Trends in the prevalence of dental caries in the US pediatric population 2011–2020

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Objective: *The aim of this study was to provide statistics on the trends and changes in the distribution of dental caries in the United States (US) pediatric population for the 10-year period 2011 through 2020.* ***Study design:*** *Using data from the 2011 to 2020 National Health and Nutrition Examination Surveys, estimates were derived for the prevalence of decayed and filled teeth in the US population aged between 2 to 11 years. Analyses were stratified by primary and permanent dentition, and prevalence was assessed amongst the various sociodemographic and body mass index (BMI) subgroups.* ***Results:*** *Over the 10-year period, the following changes were observed: the prevalence of decayed primary teeth has decreased from 14.1% to 12.2%, the prevalence of filled primary teeth has decreased from 29.8% to 26.1%, the prevalence of decayed permanent teeth has decreased from 5.2% to 2.7%, and the prevalence of filled permanent teeth has decreased from 16.1% to 12.3%. Despite these decreases in prevalence, there remains substantial inequality in how the disease is distributed, with those from ethnic minorities, poorer households, and with a non-normal BMI carrying the majority of disease burden.* ***Conclusions:*** *The prevalence of dental caries has decreased over the past 10 years, but there is still inequality in disease distribution.*

Keywords: *Dental caries, Epidemiology, Oral health, United States*

INTRODUCTION

Dental caries is one of the most prevalent diseases in the pediatric population, significantly affecting the oral health and wellbeing of children with the condition [1–3]. The condition has numerous deleterious effects on the day-to-day functioning of children, which include impairments in physical, mental, and social functioning, a significant increase in the risk of experiencing pain, and problems eating and sleeping [2–6]. Given this array of physical and psychological impacts, it is no surprise that the condition poses a significant economic burden, and many efforts are being made to take a preventative approach to addressing the disease, in order to help alleviate both the physical and economic impacts of dental caries [6–8]. These public health efforts are typically population-wide, and carried out with a view to target those subgroups who are at an elevated risk of disease.

In order to facilitate effective population-level measures to address dental caries, a comprehensive understanding of the determinants and distribution of the disease is required. However, for the US pediatric population, there is little evidence which provides thorough, up-to-date figures on the disease epidemiology, indicating a need for contemporary research in the field. For this purpose, the National Health and Nutrition Examination Survey (NHANES) studies are cross-sectional epidemiological studies, usually conducted in 2-year cycles, which have been used for health surveillance in the US population for many years [9–12]. The NHANES studies are partic-

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ularly useful in surveillance of oral health as they combine robust sampling methods, comprehensive details on sociodemographics, and full-mouth oral examination protocols, in order to allow for analyses to be conducted such that the results obtained are representative of what would be expected in the US population at large.

The aim of this study is to provide figures on trends in the prevalence of dental caries in the US pediatric population for the period 2011 to 2020. Analyses will be conducted to separately assess disease in the primary and permanent dentition, as well as evaluating how the disease is distributed amongst various sociodemographic and body mass index (BMI) subgroups within the population.

MATERIALS AND METHOD

Data source

We extracted data from the NHANES studies conducted by the National Center for Health Statistics, a division of the Centers for Disease Control and Prevention (CDC). The NHANES studies are complex, multistage, and cross-sectional in design, specifically conducted to take a sample representative of the civilian, non-institutionalized US population. In brief, the methodologies of the NHANES studies involve participants being interviewed at home, then invited to a mobile examination center for further interviews, tests, and examinations. These further tests include an oral examination by calibrated, state-licensed dental practitioners, where the dentition are charted, along with the presence of caries, restorations, missing teeth, and implants. All participants were anonymized, and results of the interviews, tests, and examinations were recorded as codes that were standardised across the NHANES studies. For this study, we combined four waves of NHANES studies: NHANES 2011–2012, NHANES 2013–2014, NHANES 2015–2016, and NHANES 2017–2020. The NHANES 2017–2020 cohort was sampled from the US population from 2017 up to March 2020, after which point no further participants were examined due to the COVID-19 pandemic. Inclusion criteria for our study were participants who: (i) were between 2 to 11 years of age (inclusive), (ii) had received a full oral examination, with at least 1 permanent or primary tooth present, (iii) had data recorded on sociodemographics and BMI.

Disease definition

Participants were defined as having decayed teeth if any tooth in the mouth had an active carious lesion; diagnostic criteria for caries examinations in NHANES were those developed by Radike and colleagues[13]. The diagnostic criteria for untreated coronal caries were the presence of any of the following features: gross cavitation; a deep pit or fissure with either softness at the base of the area or an opacity adjacent to the area providing evidence of undermining or demineralization; white spots or subsurface demineralization found to be soft on probing with the explorer; proximal caries as diagnosed using the same criteria for deep pits, fissures, or smooth surfaces; the presence of breaks in the enamel or subsurface shadowing on the proximal surfaces of teeth; and loss of translucency identified via transillumination on proximal surfaces of anterior teeth only. Teeth were classed as filled if they had been restored on any surface(s) with a direct or indirect restoration. The presence of root caries was not assessed in participants below the age of 18 years.

Briefly, the caries assessment component of the oral examination involved rinsing out the mouth before examination, removal of food debris with 2- × 2-in sponges, and examination of all teeth except third molars using visual and tactile feedback from a no. 23 explorer, hand mirror, and lighting. The teeth were examined in a standardized order for each participant, and trained health technicians documented the presence of coronal caries and the surfaces affected.

Data analysis

The population characteristics were coded as follows: age as a categorical variable; sex as a categorical variable (boys or girls); race or ethnicity as a categorical variable (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian, other (for example, mixed race or ethnicity)); family income to poverty ratio as a categorical variable (<0.5, 0.5–1.0, 1.0–2.5, 2.5–4.0, ≥ 4.0), which was calculated as the ratio between household income and the federal poverty threshold (that is, <1 indicates an income below the federal poverty threshold); BMI as a categorical variable in accordance with cutoff criteria for the CDC sex-specific 2000 BMI-for-age growth charts for the US (underweight (BMI $<$5th percentile), normal weight (BMI 5th to $<$85th percentiles), overweight (BMI 85th to $<$95th percentiles), obese (BMI $\geq$ 95th percentile)). For assessment of dental caries in the primary dentition we included all participants aged 2 to 11 years and for assessment of dental caries in the permanent dentition we included all participants aged 6 to 11 years.

We calculated summary statistics for all included participants in the four NHANES studies to characterize the cohorts. We then computed the prevalence of decayed teeth and the prevalence of filled teeth for both the primary and permanent dentition, separately. We accounted for the clustered, oversampling design of NHANES by means of using the mobile examination center-specific sample weights provided by the National Center for Health Statistics during all analyses. All analyses were conducted in Stata version 17.0 (StataCorp, College Station, Texas, United States).

RESULTS

The full details of the population characteristics for each of the NHANES studies are presented in Table 1. In total, 8394 individuals were included and analyzed from across the four NHANES studies. After adjusting for sampling weights, this was representative of 148.1 million children in the US for the period 2011 through 2020.

Primary dentition

The full details for the prevalence of dental caries in the primary dentition are presented in Table 2. In general, we have seen a decrease in the prevalence of decayed teeth in the primary dentition from 14.1% in 2011–2012 to 12.2% in 2017–2020. The most contemporary estimates from 2017–2020 in-

Table 1: Sample size and demographics of included participants from NHANES 2011 to 2020.

Characteristic	NHANES 2011–2012		NHANES 2013–2014		NHANES 2015–2016		NHANES 2017–2020	
	Sample size, n (%)	Represented in millions, n (%)	Sample size, n (%)	Represented in millions, n (%)	Sample size, n (%)	Represented in millions, n (%)	Sample size, n (%)	Represented in millions, n (%)
Total sample	1946 (100.0)	38.3 (100.0)	1995 (100.0)	37.3 (100.0)	1891 (100.0)	36.7 (100.0)	2562 (100.0)	35.8 (100.0)
Age								
2 to 5 years	797 (41.0)	15.4 (40.2)	786 (39.4)	14.6 (39.1)	740 (39.1)	13.8 (37.7)	1009 (39.4)	13.8 (38.5)
6 to 11 years	1149 (59.0)	22.9 (59.8)	1209 (60.6)	22.7 (60.9)	1151 (60.9)	22.9 (62.3)	1553 (60.6)	22.0 (61.5)
Sex								
Boys	988 (50.8)	19.4 (50.5)	1021 (51.2)	18.9 (50.7)	954 (50.5)	18.7 (51.0)	1279 (49.9)	17.9 (49.8)
Girls	958 (49.2)	19.0 (49.5)	974 (48.8)	18.4 (49.3)	937 (49.6)	18.0 (49.0)	1283 (50.1)	18.0 (50.2)
Ethnicity								
Non-Hispanic White	450 (23.1)	20.9 (54.5)	542 (27.2)	19.2 (51.3)	557 (29.5)	19.2 (52.3)	837 (32.7)	18.6 (51.9)
Non-Hispanic Black	569 (29.2)	5.5 (14.2)	522 (26.2)	5.2 (13.8)	441 (23.3)	5.1 (13.9)	695 (27.1)	4.7 (13.0)
Hispanic	612 (31.5)	8.9 (23.2)	612 (30.7)	9.0 (24.2)	609 (32.2)	8.6 (23.5)	579 (22.6)	8.5 (23.7)
Non-Hispanic Asian	201 (10.3)	1.6 (4.2)	161 (8.1)	1.7 (4.6)	141 (7.5)	1.6 (4.4)	195 (7.6)	1.7 (4.7)
Other	114 (5.9)	1.5 (3.9)	158 (7.9)	2.3 (6.1)	143 (7.6)	2.1 (5.9)	256 (10.0)	2.4 (6.7)
Family income-to-poverty ratio								
<0.5	322 (16.6)	4.3 (11.1)	306 (15.3)	4.2 (11.2)	251 (13.3)	3.2 (8.8)	333 (13.0)	3.4 (9.4)
0.5–1.0	434 (22.3)	6.7 (17.4)	445 (22.3)	6.6 (17.8)	359 (19.0)	5.2 (14.1)	500 (19.5)	5.5 (15.4)
1.0–2.5	637 (32.7)	12.4 (32.4)	647 (32.4)	11.6 (31.0)	688 (36.4)	12.5 (34.0)	878 (34.3)	10.3 (28.8)
2.5–4.0	262 (13.5)	6.2 (16.1)	274 (13.7)	6.0 (16.1)	299 (15.8)	7.7 (21.0)	382 (14.9)	6.8 (18.9)
≥4.0	291 (15.0)	8.8 (23.1)	323 (16.2)	8.9 (23.9)	294 (15.6)	8.1 (22.1)	469 (18.3)	9.8 (27.4)
BMI								
Underweight	71 (3.7)	1.2 (3.1)	80 (4.0)	1.6 (4.4)	46 (2.4)	9.4 (2.6)	85 (3.3)	1.2 (3.2)
Normal weight	1291 (66.3)	25.8 (67.3)	1274 (63.9)	24.5 (65.6)	1216 (64.3)	24.4 (66.4)	1621 (63.3)	22.9 (63.9)
Overweight	264 (13.6)	5.9 (15.5)	326 (16.3)	5.8 (15.6)	291 (15.4)	5.5 (14.9)	390 (15.2)	5.6 (15.6)
Obese	320 (16.4)	5.4 (14.1)	315 (15.8)	5.4 (14.4)	338 (17.9)	5.9 (16.2)	466 (18.2)	6.2 (17.2)

Represented population is the sample size after adjustment for sampling weights. Any discrepancies between sum of population subgroups and total sample size are due to rounding error.
Abbreviations: NHANES: National Health and Nutrition Examination Survey; BMI: body mass index.

dicate that decayed primary teeth are most prevalent in those aged 6 to 11 years (13.0%), boys (13.3%), those of Other ethnicity (18.3%), those with a family income-to-poverty ratio of <0.5 (22.7%), and those who are underweight (19.2%). We have also seen a decrease in the prevalence of filled teeth in the primary dentition from 29.8% in 2011–2012 to 26.1% in 2017–2020. The most contemporary estimates from 2017–2020 indicate that filled primary teeth are most prevalent in those aged 6 to 11 years (34.2%), boys (29.1%), those of Hispanic ethnicity (34.7%), those with a family income-to-poverty ratio of <0.5 (32.3%), and those who are overweight (29.4%).

Permanent dentition

The full details for the prevalence of dental caries in the permanent dentition are presented in Table 3. In general, we have seen a decrease in the prevalence of decayed teeth in the permanent dentition from 5.2% in 2011–2012 to 2.7% in 2017–2020. The most contemporary estimates from 2017–2020 indicate that decayed permanent teeth are most prevalent in those aged 9 to 11 years (3.5%), girls (3.6%), those of Hispanic ethnicity (5.2%), those with a family income-to-poverty ratio of <0.5 (7.2%), and those who are overweight (3.7%). We have also seen a decrease in the prevalence of filled teeth in the permanent dentition from 16.1% in 2011–2012 to 12.3% in 2017–2020. The most contemporary estimates from 2017–2020 indicate that filled permanent teeth are most prevalent in those aged 9 to 11 years (19.4 %), girls (12.7%), those of Hispanic ethnicity (18.1%), those with a family income-to-poverty ratio of <0.5 (19.3%), and those who are obese (15.5%).

Table 2: Prevalence of dental caries in the primary dentition in the US pediatric population, for the period 2011 to 2020.

Characteristic	Prevalence, % (95% CI)							
	Decayed teeth				Filled teeth			
	2011–2012	2013–2014	2015–2016	2017–2020	2011–2012	2013–2014	2015–2016	2017–2020
Total sample	14.1 (11.1–17.8)	13.0 (10.4–16.0)	11.4 (9.2–14.1)	12.2 (10.1–14.7)	29.8 (26.5–33.4)	29.2 (24.8–34.0)	29.1 (24.5–34.2)	26.1 (22.8–29.8)
Age								
2 to 5 years	10.3 (7.5–13.9)	12.0 (9.1–15.7)	8.7 (6.0–12.5)	11.0 (8.1–14.8)	16.1 (12.7–20.1)	15.7 (12.6–19.4)	14.9 (10.5–20.6)	13.3 (10.4–16.9)
6 to 11 years	16.7 (13.1–21.1)	13.6 (10.4–17.6)	13.1 (10.7–15.8)	13.0 (10.2–16.4)	39.1 (34.9–43.4)	37.8 (31.8–44.2)	37.7 (31.9–43.8)	34.2 (30.1–38.4)
Sex								
Boys	16.0 (12.3–20.6)	12.5 (9.8–16.0)	12.3 (9.4–15.9)	13.3 (10.5–16.7)	34.1 (29.1–39.6)	33.5 (28.9–38.4)	29.6 (24.1–35.8)	29.1 (25.5–32.9)
Girls	12.2 (9.5–15.5)	13.4 (9.8–18.2)	10.5 (8.1–13.5)	11.1 (9.2–13.4)	25.4 (21.3–30.0)	24.7 (20.0–30.3)	28.5 (23.6–34.1)	23.2 (19.3–27.6)
Ethnicity								
Non-Hispanic White	10.6 (7.7–14.5)	10.4 (7.0–15.2)	10.7 (7.8–14.5)	10.1 (7.1–14.1)	26.8 (21.5–32.8)	25.3 (18.7–33.3)	23.9 (19.1–29.4)	22.4 (19.1–26.1)
Non-Hispanic Black	20.3 (15.2–26.7)	16.1 (13.0–19.8)	14.9 (10.4–20.9)	11.8 (8.5–16.1)	31.0 (25.1–37.6)	25.1 (22.2–28.3)	27.8 (10.0–37.3)	23.4 (17.5–30.4)
Hispanic	19.2 (14.7–24.7)	17.0 (13.1–21.7)	11.7 (8.7–15.7)	14.9 (11.2–19.7)	36.3 (31.3–41.6)	38.2 (32.9–43.7)	42.5 (33.5–52.0)	34.7 (26.0–44.5)
Non-Hispanic Asian	14.4 (9.1–22.0)	15.7 (9.5–24.7)	6.6 (3.9–11.1)	15.1 (11.4–19.7)	27.3 (19.6–36.7)	36.8 (27.3–47.5)	28.2 (18.9–39.9)	30.0 (21.7–39.7)
Other	10.2 (4.3–22.3)	9.3 (5.2–16.1)	11.6 (6.3–20.3)	18.3 (11.1–28.7)	32.1 (22.6–43.4)	29.3 (18.6–42.8)	25.8 (16.7–37.5)	27.7 (21.5–34.8)
Family income-to-poverty ratio								
<0.5	25.8 (22.4–29.6)	24.2 (19.0–30.3)	17.3 (12.1–24.2)	22.7 (17.8–28.4)	34.1 (28.9–39.7)	31.8 (24.1–40.6)	40.3 (27.0–55.2)	32.3 (24.1–41.7)
0.5–1.0	15.8 (11.1–21.9)	12.0 (7.4–18.8)	19.1 (14.4–25.1)	16.6 (12.1–22.4)	43.9 (36.1–52.0)	34.3 (28.3–40.9)	38.0 (28.6–48.4)	30.5 (23.2–38.9)
1.0–2.5	16.5 (11.9–22.4)	14.3 (10.5–19.0)	12.8 (9.5–17.0)	14.9 (10.6–20.5)	29.1 (22.2–37.2)	34.0 (27.5–41.1)	31.5 (27.1–36.2)	32.0 (28.6–35.5)
2.5–4.0	11.8 (6.7–20.0)	10.3 (7.0–14.9)	10.6 (6.5–16.9)	9.5 (6.0–14.8)	26.9 (20.7–34.2)	24.3 (17.9–32.0)	21.5 (16.0–28.3)	24.2 (19.5–29.6)
≥4.0	5.6 (3.0–10.1)	8.6 (5.2–13.8)	2.8 (0.8–9.1)	5.3 (3.4–8.2)	20.2 (14.7–27.0)	21.2 (15.8–27.9)	22.4 (14.3–33.4)	16.9 (13.7–20.7)
BMI								
Underweight	10.3 (3.1–29.5)	12.8 (6.3–24.1)	10.0 (3.6–25.0)	19.2 (7.8–39.9)	28.1 (16.8–43.2)	30.0 (19.2–43.5)	32.4 (17.2–52.5)	25.4 (14.0–41.5)
Normal weight	14.1 (11.3–17.4)	11.9 (9.5–14.7)	12.0 (9.7–14.9)	11.8 (9.5–14.6)	30.0 (25.4–35.1)	28.4 (23.4–34.0)	29.5 (24.6–34.9)	25.9 (22.4–29.7)
Overweight	14.1 (9.1–21.3)	18.0 (11.1–27.9)	9.4 (95.7–15.3)	10.6 (7.2–15.4)	26.4 (20.4–33.6)	32.6 (26.5–39.3)	24.6 (18.6–31.8)	29.4 (24.7–34.6)
Obese	15.2 (10.5–21.5)	12.5 (8.6–17.8)	10.9 (7.6–15.4)	13.9 (9.9–19.1)	33.2 (27.2–39.8)	28.8 (21.4–37.5)	31.0 (23.2–40.1)	24.4 (19.8–29.6)

95% CI = 95% confidence interval. All prevalence values are weighted, accounting for sampling weights. Any discrepancies between sum of population subgroups and total sample size are due to rounding error.
BMI: body mass index.

Table 3: Prevalence of dental caries in the permanent dentition in the US pediatric population, for the period 2011 to 2020.

Characteristic	Prevalence, % (95% CI)							
	Decayed teeth				Filled teeth			
	2011–2012	2013–2014	2015–2016	2017–2020	2011–2012	2013–2014	2015–2016	2017–2020
Total sample	5.2 (3.7–7.2)	6.3 (4.8–8.1)	3.9 (2.8–5.6)	2.7 (1.4–4.9)	16.1 (12.9–20.0)	9.8 (7.3–13.1)	11.5 (8.6–15.1)	12.3 (9.8–15.4)
Age								
6 to 8 years	3.0 (1.6–5.7)	3.3 (2.3–4.7)	1.8 (0.8–3.8)	1.7 (0.1–4.4)	9.8 (6.7–14.2)	4.6 (2.7–7.9)	5.6 (3.2–9.6)	4.4 (2.6–7.2)
9 to 11 years	7.6 (5.3–10.7)	9.3 (6.4–13.2)	6.1 (3.9–9.6)	3.5 (2.0–6.1)	23.1 (18.4–28.6)	15.1 (11.1–20.3)	17.4 (13.9–21.5)	19.4 (16.2–23.1)
Sex								
Boys	5.1 (3.5–7.4)	5.4 (3.7–7.7)	2.9 (1.8–4.7)	1.7 (1.0–3.1)	13.6 (10.6–17.3)	9.3 (6.0–14.1)	7.6 (4.9–11.7)	12.0 (9.6–14.8)
Girls	5.2 (3.2–8.3)	7.2 (4.8–10.5)	5.0 (3.4–7.4)	3.6 (1.6–7.7)	18.8 (13.6–25.4)	10.4 (7.1–15.1)	15.5 (11.5–20.5)	12.7 (9.4–17.1)
Ethnicity								
Non-Hispanic White	3.8 (2.0–7.3)	6.0 (3.8–9.3)	3.5 (1.9–6.7)	1.4 (0.7–2.7)	14.4 (9.9–20.4)	7.7 (4.1–14.1)	6.5 (4.6–9.2)	8.7 (6.2–11.9)
Non-Hispanic Black	6.5 (3.5–11.7)	6.3 (4.3–9.1)	6.9 (4.6–10.4)	3.0 (1.7–5.1)	16.7 (11.7–23.3)	15.0 (10.8–20.6)	12.9 (7.1–22.3)	16.6 (10.9–24.5)
Hispanic	8.0 (5.3–11.7)	8.5 (5.3–13.3)	4.6 (2.9–7.5)	5.2 (1.9–13.2)	20.5 (16.4–25.3)	10.6 (6.9–16.0)	18.5 (12.9–25.8)	18.1 (13.9–23.1)
Non-Hispanic Asian	4.7 (2.2–10.0)	1.6 (0.3–8.9)	1.2 (0.2–7.8)	1.7 (0.3–8.2)	15.2 (7.6–27.9)	9.4 (4.3–19.3)	17.4 (12.7–23.3)	16.1 (10.1–24.7)
Other	3.7 (0.8–15.9)	3.5 (1.1–10.3)	– (no obs.)	3.3 (1.0–10.2)	14.7 (5.8–32.7)	13.3 (7.1–23.4)	20.3 (8.9–40.0)	9.5 (5.7–15.3)
Family income-to-poverty ratio								
<0.5	10.7 (7.3–15.6)	12.3 (7.2–20.2)	8.9 (5.7–13.7)	7.2 (3.6–14.0)	16.8 (10.6–25.5)	10.7 (5.4–10.1)	22.9 (13.1–36.9)	19.3 (12.7–28.3)
0.5–1.0	6.5 (3.7–10.9)	5.1 (2.8–9.2)	6.6 (3.2–13.1)	3.8 (1.5–9.1)	21.8 (14.6–31.2)	12.5 (7.8–19.5)	18.4 (12.1–27.0)	16.9 (12.9–21.8)
1.0–2.5	3.7 (1.9–7.1)	6.6 (3.5–12.4)	5.1 (3.4–7.5)	3.0 (1.5–5.7)	14.2 (10.7–18.6)	12.5 (9.2–16.8)	12.7 (8.2–19.1)	13.6 (9.8–18.6)
2.5–4.0	10.2 (5.2–19.0)	4.1 (1.5–10.5)	0.4 (0.1–2.1)	1.5 (0.5–4.4)	13.6 (7.4–23.6)	5.9 (2.4–13.5)	7.1 (4.2–11.9)	8.5 (5.1–14.0)
≥4.0	– (no obs.)	5.6 (2.6–11.6)	2.3 (0.7–7.8)	1.3 (0.3–4.6)	16.3 (9.3–26.9)	7.1 (2.9–16.0)	5.8 (2.9–111.0)	9.4 (5.9–14.5)
BMI								
Underweight	5.2 (1.4–17.8)	2.2 (0.5–10.1)	4.3 (1.0–17.7)	1.8 (0.2–13.9)	20.4 (10.9–34.7)	9.0 (2.9–24.8)	15.4 (5.2–37.4)	5.3 (1.8–14.9)
Normal weight	4.2 (2.5–6.8)	4.8 (3.1–7.3)	4.1 (2.4–6.9)	2.4 (1.2–4.4)	15.1 (11.2–20.0)	9.0 (6.6–12.1)	9.9 (7.5–13.0)	11.3 (8.8–14.5)
Overweight	4.4 (2.0–9.3)	9.5 (6.0–14.6)	2.1 (0.9–4.8)	3.7 (1.2–10.8)	18.0 (10.8–28.6)	11.3 (8.0–15.6)	16.0 (10.3–24.0)	13.7 (8.2–22.1)
Obese	9.3 (5.3–15.9)	9.9 (5.6–17.0)	5.0 (2.9–8.6)	2.9 (1.3–6.5)	17.3 (9.8–28.7)	11.8 (5.9–22.3)	12.2 (6.8–21.0)	15.5 (11.9–20.0)

95% CI = 95% confidence interval. All prevalence values are weighted, accounting for sampling weights. Any discrepancies between sum of population subgroups and total sample size are due to rounding error.
BMI: body mass index.

DISCUSSION

In this study, figures are presented on the epidemiology of dental caries for the period 2011 to 2020. The most contemporary statistics indicate that decayed primary teeth are present in over 10% of the US pediatric population, whilst filled primary teeth are present in over 25%. For the permanent dentition, decayed teeth are seen in just under 3% of the population, whilst filled teeth are seen in just over 12% of the population. From 2011 through 2020, for both primary and permanent dentition, disease has almost always been most prevalent in ethnic minority groups, those from lower income families, and those with an under or overweight BMI. Furthermore, disease in the primary dentition appears to be more prevalent in boys, whilst disease in the permanent dentition appears to be more prevalent in girls.

The findings of this study are consistent with previous stud-

ies which have also assessed trends across NHANES and found that we are generally seeing a decrease in the prevalence of caries [14]. Interestingly, this present study also seems to indicate that between 2015 to 2020 there has been very little change in disease prevalence. In the primary dentition, we see a small increase in the prevalence of decayed teeth and a small decrease in the prevalence of filled teeth, which equates to very little overall change. Similarly, for the permanent dentition, we see a small decrease in the prevalence of decayed teeth and small increase in the prevalence of filled teeth, once again equating to very little overall change. Therefore, it remains to be seen whether public health measures have now hit a plateau, or whether we will continue to observe a decrease in disease prevalence over the coming years. Furthermore, the observation that dental caries is most prevalent in those from minority ethnic groups and poorer backgrounds is ubiquitous across all of the NHANES studies and this finding is consistent across a huge array of literature assessing the epidemiology of dental caries in the US [14–16]. Whilst there may be some decrease in the exact magnitude of this inequality, with the gap between the most and least wealthy families having slightly decreased over time, there still exists a substantial difference between the sociodemographic subgroups that remains to be addressed. The exact factors which govern this inequality are numerous and likely interact with one another in a complex manner, including pressing public health challenges such as access to care, nutritional status, and oral health education, amongst others [1,17,18].

Given that childhood obesity, both in the US and worldwide, has become an increasingly pressing issue in recent times, it seems important to understand how oral disease affects this population [19,20]. Whilst it is true that some evidence indicates that the condition may be levelling off in prevalence, it still affects a substantial proportion of the pediatric population [21]. Furthermore, the evidence on whether BMI and dental caries are associated is highly heterogenous, with the most recent systematic review indicating some degree of association, but on the basis of a rather weak quality of evidence [22]. This present study provides up-to-date evidence in showing that disease prevalence is highest in those with a non-normal BMI (*i.e.*, underweight, overweight, or obese), but no consistent finding that one specific BMI subgroup is substantially more predisposed to disease than the others.

The strengths of this study lie in its complex sampling strategy, combined with robust analytical methods, which allow for generalization of the findings to the US population as a whole. By accounting for the multistage, clustered sampling methodology in NHANES, these allow for results to be obtained which we would expect to observe in the wider US population, meaning these findings may be informative for clinicians, policy makers, and the general population. Furthermore, there is detailed clinical and demographic data collected across the NHANES studies which allows for the trends to be stratified so that we can elucidate exactly how the distribution of disease is changing amongst various population subgroups over time. There are also some limitations to this study which must be noted. Firstly, NHANES is cross-sectional in nature and not longitudinal, therefore, it becomes difficult to infer causality between any population characteristic and the prevalence of caries. Secondly, NHANES is specifically designed to sample the non- institutionalized population and disease distribution may differ amongst the institutionalized population. Whilst it is expected that only a very small proportion of children will be living in a non-household environment, this is still a factor which should be mentioned.

It would be advised that future research continues to quantify the determinants and distribution of dental caries amongst the pediatric population and widespread surveillance is maintained, in order that we can monitor which subgroups are at greatest risk of disease. Over the coming years, it will be important to assess whether we are going to see a continued decrease in prevalence of disease, or whether we have plateaued in this regard. Finally, public health practitioners should consider methods which can be implemented to address the inequality in the disease distribution and how to improve on past interventions which have not fully solved this problem yet.

CONCLUSION

This study provides statistics on the trends in the prevalence of dental caries in the US pediatric population over the past decade. The analyses reveal that we have seen a decrease in the prevalence of disease, but very little change in the inequality in how the disease is distributed amongst the population.

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ETHICAL APPROVAL

Not applicable

CONFLICTS OF INTEREST

The author declares no conflicts of interest.

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