

Relationship of Trauma Exposure and PTSD to Cigarette Smoking Prevalence, Frequency, and Quantity: Data From a Nationally Representative Sample of U.S. Adults

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Individuals with Post-Traumatic Stress Disorder (PTSD) smoke cigarettes at much higher prevalences than the general population. Less is known about PTSD and other smoking behaviors (e.g., smoking quantity and frequency) or about smoking among individuals who experience trauma. **Objective:** To examine differences in cigarette smoking behaviors among adults in the United States (a) with no exposure to trauma or PTSD, (b) with trauma but no PTSD, and (c) with PTSD. **Methods:** Data came from Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions-II (NESARC-II, 2004–2005) and included demographics, PTSD diagnoses, traumatic events, and smoking behaviors. Odds ratios and group differences in smoking prevalence and behaviors based on PTSD diagnoses and exposure to traumatic experiences were calculated. **Results:** Traumatic events and PTSD diagnoses were both associated with greater smoking prevalences than persons without trauma or PTSD. Individuals with PTSD who smoke were more likely to report daily smoking than those without PTSD who smoke (Cohen's $d = 0.19$). Cigarette users with either trauma or PTSD smoked more cigarettes per day than cigarette users without trauma or PTSD (Cohen's $d = 0.35$). US adults with trauma exposure or PTSD have higher smoking prevalences and more intense smoking behaviors than those without PTSD or trauma. **Conclusion:** Trauma or PTSD may each serve as a clinical indicator of increased risk of cigarette smoking-related health problems and prompt the implementation of targeted interventions to reduce the harms of smoking.

Clinical Impact Statement

This study found that U.S. adults with trauma (and no diagnosis of PTSD), in addition to adults with PTSD, have higher cigarette smoking prevalences and heavier smoking behaviors (i.e., greater smoking frequency and quantity) than adults without trauma or PTSD. Trauma exposure is prevalent among U.S. adults, making individuals with trauma a large and underresearched disparity group related to cigarette smoking. Continued efforts are needed to reduce cigarette use among people with PTSD and extending efforts to reduce smoking to include people with trauma exposure may be critical for making advances in public health related to cigarettes.

Keywords: trauma, PTSD, smoking behaviors, epidemiology, comorbidity

Cigarette smoking is the leading preventable cause of morbidity and mortality in the United States, and 21 million deaths in the

United States were related to smoking over the past 50 years (U.S. Department of Health and Human Services, 2014, 2020). The U.S. adult smoking prevalence has declined from 42.4% in 1965 (Garrett et al., 2011) to 13.7% in 2018 (Creamer et al., 2019). However, this decrease is not represented among those with psychiatric disorders such as posttraumatic stress disorder (PTSD).

Lasser et al. (2000)'s landmark epidemiologic study provides a commonly used estimate for smoking prevalence among those with PTSD, which at 44.6% was double the smoking prevalence among U.S. adults (22%) at the time. A few years later, Fu et al.'s (2007) review suggested smoking prevalences among those with PTSD ranging from 34% to 86%. Recent reviews estimate the smoking prevalence among those with PTSD to be between 27%

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and 40% (Kearns et al., 2018; Pericot-Valverde et al., 2018). There remains a consistent pattern of higher smoking prevalences for persons with PTSD.

While there is a clear relationship between a diagnosis of PTSD and a higher cigarette smoking prevalence, fewer studies have examined PTSD and smoking behaviors beyond prevalence (e.g., smoking quantity and frequency). Greater PTSD symptomology has been associated with heavier smoking (in comparison to no or light-moderate smoking; Beckham et al., 1997; Bergman et al., 2019). Exploring differences in other smoking-related variables (e.g., smoking quantity [cigarettes per day, CPD] and smoking frequency) by PTSD status may provide additional information on smoking-related variables that can be targeted to reduce smoking prevalence among those with PTSD.

A necessary criterion for a diagnosis of PTSD is the experience of trauma. However, not all who experience trauma meet full criteria for a diagnosis of PTSD. The lifetime prevalence of trauma exposure among community U.S. residents is estimated to be as high as 80% (Breslau, 2009) in comparison to a lifetime PTSD prevalence of 6.8% among U.S. adults (Kessler et al., 2005); a 10:1 ratio suggesting that people with trauma exposure who do not meet PTSD criteria represent a large group that has not received as much attention in smoking research. Some research suggests a relationship between trauma and greater odds or greater severity of nicotine dependence (see Segal et al., 2017 for a review). Less is known about the relationship between trauma exposure and smoking prevalence, CPD, or smoking frequency. Examining how smoking prevalence and smoking-related behaviors vary for adults with trauma who do not meet criteria for PTSD would help to clarify whether more attention should be allocated to studying and treating smoking among people with trauma. Furthermore, understanding how smoking behaviors vary specifically by trauma type may help identify trauma-exposed individuals at increased risk of developing smoking-related health problems. Overall, further research on smoking behaviors for persons with trauma versus PTSD will help determine who should be targeted for efforts to reduce the harms of cigarette use.

It is established that PTSD is related to a higher prevalence of cigarette smoking. The current study used epidemiological data from the U.S. general adult population to extend our knowledge by examining trauma in comparison to both PTSD and no trauma, and smoking frequency and CPD in addition to smoking prevalence. This study had two primary aims: The first aim was to examine the differences in smoking prevalence among three mutually exclusive groups: (a) persons without trauma or a PTSD diagnosis, (b) persons with trauma but no PTSD diagnosis, and (c) persons with trauma and a PTSD diagnosis. It was hypothesized that the smoking prevalence would be highest among those with PTSD, followed by those with exposure to trauma (but without PTSD). The second aim of the study was to examine smoking behaviors (smoking frequency and CPD) among the three mutually exclusive groups listed above (i.e., persons without trauma or a PTSD diagnosis, persons with trauma but no PTSD diagnosis, and persons with trauma and a PTSD diagnosis). It was hypothesized that both and persons with trauma exposure and PTSD, and persons with trauma exposure and no PTSD would report smoking more cigarettes and smoking more frequently than persons without trauma or PTSD. The exploratory aims of the study were to

twofold: (a) to examine the differences in smoking prevalence, smoking frequency, and CPD among persons with exposure to trauma (with and without PTSD diagnosis) versus no trauma exposure, and (b) to describe smoking prevalence, smoking frequency, and CPD for distinct trauma types (e.g., sexual assault, combat exposure, natural disasters).

Method

Data Source and Population

Data came from Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions-II (NESARC-II), conducted by the National Institute of Alcohol Abuse and Alcoholism (NIAAA). Data were collected in 2004–2005 from a sample of 34,653 U.S. adults age 18 and older from Washington, DC, and all 50 states. Information on the NESARC-II can be found in previous publications (e.g., Grant et al., 2003).

Materials and Methods

Demographics

Respondents reported their age, gender, race, ethnicity, marital status, and education.

Smoking

Smoking Prevalence. Tobacco use prevalence, including cigarette use, and associated behaviors were assessed via the NIAAA Alcohol Use Disorder and Associated Disability Interview Schedule-*DSM-IV* Version (AUDADIS-IV; Grant & Dawson, 2006). While respondents were asked about all forms of tobacco, we limited analyses to current cigarette use which accounted for 90% of current tobacco use in the NESARC-II sample. Respondents were classified into one of three mutually exclusive cigarette smoking categories: (a) Current Smoking (i.e., reported 100 or more lifetime cigarettes and cigarette use within the past 12 months), (b) Former Smoking (i.e., reported 100 or more lifetime cigarettes and no cigarette use within the past 12 months), and (c) Never Smoking (i.e., reported fewer than 100 lifetime cigarettes and no current cigarette use).

Smoking Behaviors. Respondents who reported current cigarette smoking were asked to report the frequency of their cigarette use using the following categories: “Every day,” “5–6 days a week,” “3–4 days a week,” “1–2 days a week,” “2–3 days a month,” or “once a month or less”. Given that a substantial majority of people with current smoking reported daily cigarette smoking (87%), all respondents who reported using cigarettes every day were classified as having “daily smoking” and all other cigarette users were classified as having “non-daily smoking.” Respondents were also asked to specify the usual quantity of cigarettes smoked on the days that they smoked with an open response format (cigarettes per day [CPD]; range = 1–60).

Trauma

PTSD. PTSD symptoms were assessed via the AUDADIS-IV (Grant & Dawson, 2006). Wave 2 respondents who endorsed a threshold number of symptoms within the specific PTSD diagnosis

criteria were classified as having a lifetime diagnosis of PTSD at Wave 2.

Trauma Exposure. Respondents were asked to respond “yes/no” whether they ever experienced each of 27 individual experiences that could be endorsed as a trauma (i.e., Criterion A) for a PTSD diagnosis. The experiences were referred to as “extremely stressful events,” and included combat exposure, being kidnapped or held hostage, and being sexually abused. Our analyses only included only respondents who had directly experienced a traumatic event (i.e., did not report that the trauma was directly experienced by another person). These parameters resulted in analyses conducted on 17 types of traumatic experiences.

Data Analysis

Analyses were conducted using SAS to account for complex survey weights. Primary outcome comparisons were done across an independent variable labeled “trauma history,” which was composed of three mutually exclusive groups: (a) no trauma or PTSD diagnosis, (b) trauma and no PTSD diagnosis, and (c) trauma and a PTSD diagnosis. Between-groups differences in age, gender, race/ethnicity, marital status, and education were found across the three groups of interest (see Table 1). Odds ratios were adjusted to account for these differences (“no trauma” served as reference group). Effect sizes were estimated using Cohen’s *d* (Cohen, 2013).

Aim 1: Smoking Prevalence Among Persons by PTSD/Trauma History

The smoking prevalence for the NESARC Wave 2 sample was calculated using the three smoker categories outlined above (i.e., Current, Former, and Never Smoking). The number of respondents in each smoker category was calculated and consequently con-

verted to a percentage of the total Wave 2 sample. A chi-square analysis was performed with trauma history (no trauma, trauma without PTSD diagnosis, trauma and PTSD diagnosis) as a three-level independent variable to detect any associations between trauma history and the three smoking statuses. The Current Smoking and Former Smoking categories were then collapsed into a single “Ever Smoking” category to calculate the odds ratio of persons with or without trauma history exhibiting some versus no form of smoking behavior (i.e., Ever Smoking vs. Never Smoking).

Aim 2: Smoking Behaviors Among Those With Current Smoking by PTSD/trauma History

A chi-square analysis was performed on current smoking individuals with trauma history (no trauma, trauma without PTSD diagnosis, trauma and PTSD diagnosis) as a three-level independent variable to detect any associations between trauma history and smoking frequency (daily vs. nondaily smoking). An odds ratio was then calculated to determine if there were differences in frequency of smoking for current cigarette users with versus without a history of trauma. A *t* test was also conducted to compare CPD between those with trauma history and those without a trauma history. A generalized linear model was constructed to estimate the number of cigarettes smoked among those with trauma (with or without PTSD) versus no trauma.

Exploratory Analyses: Smoking Prevalence and Behaviors by Trauma History and Trauma Type

A chi-square analysis was conducted to examine difference in smoking prevalence between those with trauma exposure (with or without PTSD) and those without trauma exposure. Individ-

Table 1

Demographics for the Full Sample and for Persons With No Trauma Exposure or PTSD, Persons With Trauma Exposure But No PTSD, and Persons With PTSD (NESARC Wave 2, n = 34,490)

Characteristics	Full Sample		No Trauma or PTSD		Trauma (No PTSD)		PTSD	
	<i>N</i> (<i>M</i>)	% (<i>SD</i>)	<i>N</i> (<i>M</i>)	% (<i>SD</i>)	<i>N</i> (<i>M</i>)	% (<i>SD</i>)	<i>N</i> (<i>M</i>)	% (<i>SD</i>)
Age	(49.0)	(17.29)	(47.6)	(17.9)	(50.45)	(17.0)	(45.96)	(14.6)
Gender								
Male	14493	42.0	4854	36.1	9022	47.9	617	27.8
Female	19997	58.0	8607	63.9	9791	52.1	1599	72.2
Race/Ethnicity								
White, NH	10080	58.2	7425	55.2	11393	60.6	1262	57.0
Black, NH	6561	19.0	2616	19.4	3468	18.4	477	21.5
Hispanic	6324	18.3	2795	20.8	3150	16.7	379	17.1
Other	1525	4.4	625	4.6	802	4.3	98	4.4
Marital Status								
Married or living with someone as married	18792	54.5	7427	55.2	10359	55.1	1006	45.4
Widowed, divorced, separated	9096	26.4	3153	23.4	5177	27.5	766	34.6
Never married	6602	19.1	2881	21.4	3277	17.4	444	20.0
Education								
Some high school	5475	15.9	2415	18.0	2662	14.1	398	18.0
High school or equivalent	16776	48.6	6466	48.0	9159	48.7	1151	51.9
Associates degree or higher	12239	35.5	4580	34.0	6992	37.2	667	30.1
Totals	34,490	100	13,461	39.0	18,813	54.6	2216	6.4

Note. NESARC = National Epidemiological Survey of Alcohol and Related Conditions; NH = Non-Hispanic; PTSD = Posttraumatic Stress Disorder. Significant differences among the trauma/PTSD groups were found for all demographic variables listed in Table 1 (*ps* < .001).

ual chi-square analyses were then conducted for each trauma type to examine associations between trauma and smoking frequency (daily vs. nondaily smoking) among those with current smoking. An odds ratio was then calculated to determine if adults with exposure to trauma smoke more or less frequently than those without exposure to trauma. A *t* test was also conducted to compare the CPD between those with exposure to trauma and those without it. Analyses were limited to associations of smoking variables within each traumatic experience. Smoking variables were not compared across the different types of trauma (e.g., persons reporting combat exposure vs. persons reporting sexual assault).

Results

Demographic Characteristics

The full sample was on average 49 ($SD = 17.29$) years old and the majority were non-Hispanic (NH) White (58.2%) and female (58%). Of the 34,490 respondents, 2,216 (6.4%) reported a current diagnosis of PTSD, and 18,813 (54.5%) reported at least one traumatic experience. See Table 1 for demographic and smoking information by presence of trauma and lifetime PTSD diagnosis. All demographic variables significantly differed by PTSD and trauma group ($ps < 0.001$).

Aim 1: Smoking Prevalence Among Persons by Trauma/PTSD History

The smoking prevalence for the full sample was 24.5%; 24.7% of respondents reported former smoking and 50.8% reported never smoking. See Table 2 for smoking prevalence by trauma history. After adjustment for demographics, there was an association between trauma both without and with PTSD diagnosis and smoking status ($p < .001$). Persons with a history of trauma without PTSD were almost twice as likely to report current smoking than persons without a history of trauma (adjusted Odds Ratio [aOR] = 1.71, 95% Confidence Interval

[CI] = 1.65 – 1.76; $d = .30$). Persons with a history of trauma and PTSD were over three times more likely to report current smoking than persons without a history of trauma (aOR = 3.46, 95% CI = 3.25 – 3.70; $d = .68$).

Aim 2: Smoking Behaviors Among Persons by Trauma/PTSD History

There was an association between trauma history and smoking frequency ($p = .004$; see Table 2). Persons with a PTSD diagnosis were almost one and a half times more likely to smoke on a daily basis than those without a PTSD diagnosis after adjusting for demographics (aOR) = 1.42, 95% CI = 1.21–1.68; $d = .19$). Odds of daily (vs. nondaily) smoking for those with trauma without PTSD versus no trauma were similar (aOR = 1.04, 95% CI = 0.94–1.14).

On average, after adjusting for demographics, both cigarette using adults with trauma and a PTSD diagnosis ($M = 18.1$, 95% CI = 17.4–18.8) and cigarette using adults with trauma but without a PTSD diagnosis ($M = 15.7$, 95% CI = 15.4–16.0) smoked more cigarettes per day than cigarette using adults without any history of trauma ($M = 14.5$, 95% CI = 14.1–14.9; $p < .0001$). The overall effect sizes for all mean differences were moderate ($d = 0.35$).

Exploratory Aims: Smoking Prevalence and Behaviors by Trauma History and Type

The smoking prevalence among those with exposure to trauma (with or without a diagnosis of PTSD) was 26.2% whereas the smoking prevalence among those without exposure to trauma was 18.2%, ($p < .0001$). Persons exposed to a traumatic event were almost one and a half times more likely to have ever smoked than persons never exposed to trauma (aOR = 1.40, 95% CI = 1.36–1.45). Differences in smoking frequency and CPD were seen among persons who were exposed to trauma (vs. not exposed to trauma), and these differences varied by trauma type (see Table 3 for a complete list).

Table 2

Cigarette Smoking Prevalence, Frequency, and Quantity by Trauma and PTSD History

Smoking prevalence and behaviors	Full sample		No trauma or PTSD		Trauma (No PTSD)		PTSD		Exposure to trauma ³	
	N (M)	% [CI]	N (M)	% [CI]	N (M)	% [CI]	N (M)	% [CI]	N (M)	% [CI]
Smoking Status										
Current	7922	23.0	2451	18.2	4661	24.7	810	36.6	5471	26.0
Former	8325	24.1	2742	20.4	5091	28.1	492	22.2	5583	26.6
Never	18243	52.9	8268	61.4	9061	48.2	914	41.2	9975	47.4
Total	34490	100	13,461	39.0	18,813	54.6	2216	5.8	21029	60.9
Smoking Frequency										
Daily	6126	86.7	1850	85.7	3598	87.0	678	88.2	4276	87.2
Non-Daily	938	13.3	309	14.3	538	13.0	91	11.8	629	12.8
Total	7064	100	2159	30.6	4136	58.6	769	10.8	4905	69.4
Cigarettes smoked ^{1, 2}	16.11	[15.6–16.6]	14.52	[14.1–14.9]	15.71	[15.4–16.0]	18.11	[17.4–18.8]	16.6	[16.3–16.8]

Note. PTSD = Posttraumatic Stress Disorder; N = Frequency; (M) = Mean; % = Percentage, [CI] = 95% Confidence Interval. Frequencies reported by smoking status (Row 1) include the full sample. Frequencies reported by smoking frequency (Row 2) and cigarettes smoked on smoking days (Row 3) only include respondents with current cigarette smoking. Significant differences among the trauma/PTSD groups were found for all variables listed in Table 2 ($ps < .001$).

¹ Cigarettes smoked on smoking days; reported as Mean, [95% Confidence Interval]. ² Adjusted for gender, age, marital status, income, race/ethnicity, education level. ³ Exposure to trauma group combines the Trauma–No PTSD and PTSD groups for comparison to the No trauma or PTSD group.

Table 3
Smoking Prevalence Frequency, and Quantity by Trauma Type (NESARC Wave 2, n = 34,490)

Trauma Type	Full Sample		Smoking status						Smoking Frequency				Cigarettes smoked ¹		
			Current		Former		Never		Daily		Nondaily				
	N	%	N	%	N	%	N	%	N	%	N	%	M	95% CI	
Combat Exposure ^{2,3}															
No	33031	95.4	7534	94.9	7658	91.4	17839	97.7	5850	95.3	901	96.3	15.8	15.6–16.0	
Yes	1438	4.6	385	15.0	661	8.6	392	2.3	273	4.7	37	3.7	19.7	18.7–20.8	
Peacekeeper/Relief Work ³															
No	34079	98.9	7818	98.7	8178	98.3	18083	99.2	6051	98.8	928	98.7	16.0	15.8–16.2	
Yes	388	1.1	102	1.3	141	1.7	145	0.8	73	1.2	10	1.3	18.1	16.4–19.8	
Civilian in War Zone ^{2,3}															
No	33811	98.0	7804	98.5	8135	97.7	17872	97.9	6044	98.6	918	97.6	16.0	15.8–16.2	
Yes	657	2.0	115	1.5	185	2.3	357	2.1	79	1.4	20	2.4	15.1	13.9–16.2	
Refugee															
No	34046	98.7	7863	99.2	8228	99.0	17955	98.4	6081	99.2	929	98.5	16.0	15.8–16.2	
Yes	428	1.3	56	0.8	95	1.0	227	1.6	43	0.8	9	1.5	14.1	14.1–14.1	
Serious Accident ³															
No	28903	83.4	6308	78.9	6780	81.3	15815	86.5	4892	79.3	754	79.9	15.6	15.4–15.8	
Yes	5552	16.6	1606	21.1	1537	16.7	2409	13.5	1224	20.7	184	20.1	17.5	17.1–17.9	
Serious Illness ^{2,3}															
No	28507	82.9	6494	82.6	6351	76.3	15662	86.2	4972	81.7	803	86.8	15.6	15.4–15.8	
Yes	5938	17.1	1421	17.4	1963	23.7	2554	13.8	1149	18.3	134	13.2	17.7	17.2–18.2	
Natural Disaster ^{2,3}															
No	29039	84.2	6552	82.6	6836	82.3	15651	86.0	5030	82.0	794	84.3	16.0	15.8–16.2	
Yes	5416	15.8	1363	17.4	1482	17.7	2571	14.0	1091	18.0	144	15.7	15.9	15.4–16.4	
Sexual Assault															
No	31087	91.3	6803	87.4	7540	91.6	16744	92.9	5176	86.1	800	85.6	16.0	15.8–16.2	
Yes	3328	8.7	1102	12.6	768	8.4	1458	7.1	935	13.9	137	14.4	15.9	15.4–16.4	
Physical Abuse (C) ^{2,3}															
No	33121	96.5	7393	94.2	7981	69.6	17747	97.5	5676	93.4	889	96.0	15.9	15.7–16.1	
Yes	1320	3.5	521	5.8	330	3.4	469	2.5	444	6.6	49	4.0	17.5	16.7–18.3	
Neglect (C)															
No	33235	96.9	7493	95.4	8025	97.0	17717	97.6	5770	95.1	893	95.2	16.0	15.8–16.2	
Yes	1195	3.1	415	4.6	284	3.0	496	2.4	345	4.9	44	4.8	16.2	15.7–16.8	
Witnessed Violence (C) ^{2,3}															
No	30693	89.9	6728	85.6	7394	89.8	16571	92.1	5148	84.6	815	87.9	15.8	15.6–16.1	
Yes	3741	10.1	1185	14.4	915	10.2	1641	7.9	971	15.4	123	12.1	16.9	16.5–17.3	
Abused (Spouse) ^{2,3}															
No	31828	93.9	6684	88.9	7763	94.9	17211	95.7	5211	87.1	842	91.3	15.9	15.7–16.1	
Yes	2573	6.1	1028	11.1	546	5.1	999	4.3	907	12.9	96	8.7	16.5	16.0–17.1	
Abused (Someone Else) ^{2,3}															
No	31828	92.3	6929	87.5	7659	91.9	17240	94.7	5375	97.7	800	86.0	15.9	15.7–16.1	
Yes	2602	7.7	979	12.5	652	8.1	971	5.3	740	12.3	137	14.0	16.7	16.1–17.3	
Kidnapped/Hostage/POW ²															
No	34125	99.2	7794	98.7	8242	99.2	18089	99.3	6018	98.5	923	98.8	16.0	15.8–16.2	
Yes	326	0.8	122	1.3	73	0.8	131	0.7	104	1.5	15	1.2	16.7	15.1–18.3	
Stalked ³															
No	32322	94.6	7211	92.3	7926	95.9	17185	95.0	5534	91.4	847	91.8	16.0	15.8–16.2	
Yes	2102	5.4	694	7.7	386	4.1	1022	5.0	579	8.6	90	8.2	15.7	15.0–16.4	
Mugged/Threatened ³															
No	30242	88.2	6478	82.6	7276	88.1	16488	90.9	4981	82.0	765	82.5	15.8	15.6–16.1	
Yes	4205	11.8	1434	17.4	1042	11.9	1729	9.1	1137	18.0	173	17.5	16.7	16.3–17.1	
Witnessed Harm or Death ³															
No	26430	75.9	5588	69.8	6091	80.5	14751	80.5	4399	71.0	659	70.8	15.6	15.4–15.8	
Yes	8003	24.1	2325	30.2	2221	27.9	3457	19.5	1721	29.0	279	29.2	17.0	16.7–17.3	

Note. (C): Child; NESARC = National Epidemiological Survey of Alcohol and Related Conditions; POW = Prisoner of War; N = Frequency; (M) = Mean; % = Percentage; [CI] = Confidence Interval. (C) denotes that the traumatic exposure having occurred during childhood. Significant differences in smoking status were found for all trauma types listed in Table 3 (*ps* < .0001).

¹ Cigarettes smoked on smoking days; reported as Mean and 95% Confidence Interval. ² Significant difference in smoking frequency (*ps* < .05). ³ Significant different in mean number of cigarettes smoked on smoking days (*ps* < .05).

For example, cigarette using adults who reported spousal abuse smoked more frequently (*p* < .05) and smoked more CPD (*p* < .05) than cigarette using adults who did not report spousal abuse. In contrast, there was no difference in smoking behaviors

among persons with or without childhood neglect. See Table 3 for smoking behaviors by trauma exposure.

Among trauma-exposed adults, 87.2% reported using cigarettes smoked daily, compared to 85.7% of non-trauma-exposed adults

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using cigarettes ($p < .05$). In adjusted analyses, trauma-exposed individuals with current cigarette use, smoked more CPD ($M = 16.6$, 95% CI = 16.3–16.6) than those without trauma exposure ($M = 14.7$, 95% CI = 14.4–15.0; $p < .0001$).

Discussion

This study examined differences in cigarette smoking prevalences and smoking behaviors (e.g., CPD and frequency) for persons with and without PTSD and trauma in an epidemiologic sample from the U.S. adult population. The smoking prevalences among both persons with trauma (and no PTSD) and persons with trauma and PTSD were higher than the prevalence among persons without trauma or PTSD. Furthermore, cigarette using adults with trauma and cigarette using adults with PTSD smoked more CPD and smoked more frequently than cigarette using adults without PTSD or trauma. We also found that exposure to a traumatic event (vs. no trauma exposure) was associated with increased smoking behaviors (CPD, smoking frequency) and that specific trauma types were associated with higher smoking prevalence.

Our results confirmed other research suggesting higher smoking prevalences among persons with PTSD. The 35% smoking prevalence found for persons with PTSD in this study fell between the 34%–85% range estimated by Fu et al. (2007) and the 30–40% prevalence estimated by Kearns et al. (2018). Beyond confirming the higher smoking prevalence for people with PTSD, this study importantly extended previous work to examine smoking among people with trauma. Significant smoking prevalence differences were observed for persons directly exposed to traumatic events in comparison to persons without exposure to trauma, suggesting that a traumatic experience, even without meeting criteria for PTSD, is related to cigarette smoking.

Though the prevalence of PTSD among U.S. adults was less than 10%, the prevalence of direct exposure to trauma was over 50%, making individuals with trauma exposure a larger disparity group related to cigarette smoking than individuals with PTSD. Feldner and colleagues (2007) found that smoking was more directly related to a traumatic event and less to the onset of specific PTSD symptoms highlighting, along with our results, the need for additional research among people with trauma. Focusing research and interventions related to smoking only toward individuals who meet criteria for a PTSD diagnosis may overlook a much larger subset of the high-risk population vulnerable to the harmful consequences of cigarette use.

Comparisons among specific traumatic events suggest that smoking prevalence varies based on trauma type, suggesting that the nature of the traumatic event may link to smoking prevalence. For example, the proportion of ever-smoking (45.3%) to never-smoking (54.7%) among persons who have directly suffered from spousal abuse was close to 1:1, whereas the proportion of ever-smoking (32.1%) to never-smoking (67.9%) among persons who have directly experienced a serious accident was 1:2. Common PTSD screening tools (e.g., PCL-5, TELQ; Blevins et al., 2015; Gray et al., 2004) capture the fact that trauma has been experienced along with the type of trauma, and clinicians could use that information to assess smoking among higher-risk individuals, and discuss quit motivation and smoking cessation intervention options, regardless of PTSD diagnosis. Furthermore, longitudinal research that examines smoking before and after exposure to

trauma could provide insight into the impact specific traumas have on smoking and inform smoking-related prevention and intervention efforts.

Not only was there a higher proportion of people with current cigarette smoking among individuals with a PTSD diagnosis than among individuals without a PTSD diagnosis, but those with PTSD exhibited more intense smoking behaviors. CPD and frequency of smoking are both indicators of nicotine dependence (Frost-Pineda et al., 2014). Individuals with higher nicotine dependence experience greater craving to smoke and are less likely to engage in quit attempts in comparison to those with lower nicotine dependence (Dunbar et al., 2014; Messer et al., 2008, 2015) and smoking abstinence rates decrease as nicotine dependence increases (Fagerström et al., 2012). Our findings highlight the greater smoking behaviors (and therefore potential greater dependence and more difficulty quitting) exhibited by persons with PTSD and underscore the increased vulnerability of individuals with PTSD to the harmful consequences of smoking.

Differences in smoking behaviors were found between persons with and without exposure to a traumatic event, suggesting that, beyond a diagnosis of PTSD, directly experiencing trauma is associated with more intense smoking behaviors. While some existing research has examined exposure to trauma and nicotine dependence (Segal et al., 2017), few studies have examined other smoking behaviors in relation to trauma and the treatment implications of said associations. Because smoking behaviors (CPD and smoking frequency) were notably elevated, and are related to nicotine dependence, reducing these behaviors may benefit those with PTSD or trauma who smoke.

Several theories are relevant to help understand the relationship between PTSD/trauma and smoking. The self-medication hypothesis suggests that people who smoke rely on cigarettes to alleviate stress and other negative affective states (Feldner et al., 2007; Garey, Bakhshaie, et al., 2016; Parrott, 1993). Persons with PTSD experience trauma-specific symptoms alongside other day-to-day stressors, and may rely on smoking as a coping mechanism. For example, the more severe the trauma symptoms, the more individuals with PTSD reported looking to smoking to reduce their negative affect (Farris et al., 2014). Further, both negative affect reduction motives and boredom reduction motives for smoking indirectly mediated the effects of PTSD on nicotine dependence and cigarette consumption (Hruska et al., 2014; Mahaffey et al., 2016). Interestingly, the sequential effects of increased negative affect and affect-regulating smoking were seen distinctly among individuals who smoke and have exposure to trauma (regardless of PTSD diagnosis; Farris et al., 2014); a theoretical model of trauma and smoking not dependent on PTSD co-occurrence. Lifetime smoking is associated with the “Emotional Numbing” symptom cluster of PTSD (Greenberg et al., 2012). Individuals who are unable or not wanting to experience the full range of their emotions may use cigarettes to help cope with distress. Dysphoria (Garey et al., 2015) and perceived stress (Garey, Cheema, et al., 2016) may also partially explain the link between posttraumatic stress symptom severity and smoking-related cognitions (e.g., perceived barriers to smoking cessation, negative affect reduction). Together, negative affect states may play a role in the association between PTSD/trauma and smoking.

Other potential mechanisms of the relationship between PTSD/trauma and smoking include overlaps in the neurological systems impacted by smoking and PTSD/trauma and cue-induced cravings. Nicotine and PTSD both impact neurological circuitry involving pleasure pathways (e.g., dopamine and serotonin) and stress regulation (Fu et al., 2007). Fu et al. (2007) also reported that individuals who smoke and have PTSD, compared to individuals who smoke and do not have PTSD, exhibit more negative affect and stronger cravings for cigarettes during daily activities. The results of a meta-analysis of cue-reactivity in addiction research highlight the impact drug-related stimuli can have on self-reported craving and physiological responses in people who smoke (Carter & Tiffany, 1999). PTSD/trauma-related symptoms may be linked to thoughts of smoking and act as conditioned stimuli for smoking behaviors. For example, future research could use neuroimaging to examine neurological signs of cued stress and craving among adults who smoke with or without PTSD and trauma.

Our results have important clinical implications related to smoking cessation treatments for these higher-risk subgroups. Research on smoking cessation treatments for persons with PTSD is relatively limited but one area of smoking cessation research that has received attention is the integration of smoking cessation and PTSD treatment. When compared to specialized smoking cessation treatment alone, integrated treatment for smoking and PTSD resulted in greater prolonged abstinence from smoking (McFall et al., 2010). Lee et al. (2018) summarized that most integrated treatment approaches for both PTSD and smoking were superior to efforts to treat both problems separately, although some results were mixed. Gonzalez et al. (2017) found no difference between integrated treatment and smoking cessation treatments on PTSD symptoms, and Foa et al. (2017) found mixed results on the effects of integrated treatment versus smoking cessation treatment alone on smoking abstinence. There is a need for additional research into the efficacy of treatments for individuals with PTSD who use cigarettes.

Research on treatment models combining smoking cessation with treatment for trauma is sparser than for PTSD. In a review of 17 integrated treatment programs for persons with trauma and substance use disorders, Torchalla and colleagues (2012) included 2 studies on integrated treatment for smoking and PTSD and no study examined treatment for both smoking and exposure to trauma without a PTSD diagnosis. Smoking treatment for individuals with traumatic exposure alone is an area of treatment and research that appears largely unexplored and could lead to significant benefits for people with a trauma history who use cigarettes. Crisis intervention, intakes, and routine screenings are opportunities for clinicians to assess trauma history and consider smoking cessation as part of the treatment plan.

Our study presents with several limitations. First, our representative sample increased our data's generalizability to the U.S. adult population, but excluded certain subsets of people (e.g., hospital patients) to whom our results may not apply. The study only examined cigarette use and not other tobacco products (e.g., cigars, e-cigarettes). Due to the cross-sectional nature of NESARC's Wave 2 data, we were unable to examine temporal associations between smoking prevalence, smoking be-

haviors, and PTSD/traumatic exposure. The Wave 2 questionnaire assessed for a lifetime diagnosis of PTSD according to *DSM-IV* criteria. The conceptualization and criteria for a PTSD diagnosis have since changed with the implementation of the *DSM-5* (APA, 2013). PTSD's categorization shifted from an anxiety disorder to a "Trauma and Stressor-related Disorder," and definitions of trauma, PTSD symptoms, its criteria, and its specifiers were revised (Pai et al., 2017). Regardless of diagnostic criteria used, the PTSD group may not have captured respondents who met criteria for PTSD but were unaware. Also, the NESARC self-report method suggests respondent data could be affected by inconsistent recall or unwillingness to disclose information or diagnoses (e.g., PTSD). Respondents were likely more aware of being exposed to trauma, though they may not have consciously labeled it as such (e.g., a serious car accident could be considered a traumatic event to some but not everyone). Given that respondents in the PTSD group endorsed threshold criteria for lifetime diagnosis (thus possibly asymptomatic at survey completion), smoking behaviors and prevalence could not be analyzed within the context of a current (e.g., past 12 months) diagnosis of PTSD. Though the self-medication hypothesis suggests that trauma exposure/PTSD diagnosis leads individuals to smoke to alleviate stress, smoking may reduce an individual's ability to cope with traumas, placing them at higher risk of developing trauma/stress-related disorders.

Conclusions

Differences remain in smoking prevalence among U.S. adults with and without PTSD, suggesting that individuals with PTSD have not benefited equally from public health and clinical initiatives to reduce cigarette use in the general U.S. population. Furthermore, the association of traumatic experiences to greater smoking behaviors encourages further research into the effects of trauma on smoking behavior and cessation. Extending research on PTSD and smoking to include people with trauma exposure may benefit a large, vulnerable population in reducing the harmful consequences of cigarette use.

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