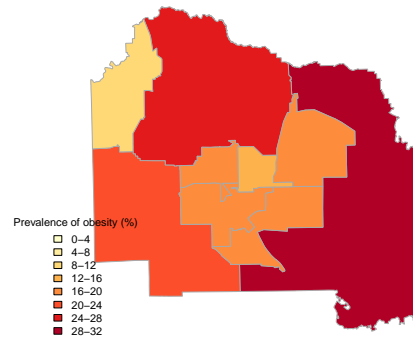


Figure 4: *Prevalence of obesity by school zone)*

II. Trends

2013-14 had the lowest prevalence of obesity among sixth-graders of any of the last seven years, and the lowest prevalence of overweight since 2007.

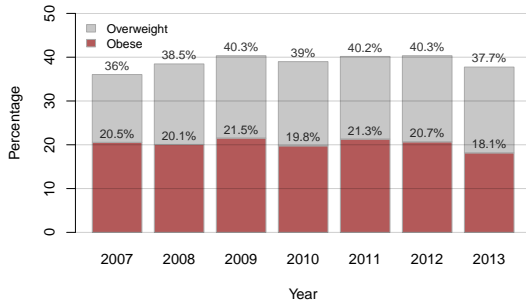


Figure 5: Obesity and overweight among Alachua County 6th-graders

The overall reduction in the prevalence of obesity and overweight in the 2013-14 school year was accompanied by a reduction across racial lines from 2012-13 levels. However, multi-year analysis suggests that disparities are increasing: the prevalence of white obesity and overweight has declined significantly since a 2010/11 peak, whereas the prevalence among non-white students has increased or declined at a slower rate.

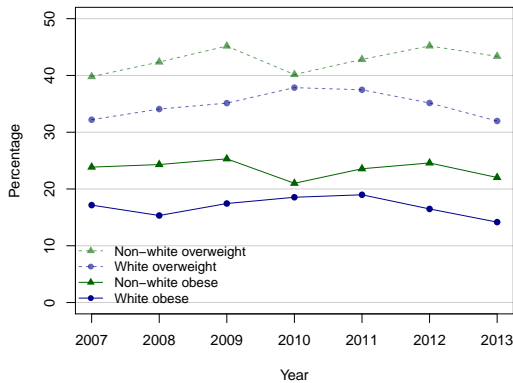


Figure 6: Obesity and overweight among Alachua County 6th-graders, by race

Likewise, a reduction was observed from the 2012-13 to 2013-14 school year in the prevalence of obesity and overweight among both students that qualify for free and reduced lunch and those that do not .

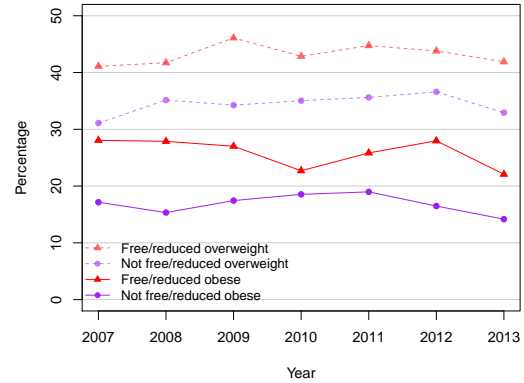


Figure 7: Obesity and overweight among Alachua County 6th-graders, by free/reduced lunch status

III. Risk factors for obesity

Race

The odds of obesity are different among students of different racial origins. White students have the lowest prevalence of obesity (14.17%). Non-white students have a 71% greater risk for obesity than their white counterparts (OR=1.71, 95% CI: 1.30-2.26). Using white, non-hispanic as the reference group, all non-white groups have greater odds for obesity; among students of black, hispanic and multiracial origin, this difference is statistically significant ($P < 0.05$).

Table 1: Weight status by race

Race	Normal	Overweight	Obese
White	485 (68.02%)	228 (31.98%)	101 (14.17%)
Asian	44 (61.97%)	27 (38.03%)	14 (19.72%)
Black	272 (57.75%)	199 (42.25%)	104 (22.08%)
Hispanic	43 (53.75%)	37 (46.25%)	15 (18.75%)
Multiracial	53 (50.48%)	52 (49.52%)	28 (26.67%)

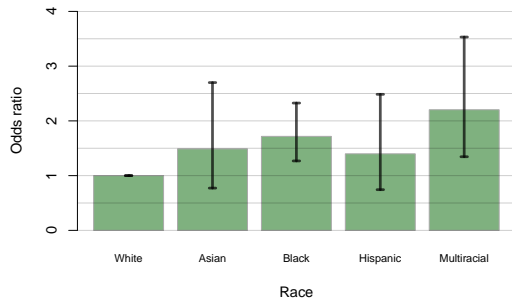


Figure 8: Odds ratios for obesity among Alachua County 6th-graders (with 95% confidence interval)

Socioeconomic status

Like race, socioeconomic status is also associated with obesity. Students who qualify for free or reduced lunch are 67% more likely to be obese than those who do not (OR=1.67, 95% CI: 1.27-2.22).

Table 2: Weight status by free/reduced lunch status

Free/reduced lunch	Normal	Overweight	Obese
Does not qualify	442 (67.07%)	217 (32.93%)	93 (14.11%)
Qualifies	455 (58.11%)	328 (41.89%)	169 (21.58%)

Physical Activity

Regular physical activity in adolescence helps control weight and promotes psychological well-being. The U.S. Department of Health and Human Services recommends that young people participate in at least 60 minutes of physical activity daily. Objective CW1.1.2 seeks to measure the incidence of middle school children who do not get sufficient exercise in order to determine contributing factors of obesity in our community. Data from the Youth Risk Behavior Survey (YRBS) shows the incidence of middle school children who do not get sufficient exercise has slightly declined over the years, along with the Florida average. In 2012, the percentage of middle school children in Alachua County who met the recommendations for sufficient exercise

was 28.3%.

Table 3: Middle school children who do not get sufficient exercise

X	Alachua	Florida
Year	Rate (%)	Rate (%)
2012	28.3	29.9
2010	29.8	30.7
2008	32.2	31.6
2006		30.9

Statistical adjustment

When controlling for race, socioeconomic status remains a significant predictor of obesity. When controlling for socioeconomic status, only multiracial students have a statistically significant greater risk of obesity than white students. However, the risk of obesity among all non-white students is greater than that of whites, but not statistically significant.

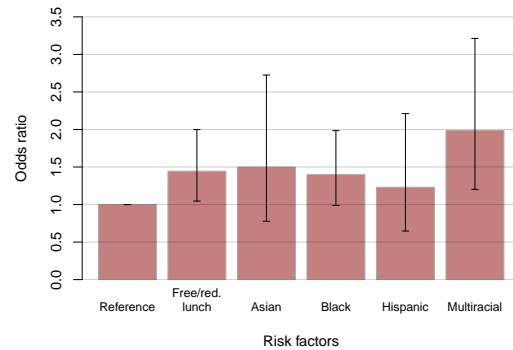


Figure 9: Adjusted odds ratios for obesity among Alachua County 6th-graders (with 95% confidence interval)

V. DISCUSSION

While the prevalence of obesity among 6th-graders has declined by 3% over the past two years, significant disparities exist along socioeconomic lines. Disparities in Alachua may echo national trends, though recent and comparable data at the national and state levels are unavailable.¹² Although we find race to be a risk factor

¹²CB Frederick CB, K Snellman, RD Putnam, Increasing socioeconomic disparities in adolescent obesity. PNAS Early Edition, 2013.

for obesity (at a level on the border of statistical significance), larger studies that account for more confounders suggest that non-racial factors related to SES are the best predictors of whether a child will be obese.¹³ Interventions aimed at reducing inequalities in obesity, therefore, should focus on SES.

Limitations

Data were collected in school screenings at 15 different schools over 7 years, with non-standardized procedures for anthropometric recording. The noise created by diverse methods of measurement, employee turnover and systematic error is evident at a number of levels (see Figures 6 and 7, year 2010), and calls into question the internal validity of this study.

Recommendations

Our recommendations are to:

1. Change goal CW1.1.1 to reflect school screening data and re-adjust goals appropriately (to somewhere in the 14-16% range), and measure future progress solely on screening data.
2. Make the addition of a sub-goal to address disparities in obesity among socioeconomic lines, with a targets established specifically for students on free and reduced lunch.

DETAILS

This analysis was conducted using data generously provided by Alachua County Public Schools' annual health screenings. The analysis was carried out entirely in the R programming language, and this report was generated in LaTeX using Sweave. Full code available upon request: Keri.White@FLHealth.gov

¹³EM Taveras, MW Gillman, KP Kleinman, JW Rich-Edwards, SL Rifas-Shiman, Reducing racial-ethnic disparities in childhood obesity: the role of early life risk factors. *JAMA Pediatrics*(8)731-8, August 1 2013.