

# Impact of a Community Dental Access Program on Emergency Dental Admissions in Rural Maryland

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**Objectives.** To characterize the expansion of a community dental access program (CDP) in rural Maryland providing urgent dental care to low-income individuals, as well as the CDP's impact on dental-related visits to a regional emergency department (ED).

**Methods.** We used de-identified CDP and ED claims data to construct a data set of weekly counts of CDP visits and dental-related ED visits among Maryland adults. A time series model examined the association over time between visits to the CDP and ED visits for fiscal years (FYs) 2011 through 2015.

**Results.** The CDP served approximately 1600 unique clients across 2700 visits during FYs 2011 through 2015. The model suggested that if the CDP had not provided services during that time period, about 670 more dental-related visits to the ED would have occurred, resulting in \$215 000 more in charges.

**Conclusions.** Effective ED dental diversion programs can result in substantial cost savings to taxpayers, and more appropriate and cost-effective care for the patient.

**Policy Implications.** Community dental access programs may be a viable way to patch the dental safety net in rural communities while holistic solutions are developed. (*Am J Public Health.* 2016;106:2165–2170. doi:10.2105/AJPH.2016.303467)

 See also Galea and Vaughan, p. 2091.

The increasing utilization of emergency departments (EDs) for the treatment of nonurgent and nontraumatic dental conditions (NTDCs) among adults in the United States is well documented.<sup>1–4</sup> NTDC-related visits, which are largely a result of avoidable dental caries and their sequelae, account for more than 1.3 million ED visits per year and \$1 billion in spending nationally.<sup>5,6</sup> This practice is particularly frequent among low-income individuals and those in rural areas, for whom dental coverage and access pose significant barriers to accessing care in more traditional dental offices.<sup>7–9</sup> EDs are often inappropriate places to receive dental care, as staff typically have limited training to diagnose and treat dental conditions.<sup>10</sup> Moreover, NTDC-related ED visits generally address pain or infection using antibiotic or analgesic prescriptions, requiring follow-up at a dental office for further treatment.<sup>8,11</sup> EDs are also costly sites for dental treatment and are significantly more expensive than a general practice dental visit.<sup>6</sup>

Dental coverage in the United States is changing dramatically, especially for urgent dental care, traumatic or otherwise.<sup>12</sup> Under the Patient Protection and Affordable Care Act (ACA), there has been considerable expansion in state Medicaid dental coverage to adults, although not all states are participating in the expansion or extension of dental benefits. Millions more children also now have dental benefits because of the ACA.<sup>13</sup> Dental professional shortage areas are fairly common, however—more than 4900 exist in the United States.<sup>14,15</sup> In areas experiencing dental professional shortages, extending dental coverage alone may not reduce Medicaid-funded dental ED visits. A confluence of constrained supplies, increasing

costs, and a lack of presence in the private sector in poorer areas continues to make access to care an issue.<sup>16,17</sup> Innovative programs are needed to effectively address the challenges that low-income individuals in rural areas encounter when accessing care.<sup>18</sup>

Researchers and policymakers alike have examined ED diversion programs as a possible way to slow or stop the rising numbers of avoidable ED visits for dental care.<sup>19</sup> In these programs, patients are referred to low- or no-cost alternatives either prospectively or after their encounter at an ED for an avoidable dental-related visit. Establishing evidence-based diversion programs is a top priority, especially in rural areas.

We chart the expansion of a community dental access program (CDP) in rural western Maryland and its impact on dental-related visits at a regional ED. Beginning in fiscal year 2012 (FY2012), the CDP received funding from the Health Resources and Services Administration's Federal Office of Rural Health Policy (FORHP) to scale up a program addressing needs related to neglected oral care among rural uninsured and underinsured individuals in the region whose income places them 250% or below the federal poverty level. The program also trained primary care providers and health professional students in how to perform oral health screenings during routine physical exams.

One of the most important components of the program was the provision of urgent dental care to individuals in need. Dental providers were recruited to deliver acute dental services at reduced rates to the payer (the CDP) and at no cost to the client. Estimated discounts ranged from 50% from

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local dentists to an 80% discount from a local health department, which agreed to treat patients for a flat hourly rate of \$150 starting in 2012. In addition to FORHP funding, the program solicited additional funding from the state, the county United Way, and several private foundations, enabling services to be provided at no cost to patients. Beginning in 2013, the CDP began collaborating with the regional ED on an in-house dental diversion program, in which patients presenting at the ED with dental conditions were referred to the CDP for access to dental treatment. The program was expanded in 2015 to include a release that allowed ED staff to share the patient's contact information to the CDP for outreach purposes. We assess the overall impact of the CDP on adult dental visits from rural Maryland residents to a regional ED.

## METHODS

Data for the study came from 2 primary sources—the CDP's claims database and claims data for dental-related ED visits for a regional ED in rural Maryland (Figure A, available as a supplement to the online version of this article at <http://www.ajph.org>). Data were available across both claims data sets for FY2011 through FY2015 (i.e., where dates of service were from July 2010 through June 2015). Although there was some funding for the CDP in FY2011 and years prior, a scale-up grant from FORHP allowed for substantial growth in the program. This began in FY2012 and wound down in FY2015, finally ending in early FY2016.

The CDP claims database included a unique client ID number, limited demographic characteristics, dates of service, state of residence, procedures performed, total charges, and total reimbursements. With the CDP's approach to paying for dental care (securing discounts from dental providers to low-income clients), total reimbursements are significantly discounted from total charges; the difference represents the provider's in-kind contribution to the program.

The ED claims database contained de-identified encounter data, including date of service, insurance provider, primary diagnosis (*International Classification of Diseases, Ninth Revision*<sup>20</sup> [ICD-9]), number of

diagnoses, state of residence, and total charges. We excluded all records from non-Maryland residents from the analyses because the CDP serves only Maryland residents. These exclusions eliminated 1839 encounters from 9724 total encounters (19%) during FY2011 through FY2015. Dental-related ICD-9 codes included were from the 521, 522, 523, 525, and 873 categories (Table A, available as a supplement to the online version of this article at <http://www.ajph.org>). We delineated dental-related ED visits into 2 major categories—those with a traumatic diagnosis (ICD-9 codes in the 873 category) and those with a nontraumatic diagnosis (largely those within the 521, 522, 523, and 525 categories).<sup>6</sup> We classified a dental-related ED visit as having a traumatic diagnosis if any of the ICD-9 codes associated with the visit were for traumatic conditions.

We performed descriptive statistics on the CDP and ED claims data sets, including analyses pertaining to CDP patient characteristics over time, charges, and procedures performed. We also examined trends in the regional ED's use for dental-related visits by Maryland residents over time. Because the CDP was the only large program of its type in the region and the ED was the only ED in the region, this study design may be viewed as a natural experiment to assess the impact of a CDP aimed at providing urgent dental treatment on ED dental-related visits. We collapsed data sets and combined them into weekly (and monthly) counts for FY2011 through FY2015. We used a 2-tailed Student *t* test to compare trends between ED use in FY2011 and FY2015. We conducted a time series analysis with weekly ED dental-related visits from Maryland residents (any cause) as the dependent variable and CDP visit counts as the primary independent variable. We also included a monthly indicator variable to adjust for seasonal effects.

We conducted the final analysis as a Prais-Winsten regression with a Cochrane-Orcutt adjustment, which uses a generalized least squares to model estimates where errors are found to be serially correlated during first-order autoregressive approach.<sup>21,22</sup> We used postestimation to model the expected number of ED visits if the CDP had not provided services during FY2011 through FY2015; we multiplied the

number of averted visits by the average visit cost for each year to create an estimate of total charges averted associated with CDP visits. Adjusted total charges represent total charges with an additional 22.5% average ED physician cost surcharge, which is billed separately to the patient (and was not available in the data).<sup>23</sup> We adjusted all charges to FY2015 using the gross domestic product deflator.<sup>23</sup> We conducted a quality check of the diagnostic ICD-9 codes to ensure that nontraumatic and traumatic events were not meaningfully correlated with each other over time.

## RESULTS

The CDP served 1565 unique clients and reimbursed providers for 2691 visits between FY2011 and FY2015. The CDP reimbursed providers for 353 visits in FY2011, 279 visits in FY2012, 540 in FY2013, 893 in FY2014, and 626 in FY2015. The population served by the CDP was mostly low-income, childless adults from 2 rural western Maryland counties (Table 1).

**TABLE 1—Patient Characteristics of a Community Dental Access Program: Rural Western Maryland, Fiscal Years 2011–2015**

Characteristic	No. (%)
Age, y	
<30	313 (26)
30–39	242 (20)
40–49	223 (18)
50–59	258 (21)
≥60	190 (15)
Unemployed	323 (27)
Homeless	17 (1)
Medicaid	491 (40)
Been to ED in last y for dental	113 (10)
Receiving unemployment	289 (25)
Non-Hispanic White	1112 (92)

*Note.* ED = emergency department. Totals vary because of missing data (total sample = 1344 patients). Numbers for item responses are as follows: age, n = 1036; unemployed, n = 1177; homeless, n = 1172; Medicaid, n = 1216; been to ED in last year for dental, n = 1172; receiving unemployment, n = 1168; non-Hispanic White, n = 1215.

Relatively few clients (30%) were younger than 30 years old, and 18% were aged 60 years or older. Ninety-two percent of the clients were non-Hispanic Whites, mirroring the broader community (91%).<sup>24</sup> Slightly fewer than half of the clients were on Medicaid (40%), and about 10% had been to the ED in the last year for dental-related issues.

### Description of Community Dental Access Program Activities

In FY2011, the CDP reimbursed providers for 1236 procedures for 353 visits and 233 unique clients. These figures exclude all exams, both billable and nonbillable. The utilization peaked in FY2014 at 3242 procedures, 893 visits, and 445 unique clients. Patients were seen almost exclusively for urgent dental treatments, largely involving extractions (32% of procedures in FY2014) and restorations (33% of procedures in FY2014). These were the most common procedures performed by providers during FY2011 through FY2015 (Table 2).

Between FY2011 and FY2015, over \$1.7 million in dental services were provided through the CDP. Providers donated 69% (\$1.17 million) of the total costs of care, and the CDP reimbursed providers \$530 000. Approximately \$200 000 in services were provided in FY2011, increasing to \$590 000 in FY2014 and decreasing to \$368 000 in FY2015. With the advent of the \$150-per-hour flat rate negotiated with the local health department, in-kind contributions increased dramatically—from 48% to 78% of the total cost of care.

### Emergency Department Visits for Dental-Related Issues

The region served by the CDP has 1 ED. In FY2011, approximately 1500 dental-related visits from Maryland residents occurred at the regional ED, serving approximately 1200 unique clients (Table 3). By FY2015, visits decreased to 1100 among 950 unique clients. The total number of ICD-9 diagnoses also decreased, from 1800 to 1500.

In FY2015, 63% of total dental visit-related charges in the regional ED were for diagnoses with a traumatic component. About 44% of total dental-related visits were for traumatic diagnoses, with 56% for nontraumatic diagnosis.

**TABLE 2—Frequencies of Dental Procedures Paid for by the Community Dental Access Program: Rural Western Maryland, Fiscal Years 2011–2015**

Procedure	FY2011, No. (%)	FY2012, No. (%)	FY2013, No. (%)	FY2014, No. (%)	FY2015, No. (%)
Extractions	712 (58)	505 (54)	824 (38)	1026 (32)	940 (43)
Restorations	145 (12)	83 (9)	645 (29)	1067 (33)	563 (26)
X-rays	230 (19)	213 (23)	516 (24)	632 (19)	411 (19)
All others	146 (12)	131 (14)	151 (7)	323 (10)	193 (9)
Preventive care	3 (0)	1 (0)	53 (2)	194 (6)	80 (4)
Grand total	1236 (100)	933 (100)	2189 (100)	3242 (100)	2187 (100)

Note. FY = fiscal year. Data are numbers of dental procedures (excluding exams) paid for by the community dental access program.

Average costs per visit were as follows: for traumatic conditions, \$515 (an estimated \$631 with physician costs added); for nontraumatic conditions, \$259 (\$318); overall, \$377 (\$462). Visits for nontraumatic conditions by Maryland residents accounted for an average of over \$156 000 in total charges (an estimated \$190 000 with physician costs).

### Estimated Impact on Dental-Related Emergency Department Visits

Overall, between FY2011 and FY2015, the CDP reimbursed providers for almost 2700 visits across 1600 unique clients (Figure 1). Bivariable comparisons indicate a marked decrease in average dental-related regional

**TABLE 3—Dental Visits to Emergency Department (ED) in a Rural Maryland Regional Hospital by Maryland Residents: Fiscal Years 2011–2015**

Variable	FY2011	FY2012	FY2013	FY2014	FY2015
Total dental-related visits to ED	1 480	1 448	1 239	1 121	1 118
Unduplicated patients, estimated <sup>a</sup>	1 170	1 200	1 040	930	950
Major ICD-9 diagnoses					
Total no. of diagnoses	1 790	1 756	1 525	1 440	1 476
Total no. of nontraumatic diagnoses	636	685	582	501	547
Total no. of traumatic diagnoses	1 154	1 071	943	939	929
Charges, \$					
Total charges <sup>b</sup>	311 000	304 000	279 000	277 000	420 000
Adjusted total charges <sup>c</sup>	381 000	372 000	342 000	339 000	515 000
Estimated impact of CDP on dental ED visits					
No. of visits to CDP	353	279	540	893	626
No. of unique clients served by CDP	233	180	314	445	393
Estimated no. of avoided dental-related visits to ED	87	70	136	222	151
Estimated % of avoided dental-related ED visits <sup>d</sup>	6	5	10	17	12
Estimated averted costs associated with ED dental visits, \$	22 000	18 000	38 000	67 000	70 000

Note. ICD-9 = International Classification of Diseases, Ninth Revision<sup>20</sup>; CDP = community dental access program.

<sup>a</sup>Individual claims with associated residency were available in the ED data, but unduplicated client count was not. Therefore, we calculated unduplicated individual estimates on the basis of the overall proportion of unique clients with any state residency (reported by the ED) compared with total visits as applied to the proportion of total visits that were from Maryland residents.

<sup>b</sup>Does not include cost of ED physician; patient is billed directly. We adjusted total charges to 2015 dollars using the gross domestic product deflator.<sup>25</sup>

<sup>c</sup>Assumes additional 22.5% average physician cost to ED charges.<sup>26</sup> ICD-9 521, 522, 523, 525 are considered nontraumatic. ICD-9 873.63 and 873.73 are considered traumatic.<sup>27</sup>

<sup>d</sup>Calculated as (ED actual visits – [ED actual + averted visits]) / (ED actual + averted visits) × 100.

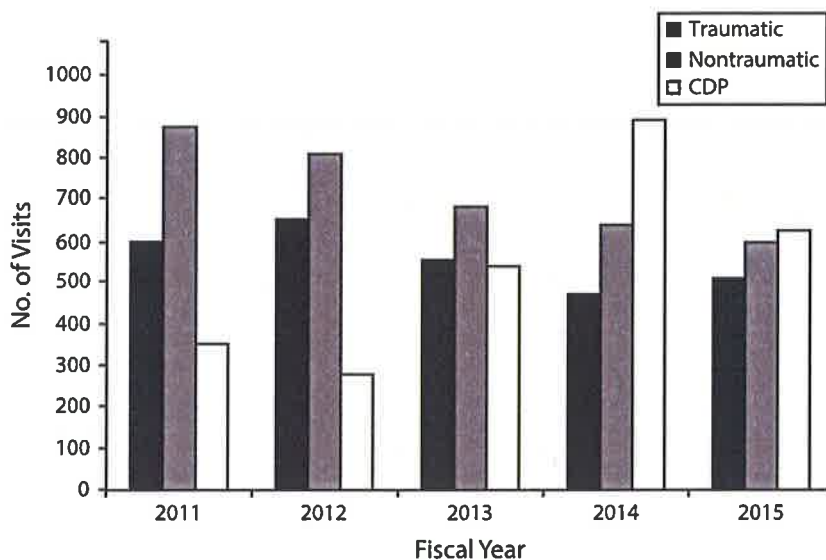


FIGURE 1—Number of Traumatic and Nontraumatic Dental-Related Visits to a Rural Western Maryland Emergency Department and a Community Dental Access Program (CDP): Fiscal Years 2011–2015

ED visits from rural Maryland residents during FY2015 compared with FY2011, on a weekly basis (from 28.4 to 21.3 visits;  $P < .001$ ) and a monthly basis (from 123.3 to 93.2 visits;  $P < .001$ ). The time series model suggests that approximately 670 dental-related visits to the ED were averted. We estimate that through CDP visits, approximately \$215 000 in total ED-related charges (included estimated physician costs) were saved from FY2011 through FY2015.

After we combined ED counts and CDP claims counts by week over FY2011 through FY2015, a time series analysis of weekly events revealed an association between CDP visits and a reduction in ED visits ( $B = -0.25$ ; 95% confidence interval [CI] =  $-0.36, -0.14$ ). A Durbin–Watson test indicated that the Prais–Winsten transformed model accounted for effects of serial correlation (Durbin–Watson statistic = 2.000479). In an analysis stratified by nontraumatic and traumatic diagnoses, we found an association between CDP visits and a reduction in ED visits for both nontraumatic ( $B = -0.15$ ; 95% CI =  $-0.23, -0.07$ ) and traumatic ( $B = -0.10$ ; 95% CI =  $-0.16, -0.04$ ) diagnoses. In separate models, after we accounted for CDP visits, nontraumatic dental-related counts and traumatic dental-related counts were not

statistically significantly associated with each other (Table B, available as a supplement to the online version of this article at <http://www.ajph.org>).

## DISCUSSION

These findings highlight the impact of a CDP in 1 community in rural Maryland. Between FY2011 and FY2015, the CDP served 1600 unique clients, providing thousands of x-rays, extractions, and restorations to patients in need of urgent dental care. The oral health literature and study findings suggest that a substantial proportion of these patients would have sought out care in the regional ED, likely resulting in over \$200 000 in unnecessary spending. In many cases, these savings could be more substantial, as patients receiving care in the ED would need to see a dental provider afterward to address underlying issues.<sup>10</sup> These findings also align with previous research that reported a greater than 52% decrease in dental-related visits to a metropolitan ED in the first year after implementing a diversion program.<sup>28</sup> Although the decrease in dental-related ED visits was smaller in the current study, it

shows that diversion programs and related urgent treatment programs within rural areas can be effective at reducing ED visits.

## A Rural Community Dental Access Program in Action

The rural CDP's approach was twofold: offer urgent dental care for free to undeserved low-income adults and, starting in 2013, work directly with the regional ED to actively divert patients by offering an accessible alternative in a more appropriate setting. In a rural community that does not have a sliding-fee-scale clinic or a Federally Qualified Health Center dental clinic, the CDP is a reasonable alternative for the receipt of services from local dental providers. Arguably, it provides more definitive care to patients in urgent need than ED settings, where patients often need follow-up dental care.<sup>10</sup> The model is built on the willingness of local dentists, oral surgeons, and health departments to discount their typical rates and see patients who would not otherwise be able to afford dental care. The CDP enables providers to supply needed urgent care to members of their community more efficiently, as it screens applicants, ensures that patients have transportation to their appointments, and is a reliable payer to the providers.

The CDP relies on grant funding to cover both overhead costs and to pay dentists and oral surgeons for their discounted treatments. The program was accelerated with the infusion of federal funding from FY2012 through the beginning of FY2015, and it also attracted funding from private foundations to supplement funds available to pay for treatment. With a greater than 75% donation rate for treatment, grant dollars were leveraged 3 to 1. The program also attracted private donations; however, coordinating and eligibility-gauging services such as those provided by the CDP are rarely reimbursable at present. Sustainability of programs like the CDP may require substantial and sustained federal investment, plausibly through reimbursement from Medicaid.

Although this study focused on treatment of dental conditions in the ED versus a dental office and the relative costs and savings of each venue, the CDP is also working to lower preventable dental emergencies by improving oral health in an underserved

population. However, more research is needed to conclusively show the impact of programs like the CDP on oral health in underserved settings. Prospective, randomized control trials could potentially address confounding by factors such as inadequate diet, poor oral hygiene habits, and other considerations that could affect the relationship between CDP-like programs and ED visits for oral health issues. Further research is needed to examine lifetime benefits, benefits of return visits, treatment costs, and related issues.

### Limitations

The study has several notable limitations. First, although encounters were tracked by date of service by ICD-9 diagnosis in the ED, CDP claims data collected only procedure codes (not diagnosis codes). Therefore, a more granular examination between types of services the CDP and its partners provided and types of ED visits was not possible. We did not attempt to compare the costs of ED diagnosis and treatment to CDP diagnosis and treatment, as the treatments are nonequivalent; ED visits tend to require follow-up visits to a dentist's office.<sup>10</sup> We did examine the costs associated with the CDP and potentially averted costs from decreased ED visits.

Second, although there is only 1 large ED and 1 CDP in the region, there are other dental providers and EDs within driving distance; therefore, the data do not fully capture a closed system of dental-related needs and services rendered. Capturing counts from all other sources would allow the model to more fully account for the variance observed in ED visit counts over time. Third, data from all EDs in the state and nearby regions were not available, so the study was unable to fully account for any statewide trends that may have occurred during this time period, including economic improvement during recovery from the Great Recession. To help account for secular trends, we calculated the study findings using robust estimators.

Finally, this study's setting should be considered—it occurs within rural western Maryland, where there are documented barriers to accessing affordable dental providers. In this way, the study may be informative to other rural jurisdictions.

However, financing and access issues are very different in urban areas, as are some state-based effects (e.g., more or less generous dental benefits), which may limit the study's generalizability to urban areas or those with alternative Medicaid benefit structures.

### Public Health Implications

As with medical care, many people who do not have insurance or the ability to pay out of pocket go to EDs with pain or infection associated with dental conditions because they do not know where or how to access dental resources in the community.<sup>26</sup> This study shows that offering an accessible alternative for urgent dental care to low-income and underinsured adults can divert them from using the ED as a source for care.

This study describes 1 model of addressing oral health care needs in an underserved rural community, but it should not be considered a long-term solution to a significant gap in health care coverage. Although the ACA has greatly increased access to medical care for millions of previously uninsured or underinsured people, dental coverage is not an included mandatory benefit for adults.<sup>27</sup> In addition, Medicare does not routinely include a dental benefit.<sup>29</sup> Many of the most vulnerable, low-income people in society—such as the disabled, the elderly (Medicare beneficiaries), and low-income adults ages 19 to 64 years—find themselves with few options when they have dental pain, dental infections, or other urgent dental conditions.<sup>14,26</sup> The inclusion of an oral health benefit as an integral part of health insurance coverage would ensure that more people could seek dental care in a cost-effective and appropriate setting, resulting in better health for the patient and potentially hundreds of millions in savings for the nation's health care delivery systems as a whole. This article was accepted August 24, 2016. *AJPH*

### CONTRIBUTORS

S. Rowland conceptualized the project and collected the data. J. P. Leider conducted the analysis and contributed to the first draft of the article. C. Davidson contributed to the first draft of the article. J. Brady conducted the analysis. A. Knudson provided project oversight. All authors conducted critical review, provided edits, and approved the final version of this article.

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### HUMAN PARTICIPANT PROTECTION

No protocol approval was necessary because de-identified secondary data were used in analyses.

### REFERENCES

- Okunseri C, Okunseri E, Thorpe JM, Xiang Q, Szabo A. Patient characteristics and trends in nontraumatic dental condition visits to emergency departments in the United States. *Clin Cosmet Investig Dent*. 2012;4:1–7.
- Wall T. Recent trends in dental emergency department visits in the United States—1997/1998 to 2007/2008. *J Public Health Dent*. 2012;72(3):216–220.
- 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.
- 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):513–516.
- 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):331–337.
- Wall T, Nasseh K, Vujicic M. *Majority of Dental-Related Emergency Department Visits Lack Urgency and Can Be Diverted to Dental Office*. Chicago, IL: American Dental Association Health Policy Institute; 2014.
- Skillman SM, Doescher MP, Mouradian WE, Brunson DK. The challenge to delivering oral health services in rural America. *J Public Health Dent*. 2010;70(suppl 1):S49–S57.
- Seu K, Hall KK, Moy E. Emergency department visits for dental-related conditions, 2009. Statistical brief #143, November 2012. Healthcare Cost and Utilization Project Statistical Briefs. Available at: <http://www.ncbi.nlm.nih.gov/books/NBK116745>. Accessed September 7, 2016.
- Shorridge EF, Moore JR. Use of emergency departments for conditions related to poor oral healthcare: implications for rural and low-resource urban areas for three states. *J Public Health Manag Pract*. 2009;15(3):238–245.
- Cohen LA. Expanding the physician's role in addressing the oral health of adults. *Am J Public Health*. 2013;103(3):408–412.
- 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):205–210.
- Vujicic M, Nasseh K. A decade in dental care utilization among adults and children (2001–2010). *Health Serv Res*. 2014;49(2):460–480.
- Nasseh K, Vujicic M, O'Dell A. *Affordable Care Act Expands Dental Benefits for Children but Does Not Address Critical Access to Dental Care Issues*. Chicago, IL: American Dental Association Health Policy Institute; 2013.
- Fingar KR, Smith MW, Davies S, McDonald KM, Stocks C, Raven MC. Medicaid dental coverage alone may not lower rates of dental emergency department visits. *Health Aff (Millwood)*. 2015;34(8):1349–1357.

15. Health Resources and Services Administration (HRSA). Designated health professional shortage areas statistics. HRSA Data Warehouse. Last modified January 2016. Available at: <https://datawarehouse.hrsa.gov/topics/shortageAreas.aspx>. Accessed September 7, 2016.
16. *Shortage Designation: Health Professional Shortage Areas & Medically Underserved Areas/Populations*. Hyattsville, MD: Health Resources and Services Administration; 2016.
17. *Oral Health in America: A Report of the Surgeon General*. Rockville, MD: US Dept of Health and Human Services; 2000.
18. *A Costly Dental Destination: Hospital Care Means States Pay Dearly*. Washington, DC: Pew Charitable Trusts; 2012.
19. American Dental Association. The issue: reduce health care costs and improve patient care by treating dental disease in the dental practice instead of the ER. 2013. Available at: [http://www.ada.org/~media/ADA/Public%20Programs/Files/ER\\_Utilization\\_Issues\\_Flyer.ashx](http://www.ada.org/~media/ADA/Public%20Programs/Files/ER_Utilization_Issues_Flyer.ashx). Accessed September 7, 2016.
20. *International Classification of Diseases, Ninth Revision*. Geneva, Switzerland: World Health Organization; 1980.
21. Cochrane D, Orcutt GH. Application of least squares regression to relationships containing auto-correlated error terms. *J Am Stat Assoc*. 1949;44(245):32–61.
22. Prais SJ, Winsten CB. *Trend Estimators and Serial Correlation*. Chicago, IL: Cowles Commission; 1954. Cowles Commission discussion paper no. 383.
23. *Maryland Outpatient Dental Emergency Department Cost and Utilization Analysis, Fiscal Year 2015 Update*. Baltimore, MD: Health Services Cost Review Commission; 2015.
24. US Census Bureau. Garrett and Allegany County Quickfacts. Available at: <https://www.census.gov/quickfacts>. Accessed September 7, 2016.
25. Federal Reserve Bank of St Louis. Gross domestic product: implicit price deflator. Available at: <https://fred.stlouisfed.org/series/GDPDEF>. Accessed September 7, 2016.
26. 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):947–955.
27. Hinton E, Paradise J. Access to dental care in Medicaid: spotlight on nonelderly adults. Henry K. Kaiser Family Foundation. May 17, 2016. Available at: <http://kff.org/medicaid/issue-brief/access-to-dental-care-in-medicaid-spotlight-on-nonelderly-adults>. Accessed September 7, 2016.
28. McCormick AP, Abubaker AO, Laskin DM, Gonzales MS, Garland S. Reducing the burden of dental patients on the busy hospital emergency department. *J Oral Maxillofac Surg*. 2013;71(3):475–478.
29. Manski RJ, Moeller J, Schimmel J, et al. Dental care coverage and retirement. *J Public Health Dent*. 2010;70(1):1–12.