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Contemporary impact of tobacco use on periodontal disease in the United States

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Keywords

Periodontal disease; tobacco use; attributable fraction

Introduction

Periodontal disease (PD) is a common chronic disease that can be expensive to treat, and when untreated, can inflict significant morbidity and tooth loss. Growing evidence also links PD to higher risks of cancer, cardiovascular, and other chronic diseases.

Cigarette smoking has been estimated to cause 8 million cases of PD in the United States (US) or more than half of the 15 million cases of PD,[1]. However, these estimates are based on data from the third National Health and Nutrition Examination Survey (NHANES), conducted from 1988–1994. The prevalence of PD was underestimated in this survey because a partial mouth exam was utilized that included many fewer sites per tooth than currently recommended,[2]. Current prevalence estimates of PD in the US are substantially higher, as they incorporate new population-based PD case definitions and full-mouth assessments,[3]. Equally important, previous estimates of the tobacco-induced PD burden failed to include the effects of non-cigarette tobacco products and environmental tobacco smoke (ETS). There have also been substantial declines in the contemporary prevalence of cigarette smoking over the past two decades,[4]. To better determine the impact of tobacco on PD, we calculated updated estimates using data from NHANES 2009–2012,[3].

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Competing interests: None declared.

Contributorship statement: AC, CCA, and NDF designed the study; EV, BG, EL, BAD, CCA, and NDF analyzed and interpreted the data; EV and NDF drafted the manuscript; BG, EL, AC, BAD, and CCA critically reviewed the manuscript; all authors gave final approval on the manuscript.

Methods

We included participants aged 30 and older with a periodontal assessment as part of the NHANES Mobile Exam Center (MEC). The main reasons for a participant not having a periodontal assessment were no natural teeth, an existing health condition requiring exclusion, or refusing the assessment. To better reflect the total US population age 30 and older from 2009–2012, we re-poststratified the original MEC sample weights for participants with data on all analytic variables. Re-poststratification ensures that our population estimates match the US population by age, race, and sex categories. The adjustment was conducted separately for the 2009–2010 and 2011–2012 NHANES. In total, with the reweighted sample, we estimated that there were 166.1 million participants with at least one tooth and we excluded 13.6 million edentulous participants. All study participants gave informed consent in accordance with the Research Ethics Review Board of the National Center for Health Statistics, Centers for Disease Control and Prevention (CDC). We determined presence of total PD (i.e., severe, moderate, or mild PD) using the current CDC and American Academy of Periodontology definition,[5]. Tobacco use was categorized using a composite variable that includes data from self-reported cigarette smoking history, past 5 day tobacco use, presence of smokers in the household, and laboratory assessed serum cotinine, as described in the legend of the Table.

We estimated the number of cases of total PD in the US and the number of cases of PD within each tobacco exposure group. We used Poisson regression to estimate relative risks and 95% confidence intervals after multivariable adjustment. We estimated the predicted marginals of PD within categories of tobacco use and the proportion of PD cases attributable to tobacco exposure as previously described,[6]. All analyses incorporated the complex survey design and sample weights with SAS-callable SUDAAN version 11.0.0.

Results

Among adults aged 30 years or older in the US, 46.3% had PD. Of those with PD, 19.1% had severe, 67.8% had moderate, and 13.1% had mild PD. The prevalence of total PD ranged from 32.1% among never cigarette smokers without ETS exposure to 62.4% among current cigarette smokers (Table).

We estimate tobacco use caused 9.7 million cases of PD among active tobacco users and 5.7 million cases among non-users (i.e., never or former smokers) exposed to ETS (Table). Altogether, tobacco use was associated with 16.0 million cases of PD in the US population, over 20% of the total burden.

Discussion

Despite declines in the prevalence of cigarette smoking, tobacco use causes about 20% of total PD in the US, resulting in substantial morbidity and health care expenditure. Reductions in tobacco use and ETS exposure are urgently needed to reduce the burden of PD and many other diseases. Unfortunately, we lacked enough users of non-cigarette tobacco products to adequately estimate the impact of individual types of non-cigarette tobacco on

total PD. Future work is needed to evaluate the effect of other tobacco products, including emerging products such as e-cigarettes, and dual use, on the burden of PD in the US.

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Table

Prevalence of periodontal disease within categories of cigarette and tobacco use in the United States population aged 30 years and older, NHANES 2009–2012

	Total N (millions)	N cases of periodontal disease (millions)	Prevalence	Relative risk		N cases due to tobacco (millions)	% due to tobacco by category
				RR	(95% CI)		
Tobacco/cigarette category [A]							
Never tobacco user[B]/no environmental tobacco exposure	39.0	15.5	32.1%	Ref		–	–
Never tobacco user[B]/environmental tobacco exposure[C]	48.2	20.7	42.9%	1.19	(1.09, 1.31)	3.2	15.5%
Former cigarette smoker[B]/no environmental tobacco exposure	16.7	7.3	43.6%	1.09	(0.90, 1.32)	0.6	7.8%
Former cigarette smoker[B]/environmental tobacco exposure[C]	21.7	11.7	53.8%	1.28	(1.16, 1.40)	2.5	21.4%
Current non-cigarette tobacco user[D]	5.4	2.8	53.0%	1.41	(1.10, 1.81)	0.9	30.4%
Current cigarette smoker	35.1	21.9	62.4%	1.70	(1.57, 1.86)	8.8	40.3%

[A] Prevalence, relative risk (RR), cases due to tobacco, and percent due to tobacco within the category were adjusted for age, sex, education, race/ethnicity, and income.

[B] Excludes current non-cigarette tobacco users.

[C] Environmental tobacco exposure was defined as either reporting living with a cigarette smoker or having detectable serum cotinine. Similar findings were observed when either of these definitions was examined separately (data not shown).

[D] Includes cigars, pipes, chewing tobacco, and snuff. When analyzed separately, the RR for periodontal disease was 1.40 (95% CI: 1.03, 1.90) for cigar and pipe smokers and 1.45 (95% CI: 1.08, 1.95) for individuals who chewed tobacco or used snuff.