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Tobacco Product Use Among Adults — United States, 2013–2014

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While significant declines in cigarette smoking have occurred among U.S. adults during the past 5 decades, the use of emerging tobacco products* has increased in recent years (*1*–*3*). To estimate tobacco use among U.S. adults aged ≥18 years, CDC and the Food and Drug Administration (FDA) analyzed data from the 2013–2014 National Adult Tobacco Survey (NATS). During 2013–2014, 21.3% of U.S. adults used a tobacco product every day or some days, and 25.5% of U.S. adults used a tobacco product every day, some days, or rarely. Despite progress in reducing cigarette smoking, during 2013–2014, cigarettes remained the most commonly used tobacco product among adults. Young adults aged 18–24 years reported the highest prevalence of use of emerging tobacco products, including water pipes/hookahs and electronic cigarettes (e-cigarettes). Furthermore, racial/ethnic and sociodemographic differences in the use of any tobacco product were observed, with higher use reported among males; non-Hispanic whites, non-Hispanic blacks, and non-Hispanics of other races†; persons aged <45 years; persons living in the Midwest or South; persons with a General Educational Development (GED) certificate; persons who were single/never married/not living with a partner or divorced/separated/widowed; persons with annual household income <$20,000; and persons who were lesbian, gay, or bisexual (LGB). Population-level interventions that focus on all forms of tobacco product use, including tobacco price increases, high-impact anti-tobacco mass media campaigns, comprehensive smoke-free laws, and enhanced access to help quitting tobacco use, in conjunction with FDA regulation of tobacco products, are critical to reducing tobacco-related diseases and deaths in the United States.§

NATS is a stratified, random-digit–dialed landline and cellular telephone survey of noninstitutionalized U.S. adults aged ≥18 years. The 2013–2014 NATS included 75,233 respondents (70% landline, 30% cellular); the overall response rate was 36.1% (landline 47.6%, cellular 17.1%). Based on established conventions regarding patterns of tobacco product use (*3*), NATS questions used varying thresholds of lifetime use to separate established users from experimenters and nonusers. Four tobacco product types assessed in NATS had lifetime usage thresholds: cigarettes (≥100 cigarettes); cigars/cigarillos/filtered little cigars (≥50 times); regular pipes (≥50 times); and chewing tobacco/snuff/dip (≥20 times). Water pipes/hookahs, e-cigarettes, snus, and dissolvable tobacco products did not have usage thresholds. Respondents who met the respective thresholds for cigarettes, cigars/cigarillos/filtered little cigars,

* Emerging tobacco products are non-cigarette tobacco products that have gained increasing popularity and use within the U.S. market over the past decade.

† Three race/ethnic groups (American Indians/Alaska natives, non-Hispanic; Native Hawaiians/other Pacific Islanders, non-Hispanic; and persons of multiple race, non-Hispanic) were combined into one category of "other, non-Hispanic" because sample sizes were too small to provide statistically reliable estimates for the individual groups. Data are presented separately for non-Hispanic white, non-Hispanic black, non-Hispanic Asian, and Hispanic adults.

§ http://www.cdc.gov/tobacco/stateandcommunity/best_practices/index.htm?source=govdelivery.

INSIDE

Continuing Education examination available at http://www.cdc.gov/mmwr/cme/conted_info.html#weekly.

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regular pipes, and chewing tobacco/snuff/dip or who reported ever using water pipes/hookahs, e-cigarettes, snus, and dissolvable tobacco products, were then asked if they used each respective product at the time of the survey. With the exception of cigarettes, response options for frequency of use at the time of survey were "every day," "some days," "rarely," or "not at all"; "rarely" was not included as a response option for cigarettes.

Data were weighted to provide nationally representative estimates of prevalence and number of users. To assess the effect of occasional tobacco use on estimates of current tobacco use, two definitions were used for all tobacco product types (except cigarettes): 1) use every day or some days; and 2) use every day, some days, or rarely. Any tobacco product use was defined as use of at least one tobacco product type.[¶] Any combustible tobacco product use was defined as use of at least one of the following tobacco product types: cigarettes, cigars/cigarillos/filtered little cigars, regular pipes, or water pipes/hookahs. All smokeless tobacco products (chewing tobacco/snuff/dip, snus, and dissolvable tobacco products) were aggregated into a single category. Prevalence estimates were calculated overall and by sex, age, race/ethnicity, U.S. Census region, education, marital status, annual household income, and sexual orientation. Prevalence estimates with a relative standard error ≥30% are not presented. Differences between groups were assessed using chi-squared statistics; estimates with $p<0.05$ were considered to be statistically significant.

Overall, the reported prevalence of every day or some day use was as follows: any tobacco product use, 21.3% (estimated 49.2 million users); any combustible tobacco product use, 18.4% (42.8 million); cigarette use, 17.0% (39.8 million); cigar/cigarillo/filtered little cigar use, 1.8% (4.1 million); regular pipe use, 0.3% (0.7 million); water pipe/hookah use, 0.6% (1.4 million); e-cigarette use, 3.3% (7.8 million); and smokeless tobacco use, 2.5% (5.7 million) (Table 1). When "rarely" was added to the definition of use, prevalence of use was as follows: any tobacco product use, 25.5% (58.8 million users); any combustible tobacco product use, 22.2% (51.5 million); cigar/cigarillo/filtered little cigar use, 5.4% (12.6 million); regular pipe use, 0.8% (2.0 million); water pipe/hookah use, 4.3% (10.0 million); e-cigarette use, 6.6% (15.5 million); smokeless tobacco product use, 3.5% (8.2 million) (Table 2).

Differences in use of any tobacco product every day or some days were observed across population groups (Table 1). Prevalence was higher among males (26.3%) than females (16.7%), and among age groups, was highest among persons aged 25–44 years (26.1%) and lowest among persons aged ≥65 years (10.3%). Prevalence was highest among non-Hispanics of other races (i.e., American Indians/Alaska natives, Native Hawaiians/other Pacific Islanders, and persons of multiple race) (32.6%) and lowest among non-Hispanic Asians

[¶] Participants who reported use of any product were considered any tobacco product users, but those who had a combination of "no" and missing responses to any of the assessed product type questions were excluded from the analysis. Participants who did not report use of any product "every day," "some days," or "rarely" who had missing responses for any of the assessed tobacco products (1.9% of respondents) were excluded.

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TABLE 1. Percentage of persons aged ≥18 years who reported tobacco product use "every day" or "some days" and met established thresholds, by tobacco product and selected characteristics — National Adult Tobacco Survey, United States, 2013–2014

Characteristic	Tobacco product % (95% CI)							
	Any tobacco product*	Any combustible tobacco product†	Cigarettes§	Cigars/Cigarillos/ Filtered little cigars¶	Regular pipe**	Water pipe/ Hookah††	E-cigarettes§§	Smokeless tobacco¶¶
Overall	**21.3 (20.8–21.7)**	**18.4 (18.0–18.8)**	**17.0 (16.6–17.4)**	**1.8 (1.6–1.9)**	**0.3 (0.2–0.4)**	**0.6 (0.5–0.7)**	**3.3 (3.1–3.5)**	**2.5 (2.3–2.6)**
Sex								
Male	26.3 (25.6–27.0)	21.5 (20.8–22.1)	19.3 (18.6–19.9)	2.8 (2.5–3.1)	0.6 (0.5–0.7)	0.8 (0.6–0.9)	4.0 (3.6–4.3)	4.8 (4.5–5.2)
Female	16.7 (16.2–17.3)	15.7 (15.1–16.2)	15.1 (14.5–15.6)	0.8(0.6–0.9)	—***	0.4 (0.3–0.5)	2.8 (2.6–3.0)	0.3 (0.2–0.3)
Age group (yrs)								
18–24	24.5 (23.0–26.1)	20.5 (19.1–22.0)	17.0 (15.7–18.4)	3.1 (2.4–3.7)	0.5 (0.3–0.8)	3.2 (2.5–3.8)	5.5 (4.8–6.3)	4.4 (3.7–5.1)
25–44	26.1 (25.2–27.0)	22.5 (21.6–23.4)	21.4 (20.6–22.3)	2.0 (1.7–2.3)	0.2 (0.1–0.3)	0.5 (0.4–0.7)	4.4 (4.0–4.8)	3.1 (2.8–3.4)
45–64	21.5 (20.9–22.2)	19.0 (18.3–19.6)	17.8 (17.2–18.5)	1.6 (1.4–1.8)	0.3 (0.2–0.4)	0.1 (0.0–0.1)	2.8 (2.6–3.1)	1.9 (1.7–2.2)
≥65	10.3 (9.8–10.8)	8.9 (8.4–9.4)	7.9 (7.5–8.4)	0.9 (0.7–1.0)	0.3 (0.2–0.4)	—***	0.9 (0.7–1.1)	1.1 (0.9–1.3)
Race/Ethnicity								
White, non-Hispanic	21.3 (20.8–21.8)	17.8 (17.3–18.3)	16.6 (16.2–17.1)	1.5 (1.3–1.7)	0.3 (0.2–0.4)	0.4 (0.3–0.5)	3.6 (3.4–3.9)	3.1 (2.8–3.3)
Black, non-Hispanic	25.1 (23.7–26.6)	23.5 (22.0–24.9)	21.3 (19.9–22.6)	3.3 (2.7–3.9)	0.3 (0.1–0.5)	0.9 (0.5–1.2)	2.1 (1.6–2.6)	1.1 (0.7–1.4)
Asian, non-Hispanic	11.2 (9.2–13.1)	9.3 (7.6–11.1)	8.1 (6.5–9.7)	—***	—***	—***	2.8 (1.8–3.8)	—***
Other, non-Hispanic	32.6 (30.1–35.2)	29.1 (26.3–31.6)	27.5 (25.1–30.0)	2.1 (1.5–2.8)	0.6 (0.3–1.0)	—***	5.2 (4.0–6.5)	4.0 (3.0–5.0)
Hispanic	17.6 (16.3–19.0)	16.2 (14.9–17.5)	14.7 (13.5–16.0)	1.8 (1.3–2.3)	—***	1.1 (0.7–1.5)	2.7 (2.1–3.2)	1.0 (0.6–1.3)
U.S. Census region†††								
Northeast	18.3 (17.3–19.3)	16.4 (15.4–17.4)	15.2 (14.2–16.1)	1.5 (1.1–1.8)	0.3 (0.1–0.4)	0.6 (0.4–0.9)	2.3 (1.9–2.7)	1.4 (1.1–1.7)
Midwest	23.2 (22.2–24.2)	20.2 (19.3–21.2)	18.8 (17.9–19.7)	1.9 (1.6–2.2)	0.2 (0.1–0.3)	0.4 (0.3–0.6)	3.5 (3.0–3.9)	2.7 (2.3–3.1)
South	24.0 (23.2–24.7)	20.4 (19.7–21.2)	18.9 (18.2–19.6)	2.1 (1.9–2.4)	0.3 (0.2–0.4)	0.6 (0.5–0.8)	3.7 (3.4–4.1)	3.2 (2.9–3.5)
West	17.6 (16.8–18.4)	15.1 (14.3–15.9)	13.8 (13.1–14.6)	1.2 (1.0–1.4)	0.3 (0.2–0.4)	0.6 (0.4–0.8)	3.4 (3.0–3.8)	1.9 (1.6–2.1)
Education								
0–12 yrs (no diploma)	31.9 (30.1–33.6)	28.9 (27.2–30.6)	27.4 (25.7–29.1)	2.8 (2.2–3.4)	0.4 (0.2–0.6)	0.6 (0.3–0.9)	3.4 (2.8–4.0)	3.3 (2.7–3.9)
GED	50.0 (46.4–53.6)	46.5 (42.9–50.1)	44.2 (40.6–47.7)	4.9 (3.2–6.6)	—***	—***	8.0 (5.9–10.0)	3.4 (2.0–4.8)
High school diploma	25.4 (24.4–26.4)	21.5 (20.6–22.5)	19.9 (19.0–20.8)	2.0 (1.7–2.3)	0.5 (0.3–0.6)	0.9(0.7–1.2)	4.2 (3.8–4.7)	3.4 (3.0–3.8)
Some college, no diploma	23.6 (22.5–24.7)	20.7 (19.7–21.8)	18.9 (17.9–19.9)	2.0 (1.7–2.4)	0.2 (0.1–0.3)	0.7 (0.5–1.0)	4.4 (3.8–4.9)	2.3 (2.0–2.7)
Associate degree	21.6 (20.6–22.7)	18.5 (17.5–19.5)	17.3 (16.3–18.3)	1.4 (1.1–1.7)	0.2 (0.1–0.3)	0.4 (0.2–0.6)	3.9 (3.4–4.4)	2.4 (2.0–2.8)
Undergraduate degree	10.2 (9.5–10.8)	8.0 (7.5–8.6)	7.1 (6.6–7.6)	0.8 (0.6–1.0)	0.2 (0.1–0.3)	0.3 (0.2–0.4)	1.4 (1.2–1.7)	1.5 (1.3–1.8)
Graduate degree	6.4 (5.8–7.0)	5.3 (4.8–5.8)	4.4 (3.9–4.9)	0.8 (0.6–1.0)	0.1 (0.1–0.2)	—***	0.9 (0.7–1.1)	0.8 (0.6–1.0)
Marital status								
Married/Living with a partner	18.0 (17.4–18.5)	15.2 (14.7–15.7)	14.1 (13.6–14.6)	1.4 (1.2–1.6)	0.2 (0.1–0.3)	0.4 (0.3–0.5)	2.9 (2.7–3.1)	2.4 (2.2–2.6)
Divorced/Separated/Widowed	26.1 (25.1–27.1)	23.2 (22.2–24.2)	22.2 (21.2–23.2)	1.6 (1.3–1.9)	0.4 (0.3–0.6)	—***	3.6 (3.2–4.1)	2.2 (1.8–2.5)
Single/Never married/ Not living with a partner	26.1 (25.0–27.2)	22.9 (21.8–23.9)	20.5 (19.5–21.5)	2.9 (2.4–3.3)	0.5 (0.3–0.6)	1.6 (1.3–2.0)	4.4 (3.9–4.9)	2.9 (2.5–3.3)
Annual household income ($)								
<20,000	32.2 (30.5–33.9)	29.9 (28.2–31.5)	28.7 (27.1–30.4)	2.7 (2.2–3.3)	0.5 (0.3–0.7)	—***	4.0 (3.3–4.7)	2.0 (1.5–2.5)
20,000–49,999	26.4 (25.4–27.4)	23.2 (22.3–24.2)	21.7 (20.8–22.6)	2.2 (1.8–2.5)	0.4 (0.2–0.5)	0.7 (0.5–1.0)	4.2 (3.8–4.7)	2.5 (2.2–2.9)
50,000–99,999	18.4 (17.5–19.2)	15.3 (14.5–16.1)	14.1 (13.4–14.9)	1.1 (0.9–1.4)	0.3 (0.2–0.4)	0.4 (0.3–0.6)	3.3 (2.9–3.7)	2.9 (2.5–3.3)
≥100,000	12.1 (11.3–13.0)	9.3 (8.5–10.1)	8.0 (7.3–8.7)	1.2 (1.0–1.5)	—***	0.6 (0.3–0.8)	2.3 (2.0–2.7)	2.2 (1.9–2.6)
Unspecified	21.4 (20.5–22.3)	18.8 (17.9–19.6)	17.2 (16.4–18.1)	1.9 (1.6–2.3)	0.3 (0.2–0.4)	0.7 (0.5–0.9)	3.0 (2.6–3.3)	2.3 (2.0–2.6)
Sexual orientation								
Heterosexual/Straight	20.7 (20.2–21.2)	17.7 (17.3–18.2)	16.4 (16.0–16.9)	1.6 (1.5–1.8)	0.3 (0.2–0.4)	0.5 (0.4–0.6)	3.3 (3.1–3.6)	2.5 (2.4–2.7)
LGB	32.1 (29.2–35.1)	29.9 (26.9–32.8)	27.1 (24.3–30.0)	4.4 (3.0–5.8)	—***	1.8 (0.9–2.6)	6.9 (5.2–8.6)	—***
Unspecified	22.3 (21.0–23.5)	19.9 (18.7–21.1)	18.5(17.3–19.7)	2.0 (1.6–2.4)	0.3 (0.1–0.4)	0.7 (0.4–0.9)	2.6 (2.1–3.0)	2.2 (1.8–2.6)

Abbreviations: CI = confidence interval; e-cigarettes = electronic cigarettes; GED = General Education Development certificate; LGB = lesbian, gay, or bisexual.

* Any tobacco use was defined as "every day" or "some days" use of cigarettes; cigars, cigarillos, or filtered little cigars; pipes; water pipes/hookahs; e-cigarettes; or smokeless tobacco (snus, dissolvable tobacco products, or snuff, chewing tobacco or dip). The survey assessed "every day" or "some days" use of the respective products only among persons who met specified lifetime usage thresholds: cigarettes (≥100 times); cigars/cigarillos/filtered little cigars (≥50 times); regular pipes (≥50 times); water pipes/hookahs (≥1 time); snus (≥1 time]; dissolvable tobacco products (≥1 time); chewing tobacco/snuff/dip (≥20 times); and e-cigarettes (≥1 time).

† Any combustible tobacco users were defined as persons who met specified lifetime usage thresholds for at least one of four different tobacco product types (cigarettes [≥100 times]; cigars/cigarillos/filtered little cigars [≥50 times]; regular pipes [≥50 times]; water pipes/hookahs [≥1 time]), and who now (at the time of the survey) used the respective product(s) every day or some days.

§ Current cigarette smokers were defined as persons who reported smoking ≥100 cigarettes during their lifetime and now smoked cigarettes every day or some days.

¶ Current cigar/cigarillo/filtered little cigar smokers were defined as persons who reported smoking cigars, cigarillos, or little filtered cigars ≥50 times during their lifetime and now smoked cigars, cigarillos, or little filtered cigars every day or some days.

** Reported smoking a regular pipe filled with tobacco ≥50 times during their lifetime and now smoked a regular pipe filled with tobacco every day or some days.

†† Reported smoking tobacco in a water pipe/hookah at least once during their lifetime and now smoked tobacco in a water pipe/hookah every day or some days.

§§ Persons who reported using electronic cigarettes at least once during their lifetime and now used e-cigarettes every day or some days.

¶¶ Smokeless tobacco users were defined as using at least one of the following three tobacco product types: 1) chewing tobacco, snuff, or dip; 2) snus; and 3) dissolvable tobacco products. Chewing tobacco, snuff, or dip users were respondents who reported using the product ≥20 times during their lifetime and now using chewing tobacco, snuff, or dip every day or some days. Snus or dissolvable tobacco product users were respondents who reported using each respective product at least once during their lifetime and now using each respective product every day or some days.

*** Estimate not presented because relative standard error ≥30%.

††† *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

TABLE 2. Percentage of persons aged ≥18 years who reported tobacco product use "every day," "some days," or "rarely" and met established thresholds, by tobacco product and selected characteristics — National Adult Tobacco Survey, United States, 2013–2014

Characteristic	Tobacco product % (95% CI)						
	Any tobacco product*	Any combustible tobacco product†	Cigars/Cigarillos/ Filtered little cigars§	Regular pipe¶	Water pipe/ Hookah**	E-cigarettes††	Smokeless tobacco§§
Overall	**25.5 (25.0–25.9)**	**22.2 (21.7–22.6)**	**5.4 (5.1–5.6)**	**0.8 (0.7–0.9)**	**4.3 (4.0–4.5)**	**6.6 (6.3–6.9)**	**3.5 (3.3–3.7)**
Sex							
Male	32.1 (31.4–32.9)	26.9 (26.2–27.6)	9.3 (8.9–9.8)	1.5 (1.3–1.7)	5.1 (4.7–5.5)	7.9 (7.4–8.3)	6.9 (6.5–7.3)
Female	19.4 (18.8–20.0)	17.9 (17.3–18.5)	1.8 (1.5–2.0)	0.2 (0.1–0.3)	3.5 (3.2–3.8)	5.5 (5.2–5.9)	0.4 (0.3–0.5)
Age group (yrs)							
18–24	37.4 (35.7–39.2)	33.0 (31.3–34.7)	8.9 (7.8–9.8)	1.6 (1.1–2.1)	20.2 (18.7–21.6)	13.6 (12.4–14.8)	6.4 (5.6–7.2)
25–44	30.9 (30.0–31.9)	26.8 (25.9–27.7)	6.9 (6.4–7.4)	0.7 (0.6–0.9)	5.0 (4.6–5.4)	9.0 (8.4–9.6)	4.7 (4.3–5.1)
45–64	23.7 (23.0–24.4)	20.7 (20.1–21.4)	4.6 (4.2–4.9)	0.8 (0.6–0.9)	0.4 (0.3–0.5)	4.7 (4.4–5.1)	2.6 (2.3–2.8)
≥65	11.5 (11.0–12.1)	9.9 (9.4–10.4)	2.1 (1.8–2.3)	0.7 (0.6–0.8)	—¶¶	1.5 (1.3–1.7)	1.3 (1.1–1.5)
Race/Ethnicity							
White, non-Hispanic	25.1 (24.6–25.6)	21.3 (20.8–21.9)	5.5 (5.2–5.8)	0.8 (0.7–1.0)	3.3 (3.1–3.6)	6.9 (6.6–7.3)	4.3 (4.0–4.5)
Black, non-Hispanic	28.6 (27.1–30.1)	26.7 (25.2–28.2)	5.9 (5.1–6.7)	0.5 (0.3–0.8)	4.7 (3.9–5.5)	4.0 (3.4–4.6)	1.4 (1.0–1.7)
Asian, non-Hispanic	16.3 (14.0–18.5)	14.2 (12.1–16.3)	1.2 (0.5–2.0)	—¶¶	6.7 (5.1–8.2)	5.0 (3.7–6.3)	1.2 (0.6–1.8)
Other, non-Hispanic	38.7 (36.1–41.3)	34.1 (31.6–36.7)	7.4 (5.9–8.8)	1.6 (1.0–2.2)	7.4 (5.9–8.9)	11.0 (9.2–12.8)	5.4 (4.3–6.5)
Hispanic	23.0 (21.5–24.5)	20.8 (19.4–22.3)	4.7 (4.0–5.5)	0.8 (0.5–1.2)	6.7 (5.8–7.6)	6.4 (5.6–7.3)	1.9 (1.4–2.4)
U.S. Census region* **							
Northeast	22.7 (21.6–23.8)	20.6 (19.5–21.7)	4.5 (4.0–5.0)	0.7 (0.5–1.0)	4.5 (3.9–5.1)	4.8 (4.3–5.4)	2.0 (1.7–2.3)
Midwest	26.7 (25.7–27.7)	23.4 (22.5–24.4)	5.6 (5.1–6.2)	0.9 (0.7–1.2)	3.4 (3.0–3.9)	7.1 (6.5–7.7)	3.8 (3.4–4.2)
South	28.1 (27.3–28.9)	24.0 (23.3–24.8)	6.0 (5.6–6.5)	0.8 (0.7–1.0)	4.0 (3.6–4.4)	7.1 (6.6–7.5)	4.5 (4.1–4.9)
West	22.2 (21.3–23.2)	19.3 (18.4–20.1)	4.8 (4.3–5.2)	0.8 (0.6–1.0)	5.2 (4.7–5.8)	6.9 (6.3–7.5)	2.9 (2.5–3.2)
Education							
0–12 yrs (no diploma)	33.8 (32.0–35.6)	30.7 (28.9–32.4)	6.2 (5.3–7.1)	1.3 (0.8–1.7)	3.2 (2.4–4.0)	6.4 (5.5–7.4)	4.4 (3.7–5.2)
GED	52.7 (49.1–56.3)	48.5 (44.9–52.1)	12.0 (9.6–14.3)	1.6 (0.8–2.3)	5.3 (3.5–7.0)	15.9 (13.1–18.6)	6.0 (4.1–7.9)
High school diploma	29.5 (28.5–30.5)	25.3 (24.3–26.2)	5.7 (5.2–6.3)	1.0 (0.8–1.3)	5.2 (4.6–5.7)	8.2 (7.6–8.9)	4.7 (4.3–5.2)
Some college, no diploma	28.9 (27.7–30.1)	25.4 (24.3–26.5)	6.2 (5.6–6.9)	0.6 (0.4–0.8)	5.8 (5.2–6.5)	8.9 (8.2–9.7)	3.6 (3.1–4.1)
Associate degree	25.7 (24.5–26.8)	22.0 (21.0–23.1)	5.7 (5.1–6.3)	0.8 (0.6–1.0)	3.6 (3.1–4.2)	7.4 (6.7–8.1)	3.3 (2.9–3.8)
Undergraduate degree	15.9 (15.1–16.6)	13.4 (12.7–14.1)	4.0 (3.6–4.4)	0.6 (0.4–0.7)	4.1 (3.7–4.6)	3.4 (3.0–3.8)	2.3 (2.0–2.6)
Graduate degree	9.9 (9.2–10.6)	8.5 (7.8–9.1)	2.7 (2.4–3.1)	0.5 (0.4–0.7)	2.1 (1.7–2.5)	1.9 (1.5–2.2)	1.2 (0.9–1.5)
Marital status							
Married/Living with a partner	21.3 (20.8–21.9)	18.2 (17.6–18.7)	4.8 (4.5–5.1)	0.7 (0.5–0.8)	2.3 (2.0–2.5)	5.3 (5.0–5.7)	3.4 (3.1–3.6)
Divorced/Separated/Widowed	28.0 (27.0–29.0)	24.5 (23.5–25.5)	4.6 (4.1–5.1)	1.1 (0.8–1.4)	1.6 (1.2–2.0)	6.7 (6.1–7.3)	3.1 (2.7–3.5)
Single/Never married/ Not living with a partner	34.6 (33.4–35.8)	31.2 (30.0–32.3)	7.7 (7.0–8.3)	1.1 (0.8–1.4)	12.4 (11.6–13.3)	10.2 (9.4–10.9)	4.4 (3.9–4.8)
Annual household income ($)							
<20,000	34.9 (33.1–36.6)	32.0 (30.3–33.7)	5.9 (5.1–6.8)	1.2 (0.8–1.6)	3.5 (2.7–4.2)	8.0 (6.9–9.0)	2.8 (2.2–3.3)
20,000–49,999	30.4 (29.4–31.4)	26.9 (25.9–27.9)	6.2 (5.7–6.8)	1.1 (0.8–1.3)	5.3 (4.7–5.8)	8.6 (7.9–9.2)	3.6 (3.2–4.0)
50,000–99,999	23.1 (22.2–24.0)	19.5 (18.7–20.3)	5.1 (4.6–5.6)	0.8 (0.7–1.0)	4.2 (3.8–4.7)	6.5 (5.9–7.0)	4.0 (3.6–4.5)
≥100,000	17.7 (16.7–18.6)	14.6 (13.7–15.5)	5.2 (4.7–5.8)	0.4 (0.3–0.6)	3.7 (3.2–4.3)	4.6 (4.0–5.1)	3.3 (2.9–3.7)
Unspecified	24.9 (24.0–25.8)	21.8 (20.9–22.7)	4.7 (4.3–5.2)	0.7 (0.6–0.9)	4.0 (3.5–4.4)	5.8 (5.3–6.3)	3.3 (2.9–3.7)
Sexual orientation							
Heterosexual/Straight	24.8 (24.3–25.3)	21.5 (21.0–21.9)	5.4 (5.1–5.6)	0.8 (0.7–0.9)	3.9 (3.7–4.2)	6.5 (6.2–6.8)	3.6 (3.4–3.8)
LGB	41.4 (38.3–44.6)	38.1 (35.0–41.1)	8.7 (6.9–10.5)	2.3 (0.9–3.7)	14.8 (12.2–17.4)	14.7 (12.4–17.1)	3.0 (1.6–4.3)
Unspecified	25.8 (24.5–27.1)	22.9 (21.6–24.2)	4.7 (4.1–5.4)	0.9 (0.6–1.2)	3.9 (3.2–4.5)	5.5 (4.8–6.2)	3.2 (2.7–3.7)

Abbreviations: CI = confidence interval; e-cigarettes = electronic cigarettes; GED = General Education Development certificate; LGB = lesbian, gay, or bisexual.

* Any tobacco use was defined as "every day" or "some days" use of cigarettes; and/or "every day," "some days," or "rarely" use of cigars, cigarillos, or filtered little cigars; pipes; water pipes/ hookahs; e-cigarettes; or smokeless tobacco (snus, dissolvable tobacco products, or snuff, chewing tobacco or dip). Cigarettes are not presented separately because the questionnaire only assessed "every day" or "some days" use (no "rarely" response option). "Every day" or "some days" use of cigarettes was assessed among those who reported smoking ≥100 cigarettes during their lifetime.

† For the other tobacco product types, the survey assessed "every day," "some days," or "rarely" use among persons who met specified lifetime usage thresholds for the different tobacco product types: cigars/cigarillos/filtered little cigars (≥50 times); regular pipes (≥50 times); water pipes/hookahs (≥1 time); snus (≥1 time]; dissolvable tobacco products (≥1 time); chewing tobacco/snuff/dip (≥20 times); and e–cigarettes (≥1 time).

§ Current cigar/cigarillo/filtered little cigar smokers were defined as persons who reported smoking cigars, cigarillos, or little filtered cigars ≥50 times during their lifetime and smoked a cigar, cigarillos, or filtered little cigars every day, some days, or rarely.

¶ Reported smoking a regular pipe filled with tobacco ≥50 times during their lifetime and now smoked a regular pipe filled with tobacco every day, some days, or rarely.

** Reported smoking tobacco in a water pipe/hookah at least once during their lifetime and now smoked tobacco in a water pipe/hookah every day, some days, or rarely.

†† Persons who reported using electronic cigarettes at least once during their lifetime and now using electronic cigarettes every day, some days, or rarely.

§§ Smokeless tobacco users were defined using at least one of the following three tobacco product types: 1) chewing tobacco, snuff, or dip; 2) snus; and 3) dissolvable tobacco products. Chewing tobacco, snuff, or dip users were respondents who reported using the product at least 20 times during their lifetime and now used chewing tobacco, snuff, or dip every day, some days, or rarely. Snus or dissolvable tobacco product users were respondents who reported using each respective product at least once during their lifetime and now used each respective product every day, some days, or rarely.

¶¶ Estimate not presented because relative standard error ≥30%.

*** *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

(11.2%); by region, prevalence was highest among persons living in the South (24.0%) and lowest among persons living in the West (17.6%). Prevalence was highest among adults with a GED certificate (50.0%) and lowest among persons with a graduate degree (6.4%). Prevalence was higher among adults who were single/never married/not living with a partner (26.1%) or divorced/separated/widowed (26.1%) than those married or living with a partner (18.0%). Prevalence was highest among adults with annual household income <$20,000 (32.2%) and lowest among those with annual household income ≥$100,000 (12.1%) and was higher among LGB adults (32.1%) than heterosexual/straight adults (20.7%). Prevalence patterns were generally similar when "rarely" was included in the definition of use (Table 2).

Among every day, some days, or rarely users, younger adults aged 18–24 accounted for 55.8% of water pipe/hookah smokers, 24.3% of e-cigarettes users, 23.1% of regular pipe smokers, 21.6% of smokeless tobacco users, and 19.5% of cigar/cigarillo/filtered little cigar smokers (Figure).

Discussion

During 2013–2014, one in five U.S. adults (an estimated 49.2 million persons) used any tobacco product every day or some days, and one in four (58.8 million persons) used any tobacco product every day, some days, or rarely. Across population groups, differences were observed in tobacco use by sex, age, race/ethnicity, U.S. Census region, education, marital status, annual household income, and sexual orientation. The magnitude and patterns of tobacco product use generally were comparable to those from other national surveys of U.S. adults during the same period.** Use of any tobacco product every day or some days was nearly threefold higher among non-Hispanics of other races (i.e., American Indians/Alaska natives, Native Hawaiian/other Pacific Islanders, and persons of multiple race) than among Asian non-Hispanics. Adults with annual household incomes of <$20,000 also reported a higher prevalence of tobacco product use than did persons with higher annual household income and LGB adults reported higher prevalence of tobacco product use than did adults who identified as heterosexual/straight.

The use of e-cigarettes and water pipes/hookahs was particularly prevalent among certain populations. Most users of these two emerging tobacco products were not daily users. Moreover, young adults had the highest prevalence of use of e-cigarettes and water pipes, which might reflect that although most experimentation with tobacco products occurs during the teenage years, young adulthood increasingly is a time of initiation of tobacco products, including emerging tobacco products.†† The higher prevalence of use among younger adults might also be a consequence of targeted marketing of e-cigarette products and varying perceptions about the relative harm or social acceptability of these products compared with conventional cigarettes (*1*,*4*,*5*). When the definition of current users included participants who reported rarely using tobacco products, current use was disproportionately higher among younger adults. These users might not consider themselves to be tobacco product users, and thus, might not consider themselves to be at risk for tobacco-related disease or death (*6*,*7*). For example, one focus group study with adult cigar smokers found that some users would only use the term "smoker" or "cigar smoker" to describe someone who smoked cigars several times a week or daily (*8*). This finding underscores the importance of further research on the ascertainment of tobacco product use, as well as efforts to educate the public about the potential harms of all tobacco product use, including risks associated with occasional use.

Continued implementation of proven population-based interventions, including increasing tobacco product prices, implementing and enforcing comprehensive smoke-free laws, warning about the dangers of tobacco use through public education media campaigns, and increasing access to proven resources to help people quit tobacco use, can help reduce tobacco use and tobacco-related disease and death (*1*,*9*). In addition, regulatory authority over the manufacture, marketing, and sales of tobacco products is an important tool to further reduce tobacco-related disease and death in the United States.§§ In May 2016, FDA finalized a rule extending its authority to all products that meet the definition of a tobacco product, including e-cigarettes, cigars, pipes, and water pipes/hookahs.¶¶ This rule sets a national minimum age for sales; requires health warnings, tobacco product ingredient reporting, and reporting of harmful and potentially harmful constituents; and ensures FDA premarket review of new and changed tobacco products and premarket review of the marketing of products as reduced-risk (modified risk tobacco products). The rule also enables future rulemaking regarding tobacco product manufacturing, marketing, and sales.

The findings in this report are subject to at least four limitations. First, self-reported tobacco use might have resulted in misreporting; however, self-reported cigarette smoking correlates highly with serum cotinine levels (*10*). Second, small sample

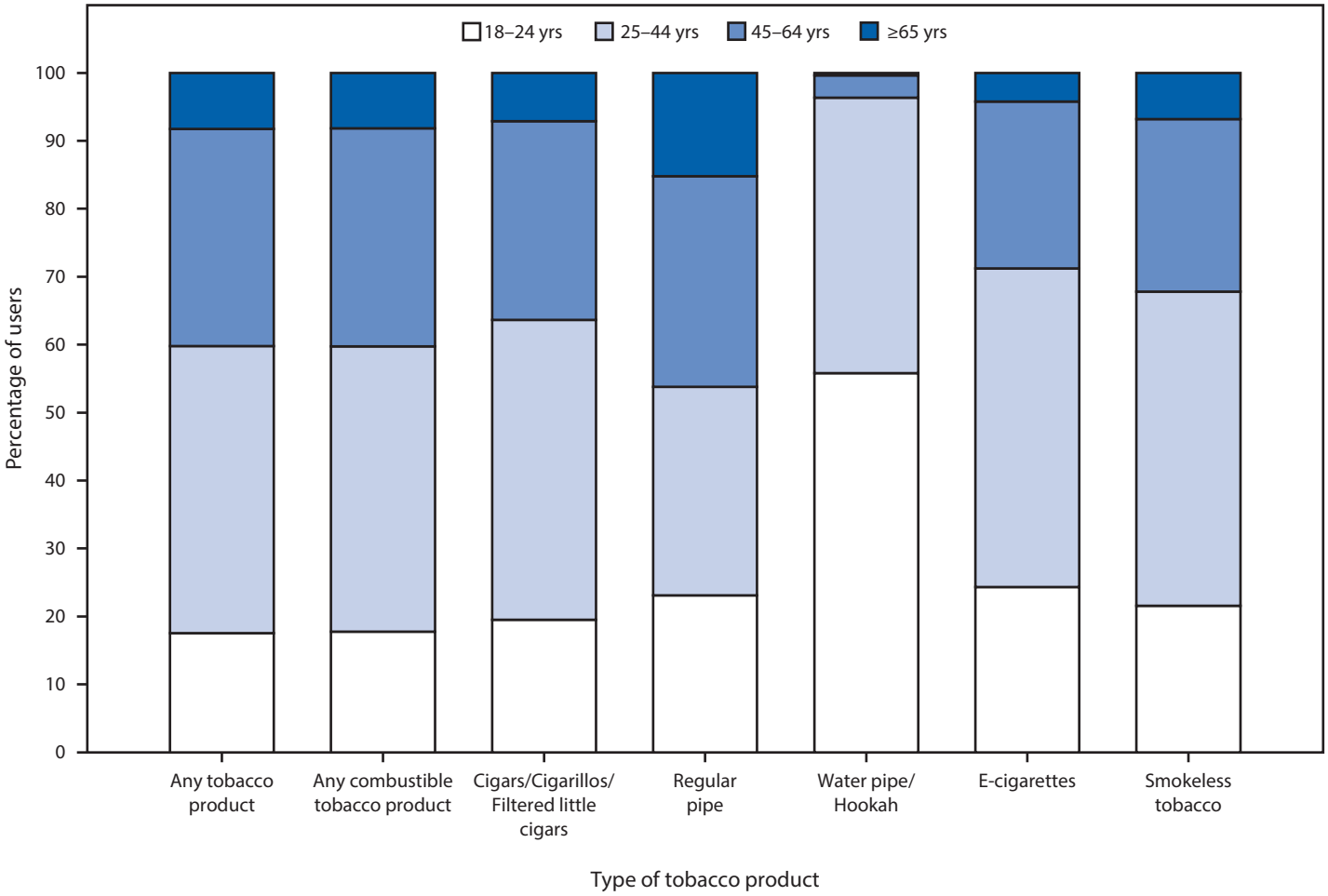
** http://www.cdc.gov/nchs/nhis/SHS/tables.htm and http://www.samhsa.gov/data/sites/default/files/NSDUH-FRR1-2014/NSDUH-FRR1-2014.pdf.

†† http://www.surgeongeneral.gov/library/reports/preventing-youth-tobacco-use/full-report.pdf.

§§ http://www.fda.gov/tobaccoproducts/guidancecomplianceregulatoryinformation/ucm246129.htm.

¶¶ https://www.federalregister.gov/articles/2016/05/10/2016-10685/deeming-tobacco-products-to-be-subject-to-the-federal-food-drug-and-cosmetic-act-as-amended-by-the.

FIGURE. Distribution of persons aged ≥18 years who were "every day," "some days," or "rarely" tobacco users and met thresholds for established use,* by age group† and type of tobacco product§ — National Adult Tobacco Survey, United States, 2013–2014



Abbreviation: e-cigarettes = electronic cigarettes.

* Any tobacco use was defined as "every day" or "some days" use of cigarettes; and/or "every day," "some days," or "rarely" use of cigars, cigarillos, or filtered little cigars; pipes; water-pipes/hookahs; e-cigarettes; smokeless tobacco (snus, dissolvable tobacco products, or snuff, chewing tobacco or dip). Cigarettes not presented separately because the questionnaire only assessed "every day" or "some days" cigarette smoking (i.e., no "rarely" response option). "Every day" or "some days" use of cigarettes was assessed only among persons who reported smoking at least 100 cigarettes during their lifetime. For the other tobacco product types, the survey assessed "everyday," "some days," or "rarely" use among persons who met specified lifetime usage thresholds, which were different for the different tobacco product types assessed: cigars/cigarillos/filtered little cigars (≥50 times); regular pipes (≥50 times); water pipes/hookahs (≥1 time); snus (≥1 time); dissolvable tobacco products (≥1 time); chewing tobacco/snuff/dip (≥20 times); and e-cigarettes (≥1 time).

† Respondents of unknown age (1.5%) were excluded from these calculations.

§ Denominator for each product comprised respondents who had ever reached the threshold for the specified product, including current and former users.

sizes among certain subgroups resulted in less precise estimates. Third, the overall response rate of 36.1% might have resulted in bias, even after adjustment for nonresponse. Finally, thresholds and current use measures varied by tobacco product type; for example, the absence of a response option of "rarely" for ascertaining cigarette smoking at the time of the survey might have resulted in underestimates for current cigarette smoking.

Sustained, comprehensive state tobacco control programs funded at CDC-recommended levels can accelerate progress toward reducing tobacco-related diseases and deaths (*1*). However, during fiscal year 2016, despite combined revenue of $25.8 billion from settlement payments and tobacco taxes for all states combined, states will spend only 1.8% of this amount ($468 million) on comprehensive tobacco control programs (<15% of the CDC-recommended level of funding for all states combined).*** Full implementation of comprehensive tobacco control programs at CDC-recommended funding levels, in conjunction with FDA regulation of tobacco products, could reduce tobacco use in the United States, thereby reducing morbidity and mortality caused by tobacco use (*1*).

*** http://www.tobaccofreekids.org/microsites/statereport2016/#introduction.

Summary

What is already known about this topic?

Although significant declines in cigarette smoking have occurred among U.S. adults during the past 5 decades, the use of emerging tobacco products has increased in recent years.

What is added by this report?

During 2013–2014, 21.3% of U.S. adults used a tobacco product every day or some days, and 25.5% of U.S. adults used a tobacco product every day, some days, or rarely. Cigarettes remained the most commonly used tobacco product. Young adults aged 18–24 years reported the highest prevalence of use of emerging tobacco products, including water pipes/hookahs and e-cigarettes. Differences in the use of any tobacco product were observed, with higher use reported among males; persons aged <45 years; non-Hispanic whites, non-Hispanic blacks, or non-Hispanics of other races; persons in the Midwest or South; persons with a General Educational Development certificate; persons who were single/never married/not living with a partner or divorced/separated/widowed; persons with annual household income <$20,000; and persons who were lesbian, gay, or bisexual.

What are the implications for public health practice?

Continued implementation of proven population-based interventions focused on the diversity of tobacco product use could help reduce tobacco use and tobacco related disease and death. These interventions include increasing tobacco product prices, implementing and enforcing comprehensive smoke-free laws, warning about the dangers of tobacco use through high-impact public education media campaigns, and increasing access to resources to help people quit tobacco use.

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Acute Poisonings from Synthetic Cannabinoids — 50 U.S. Toxicology Investigators Consortium Registry Sites, 2010–2015

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Recent reports suggest that acute intoxications by synthetic cannabinoids are increasing in the United States (*1*,*2*). Synthetic cannabinoids, which were research compounds in the 1980s, are now produced overseas; the first shipment recognized to contain synthetic cannabinoids was seized at a U.S. border in 2008 (*3*). Fifteen synthetic cannabinoids are Schedule I controlled substances (*3*), but enforcement is hampered by the continual introduction of new chemical compounds (*1*,*3*). Studies of synthetic cannabinoids indicate higher cannabinoid receptor binding affinities, effects two to 100 times more potent than Δ^9-tetrahydrocannabinol (the principal psychoactive constituent of cannabis), noncannabinoid receptor binding, and genotoxicity (*4*,*5*). Acute synthetic cannabinoid exposure reportedly causes a range of mild to severe neuropsychiatric, cardiovascular, renal, and other effects (*4*,*6*,*7*); chronic use might lead to psychosis (*6*,*8*). During 2010–2015, physicians in the Toxicology Investigators Consortium (ToxIC) treated 456 patients for synthetic cannabinoid intoxications; 277 of the 456 patients reported synthetic cannabinoids as the sole toxicologic agent. Among these 277 patients, the most common clinical signs of intoxication were neurologic (agitation, central nervous system depression/coma, and delirium/toxic psychosis). Relative to all cases logged by 50 different sites in the ToxIC Case Registry, there was a statistically significant association between reporting year and the annual proportion of synthetic cannabinoid cases. In 2015, reported cases of synthetic cannabinoid intoxication increased at several ToxIC sites, corroborating reported upward trends in the numbers of such cases (*1*,*2*) and underscoring the need for prevention.

In 2010, the American College of Medical Toxicology established the ToxIC Case Registry as a toxicology surveillance and research tool. Participating sites agree to record basic data on patients evaluated at local hospitals and clinics in cases where consultation by a medical toxicologist is requested; reported cases therefore represent severe or potentially severe toxicities. As of November 2015, there were active sites in 41 U.S. cities, with a few cities, such as Boston and New York City, having multiple sites. The registry is overseen by the Western Institutional Review Board and site-specific institutional review boards.

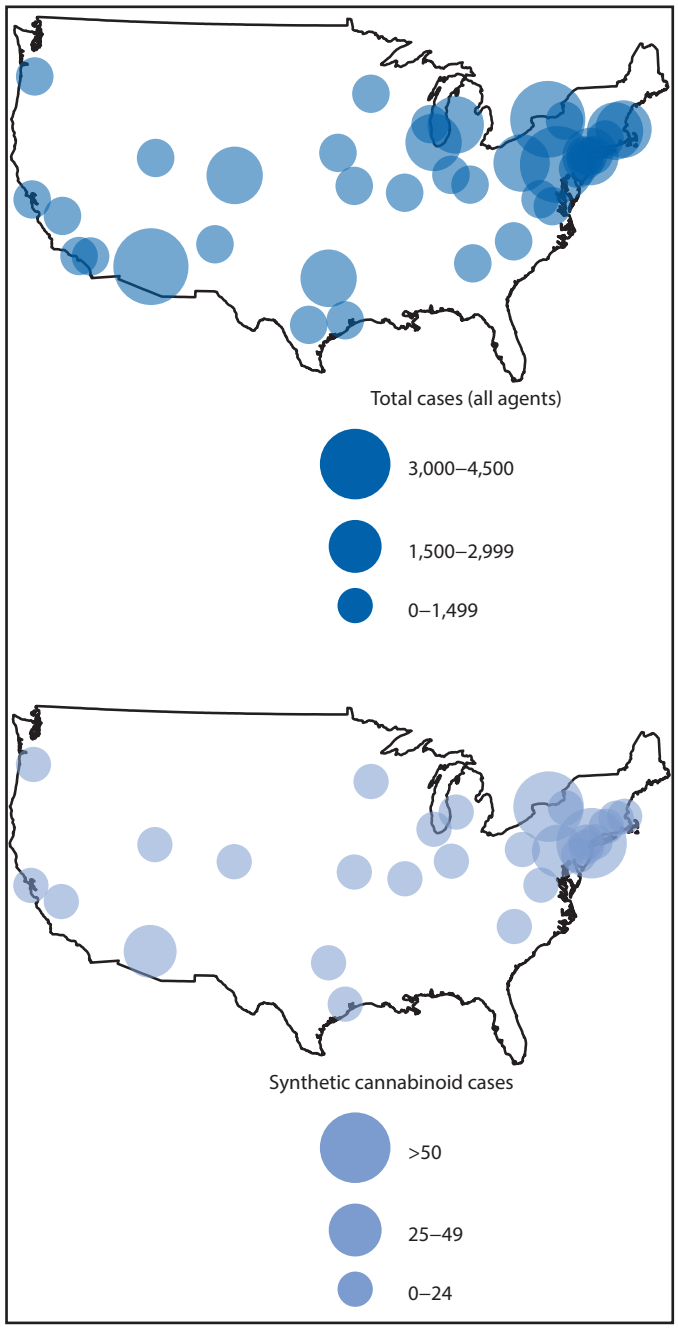
Temporal trends in the ToxIC synthetic cannabinoid case entries were investigated. Mixed logistic regression was used to evaluate the association between year and annual percentage of synthetic cannabinoid cases (among total cases, any agent), by site. The lme4 package in R (R Foundation for Statistical Computing, Vienna, Austria) was used to fit the model, accounting for intrasite and intragroup (e.g., participants in ToxIC's designer drug subregistry) correlation. To evaluate model fit, a deviance test was conducted, comparing the full model to a reduced model without the year variable. Sensitivity analyses were also conducted by dropping one site at a time and refitting the model.

During January 1, 2010–November 30, 2015, a total of 42,138 cases of toxic exposure were logged by 101 participating hospitals and clinics (Figure 1). Among these, 456 cases (at 50 ToxIC sites) involved synthetic cannabinoids, either as the sole toxicologic agent (n = 277) or as a component of a multiagent exposure (n = 179). Although most sites reported <20 synthetic cannabinoid cases, large sites in Harrisburg, Pennsylvania, New York City, Phoenix, Arizona, and Rochester, New York each recorded ≥30 synthetic cannabinoid intoxication cases. In contrast, during the same period, only 13 cases were logged by ToxIC involving nonsynthetic cannabinoids (i.e., cannabis) as the sole toxicological agent; among these, the majority (n = 11) were children (aged 2–6 years) or teenagers (age 13–18 years).

Among all 456 synthetic cannabinoid intoxication cases, 322 (70.6%) occurred in persons aged 19–65 years and 125 (27.4%) occurred in persons aged 13–18 years; 379 (83.1%) patients were male. The most common street names of synthetic cannabinoids reported by patients or accompanying friends and family members were K2 and Spice. In 415 (91.0%) cases, the patient had clinical signs or symptoms of intoxication; specific toxicologic treatments were administered to 267 (58.6%) patients, whereas the rest received standard supportive care and monitoring before being discharged. No specific synthetic cannabinoid antidotes exist.

Among the 277 (61%) patients who reported synthetic cannabinoids as the sole toxicologic exposure, the system most commonly affected was the central nervous system (Table), manifested by agitation, central nervous system depression/coma, and delirium/toxic psychosis, with seizures and hallucinations reported less frequently. Information on death during hospitalization was available for 246 (54%) patients. Among these, three (1.2%) deaths were recorded. The first occurred in

FIGURE 1. Toxicology Investigators Consortium (ToxIC)* registry cases caused by all agents and by synthetic cannabinoid,† by U.S. registry site location§ — January 1, 2010–November 30, 2015



* ToxIC is a select, volunteer network and thus not geographically representative of the United States or the cities where participating sites are located; many sites joined ToxIC after its establishment in 2010 by the American College of Medical Toxicology.
† As primary agent or part of multiagent exposure.
§ As of November 2015, there were active ToxIC registry sites in 41 U.S. cities, with a few cities (e.g., Boston and New York City) having multiple sites.

TABLE. Percentage of patients (n = 277) reporting synthetic cannabinoids as the sole toxicologic agent* among 42,138 cases of toxic exposure reported at 101 participating hospitals and clinics, by clinical sign or symptom — Toxicology Investigators Consortium (ToxIC) registry, January 1, 2010–November 30, 2015

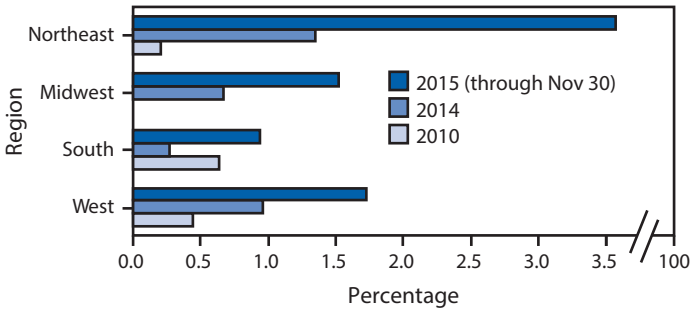
Organ system/ Syndrome	Clinical sign/symptom	Patients reporting SC as sole agent (%)†
Nervous	Agitation, coma, toxic psychosis, other	66.1
Cardiovascular	Bradycardia, tachycardia, other	17.0
Pulmonary	Respiratory depression	5.4
	Other	2.2
Renal/Muscle	Acute kidney injury	4.0
	Rhabdomyolysis	6.1
Other	Metabolic	8.7
	Gastrointestinal/Hepatic	1.4
	Significant leukocytosis	2.9
Toxidrome	Sedative-hypnotic	6.9
	Sympathomimetic syndrome	5.4
	Other	2.2

Abbreviation: SC = synthetic cannabinoid.
* A total of 456 reported cases (at 50 ToxIC sites) involved synthetic cannabinoids, either as the sole toxicologic agent (n = 277) or as a component of a multiagent exposure (n = 179).
† Percentages do not sum to 100% because some patients had more than one clinical sign.

a male aged 17 years, who suffered a cardiac arrest after reportedly taking a single "hit" of K2/Spice; the second occurred in an adult male with respiratory depression, agitation, and delirium/toxic psychosis after allegedly taking a synthetic cannabinoid and oxycodone; and the third occurred in an adult male with similar signs, who developed acute kidney injury after reportedly taking a synthetic cannabinoid, a synthetic cathinone (commonly known as bath salts), and the psychedelic drug lysergic acid diethylamide (LSD).

During 2010–2015, the annual percentage of synthetic cannabinoid cases among sites increased in all four U.S. Census regions; during 2014–2015, the annual percentage increased in all regions except the South (Figure 2). The largest overall increases during these periods took place in the Northeast, primarily driven by increases at the New York City sites. Less distinct but discernable increases occurred at sites in several other cities nationwide, and a decrease occurred at the Rochester, New York, site; heterogeneous patterns occurred elsewhere (not shown). In the mixed regression analysis, the deviance test indicated that including year in the model provided a significantly ($p<0.05$) better fit, evidence of a statistically significant temporal trend. In the sensitivity analyses, including the year variable improved model fit in a statistically significant manner, in each iteration (i.e., when the model was refit after dropping one site at a time).

FIGURE 2. Percentage of reported ToxIC* registry cases† caused by synthetic cannabinoids, by U.S. Census region — 2010, 2014, and 2015



* ToxIC is a select, volunteer network and thus not geographically representative of the United States or the cities where participating sites are located; many sites joined ToxIC after its establishment in 2010 by the American College of Medical Toxicology.

† Includes only cases from sites that reported any synthetic cannabinoid cases.

Summary

What is already known about this topic?

Acute intoxications by synthetic cannabinoids appear to be increasing in the United States. Synthetic cannabinoids are two to 100 times more potent than Δ^9-tetrahydrocannabinol, the active ingredient in cannabis; acute exposure is associated with a range of mild to severe neuropsychiatric, cardiovascular, renal, and other effects.

What is added by this report?

During 2010–2015, among 456 cases of synthetic cannabinoid intoxication among patients treated by U.S. medical toxicologists, 277 (61%) had reports of synthetic cannabinoids as the sole toxicologic agent. Three deaths were recorded, one with synthetic cannabinoids given as the sole agent and two with multiple agent exposures. Synthetic cannabinoid poisonings increased in all U.S. Census regions.

What are the implications for public health practice?

The increase in acute synthetic cannabinoid poisonings underscores the importance of targeted prevention interventions and the need for education about the potentially life-threatening consequences of synthetic cannabinoid use.

Discussion

The ToxIC data complement data from health agencies, poison centers, and other sources to produce a more detailed picture of the acute public health impacts of synthetic cannabinoid use in the United States. Although some potential for report overlap exists, cases in the ToxIC Registry are not routinely reported to poison centers. The significant increase in synthetic cannabinoid poisonings identified through this consortium reflects recent trends, which include a Drug Enforcement Agency report of 22 synthetic cannabinoid clusters (including two deaths) and 25 additional episodes (including 18 deaths) in 25 states during August 2011–April 2015 (*1*), as well as a 330% increase in synthetic cannabinoid–related calls to U.S. poison centers during the first 4 months of 2015 (*2*). The observed increases might result from increased synthetic cannabinoid use; the appearance of more toxic and potent synthetic cannabinoid compounds or multisynthetic cannabinoid formulations; increased recognition of synthetic cannabinoids as a cause of acute poisoning; increased familiarity among medical personnel with the clinical signs and symptoms of synthetic cannabinoids; or a combination of these factors (*6*,*7*).

The findings in this report are subject to at least five limitations. First, although ToxIC is a unique tool, it is clinically based, not population-based, and thus is not geographically representative of the United States or the cities where participating sites are located. The consortium includes most U.S. medical toxicology clinical services, but large areas of the country that do not have direct access to medical toxicologists are underrepresented. Second, although the consortium strives to report all cases treated by medical toxicologists at participating sites, reporting might be affected by several factors, including clinical caseload, personnel changes, and referral patterns. Nonetheless, the consortium's use of normalized statistics (the proportion of all consultations that were related to synthetic cannabinoids) and a mixed regression approach, which accounts for intrasite variability, improves confidence that the observed temporal increases are real. Third, synthetic cannabinoid case identification was based on patient history and clinical presentation; analytical confirmation is not available for most synthetic cannabinoid cases in the registry. The development of analytical tests that reliably detect synthetic cannabinoids and their metabolites in biologic samples is hindered by the production of new chemical compounds for which no analytical standards exist, difficulties in finding unique synthetic cannabinoid biomarkers, and other challenges (*2*,*9*,*10*); thus, analytical tests are not routinely used by every ToxIC physician. Instead, these physicians rely on patient self-reports or reports of accompanying family members or friends. Because of this, reports of drugs taken might be inaccurate, leading to misattribution of certain clinical signs and symptoms to synthetic cannabinoids. Fourth, as is common in drug abuse/misuse cases (*8*), approximately half of the ToxIC synthetic cannabinoid cases involved multiagent exposures, including synthetic cannabinoids in combination with other illicit or prescription drugs or alcohol. Consequently, other agents, or the combination of psychoactive substances, might have been responsible for the effects observed. A small German study, with analytical confirmation of the synthetic cannabinoids and other drugs in patient samples, reported that clinical signs in patients with concurrent drug exposures were similar to those who were exposed only to synthetic cannabinoids (*7*). Finally, patients occasionally declined to divulge details

of their exposure. For example, among 37,984 total cases recorded at ToxIC's U.S. sites during January 1, 2010–June 30, 2015, a total of 3,153 (8.3%) were missing agent information or recorded as unknown agent. Some of these cases possibly involved synthetic cannabinoids but were not recorded as such.

The increase in acute synthetic cannabinoid poisonings observed in ToxIC underscores the need for targeted prevention interventions. Educating the public on the potentially life-threatening consequences of synthetic cannabinoid use is important for countering the observed upward trend in synthetic cannabinoid poisonings.

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Notes from the Field

Meningococcal Disease in an International Traveler on Eculizumab Therapy — United States, 2015

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On June 2, 2015, CDC was notified that a male airline passenger, aged 41 years, with a fever of 105.4°F, headache, nausea, photophobia, diarrhea, and vomiting, which began approximately 3 hours after departure, was arriving to San Francisco, California, on a flight from Frankfurt, Germany. His symptoms reportedly started with neck stiffness 1 day earlier. Upon arrival, the patient was immediately transported to a local hospital, where he was in septic shock, which was followed by multisystem organ failure. Cerebrospinal fluid, obtained approximately 12 hours after initiation of treatment, was Gram stain- and culture-negative. Blood cultures, which were drawn before antibiotic treatment, were positive for *Neisseria meningitides* of indeterminate serogroup. A review of the patient's medical records revealed a history of paroxysmal nocturnal hemoglobinuria and current biweekly eculizumab (Soliris) therapy.

In 2007, eculizumab became the first Food and Drug Administration (FDA)-approved therapy for paroxysmal nocturnal hemoglobinuria, a rare type of autoimmune hemolytic anemia (*1*). Eculizumab is a monoclonal antibody that inhibits activation of the complement system, thus rendering patients vulnerable to infection with encapsulated organisms such as *N. meningitidis* (*1*,*2*). Eculizumab carries a FDA black box warning about meningococcal infections, with the recommendation that patients receive quadrivalent meningococcal conjugate vaccine at least 2 weeks before starting eculizumab therapy and a booster dose every 5 years thereafter (*3*,*4*). This patient received quadrivalent meningococcal polysaccharide vaccine in 2012, before beginning therapy.

On the basis of the patient's history of eculizumab therapy, CDC initiated an aviation contact investigation for suspected meningococcal disease before receiving laboratory confirmation. Current CDC guidelines for meningoccal disease recommend that on flights of ≥8 hours duration, passengers seated on either side of the patient and any crew with close contact to the patient receive postexposure prophylaxis (*3*). To identify passenger contacts, CDC obtained the airline passenger manifest and customs declaration forms for the flight. Interviews with responding paramedics and cabin crew also identified two unnamed medical volunteers on the flight: a nurse and a paramedic. Using the limited information provided (physical description, professions, and traveling companions) CDC was able to identify the medical volunteers through crossreferencing manifest information with the California Department of Consumer Affairs License Verification page and photos associated with electronic customs declarations forms. Six conveyance contacts were identified (one passenger, two medical volunteers, and three flight crew); five received postexposure prophylaxis within 48 hours of the flight and one declined. In addition, two responding paramedics who were initially not wearing masks and two laboratory technicians at the treating hospital received postexposure prophylaxis. After intravenous antibiotic treatment, the patient recovered fully.

Although evidence is limited for the risk for in-flight *N. meningitidis* transmission, there are at least two documented instances of probable transmission, including a case on a commercial flight from Los Angeles to Sydney, Australia in 2003 (*5*) and a cluster associated with a charter flight in 2005 (*6*). When meningococcal disease is suspected in an air traveler, close coordination with federal, state, local, and private sector partners is critical to obtain contact information for persons with potential exposure to the patient to ensure their rapid postexposure prophylaxis and, thus, prevent additional cases. This case also highlights the importance of heightened clinical suspicion for meningococcal disease in patients on eculizumab therapy, regardless of vaccination history.

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Notes from the Field

Acute Sulfuryl Fluoride Poisoning in a Family — Florida, August 2015

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On August 19, 2015, the Florida Department of Health (FDOH) was notified by the Florida Poison Information Center Network and a local hospital of possible sulfuryl fluoride poisonings affecting a family in Martin County, in southeastern Florida. Sulfuryl fluoride is a highly toxic (toxicity category I) gas fumigant used for termite control of homes and buildings.* FDOH personnel in Martin County commenced an investigation and identified a family of five (a grandmother, mother, father, son, and daughter) exposed to sulfuryl fluoride after their house was fumigated. The Florida Department of Agriculture and Consumer Services (FDACS), and the U.S. Environmental Protection Agency (EPA) Criminal Investigation Division also conducted an investigation after being notified by FDOH. Medical records were reviewed, and the father was interviewed by FDOH.

On August 14, 2015, the house was fumigated with sulfuryl fluoride† to eradicate a dry-wood termite infestation. At 4:00 p.m. on August 16, approximately 48 hours after the fumigation began, the family was permitted to reenter the house. That evening, the mother and son developed nausea and vomiting. By 6:00 a.m. the next morning, all family members had similar symptoms, prompting all family members except the father to visit a hospital emergency department. The grandmother, mother, and daughter were released the same day with diagnoses of chemical inhalation. The son, a previously healthy boy aged 9 years, was found to have altered mental status, dysarthria, dystonia, rigidity, and hyperreflexia, but was alert and answering questions. He was treated with calcium gluconate to correct hypocalcemia; other laboratory tests were normal, and a urinary toxicology profile was negative. He was admitted to the pediatric intensive care unit and was intubated for the first 2 days of hospitalization for airway protection from aspiration. Computerized tomography scan of the brain showed no cerebral edema or evidence of bleeding. On August 18, he developed choreoathetosis that progressed to involve both arms, legs, and both sides of his face; a brain magnetic resonance imaging study was consistent with basal ganglia injury. He underwent two rounds of hemodialysis to assist with fluoride ion removal, although documentation of his serum fluoride concentration was not found in the medical record. After excluding carbon monoxide and heavy metal poisoning, anoxic brain injury, and metabolic disorders, the treating physicians attributed his neurologic findings to sulfuryl fluoride poisoning, manifested by basal ganglia necrosis. Because there is no specific antidote for sulfuryl fluoride poisoning, his management was supportive; symptoms improved slightly during hospitalization, although dysarthria and choreoathetosis continued. On September 4, he was transferred to a rehabilitation facility where he experienced some additional improvement, but continued to have expressive aphasia and choreoathetoid movements of the face, trunk, and extremities. He was released on September 25, 2015.

On August 20, 2015, FDACS initiated an investigation and identified multiple violations related to the fumigation of the family's home, including failure to have functioning devices to measure sulfuryl fluoride concentrations and failure of the pest control operator to participate in the sulfuryl fluoride manufacturer's training and stewardship plan. Pest control operators are required to measure the level of sulfuryl fluoride remaining in each room of the fumigated space until all measurements are below the EPA approved concentration of 1 part per million or less before buildings are cleared for reentry. On September 29, FDACS revoked both the business license of the pest control company and certification of the pest control operator who conducted the fumigation. On March 10, 2016, the pest control company and two of its pest control operators pled guilty in federal court to the above-mentioned violations and others (*1*).

Based on the surveillance case definition (*2*), FDOH determined that sulfuryl fluoride exposure was the most likely cause of illness among these five family members. Four persons (the grandmother, mother, daughter, and son) were classified as confirmed cases of pesticide-related illness, and

* The toxicity of a pesticide is determined by the U.S. Environmental Protection Agency under guidance available from the Code of Federal Regulations 40 CFR 156.208(c)(1). Pesticides in category I are the most acutely toxic and pesticides in category IV are the least. The EPA has classified sulfuryl fluoride as a restricted use pesticide that can only be used by certified pest control operators.

† Zythor (Ensystex II, Inc., Fayetteville, NC; EPA toxicity category I; EPA registration number 81824-1; active ingredient = 99.3% sulfuryl fluoride, pesticide label, http://iaspub.epa.gov/apex/pesticides/f?p=PPLS:1). The structure to be fumigated is usually covered with a tarp or tent and sealed completely before releasing the gas. Chloropicrin, a colorless liquid lacrimating agent with a strong odor, is added to the gas fumigant as a warning agent to deter persons from entering or remaining in an area that has been fumigated. Applicators post warning signs around the building. After fumigating for 2–72 hours, the tarp is removed and the structure is aerated using fans.

the father as a probable case. The severity of illness of the son was high and of the others was low.[§]

Although sulfuryl fluoride is highly toxic and can cause severe injury if recommended safety measures are not followed, severe poisoning and death caused by sulfuryl fluoride are uncommon (*3*); since 2010, only one other such case has been reported in Florida. Signs and symptoms of sulfuryl fluoride poisoning include irritation of the nose, eyes, and respiratory tract, dyspnea, numbness, weakness, nausea, vomiting, abdominal pain, slowed speech or motor movements, cough, restlessness, muscle twitching, seizures, and pulmonary edema (*3*).

The findings in this report are subject to at least two limitations. First, concentrations of sulfuryl fluoride were not measured at the house at the time of the incident and no laboratory tests were available to confirm exposure to sulfuryl fluoride. Second, it is not known why only the son developed high severity illness. It is possible he spent more time in less ventilated parts of the house with higher sulfuryl fluoride concentrations or had higher susceptibility.

Although sulfuryl fluoride has been observed to cause basal ganglia injury in animals (*4*), this is the first report of basal ganglia injury in humans resulting from systemic sulfuryl fluoride poisoning. This exposure underscores the importance of strict compliance with pesticide label requirements. The EPA recently proposed revised rules for enhanced training and certification of pesticide applicators (*5*).

[§] Standardized coding was used to determine severity of illness (http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sevindexv6.pdf). Low severity cases usually resolve without treatment and cause minimal time lost from work (<3 days). High severity cases are considered life threatening and typically require treatment, hospitalization for >3 days or result in ≥6 days lost from work or from normal activities.

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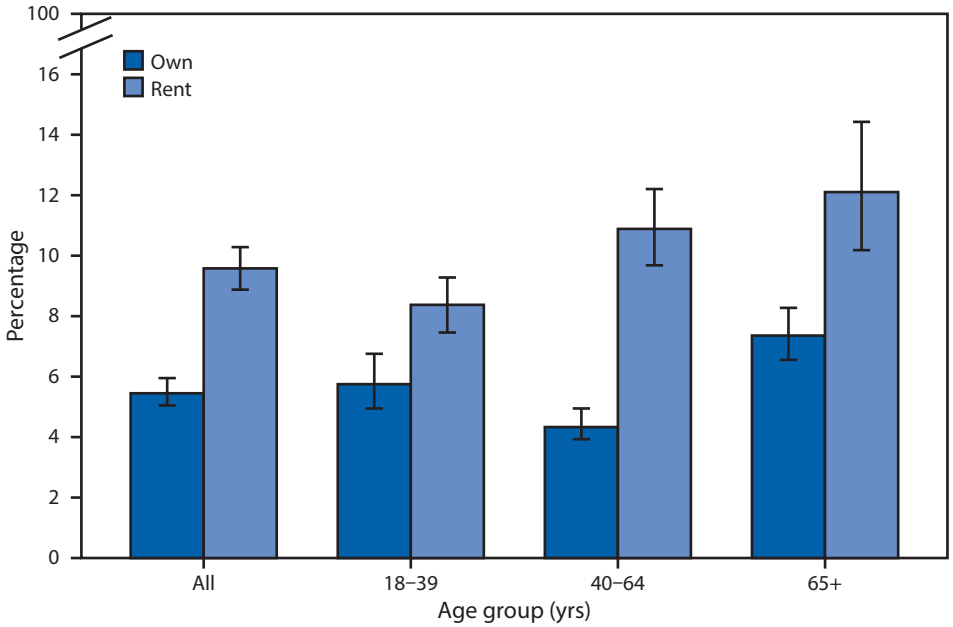
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥18 Years with Two or More Visits to an Emergency Department† in the Previous 12 Months, by Home Ownership§ and Age Group — National Health Interview Survey,¶ United States, 2015



* With 95% confidence intervals indicated with error bars.
† Based on a response to the following question on sample adult questionnaire: "During the past 12 months, how many times have you gone to a hospital emergency room about your own health? (This includes emergency room visits that resulted in a hospital admission.)"
§ Defined by family respondent's answer to the following question on family core questionnaire: "Is this house/apartment owned or being bought, rented, or occupied by some other arrangement by [you/or someone in your family]?"
¶ Estimates are based on household interviews of a sample of the noninstitutionalized U.S. civilian population and are derived from the National Health Interview Survey family core and sample adult components.

In 2015, the percentage of adults that visited an emergency department two or more times in the previous 12 months was higher among renters (9.5%) than among homeowners (5.4%). A higher percentage of homeowners aged ≥65 years (7.3%) visited the emergency department two or more times during the previous 12 months compared with homeowners aged 40–64 years (4.3%). Compared with renters aged 18–39 years (8.3%), the percentage of renters who visited the emergency department two or more times in the previous 12 months was higher among renters aged 40–64 years (10.8%) and ≥65 years (12.0%).

Source: National Health Interview Survey, 2015 data. http://www.cdc.gov/nchs/nhis.htm.

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