

# Trends of cigarette smoking and smokeless tobacco use among US firefighters and law enforcement personnel, 1992–2019

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## Abstract

**Background:** Previous studies indicate tobacco use was more prevalent among firefighters and law enforcement personnel than in the US adult population. Trends of smoking and smokeless tobacco (SLT) use among these first responders are unknown. We examined trends in current smoking and SLT use among US firefighters and law enforcement personnel and compared smoking and SLT use prevalence in firefighters and law enforcement personnel to US adults in non-first-responder occupations.

**Methods:** Trends of smoking and SLT use prevalence among firefighters, law enforcement personnel, and adults in other occupations were assessed by fitting joinpoint regression models using the 1992–2019 Tobacco Use Supplement to the Current Population Survey (TUS-CPS). We used multivariable logistic regression models adjusted for demographics to examine associations between occupation and smoking and SLT use status using the 2018–2019 TUS-CPS data. Analyses were conducted in 2021.

**Results:** From 1992 to 2019, the smoking prevalence declined overall (all  $p$ 's < 0.01). Though SLT use prevalence among adults in non-first-responder occupations declined (annual percentage change [APC] = -1.2%; 95% confidence interval [CI] = -1.7% to -0.7%), no changes were shown among firefighters and law enforcement personnel which suggests SLT use may be increasing among firefighters over time. In 2018–2019, firefighters (adjusted odds ratio [AOR] = 3.4; 95% CI = 1.7 to 6.8) and law enforcement personnel (AOR = 3.2; 95% CI = 2.1 to 4.7) were more likely than adults in non-first-responder occupations to use SLT.

**Conclusions:** While smoking prevalence declined overall, SLT use is higher among firefighters and law enforcement personnel and may be increasing over time among firefighters. Research should examine reasons for SLT use by first responders. Comprehensive tobacco policies and SLT-specific cessation programs are needed for first responders.

## KEYWORDS

firefighters, law enforcement, smokeless tobacco, smoking, tobacco

## 1 | INTRODUCTION

Firefighters and law enforcement personnel experience physical (e.g., fitness and endurance) and mental (e.g., alertness, occupational and traumatic stress) occupational demands<sup>1,2</sup> that can influence tobacco use.<sup>1–4</sup> A 2010–2011 national study indicated that despite lower rates of smoking among firefighters than the US adult population, firefighters had markedly higher rates of smokeless tobacco (SLT) use than other occupational groups: approximately 20.8% of firefighters used commercial tobacco, with 34.5% smoking cigarettes and 53.3% using SLT.<sup>2</sup> Although less is known about tobacco use among law enforcement personnel, a 2004–2009 cross-sectional study found a higher smoking proportion (16.7%) among police officers in Buffalo, New York than among the US adult population at that time (13.6%).<sup>5</sup> Taken together, these findings suggest disproportionate smoking and SLT use rates among firefighters and law enforcement personnel in comparison to the general US adult population.

However, more recent, nationally representative prevalence estimates and trends of smoking and SLT use among these first responder groups have not been examined. To begin to address this research gap, we used nationally representative data from the 1992–2019 Tobacco Use Supplement to the Current Population Survey (TUS-CPS) to examine prevalence trends of smoking and SLT use among US firefighters and law enforcement personnel. We also examined the 2018–2019 prevalence of smoking and SLT use among these two first responder groups compared to those of US adults in other occupations to assess whether and the extent to which occupational differences in smoking and SLT use exist in the most recent data collection. Findings from this study inform tobacco prevention and cessation efforts serving firefighters and law enforcement personnel in the United States.

## 2 | METHODS

### 2.1 | Study population

TUS-CPS is a national, cross-sectional survey comprising of approximately 240,000 civilian, non-institutionalized adults per cycle who completed telephone or in-person interviews. The 1992–2019 TUS-CPS includes national, state, and substate data on tobacco use behaviors, attitudes, and policies.<sup>6</sup> This study used de-identified data from self-respondents, which does not require review or approval from the Institutional Review Board per National Institutes of Health policy and 45 CFR 46. The self-respondent response rate ranged from 74.5% to 86.9% for the TUS-CPS data collection cycles completed from 1995 to 2019. The self-respondent response rate for the 1992–1993 data collection cycle has not been reported.<sup>6</sup>

We identified firefighters and law enforcement personnel using the U.S. Census Bureau's Industry and Occupation Indexes.<sup>7</sup> Law enforcement personnel included police officers, sheriffs, bailiffs, detectives, correctional officers and jailers. U.S. adults in "other occupations" characterized respondents employed in occupations

other than as a first responder (i.e., firefighters, law enforcement personnel, lifeguards including recreational and protective service workers, paramedics, ambulance drivers, and emergency medical technicians) or military personnel since these occupations have similar duties to those of firefighters and law enforcement personnel.<sup>8,9</sup>

### 2.2 | Measures

Demographic characteristics including age (categorized into 18–30, 31–45,  $\geq 46$  years old), gender (male and female), race/ethnicity (categorized into non-Hispanic White, non-Hispanic Black, Hispanic, and non-Hispanic other race), education (categorized into  $\leq$ high school, and  $\geq$ some college), and family income (categorized into  $<$ \$50,000,  $\geq$ \$50,000, missing) were assessed. Respondents were characterized as current smokers (vs. non-smokers) if they smoked  $\geq 100$  cigarettes in their lifetime and currently smoked cigarettes every day or some days. Respondents who currently used SLT including moist snuff or dip, spit or chew tobacco, or snus every day or some days were defined as current SLT users (vs. non-users).

### 2.3 | Statistical analysis

We conducted analyses in 2021 using balanced repeated replication in SUDAAN Release 11.0.1, RTI International, North Carolina to account for the complex sample design.<sup>10</sup> We created new replicate weights for pooled analyses across all survey waves by extending the methods described by Liu<sup>10</sup> from two to three sample design periods.<sup>11</sup>

We assessed unadjusted trends by fitting joinpoint regression models using the Joinpoint Regression Program, version 4.8.0.1,<sup>12</sup> Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute, Maryland. We chose log-linear models, grid search modeling, a minimum of two observations from a joinpoint to either end of the data, and a minimum of two observations between two joinpoints. We used the permutation test model selection method with an overall significance level 0.05 and 4499 randomly permuted data sets. Additionally, we used 2018–2019 TUS-CPS data to first examine associations between occupation and each type of tobacco use (i.e., smoking and SLT use) in separate, unadjusted logistic regression models. We then used multivariable logistic regression models adjusted for age, gender, race/ethnicity, education, and family income to examine associations between occupation and each type of tobacco use (i.e., smoking and SLT use) in 2018–2019.

## 3 | RESULTS

The analytical sample included  $n = 1991$  firefighters,  $n = 7808$  law enforcement personnel and  $n = 1,133,593$  US adults in other occupations. Table 1 presents respondent demographic characteristics by

**TABLE 1** Respondent demographic characteristics by occupation, combined data from tobacco use supplement of the current population survey, 1992–2019 (N = 1,143,392)

Demographic characteristics	Firefighters		Law enforcement personnel		Other occupation	
	N	%	N	%	N	%
Age						
18–30	475	23.9	1994	25.5	259,916	22.9
31–45	1073	53.9	3753	48.1	434,638	38.3
46+	443	22.3	2061	26.4	439,039	38.7
Gender						
Male	1900	95.4	6298	80.7	548,038	48.3
Female	91	4.6	1510	19.3	585,555	51.7
Race/ethnicity						
Hispanic	119	6.0	609	7.8	100,862	8.9
Non-Hispanic White	1648	82.8	5908	75.7	875,977	77.3
Non-Hispanic Black	144	7.2	1039	13.3	98,388	8.7
Non-Hispanic Other	80	4.0	252	3.2	58,366	5.1
Education						
≤ high school	536	26.9	2176	27.9	444,601	39.2
≥ some college	1455	73.1	5632	72.1	688,992	60.8
Family Income						
< \$50,000	637	32.0	3104	39.8	540,495	47.7
≥ \$50,000	1200	60.3	4118	52.7	490,562	43.3
Missing	154	7.7	586	7.5	102,536	9.0

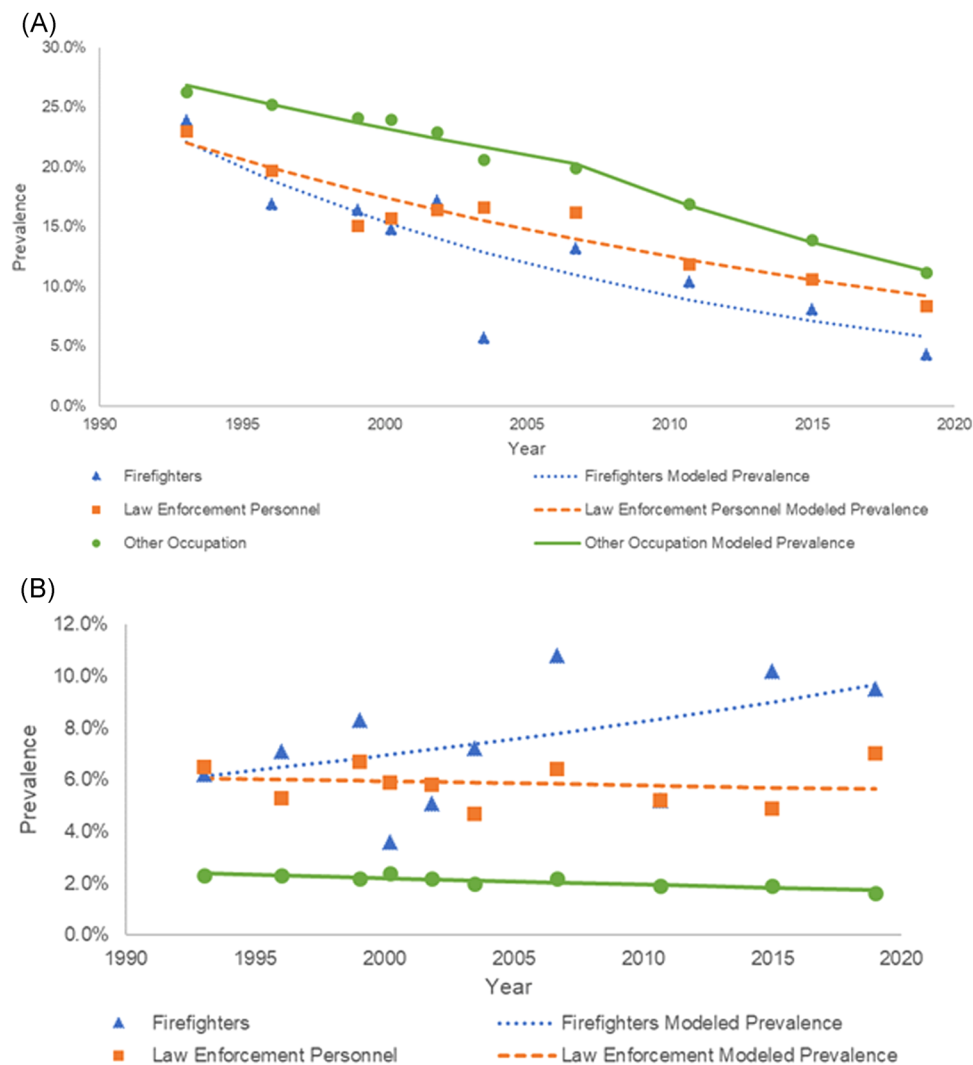
occupation. From 1992 to 2019, the smoking prevalence among firefighters and law enforcement personnel declined at a  $-5.0\%$  (95% confidence interval [CI] =  $-7.7\%$  to  $-2.3\%$ ) and  $-3.3\%$  (95% CI =  $-4.3\%$  to  $-2.3\%$ ) annual percentage change (APC), respectively. The smoking prevalence among US adults in other occupations declined at a  $-2.0\%$  APC (95% CI =  $-2.9\%$  to  $-1.2\%$ ) from 1993 to 2007 and at a  $-4.6\%$  APC (95% CI =  $-6.2\%$  to  $-3.0\%$ ) from 2007 to 2019 (Figure 1A). The prevalence of SLT use among US adults in other occupations declined at a  $-1.2\%$  APC (95% CI =  $-1.7\%$  to  $-0.7\%$ ) from 1992 to 2019, while no trend changes occurred for firefighters (APC =  $1.8\%$ ; 95% CI =  $-0.9\%$  to  $4.4\%$ ) and law enforcement personnel (APC =  $-0.3\%$ ; 95% CI =  $-1.5\%$  to  $1.0\%$ ) (Figure 1B).

In 2018–2019, unadjusted logistic regression models showed that firefighters (odds ratio [OR] = 6.4; 95% CI = 3.3 to 12.4) and law enforcement personnel (OR = 4.6; 95% CI = 3.1 to 6.7) were more likely to use SLT, while the prevalence of smoking was lower among firefighters (OR = 0.4; 95% CI = 0.1 to 1.0) but not law enforcement personnel (OR = 0.7; 95% CI = 0.5 to 1.0) compared with US adults in other occupations. In adjusted logistic regression models, firefighters (adjusted OR [AOR] = 3.4; 95% CI = 1.7 to 6.8) and law enforcement personnel (AOR = 3.2; 95% CI = 2.1 to 4.7) were approximately three times more likely to use SLT than US adults in other occupations, and no differences were found in smoking prevalence across occupations.

## 4 | DISCUSSION

While smoking prevalence has declined overall, the prevalence of SLT use is substantially higher among firefighters and law enforcement personnel and may be increasing over time among firefighters. Our findings are consistent with prior studies that found high rates of SLT use among firefighters.<sup>2,13</sup> These findings may be due in part to several reasons. Joining the fire service has been found to be a risk factor for late-age SLT use initiation.<sup>14</sup> Initiating SLT use may be related to the strenuous occupational demands of the fire service<sup>1,2</sup> or to previously reported tobacco use associations with depressive symptoms<sup>2</sup> and anxiety disorder<sup>3</sup> among firefighters. Firefighters have also expressed that some may use SLT as an alternative to cigarettes given their concerns about the health risks of smoking and the fire service's departmental smoking restrictions.<sup>8</sup>

Given firefighters' and law enforcement personnel's exposure to occupational health hazards, modifying the anti-smoking culture<sup>8</sup> to include SLT and other tobacco products may be crucial to reducing the additional harms presented by commercial tobacco use on the health of firefighters and law enforcement personnel. Including SLT use in state and local policies such as smoking restrictions to serve as a firefighter or police officer,<sup>15,16</sup> and while on duty,<sup>17</sup> and smoking bans in vehicles and facilities<sup>18</sup> may be effective. Tobacco prevention and cessation efforts targeting firefighters and law enforcement



**FIGURE 1** Trends in cigarette smoking and smokeless tobacco use prevalence by occupation among US firefighters, law enforcement personnel, and adults in other occupations, 1992–2019 Tobacco Use Supplement to the Current Population Survey: (A) cigarette smoking prevalence trends, (B) smokeless tobacco use prevalence trends

personnel may also greatly benefit from SLT-specific cessation interventions and health education messaging about the health and addictive risks of SLT similar to cigarettes. Additionally, given smoking and SLT use rates are substantially higher among male (smoking 13.2%; SLT use 10.5%) than female (smoking: 1.9%; SLT use: 1.2%) firefighters,<sup>2,4</sup> future studies should examine the role of gender in the prevalence trends of smoking and SLT use among firefighters and law enforcement personnel.

#### 4.1 | Limitations

This analysis has a few limitations. Current smoking and SLT use were self-reported which may be subject to recall errors. Additionally, we were unable to examine prevalence trends of dual-use among firefighters and law enforcement personnel due to small sample sizes.

## 5 | CONCLUSIONS

The prevalence of SLT use is markedly higher among firefighters and law enforcement personnel than the general US adult population, and importantly, may be increasing over time among firefighters. Comprehensive tobacco policies that include SLT for the fire and law enforcement services may be crucial to curbing tobacco use among these first responder groups. Future research is needed to understand firefighters' and law enforcement personnel's reasons for using SLT to inform appropriate prevention and cessation interventions.

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## CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

## DISCLOSURE BY AJIM EDITOR OF RECORD

Leena Nylander-French declares that she has no conflict of interest in the review and publication decision regarding this article.

## AUTHOR CONTRIBUTIONS

Lilianna Phan participated in the drafting of the work; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Timothy S. McNeel participated in the analysis of data for the work; revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Bambi Jewett participated in the revising of the work critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Katherine Moose participated in the conception of the work; critical revisions for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. Kelvin Choi participated in all aspects of the work, including: conception, acquisition, and interpretation of data; critical revisions for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in TUS-CPS Questionnaires and Data Files at <https://cancercontrol.cancer.gov/brp/tcrb/tus-cps/questionnaires-data>.

## ETHICS APPROVAL AND INFORMED CONSENT

This study used public-use data sets from the 1992-2019 Tobacco Use Supplement to the Current Population Survey. We conducted secondary data analysis using de-identified data from self-respondents, which does not require review or approval from the Institutional Review Board per National Institutes of Health policy and 45 CFR 46.

## DISCLAIMER

The content is solely the responsibility of the authors. Opinions and comments expressed in this articles belongs to the authors and do not necessarily reflect those of the U.S. Government, Department of Health and Human Services, National Institutes of Health, and

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