

## ORIGINAL RESEARCH

# The Relationship of Pediatric Obesity & Non-Pandemic Influenza

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## KEYWORDS:

Pediatric

Obesity

Influenza

Vaccinations

BMI

**Background:** Very little research has been performed examining obesity and non-pandemic flu contracture in pediatric patients. The hypothesis of this study was that patients aged 2 through 12 years of age with a body mass index (BMI) of greater than or equal to the 85<sup>th</sup> percentile for their age have a significantly greater chance of contracting non-pandemic influenza.

**Methods:** This was a retrospective cohort chart review. Patients aged 2 through 12 with a positive rapid flu test between the 2010 through 2014 flu seasons were identified and categorized into two groups; patients with BMIs greater than or equal to the 85<sup>th</sup> percentile and patients with BMIs less than the 85<sup>th</sup> percentile for their age.

**Results:** Patients aged 2 through 12 years with a BMI of greater than or equal to the 85<sup>th</sup> percentile for their age had a significantly higher rate of influenza than those less than the 85<sup>th</sup> percentile, 46.55% v. 28.47%, respectively ( $p = 0.0201$ ). Additionally, the average BMI of patients with positive rapid influenza tests was significantly higher than those with negative influenza tests, 20.3 vs. 15.8, respectively ( $p < 0.0001$ ).

**Discussion:** In this study, patients 2 through 12 years of age with a BMI of greater than or equal to the 85<sup>th</sup> percentile had a significantly greater chance of contracting non-pandemic influenza. To confirm these results, a larger population needs to be studied. If true, the results serve as evidence that clinicians may need to focus on targeting non-pandemic influenza vaccinations toward the obese pediatric population more aggressively.

## INTRODUCTION

Obesity is a well-known growing epidemic within the United States. In 2012, childhood obesity affected 12.5 million children, comprising 33% of children between the ages of 2 and 19 years.<sup>1</sup> The CDC classifies children as overweight if their BMI is at or greater than the 85<sup>th</sup> percentile for children of same height and sex and obese if their BMI is at or greater than the 95<sup>th</sup> percentile. Previous research in adult populations regarding influenza has demonstrated an inadequate immune response in obese populations is associated with increased infection.<sup>2,3,4</sup> Some research has examined the association of pandemic H1N1 influenza and obesity in adults and pediatric populations; however, very little research has been performed to examine obesity and non-pandemic flu contracture in pediatric patients.<sup>5,6</sup>

The 2013-2014 influenza season brought about 7,725 hospitalizations and 65 pediatric influenza deaths in the United States, highlighting the importance of examining possible risk factors in the pediatric population.<sup>7,8</sup> The influenza vaccine is one of the most effective ways of providing prophylaxis for the seasonal flu; if the list of most at-risk groups is not reevaluated

regularly to identify new at risk populations, the ongoing ability to prevent influenza on a seasonal basis may be lost.

Children less than 5 years of age are already targeted as high-risk populations to receive influenza vaccines; however, overweight and obese individuals in the pediatric population have not been specifically targeted.<sup>9</sup> Demonstrating that overweight and obese children are at more risk of developing influenza than their normal weight counterparts would allow more aggressive vaccine targeting to at-risk populations and further impetus to adopt aggressive lifestyle modifications to target a healthy weight.

The aim of this study was to examine overweight and obese pediatric patients and their risk of contracting non-pandemic influenza. The hypothesis was that patients aged 2 through 12 years of age with a BMI of greater than or equal to the 85<sup>th</sup> percentile for their age have a significantly greater chance of contracting non-pandemic influenza during the CDC defined flu season from October 1<sup>st</sup> and March 31<sup>st</sup> than those with a normal BMI falling between the 6<sup>th</sup> and 84<sup>th</sup> percentiles.

## METHODS

A retrospective cohort chart review of pediatric patients from a single center pediatric practice in Spartanburg, South Carolina was conducted based on records from the 2010 through the

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2014 flu seasons. Data of patients were collected from electronic medical records and identity was removed prior to analysis. Data was obtained for all patients who received an in-office rapid influenza A/B test (sensitivity: 50-70%; specificity 90-95%)<sup>10</sup> from 2010 to 2014. Patients were included in the study if they received a rapid influenza A/B test between October 1<sup>st</sup> and March 31<sup>st</sup> and they were between the ages of 2 and 12 at the time of flu testing.

The following data were collected: age, gender, race, date of office visit and rapid flu test, medical record number, height, weight, and body mass index percentile for age. Abstracted data also included chronic conditions such as asthma, diabetes, or immunocompromised due to disease or drug therapy such as use of chronic corticosteroids or other immunosuppressants. Vaccination status and route of administration for each patient was documented, as well as hospitalizations, emergency room visits and mortality due to non-pandemic flu, if applicable.

All patients who were identified with a positive rapid flu test within the 2010-2011, 2011-2012, 2012-2013 and 2013-2014 flu seasons were categorized into two groups. One group contained patients with BMIs greater than or equal to the 85<sup>th</sup> percentile for their age. The second group contained patients with BMIs less than the 85<sup>th</sup> percentile for their age. The number of patients with a positive rapid flu test in each group was identified.

The difference between average age in years was compared using a Wilcoxon Rank Sum, in gender a Binomial Proportions Test and in race a Fisher’s Exact Test. Subsequently, a Two-Tail Fisher’s Exact Test compared the likelihood of contracting flu based on BMI. This study was approved by the Spartanburg Regional Healthcare System Institutional Review Board.

**RESULTS**

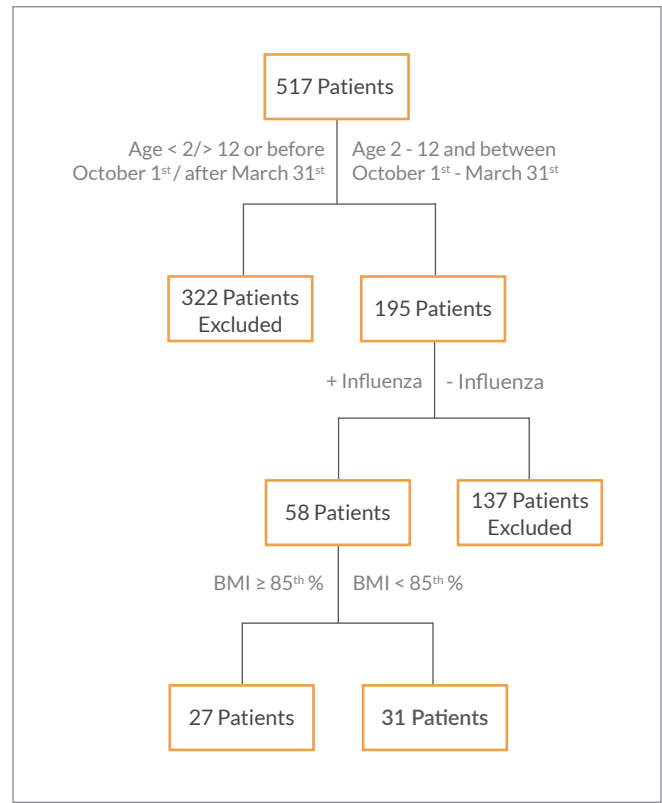
A total of 517 patients were identified between the 2010 and 2014 influenza seasons in this retrospective cohort. Patients were then separated into two categories. One hundred ninety-five patients met our inclusion criteria. Of the 195 patients, 58 tested positive for influenza and 137 tested negative. Of the 58 patients that tested positive for influenza, 27 patients had a BMI greater than or equal to the 85<sup>th</sup> percentile and 31 patients were below the 85<sup>th</sup> percentile (Figure 1).

The average age of patients that tested positive for influenza was slightly higher than the age of those who tested negative, 4.98 v. 4.55 years, respectively (p = 0.0534). Other demographic characteristics were not significantly different between the two groups (Table 1).

Pediatric patients in our cohort aged 2 to 12 with a BMI of greater than or equal to the 85<sup>th</sup> percentile for their age had a significantly higher rate of influenza infection identified by rapid testing than those with BMI less than the 85<sup>th</sup> percentile, 46.55% v. 28.47%, respectively (p = 0.0201) (Figure 2). Additionally, the average BMI of patients with positive rapid influenza tests was significantly higher than those with negative influenza tests, 20.3 vs. 15.8 kg/m<sup>2</sup> (p<0.0001) (Figure 3).

**FIGURE 1:**

Patient Selection Process



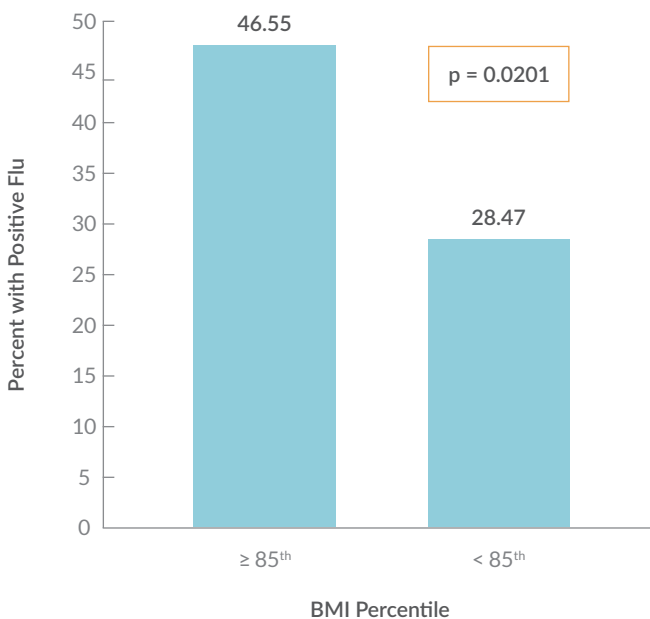
**TABLE 1:**

Patient demographics

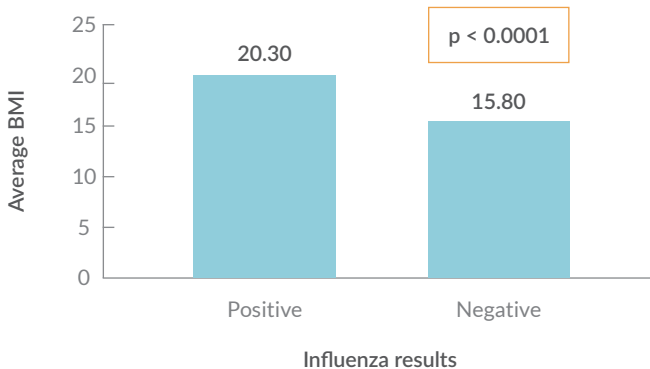
	Positive for Flue	Negative for Flue	p-value
Average Age (years)	4.98	4.55	0.0534
<b>GENDER</b>			
Female	26	67	0.6228
Male	32	70	
<b>RACE</b>			
Hispanic	19	27	0.1572
Caucasian	18	65	
African American	21	45	

**FIGURE 2:**

Comparison of positive influenza rates and BMI percentiles

**FIGURE 3:**

Comparison of BMI between children positive and negative for influenza



## CONCLUSION/DISCUSSION

In our single center introductory study, patients aged 2 through 12 years of age with a BMI of greater than or equal to the 85<sup>th</sup> percentile had a significantly greater chance of contracting non-pandemic influenza than those with a BMI between the 6<sup>th</sup> and 84<sup>th</sup> percentiles. A major limitation of this study was the sample size and single center distribution. Additional research including multiple centers and environments would allow a more robust generalization of our preliminary data. A prospective study would allow for better stratification where vaccination, route of administration and BMI at initiation could be controlled. Stratifying these factors would allow researchers to examine whether vaccinations in obese children are as effective as those in non-obese children.

Prior studies in adults have demonstrated that obesity confers decreased serum titers to influenza vaccination; until this point no research has been performed concerning pediatric populations.<sup>2,3</sup> A continuation of this study with the aforementioned stratification measures and data from a larger multi-site study could include testing serum antibody titers to influenza vaccines in children. Additionally, a prospective study could look at timing of influenza vaccination and association between obesity and contracture of flu.

Studies such as this are becoming more important for education and awareness due to the growing population of parents refusing vaccines for their children. Confirming that overweight and obese children are at increased risk of contracting influenza than their normal weight counterparts provides an opportunity for osteopathic family physicians to offer more counseling to a previously unrecognized at-risk population of obese and overweight children.

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