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Smoking Behavior among US Adults with Diabetes or Impaired Fasting Glucose

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Abstract

BACKGROUND—Cigarette smoking is a well-known cardiovascular risk factor and its impact on cardiovascular disease is even greater among people with diabetes. The aim of this study is to compare the prevalence and determinants of smoking among US adults with diabetes or impaired fasting glucose, and those without diabetes or impaired fasting glucose.

METHODS—We analyzed data from the National Health and Nutrition Examination Surveys (1999–2008). Age-adjusted prevalence of smoking was calculated, and we used logistic regression models to identify the correlates of smoking among people with diabetes, impaired fasting glucose, and normal glucose metabolism.

RESULTS—Among 24,649 participants ≥ 20 years old, age-adjusted smoking prevalence was 25.7% in 3111 individuals with diabetes, 24.2% in 3557 individuals with impaired fasting glucose, and 24.1% in 17,981 individuals without diabetes. Smoking prevalence did not differ across groups or change over time (1999–2008) in any group. Younger age, less education, more alcohol consumption, less physical activity, and major depression symptoms were associated with smoking in people with diabetes, impaired fasting glucose, and normal glucose metabolism.

CONCLUSIONS—In the US, smoking prevalence among people with diabetes and impaired fasting glucose has not changed and is comparable with the nondiabetic population. Tobacco control efforts should be intensified among this population at high risk for complications and mortality.

Keywords

Diabetes; Impaired fasting glucose; Smoking

Smoking is a key modifiable cardiovascular risk factor that all patients should avoid. The impact of smoking on cardiovascular disease and mortality is especially important for people with diabetes.[1] Smokers with diabetes have a substantially increased risk of macrovascular and microvascular complications, morbidity, and mortality compared with nonsmokers with diabetes. Despite this knowledge, smoking remains common among people with diabetes. The prevalence of smoking in national surveys in the 1990s was similar among individuals with and without diabetes (27.3% and 25.9%, respectively).[2,3] A more recent report showed that among individuals with diagnosed diabetes, there was no change in smoking prevalence between 1988–1994 and 1999–2008.[4] However, these reports considered only participants with diagnosed diabetes and did not look more broadly at participants with undiagnosed diabetes or people with impaired fasting glucose. Undiagnosed diabetes accounts for ~40% of all diabetes cases, and the prevalence of impaired fasting glucose is about 26% according to a recent analysis.[5] By looking at diagnosed diabetes only, important information might be missed. This study updates data on smoking prevalence from a national survey and compares it among individuals with diabetes, with impaired fasting glucose, and with normal glucose metabolism. The study also examines characteristics associated with smoking according to diabetes state. In the general population there are important disparities in cigarette smoking, with higher use reported among persons with low socioeconomic status and histories of mental illness and substance abuse.[6] We hypothesized that similar disparities exist among people with diabetes.

RESEARCH DESIGN AND METHODS

We analyzed data from the continuous National Health and Nutrition Examination Survey (NHANES) 1999–2008, a nationally representative, cross-sectional survey.[7] We limited the analysis to people aged 20 years who were both interviewed and examined. We excluded subjects with missing data on smoking or diabetes. The NHANES protocol was approved by the NHANES Institutional Review Board and informed consent was obtained from all participants.

The diabetes group consisted of people who had been told by a health professional that they had diabetes, who reported taking insulin or diabetic pills, or who had a fasting blood glucose 126 mg/dL.[8] Impaired fasting glucose consisted of individuals who had been told by a health professional that they were "borderline" for diabetes but did not take insulin or diabetic pills, or who had a fasting blood glucose 100 mg/dL and <126 mg/dL. All other participants were classified as not having either diabetes nor impaired fasting glucose. Current smoking was defined as having smoked at least 100 cigarettes during their lifetime and smoking every day or some days. Former smoking was defined as having smoked at least 100 cigarettes during their lifetime and reporting not smoking at all at the time of interview. Participants who reported not smoking or smoking fewer than 100 cigarettes during their lifetime were defined as never smokers. Covariates included demographic variables, body mass index, alcohol consumption, physical activity, and depression, which are all associated with smoking in the general population.[9–12] Depression was assessed using the Patient Health Questionaire-9, a brief self-administered questionnaire for the criteria-based diagnosis of depressive disorders. Major depression was defined as a score

10.[13] Because the Patient Health Questionaire-9 has been used only in the last 2 surveys, we used data from the last survey (2007–2008) to assess the relationship between demographic, health, and behavior characteristics and smoking.

All analysis accounted for sampling design and used sample weights that account for unequal probabilities of selection and include adjustment for noncoverage and nonresponse. We calculated age-adjusted prevalence of smoking among people with diabetes, with impaired fasting glucose, and with neither condition in each survey. We compared those estimates using *t* tests and calculated linear trends to look for change over time. To adjust for age, we used the direct method to the year 2000 Census population projections using the age groups 20–29, 30–39, 40–49, 50–59, 60–69, and 70+ years. We built logistic regression models to identify the correlates of smoking among people with diabetes, with impaired fasting glucose, and with neither condition. We used SAS software version 9.2 (SAS Institute Inc, Cary, NC) and SUDAAN software version 10.0 (RTI, Research Triangle Park, NC) for our analysis.

RESULTS

Our sample consisted of 24,649 people, 17,981 without diabetes (weighted proportion 76.8%), 3557 with impaired fasting glucose (14.1%), and 3111 with diabetes (9.1%). The age-adjusted prevalence of smoking was 25.7% among individuals with diabetes, 24.2% among individuals with impaired fasting glucose, and 24.1% among individuals without diabetes.

Age-adjusted smoking prevalence varied over time in each group, but there was no statistically significant trend in the prevalence of smoking over time in any group (Figure). Age-adjusted smoking prevalence did not differ significantly by diabetes status.

The latest survey (2007–2008) included 5086 participants with complete data for all covariates. The independent correlates of smoking stratified by diabetes status are shown in the Table. Among people with diabetes, smoking was more common in younger individuals and in individuals with less education, higher alcohol consumption, less physical activity, lower weight, and more symptoms of major depression. Among people with impaired fasting glucose and those without diabetes or impaired fasting glucose, we found similar associations with smoking, but the effect of depression was less marked (Table).

CONCLUSIONS

The age-adjusted prevalence of smoking in national samples of adults aged 20 years and older was comparable among individuals with diabetes, with impaired fasting glucose, and with neither condition during 1999–2008, and did not change over that period of time. This is of concern, as mortality risks are almost 80% higher among smokers with diabetes compared with nonsmokers with diabetes.[1] Among people with diabetes, age, education, alcohol consumption, lack of physical activity, and symptoms of major depression were associated with smoking.

In data from the 1989 National Health Interview,[2] the prevalence of smoking did not differ significantly between people with (27.3%) and without diagnosed diabetes (25.9%). More than 10 years later, the conclusion remains the same. The prevalence of smoking we found is slightly higher than in other recent reports using NHANES data.[4,14] This is probably due to methodology and definition differences. In our study we reported age-adjusted smoking prevalence among people 20 years old with diagnosed and undiagnosed diabetes, whereas in the other reports, diagnosed diabetes cases only were considered and smoking prevalence was not adjusted to age.

The fact that smoking was associated with a younger age in our analyses could be related to a survival bias. Indeed, people who smoke are more at risk to die younger, and this is especially true among people with diabetes.

In conclusion, the smoking prevalence remains comparable and substantial among people with diabetes, with impaired fasting glucose and without diabetes. Tobacco control efforts should be intensified among people with diabetes and impaired fasting glucose and target especially younger, sedentary, less educated people, as well as people who consume alcohol or suffer from major depression.

Acknowledgments

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CLINICAL SIGNIFICANCE

- Cigarette smoking is as prevalent in people with diabetes or impaired fasting glucose as in the nondiabetic population.

- People with diabetes or impaired fasting glucose who smoke are at high risk for complications and mortality.

- Tobacco control efforts should be intensified among people with diabetes and impaired fasting glucose and target especially younger, sedentary, less educated people as well as people who consume alcohol or suffer from major depression.
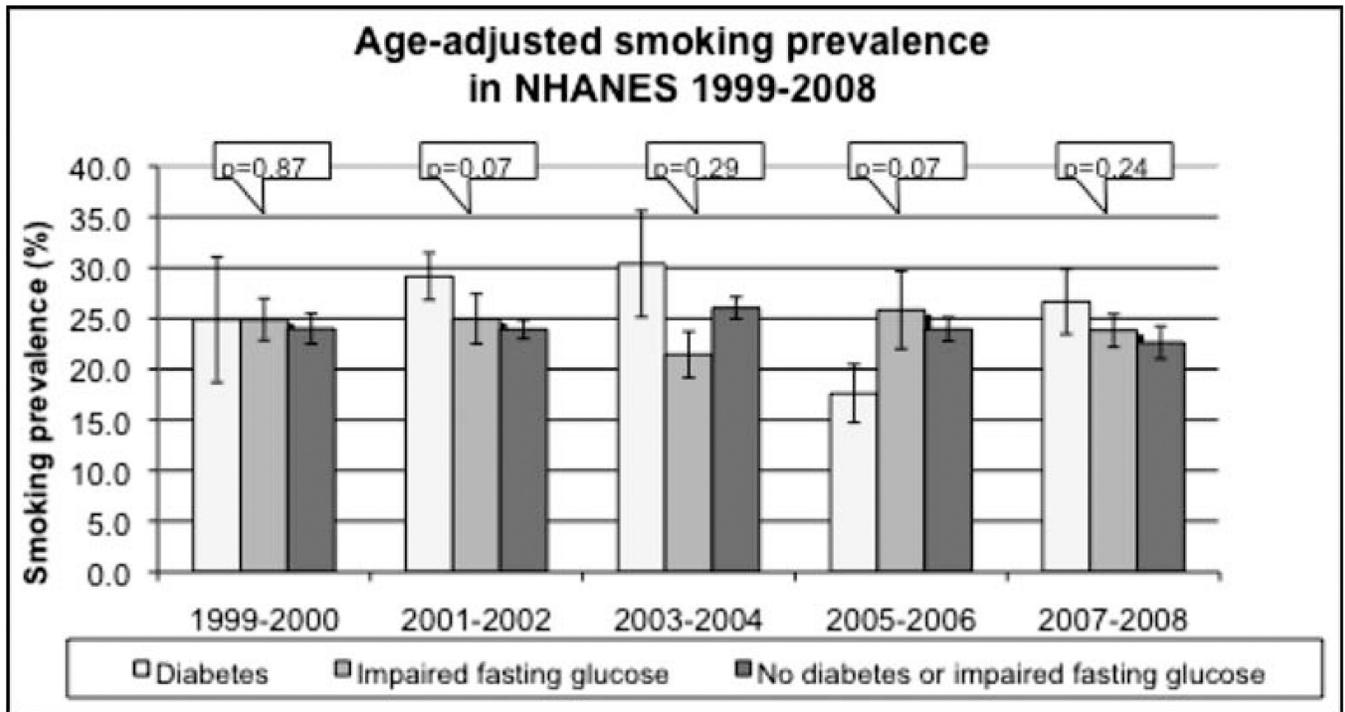
Figure.
Age-adjusted smoking prevalence (with SE) in participants 20 years old in the National Health and Nutrition Examination Survey (NHANES) from 1999 to 2008. *P = P*-values comparing people with diabetes to people without diabetes or impaired fasting glucose. *P* for trend over time = .88 for people with diabetes. *P* for trend over time = .63 for people with impaired fasting glucose. *P* for trend over time = .61 for people without diabetes or impaired fasting glucose.

Table

Adjusted[*] Odds Ratios (ORs) of Smoking for Demographic Characteristics, Health Status, and Health Behaviors Stratified by Diabetes State in NHANES 2007–2008

Variables	Diabetes (n = 778)	Impaired Fasting Glucose (n = 997)	No Diabetes or Impaired Fasting Glucose (n = 3311)
Age <50 years	2.83 (1.79–4.50)	1.86 (1.24–2.79)	2.47 (1.81–3.38)
Female	0.66 (0.37–1.18)	0.82 (0.51–1.31)	0.60 (0.51–0.72)
Education			
> High school	1.00 (reference)	1.00 (reference)	1.00 (reference)
High school	1.60 (1.02–2.51)	2.39 (1.39–4.10)	2.11 (1.69–2.65)
< High school	2.20 (1.33–3.64)	2.88 (1.58–5.25)	3.15 (2.37–4.20)
Race/ethnicity			
Non-Hispanic white	1.00 (reference)	1.00 (reference)	1.00 (reference)
Hispanic	0.83 (0.44–1.58)	0.53 (0.27–1.05)	0.40 (0.26–0.63)
Non-Hispanic black	1.40 (0.65–2.98)	1.51 (0.99–2.29)	0.88 (0.70–1.11)
Other race	0.59 (0.09–3.68)	2.04 (0.88–4.71)	0.54 (0.26–1.13)
Body-mass index			
<18.5 kg/m^2	—[†]	0.50 (0.10–2.54)	2.03 (0.95–4.33)
18.5–24.9 kg/m^2	1.00 (reference)	1.00 (reference)	1.00 (reference)
25–29.9 kg/m^2	0.31 (0.13–0.74)	0.55 (0.30–1.03)	0.78 (0.58–1.06)
30–34.9 kg/m^2	0.34 (0.21–0.56)	0.38 (0.19–0.78)	0.74 (0.56–0.97)
35 kg/m^2	0.30 (0.15–0.57)	0.28 (0.15–0.54)	0.58 (0.40–0.83)
P for trend[‡]	.006	.002	.0005
Alcohol consumption	2.34 (1.19–4.60)	2.78 (1.66–4.96)	1.91 (1.52–2.40)
Physical activity			
Vigorous	1.00 (reference)	1.00 (reference)	1.00 (reference)
Moderate	0.99 (0.30–3.34)	2.10 (1.15–3.84)	1.84 (1.22–2.78)
None/light	2.88 (1.26–6.55)	2.87 (1.66–4.96)	2.47 (1.75–3.49)
Major depression	4.03 (2.08–7.80)	2.84 (1.51–5.37)	2.49 (1.92–3.22)

N = 5086.

[*] Adjusted for age, sex, education level, ethnicity, body-mass index categories, alcohol consumption, physical activity and presence of major depression.

[†] OR not calculable (n = 1).

[‡] The test for linear trend was calculated by modeling the body mass index ordinal category as a continuous variable.