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Infant Mortality Attributable to Birth Defects — United States, 2003–2017

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Birth defects are a leading cause of infant mortality in the United States, accounting for 20.6% of infant deaths in 2017 (*1*). Rates of infant mortality attributable to birth defects (IMBD) have generally declined since the 1970s (*1*–*3*). U.S. linked birth/infant death data from 2003–2017 were used to assess trends in IMBD. Overall, rates declined 10% during 2003–2017, but decreases varied by maternal and infant characteristics. During 2003–2017, IMBD rates decreased 4% for infants of Hispanic mothers, 11% for infants of non-Hispanic black (black) mothers, and 12% for infants of non-Hispanic white (white) mothers. In 2017, these rates were highest among infants of black mothers (13.3 per 10,000 live births) and were lowest among infants of white mothers (9.9). During 2003–2017, IMBD rates for infants who were born extremely preterm (20–27 completed gestational weeks), full term (39–40 weeks), and late term/postterm (41–44 weeks) declined 20%–29%; rates for moderate (32–33 weeks) and late preterm (34–36 weeks) infants increased 17%. Continued tracking of IMBD rates can help identify areas where efforts to reduce IMBD are needed, such as among infants born to black and Hispanic mothers and those born moderate and late preterm (32–36 weeks).

Linked birth/infant death records for infants aged <1 year born to U.S. residents (excluding U.S. territories) from 2003, the first year of the birth certificate revision,* through 2017 were obtained from the National Vital Statistics System.† Most (98.4%–99.6%) infant death records were linked to their corresponding birth certificates (percentage of matched records varied by year). To account for nonlinkage, the linked birth/infant death file was weighted by the proportion of death certificates unlinked to their corresponding birth certificate each year by state and age at death. Last menstrual period date obtained from the birth certificate was used to calculate gestational age at birth. Records of 7.8% of infant deaths and 1.4% of live births with missing or implausible gestational age (i.e., gestational age <20 weeks, >44 weeks, or incompatible with birthweight) (*4*) were excluded. Maternal race/ethnicity was obtained from the birth certificate where multiple-race/Hispanic-origin responses were converted to single bridged-race categories (*5*). *International Classification of Diseases, Tenth Revision* was used to identify deaths with a major birth defect listed as the underlying cause of death (codes Q00.0–Q99.9).

* https://www.cdc.gov/nchs/nvss/revisions-of-the-us-standard-certificates-and-reports.htm.
† https://www.cdc.gov/nchs/data_access/vitalstatsonline.htm.

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The following conditions were not considered causes of IMBD: undescended testicles (Q53.1, Q53.2, and Q53.9); cardiovascular conditions not considered to be structural heart defects (Q27.0–Q28.9); and preterm births (20–36 weeks) with an underlying cause of death considered to be a complication of prematurity (lung hypoplasia [Q33.6]). In addition, underlying causes of death listed as persistent foramen ovale (Q21.1) and patent ductus arteriosus (Q25.0) were excluded for all preterm births and for infants born at term/postterm (37–44 weeks) with an age of death <28 days (neonatal).

IMBD rates and 95% confidence intervals (CIs) were calculated for each year and stratified by maternal race/ethnicity (white, black, or Hispanic), maternal age at delivery (<20 years, 20–34 years, or >34 years), infant sex, gestational age (20–27, 28–31, 32–33, 34–36, 37–38, 39–40, or 41–44 weeks), and infant age at death (neonatal [<28 days] or postneonatal [28–364 days]). Births from other racial/ethnic groups were excluded from race/ethnicity analyses but were included in the total counts. Overall and for each stratum, percent changes in IMBD rates were calculated by dividing the difference between the rates in 2003 and 2017 by the rate in 2003, and then multiplying by 100. References to decreasing or increasing trends during 2003–2017 are statistically significant and were assessed using the Cochran–Armitage test for trend. SAS statistical software (version 9.4; SAS Institute) was used for analyses.

The 2003–2017 linked birth/infant death data included 60,036,305 live births and a weighted total of 384,223 infant deaths (349,049 after exclusions). A birth defect was listed as the underlying cause of death for 70,954 (20.3%) infant deaths during 2003–2017, ranging from 19.5% (4,898 of 25,069) in 2003 to 20.7% (4,186 of 20,179) in 2017. IMBD rates decreased 10% from 2003 (12.2 per 10,000 live births [95% CI = 11.9–12.6]) to 2017 (11.0 per 10,000 live births [95% CI = 10.7–11.3]) (Table) (Figure 1).

Significant trends in IMBD during 2003–2017 were observed across most maternal racial/ethnic, maternal age, infant sex, gestational age, and infant age at death categories (Table). Rates decreased 4% during 2003–2017 for infants of Hispanic mothers (from 13.0 infant deaths per 10,000 live births to 12.5), 11% for infants of black mothers (from 14.9 to 13.3), and 12% for infants of white mothers (from 11.3 to 9.9) (Table) (Figure 1). During 2003–2017, rates were consistently higher among infants of black mothers and lowest among infants of white mothers (Figure 1). Trends varied by maternal age: rates for infants of mothers aged <20 years were stable from 2003 (13.3) to 2017 (12.9), but rates decreased 12% for infants of mothers aged 20–34 years (from 11.5 to 10.1) and 6% for mothers aged >34 years (from 15.5 to 14.5). IMBD rates decreased 14% during 2003–2017 for male infants (from 12.8 to 11.0) and 6% for female infants (from 11.7 to 11.0). Among extremely preterm infants (20–27 weeks), rates declined 20% (from 198.5 to 158.8); however, significant 17% increases occurred among infants born at 32–33 weeks (from 58.2 to 67.9) and 34–36 weeks (from 25.4 to 29.6) (Figure 2) (Table). IMBD rates declined 29% among infants born at 39–40 weeks (from 5.9 to 4.2) and 25% among infants born

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TABLE. Rates of infant mortality attributable to birth defects (IMBD) in 2003 and 2017 and percentage change, by maternal race/ethnicity, maternal age at delivery, infant sex, gestational age, and infant age at death — United States, 2003–2017

Characteristic	IMBD rates per 10,000 live births (95% CI)		% Change* 2003–2017
	2003	2017	
	Total IMBD cases = 4,897; total infant births = 3,998,383	Total IMBD cases = 4,186; total infant births = 3,809,747	
Total IMBD	**12.2 (11.9–12.6)**	**11.0 (10.7–11.3)**	**−10§**
Maternal race/ethnicity†			
White, non-Hispanic	11.3 (10.9–11.8)	9.9 (9.4–10.3)	−12§
Black, non-Hispanic	14.9 (13.8–15.9)	13.3 (12.4–14.3)	−11§
Hispanic	13.0 (12.2–13.7)	12.5 (11.8–13.2)	−4§
Maternal age at delivery (yrs)			
<20	13.3 (12.2–14.4)	12.9 (11.3–14.5)	−3
20–34	11.5 (11.1–11.9)	10.1 (9.7–10.4)	−12§
>34	15.5 (14.5–16.5)	14.5 (13.5–15.4)	−6§
Infant sex			
Male	12.8 (12.3–13.3)	11.0 (10.5–11.5)	−14§
Female	11.7 (11.2–12.2)	11.0 (10.5–11.4)	−6§
Gestational age (wks)			
20–27	198.5 (181.5–215.6)	158.8 (142.7–175.0)	−20§
28–31	110.0 (99.9–120.0)	104.0 (93.8–114.1)	−5
32–33	58.2 (52.1–64.3)	67.9 (61.0–74.8)	17§
34–36	25.4 (23.8–27.1)	29.6 (27.7–31.5)	17§
37–38	10.5 (9.9–11.1)	10.5 (9.9–11.2)	0
39–40	5.9 (5.5–6.2)	4.2 (3.9–4.5)	−29§
41–44	7.1 (6.4–7.7)	5.3 (4.6–5.9)	−25§
Infant age category at death¶			
Neonatal	8.5 (8.2–8.7)	7.9 (7.6–8.2)	−7§
Postneonatal	3.8 (3.6–4.0)	3.1 (2.9–3.3)	−18§

Abbreviation: CI = confidence interval.
* Overall percent change was calculated as $100 \times ((IMBDrate_{2003} - IMBDrate_{2017})/IMBDrate_{2003})$.
† Excludes infants born to mothers of other reported racial/ethnic groups and other/unknown maternal race/ethnicity.
§ Significant trend in IMBD rates during 2003–2017 using the Cochran-Armitage test for trend.
¶ Neonatal: <28 days; postneonatal: 28–364 days.

at 41–44 weeks (from 7.1 to 5.3). Since 2003, rates were stable among infants born at 28–31 weeks (from 110.0 to 104.0) and 37–38 weeks (10.5 in both years). Trends in IMBD also differed by infant age category at death (neonatal or postneonatal); rates in both categories declined significantly: a 7% decline (from 8.5 to 7.9) in neonatal rates and an 18% decline (from 3.8 to 3.1) in postneonatal rates.

Discussion

Rates of IMBD decreased 10% during 2003–2017 overall and across the categories of maternal race/ethnicity, infant sex, and infant age at death. Although rates declined among infants of Hispanic, black, and white mothers, racial/ethnic disparities persisted. The IMBD rate was 32% (2003) and 34% (2017) higher among infants born to black mothers than that among those born to white mothers and 15% (2003) and 26% (2017) higher among infants born to Hispanic mothers than among those born to white mothers. Across gestational age categories, declines in IMBD rates were limited to infants born at 20–27 and 39–44 weeks, and rates increased for those born at 32–36 weeks and were stable for those born at 28–31 and 37–38 weeks.

Summary

What is already known about this topic?

Rates of infant mortality attributable to birth defects have been declining since 1970.

What is added by this report?

During 2003–2017, rates of infant mortality attributable to birth defects declined 10% overall, including among infants of Hispanic mothers (4%), non-Hispanic black mothers (11%), and non-Hispanic white mothers (12%); however, racial/ethnic disparities remained. Rates decreased for extremely preterm infants (20–27 completed gestational weeks) and late term/postterm infants (39–44 weeks) but increased for moderate/late preterm infants (32–36 weeks).

What are the implications for public health practice?

Continued tracking of rates of infant mortality attributable to birth defects by maternal and infant characteristics can help identify areas where efforts to reduce mortality rates are needed.

The decline in IMBD could be influenced by improvements in prenatal care, birth defects prevention measures, and improvements in medical care of infants with birth defects, in addition to factors influencing the overall infant

FIGURE 1. Rates of infant mortality attributable to birth defects, by maternal race/ethnicity — United States, 2003–2017

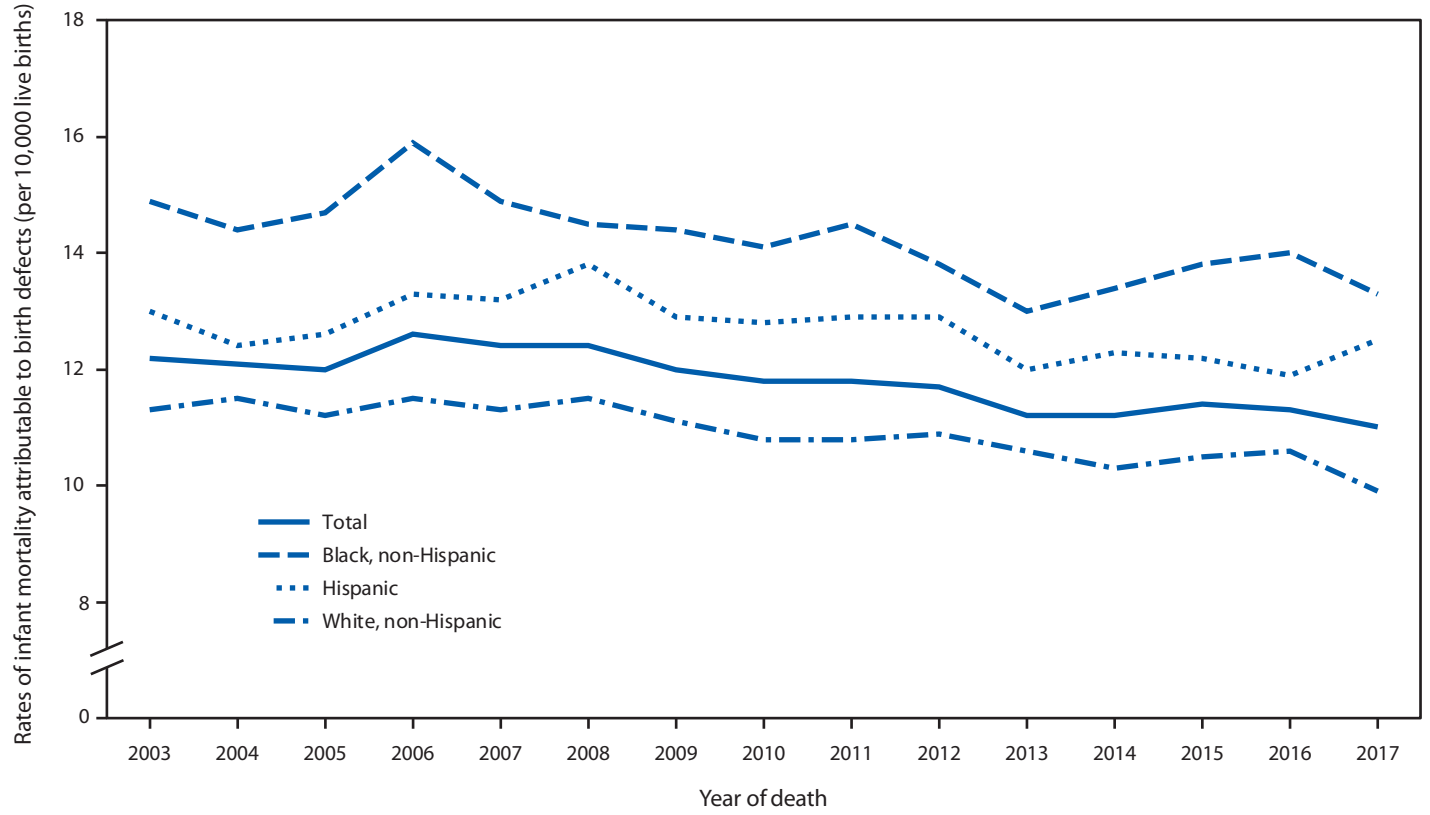
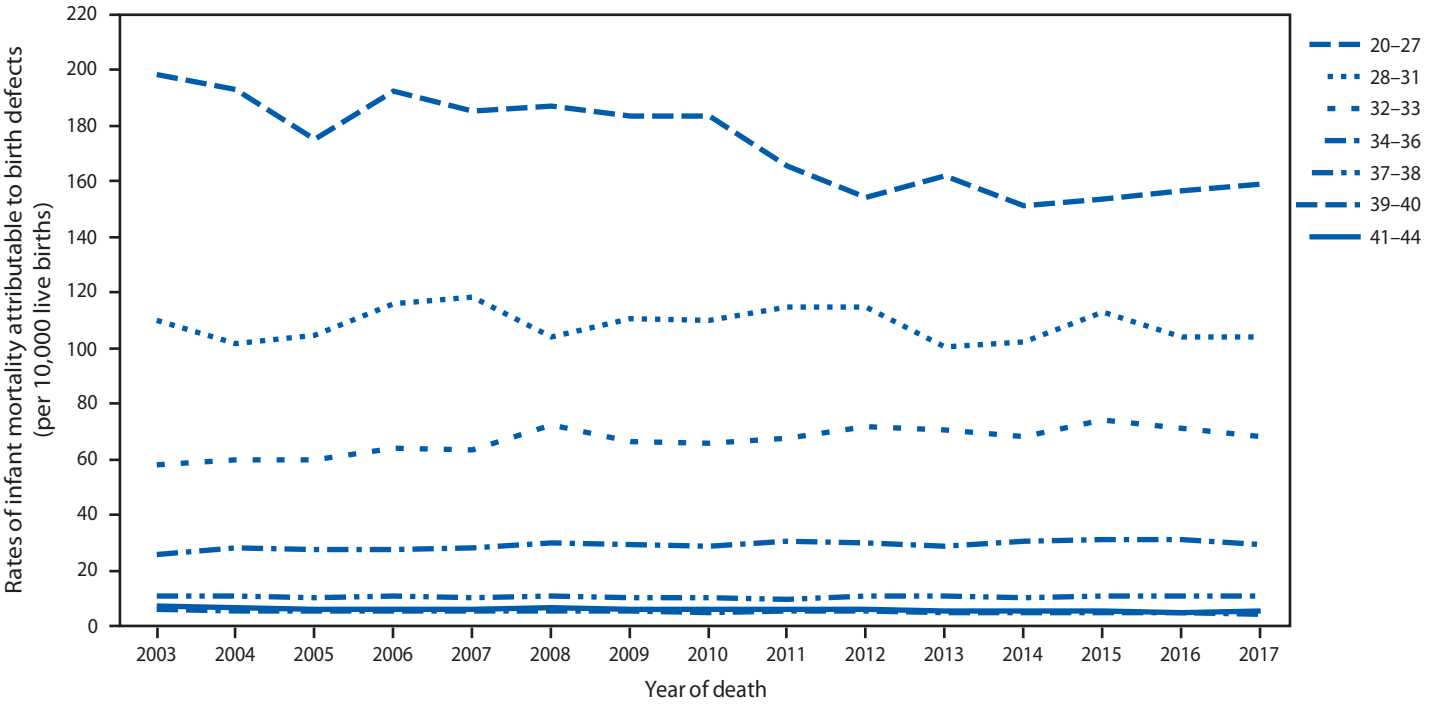


FIGURE 2. Rates of infant mortality attributable to birth defects, by infant gestational age at birth (weeks) — United States, 2003–2017



mortality rate. The observed differences in IMBD rates by race/ethnicity might be influenced by access to and utilization of health care before and during pregnancy, prenatal screening, losses of pregnancies with fetal anomalies, and insurance type (*6*,*7*). Although IMBD rates for extremely preterm and late term/postterm infants significantly decreased over the 15-year period, rates among moderate and late preterm infants increased. These trends could be influenced by the quantity and quality of care for infants born before 30 weeks gestation, compared with that of those born closer to term (*8*).

The findings in this report are subject to at least four limitations. First, deaths for which birth defects were listed as a contributing but not the underlying cause of death (13%–15% during 2003–2017)[§] were not included, possibly resulting in an underestimation of IMBD. Second, cause of death classifications might vary by the maternal and infant factors considered in this report. Third, gestational age categories in this report were calculated from date of the last menstrual period and thus are subject to misclassification. Gestational age categories determined by obstetric estimates have shown increased validity and are the preferred measure (*9*), but these were not available for the full period under study. Finally, examining trends in IMBD rates by specific type of birth defect was beyond the scope of the study, but could provide additional information to inform prevention efforts.

Birth defects occur in approximately 3% of births (*10*) yet are a leading cause of infant mortality (*1*). The results from this analysis can inform future research into areas where efforts to reduce IMBD rates are needed, such as among infants born to black and Hispanic mothers and those born moderate/late preterm (32–36 weeks).

[§] Data are from CDC WONDER's Multiple Cause of Death Files, 1999–2017, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. https://wonder.cdc.gov/mcd-icd10.html.

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Trends in Total Binge Drinks per Adult Who Reported Binge Drinking — United States, 2011–2017

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Each year, excessive drinking accounts for one in 10 deaths among U.S. adults aged 20–64 years (*1*), and approximately 90% of adults who report excessive drinking* binge drink (i.e., consume five or more drinks for men or four or more drinks for women on a single occasion) (*2*). In 2015, 17.1% of U.S. adults aged ≥18 years reported binge drinking approximately once a week and consumed an average of seven drinks per binge drinking episode, resulting in 17.5 billion total binge drinks, or 467 total binge drinks per adult who reported binge drinking (*3*). CDC analyzed 2011–2017 Behavioral Risk Factor Surveillance System (BRFSS) data to assess trends in total annual binge drinks per adult who reported binge drinking in the United States overall and in the individual states. The age-adjusted† total annual number of binge drinks per adult who reported binge drinking increased significantly from 472 in 2011 to 529 in 2017. Total annual binge drinks per adult who reported binge drinking also increased significantly from 2011 to 2017 among those aged 35–44 years (26.7%, from 468 to 593) and 45–64 years (23.1%, from 428 to 527). The largest percentage increases in total binge drinks per adult who reported binge drinking during this period were observed among those without a high school diploma (45.8%) and those with household incomes <$25,000 (23.9%). Strategies recommended by the Community Preventive Services Task Force§ for reducing excessive drinking (e.g., regulating alcohol outlet density) might reduce binge drinking and related health risks.

BRFSS is a state-based, random-digit–dialed landline and cellular telephone survey of noninstitutionalized, civilian U.S. adults aged ≥18 years that collects data during each calendar month, yielding a representative sample for the year.¶ Because important disparities in binge drinking behavior are not apparent based on an assessment of binge drinking prevalence alone, a new measure of binge drinking among U.S. adults was used (*3*). For each adult who reported binge drinking, the annual number of binge drinking episodes was calculated by multiplying the past 30-day frequency of binge drinking by 12. The largest number of drinks consumed by adults who reported binge drinking during any occasion in the past 30 days was used to assess binge drinking intensity. The total annual number of binge drinks was calculated as the product of the annual number of binge drinking episodes and the binge drinking intensity among adults who reported binge drinking. Total annual binge drinks per adult who reported binge drinking was then determined by dividing total binge drinks by the weighted population estimates of U.S. adults who reported binge drinking.

To assess trends in total binge drinks per adult who reported binge drinking overall, by sociodemographic characteristics, and by state, CDC analyzed 2011–2017 BRFSS data. Total BRFSS sample sizes ranged from 441,456 (2015) to 506,467 (2011). The median survey response rates declined from 49.7% in 2011 to 45.9% in 2017.** Data were weighted to each state's adult population and to each respondent's probability of selection. SAS (version 9.4; SAS Institute) and SAS-callable SUDAAN (version 10.0.3; RTI International) were used to calculate the mean of total binge drinks per adult who reported binge drinking, age-adjusted to the 2000 projected U.S. population. Linear and quadratic trends of the total annual binge drinks per adult who reported binge drinking were assessed by orthogonal polynomial contrast; only linear trends were consistent with the temporal distribution of the study data and were reported. Two-tailed t-tests were used to assess the statistical significance ($p<0.05$) of linear trends overall and among specific subgroups.

The age-adjusted prevalence of binge drinking decreased from 18.9% in 2011 to 18.0% in 2017 (Table 1). However, the overall age-adjusted total annual number of binge drinks per adult who reported binge drinking increased significantly (12.1%) from 472 in 2011 to 529 in 2017 (Figure). The total number of binge drinks per adult who reported binge drinking also significantly increased from 2011 to 2017, both for men (from 587 to 666) and women (from 256 to 290) (Table 1). During this period, the total number of binge drinks per adult who reported binge drinking also increased significantly: from

* Excessive alcohol consumption includes binge drinking (i.e., five or more drinks on an occasion for men and four or more drinks on an occasion for women), heavy weekly alcohol consumption (i.e., 15 or more drinks per week for men; eight or more drinks per week for women), and any drinking by pregnant women or those aged <21 years. https://www.cdc.gov/alcohol/fact-sheets/alcohol-use.htm.

† https://www.cdc.gov/nchs/data/statnt/statnt20.pdf.

§ https://www.thecommunityguide.org/topic/excessive-alcohol-consumption.

¶ https://www.cdc.gov/brfss/annual_data/2017/pdf/overview-2017-508.pdf.

** Response rates for BRFSS are calculated using standards set by the American Association for Public Opinion Research response rate formula 4 (https://www.aapor.org/AAPOR_Main/media/publications/Standard-Definitions20169theditionfinal.pdf). The response rate is the number of respondents who completed the survey as a proportion of all eligible and likely eligible persons.

TABLE 1. Age-adjusted* binge drinking prevalence,† frequency,§ intensity,¶ and total binge drinks per adult who reported binge drinking among adults aged ≥18 years,†† by selected characteristics and year — Behavioral Risk Factor Surveillance System, United States,§§ 2011–2017**

Characteristic	Year Mean (95% CI) 2011 (n = 36,759,000)¶¶	2012 (n = 35,765,000)¶¶	2013 (n = 35,044,000)¶¶	2014 (n = 33,465,000)¶¶	2015 (n = 35,084,000)¶¶	2016 (n = 36,617,000)¶¶	2017 (n = 36,896,000)¶¶	Linear trend p-value
Binge drinking prevalence %†	18.9 (18.6–19.1)	17.5 (17.3–17.8)	17.2 (17.0–17.5)	16.7 (16.5–17.0)	17.1 (16.9–17.4)	17.8 (17.5–18.0)	18.0 (17.7–18.2)	<0.01
Binge drinking frequency§	4.2 (4.1–4.3)	4.3 (4.2–4.4)	4.5 (4.4–4.6)	4.4 (4.3–4.5)	4.4 (4.3–4.5)	4.6 (4.5–4.7)	4.6 (4.5–4.7)	<0.001
Binge drinking intensity¶	7.2 (7.1–7.3)	7.1 (7.0–7.2)	7.2 (7.1–7.3)	7.2 (7.1–7.3)	7.0 (6.9–7.1)	7.1 (7.0–7.1)	7.1 (7.0–7.2)	<0.01
Total binge drinks per adult who reported binge drinking								
Overall*	472 (455–489)	473 (456–489)	497 (478–516)	501 (481–521)	493 (473–512)	516 (497–535)	529 (505–552)	<0.001
Sex*								
Men	587 (564–611)	586 (562–610)	620 (594–647)	625 (597–653)	615 (586– 644)	641 (612–669)	666 (632–700)	<0.001
Women	256 (239–272)	261 (245–277)	267 (249–285)	272 (250–294)	267 (250– 284)	299 (280–317)	290 (266–314)	<0.001
Age group (yrs)								
18–24	619 (557–681)	538 (495–581)	558 (512–604)	553 (501–605)	531 (483–579)	542 (481–603)	545 (483–607)	NS
25–34	496 (461–531)	491 (449–534)	532 (486–579)	520 (473–566)	501 (452–551)	479 (448–509)	479 (442–515)	NS
35–44	468 (430–505)	492 (449–534)	494 (455–533)	513 (465–562)	491 (451–532)	531 (485–577)	593 (530–655)	<0.01
45–64	428 (406–451)	462 (438–487)	480 (450–510)	497 (466–528)	483 (452–514)	552 (517–587)	527 (488–567)	<0.001
≥65	416 (367–465)	397 (358–437)	447 (394–501)	434 (383–485)	473 (411–535)	454 (407–500)	490 (424–556)	<0.05
Race/Ethnicity*,***								
White	487 (468–506)	485 (468–503)	506 (486–525)	527 (503–551)	503 (482–525)	529 (509–549)	539 (513–565)	<0.001
Black	386 (339–433)	421 (365–477)	429 (373–486)	392 (338–446)	430 (360–499)	415 (367–463)	433 (377–489)	NS
Hispanic	448 (367–530)	409 (352–466)	470 (394–546)	420 (369–472)	428 (359–497)	464 (396–531)	461 (390–533)	NS
American Indian/ Alaska Native	725 (474–975)	753 (528–977)	688 (486–890)	885 (467–1,302)	738 (483–994)	803 (620–987)	1,179 (729–1,629)	NS
Asian/Pacific Islander	399 (225–573)	392 (267–517)	337 (247–428)	299 (183–415)	539 (194–885)†††	355 (200–511)	421 (314–528)	NS
Education level*								
Less than high school diploma	646 (573–719)	682 (600–764)	685 (604–765)	717 (628–806)	786 (670–902)	766 (675–858)	942 (815–1,069)	<0.001
High school diploma	565 (530–600)	545 (515–574)	604 (565–643)	600 (561–639)	585 (546–624)	642 (597–688)	647 (594–699)	<0.01
Some college	442 (412–472)	453 (427–480)	481 (450–512)	489 (456–522)	460 (430–491)	485 (457–513)	501 (463–539)	<0.05
College graduate	327 (308–345)	334 (314–354)	329 (310–348)	335 (308–361)	334 (315–353)	340 (322–357)	317 (301–333)	NS
Annual household income*								
<$25,000	543 (504–581)	596 (549–642)	598 (549–646)	648 (589–706)	590 (538–643)	590 (545–636)	673 (596–750)	<0.05
$25,000–$49,999	512 (481–544)	482 (450–513)	518 (482–554)	540 (496–583)	528 (483–573)	608 (558–658)	569 (515–622)	<0.01
$50,000–$74,999	462 (414–511)	448 (411–484)	493 (449–538)	475 (430–521)	489 (442–536)	509 (465–553)	519 (465–573)	<0.05
≥$75,000	413 (379–447)	413 (386–439)	435 (402–467)	425 (393–457)	440 (403–477)	455 (427–483)	457 (422–493)	<0.05

Abbreviations: CI = confidence interval; NS = not significant.

* Age-adjusted mean of total binge drinks per adult who reported binge drinking was standardized to the projected 2000 U.S. Census population.

† Binge drinking was defined as consumption of five or more drinks on an occasion for men and four or more drinks on an occasion for women, during the past 30 days.

§ Average number of binge-drinking episodes reported by all adults who reported binge drinking during the past 30 days.

¶ Average largest number of drinks consumed by adults who reported binge drinking on any occasion during the past 30 days.

** Total number of binge drinks was calculated by multiplying the frequency of binge drinking (i.e., total annual number of binge drinking episodes) by the binge drinking intensity (i.e., the largest number of drinks consumed by adults who reported binge drinking on any occasion) for each adult who reported binge drinking.

†† Including respondents aged 18–20 years who are under the legal drinking age.

§§ Respondents were from all 50 states and the District of Columbia.

¶¶ Weighted total population of adults who reported binge drinking.

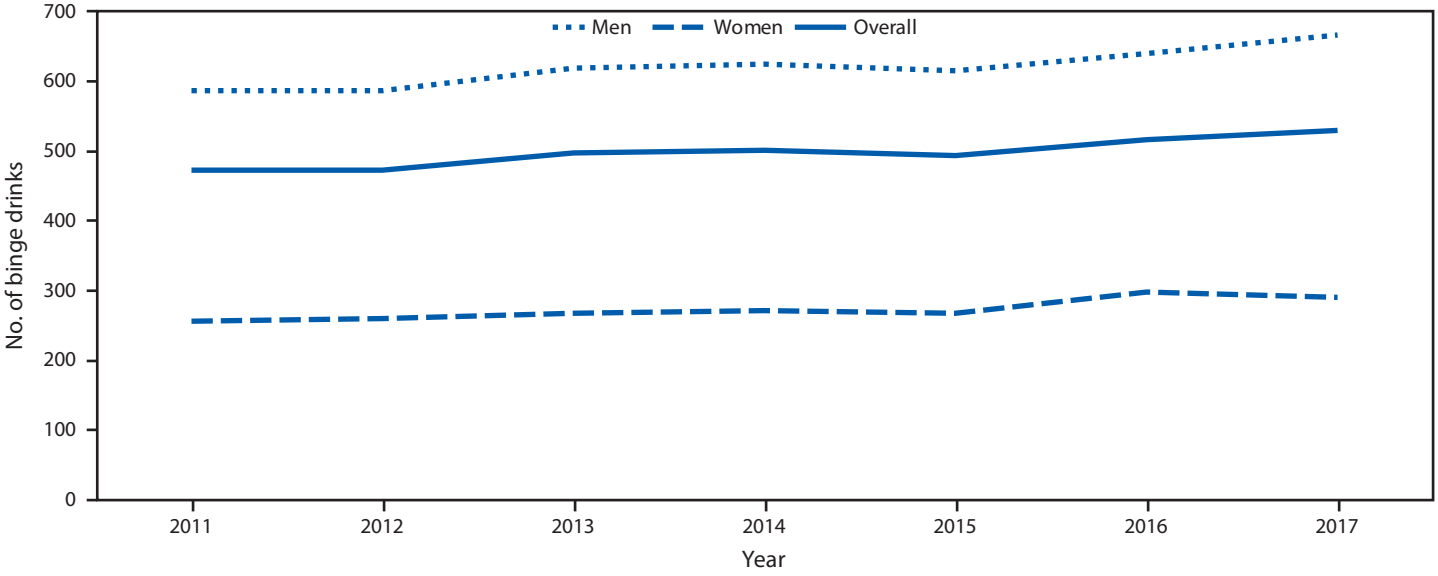
*** Whites, blacks, American Indian/Alaska Natives, and Asian/Pacific Islanders were non-Hispanic; Hispanic persons could be of any race.

††† Unreliable estimates if relative standard error >0.3 or n<50.

468 to 593 among those aged 35–44 years, from 428 to 527 among those aged 45–64 years, from 416 to 490 among those aged ≥65 years, and from 487 to 539 among non-Hispanic white adults. In addition, the total number of binge drinks per adult who reported binge drinking increased significantly among persons with some college education or less and across all income categories. However, from 2011 to 2017, the largest percentage increases in total number of binge drinks per adult who reported binge drinking were among those with less than a high school diploma (45.8%; from 646 to 942) and those with household incomes <$25,000 (23.9%; from 543 to 673).

In 2017, the total number of binge drinks per adult who reported binge drinking ranged from 320 in Massachusetts to 1,219 in Wyoming (Table 2). From 2011 to 2017, total number of binge drinks per adult who reported binge drinking increased significantly in nine states (Idaho, Indiana, Maine, Montana, New Jersey, New York, North Dakota, Ohio, and Virginia), decreased significantly in Massachusetts and West Virginia, and did not change significantly in the other 39 states and the District of Columbia.

FIGURE. Age-adjusted* annual number of binge drinks per adult who reported binge drinking† among adults aged ≥18 years,§ by sex — Behavioral Risk Factor Surveillance System, United States,¶ 2011–2017



* Age-adjusted mean of total binge drinks per adult who reported binge drinking was standardized to the projected 2000 U.S. Census population.
† Total number of binge drinks was calculated by multiplying the frequency of binge drinking (i.e., total annual number of binge drinking episodes) by the binge drinking intensity (i.e., the largest number of drinks consumed by adults who reported binge drinking on any occasion) for each adult who reported binge drinking.
§ Including respondents aged 18–20 years who were under the legal drinking age.
¶ Respondents were from all 50 states and the District of Columbia.

Discussion

The total annual number of binge drinks consumed per U.S. adult who reported binge drinking increased significantly by 12% from 2011 to 2017, including among non-Hispanic white adults and those aged ≥35 years. These increases are consistent with other recent evidence of an approximately 30% increase in high-risk drinking,†† including binge-level alcohol consumption, particularly among middle-aged and older adults (*4*). Because binge drinking contributes a substantial proportion of all alcohol consumption in the United States, these increases also are consistent with an increase in per capita alcohol consumption (derived from sales and shipment data) in the United States,§§ from 2.29 gallons in 2011 to 2.34 gallons in 2017.

The finding that the total number of binge drinks consumed per U.S. adult who reported binge drinking increased significantly among those with lower education and income levels is also consistent with a recent study that found the majority of persons reporting prescription opioid misuse also are adults who reported binge drinking, and that prescription opioid misuse tends to be most common among persons with lower household incomes (*5*). Socioeconomic disparities in the total number of binge drinks per adult who reported binge drinking also might have contributed to the lower life expectancies reported among persons with lower socioeconomic status in the United States (*6*).

The total annual number of binge drinks per adult who reported binge drinking did not change significantly in most states from 2011 to 2017, although it did increase significantly in nine states. At the state or local levels, examining the total

Summary

What is already known about this topic?

In 2015, 37 million (17.1%) U.S. adults reported binge drinking approximately once a week and consumed an average of seven drinks per binge drinking episode, resulting in approximately 450 total binge drinks per adult who reported binge drinking annually.

What is added by this report?

From 2011 to 2017, the total number of binge drinks consumed annually by U.S. adults who reported binge drinking increased significantly, from 472 to 529. Significant increases were observed among adults who reported binge drinking of both sexes, those aged ≥35 years, and those with lower educational levels and household incomes.

What are the implications for public health practice?

Application of population-level evidence-based prevention strategies (e.g., regulating alcohol outlet density) could reduce binge drinking and related harms.

†† High-risk drinking was defined as drinking four or more standard drinks on any day for women or five or more standard drinks on any day (not necessarily during one sitting) for men.
§§ https://pubs.niaaa.nih.gov/publications/surveillance113/CONS17.htm.

TABLE 2. Age-adjusted* total number of binge drinks per adult who reported binge drinking† among adults aged ≥18 years,§ by state — Behavioral Risk Factor Surveillance System, United States, 2011–2017

State	Year Mean (95% CI)							Linear trend p-value
	2011	2012	2013	2014	2015	2016	2017	
Alabama	520 (257–783)	530 (423–637)	414 (320–507)	457 (375–539)	570 (450–690)	481 (400–562)	451 (296–606)	NS
Alaska	535 (341–729)	466 (369–562)	640 (415–865)	702 (529–875)	649 (447–852)	405 (326–484)	683 (376–989)	NS
Arizona	412 (335–489)	405 (333–476)	729 (486–972)	499 (409–589)	547 (403–690)	522 (431–613)	492 (419–566)	NS
Arkansas	710 (332–1,088)	732 (479–985)	748 (334–1,161)	449 (357–541)	819 (552–1,086)	843 (479–1,207)	774 (512–1,036)	NS
California	417 (359–476)	372 (323–420)	445 (370–520)	470 (391–549)	400 (342–459)	430 (358–502)	470 (379–562)	NS
Colorado	390 (334–445)	409 (353–464)	450 (385–516)	403 (352–453)	426 (367–486)	430 (358–502)	434 (368–500)	NS
Connecticut	410 (306–514)	483 (357–608)	455 (333–578)	402 (324–480)	565 (412–719)	489 (329–648)	365 (287–442)	NS
Delaware	543 (378–709)	459 (372–545)	432 (339–525)	482 (351–614)	435 (319–551)	560 (391–729)	640 (301–979)	NS
District of Columbia	353 (281–425)	325 (264–387)	354 (289–419)	379 (273–484)	323 (252–394)	342 (265–418)	334 (267–401)	NS
Florida	497 (421–573)	513 (422–603)	559 (485–632)	511 (426–596)	455 (378–531)	617 (453–781)	619 (489–749)	NS
Georgia	487 (394–579)	548 (411–685)	529 (404–654)	535 (425–646)	496 (377–616)	576 (424–727)	473 (367–580)	NS
Hawaii	636 (476–796)	703 (594–812)	634 (514–755)	577 (493–661)	635 (529–741)	646 (512–781)	622 (520–724)	NS
Idaho	433 (329–538)	434 (360–509)	556 (429–682)	448 (339–558)	533 (402–663)	520 (404–636)	793 (506–1,079)	<0.05
Illinois	497 (424–571)	499 (396–602)	525 (426–623)	517 (415–620)	451 (370–532)	532 (428–637)	441 (363–519)	NS
Indiana	482 (397–566)	511 (430–592)	562 (455–669)	582 (453–711)	521 (412–631)	625 (517–733)	699 (588–810)	<0.01
Iowa	580 (481–679)	466 (398–535)	568 (471–664)	560 (433–688)	523 (435–611)	553 (468–639)	586 (499–672)	NS
Kansas	480 (420–539)	532 (444–619)	516 (463–569)	495 (422–568)	475 (423–526)	570 (470–669)	505 (429–582)	NS
Kentucky	641 (527–756)	797 (630–964)	575 (471–679)	763 (577–950)	722 (585–858)	833 (593–1,072)	699 (554–843)	NS
Louisiana	522 (422–623)	581 (431–730)	635 (413–858)	522 (343–702)	609 (475–742)	416 (329–504)	505 (402–609)	NS
Maine	518 (437–600)	489 (416–562)	508 (418–597)	567 (450–684)	510 (435–586)	595 (487–703)	762 (503–1,021)	<0.05
Maryland	450 (324–576)	391 (336–446)	468 (374–561)	374 (310–437)	477 (365–589)	442 (382–501)	477 (384–571)	NS
Massachusetts	416 (369–463)	499 (420–578)	448 (377–518)	471 (387–555)	440 (333–547)	386 (319–452)	320 (267–372)	<0.01
Michigan	567 (473–661)	478 (399–556)	468 (413–523)	602 (494–711)	609 (491–727)	582 (475–690)	531 (454–608)	NS
Minnesota	400 (352–447)	421 (366–475)	445 (385–504)	410 (352–467)	452 (408–496)	427 (378–475)	409 (365–453)	NS
Mississippi	665 (502–827)	512 (412–612)	631 (496–766)	521 (372–669)	761 (425–1,097)	622 (449–794)	640 (437–842)	NS
Missouri	535 (433–636)	479 (371–588)	614 (438–791)	592 (456–728)	653 (488–819)	603 (499–708)	493 (408–578)	NS
Montana	467 (403–530)	481 (418–544)	454 (394–514)	550 (435–665)	498 (398–598)	475 (377–572)	658 (503–813)	<0.05
Nebraska	460 (419–502)	526 (463–589)	500 (426–574)	472 (417–528)	472 (385–559)	479 (413–545)	477 (414–540)	NS
Nevada	480 (377–582)	470 (389–551)	677 (487–868)	448 (333–564)	623 (377–868)	421 (304–538)	483 (341–624)	NS
New Hampshire	530 (348–712)	586 (408–764)	399 (328–470)	458 (355–560)	414 (331–497)	479 (388–571)	506 (366–647)	NS
New Jersey	438 (330–546)	344 (287–402)	355 (311–399)	394 (335–452)	429 (234–624)	473 (352–595)	563 (436–690)	<0.05
New Mexico	442 (376–508)	512 (427–597)	480 (407–552)	580 (478–682)	440 (351–528)	512 (369–654)	558 (428–688)	NS
New York	364 (293–435)	370 (303–438)	368 (316–420)	375 (281–469)	389 (344–435)	448 (401–495)	481 (400–561)	<0.01
North Carolina	483 (384–582)	463 (397–529)	465 (374–556)	464 (351–577)	434 (356–511)	523 (376–671)	445 (253–636)	NS
North Dakota	436 (336–535)	471 (389–553)	459 (396–523)	624 (462–785)	547 (444–649)	610 (506–713)	505 (434–576)	<0.05
Ohio	474 (402–546)	541 (466–616)	488 (428–548)	606 (481–731)	608 (444–772)	633 (527–738)	764 (603–925)	<0.01
Oklahoma	604 (459–748)	583 (490–675)	616 (465–767)	539 (438–641)	555 (417–693)	563 (373–753)	490 (389–592)	NS
Oregon	455 (361–549)	457 (358–557)	508 (400–615)	406 (335–477)	400 (322–479)	383 (325–442)	425 (356–494)	NS
Pennsylvania	472 (406–537)	497 (412–582)	599 (492–707)	450 (376–525)	471 (351–590)	505 (422–589)	584 (454–715)	NS
Rhode Island	370 (290–449)	427 (346–508)	416 (338–494)	407 (325–490)	562 (271–853)	435 (331–538)	533 (378–688)	NS
South Carolina	537 (431–643)	595 (455–735)	512 (423–602)	519 (436–602)	625 (529–721)	478 (408–548)	510 (437–584)	NS
South Dakota	423 (338–507)	497 (396–597)	458 (365–551)	456 (311–602)	425 (344–505)	491 (357–625)	590 (439–742)	NS
Tennessee	421 (214–628)	428 (321–536)	319 (196–443)	505 (335–676)	529 (395–664)	534 (423–646)	497 (367–626)	NS
Texas	525 (431–620)	512 (430–594)	536 (448–623)	545 (450–640)	516 (425–608)	546 (462–630)	568 (458–679)	NS
Utah	554 (459–649)	471 (394–549)	576 (457–694)	667 (530–803)	457 (389–525)	630 (503–757)	549 (442–656)	NS
Vermont	473 (395–551)	454 (357–551)	472 (372–572)	627 (335–919)	488 (381–595)	685 (540–831)	490 (395–585)	NS
Virginia	409 (343–476)	441 (364–517)	440 (367–513)	538 (431–645)	523 (409–637)	562 (450–674)	531 (439–624)	<0.01
Washington	374 (319–429)	482 (349–615)	444 (382–506)	441 (362–519)	384 (321–447)	427 (363–491)	428 (376–480)	NS
West Virginia	792 (575–1,009)	761 (573–949)	799 (639–959)	886 (602–1,171)	517 (419–614)	766 (574–959)	565 (450–679)	<0.05
Wisconsin	511 (392–631)	514 (421–607)	452 (393–511)	490 (385–594)	493 (414–572)	460 (390–529)	478 (378–578)	NS
Wyoming	617 (448–787)	547 (371–723)	686 (488–884)	541 (357–725)	431 (336–526)	513 (355–672)	1,219 (586–1,852)	NS

Abbreviations: CI = confidence interval; NS = not significant.

* Age-adjusted mean of total binge drinks per adult who reported binge drinking was standardized to the projected 2000 U.S. Census population.

† Total number of binge drinks was calculated by multiplying the frequency of binge drinking (i.e., total annual number of binge drinking episodes) by the binge drinking intensity (i.e., the largest number of drinks consumed by adults who reported binge drinking on any occasion) for each adult who reported binge drinking.

§ Including respondents aged 18–20 years who are under the legal drinking age.

number of binge drinks consumed by adults who reported binge drinking is a relatively new way to assess binge drinking and related harms. However, by combining public health surveillance data on the prevalence, frequency, and intensity of binge drinking, this measure provides a more complete and sensitive indicator of this health risk and facilitates assessment of sociodemographic and geographic disparities in binge drinking. This measure also might be useful for assessing health risks related to binge drinking (e.g., opioid misuse) (*5*), and for planning and evaluating effective strategies for preventing binge drinking at the state and local levels.

The findings in this report are subject to at least four limitations. First, BRFSS data are self-reported, and the BRFSS substantially underestimates alcohol consumption in the United States relative to alcohol sales data (*7*). Second, the BRFSS measure of the largest number of drinks among adults who reported binge drinking might have resulted in higher estimates of binge drinking intensity than would other survey methods, such as when collecting information on the most recent binge drinking episode for adults who reported binge drinking, including the number of drinks consumed by beverage type (*8*). However, because the underreporting of alcohol consumption tends to be greater among binge drinkers than among non-binge drinkers and tends to increase with binge drinking intensity (*9*), the prevalence, frequency, and intensity of binge drinking are likely to have been substantially underestimated in this study. Third, similar to other telephone surveys, BRFSS response rates have been declining, which could affect the representativeness of the survey responses. However, BRFSS response rates did not change substantially during the study period, and were, therefore, unlikely to have affected trends. Finally, BRFSS does not survey institutionalized adults, which limits the generalizability of the findings to noninstitutionalized persons.

Reducing binge drinking is essential to reducing excessive drinking at the population level. These findings highlight the need to reduce the total number of binge drinks per adult who reported binge drinking by reducing the prevalence, frequency, and intensity of binge drinking. Moreover, monitoring binge drinking prevalence alone, the most commonly used measure of binge drinking, portrays an incomplete picture of the problem of binge drinking, and might mask important sociodemographic and socioeconomic disparities in binge drinking behavior. Binge drinking is also strongly affected by the social context within which persons make their drinking decisions. For example, persons living in states with more restrictive alcohol policies are also less likely to binge drink and experience alcohol-attributable harms, including motor vehicle crash deaths, alcoholic liver cirrhosis, and alcohol-involved homicides and suicides than are persons living in states with less restrictive alcohol policies (*10*). Evidence-based prevention strategies to decrease excessive drinking that the Community Preventive Services Task Force recommends include increasing alcohol taxes, regulating the number and concentration of alcohol outlets in communities, and enforcing minimum legal drinking age laws.

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HIV Partner Service Delivery Among Transgender Women — United States, 2013–2017

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Transgender women* in the United States are disproportionately affected by human immunodeficiency virus (HIV) infection because of multiple factors, including stigma related to gender identity, unstable housing, limited employment options, and high-risk behaviors, such as sex work, unprotected receptive anal intercourse, and injection drug use, that tend to increase their vulnerability to becoming infected with HIV (*1*,*2*). In a recent meta-analysis of 88 U.S. studies conducted during 2006–2017, the mean estimated laboratory-confirmed prevalence of HIV infection among transgender women was 14.2%, and the mean self-reported prevalence estimate was 21.0% (*3*). The Ending the HIV Epidemic initiative calls for accelerating the implementation of evidence-based strategies in the right geographic areas targeted to the right persons to end the HIV epidemic in the United States (*4*). HIV partner services are effective strategies offered by public health workers to persons with a diagnosis of HIV infection (index persons) and their sex or needle-sharing partners (partners), who are notified of potential HIV exposure and offered HIV testing and related services. CDC analyzed HIV partner services data submitted by 61 health departments† during 2013–2017. Among 208,304 index persons, 1,727 (0.8%) were transgender women. Overall, 71.5% of index transgender women were interviewed for partner services, which was lower than that for all index persons combined (81.1%). Among 1,089 transgender women named as partners by index persons, 71.2% were notified of potential HIV exposure, which was lower than that for all partners combined (77.1%). Fewer than half (46.5%) of notified transgender women partners were tested for HIV, and approximately one in five (18.6%) of those who were tested received a new diagnosis of HIV infection, slightly higher than for all partners combined (17.6%). Additional efforts are needed to effectively implement partner services among transgender women and identify those whose infection with HIV is undiagnosed, provide timely prevention and care services, reduce HIV transmission, and contribute to ending the HIV epidemic.

During 2013–2017, CDC funded 61 state and local health departments to implement comprehensive HIV prevention programs, including partner services. CDC analyzed HIV partner services person-level data for transgender women, identified using self-reported sex at birth and current gender identity. Data were stratified by age group, race/ethnicity, and U.S. Census region.§ Index persons are eligible for partner services if they live within the jurisdiction at the time of report. During partner services interviews, index persons can provide information about their sex or needle-sharing partners. Named partners are eligible for partner services if there is sufficient information to locate and notify them of their potential HIV exposure. Partners with newly diagnosed HIV infection are defined as those who test positive for HIV through partner services–initiated HIV testing and have no evidence of a previous diagnosis of HIV infection. Partners with previously diagnosed HIV infection should have evidence of an HIV diagnosis from cross-check with the health department surveillance system, review of laboratory reports, medical records, other available data sources (e.g., partner services database), or patient self-report. Data on index persons and partners were extracted from index person and partner information–specific databases; index persons could not be directly linked with their named partners. The outcomes for this analysis are the percentage of index transgender women interviewed for partner services and the percentage of transgender women partners notified and tested for HIV, and who newly or previously received a diagnosis of infection with HIV. Multivariate binomial regression was used to assess the association between index person or partner characteristics and partner services outcomes.

* Transgender persons are those whose current gender identity differs from their sex assigned at birth. In this analysis, transgender women included those who identified themselves as "male-to-female transgender" or those who identified "male" as their sex assigned at birth and "female" as their current gender.

† Fifty states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and eight directly funded metropolitan statistical areas (MSAs) or specified metropolitan divisions: Baltimore, Chicago, Fulton County (Atlanta), Houston, Los Angeles County, New York City, Philadelphia, San Francisco.

§ U.S. Census regions (states and MSAs): *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, New York City (New York), Pennsylvania, Philadelphia (Pennsylvania), Vermont, and Rhode Island. *Midwest*: Illinois, Chicago (Illinois), Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Atlanta (Georgia), Kentucky, Louisiana, Maryland, Baltimore (Maryland), Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, Texas, and West Virginia. *West*: Alaska, Arizona, California, Los Angeles (California), San Francisco (California), Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; U.S. dependent areas: Puerto Rico and U.S. Virgin Islands.

However, because of the small number of partners with newly or previously diagnosed HIV infection, associations between partner characteristics and diagnosis of infection with HIV were not analyzed. SAS (version 9.4; SAS Institute) was used to conduct all analyses.

Among the 208,304 index persons reported to CDC during 2013–2017, 81.1% overall were interviewed for partner services (Table 1). Among all index persons, 1,727 (0.8%) were identified as transgender women, among whom 71.5% were interviewed for partner services. Compared with transgender women aged 13–24 years, those aged ≥35 years were less likely to be interviewed for partner services (adjusted prevalence ratio [aPR] for persons aged 35–44 years = 0.86; ≥45 years = 0.82). Compared with transgender women residing in the Northeast, those residing in the Midwest (aPR = 1.18) and in the South (aPR = 1.15) were more likely, and those residing in the West (aPR = 0.75) were less likely to be interviewed for partner services.

Among partners identified in partner services interviews, 132,938 with sufficient information for follow-up were reported to CDC during 2013–2017 (Table 2), 102,500 (77.1%) of whom were notified. Transgender women partners with sufficient information for follow-up accounted for 1,089 (0.8%), among whom, 775 (71.2%) were notified of their potential HIV exposure. Compared with transgender women partners aged 13–24 years, those aged ≥25 years were less likely to be notified (aPR for 25–34 years = 0.88; 35–44 years = 0.79; ≥45 years = 0.77); compared with transgender women partners who were non-Hispanic white (white), those who were non-Hispanic black (black) were less likely to be notified (aPR = 0.89). Transgender women partners residing in the South and the West U.S. Census regions were more likely to be notified than those residing in the Northeast (aPR = 2.00 and aPR = 1.35, respectively).

Among all 102,500 notified partners, 50.8% (52,071) were tested for HIV, among whom 9,146 (17.6%) received a new diagnosis of HIV infection (Table 3). Overall, 0.76% (775) of notified partners were transgender women, among whom 360 (46.5%) were tested for HIV; 67 (18.6%) of these women received a new diagnosis of HIV infection, and 18 (5.0%) had a previous diagnosis of infection with HIV. The highest testing percentages among transgender women partners were in those aged 25–34 years (52.5%), Hispanics/Latinos (51.0%), and residents of the Midwest (71.4%) Census regions (excluding U.S. dependent areas). Compared with transgender women partners who were white, those who were black were less likely to be tested for HIV (aPR = 0.83).

Summary

What is already known about this topic?

An overall estimate of prevalence of infection with human immunodeficiency virus (HIV) was 18.8% among transgender women based on a meta-analysis of studies in the United States conducted during 2006–2017.

What is added by this report?

During 2013–2017, 71.5% of index transgender women were interviewed for partner services, 71.2% of transgender women partners were notified of their potential HIV exposure, 46.5% were tested for HIV, and 18.6% received a new diagnosis of HIV-positivity.

What are the implications for public health practice?

Providing partner services to index transgender women and transgender women partners requires additional efforts to address the social and structural barriers unique to this population, provide timely prevention services, help reduce HIV transmission, and end the HIV epidemic in the United States.

Discussion

This analysis found that the percentage of index transgender women interviewed by CDC-funded health departments was lower (71.5%) than that for all index persons combined (81.1%). There were also significant regional and age group differences among index transgender women interviewed. The percentage of transgender women partners notified of their potential HIV exposure (71.2%) was lower than that for all partners combined (77.1%), suggesting that there are missed opportunities to improve health of transgender women and to interrupt onward transmission of HIV.

Although 46.5% of transgender women partners were tested for HIV, this represented an improvement compared with the 35.6% ever testing and 10.0% past-year testing among transgender women found in an analysis of 2014–2015 Behavioral Risk Factor Surveillance data from 27 states and Guam (*5*) and was similar to the percentage of transgender women tested for HIV during the past 12 months (53.5%) through CDC-funded community-based organizations in three cities in 2008 (*6*). HIV testing is the gateway to other HIV-related services, and low rates of testing limit opportunities for timely linkage to care and prevention services (*7*).

Among transgender women partners who were tested, approximately one in five (18.6%) received a new diagnosis of HIV infection. This is consistent with an overall estimate of self-reported and laboratory-confirmed HIV prevalence of 18.8% among transgender women found in a meta-analysis of U.S. studies (*3*) and 19% pooled prevalence from 14 countries (*8*). Among transgender women partners with HIV-positive

TABLE 1. Human immunodeficiency virus (HIV)-positive transgender women who were interviewed for partner services, by demographic characteristics — United States,* 2013–2017

Characteristic	All index persons			Index transgender women			
	Total, no.	Interviewed, no. (column %)	% Interviewed	Total, no. (%)	Interviewed, no. (column %)	% Interviewed	aPR (95% CI)
Total	**208,304**	**168,977 (100.0)**	**81.1**	**1,727 (100.0)**	**1,234 (100.0)**	**71.5**	—
Age group (yrs)†							
13–24	**31,005**	26,809 (15.9)	86.5	**364 (21.1)**	298 (24.2)	81.9	Reference
25–34	**64,870**	53,284 (31.5)	82.1	**721 (41.8)**	538 (43.6)	74.6	0.95 (0.89–1.01)
35–44	**42,377**	33,346 (19.7)	78.7	**371 (21.5)**	236 (19.1)	63.6	0.86 (0.78–0.94)**
≥45	**62,029**	48,827 (28.9)	78.7	**269 (15.6)**	162 (13.1)	60.2	0.82 (0.73–0.91)**
Race/Ethnicity§							
White, non-Hispanic	**60,649**	46,513 (27.5)	76.7	**205 (11.9)**	127 (10.3)	62.0	Reference
Black, non-Hispanic	**88,878**	76,198 (45.1)	85.7	**890 (51.5)**	694 (56.2)	78.0	1.09 (0.98–1.22)
Hispanic/Latino	**42,460**	34,417 (20.4)	81.1	**453 (26.2)**	301 (24.4)	66.4	1.09 (0.96–1.24)
Others, non-Hispanic	**6,325**	4,739 (2.8)	74.9	**100 (5.8)**	69 (5.6)	69.0	1.18 (1.00–1.14)
U.S. Census region¶							
Northeast	**26,658**	23,442 (13.9)	87.9	**410 (23.7)**	301 (24.4)	73.4	Reference
Midwest	**26,678**	23,656 (14.0)	88.7	**160 (9.3)**	140 (11.4)	87.5	1.18 (1.08–1.28)**
South	**110,039**	95,961 (56.8)	87.2	**596 (34.5)**	497 (40.3)	83.4	1.15 (1.07–1.23)**
West	**43,163**	24,167 (14.3)	56.0	**559 (32.4)**	294 (23.8)	52.6	0.75 (0.67–0.83)**
U.S. dependent areas	**1,766**	1,751 (1.04)	99.2	**2 (0.1)**	2 (0.2)	100.0	—

Abbreviations: aPR = adjusted prevalence ratio for each binomial relationship controlling for other characteristics in the model; CI = confidence interval; MSA = metropolitan statistical area.

* Includes U.S. dependent areas of Puerto Rico and the U.S. Virgin Islands.

† Because of missing/invalid data, records were excluded in the column "All index persons" for number of total (8,023; 3.9%) and number of interviewed (6,711; 4.0%) and in the column "Transgender women index persons" for number of total (2; 0.1%).

§ Because of missing/invalid data, records were excluded in the column "All index persons" for number of total (9,992; 4.8%) and number of interviewed (7,110; 4.2%) and in the column "Index transgender women" for number of total (79; 4.6%) and number of interviewed (43; 3.5%).

¶ U.S. Census regions (states and MSAs): *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, New York City (New York), Pennsylvania, Philadelphia (Pennsylvania), Vermont, and Rhode Island. *Midwest*: Illinois, Chicago (Illinois), Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Atlanta (Georgia), Kentucky, Louisiana, Maryland, Baltimore (Maryland), Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, Texas, and West Virginia. *West*: Alaska, Arizona, California, Los Angeles (California), San Francisco (California), Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; U.S. dependent areas: Puerto Rico and U.S. Virgin Islands.

** p<0.001.

test results, 64.2% were aged ≤34 years, 56.7% were black, and 56.7% resided in the South. These findings are similar to those from the National HIV Surveillance System during 2009–2014, in which 72.6% of transgender women with HIV-positive test results were aged ≤34 years, 50.8% were black, and 42.8% resided in the South at the time of their diagnosis (*9*). Previous studies have attributed the higher levels of diagnosis of infection with HIV among transgender women, compared with those among other genders, to individual, social, and structural factors, including higher levels of sexual and drug use risk behaviors, gender and HIV-related stigma, homelessness, and mental health and substance use disorders (*1*,*2*).

The findings in this report are subject to at least four limitations. First, these analyses are based on HIV partner services program data reported from CDC-funded health departments and might not be generalizable to HIV partner services among all transgender women nationally. Second, the partners in the current analysis are those for whom sufficient information to be contacted by partner services programs was available and not all partners named by index persons. Third, the percentage of persons with newly diagnosed infection with HIV might be overestimated in jurisdictions that do not routinely check surveillance records to identify persons with previous diagnoses. Finally, health departments differ in implementation of partner services, which can contribute to varying data completeness and comparability.

Full and effective implementation of partner services programs is important to identify persons who are unaware of their HIV status. Partner services is a successful strategy for identifying persons with undiagnosed infection with HIV. However, the percentage of index person interview or partner notification for transgender women are lower than the national average for all genders combined. Approximately half of notified transgender women partners were tested for HIV. Efforts to address social and structural barriers to effective implementation of partner services among transgender women, including client concerns about compromised confidentiality and fear of negative impacts (e.g., abuse, stigmatization, medical mistrust,

TABLE 2. Partner notification services delivery among transgender women partners, by demographic characteristics — United States,* 2013–2017

Characteristic	All partners			Transgender women partners			
	Total, no.	Notified (column %)	% Notified	Total, no. (%)	Notified (column %)	% Notified	aPR (95% CI)
Total	**132,938**	**102,500 (100.0)**	**77.1**	**1,089 (100.0)**	**775 (100.0)**	**71.2**	—
Age group (yrs)†							
13–24	**21,502**	17,717 (17.3)	82.4	**217 (19.9)**	180 (23.2)	82.9	Reference
25–34	**41,969**	33,749 (32.9)	80.4	**356 (32.7)**	259 (33.4)	72.8	0.88 (0.81–0.95)††
35–44	**22,936**	17,957 (17.5)	78.3	**195 (17.9)**	123 (15.9)	63.1	0.79 (0.70–0.89)**
≥45	**27,088**	20,998 (20.5)	77.5	**165 (15.2)**	99 (12.8)	60.0	0.77 (0.68–0.88)**
Race/Ethnicity§							
White, non-Hispanic	**38,622**	29,528 (28.8)	76.5	**245 (22.5)**	193 (24.9)	78.8	Reference
Black, non-Hispanic	**53,805**	42,715 (41.7)	79.4	**601 (55.2)**	437 (56.4)	72.7	0.89 (0.81–0.97)††
Hispanic/Latino	**24,593**	19,615 (19.1)	79.8	**172 (15.8)**	102 (13.2)	59.3	0.93 (0.80–1.07)
Others, non-Hispanic	**3,456**	2,539 (2.5)	73.5	**21(1.9)**	10 (1.3)	47.6	0.90 (0.60–1.36)
U.S. Census region¶							
Northeast	**19,495**	11,420 (11.1)	58.6	**151 (13.9)**	58 (7.5)	38.4	Reference
Midwest	**14,291**	8,185 (8.0)	57.3	**26 (2.4)**	14 (1.8)	53.8	1.43 (0.94–2.19)
South	**71,459**	65,640 (64.0)	91.9	**766 (70.3)**	629 (81.2)	82.1	2.00 (1.61–2.47)**
West	**25,614**	15,470 (15.1)	60.4	**145 (13.3)**	73 (9.4)	47.4	1.35 (1.03–1.76)††
U.S. dependent areas	**2,079**	1,785 (1.7)	85.9	**1 (0.1)**	1 (0.1)	100.0	—

Abbreviations: aPR = adjusted prevalence ratio for each binomial relationship controlling for other characteristics in the model; CI = confidence interval; MSA = metropolitan statistical area.

* Includes U.S. dependent areas of Puerto Rico and the U.S. Virgin Islands.

† Because of missing/invalid data, records were excluded in the column "All partners" for number of total (19,443; 14.6%) and number of notified (12,079; 11.8%) and in the column "Transgender women partners" for number of total (156; 14.3%) and number of notified (114; 14.7%).

§ Because of missing/invalid data, records were excluded in the column "All partners" for number of total (12,462; 9.4%) and number of notified (8,103; 7.9%) and in the column "Transgender women partners" for number of total (50; 4.6%) and number of notified (33; 4.3%).

¶ U.S. Census regions (states and MSAs): *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, New York City (New York), Pennsylvania, Philadelphia (Pennsylvania), Vermont, and Rhode Island. *Midwest*: Illinois, Chicago (Illinois), Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Atlanta (Georgia), Kentucky, Louisiana, Maryland, Baltimore (Maryland), Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, Texas, and West Virginia. *West*: Alaska, Arizona, California, Los Angeles (California), San Francisco (California), Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; U.S. dependent areas: Puerto Rico and U.S. Virgin Islands.

** p<0.001.

†† p<0.05.

and abandonment), would improve partner services delivery in this disproportionately affected population (*2*,*10*). To that end, CDC has been supporting a variety of strategies, including conducting prevention research to identify evidence-based interventions that focus on transgender women, funding HIV prevention projects that prioritize transgender persons, and developing social media and marketing campaigns that promote HIV testing, prevention, and treatment among transgender persons (*1*). HIV prevention programs tailored to the needs of transgender women, particularly transgender women who are black, aged ≤35 years, and residing in the South, could help to reduce onward HIV transmission, increase linkage to HIV medical care and prevention, reduce HIV-related health disparities, and contribute to ending the HIV epidemic in the United States.

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TABLE 3. Human immunodeficiency virus (HIV) testing and HIV positivity among transgender women partners, by demographic characteristics — United States,* 2013–2017

	All notified partners				Notified transgender women partners					
			Newly diagnosed HIV infection					Newly diagnosed HIV infection		Previously diagnosed HIV infection
Characteristic	Notified, no.	Tested, no. (%)	No. (column %)	Row %	Notified, no.	Tested, no. (%)	aPR (95% CI)	No. (column %)	Row %	No. (%)
Total	**102,500**	**52,071 (50.8)**	**9,146 (100.0)**	**17.6**	**775**	**360 (46.5)**	**—**	**67 (100.0)**	**18.6**	**18 (5.0)**
Age group (yrs)†										
13–24	17,717	10,580 (59.7)	1,769 (19.3)	16.7	180	90 (50.0)	Reference	20 (29.9)	22.2	6 (6.7)
25–34	33,749	18,094 (53.6)	3,075 (33.6)	17.0	259	136 (52.5)	1.03 (0.85–1.24)	23 (34.3)	16.9	9 (6.6)
35–44	17,957	9,690 (54.0)	1,725 (18.9)	17.8	123	56 (45.5)	0.90 (0.70–1.15)	10 (14.9)	17.9	2 (3.6)
≥45	20,998	10,838 (51.6)	2,258 (24.7)	20.8	99	49 (49.5)	0.95 (0.74–1.23)	9 (13.4)	18.4	1 (2.0)
Race/Ethnicity§										
White, non-Hispanic	29,528	15,607 (52.9)	2,520 (27.6)	16.1	193	95 (49.2)	Reference	14 (20.9)	14.7	2 (2.1)
Black, non-Hispanic	42,715	21,658 (50.7)	4,666 (51.0)	21.5	437	193 (44.2)	0.83 (0.69–0.99)**	38 (56.7)	19.7	13 (6.7)
Hispanic/Latino	19,615	10,240 (52.2)	1,374 (15.0)	13.4	102	52 (51.0)	0.97 (0.75–1.26)	12 (17.9)	23.1	3 (5.8)
Others, non-Hispanic	2,539	1,286 (50.6)	200 (2.2)	15.6	10	4 (40.0)	0.60 (0.25–1.46)	1 (1.5)	25.0	0 (0.0)
U.S. Census region¶										
Northeast	11,420	4,245 (37.2)	707 (7.7)	16.7	58	30 (51.7)	Reference	13 (19.4)	43.3	2 (6.7)
Midwest	8,185	4,342 (53.0)	884 (9.7)	20.4	14	10 (71.4)	1.31 (0.85–2.04)	6 (9.0)	60.0	0 (—)
South	65,640	34,122 (52.0)	6,465 (70.7)	18.9	629	286 (45.5)	0.91 (0.71–1.17)	38 (56.7)	13.3	14 (4.9)
West	15,470	8,294 (53.6)	978 (10.7)	11.8	73	33 (45.2)	0.78 (0.53–1.13)	9 (13.4)	27.3	2 (6.1)
U.S. dependent areas	1,785	1,068 (59.8)	112 (1.2)	10.5	1	1 (100.0)	—	1 (1.5)	100.0	0 (—)

Abbreviations: aPR = adjusted prevalence ratio for each binomial relationship controlling for other characteristics in the model; CI = confidence interval; MSA = metropolitan statistical area.

* Includes U.S. dependent areas of Puerto Rico and the U.S. Virgin Islands.

† Because of missing/invalid data, records were excluded in the column "All notified partners" for number of notified (12,079; 11.8%), number of tested (2,869; 5.5%), number of newly diagnosed HIV (319; 3.5%) and in the column "Notified transgender women partners) for number of notified (114; 14.7%), number of tested (29; 8.1%), number of newly diagnosed HIV (5; 7.5%).

§ Because of missing/invalid data, records were excluded in the column "All notified partners" for number of notified (8,103; 7.9%), number of tested (3,280; 6.3%), number of newly diagnosed HIV (386; 4.2%) and in the column "Notified transgender women partners" for number of notified (33; 4.3%), number of tested (16; 4.4%), number of newly diagnosed HIV (2; 3.0%).

¶ U.S. Census regions (states and MSAs): *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, New York City (New York), Pennsylvania, Philadelphia (Pennsylvania), Vermont, and Rhode Island. *Midwest*: Illinois, Chicago (Illinois), Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Atlanta (Georgia), Kentucky, Louisiana, Maryland, Baltimore (Maryland), Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Virginia, Texas, and West Virginia. *West*: Alaska, Arizona, California, Los Angeles (California), San Francisco (California), Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming; U.S. dependent areas: Puerto Rico and U.S. Virgin Islands.

** $p<0.05$.

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Early Season Pediatric Influenza B/Victoria Virus Infections Associated with a Recently Emerged Virus Subclade — Louisiana, 2019

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Multiple genetically distinct influenza B/Victoria lineage viruses have cocirculated in the United States recently, circulating sporadically during the 2018–19 season and more frequently early during the 2019–20 season (*1*). The beginning of the 2019–20 influenza season in Louisiana was unusually early and intense, with infections primarily caused by influenza B/Victoria lineage viruses. One large pediatric health care facility in New Orleans (facility A) reported 1,268 laboratory-confirmed influenza B virus infections, including 23 hospitalizations from July 31 to November 21, 2019, a time when influenza activity is typically low. During this period, Louisiana also reported one pediatric death associated with influenza B virus infection. An investigation of the influenza B virus infections in Louisiana, including medical and vaccine record abstraction on 198 patients, primarily from facility A, with sporadic cases from other facilities in the state, found that none of the patients had received 2019–20 seasonal influenza vaccine, in part because influenza activity began before influenza vaccination typically occurs. Among 83 influenza B viruses sequenced from 198 patients in Louisiana, 81 (98%) belonged to the recently emerged B/Victoria V1A.3 genetic subclade. Nationally, to date, B/Victoria viruses are the most commonly reported influenza viruses among persons aged <25 years (*2*). Of the 198 patients in the investigation, 95% were aged <18 years. Although most illnesses were uncomplicated, the number of hospitalizations, clinical complications, and the reported pediatric death in Louisiana serve as a reminder that, even though influenza B viruses are less common than influenza A viruses in most seasons, influenza B virus infection can be severe in children. All persons aged ≥6 months should receive an annual influenza vaccination if they have not already received it (*3*). Antiviral treatment of influenza is recommended as soon as possible for all hospitalized patients and for outpatients at high risk for influenza complications (including children aged <2 years and persons with underlying medical conditions) (*4*).

In November 2019, a field investigation was conducted to characterize the early influenza B virus–associated illnesses in Louisiana and to determine the influenza B virus subclades responsible for the outbreak. Medical chart abstraction, using a standard case report form, was conducted for 198 persons with laboratory-confirmed influenza B virus infection who had respiratory specimens submitted to the Louisiana Public Health Laboratory, including 173 outpatients and 25 hospitalized patients, from May 24 to November 21, 2019. Among 198 completed medical chart abstractions, 181 patients (158 outpatients and 23 inpatients) were from facility A; 17 were from other facilities in Louisiana.

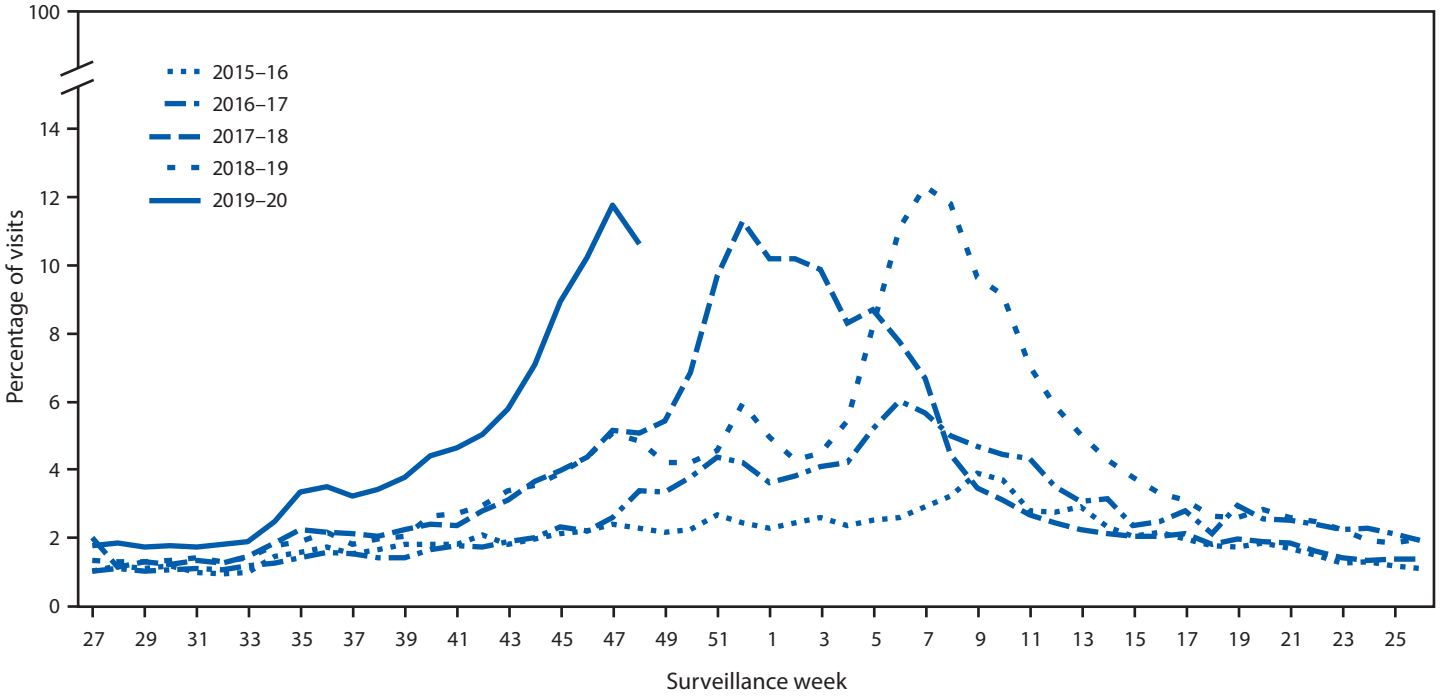
The percentage of health care visits for influenza-like illness in Louisiana began to increase in mid-August 2019, corresponding to surveillance week 33 (Figure). Illness onset among the 198 patients occurred during May 24–October 29, 2019 with median onset during surveillance week 38 (ending September 21, 2019). The median age of patients was 6 years (range = <1 month–29 years); 95% were aged <18 years, reflecting both the increased circulation of influenza B viruses in children and the general patient population of facility A. None of the 198 patients had received the 2019–20 seasonal influenza vaccine before becoming ill, likely at least in part because influenza activity began early, before influenza vaccine campaigns start. Most patients reported subjective fever (95%), cough (68%), and runny nose (61%). Among the 173 outpatients, 41 (24%) had an underlying medical condition, the most common of which was asthma (Table); 17 (10%) had a complication associated with their infection, and 122 (71%) were prescribed influenza antivirals. Among 25 hospitalized patients, 14 (56%) had an underlying medical condition, 23 (92%) were prescribed influenza antivirals, 11 (44%) had complications associated with their infection, and six (24%) were admitted to intensive care units.

Among 83 influenza B viruses sequenced from the 198 patients, 81 (98%) belonged to the influenza B/Victoria V1A.3 subclade, which began circulating in the United States in the latter half of the 2018–19 influenza season (*5*). One of the detected viruses in Louisiana belonged to subclade V1A.1, which is the subclade of the influenza B/Victoria component (B/Colorado/06/2017) of the 2019–20 Northern Hemisphere vaccine. One of the 83 viruses could not be classified.

Discussion

Typically, influenza B viruses circulate during the spring, near the end of influenza season; however, in the current 2019–20 season, influenza B/Victoria viruses are the predominant circulating influenza virus in the United States to date (*2*).

FIGURE. Percentage of visits for influenza-like illness* reported by sentinel clinics, by surveillance week — Louisiana, influenza seasons 2015–16 to 2019–20



* Defined as fever (temperature of ≥100°F [≥37.8°C], oral or equivalent) and cough or sore throat, without a known cause other than influenza.

Influenza B viruses have not been the predominant virus in the United States since the 1992–93 season (*6*). B/Victoria viruses did not circulate widely during the past three influenza seasons, accounting for <10% of influenza virus isolates reported during the 2016–17 to 2018–19 seasons.* Of the multiple genetically distinct B/Victoria virus subclades, viruses with two amino acid deletions in the hemagglutinin protein, belonging to the V1A.1 subclade, and viruses with three amino acid deletions, belonging to the V1A.2 or V1A.3 subclades, cocirculated during May–September, 2019 (*1*). Although the V1A.1 and V1A.3 subclades are genetically distinct, sera from previous studies conducted among humans vaccinated with a V1A.1 virus cross-reacted well with B/Victoria viruses with a three amino acid deletion, such as the V1A.3 viruses (*1*). These findings suggest that vaccination with the current season's vaccine might offer protection against circulating B/Victoria viruses.

Nationally, from September 29 to December 28, 2019, influenza B viruses accounted for 59.2% of influenza-positive results reported by public health laboratories, and, among those with lineage testing, 97.9% belonged to the B/Victoria lineage (*2*). Through December 28, B/Victoria viruses were the most commonly reported influenza viruses among persons aged <25 years, and influenza A(H1N1)pdm09 viruses were the most commonly reported among persons aged ≥25 years (*2*). In addition, 70% of influenza-associated hospitalizations among children reported through the Influenza Hospitalization Surveillance Network (Shikha Garg, personal communication, January 2020) and 18 of 27 influenza-associated pediatric deaths were associated with influenza B viruses (five of the 18 deaths had virus lineage reported and all were B/Victoria) (*2*).

Symptoms and outcomes among patients with influenza B/Victoria virus infection in Louisiana were typical of seasonal influenza A or B virus infections (*7*,*8*), primarily resulting in uncomplicated respiratory illness. However, the number of hospitalizations, clinical complications, and the reported pediatric death in Louisiana serve as a reminder that, even though influenza B viruses are less common than influenza A viruses in most seasons, influenza B virus infection can be severe in children. Common complications of influenza, such as pneumonia and bacterial coinfection, have previously been as frequent among children hospitalized with influenza B virus infection as among those with influenza A virus infection (*8*). During 2010–2016, the percentage of influenza B viruses detected in children who died with influenza was higher than the percentage of B viruses detected in the general pediatric population (*9*). Further, a large autopsy series found that the histology of fatal influenza B virus infection was similar to that of fatal influenza A virus infection; however, younger patients

* https://gis.cdc.gov/grasp/fluview/fluportaldashboard.html.

TABLE. Underlying medical conditions and influenza-associated complications in patients with influenza B virus infections (N = 198) — Louisiana, 2019

Characteristic	No. (%) Outpatients (n = 173)	Inpatients (n = 25)
Prescribed influenza antivirals	122 (71)	23 (92)
Underlying medical conditions*		
Asthma	28 (16)	9 (36)
Cardiovascular disease	0	2 (8)
Febrile seizure	3 (2)	0
Blood disorder	4 (2)	3 (12)
Immunosuppression	0	1 (4)
Neurologic disorder	6 (3)	2 (8)
Neuromuscular disorder	0	2 (8)
Premature birth	3 (2)	0
Complications†		
Acute otitis media	10 (6)	0
Acute respiratory failure	0	2 (8)
Asthma exacerbation	4 (2)	4 (16)
Myopericarditis	0	1 (4)
Pneumonia	5 (3)	3 (12)
Rhabdomyolysis	0	1 (4)
Seizures	1 (0.6)	0
Sepsis	0	3 (12)

* Some patients had more than one underlying medical condition.
† Some patients had more than one complication.

who died with influenza B virus infection were less likely to have bacterial coinfection and frequently had myocardial injury (*10*).

Influenza activity is expected to continue for many weeks in the United States; additional hospitalizations and deaths, including among children, are expected to occur. To prevent influenza, all persons aged ≥6 months should receive an annual influenza vaccine, and it is not too late to be vaccinated for the 2019–20 season (*3*). In addition, influenza antiviral treatment is an important tool to reduce symptom duration and the risk for complications and is recommended as soon as possible for all influenza patients who are hospitalized and outpatients at high risk for influenza-associated complications, including children aged <2 years and those with underlying medical conditions† (*4*). Resources, such as HealthMap Vaccine Finder (https://www.vaccinefinder.org) and Medfinder (https://www.medfinder.org), are available to assist in identifying places to get age-appropriate influenza vaccines or fill prescriptions for influenza antivirals.

† https://www.cdc.gov/flu/professionals/antivirals/summary-clinicians.htm.

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Alicia Budd, Erin Burns, Leron Finger, Shikha Garg, Rachel Holstein, Jennifer Schroeder.

Summary

What is already known about this topic?

Influenza B viruses have not predominated in the United States for 27 years. Influenza B virus infection is more common among children and can cause complications, resulting in hospitalization or death.

What is added by this report?

Early influenza B/Victoria virus activity in Louisiana resulted in illnesses in children that were similar to typical seasonal influenza; however, some illnesses were severe, and one death was reported.

What are the implications for public health practice?

Annual influenza vaccination is recommended for all persons aged ≥6 months. It is not too late to be vaccinated for the 2019–20 influenza season. Influenza antiviral treatment is recommended for those hospitalized with influenza or outpatients with influenza who are at risk for complications.

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Update: Product, Substance-Use, and Demographic Characteristics of Hospitalized Patients in a Nationwide Outbreak of E-cigarette, or Vaping, Product Use–Associated Lung Injury — United States, August 2019–January 2020

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On January 14, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

CDC, the Food and Drug Administration (FDA), state and local health departments, and public health and clinical stakeholders continue to investigate a nationwide outbreak of e-cigarette, or vaping, product use–associated lung injury (EVALI) (*1*). EVALI patients in Illinois, Utah, and Wisconsin acquired tetrahydrocannabinol (THC)-containing products primarily from informal sources (*2,3*). This report updates demographic characteristics and self-reported sources of THC- and nicotine-containing e-cigarette, or vaping, products derived from EVALI patient data reported to CDC by state health departments. As of January 7, 2020, among 1,979 (76%) patients with available data on substance use, a total of 1,620 (82%) reported using any THC-containing products, including 665 (34%) who reported exclusive THC-containing product use. Use of any nicotine-containing products was reported by 1,128 (57%) patients, including 264 (13%) who reported exclusive nicotine-containing product use. Among 809 (50%) patients reporting data on the source of THC-containing products, 131 (16%) reported acquiring their products from only commercial sources (i.e., recreational dispensaries, medical dispensaries, or both; vape or smoke shops; stores; and pop-up shops), 627 (78%) from only informal sources (i.e., friends, family, in-person or online dealers, or other sources), and 51 (6%) from both types of sources. Among 613 (54%) EVALI patients reporting nicotine-containing product use with available data on product source, 421 (69%) reported acquiring their products from only commercial sources, 103 (17%) from only informal sources, and 89 (15%) from both types of sources. Adolescents aged 13–17 years were more likely to acquire both THC- and nicotine-containing products from informal sources than were persons in older age groups. The high prevalence of acquisition of THC-containing products from informal sources by EVALI patients reinforces CDC's recommendation to not use e-cigarette, or vaping, products that contain THC, especially those acquired from informal sources. Although acquisition of nicotine-containing products through informal sources was not common overall, it was common among persons aged <18 years. While the investigation continues, CDC recommends that the best way for persons to ensure that they are not at risk is to consider refraining from the use of all e-cigarette, or vaping, products.

This report updates patient demographic characteristics, self-reported substance use, and e-cigarette, or vaping, product sources reported to CDC as of January 7, 2020. States and jurisdictions voluntarily report data on confirmed and probable hospitalized or deceased EVALI patients to CDC weekly using established case definitions* and data collection tools.† Data on substance use and product source were collected from EVALI patients or their proxies (e.g., family members) via standard interview. Commercial product sources were defined as recreational or medical dispensaries, vape or smoke shops, stores, and pop-up shops. Informal sources were defined as friends, family, in-person or online dealers, or other sources. Severe clinical course was defined as hospital stay of ≥10 days; admission to an intensive care unit; requirement for endotracheal intubation, continuous positive airway pressure, or bilevel positive airway pressure; or death. All analyses were conducted using R software (version 3.6; R Foundation for Statistical Computing). The association of age group and product source was tested using Fisher's exact test, with p-values <0.05 considered statistically significant.

As of January 7, 2020, among 1,979 (76%) patients with substance use data available, 1,620 (82%) reported using any THC-containing e-cigarette, or vaping, products, and 665 (34%) (i.e., 41% of patients reporting any THC-containing product use) reported exclusive use of these products (Table). Among patients reporting any THC-containing product use, 865 (53%) had data on frequency of use; 641 (74%) reported daily use, and 122 (14%) reported using these products a few times per week. Among EVALI patients reporting any THC-containing product use, 809 (50%) reported product source,

* https://www.cdc.gov/tobacco/basic_information/e-cigarettes/assets/2019-Lung-Injury-Surveillance-Case-Definition-508.pdf.

† https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease/healthcare-providers/pdfs/National-Case-Report-Form-v01.pdf.

TABLE. Demographic characteristics, substances used, and product sources among hospitalized* cases of e-cigarette, or vaping, product use–associated lung injury (EVALI) reported to CDC — United States, August 2019–January 2020†

Characteristic	Substance used No./Total no. (%)				All cases (N = 2,602)
	Any THC (N = 1,620)	Exclusive THC§ (N = 665)	Any nicotine (N = 1,128)	Exclusive nicotine¶ (N = 264)	
Sex					
Male	1,116/1,613 (69)	447/662 (68)	759/1,124 (68)	154/264 (58)	1,658/2,486 (67)
Female	497/1,613 (31)	215/662 (32)	365/1,124 (32)	110/264 (42)	828/2,486 (33)
Age group (yrs)					
13–17	272/1,615 (17)	93/663 (14)	204/1,125 (18)	32/264 (12)	383/2,497 (15)
18–24	630/1,615 (39)	214/663 (32)	481/1,125 (43)	87/264 (33)	931/2,497 (37)
25–34	387/1,615 (24)	180/663 (27)	239/1,125 (21)	62/264 (23)	605/2,497 (24)
35–44	200/1,615 (12)	98/663 (15)	115/1,125 (10)	35/264 (13)	322/2,497 (13)
45–64	110/1,615 (7)	65/663 (10)	68/1,125 (6)	34/264 (13)	213/2,497 (9)
65–85	16/1,615 (1)	13/663 (2)	18/1,125 (2)	14/264 (5)	43/2,497 (2)
Race/Ethnicity**					
White	969/1,293 (75)	362/503 (72)	744/940 (79)	175/216 (81)	1,333/1,768 (75)
Black	43/1,293 (3)	16/503 (3)	34/940 (4)	11/216 (5)	64/1,768 (4)
Hispanic	219/1,293 (17)	110/503 (22)	104/940 (11)	18/216 (8)	281/1,768 (16)
Other	62/1,293 (5)	15/503 (3)	58/940 (6)	12/216 (6)	90/1,768 (5)
Clinical course					
Severe	538/1,600 (34)	211/649 (33)	409/1,122 (36)	106/262 (40)	810/2,533 (32)
Not severe	1,062/1,600 (66)	438/649 (67)	713/1,122 (64)	156/262 (60)	1,723/2,533 (68)
Outcome					
Died	28/1,493 (2)	16/597 (3)	26/1,060 (2)	16/244 (7)	57/2,355 (2)
Survived	1,465/1,493 (98)	581/597 (97)	1,034/1,060 (98)	228/244 (93)	2,298/2,355 (98)
E-cigarette, or vaping, substances reported††					
Any THC	1,620/1,620 (100)	665/665 (100)	811/1,128 (72)	N/A	1,620/1,979 (82)
Any nicotine	811/1,620 (50)	N/A	1,128/1,128 (100)	264/264 (100)	1,128/1,979 (57)
Any CBD	251/1,620 (15)	N/A	154/1,128 (14)	N/A	308/1,979 (16)
Any other substances§§	115/1,620 (7)	N/A	111/1,128 (10)	N/A	158/1,979 (8)
THC use frequency					
Daily	641/865 (74)	225/294 (77)	331/468 (71)	N/A	641/865 (74)
A few times per week	122/865 (14)	48/294 (16)	61/468 (13)	N/A	122/865 (14)
A few times per month	49/865 (6)	5/294 (2)	41/468 (9)	N/A	49/865 (6)
Monthly or less	53/865 (6)	16/294 (5)	35/468 (7)	N/A	53/865 (6)
Nicotine use frequency					
Daily	407/481 (85)	N/A	580/681 (85)	135/160 (84)	580/681 (85)
A few times per week	39/481 (8)	N/A	55/681 (8)	14/160 (9)	55/681 (8)
A few times per month	17/481 (4)	N/A	22/681 (3)	5/160 (3)	22/681 (3)
Monthly or less	18/481 (4)	N/A	24/681 (4)	6/160 (4)	24/681 (4)

See table footnotes on the next page.

including 131 (16%) who reported acquiring products from only commercial sources, 627 (78%) from only informal sources, and 51 (6%) from both sources. The most common sources reported for THC-containing products were family members or friends (38%), followed by dealers (31%), and other sources (23%). Medical dispensaries were reported as a source for THC-containing products by 3% of EVALI patients and recreational dispensaries by 8% of EVALI patients.

Overall, 1,128 (57%) patients reported using any nicotine-containing products, and 264 (13%) (i.e., 23% of patients reporting any nicotine-containing product use) reported exclusive use of these products. Among 681 (60%) patients with data available on frequency of nicotine-containing product use, 580 (85%) reported daily use, with a similar percentage among exclusive (84%) users. Among EVALI patients reporting use of any nicotine-containing product, 613 (54%) reported product source, including 421 (69%) who reported acquiring products from only commercial sources, 103 (17%) from only informal sources, and 89 (15%) from both sources. Among EVALI patients reporting use of any nicotine-containing products, the most commonly reported sources for nicotine-containing products were vape or smoke shops (48%), stores (43%), and family members or friends (15%).

Younger age was significantly associated with acquiring THC-containing and nicotine-containing products through informal sources (Figure 1). Among EVALI patients reporting use of any THC-containing products, 122 of 130 (94%) of those aged 13–17 years acquired products through only informal sources, compared with 42 of 68 (62%) of those aged 45–77 years ($p<0.001$). Among EVALI patients reporting

TABLE. (*Continued*) Demographic characteristics, substances used, and product sources among hospitalized* cases of e-cigarette, or vaping, product use–associated lung injury (EVALI) reported to CDC — United States, August 2019–January 2020†

Characteristic	Substance used No./Total no. (%)				
	Any THC (N = 1,620)	Exclusive THC§ (N = 665)	Any nicotine (N = 1,128)	Exclusive nicotine¶ (N = 264)	All cases (N = 2,602)
THC source					
Pop-up shop¶¶	20/783 (3)	9/277 (3)	6/423 (1)	N/A	20/783 (3)
Recreational dispensary¶¶	63/783 (8)	26/277 (9)	28/423 (7)	N/A	63/783 (8)
Medical dispensary¶¶	27/783 (3)	10/277 (4)	14/423 (3)	N/A	27/783 (3)
Vape or smoke shop¶¶	44/783 (6)	15/277 (5)	23/423 (5)	N/A	44/783 (6)
Store¶¶	15/783 (2)	4/277 (1)	10/423 (2)	N/A	15/783 (2)
Family or friend***	294/783 (38)	99/277 (36)	174/423 (41)	N/A	294/783 (38)
Dealer***	240/783 (31)	82/277 (30)	140/423 (33)	N/A	240/783 (31)
Online***	43/783 (5)	19/277 (7)	19/423 (4)	N/A	43/783 (5)
Other***	177/783 (23)	62/277 (22)	86/423 (20)	N/A	177/783 (23)
Only commercial sources	131/809 (16)	47/285 (16)	61/436 (14)	N/A	131/809 (16)
Only informal sources	627/809 (78)	216/285 (76)	352/436 (81)	N/A	627/809 (78)
Commercial and informal	51/809 (6)	22/285 (8)	23/436 (5)	N/A	51/809 (6)
Nicotine source					
Pop-up Shop¶¶	2/430 (0)	N/A	2/595 (0)	0/131 (0)	2/595 (0)
Recreational dispensary¶¶	7/430 (2)	N/A	7/595 (1)	0/131 (0)	7/595 (1)
Vape or smoke shop¶¶	197/430 (46)	N/A	287/595 (48)	67/131 (51)	287/595 (48)
Store¶¶	188/430 (44)	N/A	253/595 (43)	54/131 (41)	253/595 (43)
Family or friend***	76/430 (18)	N/A	91/595 (15)	13/131 (10)	91/595 (15)
Dealer***	15/430 (3)	N/A	15/595 (3)	0/131 (0)	15/595 (3)
Online***	40/430 (9)	N/A	54/595 (9)	10/131 (8)	54/595 (9)
Other***	42/430 (10)	N/A	57/595 (10)	12/131 (9)	57/595 (10)
Only commercial sources	289/442 (65)	N/A	421/613 (69)	105/136 (77)	421/613 (69)
Only informal sources	77/442 (17)	N/A	103/613 (17)	23/136 (17)	103/613 (17)
Commercial and informal	76/442 (17)	N/A	89/613 (15)	8/136 (6)	89/613 (15)

Abbreviations: CBD = cannabidiol; N/A = not applicable; THC = tetrahydrocannabinol.
* Includes all hospitalized EVALI patients and EVALI-associated deaths (n = 57) regardless of hospitalization status.
† For cases reported as of January 7, 2020.
§ Exclusive THC use defined as anyone who reported THC and no other substances (e.g., nicotine, CBD, synthetics, flavors, or other).
¶ Exclusive nicotine use defined as anyone who reported nicotine and no other substances (e.g., THC, CBD, synthetics, flavors, or other).
** Whites, blacks, and others were all non-Hispanic. Hispanic persons could be of any race.
†† In the 3 months preceding symptom onset.
§§ Includes synthetic cannabinoids and flavors.
¶¶ Commercial source.
*** Informal source.

use of any nicotine-containing products, 46 of 109 (42%) of those aged 13–17 years acquired products through only informal sources, compared with five of 43 (12%) of those aged 45–75 years (p<0.001).

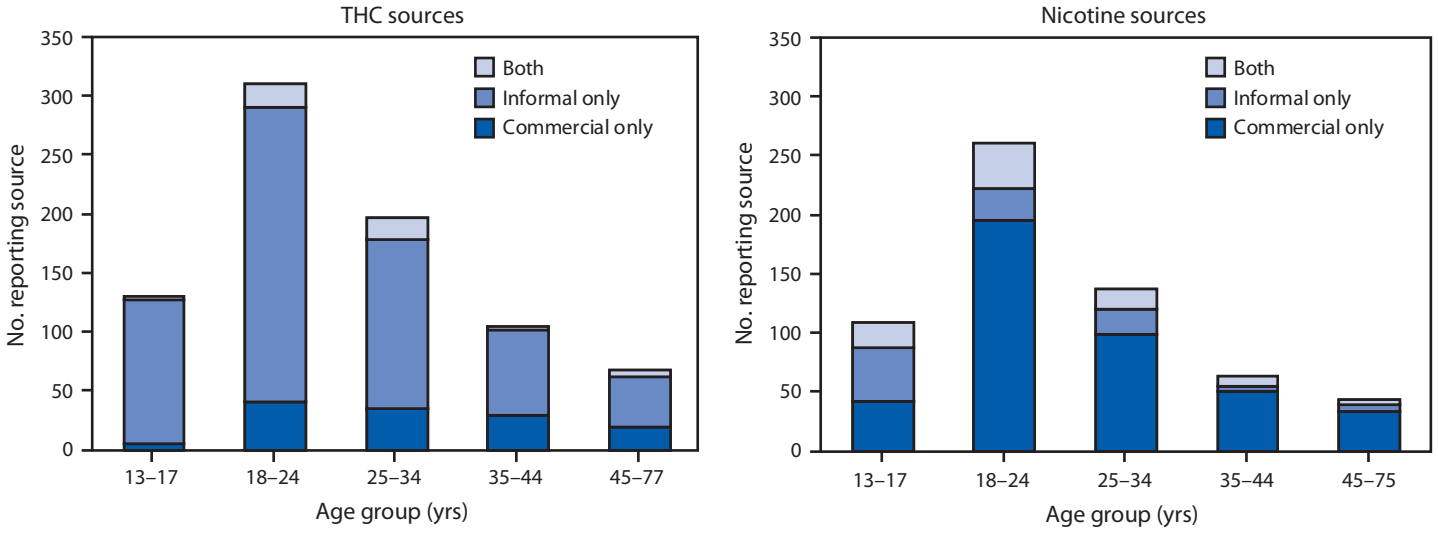
The percentage of EVALI patients in each state acquiring THC-containing products from informal sources varied (Figure 2). Alaska, Hawaii, Idaho, Iowa, Mississippi, Montana, Oklahoma, Rhode Island, South Dakota, and Vermont had the highest percentages of patients acquiring THC-containing products from informal sources (50–100%). The percentage of EVALI patients acquiring nicotine-containing products from informal sources also varied by state, with Nevada having the highest percentage (57%).

Discussion

Differences in product sources for THC- and nicotine-containing products were identified: obtaining products from only informal sources was substantially more common for THC- than for nicotine-containing products, whereas obtaining products only from commercial sources was much more common for nicotine- than for THC-containing products. These findings are consistent with previous reports on EVALI cases from Illinois, Utah, and Wisconsin, which also found that most THC-containing products were acquired from informal sources, whereas most nicotine-containing products were acquired from commercial sources (*2*,*3*).

The reported use of THC-containing products from informal sources by most EVALI patients is important because vitamin E acetate has been detected in products obtained from these sources and has been associated with EVALI. As part of the investigation into the nationwide outbreak, FDA has conducted testing on products obtained from 73 EVALI patients; 79% of them had at least one product test positive for THC; among those, 78% had at least one product test

FIGURE 1. Reported product sources,*,†,§ by age group,¶, among hospitalized e-cigarette, or vaping, product use–associated lung injury (EVALI) patients — United States, August 2019–January 2020**



Abbreviation: THC = tetrahydrocannabinol.
* Among 809 EVALI patients reporting use of THC-containing products and for whom data on product source (commercial or informal) and age were available.
† Among 613 EVALI patients reporting use of nicotine-containing products and for whom data on product source (commercial or informal) and age were available.
§ Informal sources are defined as friends, family, in-person or online dealers, or other sources.
¶ P<0.001 for comparison of proportions reporting THC source by age.
** P<0.001 for comparison of proportions reporting nicotine source by age.

positive for vitamin E acetate.§ A recent case-control study found vitamin E acetate in the bronchoalveolar lavage fluid of 94% of 51 EVALI patients and in none of 99 healthy controls in the comparator group (*4*). In addition, an analysis of THC-containing products seized by law enforcement in Minnesota found no vitamin E acetate in 10 products seized in 2018, and 100% of 20 products seized in 2019 contained vitamin E acetate (*5*).

Although most EVALI cases have been associated with use of informally sourced THC-containing products, 16% of patients reporting use of THC-containing products reported acquiring them only from commercial sources. Even in states where marijuana has been legalized for recreational use by adults,¶ it might be difficult to determine whether a source is licensed through the state. For example, in California, the Bureau of Cannabis Control seized nearly 10,000 illegal vape pens from unlicensed retailers during December 10–12, 2019.** The high prevalence of informally sourced THC-containing products among EVALI patients reinforces current recommendations to not use THC-containing e-cigarette, or vaping, products, particularly those acquired from informal sources.

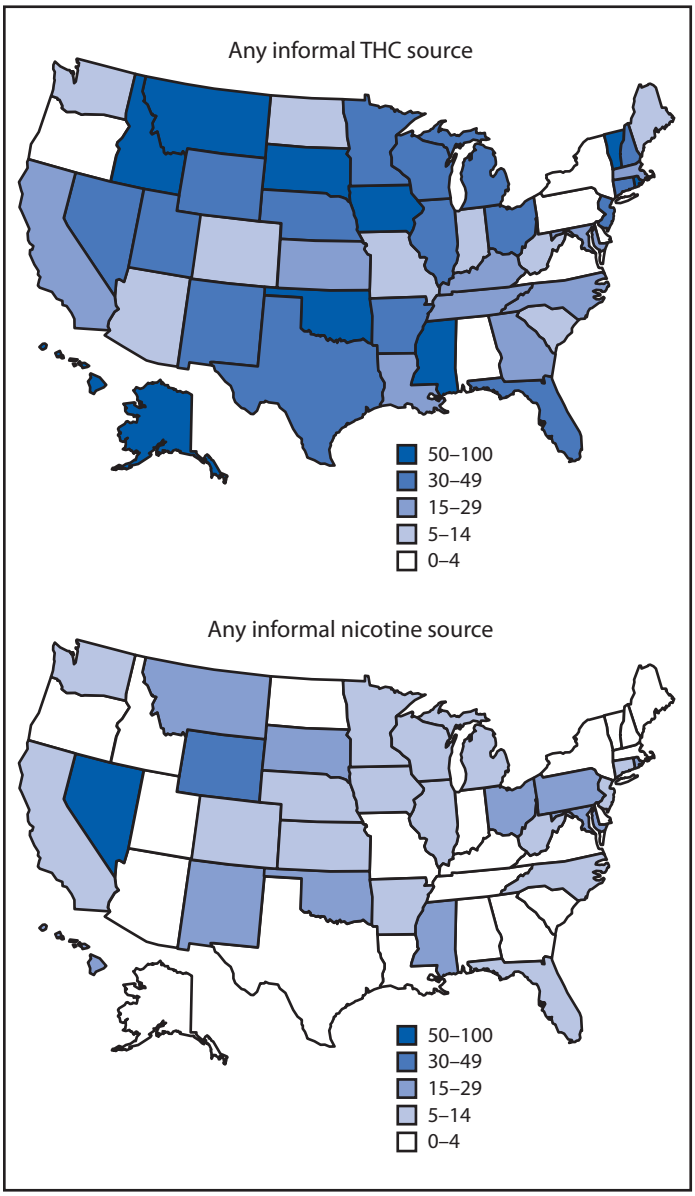
The findings in this report are subject to at least four limitations. First, data on substances used and product sources were reported by patients or their proxies and might be subject to recall or social desirability bias. A recent study found that among 11 EVALI patients who reported no use of THC-containing e-cigarette, or vaping, products, nine had THC or its metabolites detected in bronchoalveolar lavage fluid (*4*). Second, data on e-cigarette, or vaping, product substances used were missing for 24% of patients overall, and product source was missing for 50% of THC-containing product users and 46% of nicotine-containing product users. Therefore, conclusions derived from these data might not be generalizable to all EVALI patients. Third, patients might not know the contents of their e-cigarette, or vaping, products, which might lead to misclassification of substance use. Finally, EVALI is a diagnosis of exclusion with an intentionally sensitive case definition, and it is possible that cases caused by other etiologies could be misattributed to EVALI.

Vitamin E acetate has been identified as an additive in THC-containing e-cigarette, or vaping, products used by EVALI patients, and laboratory studies have demonstrated that it is associated with lung injury†† (*4–6*). However, additional research is needed because there might be more than

§ https://www.fda.gov/news-events/public-health-focus/lung-illnesses-associated-use-vaping-products.
¶ https://teens.drugabuse.gov/blog/post/how-legal-marijuana.
** https://bcc.ca.gov/about_us/documents/media_20191213_2.pdf.

†† https://www.fda.gov/news-events/public-health-focus/lung-illnesses-associated-use-vaping-products.

FIGURE 2. Percentage of hospitalized e-cigarette, or vaping, product use–associated lung injury (EVALI) patients reporting informal product sources,* by state — United States, August 2019–January 2020



Abbreviation: THC = tetrahydrocannabinol.
* Informal sources are defined as friends, family, in-person or online dealers, or other sources.

one cause of this outbreak, and some patients report using only nicotine-containing products. Therefore, while the investigation continues, CDC recommends that the best way for persons to ensure that they are not at risk is to consider refraining from the use of all e-cigarette, or vaping, products. Adults using e-cigarette, or vaping, products to quit smoking should not return to smoking cigarettes; they should weigh all risks and benefits and consider using FDA-approved cessation medications.[§§] Adults who continue to use e-cigarette, or vaping, products should carefully monitor themselves for symptoms and see a health care provider immediately if they develop symptoms similar to those reported in this outbreak (*7*). Irrespective of the ongoing investigation, e-cigarette, or vaping, products should never be used by youths, young adults, or pregnant women.

Summary

What is already known about this topic?

E-cigarette, or vaping, product use–associated lung injury (EVALI) patients in Illinois, Utah, and Wisconsin acquired tetrahydrocannabinol (THC)-containing products primarily from informal sources.

What is added by this report?

Nationwide, most EVALI patients with data on product source reported acquiring THC-containing products from only informal sources, whereas most nicotine-containing products were acquired from commercial sources. EVALI patients aged 13–17 years were more likely to acquire both THC- and nicotine-containing products from informal sources than were adults.

What are the implications for public health practice?

While the investigation continues, CDC recommends that the best way for persons to ensure that they are not at risk is to consider refraining from the use of all e-cigarette, or vaping, products.

[§§] https://www.cdc.gov/tobacco/campaign/tips/quit-smoking/index.html.

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Notes from the Field

Multistate Outbreak of Eastern Equine Encephalitis Virus — United States, 2019

Nicole P. Lindsey, MS[1]; Stacey W. Martin, MS[1]; J. Erin Staples, MD, PhD[1]; Marc Fischer, MD[1]

Eastern equine encephalitis virus (EEEV), a mosquito-borne alphavirus, is the cause of one of the most severe arboviral diseases in North America (*1*). The clinical course typically begins as a systemic febrile illness but often progresses to neurologic disease (*2*). EEEV neuroinvasive disease is estimated to have a 30% case-fatality rate with approximately half of survivors left with neurologic sequelae (*2*,*3*). Although veterinary EEEV vaccines are available for use in horses, there are no licensed vaccines or effective treatments for humans. During 2003–2018, an average of eight EEEV disease cases were reported annually in the United States (range = 4–21 cases) (*3*,*4*). However, as of October 15, 2019, CDC received reports of 34 cases of EEEV disease from 21 counties in seven states (Figure). Cases were reported from Massachusetts (12 cases), Michigan (10), Connecticut (four), New Jersey (three), Rhode Island (three), North Carolina (one), and Tennessee (one). Dates of illness onset ranged from June 18 to September 20, 2019. Among the 34 patients, 21 (62%) had illness onset in August; 32 (94%) had a diagnosis of encephalitis, and two (6%) had a diagnosis of meningitis. Twenty-six (76%) patients were male. The median age was 64 years (range = 5–78 years); 21 (62%) of the 34 patients were aged ≥60 years.

All 34 patients were hospitalized; 12 (35%) died. Deaths occurred a median of 12 days after illness onset (range = 4–38 days). Among the fatal cases, 10 (83%) patients were male, and the median age was 72 years (range = 58–78 years). The case-fatality ratio was highest among patients aged ≥70 years (seven of 11; 64%) and was 22% (five of 23) among patients aged <70 years.

EEEV is primarily maintained in an enzootic cycle between birds and *Culiseta melanura* mosquitoes, which breed in freshwater hardwood swamp environments in the eastern United States (*1*). Spread of EEEV to mammals typically requires mosquitoes (e.g., *Aedes* or *Coquillettidia* species) that feed on both birds and mammals (bridge vectors). Because of these complex interactions, the risk for human infection in a given year depends on multiple factors, including weather, abundance of birds and mosquitoes that can transmit the virus, human behavior, and clinical awareness and diagnostic testing practices (*5*).

It is not clear why more cases were reported in 2019 than in recent years. Larger outbreaks of EEEV occurred in several northeastern states in the 1930s and 1950s (*6*,*7*). These preliminary data for 2019 represent the largest number of cases reported in a single year since that time. However, changes in available diagnostic testing, populations at risk, national surveillance case definitions, and reporting systems make it difficult to compare annual case numbers before 2003.

Case counts in this report are provisional and might differ from those reported elsewhere. In areas at risk for EEEV transmission, health care providers should consider EEEV infection in the differential diagnosis of cases of aseptic meningitis and encephalitis and obtain appropriate serum or cerebrospinal fluid specimens for laboratory testing. Providers are encouraged to report suspected infections and send specimens to their state or local health department to facilitate diagnosis, increase public awareness, and potentially implement vector control to mitigate the risk for further transmission. Because human vaccines against EEEV are not available, prevention depends on community and household efforts to reduce vector populations (e.g., applying insecticides and reducing breeding sites) and personal protective measures to decrease exposure to mosquitoes (e.g., use of repellents and wearing protective clothing).

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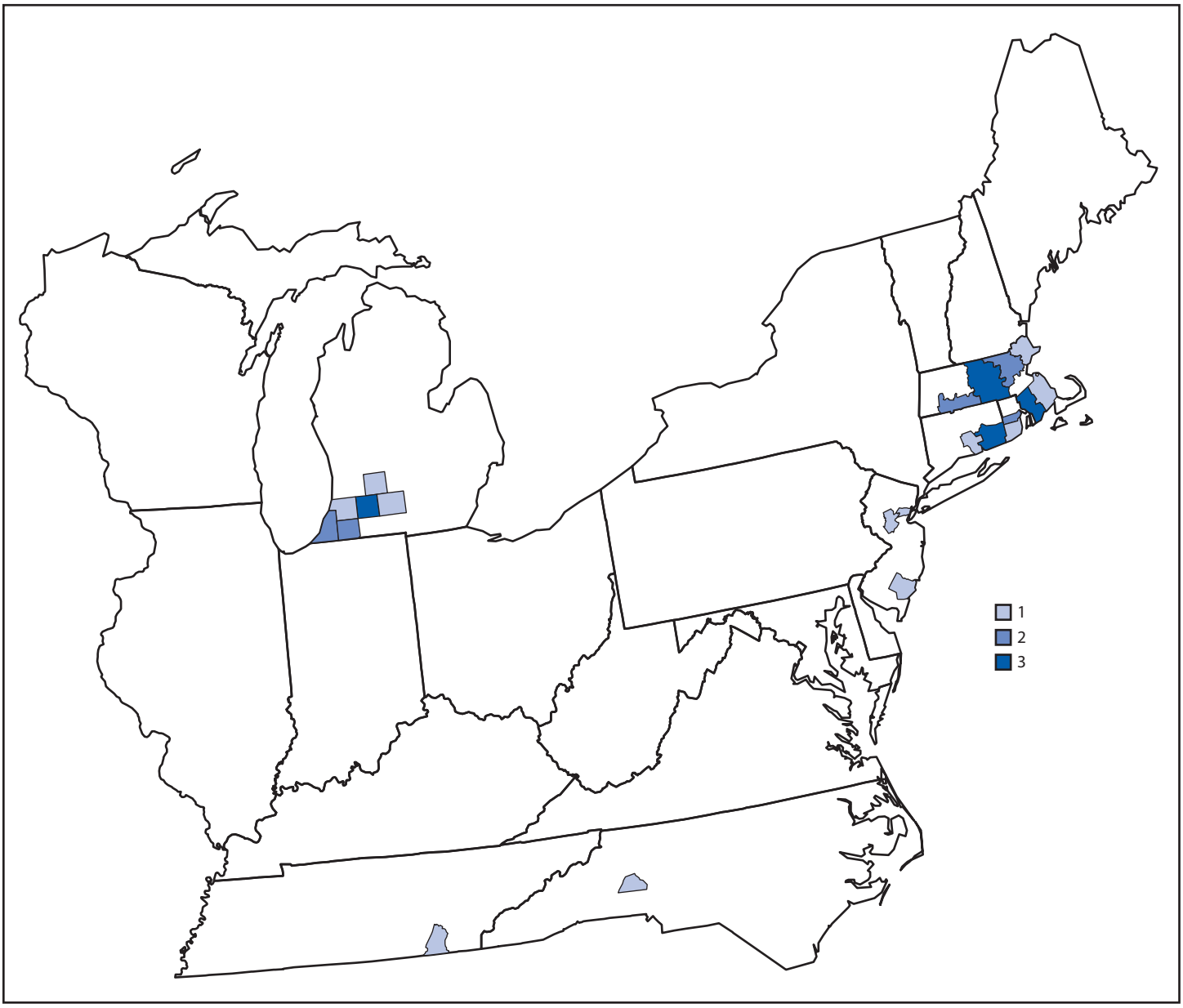
FIGURE. Number of reported cases of Eastern equine encephalitis virus disease (N = 34), by county of residence — United States, 2019*



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Correction and Republication: Associations Among School Absenteeism, Gastrointestinal and Respiratory Illness, and Income — United States, 2010–2016

On March 8, 2019, *MMWR* published "Associations Among School Absenteeism, Gastrointestinal and Respiratory Illness, and Income — United States, 2010-2016" (*1*). On March 18, 2019, the National Center for Health Statistics, which manages the National Health Interview Survey, notified the authors of a concern that the analysis had not correctly accounted for the complex survey design and did not use the imputed income files or the survey weights. *MMWR* was informed about these concerns on March 27, 2019. The authors have corrected these errors and confirmed that they do not change the interpretation or the conclusions of the original report. In addition, several wording changes were made to clarify the text and interpretation. In accordance with December 2017 guidance from the International Committee of Medical Journal Editors (*2*), *MMWR* is republishing the report (*3*). The republished report includes the original report with clearly marked corrections in supplementary materials.

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1. Berendes D, Andujar A, Barrios LC, Hill V. Associations among school absenteeism, gastrointestinal and respiratory illness, and income—United States, 2010–2016. MMWR Morb Mortal Wkly Rep 2019;68:209–13. https://doi.org/10.15585/mmwr.mm6809a1
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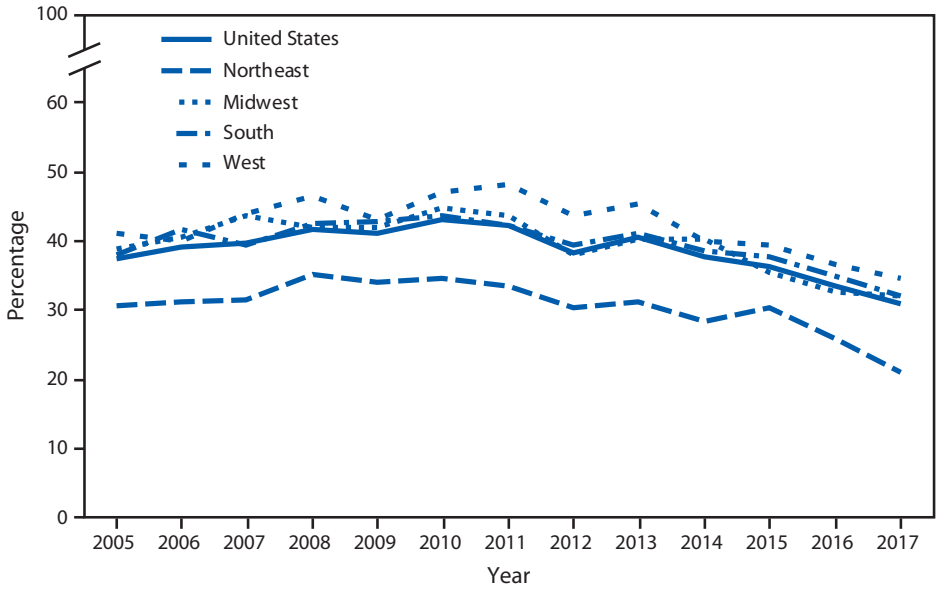
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Emergency Department Visits for Pain* at Which Opioids† Were Given or Prescribed, by Geographic Region§ of the Hospital — United States, 2005–2017



* Based on a sample of visits to emergency departments (EDs) in noninstitutional general and short-stay hospitals, exclusive of federal, military, and Veterans Administration hospitals, located in the 50 states and the District of Columbia. Pain-related visits were defined using up to three reasons for visit coded according to the National Center for Health Statistics Reason for Visit Classification (https://www.cdc.gov/nchs/data/series/sr_02/sr02_078.pdf) and grouped using an algorithm from https://jamanetwork.com/journals/jama/fullarticle/1149438.

† Visits with at least one opioid among up to eight medications listed as given in the ED or prescribed at discharge. Opioids were defined using the Cerner Multum third-level therapeutic category codes for narcotic analgesics (60) and narcotic analgesic combinations (191). Cold and cough products containing opioids and buprenorphine products indicated for conditions other than pain were excluded.

§ *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.

The percentage of ED visits for pain at which an opioid was given or prescribed increased from 37.4% in 2005 to 43.1% in 2010 and then decreased to 30.9% in 2017. A similar pattern was observed in all four regions. Percentages for the Northeast were lower than for the nation as a whole for all years analyzed. In 2017, the percentage was 21.1% in the Northeast, compared with 32.0% in the Midwest, 32.0% in the South, and 34.7% in the West.

Source: National Center for Health Statistics. National Hospital Ambulatory Medical Care Survey, 2005–2017. https://www.cdc.gov/nchs/ahcd/ahcd_questionnaires.htm.

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