HHS Public Access

Author manuscript

Community Dent Oral Epidemiol. Author manuscript; available in PMC 2020 August 01.

Published in final edited form as:

Community Dent Oral Epidemiol. 2019 August ; 47(4): 283–290. doi:10.1111/cdoe.12453.

Predictors of Dental Care Utilization in North Central Appalachia in the USA

Mengxia Chen[1], **Casey D. Wright**[2,3], **Oluwabunmi Tokede**[1], **Alfa Yansane**[1], **Alexander Montasem**[1], **E. Kalenderian**[1], **Terri H. Beaty**[4], **Eleanor Feingold**[2,5,6], **John R. Shaffer**[2,5,7], **Richard J. Crout**[2,8], **Katherine Neiswanger**[2,7], **Robert J. Weyant**[2,9], **Mary L. Marazita**[2,5,7,9], and **DR Daniel W. McNeil**[2,3,10]

[1]Harvard School of Dental Medicine, Department of Oral Health Policy and Epidemiology, Boston, MA, 02115, USA

[2]Center for Oral Health Research in Appalachia (COHRA), University of Pittsburgh, Pittsburgh, PA 15219, USA, and West Virginia University, Morgantown, WV, 26506, USA

[3]Department of Psychology, Eberly College of Arts and Sciences, West Virginia University, 53 Campus Drive, PO Box 6040, Morgantown, WV 26506, USA

[4]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, 21205, USA

[5]Graduate School of Public Health, Department of Human Genetics, University of Pittsburgh, 130 De Soto Street, Pittsburgh, PA 15261, USA

[6]Graduate School of Public Health, Department of Biostatistics, University of Pittsburgh, 130 De Soto Street, Pittsburgh, PA 15261, USA

[7]School of Dental Medicine, Center for Craniofacial and Dental Genetics, Department of Oral Biology, University of Pittsburgh, Bridgeside Point Suite 500, 100 Technology Drive, Pittsburgh, PA 15219, USA

[8]Department of Periodontics, School of Dentistry, West Virginia University, 1070 HSC North, PO Box 9490, Morgantown, WV 26506-9490, USA

[9]Department of Dental Public Health, School of Dental Medicine, University of Pittsburgh, 3501 Terrace Street, Pittsburgh, PA 15261

[10]Department of Dental Practice & Rural Health, School of Dentistry, West Virginia University, G110 HSC North, PO Box 9415, Morgantown, WV 26506-9415, USA

Corresponding author: dmcneil@wvu.edu.

Statement of Author Contributions

MC – MPH project design, data analysis and interpretation, write-up, approval of final manuscript; CDW – Data management, data analysis and interpretation, write-up, approval of final manuscript; OT, AY, AM, and EK – Data analysis and interpretation, approval of final manuscript; THB- Supervision of MC and overall MPH project; approval of final manuscript; EF, JRS – Data processing, data analysis, interpretation, write-up, approval of final manuscript; RJC, KN, RJW – Design of COHRA project, supervision of data collection, interpretation of results; final approval of manuscript; KN – Data management, write-up, approval of final manuscript; MLM – Overall COHRA project supervision; approval of design; data analysis plan, approval of final manuscript; DWM - Overall COHRA project supervision; approval of design; data analysis plan, supervision of MC and CDW, write-up, approval of final manuscript.

Abstract

Objectives: Dental utilization is an important determinant of oral health and well-being. The aim of this study was to evaluate potential associations between a variety of biopsychosocial factors and dental utilization in north central Appalachia, USA, a region where oral health disparities are profound.

Methods: This study used household-based data from the Center for Oral Health Research in Appalachia (COHRA1) study in north central Appalachia, including 449 families with 868 adults. The generalized estimating equation (GEE) approach was used to determine the best fitting predictor model for dental utilization among adult family members.

Results: On average across West Virginia and Pennsylvania, having dental insurance was associated with greater dental utilization over a three-year time period (OR = 2.20, 95% CI = 1.54, 3.14). When stratified by state, the effect held for only West Virginia (OR = 2.41, 95% CI = 1.54, 3.79) and was non-significant for Pennsylvania residents (OR = 1.50, 95% CI = 0.80, 2.79). Individuals from Pennsylvania were more likely to utilize dental care, and participants from West Virginia less so (2.31, 95% CI = 1.57, 3.40). Females from Pennsylvania were more likely than males to regularly seek dental care (OR = 1.44, 95% CI = 1.00, 2.05), and a higher income was associated with greater frequency of regular dental visits (OR = 1.21, 95% CI = 1.09, 1.34) in West Virginia. Individuals from Pennsylvania who scored higher on the Physiological Arousal subscale of the Dental Fear Survey were more likely to attend routine care visits (OR = 1.18, 95% CI = 1.03, 1.35). Across both states, more fatalistic beliefs related to oral health care also predicted less routine care (OR = 0.87, 95% CI = 0.81, 0.94), and more investment or more positive attitudes toward one’s oral health also was associated with higher utilization (OR = 1.18, 95% CI = 1.13, 1.23).

Conclusions: Overall, the findings of this study suggest state residency, sex, insurance, income, fatalistic beliefs, health values, and aspects of dental care-related anxiety and fear predicted dental care utilization in north central Appalachia. These findings reinforce the need to address insurance and other economic factors affecting utilization, and to consider how individual-level fatalistic beliefs and oral health values may affect utilization of routine oral health care.

Keywords

Appalachia; dental utilization; dental care-related anxiety and fear; avoidance of dental care

Introduction

Understanding how, when, and why individuals utilize healthcare resources is an important public health topic in dentistry and across a variety of disciplines[1]. Several studies and theories have highlighted a variety of reasons why some individuals utilize healthcare resources and why others may underutilize healthcare resources[2]. The Andersen model[2] is one of the most widely researched models of health care utilization and outcomes, which has undergone several revisions and modifications[3,4]. This model includes components at both an individual as well as societal level[2] that apply to a number of health care areas, including oral health care utilization, which is the primary focus of this study[5]. The Andersen[2,4] model includes predisposing (e.g., gender, socioeconomic status), enabling (e.g., family and

community support), and need-related (e.g., health beliefs and values associated with preventive care) predictive domains.

Studies in dentistry frequently have used aspects of the Andersen model[2,4] to explain factors influencing use of oral health services. While rates vary even within industrialized countries, revealing disparities in utilization, fully one-third of the population in the USA does not utilize professional dental care annually (e.g., 2003 – 33.6%; 2008 – 34.1%)[6]. The weight and relative importance of factors affecting utilization has long been an area of focus. Burt and Eklund[7], among numerous studies, suggested there is less use of dental services by males, ethnic/racial minorities, those with lower education, and those who lack dental insurance. Other investigations have suggested geographic location as an important factor[8–10]. People who live in more rural areas, both adults and children, have comparatively worse oral health than their urban counterparts[8] and may be less likely to utilize oral health care[10].

Other studies have found variables such as dental care-related anxiety and fear to be important forces affecting dental care utilization[11–12]. Around 45% of the population in the USA have levels of anxiety and/or fear about dental care of sufficient intensity to lead approximately 15% to avoid care[12–13]. High levels of dental care-related anxiety and/or fear are associated with cancelling dental visits or failing to keep appointments[12]. Anxiety and fear also are known to be more prevalent in dental care avoiders than regular attenders[14]. Additionally, how people perceive the value of their oral health, plus their beliefs about their ability to affect their oral health and other psychosocial factors may contribute to an overall lack of dental or oral health care utilization.

The aforementioned research has implications for understanding the impact of dental care utilization as an important component of improving oral health and well-being. Limited data, however, are available on these factors (i.e., sex, ethnicity/race, education, dental insurance, geography, other psychosocial variables) related to dental-care utilization in rural and other under-served areas[15] such as the Appalachian region of the USA, where there are oral and other health inequalities.

The topography of the Appalachian region extends across twelve states from southern New York to northern Mississippi. All of West Virginia is part of Appalachia, while Pennsylvania has approximately 81% percent of its counties or land area and about 45% of its population in Appalachia[16]. Parts of the Appalachian region are characterized by high rates of poverty, unemployment, low income, and rurality[17]. There also are oral health concerns in Appalachia. Of the 10 USA states with the lowest rate of regular dental visits, five are located in Appalachia (i.e., Mississippi, Tennessee, South Carolina, Kentucky, and West Virginia[8]). In general, the entire Appalachian region has poorer general and oral health relative to national norms in the USA[8]. Even within Appalachia, public policy (e.g., Medicaid) and cultural norms differ by state, as further noted in the Appendix.

Appalachia has one the greatest burdens of oral health problems per capita in the USA and the lowest rates of dental utilization[8]. More specifically, greater rates of caries and edentulism are found in Appalachia than in other regions of the USA[8–9,18]. The desire for

utilizing specialty oral health care (e.g., orthodontics) has been shown to be lower in Appalachia[19]. Although access to care may be one obvious concern, other factors related to the Andersen[2] model may have a role in the low levels of dental utilization in this region. Thus, it is important to better understand the underlying determinants of low dental utilization for those living in Appalachia.

The purpose of this investigation was to explore predisposing characteristics, enabling resources, and need, per the Andersen[2,4] model, as factors associated with dental utilization in a north central Appalachian sample. Identifying factors related to dental utilization may help in targeting future public policy changes and public health interventions.

Methods

Participants

The Center for Oral Health Research in Appalachia (COHRA1) was a multilevel and family-based study, conducted through a collaboration between West Virginia University and the University of Pittsburgh. The aims of COHRA1 were to identify biopsychosocial etiologies of oral disease disparities in north central Appalachia[20]. The unit of recruitment was the household via volunteers who responded to community engagement efforts and advertising. The catchment area included regions of several counties in two Appalachian states – West Virginia and Pennsylvania. The West Virginia sample was from Webster and Nicholas counties; the Pennsylvania sample included the communities of Burgettstown, Bradford and Braddock. Except for Braddock, a borough east of Pittsburgh, all other catchment areas are rural[21]. West Virginia has lower income, lower education, and fewer dental visits per year[8], relative to Pennsylvania.

The present study involved adults from the COHRA1 sample (18 years and older; $n = 868$). A detailed description of the methods and design of the study has been published elsewhere[20]. The study protocol included written informed consent and was approved by the Institutional Review Boards at West Virginia University (IRB#s: H-24094 and 1309099825) and the University of Pittsburgh (IRB#'s: IRB020773 and IRB0506048). Additional methodological details are in the Appendix.

Measures

A variety of biological, environmental, and psychosocial data were collected in the COHRA1 sample, with full details on all scales in the on-line Appendix. Dental care utilization was the primary outcome of interest and was measured using a dichotomous item about routine dental care over the last three years (i.e., "During the past 3 years, have you been to the dentist for routine check-ups or cleanings?" (0 = "no"; 1 = "yes"). Those who had attended in the three years prior to data collection were identified as "regular" attenders and those who had not as "non-regular."

Predisposing characteristics.—Specific measures were selected for inclusion as predictor variables, which coincided with components from the Andersen model[2,4]. Predisposing characteristic data included the participant's state residency, sex, age, dental anxiety and fear, and fatalistic beliefs about oral health.

The Dental Fear Survey (DFS[22]) was used to assess dental care-related anxiety and fear. This instrument has well-established psychometric properties[13], although it has limitations[23], as with all self-report instruments of dental care-related anxiety and fear. The DFS has been used internationally, and has three subscales and one total score, as detailed in Table 1. Higher scores indicate greater dental care-related anxiety and fear.

Fatalistic beliefs are an acceptance of the likelihood of negative outcomes, particularly ones largely controlled by chance or external forces[24–26]. A total score was derived from a four-item Oral Health Fatalism Scale that was developed and patterned after the fatalism subscale of the Multiphasic Assessment of Cultural Constructs – Short Form (MACC-SF[25]). Higher total scores indicate greater fatalistic beliefs.

Enabling resources.—Variables related to *enabling resources* included dental insurance status, education, and income level. As one aspect of the enabling resources in the Andersen model[2,4], participants were asked whether they had dental insurance or not. The dental insurance item was dummy-coded for inclusion in the analyses such that “none” was coded as “0” and any indication of six other private and public assistance options was coded as “1” regardless of type. Both education and household income were assessed and treated as continuous variables in the final model.

Need factors.—The Dental Neglect Scale (DNS[27]) was included to gather indicators about one’s attitude or perception toward being invested in his or her oral health. The DNS consists of six items targeting overall behaviors and attitudes toward oral health. One item is reverse-scored; items then are summed and higher scores indicate less neglect (i.e. a higher value of oral health). Previous work has shown the DNS to have acceptable reliability[27] and psychometric data are available attesting to its validity[28].

Analyses

Parameter estimates, measures of association, and *p*-values were obtained from mixed models. Mixed models were used to account for within-household correlation between regular attenders and non-regular attenders. All tests were conducted at the significance level of $\alpha = 0.05$ and models were analyzed using SPSS 25[29].Cronbach alpha values were calculated for this sample for each of the psychosocial scales and subscales, and are included in Table 1.

To account for the dependence among observations obtained from the same household, a Generalized Estimating Equation (GEE) modeling approach was conducted to test whether sex, age, education, income, dental insurance, state residency, dental care-related anxiety and fear, oral health fatalism, and dental neglect significantly predicted dental utilization among adults. In addition to the total sample, stratified analyses were performed by state (i.e., West Virginia and Pennsylvania) to compare differences. Only subjects with complete data across all variables were included (i.e., missing data was handled via listwise deletion).

Results

Of 1,339 adults (≥18 years old), a total of 1,262 (92.2%) responded to the outcome item about routine dental visits during the past three years. Of those 1,262, there were 868 (68.8%) individuals from 449 families with complete data for all variables included in the GEE model. Table 1 presents demographic information for the sample. Mean differences were compared between those included and those excluded due to missing data. Individuals included did not differ on most variables, but those who answered that item had higher levels of education, endorsed less fatalistic attitudes, and endorsed greater investment in their oral health. About half (n = 454, 52.3%) of the final sample indicated they had visited the dentist for routine care during the last three years. For West Virginia, only 42.2% were categorized as “regular attenders”, while that designation applied to 71.1% of the participants from Pennsylvania. The GEE model results for the entire sample are displayed in Table 2. Results for the GEE models based on state residency are in Table 3.

Predisposing Characteristics

After controlling for all other variables in the model, residents of Pennsylvania had an increased likelihood of attending the dentist for regular care within the last three years, relative to residents of West Virginia (OR = 2.31, 95% CI = 1.57, 3.40). In the combined state model and in the Pennsylvania sample, females were more likely to regularly attend than males (combined OR = 1.88, 95% CI = 1.35, 2.61; PA OR = 2.50, 95% CI = 1.31, 4.73) but the attendance rates were the same for West Virginia females and males (OR = 1.22, 95% CI = 0.79, 1.87). Lower scores on fatalistic beliefs related to oral health care also were associated with more recent routine care (OR = 0.87, 95% CI = 0.81, 0.94) in the combined and both state-specific models. In the combined state model, scores from the Dental Fear Survey subscales were not significantly associated with dental utilization. In the Pennsylvania specific model, though, higher scores on the Physiological Arousal subscale of the Dental Fear Survey were significantly associated with more routine care visits (OR = 1.18, 95% CI = 1.03, 1.35). Age was not a significant predictor.

Enabling Resources

Having dental insurance was associated with greater regular attendance in the combined model (OR = 2.20, 95% CI = 1.54, 3.14) and in the West Virginia model (OR = 2.41, 95% CI = 1.54, 3.79), but was not a significant predictor for those in the Pennsylvania-specific analysis. Likewise, in the combined model, individuals with higher income also had greater attendance (OR = 1.21, 95% CI = 1.09, 1.34). This relation also was significant in the West Virginia model (OR = 1.25, 95% CI = 1.10, 1.42), but not in the Pennsylvania model. Education was not a significant predictor.

Need Factors

Greater investment in one’s oral health (i.e., Dental Neglect Scale) was significantly associated with more routine oral health care visits (OR = 1.18, 95% CI = 1.13, 1.23). This relation held for both the overall analysis, and each of the state-specific analyses.

Discussion

In this study, the strongest predictors of dental utilization among adults in north central Appalachia were state residency (Pennsylvania or West Virginia), whether an individual had dental insurance or not, and the sex of the participant. Additionally, however, household income, dedication to good oral health, and less fatalistic oral health beliefs also predicted utilization. Thus, from the perspective of the Andersen[2,4] model, multiple potential "arenas of influence" (i.e., predisposing characteristics, enabling resources, and need factors) predicted utilization of routine dental services. Additional discussion can be found in the Appendix.

When the separate models for each state were constructed, the pattern of findings differed in informative ways. Among Pennsylvania residents, one component (i.e., physiological reactions) of dental care-related anxiety and fear[22] emerged as a significant predictor. Those who attend regular routine dental care, when there are not mitigating economic circumstances, experienced greater physiological reactions during dental appointments. Rather than being negative, this experience speaks to utilization of dental care even with moderate (or even higher) levels of fear[30]. In the West Virginia group, all predictors significant for the combined sample remained, with the exception sex of participant. It is speculated that in West Virginia, sex differences[12] observed elsewhere in dental care-related fear and anxiety are overwhelmed by other, more dominant factors, such as economic ones and the relative unavailability of dental insurance. In the Pennsylvania group, from a more economically-prosperous state[31], both enabling resources (i.e., income and dental insurance) dropped out as significant predictors, while others remained. Given the higher household income in the Pennsylvania group, it is perhaps expected that resource availability would be less important in comparison to West Virginia.

The reported findings should be considered in the light of methodological and theoretical limitations. The COHRA1 study had recruitment strategies to accumulate a study population with broad representation across all dimensions of education, geographic residence, and cultural identification within Appalachia, however, statistical sampling was not utilized, and consequently, this cohort may not be fully representative of the underlying population in all dimensions[21]. It is possible that the statewide differences might be confounded by almost all ethnic/racial minority individuals in this sample being from Pennsylvania, which is consistent, however, with statewide population statistics. Additionally, the most urban area was Braddock, in Pennsylvania, but the rural-urban differences also are consistent with the characteristics of each state. The findings of this study may not generalize to other Appalachian regions or the USA population at large. As this study utilized a cross-sectional study design, assessing dental utilization over time is not possible. Research based on panel data and longitudinal designs are warranted so surveillance of dental utilization could be accurately monitored during developmental periods (e.g., transition between adolescence and adulthood) which may be pivotal in terms of future use of oral health services. Another limitation is the reliance on self-reported responses, which have inherent limitations (e.g., social desirability responding, recall bias) but strengths as well (e.g., ease of administration, cost). In spite of assessments in each of the Andersen[2,4] model's domains, there are other, unmeasured potential factors that may affect utilization, such as geographic topography

(e.g., mountainous terrain in Appalachia, with less advanced roadways in rural areas). Finally, but importantly, this study also did not capture the many cultural strengths of the Appalachian population. These strengths, such as strong family ties and community interdependence[32], would be enabling factors that possibly could be protective or be harnessed to implement interventions, and enhance dental utilization.

Some parts of the Appalachian Region are characterized by high rates of poverty and unemployment, low incomes and a large rural population[30]. Previous studies consistently found associations between socioeconomic status and oral health outcomes[34,35–37]. This study further confirmed this observation by showing its influence on dental utilization. The present findings highlight the potentially additive effects of poverty and poor Medicaid or other insurance coverage for dental services in Appalachia, particularly for males, and in those who have negative beliefs and perceptions of need. The Health Resources and Services Administration (HRSA) has made several recommendations about policy interventions including new financing mechanisms[38]. For example, seeking a Medicaid initiative to increase affordability of oral health services has been recommended as one possible route to improved dental utilization[38].

A strength of the COHRA[9,20,21] project is the variability inherent in two states (West Virginia and Pennsylvania), each with its own unique cultural aspects and public policies affecting oral and other health care. The important distinctions even between two adjoining states seem to imply important considerations for future research directions on cultural factors and public oral health policy.

Future research should further explore fatalistic beliefs towards oral health and dental utilization as they remain relatively under studied. Findings from this study indicate individuals with more fatalistic thinking and beliefs about oral health tend to go to dental visits less than those with more empowering attitudes. The literature remains sparse in this area and much more could be done to understand the dimensions of oral health-related fatalism, and why and how to improve fatalistic thinking, as an interventional target.

In conclusion, this study elucidated important enabling, resource, and need predictors[2,4] of dental care utilization among adults in north central Appalachia in the USA, from a state-specific perspective. Findings identified dental insurance status, fatalistic beliefs about oral health, perceptions of dental need and value associated with oral health status, and aspects of dental care-related anxiety and fear as potential, mutable factors. These general and state-specific findings suggest potential areas in which public policy and public health initiatives may enhance dental utilization among adults in Appalachia.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

Most of all, we thank those individuals and families who participated in the COHRA1 study, without whom this work would not be possible. Appreciation also is expressed to those community partners who provided research space and support in both West Virginia and Pennsylvania. Thanks also are extended to the West Virginia Rural

Health Education Partnerships program, and community advisory boards for the Center for Oral Health Research in Appalachia. The present research teams in West Virginia (Linda Brown, Dr. Elizabeth Kao, Renea LoPetrone, Natalie Marquart, Aliyah S. Pugh, Karolyn Ruggles, and Barb Thaxton) and Pittsburgh (Jill Beach, Wendy Carricato, Zelda Dahl, Tonya Dixon, Jessica Ferraro, Jennifer Maurer, Chika Richter, Alicia Wicks, Lauren Winter, and Jayme Zovko), and their predecessors, are recognized with appreciation. This research was supported by grants from the National Institute of Dental and Craniofacial Research (R01 DE014899) and the National Institute of General Medical Sciences (T32 GM081741).

References

1. Bernstein AB, Hing E, Moss AJ, Allen KF, Siller AB, Tiggle RB. Health care in America: Trends in utilization. Hyattsville, Maryland: National Center for Health Statistics 2003 https://www.cdc.gov/nchs/data/misc/healthcare.pdf
2. Andersen R, Newman JF. Societal and individual determinants of medical care utilization in the United States. Milbank Mem Fund Q Health Soc 1973;51:95–124. [PubMed: 4198894]
3. Gochman DS. Handbook of health behavior research I: Personal and social determinants: Springer Science & Business Media 1997.
4. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? J Health Soc Behav 1995;36:1–10. [PubMed: 7738325]
5. Muirhead VE, Quiñonez C, Figueiredo R, Locker D (2009). Predictors of dental care utilization among working poor Canadians. Community Dent Oral Epidemiol 2009; 37(3):199–208. [PubMed: 19508268]
6. Wall TP, Vujicic M, Nasseh K. Recent trends in the utilization of dental care in the United States. J Dent Educ 2012;76(8):1020–27. [PubMed: 22855587]
7. Burt BA, Eklund SA. Dentistry, dental practice, and the community: Elsevier Health Sciences; 2005.
8. Krause DD, May WL, Cossman J, Konrad T. An analysis of oral health disparities and access to services in the Appalachian region Prepared for: Appalachian Regional Commission. In: Lane N, editor. Washington, DC: University of Mississippi Medical Center, Mississippi State University; 2012.
9. McNeil DW, Hayes SE, Randall CL, Polk DE, Neiswanger K, Shaffer JR … Marazita ML. Depression and rural environment are associated with poor oral health among pregnant women in Northern Appalachia. Behav Modif 2016; 40(1–2):325–340. [PubMed: 26643277]
10. Vargas CM, Dye BA, Hayes KL, Oral health status of rural adults in the United States. J Am Dent Assoc 2002; 133:1672–1681. [PubMed: 12512669]
11. Al Johara A Factors affecting utilization of dental health services and satisfaction among adolescent females in Riyadh City. Saudi Dental Journal 2010;22(1):19–25. [PubMed: 23960475]
12. McNeil DW, Randall CL. Dental fear and anxiety associated with oral health care: Conceptual and clinical issues In: Mostofsky DI, Fortune F, editors. Behavioral Dentistry, 2nd ed.,: John Wiley & Sons; 2014.
13. Dionne RA, Gordon SM, McCullagh LM, & Phero JC. Assessing the need for anesthesia and sedation in the general population. J Am Dent Assoc 1998; 129: 1111–1119. [PubMed: 9715012]
14. Gatchel RJ, Ingersoll BD, Bowman L, Robertson MC, Walker C. The prevalence of dental fear and avoidance: a recent survey study. J Am Dent Assoc (1939) 1983;107(4):609–10.
15. Spencer AJ, Harford JE. Oral health of Australians: National planning for oral health improvement 2001.
16. Pollard K, and Jacobsen LA. The Appalachian region in 2010: A census data overview 2011; retrieved from http://www.prb.org/pdf12/appalachia-census-chartbook-2011.pdf
17. Behringer B, Friedell GH, Dorgan KA, Hutson SP, Naney C, Phillips A, et al. Understanding the challenges of reducing cancer in Appalachia: Addressing a place-based health disparity population. Californian J Health Promot 2007;5:40–49.
18. Slade GD, Akinkugbe AA, Sanders AE. Projections of U.S. edentulism prevalence following 5 decades of decline. J Dent Res 2014; 93:959–965. [PubMed: 25146182]
19. Martin CA, McNeil DW, Crout RJ, Ngan PW, Weyant RJ, Heady HR, Marazita ML. Oral health disparities in Appalachia: Orthodontic treatment need and demand. J Am Dent Assoc 2008; 139:598–604. [PubMed: 18451377]

20. Polk DE, Weyant RJ, Crout RJ, McNeil DW, Tarter RE, Thomas JG, et al. Study protocol of the Center for Oral Health Research in Appalachia (COHRA) etiology study. BMC Oral Health 2008;8(1):18. [PubMed: 18522740]
21. Shaffer JR, Leslie EJ, Feingold E, Govil M, McNeil DW, Crout RJ, et al. Caries experience differs between females and males across age groups in Northern Appalachia. Int J Dent 2015;2015.
22. Kleinknecht RA, Klepac RK, Alexander LD. Origins and characteristics of fear of dentistry. J Am Dent Assoc 1973;86(4):842–8. [PubMed: 4511174]
23. Armfield JM. How do we measure dental fear and what are we measuring anyway? Oral Health and Preventative Dentistry 2010; 8(2):107–15.
24. Chiappone DI, Kroes WH. Fatalism in coal miners. Psychol Rep 1979; 44:1175–80. [PubMed: 538148]
25. Cuellar I, Arnold B, Gonzalez G. Cognitive referents of acculturation: Assessment of cultural constructs in Mexican Americans. J Community Psychol 1995; 23:339–56.
26. McNeil DW, Crout RJ, Lawrence SM, Shah P, Rupert N. Oral health values in Appalachia: Specific dental-related fatalism? J Dent Res 2004; 83(A-203), [Abstract].
27. Thomson WM, Locker D. Dental neglect and dental health among 26-year-olds in the Dunedin Multidisciplinary Health and Development study. Community Dent Oral Epidemiol 2000; 28(6): 414–8. [PubMed: 11106013]
28. Jamieson LM, Thomson WM. The Dental Neglect and Dental Indifference scales compared. Community Dent Oral Epidemiol 2002; 30: 168–75. [PubMed: 12000339]
29. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp 2017.
30. Armfield JM, Stewart JF, Spencer AJ. The vicious cycle of dental fear: Exploring the interplay between oral health, service utilization and dental fear. BMC Oral Health 2007;7(1):1. [PubMed: 17222356]
31. Index Mundi. 2017 https://www.indexmundi.com/facts/united-states/quick-facts/compare/west-virginia.pennsylvania
32. Jones L, Brunner WE. Appalachian values. Ashland, KY: Jesse Stuart Foundation; 1994.
33. Arcury TA, Savoca MR, Andersen AM, Chen H, Gilbert GH, Bell RA, et al. Dental care utilization among North Carolina rural older adults. J Public Health Dent 2012;72(3):190–97. [PubMed: 22536828]
34. Roberts-Thomson K, Slade G. Factors associated with infrequent dental attendance in the Australian population. Aust Dent J 2008;53(4):358–62. [PubMed: 19133953]
35. Ajayi D, Arigbede A. Barriers to oral health care utilization in Ibadan, South West Nigeria. Afr Health Sci 2013;12(4):507–13.
36. Edelstein BL, Chinn CH. Update on disparities in oral health and access to dental care for America's children. Acad Pediatr 2009;9(6):415–19. [PubMed: 19945076]
37. Guay AH. Access to dental care: Solving the problem for underserved populations. J Amer Dent Assoc 2004;135(11):1599–605. [PubMed: 15622666]
38. Selwitz RH, Ismail AI, Pitts NB. Dental caries. Lancet 2007; 369(9555):51–59. [PubMed: 17208642]

Table 1:

Demographic characteristics of the study sample.

		N (%) / Mean (SD) Total sample	Irregular attender	Regular attender
State (n = 868)				
West Virginia		564 (60.5%)	326 (57.8%)	238 (42.2%)
Pennsylvania		304 (35.0%)	88 (28.9%)	216 (71.1%)
Sex (n = 868)				
Men		306 (35.3%)	177 (42.8%)	129 (28.4%)
Women		562 (64.7%)	237 (57.2%)	325 (71.6%)
Age (n = 868)		34.6 (9.2)	33.9 (8.8)	35.3 (9.4)
Dental insurance (n = 868)				
Yes		387 (44.6%)	112 (27.1%)	275 (60.6%)
No		481 (55.4%)	302 (72.9%)	179 (39.4%)
Education (n = 868)				
No high school diploma		103 (11.9%)	71 (17.1%)	32 (7.0%)
High School diploma/GED		385 (44.4%)	208 (50.2%)	177 (39.0%)
Technical school		117 (13.5%)	57 (13.8%)	60 (13.2%)
Some college, no degree		114 (13.1%)	41 (9.9%)	73 (16.1%)
Undergraduate degree		100 (11.5%)	30 (7.2%)	70 (15.4%)
Graduate degree		49 (5.6%)	7 (1.2%)	42 (9.3%)
Household Income* (n = 868)				
Less than 10,000		185 (21.3%)	115 (27.8%)	70 (15.4%)
10,000 to 14,999		148 (17.1%)	85 (20.5%)	63 (13.9%)
15,000 to 24,999		176 (20.3%)	95 (22.9%)	81 (17.8%)
25,000 to 34,999		117 (13.5%)	52 (12.6%)	65 (14.3%)
35,000 to 49,999		126 (14.5%)	47 (11.4%)	79 (17.4%)
50,000 to 74,999		64 (7.4%)	11 (2.7%)	53 (11.7%)
75,000 to 99,999		31 (3.6%)	7 (1.7%)	24 (5.3%)
100,000 to 149,999		16 (1.8%)	2 (0.5%)	14 (3.1%)
150,000 to 199,999		1 (0.1%)	0 (0.0%)	1 (0.2 %)
200,000 or more		4 (0.5%)	0 (0.0%)	4 (0.9%)
Dental Fear Survey (n = 868)				
Total Score	α^{+} = .97	36.4 (17.7)	38.4 (19.2)	34.62 (16.0)
Avoidance	α = .95	12.9 (7.2)	14.0 (8.0)	12.0 (6.3)
Specific Stimuli	α = .95	14.6 (7.5)	15.0 (7.9)	14.1 (7.2)
Physiological Response	α = .91	8.9 (4.6)	9.4 (4.9)	8.5 (4.2)
Oral health fatalism (n = 868)	α = .68	7.6 (2.6)	8.4 (2.7)	6.8 (2.4)
Dental Neglect Scale (n = 868)	α = .71	19.8 (5.2)	17.4 (4.6)	22.0 (4.7)

*The Federal Poverty Level (FPL) for a family of four at beginning of data collection (2000) was $17,050 and at end of data collection (2008) was $21,200.

+Cronbach's α indicates the internal consistency reliability for each of the scales or subscales for the current sample

Table 2:

Combined (West Virginia and Pennsylvania) prediction model of dental utilization with a Generalized Estimating Equation organized by Andersen model factors.

	Odds ratio	Confidence interval	p-value
Predisposing characteristics			
State (PA)	2.31	[1.57, 3.40]	< **0.001**
Sex (Female)	1.44	[1.00, 2.05]	**0.048**
Age	1.00	[0.98, 1.02]	0.622
Dental Fear Survey			
Avoidance	0.98	[0.93, 1.02]	0.234
Stimulus	1.01	[0.97, 1.05]	0.505
Physiological	1.01	[0.94, 1.08]	0.753
Oral health fatalism	0.87	[0.81, 0.94]	< **0.001**
Enabling resources			
Dental insurance	2.20	[1.54, 3.14]	< **0.001**
Income	1.21	[1.09, 1.34]	< **0.001**
Education	1.05	[0.91, 1.20]	0.499
Need			
Dental Neglect Scale	1.18	[1.13, 1.23]	< **0.001**

Note: West Virginia was the reference group for state. Males were the reference group for sex.

Table 3:

State-stratified prediction models of dental utilization with a Generalized Estimating Equation organized by the Andersen model factors.

	Odds ratios		**Confidence intervals**		**p-values**	
	WV	PA	WV	PA	WV	PA
Predisposing characteristics						
Sex (Female)	1.22	2.50	[0.79, 1.87]	[1.31, 4.73]	0.372	**0.006**
Age	0.99	1.01	[0.96, 1.01]	[0.99, 1.05]	0.275	0.191
Dental Fear Survey						
Avoidance	0.98	0.94	[0.94, 1.03]	[0.86, 1.04]	0.441	0.238
Stimulus	1.04	0.95	[0.99, 1.09]	[0.89, 1.01]	0.099	0.119
Physiological	0.96	1.18	[0.88, 1.04]	[1.03, 1.35]	0.311	**0.020**
Oral health fatalism	0.86	0.87	[0.78, 0.95]	[0.76, 0.99]	**0.002**	**0.039**
Enabling resources						
Dental insurance	2.41	1.50	[1.54, 3.79]	[0.80, 2.79]	< **0.001**	0.211
Income	1.25	1.13	[1.10, 1.42]	[0.95, 1.35]	**0.001**	0.161
Education	1.02	1.11	[0.86, 1.22]	[0.87, 1.40]	0.821	0.406
Need						
Dental Neglect Scale	1.19	1.15	[1.13, 1.26]	[1.08, 1.22]	< **0.001**	< **0.001**

Note: Reference group for sex was male.