



The Relationship Between Body Mass Index in Children and Insurance Type, Parental Eating Concern, Asthma, and Allergies

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ABSTRACT

Introduction: Trust for America's Health reported rising levels of obesity contributed to increased disease rates and health care costs (Levi et al., 2013). Factors associated with overweight and obesity rates include lower socioeconomic status, public insurance, and increased chronic disease rates.

Methods: Body mass index percentile, health insurance, parental eating concern, asthma, and allergy information were evaluated from a dataset of 870 de-identified health assessment records.

Results: Among overweight/obese children, we found significant differences in children insured by Medicaid (26%) versus

commercial insurance (15.9%), children with asthma (22.1%) versus children without asthma (14.8%), and children with known allergies (7.8%) versus children without known allergies (16.7%). The difference between children with parental eating concerns (3.7%) and children without (18.1%) was nearly significant.

Discussion: The associations depicted can assist pediatric providers in recognizing risk factors for overweight/obesity among their patients. Combating obesity in childhood can improve health outcomes. *J Pediatr Health Care.* (2019) 33, e29–e37

KEY WORDS

Obesity, asthma, allergies, eating concerns, pediatrics

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INTRODUCTION

In their review of the 2015–2016 National Health and Nutrition Examination Survey, Ogden, Carroll, Kit, and Flegal (2014) explained that the prevalence of obesity has been stagnant near 39.8% in adults and 18.5% in youths; new approaches must be taken to alleviate this public health concern. Whereas obesity is a larger problem in the adult population, studies have shown that it is more achievable to overcome caloric imbalance in newborns to children aged 5 years than it is in older children and adults (Dietz, 2012). Our particular interest in the pediatric population, specifically aged 2–5 years, stems from the plasticity of this age group's bodies and habits. There are many factors that contribute to a healthy weight in the pediatric population, including environmental, genetic, sleep, and medications (Kumar & Kelly, 2017). In this study, the research questions that were addressed are (1) What is the relationship between public and private insurance provider type and overweight/obese body mass index (BMI) in children aged 2–5 years,

(2) What is the relationship between parental eating concern and overweight/obese BMI in children aged 2–5 years, (3) What is the relationship between asthma and overweight/obese BMI in children aged 2–5 years, and (4) What is the relationship between allergies and overweight/obese BMI in children aged 2–5 years?

The intent of this study is to illuminate, more specifically than in previous studies, critical factors associated with childhood obesity. Whereas previous studies have used objective comorbid conditions to predict obesity, this study is unique in that it explores the intersection of a subjective factor, parental eating concern, with objective data regarding asthma, allergies, and insurance type. The researchers' hypotheses are that young children in the overweight and obese BMI percentiles are more likely to be insured by Medicaid and have an asthma diagnosis than their peers in the normal BMI percentiles. This study hypothesizes that children in the overweight and obese BMI percentiles are less likely to have allergies and parental eating concerns than their peers in the normal BMI percentiles.

In 2014, the Child Health and Development Institute of Connecticut published a report about the maternal-child life course approach to preventing childhood obesity. The authors reported that access to adequate periconceptional nutrition, breastfeeding support, and nutritious food for complementary feeding of the infant can greatly affect a child's weight gain in the first few years of life (Pérez-Escamilla & Meyers, 2014). Furthermore, these factors were often influenced by socioeconomic status. Integrating factors are necessary to target the specific behaviors to change (Kumar & Kelly, 2017). In this study, insurance provider type is used as a proxy for socioeconomic status; children insured by HUSKY Health (Medicaid in Connecticut) were considered to be of lower socioeconomic status than those covered by commercial insurance.

Whereas the relationship between childhood overweight/obesity and parental concern for their child's eating habits has not specifically been analyzed, it is shown that the mothers of children who are both picky eaters and in the lower BMI percentile are more likely to be concerned with undernutrition. These mothers are also likely to exhibit pressuring behaviors during mealtime. Additionally, one third of mothers in low-income households are concerned that their 4–8-year-olds might not eat enough (Brown et al., 2016). However, undernutrition is not the only concern elucidated from parents. Studies have also shown that when parents are overly restrictive regarding nutrition, it can be counterproductive, leading to increased eating and BMI (Clarke, Goyder, Bissell, Blank, & Peters, 2007).

Asthma is known to affect children in lower socioeconomic classes more frequently than those in higher socioeconomic classes, with poor air quality in disadvantaged neighborhoods, home allergens associated with poor pest control, dust mites, and mold spores as key contributors (Kranjac et al., 2017). A recent study associated increased adiposity with asthma and airway inflammation in children (Chen et al., 2017). Additionally, a positive relationship has

been established between obesity and atopy in the pediatric population, which could increase the likelihood for developing asthma (Visness et al., 2009). Obesity may increase the risk of developing asthma, possibly because of airway inflammation or other obstruction or variance in physical activity and diet (Story, 2007).

Allergies in children, particularly those to foods and medications, do not show a clear direct or inverse relationship with the occurrence of overweight/obesity. Whereas obesity and eczema seem to correlate positively, the relationship between obesity and allergic rhinitis/rhinoconjunctivitis tends to be more inverse in nature (Raj, Kabra, & Lodha, 2014). Some studies have shown an increase in sensitization to food and IgE levels, more so in the obese weight category than the overweight category, indicating a positive correlation between BMI and allergic predisposition (Visness et al., 2009).

This topic is of importance in pediatric primary care because of the increasing comorbidity of conditions such as obesity and asthma. If physicians identify a condition that could lead to obesity, then it could act as a forewarning to increase preventive measures in that area (Chen et al., 2017; Kumar & Kelly, 2017; Ogden et al., 2014). This would allow a more comprehensive perspective on how to reduce rates of obesity and its associated negative health conditions.

METHODS

BMI percentile, health insurance, parental eating concern, asthma, and allergy information were evaluated from a dataset of 870 de-identified health assessment records (Figure 1) provided by the Child Health and Development Institute of Connecticut. The records were for children aged 2–5 years who were enrolled in licensed Early Care and Education (ECE) programs in Connecticut in 2013–2014. In this form, the parent or guardian filled out Part I, which included portions of whether they had HUSKY insurance. The form did not ask whether HUSKY was their only form of insurance, or whether they were also covered by commercial insurance. Additionally, the form did not inquire about Children's Health Insurance Program. Part I of the form also asked parents if they had parental eating concerns, and if yes, parents were asked to elaborate more on their response. Physicians filled out Part II, which contained portions regarding asthma and allergies. They elaborated on the extent of the asthma; whether it was intermittent, mild persistent, moderate persistent, severe persistent, or exercise induced. Physicians were asked whether the child had allergies and to elaborate on their response. Physicians listed allergies, including, but not limited to, dander, seafood, fruits, antibiotics, and nuts. This study did not incorporate the specific asthma types or allergens in the analysis. The assessment records were required to be completed by health care providers and parents or guardians before enrolling in one of the centers. The purpose of the health record is to confirm that a child is socially, emotionally, medically, and developmentally ready to attend child care (Crowley & Whitney, 2005). An Institutional Review Board exemption was approved based

FIGURE 1. Early Childhood Health Assessment Record



State of Connecticut Department of Education
Early Childhood Health Assessment Record
 (For children ages birth – 5)



To Parent or Guardian: In order to provide the best experience, early childhood providers must understand your child's health needs. This form requests information from you (Part I) which will be helpful to the health care provider when he or she completes the health evaluation (Part II). State law requires complete primary immunizations and a health assessment by a physician, an advanced practice registered nurse, a physician assistant, or a legally qualified practitioner of medicine, an advanced practice registered nurse or a physician assistant stationed at any military base prior to entering an early childhood program in Connecticut.

Please print

Child's Name (Last, First, Middle)		Birth Date (mm/dd/yyyy)	☐ Male ☐ Female
Address (Street, Town and ZIP code)			
Parent/Guardian Name (Last, First, Middle)		Home Phone	Cell Phone
Early Childhood Program (Name and Phone Number)		Race/Ethnicity	
Primary Health Care Provider:		☐ American Indian/Alaskan Native ☐ Hispanic/Latino ☐ Black, not of Hispanic origin ☐ Asian/Pacific Islander ☐ White, not of Hispanic origin ☐ Other	
Name of Dentist:			
Health Insurance Company/Number* or Medicaid/Number*			
Does your child have health insurance? Y N		If your child does not have health insurance, call 1-877-CT-HUSKY	
Does your child have dental insurance? Y N			
Does your child have HUSKY insurance? Y N			

* If applicable

Part I — To be completed by parent/guardian.

Please answer these health history questions about your child before the physical examination.

Please circle **Y** if "yes" or **N** if "no." Explain all "yes" answers in the space provided below.

Any health concerns Y N	Frequent ear infections Y N	Asthma treatment Y N
Allergies to food, bee stings, insects Y N	Any speech issues Y N	Seizure Y N
Allergies to medication Y N	Any problems with teeth Y N	Diabetes Y N
Any other allergies Y N	Has your child had a dental examination in the last 6 months Y N	Any heart problems Y N
Any daily/ongoing medications Y N	Very high or low activity level Y N	Emergency room visits Y N
Any problems with vision Y N	Weight concerns Y N	Any major illness or injury Y N
Uses contacts or glasses Y N	Problems breathing or coughing Y N	Any operations/surgeries Y N
Any hearing concerns Y N		Lead concerns/poisoning Y N
Developmental — Any concern about your child's:		Sleeping concerns Y N
1. Physical development Y N	5. Ability to communicate needs Y N	High blood pressure Y N
2. Movement from one place to another Y N	6. Interaction with others Y N	Eating concerns Y N
3. Social development Y N	7. Behavior Y N	Toileting concerns Y N
4. Emotional development Y N	8. Ability to understand Y N	Birth to 3 services Y N
	9. Ability to use their hands Y N	Preschool Special Education Y N

Explain all "yes" answers or provide any additional information:

Have you talked with your child's primary health care provider about any of the above concerns? Y N

Please list any **medications** your child will need to take during program hours:

*All medications taken in child care programs require a separate **Medication Authorization Form** signed by an authorized prescriber and parent/guardian.*

I give my consent for my child's health care provider and early childhood provider or health/nurse consultant/coordinator to discuss the information on this form for confidential use in meeting my child's health and educational needs in the early childhood program.

Signature of Parent/Guardian

Date

ED 191 REV. 3/2015 C.G.S. Section 10-16q, 10-206, 19a-79(a), 19a-87(b)(c); P.H. Code Section 19a-79-5a(a)(2), 19a-87b-10b(2)

FIGURE 1. Continued

Part II — Medical Evaluation

ED 191 REV. 3/2015

Health Care Provider must complete and sign the medical evaluation, physical examination and immunization record.

Child's Name _____ Birth Date _____ Date of Exam _____
☐ I have reviewed the health history information provided in Part I of this form (mm/dd/yyyy) (mm/dd/yyyy)

Physical Exam

Note: *Mandated Screening/Test to be completed by provider.

*HT _____ in/cm _____ % *Weight _____ lbs. _____ oz / _____ % BMI _____ / _____ % *HC _____ in/cm _____ % *Blood Pressure _____ / _____
 (Birth – 24 months) (Annually at 3 – 5 years)

Screenings

*Vision Screening ☐ EPSTD Subjective Screen Completed (Birth to 3 yrs) ☐ EPSTD Annually at 3 yrs (Early and Periodic Screening, Diagnosis and Treatment) Type: <u>Right</u> <u>Left</u> With glasses 20/ 20/ Without glasses 20/ 20/ ☐ Unable to assess ☐ Referral made to: _____	*Hearing Screening ☐ EPSTD Subjective Screen Completed (Birth to 4 yrs) ☐ EPSTD Annually at 4 yrs (Early and Periodic Screening, Diagnosis and Treatment) Type: <u>Right</u> <u>Left</u> ☐ Pass ☐ Pass ☐ Fail ☐ Fail ☐ Unable to assess ☐ Referral made to: _____	*Anemia: at 9 to 12 months and 2 years <table border="1"> <tr> <td data-bbox="995 598 1230 651">*Hgb/Hct:</td> <td data-bbox="1230 598 1353 651">*Date</td> </tr> </table> *Lead: at 1 and 2 years; if no result screen between 25 – 72 months History of Lead level ≥ 5µg/dL ☐ No ☐ Yes	*Hgb/Hct:	*Date
*Hgb/Hct:	*Date			
*TB: High-risk group? ☐ No ☐ Yes Test done: ☐ No ☐ Yes Date: _____ Results: _____ Treatment: _____	*Dental Concerns ☐ No ☐ Yes ☐ Referral made to: _____ Has this child received dental care in the last 6 months? ☐ No ☐ Yes	*Result/Level: *Date Other:		

***Developmental Assessment:** (Birth – 5 years) ☐ No ☐ Yes **Type:**

Results:

***IMMUNIZATIONS** ☐ Up to Date or ☐ Catch-up Schedule: **MUST HAVE IMMUNIZATION RECORD ATTACHED**

*Chronic Disease Assessment:

Asthma	☐ No ☐ Yes: ☐ Intermittent ☐ Mild Persistent ☐ Moderate Persistent ☐ Severe Persistent ☐ Exercise induced <i>If yes, please provide a copy of an Asthma Action Plan</i>
	☐ Rescue medication required in child care setting: ☐ No ☐ Yes
Allergies	☐ No ☐ Yes: _____ Epi Pen required: ☐ No ☐ Yes
	History/risk of Anaphylaxis: ☐ No ☐ Yes: ☐ Food ☐ Insects ☐ Latex ☐ Medication ☐ Unknown source <i>If yes, please provide a copy of the Emergency Allergy Plan</i>
Diabetes	☐ No ☐ Yes: ☐ Type I ☐ Type II Other Chronic Disease: _____
Seizures	☐ No ☐ Yes: Type: _____

- ☐ This child has the following problems which may adversely affect his or her educational experience:
☐ Vision ☐ Auditory ☐ Speech/Language ☐ Physical ☐ Emotional/Social ☐ Behavior
- ☐ This child has a developmental delay/disability that may require intervention at the program.
- ☐ This child has a special health care need which may require intervention at the program, e.g., special diet, long-term/ongoing/daily/emergency medication, history of contagious disease. *Specify:* _____
- ☐ No ☐ Yes This child has a medical or emotional illness/disorder that now poses a risk to other children or affects his/her ability to participate safely in the program.
- ☐ No ☐ Yes Based on this comprehensive history and physical examination, this child has maintained his/her level of wellness.
- ☐ No ☐ Yes This child may fully participate in the program.
- ☐ No ☐ Yes This child may fully participate in the program with the following restrictions/adaptation: (Specify reason and restriction.) _____
- ☐ No ☐ Yes Is this the child's medical home? ☐ I would like to discuss information in this report with the early childhood provider and/or nurse/health consultant/coordinator.

Signature of health care provider MD / DO / APRN / PA Date Signed Printed/Stamped **Provider** Name and Phone Number

on the understanding that the research involves existing data and the information collected is not identifiable.

The Early Childhood Health Data Initiative project was a pilot project designed to help community early childhood councils inform their early childhood planning using health data reported to ECE programs. The goals included helping medical homes maintain the health of patients in ECE programs, helping communities target health issues, and informing the state's early childhood efforts to monitor the health of young children ([Early Childhood Health Data Initiative, 2017](#)). All children enrolled in the ECE program were required to have an assessment record completed by a parent or guardian on file in the ECE site. A second aim of the data project was to assess the value of the record in supporting communication between pediatric primary-care providers and ECE programs. Twenty-six ECE programs from eight communities participated in the project, including 80.8% ($n = 21$) center-based programs, 15.4% ($n = 4$) school-based programs, and 3.8% ($n = 1$) home-based programs. Among the 26 ECE programs, there were 41 ECE program sites. Half of these sites (51.2%, $n = 21$) received

state or federal childcare subsidies, including one Head Start program. Head Start is a federal program that promotes school readiness for children from birth to age 5 years from low-income families with the goal of enhancing their cognitive, social, and emotional development ([Connecticut Head Start Program, n.d.](#)).

BMI percentiles were calculated and categorized according to the guidelines of the Centers for Disease Control and Prevention, for all heights and weights reported: underweight (<5th percentile), normal weight (5th percentile to <85th percentile), overweight (85th percentile to <95th percentile), and obese (≥ 95 th percentile; [Healthy Weight, 2018](#)).

A cross tabulation was conducted for each variable using Statistical Package for the Social Sciences, along with a Pearson χ^2 test giving a two-sided asymptotic significance p value.

RESULTS

The n values for measures reflected responses on the health forms that were completely filled out by the parent or provider regarding that specific measure. Among children with

FIGURE 2. Proportion of overweight/obese by insurance type

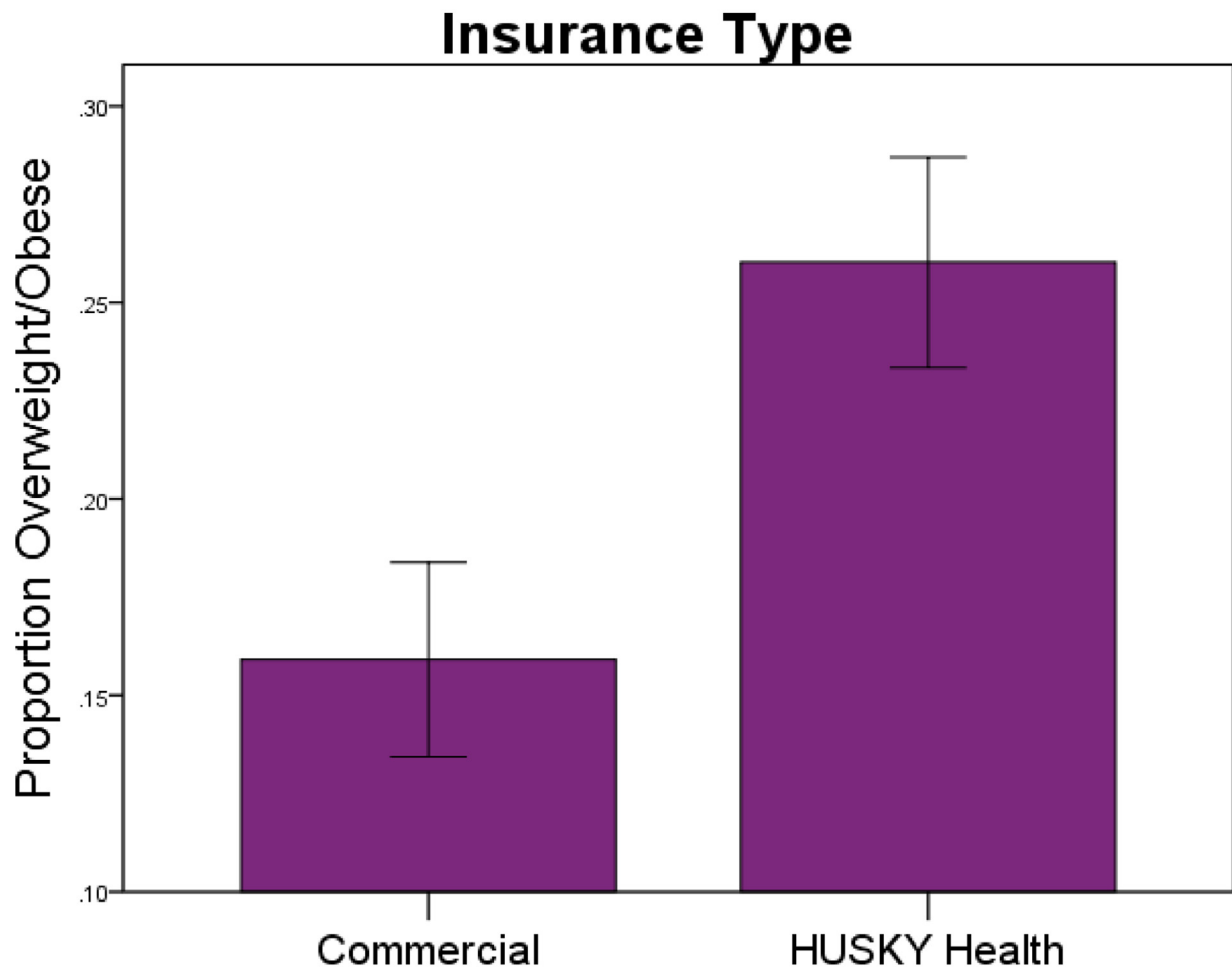
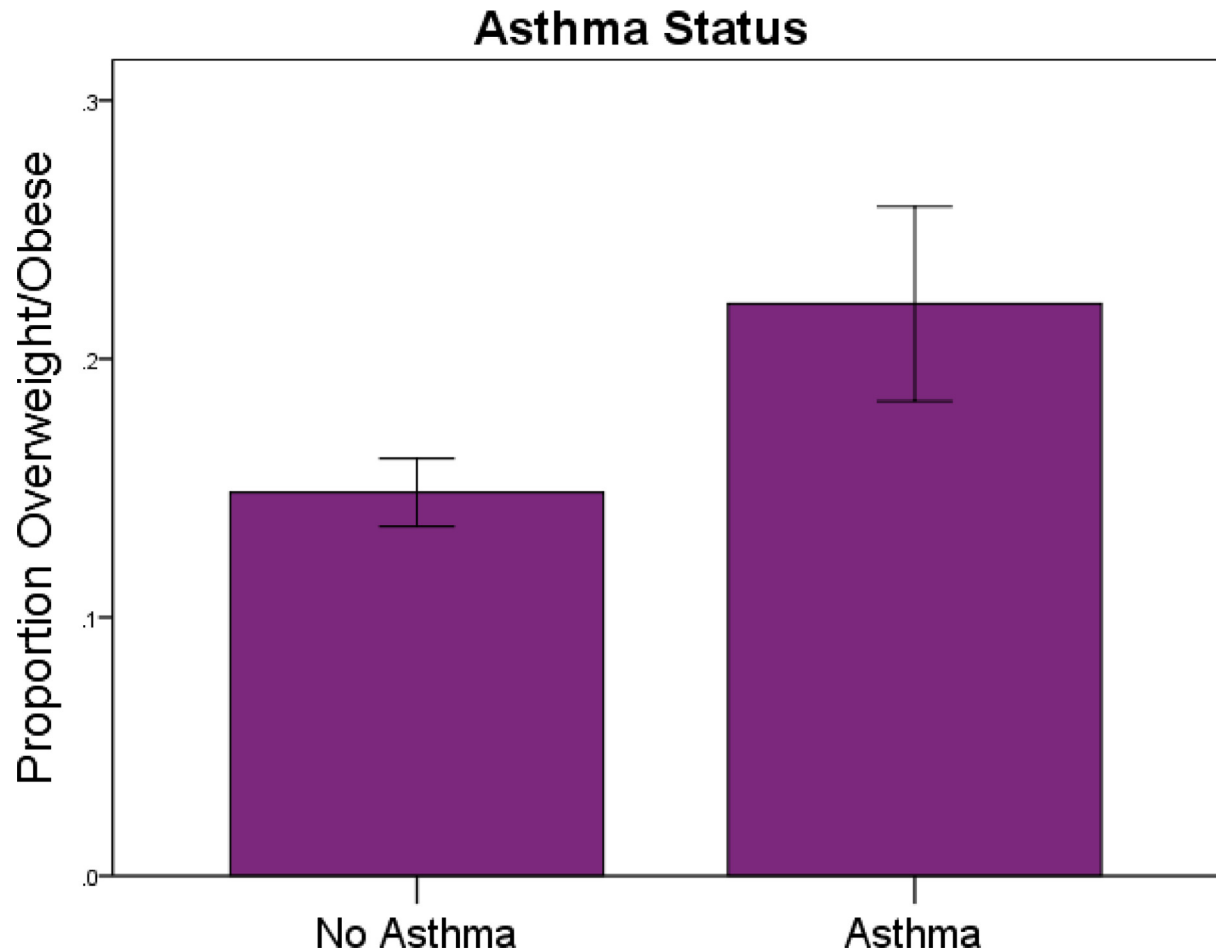


FIGURE 3. Proportion of overweight/obese by asthma status



BMI in the overweight/obese category, we found significant differences between children insured by HUSKY Health, Connecticut’s Medicaid program for low-income families, and children with commercial insurance. For children with HUSKY Health, 26.0% were overweight/obese compared with children with commercial insurance, which was 15.9% ($n = 489, p = .007$; [Figure 2](#)).

For asthma, health care providers reported whether the child has asthma and then ranked it on a scale from intermittent, mildly persistent, moderately persistent, severely persistent, and exercise induced. The overall analysis included children with any form of asthma. Results showed that 22.1% of children were in the overweight/obese category compared with children without asthma, in which the total was 14.8% ($n = 850, p = .041$; [Figure 3](#)).

Health care providers also completed items on the health record about the children’s allergies, and if there were reported allergies, they asked them to expand on what the allergies were. Data collected included allergies to drugs such as amoxicillin and to foods such as eggs and peanuts. For children with known allergies, 7.8% fell into the overweight/obese category, compared with 16.7% of children without reported allergies ($n = 831, p = .041$; [Figure 4](#)).

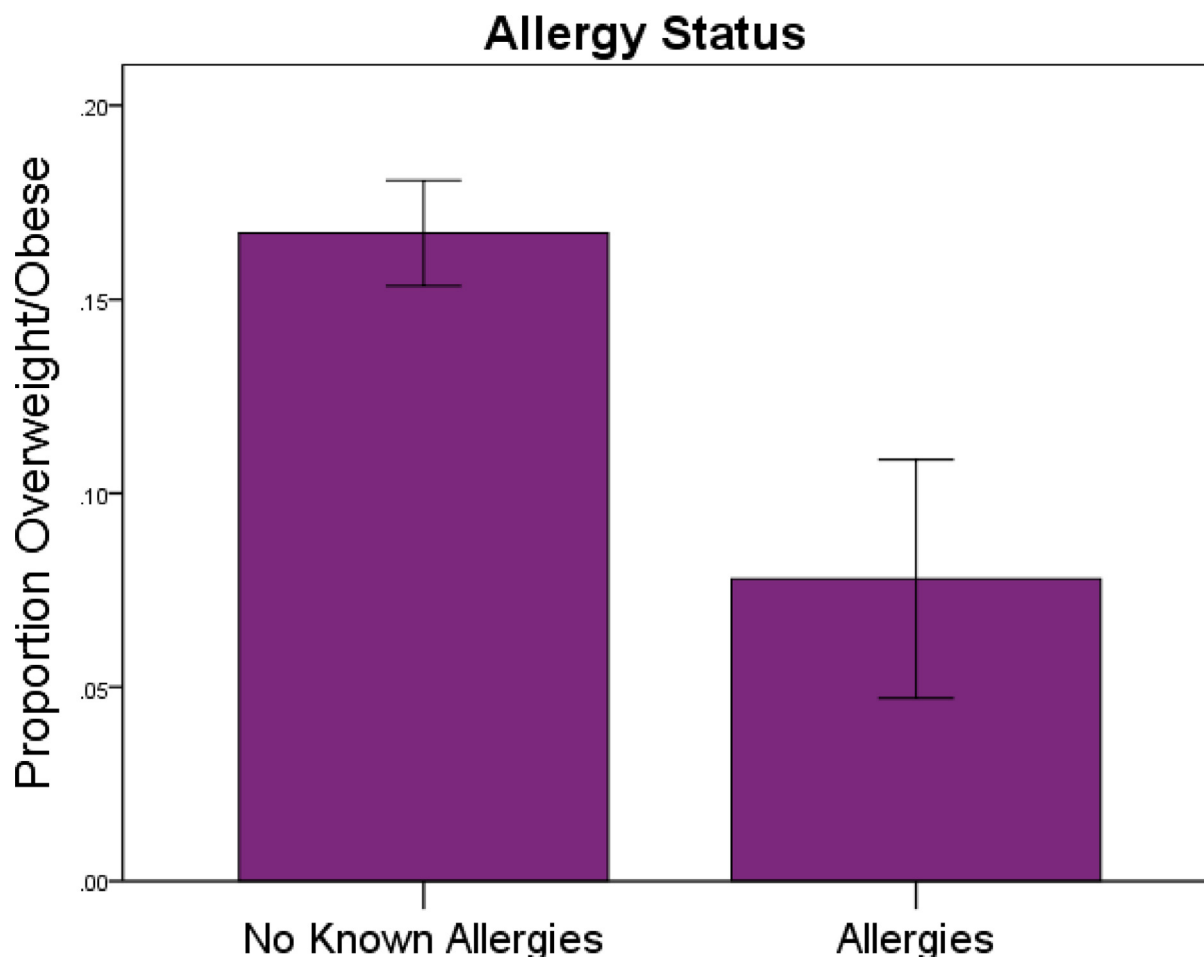
The difference in obesity status between children with parental eating concerns (3.7%) compared with children without parental eating concerns (18.1%) was nearly significant ($n = 646, p = .054$; [Figure 5](#)).

DISCUSSION

This project provides important information about the interplay between childhood overweight/obesity and socioeconomic status, parental eating concern, asthma, and allergies. Using insurance type as a proxy for socioeconomic status, we show a significant increase in the risk for overweight/obesity in children of lower socioeconomic status. Overweight and obesity rates are rising sharply among children in lower socioeconomic classes, which are also associated with government-funded insurance ([Taveras et al., 2013](#)). Our study provides further evidence to support lower socioeconomic status as a risk factor for childhood overweight/obesity.

Although our study did not reach statistical significance in relating parental eating concerns to BMI percentile, there was a notable decrease in our data for the overweight/obesity category in children whose parents indicated a concern for their eating habits. On the forms used for this study,

FIGURE 4. Proportion of overweight/obese as per allergy status



parents simply circled either “Y” for yes or “N” for no to indicate whether they have a concern about their child’s eating habits and were given the option to explain further, if they desired. However, the researchers for this study were not privy to these explanations. In dealing with obesity in a pediatric population, often the obstacle is gaining parental motivation to begin a behavior change (Brown et al., 2016). With this information, pediatric providers should inquire about and act upon parental concerns about eating and perhaps, view lack of parental concern as a red flag for increased risk of overweight/obesity. Although sometimes providers may be unsure of how to address obesity with parents, parental concern might be a way to promote conversations regarding modification of weight-related behaviors (Hernandez, Cheng, & Serwint, 2010).

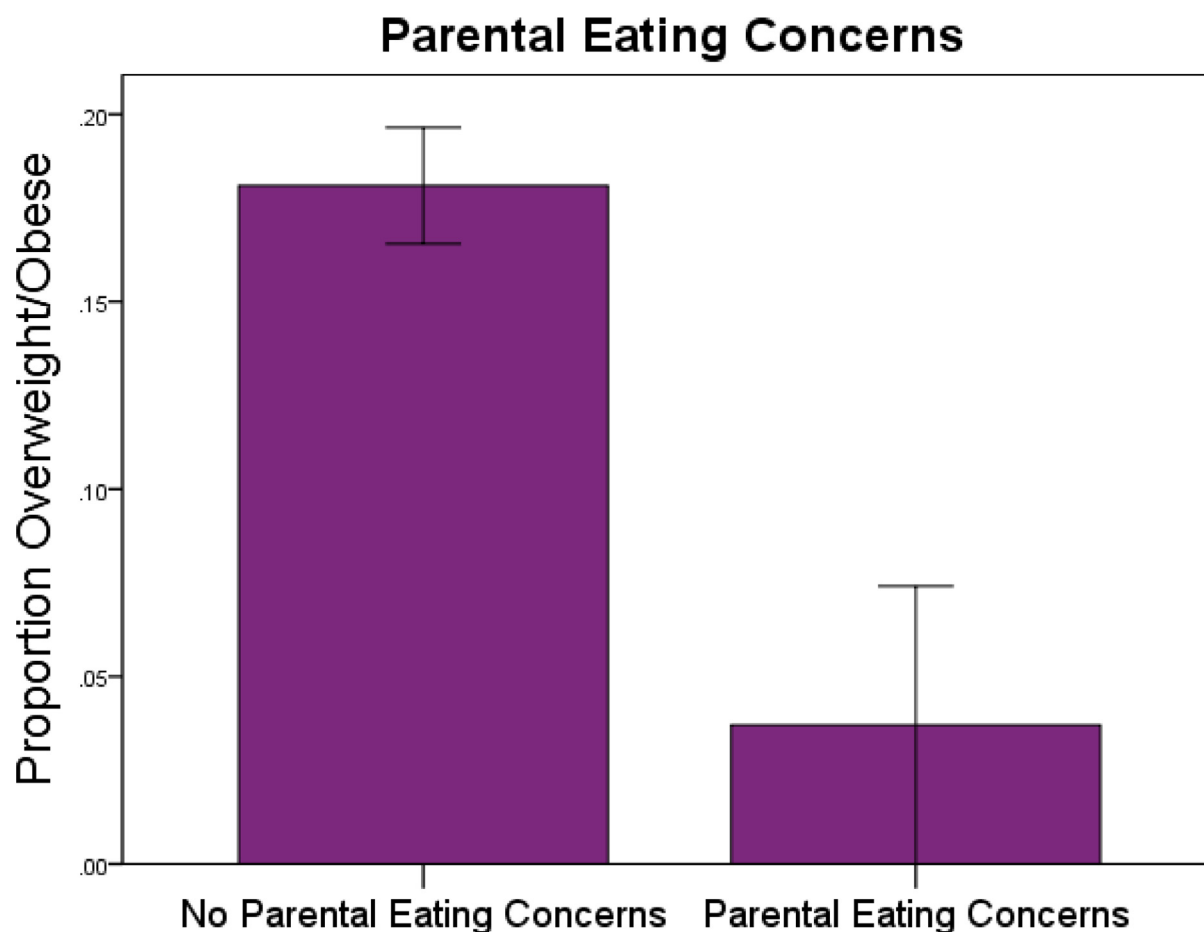
Obesity increases the risk of developing asthma, possibly because of airway inflammation or other obstruction or variance in physical activity and diet (Chen et al., 2017; Lang et al., 2018). It is shown that obese patients have an increased severity of asthma with potentially decreased efficacy of traditional asthma therapies, such as corticosteroids (Lugogo, Kraft, & Dixon, 2010). Pediatric obesity accounts for a substantial component of new asthma cases in the United States

(Lang et al., 2018). This study shows that asthma increases the propensity for children being overweight or obese. These conclusions shed light on the importance of pediatric providers monitoring their patients with asthma for unhealthy weight gain. Additionally, patients with unhealthy BMIs should be monitored for the onset of asthma.

Our study indicates that children with allergies are less likely to be overweight or obese. It is possible that children who are overweight and have asthma have lower rates of allergen sensitization and polysensitization than children of a normal BMI who have asthma (Lucas, Moonie, Olsen-Wilson, & Hogan, 2017). Interestingly, our allergy findings could potentially correlate with parental eating concern, considering that parents of children with food allergies must be more mindful of what their child consumes. This may impart increased mindfulness regarding eating habits to avoid adverse reactions.

The results provide valuable information for the obesity prevention effort by highlighting areas of risk and potential opportunities for pediatric providers to intervene. Pediatric providers should build the question of parental eating concern into their well-visit templates and be prepared to educate parents and patients based on the response. This way,

FIGURE 5. Proportion of overweight/obese by parental eating concerns



even children who are not being evaluated for day care will be assessed regarding parental eating concern. However, there are potential barriers in adopting lifestyle behavior changes in pediatric populations, which also need to be addressed to create sustainable interventions. As mentioned previously, facilitating provider conversations about a child's weight with the parents may alert them to imminent obesity (Hernandez et al., 2010). Factors such as socioeconomic status having an impact on obesity show the need for appropriate identification of risk factors and sustainable, yet feasible interventions, on the family level (Williams et al., 2018). Conversely, too much concern and regulation could backfire, so it is important for providers to encourage parents to strike a balance between the two extremes (Clark et al., 2007). Pediatric providers should make themselves aware of the local resources, such as affordable grocery stores and safe parks for exercise, to ensure they can provide the best possible help for parents seeking healthy weight advice.

Limitations of this study are largely associated with the nature of the Early Childhood Health Data Initiative assessment records. The forms were not designed for research purposes, but rather for physicians to certify that children were fit for child care. The forms were completed by parents and

physicians, who may not have wanted to overstate the child's health issues because they could jeopardize their participation in child care. Additionally, the data only represented children enrolled in child care and not a randomized sample of children. Another limitation included the use of BMI as a universal screening tool. BMI creates a value based on the height and weight of a child; however, it could overestimate obesity in children who have increased muscle mass or are shorter in height. It is valuable, with a high specificity but low sensitivity, to identify excess adiposity (Javed et al., 2015). Another limitation of this study is the lack of retrospective data in regard to age of asthma diagnosis and pattern of weight gain, which could shed light on which condition precipitated the other. Finally, the subjective nature of the question regarding parental eating concern may have also affected the results of this study. These limitations can guide future studies, which will yield a better understanding of parental knowledge and commitment to healthy eating for children.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at <https://doi.org/10.1016/j.pedhc.2019.06.003>.

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