

# The impact of COVID-19 on weight-gain trend among children in US

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## Abstract

- The Coronavirus disease of 2019 (COVID-19) evinced a significant change in modern lifestyle, already been associated with weight gain among adults; the impact of COVID-19 in children especially on weight gain needs to be evaluated.
- We studied the weight gain trend on COVID-19 positive children of age 2-18 years before and after the diagnosis for a total of 12 months using  $\%BMI_{p95}$ , adjusted for age group, sex, race and ethnicity and evaluated the change of BMI group among the children.
- The observation of significant change underscores the importance of obesity management and prevention efforts during and following the diagnosis of COVID-19.

## Purpose & Research Question

- The purpose of the study is to evaluate the impact of COVID-19 on weight gain trend in children adjusted for age group, sex, race and ethnicity.
- The questions are:
  - Is there any significant change in weight gain trend among children in US?
  - If so, how is it distributed among different age groups, sex, race and ethnicity?
  - How much change among the BMI groups have been observed among cohort?

## Subjects, Methods & Analysis

### Study Cohort

- The National COVID Cohort Collaborative (N3C)**
  - Formed to improve the understanding of SARS-CoV-2 infections and clinical outcomes via a novel approach to data sharing and analytics.
  - Comprised of members from the National Institutes of Health (NIH) clinical and translational science (NCATS)
  - N3C includes encounters after 1 January 2020, from the study sites who meet SARS-CoV-2 testing and diagnosis code criteria.

### Included patients (n=35,354)

- Aged between 2-18
- Diagnosed COVID-19 positive between 1 January 2019 and 31 October 2021
- Having BMI measurements and/or body height and weight measurements within the timeframe, at least one measurement in 6 months prior to diagnosis and one measurement in 6 months after diagnosis

### Data cleaning and preprocessing

- Invalid or implausible readings for body weight or height measurements were removed.
- Extreme BMI values were excluded using modified BMI z-scores following the CDC guidelines

### Method

#### Weight gain trend metrics

##### BMI

$$BMI = weight/height^2$$

##### BMI z score

$$BMIz = \left(\frac{BMI}{M}\right)^L - 1 / (L \times S)$$

values for L, M and S are available on the CDC website.

##### Percent over BMI 95% percentile

$$\%BMI_{p95} = \frac{BMI}{BMI_{p95}} \times 100\%$$

where,  $BMI_{p95}$ : BMI 95% percentile

- BMI was calculated using body weight and height measurements occurred within 30 days window, raw BMI measurements were included as it is.
- The missing BMI values were imputed using python Pandas polynomial imputation and padded with first/last observed values in both ends.

- Change in  $\%BMI_{p95}$  was calculated  $\frac{(\%BMI_{p95}^{final} - \%BMI_{p95}^{initial})}{\%BMI_{p95}^{initial}} \times 100\%$

##### BMI categories:

Normal	Overweight	Obese	Severely Obese
$BMI < BMI_{p85}$	$BMI_{p85} \leq BMI \leq BMI_{p95}$	$BMI_{p95} < BMI$	$\%BMI_{p95} \geq 120$

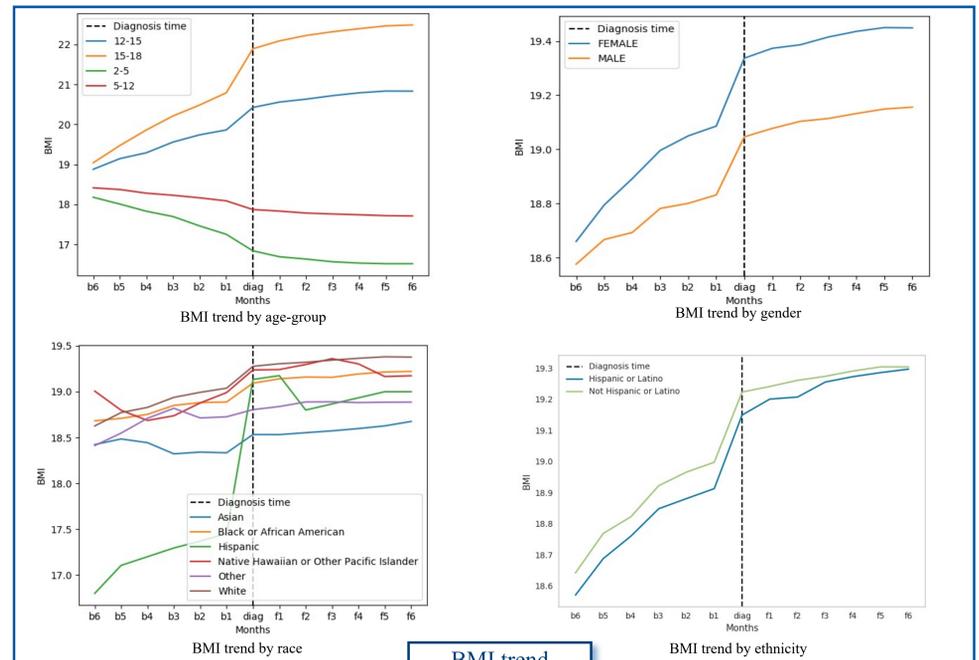
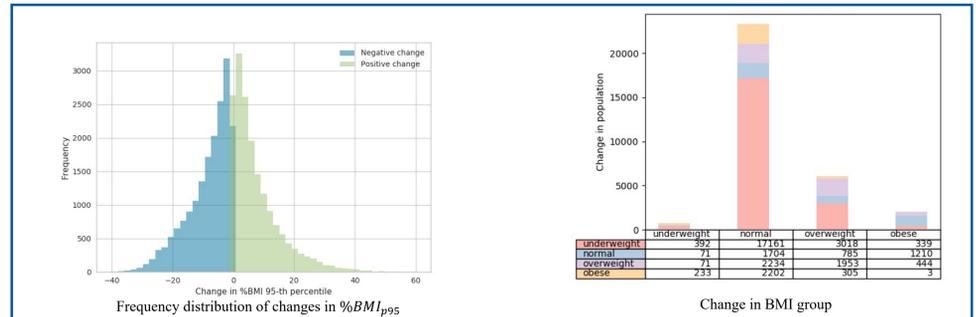
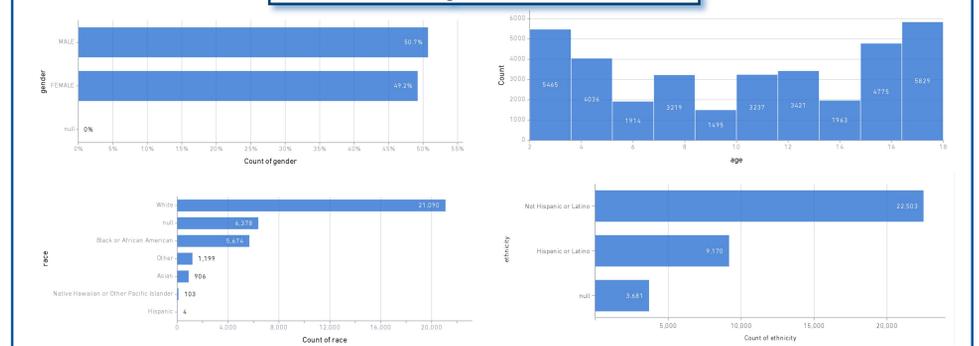
- Change in BMI categories were calculated
- Change in prevalence of obesity was calculated using the change in  $\%BMI_{p95}$  and evaluated using one-way ANOVA

## Introduction

- The devastating effects of COVID-19 entailed millions of death and severe health complications, the World Health Organization (WHO) characterized this multisystem disease caused by the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) displaying high morbidity and mortality as pandemic on March 11, 2020.
- In response to COVID-19, multinational measures were implemented by the authorities, including school closures, lockdown, quarantine and social distancing recommendations, aiming to mitigate the virus spread and decrease the pressure on health care systems.
- Change in lifestyle and eating behaviors is supposed to affect the weight gain trend in population.
- As reported in the past, children and adolescents tend to gain weight during summer holidays, and it has been postulated that childhood obesity will increase proportionately during this period.
- On the other hand, obesity has been highly associated with the severe COVID-19, increasing disease mortality, even in childhood.
- Considering the special circumstances derived from COVID-19, the research of the impact on weight gain and the possible increase in the prevalence of childhood obesity rates is highly recommended.
- To evaluate pandemic-related changes in weight in children, we use the Body Mass Index (BMI) value as the ratio of weight and height squared.
- To rectify the problem of scaling of the BMI values on extremities, the percent over BMI 95% percentile is used.

## Results

### Cohort Description and Distribution



## Discussion

- The cohort was diverse in race, ethnicity and comparable to the overall population of the N3C data enclave average age of 10.2 ( $\pm 5.4$ ), 50.7% male.
- 3.1% Asian, 0.4% Native Hawaiian and other Pacific islander, 19.6% Black or African American, 72.8% White and remaining were Hispanic or people of other races
- 71.1% were of Hispanic or Latino ethnicity, remaining were non-Hispanic
- As suspected, the weight gain trajectory is different after the diagnosis of COVID-19
- Children of age-group 15-18 gained more weight compared to the other classes after diagnosis, 12-15 were second in weight gain
- Among different races, Hispanic population gained more weight, others also showed rise in BMI
- Female children gained more weight than male
- There are some groups with lower rate of weight gain after diagnosis which can be due to residing in care units or close supervision

## Directions for Future Research

- School closures, lockdown along with other COVID-19 restrictions have disrupted the everyday routine of children, leading to changes in eating behaviors and physical activities.
- Information gained from the study on COVID-19 impact on weight gain trend in children in US can be applied to design and implement measures to protect children from tending to obesity.
- Obesity prevention and management efforts during and following the diagnosis of COVID-19 can include screening for BMI and other social determinants of health and increased access to evidence-based pediatric weight management programs.
- Future research directions could be clustering the children based on the weight gain trajectory and provide special care and support for the rapidly gaining group, taking lesson from the slower gaining groups.