Longitudinal Analysis of Body Mass Index (BMI) Trends among a Pediatric Dental Patient Population

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Abstract

Introduction and Objective: Over the past few decades, a growing trend of overweight and obesity has emerged among the pediatric population. This is a cause of significant concern as these are significantly correlated to other negative oral and systemic health outcomes over time. Although measurement of body mass index (BMI) is common among pediatric physicians and primary care providers, few studies have explored the feasibility of BMI measurement and analysis from pediatric dental providers. The primary objective of this study was to compile and analyze pediatric BMI measurements taken from a pediatric dental school patient population.

Methods: This study was a retrospective analysis of previously collected data of pediatric patients between 2012 and 2020 (N = 624), which was reviewed and approved by the Institutional Review Board (IRB). Descriptive statistics and trend analysis were compiled to determine the trends in pediatric BMI over time.

Results: A total of n = 624 patients were identified, with nearly equal percentages of females and males represented in the study (p = 0.6891) and the overwhelming majority identified as racial/ethnic minorities (73.6%), which closely mirrors the clinic population, p = 0.6484. These data revealed that pediatric BMI increased significantly from 25.6 in 2012 to 31.33 in 2020 (22.3%), p = 0.028. No significant differences between males and females were observed (p = 0.2025) or between minority and non-minority patients (p = 0.8288).

Conclusion: This study provides significant novel temporal information regarding pediatric BMI among this low-income, minority patient population and highlights the need for expanding the dental school (and pediatric dental residency) curriculum to include more topics related to measuring and tracking overweight and obese children and the most appropriate methods for use in the pediatric dental office.

Keywords: Pediatric Dental Patient; Body Mass Index (BMI); Overweight; Obesity

Introduction

In recent years, obesity has become a major public health crisis in the United States (US) [1,2]. Recent epidemiologic evidence has revealed increasing trends in body mass index (BMI) with nearly one-third of US adults currently overweight and an additional one-third meeting or surpassing the clinical definition of obesity [3,4]. Overweight and obesity are defined as BMI of 25.0 - 29.9 and at or above 30.0, respectively. These trends have also revealed significantly increased risk among specific population sub-groups, such as racial and ethnic minorities that demonstrate strong correlations with lower socioeconomic status and other sociocultural disparities [5,6].

These trends are not restricted to adults, with increasing rates of overweight and obesity also observed among children and adolescents [7,8]. Although a smaller percentage of the pediatric population is either overweight or obese (approximately one-third) more detailed analysis has revealed that racial and ethnic disparities have been demonstrated among overweight and obese children, similar to those found among adults [9-11]. Therefore, a combined demographic shift towards increasing minority subgroup populations and increasing BMI among these subgroups (particularly among children and adolescents) has been cause for more focused attention and research among public health experts [12,13].

Nevada is one of the US states that has observed both of these recent trends, an increasing demographic shift in the minority population, as well as an increase in the percentage of children and adults that are overweight or obese [14,15]. To address the childhood obesity epidemic, many research studies have focused on methods to monitor and track childhood weight and BMI to identify unhealthy trajectories and implement appropriate interventions as quickly as possible [16,17]. Due to the frequent visitation patterns of young children, pediatric dentists and pediatric dental providers may represent an unusual and unique opportunity for healthcare assessment of pediatric obesity through regular monitoring of height, weight and changes in BMI [18,19].

The mission of the University of Nevada, Las Vegas - School of Dental Medicine (UNLV-SDM) has been to improve the health of the residents of Nevada through programs of healthcare services to the community, educational programs and public health research. Although some research has been done to analyze the oral healthcare services provided to low-income and minority patients through the UNLV-SDM pediatric dental clinic, to date no studies have specifically evaluated the BMI of these patients or any associated trends [20,21]. To specifically address this deficiency, the primary goal of this study was to evaluate the BMI of UNLV-SDM pediatric patients between 2011 and 2020.

Methods

Study approval

The protocol for this study "Retrospective analysis of Oral Health Status of UNLV-SDM Dental population" was reviewed and approved by the Office for the Protection of Human Subjects (OPRS) and the Institutional Review Board (IRB) at the University of Nevada, Las Vegas (UNLV) on July 24, 2020 [Protocol 1619329-1]. This study was a retrospective analysis of previously collected data including saliva and oral samples, which was previously reviewed and approved by the UNLV OPRS and IRB under protocols OPRS#1305-4466M and #1502-506M "The Prevalence of Oral Microbes in Saliva from the UNLV-SDM Pediatric and Adult Clinical Population".

Original study collection

Using the original study protocols, pediatric patients above the age of seven were asked for their voluntary participation and asked to provide Pediatric Assent. In addition, the parent or guardian was asked to provide Informed Consent. Each sample was collected and given a randomly generated, non-duplicated number. No patient information, medical record number, or other identifying information was collected. Only basic demographic information, such as age, sex and race/ethnicity were noted - as well as height, weight and BMI. No personally identifying information was obtained for any sample and all records comply with the Health Information Portability and Accountability (HIPAA) standards for privacy of individual patient health information.

Statistical analysis

Demographic analysis was facilitated using simple descriptive statistics, including sample numbers and demographic characteristics and percentages. Data were sorted by year and then broken down by demographic characteristics for further analysis by BMI and year-on-year trends were analyzed. Differences between categorical variables were analyzed using Chi Square (X^2) analysis, which reports the degrees of freedom (d.f.) and associated p-values.

Results

The compilation of these data from studies between 2012 and 2020 revealed a total of n = 624 pediatric patients for analysis (Table 1). More specifically these data included n = 305 females (49%) and n = 319 males (51%), which were nearly equal to their distribution in the pediatric clinic, p = 0.6891. The sample included similar percentages of minority patients (74%) compared with the overall clinic (72%), which was not statistically significant, p = 0.6484.

	Females	Males	Statistical analysis
2 - 17 year olds	n = 305 (48.9%)	n = 319 (51.1%)	χ^2 = 0.160, d.f. = 1
Pediatric clinic	51.1%	48.9%	p = 0.6891
	White	Minority	
2 - 17 year olds	n = 165 (26.4%)	n = 459 (73.6%)	χ^2 = 0.208, d.f. = 1
Pediatric clinic	28%	72%	p = 0.6484
	Black	Hispanic/Latino	Other/Non-White
	n = 171 (27.4%)	n = 229 (36.7%)	n = 59 (9.5%)

Table 1: Demographic analysis of study sample.

Analysis of these data graphing the BMI year-by-year revealed an overall increase in average pediatric BMI of 22.3% between 2012 and 2020 (Figure 1). More specifically, the average BMI in 2012: 25.62 increased each year to the highest observed in 2020: 31.33, which was statistically significant, p = 0.028. Patient BMI data were not available for all years (e.g. 2016, 2017).
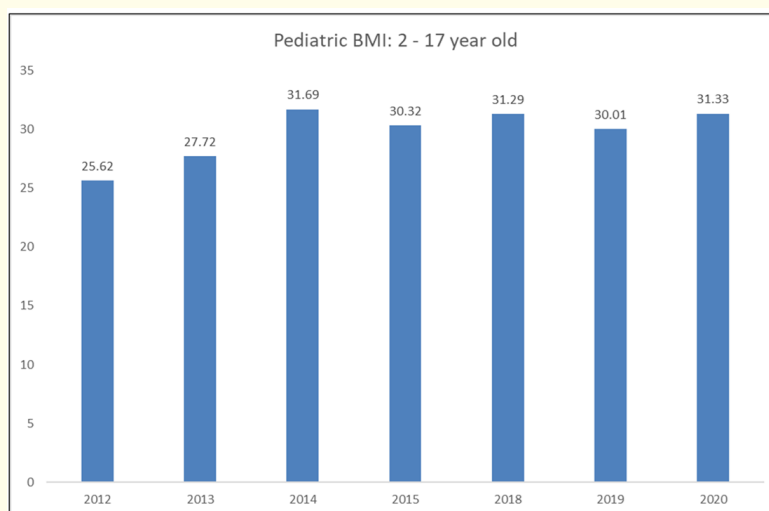

Figure 1: Changes in Pediatric BMI 2012-2020. Pediatric BMI increased from an average of 25.62 in 2012 to 31.33 in 2020 (the last year data was available from a study sample), which represents an overall increase of 22.3%, p = 0.028.

To determine if the increases in pediatric BMI were associated with demographic variables, these data were initially sorted by sex (Figure 2). These data revealed that pediatric BMI increased among both males and females, although these rates were not equivalent. More specifically, BMI increased among females from an average in 2012 of 24.53 to an average of 30.6 in 2020 - a statistically significant increase of 19.8%, p = 0.22. In addition, BMI among males increased from an average of 26.71 in 2012 to 31.1 in 2020, an statistically significant increase of 14.1% over this time period, p = 0.033. Although the increase among females was slightly higher than males, more detailed analysis of these data reveals these increases were not statistically significant between males and females, p = 0.228.
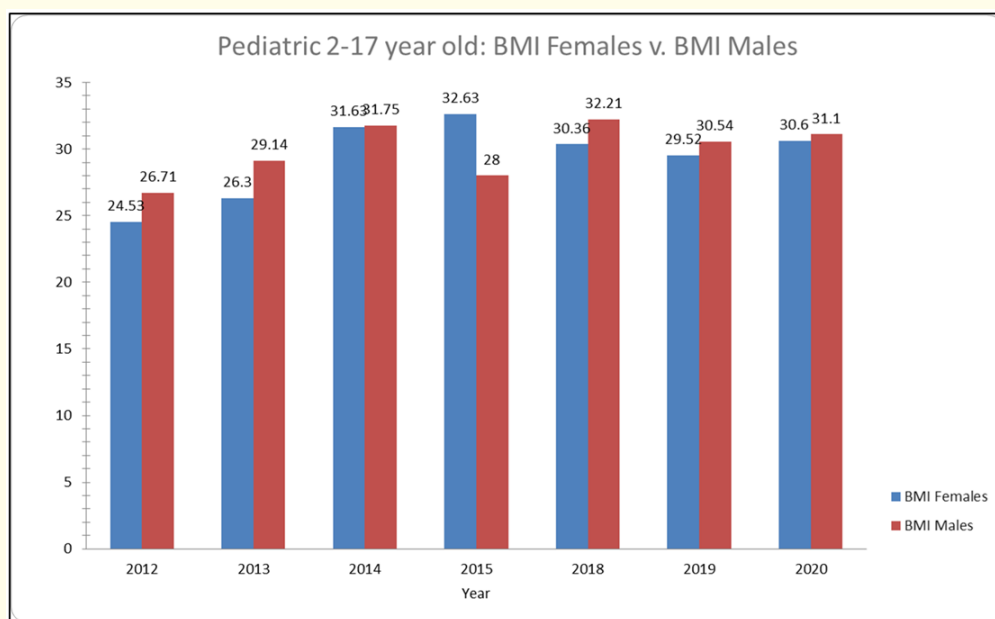

Figure 2: Changes in Pediatric BMI 2012-2020 sorted by Sex. Pediatric BMI among females increased significantly from an average of 24.53 in 2012 to 30.6 in 2020, p = 0.022. Average pediatric BMI among males also increased significantly from 26.71 in 2012 to 31.1 in 2020, p = 0.033. However, the observed increases in BMI among males and females were not statistically significant from one another ($\chi2 = 1.624$, d.f. = 1, p = 0.2025).

To determine if the observed changes in pediatric BMI were associated with other demographic variables, these data were then sorted by race and ethnicity (Figure 3). These data revealed that pediatric BMI increased among White (non-minority) patients from an average of 27.1% in 2012 to an average of 30.14% in 2020, p = 0.028. BMI among minority (non-White) pediatric patients increased from an average of 27.6% in 2012 to 31.88% in 2020, p = 0.201. Analysis of the observed increases in BMI among these demographic groups revealed that these changes were similar and not statistically significant from one another ($\chi^2 = 0.047$, d.f. = 1, p = 0.8288).
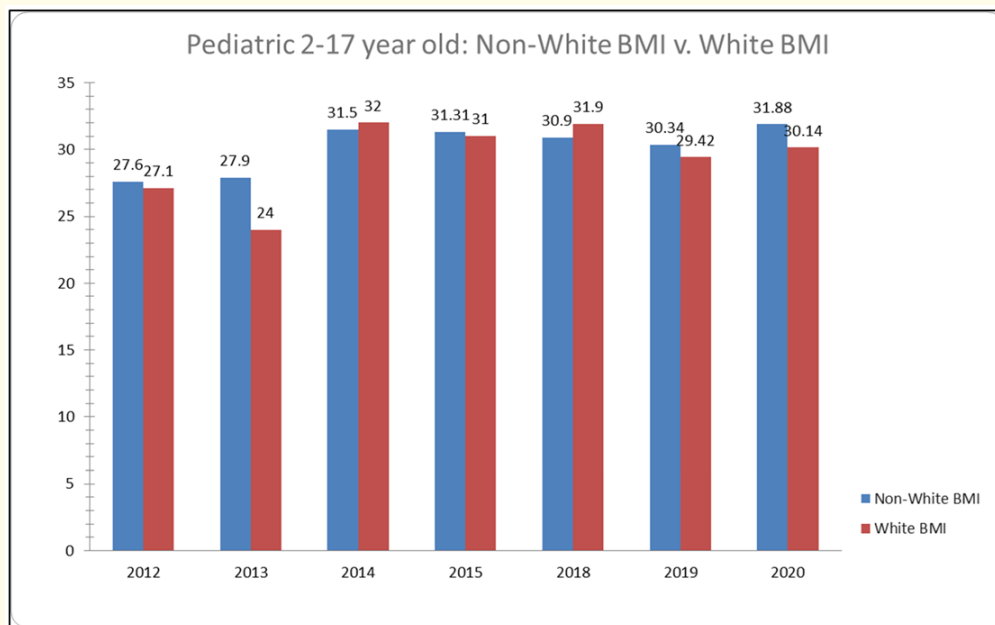
Figure 2: Changes in pediatric BMI 2012-2018 sorted by Race/Ethnicity. Pediatric BMI among White (non-minority) patients increased significantly from an average of 27.1 in 2012 to 30.14 in 2020, p = 0.028. Average pediatric BMI among Minority (non-White) patients also increased significantly from 27.6 in 2012 to 31.88 in 2020, p = 0.201. However, the observed changes in BMI were not statistically significant from one another ($\chi 2$ = 0.047, d.f. = 1, p = 0.8288).

Discussion

The results of this study revealed that BMI among UNLV-SDM pediatric patients may be significantly changing over time. This study found an overall increase over time from an average BMI of 25.6 to 31.33 (22.3%) between 2012 and 2020, a remarkable increase that mirrors the findings from other epidemiological studies of pediatric populations over the same time period [22,23]. These findings suggest that the UNLV-SDM pediatric clinic may also be a suitable environment for healthy weight and dietary interventions that may simultaneously foster pediatric oral health and caries prevention, as well as weight management and weight reduction [24-26]. As the COVID-19 crisis continues to decrease play and social interactions and directed exercise activities at school, the carefully monitoring of these trends may be needed.

In fact, recent studies have suggested that pediatric obesity may be a key curricular topic for pediatric dental residency programs due to the increasing percentage of overweight and obese patients [27,28]. As obesity and overweight effects on systemic and oral health are evident, more calls for integrated care and intervention that include pediatric dentists and more targeted and focused training of these dentists in this area are coming from interdisciplinary and public health organizations [29]. It is only by utilizing the most relevant and available opportunities for assessing and coordinating these interventions, such as the pediatric dental office visit, that significant progress can be made towards reducing pediatric obesity [30].

However, due to the retrospective nature of this study there are several limitations that should be considered when evaluating these data and subsequent analysis. First, the studies from which these samples were collected was cross sectional in nature, which allowed for one-time data and sample collection and does not include any temporal information regarding individual patients. As the nature of this problem becomes evident, more detailed studies will be needed to determine the combined rate of change among individual patients to determine if most or all these patients are becoming more overweight or obese [31]. In addition, as more studies for predicting caries risk incorporate BMI as a potential independent variable - these data should be captured and analyzed separately to determine the rate and direction of BMI change for these patient groups [32,33].

As future studies of this nature commence, it is also important to determine the most appropriate methods for use in determining pediatric obesity in different healthcare settings [34,35]. For example, although BMI-for-age specific percentiles are commonly used for determinations of weight status categorization of children in pediatric primary care settings, strong evidence has emerged that the incorporation of neck circumference measurements (easily performed in a dental setting) may provide an accurate index of overweight and obesity status in children [36,37]. In fact, new datasets of neck circumference in children have created reference standards for the purpose of validating and predicting overweight and obese status among pediatric patients [38,39].

Conclusion

Although some studies of pediatric obesity and BMI specifically related to asthma have been completed in Nevada, this may be among the first studies to measure and analyze trends of pediatric overweight and obesity in a dental setting [40,41]. These data and studies of this nature are important studies to determine the nature and scope of pediatric overweight and obesity within this patient population, which is a predominantly low-income and minority patient population at significant risk for multiple oral and systemic health disparities [42,43].

Author Contributions

KK and TS were responsible for the overall project design. KS and MJ were responsible for data generation. All authors were responsible for analysis and the writing of this manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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