CROSS-SECTIONAL STUDY

National Trends and Characteristics in Emergency Department Visits for Nontraumatic Dental Conditions Among Pediatric Patients

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Abstract: ***Purpose:*** *The purpose of this study was to examine trends and characteristics of pediatric nontraumatic dental condition (NTDC) visits to emergency departments (EDs) in the United States from 2010 to 2017.* ***Methods:*** *The 2010 to 2017 Nationwide Emergency Department Sample (NEDS) was analyzed for NTDC visits to EDs for children (zero to 20 years old). NTDC visits were identified based on ICD-9 and ICD-10 codes. Patient characteristics analyzed included age, sex, primary payor, county population, day of discharge, and household income. Descriptive statistics and a logistic regression analysis for 2016 and 2017 were completed.* ***Results:*** *Pediatric NTDC visits to EDs decreased from 103.1 to 89.3 per 10,000 ED visits between 2010 and 2017. Pediatric NTDC ED visits by Medicaid enrollees increased from 51 percent to 65.3 percent from 2010 to 2017. This was followed by a corresponding decrease among uninsured pediatric patients with NTDC visits to EDs. The odds of NTDC visits to EDs were higher among Medicaid enrollees, 15- to 20-year-olds, and the uninsured but were lower among those in wealthier zip codes.* ***Conclusions:*** *Emergency department visits for nontraumatic dental condition visits by pediatric patients decreased over time following the implementation of the Affordable Care Act. Despite this decrease, low socioeconomic status children continue to utilize emergency departments for dental conditions at higher rates than their peers.* *(Pediatr Dent 2021;43(3):211-7) Received October 8, 2020 | Last Revision December 14, 2020 | Accepted December 17, 2020*

KEYWORDS: PEDIATRIC DENTISTRY, EPIDEMIOLOGY, EMERGENCY DEPARTMENTS, MEDICAID

Access to regular dental care remains an enduring challenge in the United States.[1-4] Consequently, poor oral health in adult and pediatric populations persists as a significant public health concern.[3,5-7] Sequelae of poor oral health include missing school days or work, oral pain, and the ill-suited usage of hospital emergency departments (**EDs**) for dental conditions.[2,3,8] U.S. hospital EDs are required to assess and treat all individuals who present with an emergent medical condition, irrespective of their ability to pay.[9] This requirement, combined with inadequate access to preventive care, results in EDs being overutilized as an expensive treatment facility for nontraumatic dental conditions (**NTDCs**).[2,10-15] NTDCs include dental caries, gingival and periodontal conditions, pulpal and periapical conditions, cellulitis, and unspecified disorders of the teeth and supporting structures.[16]

These conditions are poorly managed in hospital EDs.[2,11,14,17] ED staff may lack the requisite equipment and training to manage dental conditions. Visits to EDs to manage these conditions often lead to the provision of temporary care that does not resolve the underlying dental condition.[2,14] As a result, adult and pediatric patients with NTDCs seeking treatment at EDs contribute to the increasing hospital burden[10,18,19] and cost of ED visits for dental conditions in the United States.[11,13-15]

Additional national epidemiological data about pediatric NTDC visits to EDs would provide valuable data for providers and policymakers. Nalliah et al. analyzed nationwide data from 2006 and found that Medicaid was the primary payor for ED visits due to dental caries in children.[20] Allareddy et al. found that Medicaid was a payor for 43 percent of pediatric dental condition visits to EDs in 2008.[21] Additionally, individuals from the lowest income quartile were found to be more likely to visit EDs for dental conditions.[21]

A recent guest editorial in *Pediatric Dentistry* also recommended more investigation into pediatric NTDC visits to EDs and hypothesized that these visits may serve as a portal to the preventive dental care system.[22] The authors of the present study agree that there is a relative paucity of research regarding NTDC visits to EDs in children compared to adults.

With this in mind, the purposes of this study were to: (1) examine trends in pediatric nontraumatic dental condition visits to emergency departments from 2010 to 2017; (2) examine factors associated with ED utilization by pediatric patients for NTDCs in recent years. The years from 2010-2017 are especially salient, due to the passage of the Patient Protection and Affordable Care Act (**ACA**) in 2010.[24] One of the objectives of the ACA was to expand children's access to dental care by mandating that pediatric dental insurance be an Essential Health Benefit offered on health insurance marketplaces and by

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HOW TO CITE:
Morgan T, Samtani MT, Yeroshalmi F, et al. National Trends and characteristics in emergency department Visits for nontraumatic dental conditions among pediatric patients. Pediatr Dent 2021;43(3):211-7.

expanding children's eligibility for Medicaid.[24] The scope of changes due to the ACA provide a compelling period to examine, and it is hoped that this study's analysis will provide policymakers, dentists, and physicians information to aid in formulating policies to improve access to dental care and limit inappropriate NTDC visits to EDs across the United States.

Methods

The authors obtained data from the Nationwide Emergency Department Sample (**NEDS**) for the years 2010 to 2017. NEDS is the largest, all-payor ED database in the United States. It contains a 20 percent stratified, single-stage cluster sample of ED visits from across the U.S.[23,25] NEDS includes information on geographic, hospital, and patient characteristics. It is sponsored by the Agency for Healthcare Research and Quality through its Healthcare Cost and Utilization Project. NEDS provides appropriate weights to obtain national-level estimates of all hospital-based ED visits.[23]

For this study, the authors limited the analysis to children aged 20 years and younger who made ED visits that did not result in an admission to the same hospital, using data from NEDS.[23] The Western Institutional Review Board, fully accredited by the Association for the Accreditation of Human Research Protection Programs and the Albert Einstein College of Medicine Institutional Review Board, reviewed and approved the study.

Dependent variable. The primary outcome variable of interest was ED utilization for NTDCs based on the principal or first listed diagnosis, as recommended by the Association of State and Territorial Dental Directors (**ASTDD**).[16] The first listed diagnosis is the main reason a patient presents to an ED.[26] When analyzing trends and characteristics of pediatric patients presenting to EDs specifically to manage NTDCs, the principal diagnosis is the diagnosis of interest. NTDCs were defined using the International Classification of Diseases, Ninth or Tenth Revision, Clinical Modification (**ICD-9-CM** or **ICD-10-CM** codes, respectively),[27,28] as recommended by the ASTDD, a validated approach to identify NTDC ED visits.[16] For 2010 through the third quarter of 2015 and for the fourth quarter of 2015 through 2017, the authors included patients whose principal diagnosis was an ICD-9-CM or ICD-10-CM code, respectively, as included in a modified ASTDD recommended case definition of NTDCs.

Independent variables. The authors examined patient and neighborhood characteristics. These included: age categorized by age group in years as zero to four, five to nine, 10 to 14, or 15 to 20; sex coded as male or female; primary payor coded as private, Medicaid, uninsured, or other; area of residence categorized into central counties, fringe counties, medium or small metropolitan areas, or rural areas; annual median household income quartiles estimated using residential zip code (the first quartile being the poorest); and discharge day coded as weekday or weekend. Age categories were broadly chosen due to dental development and developmental stages. Ages zero to four years represent patients with only primary teeth. Ages five to nine years represent the earliest stages of mixed dentition. Ages 10 to 14 years represent early adolescents and late mixed dentition. Ages 15 to 20 years represent permanent dentition and late adolescents, To assess the independent risk factors associated with ED utilization for NTDCs, the authors also created the Elixhauser comorbidity index based on all listed diagnoses, including all diagnosis codes to create this index, which helped accurately capture the presence of comorbidities in the present study's population.[29]

Statistical analyses. First, the authors used descriptive statistics to summarize ED utilization for NTDCs from 2010 to 2017 as a rate per 10,000 pediatric ED visits and per 10,000 children in the population. Second, the authors described NTDC-related ED visits by each of the independent variables across all years. Further, a multivariable logistic regression model was used to examine patient and neighborhood characteristics (age, sex, primary payor, residence, annual median household income, and Elixhauser comorbidity score) as potential predictors of an NTDC-related ED visit. They created this model by combining the most recent two years of data: 2016 and 2017. All descriptive estimates were weighted using population weights in the data and, as such, were nationally

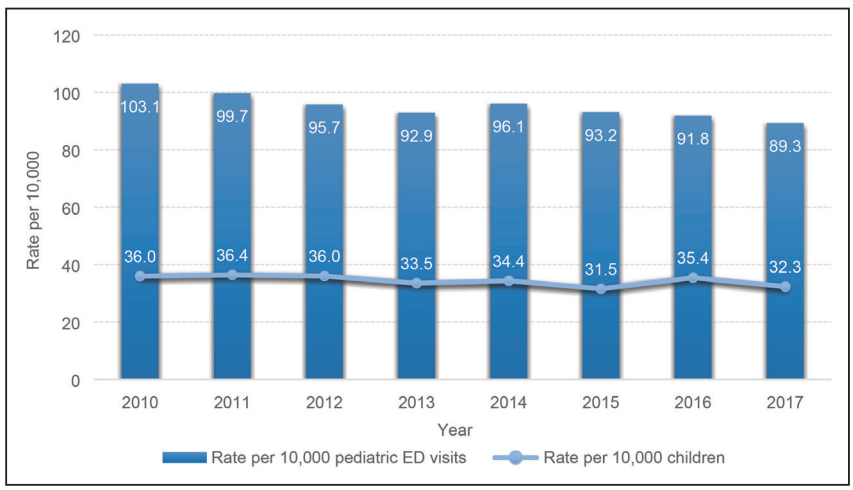

Figure 1. Trends in nontraumatic dental conditions visit rate to the emergency department (ED) among patients aged 0-20 years from 2010 to 2017.

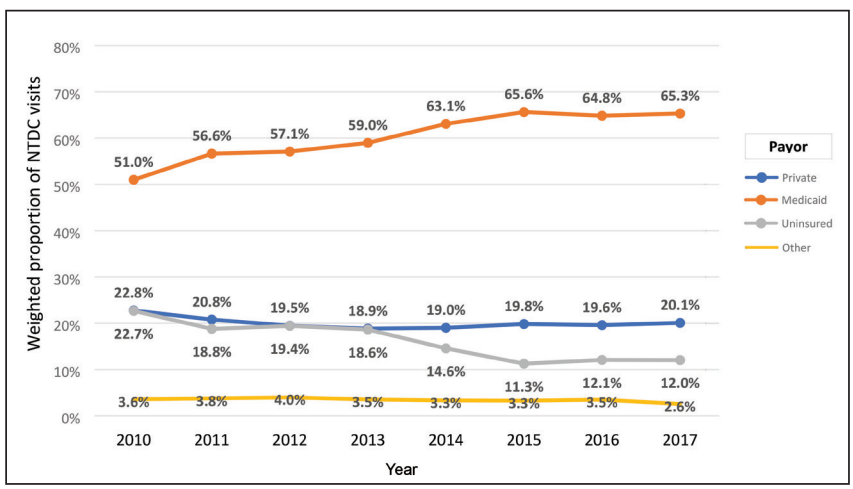

Figure 2. Emergency department utilization for nontraumatic dental conditions (NTDCs) among 0-20 year-old patients by payor type from 2010-2017.

representative and computed using the discharge weight variable assigned for each visit. Each ED visit was the unit of analysis. The authors deemed a *P*-value of <0.05 to be statistically significant. All analyses were performed using Stata 16.0 software (StataCorp LLC, College Station, Texas, USA) to account for complex sample design.

Results

Figure 1 outlines the number of pediatric NTDC visits per ED visit and per capita in the years 2010 to 2017. The authors observed a 13.3 percent decrease from 103.1 pediatric NTDC visits per 10,000 pediatric ED visits in 2010 to 89.3 NTDC visits per 10,000 pediatric ED visits in 2017. A 10.2 percent decrease from 36.0 pediatric NTDC visits per 10,000 children to 32.3 NTDC visits per 10,000 children was also observed.

Table 1 contains the study population sociodemographic (age, sex, income quartile, primary payor, and location type) characteristics and discharge day trends in NTDC visits to EDs from 2010 to 2017. The NTDC visits to EDs for the first (lowest) median income quartile zip codes increased from 37.9 percent to 42.0 percent of total pediatric NTDC visits to EDs in the study years. The second income quartile decreased from 31.3 percent of pediatric visits to EDs for NTDCs in 2010 to 28.1 percent of visits in 2017. A minimal change occurred in the third and fourth income quartile between 2010 and 2017. The authors observed a relative increase in NTDC visits to

Table 1. WEIGHTED ESTIMATES OF EMERGENCY DEPARTMENT (ED) UTILIZATION FOR NONTRAUMATIC DENTAL CONDITIONS (NTDCs) AMONG ZERO- TO 20-YEAR-OLD PATIENTS BY COVARIATES BETWEEN 2010 AND 2017

	2010	2011	2012	2013	2014	2015	2016	2017
Total subpopulation of ED visits (N)	30,616,983	31,898,273	32,714,595	31,265,960	30,933,011	29,263,667	33,326,864	31,230,553
ED visits for an NTDCs (N)	315,528	318,150	313,210	290,512	297,216	272,603	306,079	278,932
ED utilization for NTDCs (rate per 10,000 ED visits)	103.1	99.7	95.7	92.9	96.1	93.2	91.8	89.3
Age (years) (%)								
0-4	22.9	24.3	25.2	24.8	25.8	26.4	27.8	25.9
5-9	14.1	15.8	17.4	18.3	19.4	20.3	21.6	22.4
10-14	9.0	9.9	10.4	10.8	11.0	11.4	12.0	13.0
15-20	54.0	50.1	46.9	46.2	43.8	41.9	38.6	38.8
Sex (%)								
Male	47.5	48.0	48.4	49.1	49.5	49.6	48.7	49.6
Female	52.6	52.0	51.6	50.9	50.5	50.4	51.3	50.4
Primary payor (%)								
Private	22.8	20.8	19.5	18.9	19.0	19.8	19.6	20.1
Medicaid	51.0	56.6	57.1	59.0	63.1	65.6	64.8	65.3
Uninsured	22.7	18.8	19.4	18.6	14.6	11.3	12.1	12.0
Other	3.6	3.8	4.0	3.5	3.3	3.3	3.5	2.6
Location type (%)								
Central counties of ≥1 million population	25.8	26.6	28.1	30.0	28.7	28.2	31.1	30.5
Fringe counties of ≥1 million population	16.9	19.8	19.1	18.9	17.6	20.2	18.6	18.2
Medium or small metro of 50,000-999,999 population	34.4	31.5	32.5	30.8	35.1	32.9	32.4	33.5
Rural	23.0	22.1	20.3	20.3	18.6	18.8	17.8	17.8
Median household income (%)								
1st quartile	37.9	37.4	39.5	40.9	39.7	40.6	41.4	42.0
2nd quartile	31.3	28.5	28.3	28.5	30.4	27.3	28.2	28.1
3rd quartile	19.9	22.3	20.6	19.9	18.8	20.6	18.7	19.6
4th quartile	10.9	11.8	11.6	10.7	11.1	11.4	11.6	10.3
Discharge day (%)								
Weekday	67.1	66.4	66.6	66.9	67.1	66.8	66.9	66.9
Weekend	32.9	33.6	33.4	33.1	32.8	33.2	33.1	33.1

Table 2. MULTIVARIABLE LOGISTIC REGRESSION MODEL TO EXAMINE FACTORS ASSOCIATED WITH EMERGENCY DEPARTMENT VISITS WITH PRIMARY DIAGNOSIS OF NONTRAUMATIC DENTAL CONDITIONS AMONG PATIENTS ZERO TO 20 YEARS OLD: COMBINED YEARS 2016 TO 2017

	Odds ratio	95% confidence interval	*P*-value*
Age (years)			
0-4		Ref	
5-9	1.61	1.58-1.63	<0.001
10-14	1.1	1.08-1.12	<0.001
15-20	1.97	1.95-2.00	<0.001
Sex			
Male		Ref	
Female	0.93	0.92-0.94	<0.001
Elixhauser comorbidity score	0.44	0.43-0.45	<0.001
Year			
2016		Ref	
2017	0.96	0.95-0.98	<0.001
Primary payor			
Private		Ref	
Medicaid	1.69	1.67-1.72	<0.001
Uninsured	2.11	2.07-2.15	<0.001
Other	1.15	1.11-1.19	<0.001
Location type			
Central counties of ≥1 million population		Ref	
Fringe counties of ≥1 million population	1.03	1.01-1.05	0.001
Medium or small metro of 50,000-999,999 population	1.02	1.01-1.04	0.002
Rural	0.99	0.98-1.01	0.518
Median household income			
1st quartile		Ref	
2nd quartile	0.95	0.94-0.96	<0.001
3rd quartile	0.88	0.87-0.90	<0.001
4th quartile	0.76	0.75-0.78	<0.001
Discharge day			
Weekday		Ref	
Weekend	1.21	1.20-1.23	<0.001

* Statistical significant; $P<0.05$ by Wald chi-square statistic.

EDs, from 14.1 percent to 22.4 percent between 2010 and 2017 in the five- to nine-year-old group. The relative percentage of pediatric NTDC visits to EDs in the 15- to 20-year-old group decreased from 54 percent in 2010 to 38.8 percent in 2017. Medicaid as a payor increased from 51.0 percent to 65.3 percent of NTDC ED visits from 2010 to 2017. This increase aligns with a decrease in uninsured payers from 22.7 percent to 12.0 percent, a slight decrease in private (22.8 percent to 20.1 percent), and a decrease in other (3.6 percent to 2.6 percent) as a payor for NTDC ED visits in children from 2010 to 2017.

Figure 2 includes NTDC visits to EDs among zero- to 20-year-olds by payor type from 2010 to 2017. Medicaid was consistently the primary payor for NTDC visits to EDs for zero- to 20-year-old patients. Medicaid as the primary payor in this age group increased from 51 percent to 65.3 percent. There was also a corresponding decrease from 22.7 percent to 12 percent in uninsured NTDC visits to EDs.

Table 2 shows the logistic regression model for factors associated with NTDC visits to EDs for the combined years 2016 and 2017. Children in the 15- to 20-year-old age group were 1.97 times (95 percent confidence interval [**95% CI**] equals 1.95 to 2.00) more likely to present to EDs with a primary diagnosis of NTDCs compared to the referent zero- to four-year-old age group. Children in the five- to nine-year-old group were 1.61 times (95% CI equals 1.58 to 1.63) more likely to present to EDs for NTDCs compared to the referent group. Uninsured children were 2.11 times (95% CI equals 2.07 to 2.15) more likely to present to EDs with NTDCs compared to children with private insurance. Children with Medicaid were 1.69 times (95% CI equals 1.67 to 1.72) more likely to present to EDs with NTDCs compared to private insurance. Children in the second median income quartile (0.95 odds ratio [**OR**], 95% CI equals 0.94 to 0.96), third income quartile (0.88 OR, 95% CI equals 0.87 to 0.90), and fourth income quartile (0.76 OR, 95% CI equals 0.75 to 0.78) had decreasing odds of having an NTDC ED visit compared to the first (lowest) median income quartile referent group. Pediatric patients were 1.21 times (95% CI equals 1.20 to 1.23) more likely to have an NTDC ED visit on weekends compared to weekdays. Compared to children in central counties of at least one million people, children in fringe counties of areas of at least one million people (1.03 OR, 95% CI equals 1.01 to 1.05) and small metro areas (1.02 OR, 95% CI equals 1.01 to 1.04) were more likely to present to EDs with NTDCs.

This study's findings regarding children in rural areas compared to central counties were not significant. The authors also found an Elixhauser comorbidity score capital OR of 0.44 (95% CI equals 0.43 to 0.45), which indicates that children with other comorbid conditions are less likely to present to EDs with NTDCs as the primary diagnosis.

Discussion

Limited contemporary descriptive data exists regarding pediatric patients with NTDCs presenting to EDs in the United States. The present study provides valuable information regarding sociodemographic characteristics and trends in NTDC visits to EDs for children from 2010 to 2017. Demographic data during this time is especially important due to the expansion of children's private insurance and Medicaid coverage as a result of the ACA.[24,30]

After completing the initial data analysis, the authors noticed a large decrease in ED visits for NTDCs between 2015 and 2016. As ICD-10 codes became standard on October 1, 2015, the authors were concerned the ICD-9 to ICD-10 crosswalk had been completed incorrectly. During a review of the codes, they observed that the ASTDD guidance listed 5258 (Other specified disorders of the teeth and supporting structures) as an included ICD-9 code but not the associated K08.89 ICD-10 code.[16] This omission meant that approximately 30 percent of NTDC ED visits were not included, simply due to the change in definition. The authors contacted the ASTDD

to seek clarification and worked with the primary author of the ASTDD report to test the implications of different code sets. The K08.89 ICD-10 code was included in the final analysis. As of the submission of this article, updated guidance is anticipated to be published by the ASTDD in early 2021. The authors advise that all analysts of large databases confirm that definitions are consistent across the entire sample period, especially if this sample period contains the ICD-9 to ICD-10 switch.

Findings from this study's logistic regression model and descriptive data confirm previous research that demonstrates children in the lowest median income quartile are more likely to use hospital EDs to manage dental conditions and there is a decreasing likelihood of presenting to EDs due to NTDCs in each subsequent income quartile.[21] This finding further aligns with existing literature regarding the heightened use of EDs to manage NTDCs by adults of lower economic status.[12,13,15,20] The literature suggests that irregular preventive medical care has been shown to increase the likelihood of nondental ED visits.[31] With this in mind, the authors hypothesize that irregular preventive dental care leads to low socioeconomic status families utilizing EDs to manage their children's NTDCs. The present study's findings also point to weekends as comparatively more likely than weekdays to be a day of discharge. This likely results from fewer open dental offices on weekends and conflicts due to employed parents or school. Previous research found that children are more likely to be taken to EDs for NTDCs during nonworking hours.[32] As a result of these conflicts, care is likely delayed until EDs are the only open facility for the management of NTDCs.

Of the pediatric patients utilizing EDs to manage NTDCs, visits by 15- to 20-year-olds and five- to nine-year-old patients are comparatively more likely. Existing research of young adults and late adolescents show them as frequent users of EDs for dental conditions compared to their younger peers.[18,19,21,32] In younger populations, Allareddy et al. found that six- to 10-year-olds were more likely to have an ED visit due to NTDCs than the surrounding age groups.[21] What is less clear from the literature are explanations for why these groups are more likely to be utilizing EDs for NTDCs. Dental disease may be accumulating in the primary or permanent dentition at a rate that finally necessitates emergent care while in the five- to nine-year-old or 15- to 20-year-old age group, respectively. In the younger five- to nine-year-old group, the beginning of eruption of permanent teeth may also lead to a higher frequency of NTDC ED visits.[21] Additional qualitative research may elucidate the precise reasons for higher ED utilization rates in these age groups.

Considering the difficulties accessing preventive children's dental care in rural areas,[34] the authors were dismayed at the lack of significance in the relationship between location type and visits to EDs for NTDCs. Confounding variables may be altering the effect of location in the regression model. A future examination of state-level data may present additional findings regarding the relationship between location and ED visits for NTDCs.

The authors found several interesting trends in primary payor data during the study years. The sustained increase in the relative percentage of children who had Medicaid as a primary payor is likely a result of uninsured patients gaining Medicaid benefits during the study period. This finding is supported by the decrease seen among the uninsured payers for NTDC visits to EDs and is consistent with the expansion of Medicaid due to the ACA. It is important to note that the study period begins just after a global economic recession and the timeline of Medicaid expansion, which some states opted out of, varied by state. Additionally, national data were utilized for this study. As such, it is difficult to ascribe particular policy changes to any specific single year changes in this study's findings. Even so, the overall trend in this study's results points to an expansion of Medicaid enrollees from the previously uninsured and the subsequent usage of these benefits for NTDC ED visits in the years around the implementation of the ACA. Though previous research found an increase in the percentage of children covered by private dental insurance after the passage of the ACA[30], the authors did not find a corresponding increase in the relative usage of private dental insurance as a payor for pediatric visits to EDs for NTDCs in the post-ACA period.

Along with the present study's findings regarding the expansion of Medicaid as a primary payor for NTDC ED visits, the authors also observed decreases in children's NTDC ED visits per capita and on a per-ED-visit basis. These findings taken together are encouraging. It seems that either the management of pediatric NTDCs is increasingly taking place outside of EDs or NTDCs are being prevented before the ED visit. Pediatric preventive dental visits increased in the years immediately after the passage of the ACA.[35,36] Additionally, states that expanded adult Medicaid saw a decrease in the usage of EDs by adults to manage NTDCs.[37] Therefore, it is plausible that expanded children's dental insurance coverage due to the ACA led to an increase in pediatric preventive dental visits during the study period and a subsequent decrease in pediatric visits to EDs to manage NTDCs.

Another interesting observation from the data was the large relative decrease in NTDC visits to EDs from 2010 to 2017 in the 15- to 20-year-old age group. Additionally, the five- to nine-year-old age group saw a relative increase in NTDC visits. The reason for these two trends is unknown. The ACA expanded coverage for all newly qualified individuals under 21. Eligibility for dependent child coverage for 18- to 26-year-olds increased, but these insurance gains were likely limited. More research is needed to determine the origin of the large relative decline in NTDC ED visits in 15- to 20-year-olds and the relative increase in NTDC ED visits in five- to nine-year-olds.

It is important to recognize that this study does not contain any pre- or postvisit information regarding ED encounters. More research on the pre- and postevent period of pediatric dental patients' care in EDs could prove beneficial. Some of these visits may be recommended by a patient's dental home. In other cases, children may be brought to EDs for NTDCs due to limited parental oral health literacy. Parents may lack knowledge regarding the timing of the first dental visit, how to access care, or the importance of regular preventive dental care.[22] EDs could also serve as an important conduit to regular dental care with appropriate referrals and physician training. Even so, the dental literature presents a convincing argument that NTDCs are poorly managed in EDs[2,11,14,17] and policy efforts should continue to be made to shift the location of care from EDs to dental offices.

There are methodological limitations to this study. The NEDS does not contain a census of all ED visits. Each visit is weighted to create a nationally representative sample. The NEDS contains encounter-level data but does not uniquely identify patients; hence, individuals may be represented by multiple visits

in any given year. One cannot draw causal relationships from the NEDS, as it is cross-sectional data. The study builds its analysis on ICD-9 and ICD-10 codes which can be unreliable dental diagnostic codes when utilized by physicians.[38] Furthermore, the switch from ICD-9 to ICD-10 in 2015 may have created additional confusion about the proper diagnosis code for dental conditions.

Conclusions

Based on this study's results, the following conclusions can be made:

1. The rate of pediatric visits to emergency departments for nontraumatic dental conditions decreased from 2010 to 2017. This period is consistent with the implementation of the Affordable Care Act and its expansion of Medicaid eligibility for children.
2. Uninsured individuals were a decreasing percentage of ED visits for NTDCs due to this Medicaid expansion. Increasing access to Medicaid among the uninsured will likely continue this trend.
3. However, disparities exist for vulnerable populations. Medicaid enrollees, low socioeconomic status children, and uninsured children continue to utilize EDs for dental conditions at higher rates compared to their peers. Policies to reduce these disparities should include programs that target those in late adolescence and young adulthood to reduce the peak prevalence of ED visits for NTDCs.

References

1. Chevarley FM. Percentage of Persons Unable to Get or Delayed in Getting Needed Medical Care, Dental Care, or Prescription Medicines: United States, 2007. Statistical Brief #282. Rockville, Md., USA: Agency for Healthcare Research and Quality; 2010. Available at: "http://www.meps.ahrq.gov/mepsweb/data_files/publications/st282/stat282.pdf". Accessed May 24, 2021.
2. Cohen LA, Bonito AJ, Eicheldinger C, et al. Comparison of patient visits to emergency departments, physician offices, and dental offices for dental problems and injuries. J Public Health Dent 2011;71(1):13-22.
3. Institute of Medicine. Advancing Oral Health in America. Washington, D.C., USA: The National Academies Press; 2011:1-44.
4. Vujicic M, Buchmueller T, Klein R. Dental care presents the highest level of financial barriers, compared to other types of health care services. Health Aff (Millwood) 2016; 35(12):2176-82.
5. Rozier RG, White BA, Slade GD. Trends in oral diseases in the US population. J Dent Educ 2017;81(8):eS97-eS109.
6. Dye BA, Mitnik GL, Iafolla TJ, Vargas CM. Trends in dental caries in children and adolescents according to poverty status in the United States from 1999 through 2004 and from 2011 through 2014. J Am Dent Assoc 2017; 148(8):550-565, e557.
7. Griffin SO, Jones JA, Brunson D, Griffin PM, Bailey WD. Burden of oral disease among older adults and implications for public health priorities. Am J Public Health 2012;102(3):411-8.
8. Guarnizo-Herreno CC, Lyu W, Wehby GL. Children's oral health and academic performance: Evidence of a persisting relationship over the last decade in the United States. J Pediatr 2019;209:183-189.e2.
9. Centers for Medicare and Medicaid Services. Emergency Medical Treatment and Labor Act (EMTALA). Baltimore, Md., USA: Department of Health and Human Services; 2012. Available at: "https://www.cms.gov/Regulations-and-Guidance/Legislation/EMTALA/index". Accessed May 24, 2021.
10. Lee HH, Lewis CW, Saltzman B, Starks H. Visiting the emergency department for dental problems: Trends in utilization, 2001 to 2008. Am J Public Health 2012; 102(11):e77-e83.
11. Davis EE, Deinard AS, Maiga EW. Doctor, my tooth hurts: The costs of incomplete dental care in the emergency room. J Public Health Dent 2010;70(3):205-10.
12. Kelekar U, Naavaal S. Dental visits and associated emergency department charges in the United States: Nationwide Emergency Department Sample, 2014. J Am Dent Assoc 2019;150(4):305-312, e301.
13. Allareddy V, Rampa S, Lee MK, Allareddy V, Nalliah RP. Hospital-based emergency department visits involving dental conditions: Profile and predictors of poor outcomes and resource utilization. J Am Dent Assoc 2014;145(4): 331-7.
14. Sun BC, Chi DL, Schwarz E, et al. Emergency department visits for nontraumatic dental problems: A mixed-methods study. Am J Public Health 2015;105(5):947-55.
15. Darling BG, Singhal A, Kanellis MJ. Emergency department visits and revisits for nontraumatic dental conditions in Iowa. J Public Health Dent 2016;76(2):122-8.
16. Manz MC. Recommended Guidelines for Surveillance of Non-Traumatic Dental Care in Emergency Departments. Reno, Nev., USA: Association of State and Territorial Dental Directors; 2017. Available at: "https://www.astdd.org/docs/ed-dental-care-protocols-w-appendices.pdf". Accessed Accessed May 24, 2021.
17. Okunseri C, Pajewski NM, Jackson S, Szabo A. Wisconsin Medicaid enrollees' recurrent use of emergency departments and physicians' offices for treatment of nontraumatic dental conditions. J Am Dent Assoc 2011;142(5): 540-50.
18. Anderson L, Cherala S, Traore E, Martin NR. Utilization of hospital emergency departments for non-traumatic dental care in New Hampshire, 2001-2008. J Community Health 2011;36(4):513-6.
19. Lewis C, Lynch H, Johnston B. Dental complaints in emergency departments: A national perspective. Ann Emerg Med 2003;42(1):93-9.
20. Nalliah RP, Allareddy V, Elangovan S, Karimbux N, Allareddy V. Hospital-based emergency department visits attributed to dental caries in the United States in 2006. J Evid Based Dent Pract 2010;10(4):212-22.
21. Allareddy V, Nalliah RP, Haque M, Johnson H, Rampa SB, Lee MK. Hospital-based emergency department visits with dental conditions among children in the United States: Nationwide epidemiological data. Pediatr Dent 2014; 36(5):393-9.
22. Casamassimo PS. Pediatric emergency department visits for non-traumatic dental conditions (ED NTDCs): Problem or portal or both? Pediatr Dent 2020;42(3): 176-7.

23. Healthcare Cost and Utilization Project (HCUP). 2010 Introduction to the HCUP Nationwide Emergency Department Sample (NEDS). Rockville, Md., USA: Agency for Healthcare Research and Quality; 2015. Available at: "https://www.hcup-us.ahrq.gov/db/nation/neds/NEDS_Introduction_2010.jsp". Accessed Accessed May 24, 2021.
24. 111th Congress. H.R. 3590 – Patient Protection and Affordable Care Act. Washington, D.C., USA: United States Congress; 2010. Available at: "https://www.congress.gov/bill/111th-congress/house-bill/3590/". Accessed May 24, 2021.
25. Healthcare Cost and Utilization Project (HCUP). NEDS Overview. Rockville, Md., USA: AHRQ; 2020. Available at: "https://www.hcup-us.ahrq.gov/nedsoverview.jsp". Accessed May 24, 2021.
26. Senathirajah M, Owens P, Mutter R, Nagamine M. Special Study on the Meaning of the First-Listed Diagnosis on Emergency Department and Ambulatory Surgery Records: 2011. HCUP Methods Series Report #2011-03. Rockville, Md., USA: Agency for Healthcare Research and Quality; 2011. Available at: "https://www.hcup-us.ahrq.gov/reports/methods/2011_03.pdf". Accessed May 24, 2021.
27. National Center for Health Statistics. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Atlanta, Ga., USA: Centers for Disease Control and Prevention; 2015. Available at: "https://www.cdc.gov/nchs/icd/icd9cm.htm". Accessed May 24, 2021.
28. National Center for Health Statistics. International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM). Atlanta, Ga., USA: Centers for Disease Control and Prevention; 2018. Available at: "https://www.cdc.gov/nchs/icd/icd10cm.htm". Accessed May 24, 2021.
29. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. Med Care 1998;36(1):8-27.
30. Kranz AM, Dick AW. Changes in pediatric dental coverage and visits following the implementation of the affordable care act. Health Serv Res 2019;54(2):437-45.
31. Christakis DA, Mell L, Koepsell TD, Zimmerman FJ, Connell FA. Association of lower continuity of care with greater risk of emergency department use and hospitalization in children. Pediatrics 2001;107(3):524-9.
32. Okunseri C, Okunseri E, Fischer MC, Sadeghi SN, Xiang Q, Szabo A. Nontraumatic dental condition-related visits to emergency departments on weekdays, weekends and night hours: findings from the National Hospital Ambulatory Medical Care survey. Clin Cosmet Investig Dent 2013;5:69-76.
33. Laniado N, Badner VM, Silver EJ. Expanded Medicaid dental coverage under the Affordable Care Act: An analysis of Minnesota emergency department visits. J Public Health Dent 2017;77(4):344-9.
34. Simon L, Karhade DS, Fox K, Barrow J, Palmer N. Dental services utilization by rurality among privately insured children in the United States. Pediatr Dent 2020;42(5):387-91.
35. Adams SH, Park MJ, Twietmeyer L, Brindis CD, Irwin CE Jr. Association between adolescent preventive care and the role of the Affordable Care Act. JAMA Pediatr 2018;172(1):43-8.
36. Lau JS, Adams SH, Park MJ, Boscardin WJ, Irwin CE Jr. Improvement in preventive care of young adults after the Affordable Care Act: the Affordable Care Act is helping. JAMA Pediatr 2014;168(12):1101-6.
37. Elani HW, Kawachi I, Sommers BD. Changes in emergency department dental visits after Medicaid expansion. Health Serv Res 2020;55(3):367-4.
38. Figueiredo RL, Singhal S, Dempster L, Hwang SW, Quinonez C. The accuracy of International Classification of Diseases coding for dental problems not associated with trauma in a hospital emergency department. J Public Health Dent 2015;75(4):343-7.