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National Diabetes Month — November 2019

November is National Diabetes Month. In the United States, 30 million adults aged ≥18 years are living with diabetes and 84 million with prediabetes (*1*). Among persons aged ≥65 years, one in four is estimated to have diabetes, and one in two has prediabetes (*1*). Persons with prediabetes are at risk for developing type 2 diabetes, heart disease, and stroke (*2*). However, type 2 diabetes can be prevented or delayed through a structured lifestyle change program that promotes weight loss, healthy eating, and increased physical activity (*2*). A report on diabetes among Medicare beneficiaries is included in this issue of *MMWR* (*3*).

CDC plays a crucial role in preventing type 2 diabetes and diabetes complications. The National Diabetes Prevention Program (National DPP) (https://www.cdc.gov/diabetes/prevention/index.html) is a public-private partnership building a nationwide system to deliver an affordable, evidence-based lifestyle change program to prevent or delay type 2 diabetes. In 2018, the National DPP lifestyle change program became a covered service for Medicare beneficiaries with prediabetes. The first national prediabetes awareness campaign, DoIHavePrediabetes.org, done in collaboration with partners, encourages persons to learn their prediabetes risk. CDC also works to increase access to diabetes self-management education and support services to help persons with diabetes manage their daily diabetes care (https://www.cdc.gov/diabetes/dsmes-toolkit/index.html). More information is available at https://www.cdc.gov/diabetes.

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Diabetes Prevalence and Incidence Among Medicare Beneficiaries — United States, 2001–2015

Linda J. Andes, PhD[1]; Yanfeng Li, MD[2]; Meera Srinivasan, MS[1]; Stephen R. Benoit, MD[1]; Edward Gregg, PhD[3]; Deborah B. Rolka, MS[1]

Diabetes affects approximately 12% of the U.S. adult population and approximately 25% of adults aged ≥65 years. From 2009 to 2017, there was no significant change in diabetes prevalence overall or among persons aged 65–79 years (*1*). However, these estimates were based on survey data with <5,000 older adults. Medicare administrative data sets, which contain claims for millions of older adults, afford an opportunity to explore both trends over time and heterogeneity within an older population. Previous studies have shown that claims data can be used to identify persons with diagnosed diabetes (*2*). This study estimated annual prevalence and incidence of diabetes during 2001–2015 using Medicare claims data for beneficiaries aged ≥68 years and found that prevalence plateaued after

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2012 and incidence decreased after 2006. In 2015 (the most recent year estimated) prevalence was 31.6%, and incidence was 3.0%. Medicare claims can serve as an important source of data for diabetes surveillance for the older population, which can inform prevention and treatment strategies.

To estimate diabetes prevalence and incidence for the study years 2001–2015, the 100% claims data for 1999–2017 were obtained from the Centers for Medicare & Medicaid Services Chronic Conditions Warehouse (*3*) (1999–2017 data were required to identify claims for up to 2 years before and 2 years after each "index" year). These data include all claims for hospital inpatient and outpatient, physician/provider services ("carrier claims"), home health agency, and skilled nursing facility services. Diabetes-related claims were identified by any diagnosis code for primary diabetes (*International Classification of Diseases, Ninth Revision* [ICD-9] code 250.x or ICD-10 code E10 or E11). A prevalent case must have had at least 1) one inpatient claim in the index year or the preceding 2 years or 2) one outpatient diabetes claim in the index year and one inpatient or outpatient claim in the 2 years following the first claim (*2*). Incident cases were defined as prevalent cases with a 2-year period with no diabetes-related diagnosis codes at the beginning of the 5-year window.

Although all U.S. residents and lawful permanent residents aged ≥65 years are eligible for Medicare,* claims are only available for those who are enrolled in Medicare Part A (hospital insurance) and Part B (medical insurance), also known as fee-for-service. Because beneficiaries can switch between fee-for-service and Medicare Advantage privately managed plans during open enrollment every year, they were only included if they were enrolled in both Part A and Part B for all 60 months of a 5-year window centered on the index year, or if they died during the window and were enrolled until the date of death. Because beneficiaries must be fully enrolled for 60 months, and incident cases must have a 24-month period with no diabetes-related diagnosis codes at the beginning of the 5-year window, persons who turned 65 during the index year or in the 2 preceding years were not eligible to be in the study population. Therefore, each index year included only beneficiaries aged ≥68 years at the end of the index year. To focus on older adults, Medicare beneficiaries with a disability or who had end-stage renal disease were not included unless they were also aged ≥68 years.

Prevalence and incidence rates were stratified by age group (68–69, 70–74, 75–79, 80–84, and ≥85 years), sex, and race/ethnicity (mutually exclusive categories of white, black, Hispanic, Asian/Pacific Islander, and "other"). Race/ethnicity was as reported by the Social Security Administration and modified by a first- and last-name algorithm that identifies more Hispanic and Asian beneficiaries (*3*). Prevalences were computed by dividing the number of prevalent cases by the number of beneficiaries fully enrolled in the 5-year window for each index year. Incidences were calculated by dividing

*https://www.cms.gov/Medicare/Eligibility-and-Enrollment/OrigMedicarePartABEligEnrol/index.html.

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the number of incident cases by the sum of the number of beneficiaries without evidence of diabetes and incident cases fully enrolled in the 5-year window. Standard errors and confidence intervals were not reported because the margin of error for all estimates was <0.02%. SAS software (version 9.4; SAS Institute) was used to conduct statistical analyses. Joinpoint regression (version 4.7.0.0; National Cancer Institute) was used to assess trends over time.

The overall national prevalence of diabetes among Medicare fee-for-service beneficiaries increased from 23.3% in 2001 to a high of 32.2% in 2012, and then remained approximately level through 2015 (Table). Joinpoint regression yielded three significant trends for prevalence: from 2001 to 2008, average annual percentage change (APC) was +4%; from 2008 to 2012, APC declined (-1.4%); and from 2012 to 2015, APC decreased slightly (-0.7%) (Figure 1). The prevalence of diabetes was lower among whites than among other racial/ethnic groups and was higher among men (range = 24.7% [2001] to 34.6% [2013]) than among women (range = 22.3% [2001] to 30.3% [2012]). Prevalence among both men and women remained stable from their peak years through 2015; however, this relationship varied by racial/ethnic group. Among whites and Asians/Pacific Islanders, prevalence was higher in men, whereas among blacks and Hispanics, prevalence was higher in women.

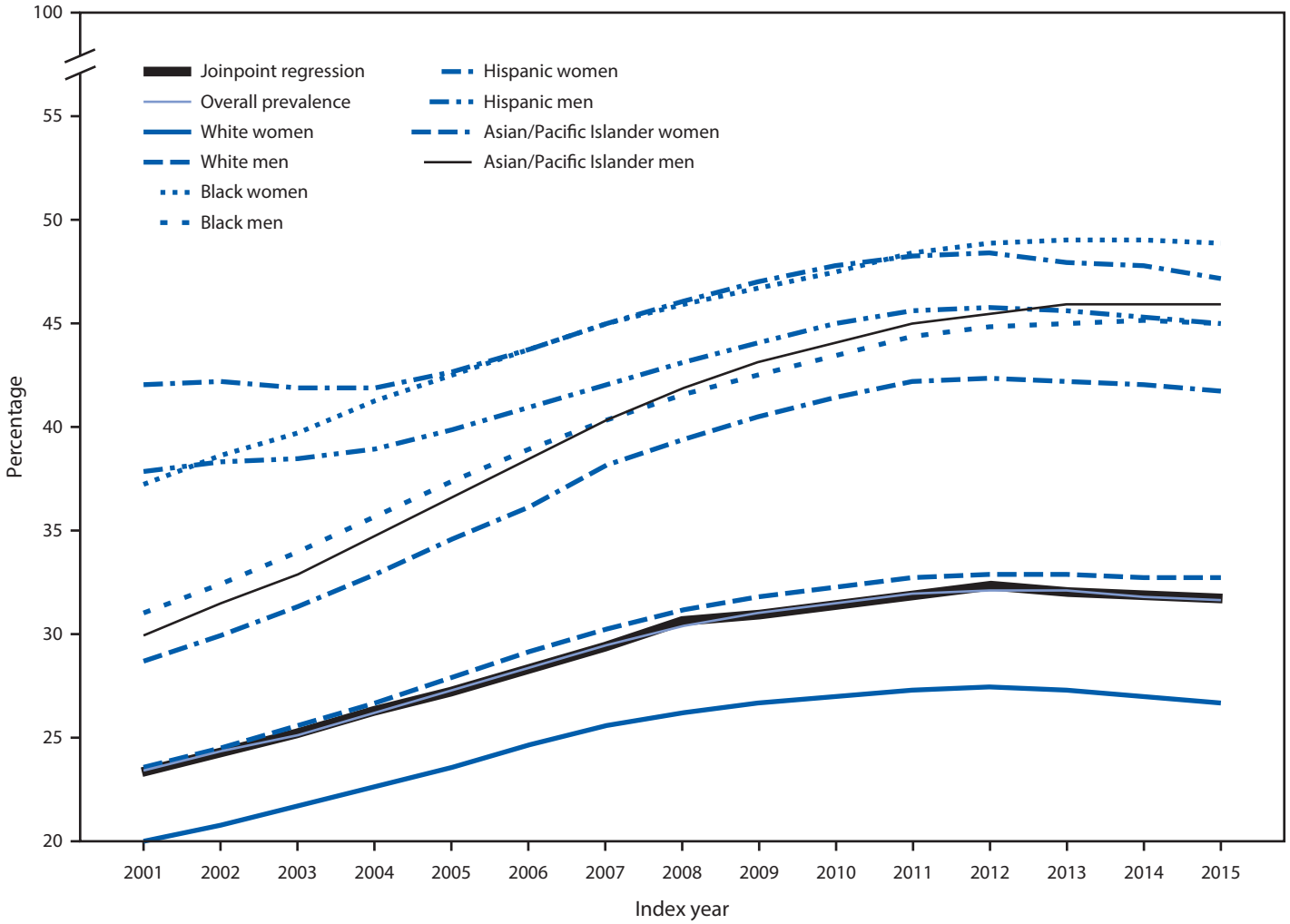
Two significant trends in incidence were observed. From 2001 to 2006, APC was +4.5%; after 2006, incidence decreased (APC = -3.3%) (Figure 2). Although incidence

TABLE. Prevalence and incidence of diabetes among Medicare fee-for-service beneficiaries, aged ≥68 years, by demographic characteristic and year — United States, 2001–2015

Characteristic	Index year*														
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Prevalence (%)†															
Overall	**23.3**	**24.2**	**25.1**	**26.1**	**27.2**	**28.4**	**29.5**	**30.3**	**31.0**	**31.5**	**32.0**	**32.1**	**32.0**	**31.8**	**31.6**
Sex															
Women	22.3	23.2	24.0	24.9	25.9	26.9	28.0	28.8	29.4	29.8	30.2	30.3	30.2	29.9	29.6
Men	24.7	25.8	26.8	27.9	29.2	30.4	31.6	32.6	33.3	33.9	34.4	34.6	34.7	34.5	34.3
Race/Ethnicity															
White	21.3	22.2	23.1	24.2	25.3	26.4	27.5	28.2	28.8	29.2	29.6	29.7	29.6	29.4	29.2
Black	35.0	36.4	37.7	39.2	40.6	42.0	43.3	44.3	45.1	46.0	46.9	47.4	47.6	47.5	47.4
Hispanic	40.3	40.6	40.5	40.6	41.5	42.6	43.8	44.9	45.8	46.6	47.2	47.3	47.0	46.7	46.3
Asian/Pacific Islander	29.2	30.5	32.0	33.7	35.4	37.1	39.1	40.5	41.6	42.5	43.4	43.7	43.7	43.6	43.5
Other	30.5	31.5	32.5	33.5	34.7	35.8	37.5	38.5	39.4	40.1	40.6	41.1	41.4	41.5	41.6
Age group (yrs)															
68–69	22.4	23.4	24.2	25.0	26.0	26.9	28.0	28.8	29.3	29.6	29.8	29.9	29.7	29.2	28.7
70–74	23.6	24.6	25.5	26.5	27.6	28.8	29.9	30.6	31.2	31.7	32.1	32.0	31.8	31.5	31.2
75–79	24.6	25.6	26.5	27.6	28.8	30.0	31.1	32.0	32.7	33.3	33.9	34.1	34.0	33.8	33.6
80–84	23.9	24.9	25.9	27.0	28.2	29.5	30.8	31.7	32.4	33.0	33.6	33.9	33.9	33.8	33.8
≥85	20.7	21.5	22.3	23.2	24.3	25.5	26.7	27.7	28.4	29.0	29.6	30.0	30.2	30.1	30.2
Incidence (%)§															
Overall	**3.4**	**3.5**	**3.5**	**3.8**	**4.0**	**4.0**	**4.0**	**3.8**	**3.7**	**3.6**	**3.6**	**3.3**	**3.2**	**3.1**	**3.0**
Sex															
Women	3.2	3.2	3.3	3.6	3.7	3.8	3.8	3.6	3.5	3.4	3.3	3.1	2.9	2.8	2.8
Men	3.7	3.8	3.8	4.1	4.3	4.4	4.4	4.2	4.1	4.0	4.0	3.7	3.6	3.5	3.5
Race/Ethnicity															
White	3.1	3.2	3.2	3.5	3.7	3.8	3.7	3.5	3.4	3.3	3.3	3.0	2.9	2.8	2.8
Black	4.9	5.3	5.4	5.8	6.0	6.1	6.1	5.9	5.7	5.8	5.9	5.5	5.4	5.2	5.1
Hispanic	6.5	6.6	6.5	6.6	6.8	6.9	6.9	6.6	6.4	6.4	6.4	6.0	5.7	5.4	5.2
Asian/Pacific Islander	4.6	4.8	5.0	5.5	5.8	6.1	6.2	6.0	5.8	5.7	5.6	5.3	5.0	4.8	4.7
Other	4.2	4.1	4.2	4.4	4.6	4.6	4.8	4.7	4.6	4.7	4.4	4.3	4.0	3.9	3.9
Age group (yrs)															
68–69	3.3	3.5	3.5	3.7	3.9	4.0	4.0	3.7	3.7	3.6	3.5	3.2	3.1	3.0	3.0
70–74	3.4	3.5	3.5	3.8	4.0	4.1	4.1	3.8	3.8	3.7	3.6	3.3	3.1	3.0	3.0
75–79	3.5	3.6	3.6	3.9	4.1	4.2	4.2	3.9	3.8	3.7	3.7	3.4	3.2	3.1	3.1
80–84	3.4	3.5	3.6	3.8	4.1	4.1	4.1	3.9	3.8	3.7	3.7	3.4	3.3	3.2	3.2
≥85	3.1	3.2	3.2	3.5	3.6	3.7	3.8	3.6	3.5	3.4	3.5	3.3	3.1	3.0	3.0
Total no., in millions	**25.2**	**25.5**	**26.0**	**25.9**	**25.6**	**25.0**	**24.8**	**24.6**	**24.6**	**24.7**	**24.6**	**24.5**	**24.4**	**24.6**	**24.5**

* Index year indicates the year for which prevalence and incidence is reported. It is the year at the center of a 5-year data window.
† Calculated by dividing the number of prevalent cases by the number of beneficiaries fully enrolled during the 5-year window for each index year.
§ Calculated by dividing the number of incident cases by the sum of the number of beneficiaries without evidence of diabetes and incident cases fully enrolled during the 5-year window.

FIGURE 1. Prevalence of diabetes among Medicare fee-for-service beneficiaries aged ≥68 years — United States, 2001–2015



varied little by age, there were substantial differences by race/ethnicity and sex (Table). As with prevalence, incidence among whites and Asians/Pacific Islanders was higher among men, although among blacks and Hispanics, incidence was similar among men and women.

Discussion

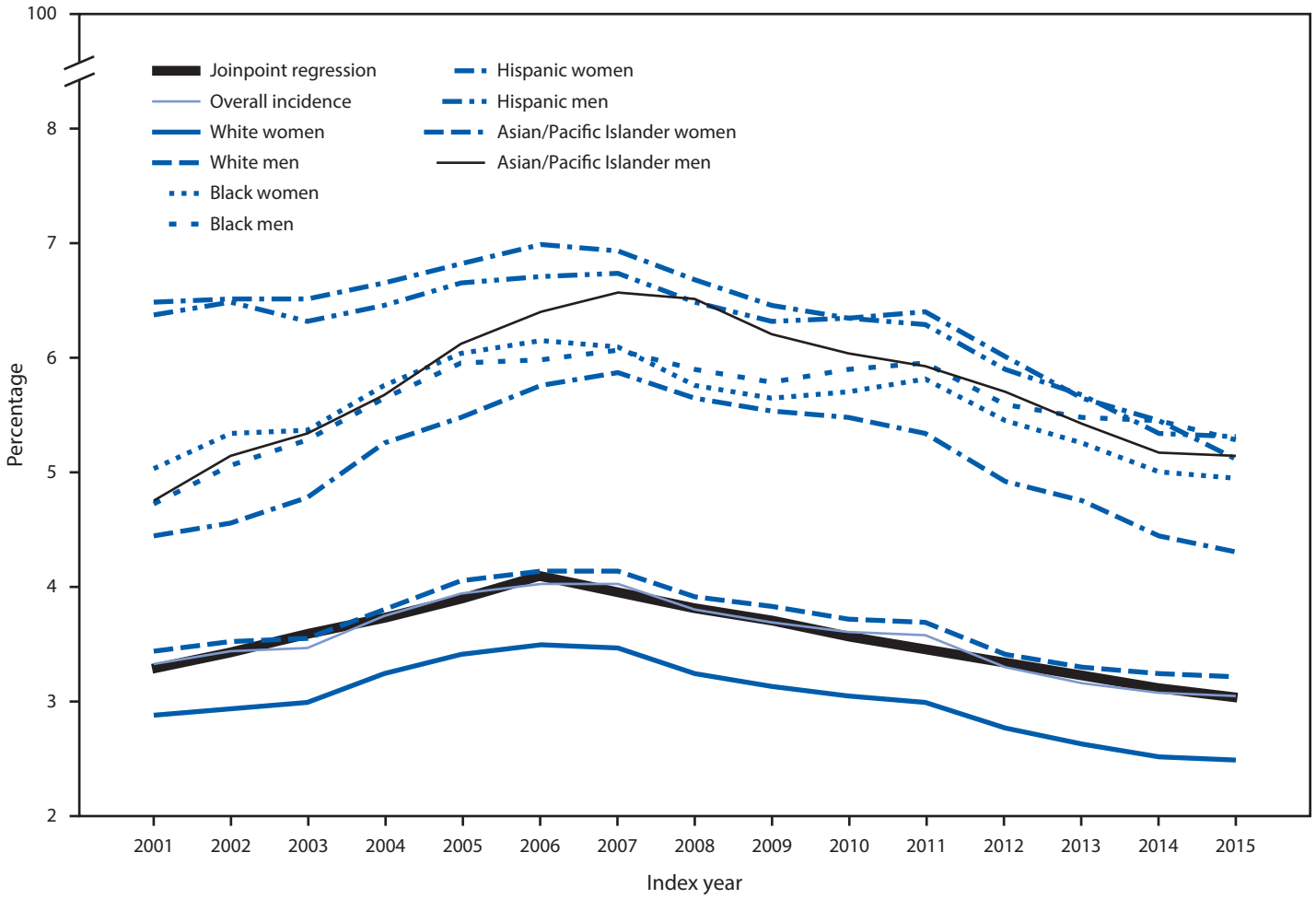
This study found that, among Medicare beneficiaries, the overall prevalence of diabetes increased from 2001 to 2012 and then remained approximately stable through 2015, and that the overall incidence decreased from 2006 to 2015. During 2015, the overall prevalence and incidence of diabetes among Medicare fee-for-service beneficiaries aged ≥68 years were 31.6% and 3.0%, respectively.

These findings are consistent with survey-based estimates showing a flattening of prevalence after the year 2008 for all age groups and a decrease in incidence from 2009 to 2017 among all age groups (*4*). Several factors could explain these trends in diabetes prevalence and incidence. National data have suggested that some important risk factors, including total dietary intake, added sugar and sugar-sweetened beverage intake, and physical inactivity, might have decreased in the past decade (*5*,*6*).

According to national survey data (*4*), the prevalence of self-reported diabetes diagnosed by a health care provider among Americans aged ≥65 years in 2017 was 20.8%, and the incidence was 0.9%. In comparison, claims-based prevalence and incidence reported in this study were substantially higher. However, both claims-based and survey-based estimates are subject to several sources of bias that might explain the difference in estimates.

The study sample might not be representative of the population of Medicare beneficiaries because claims for those enrolled in Medicare Advantage were not included in the data. However, a recent study of data from the National Health and Nutrition Examination Survey linked to Medicare enrollment

FIGURE 2. Incidence of diabetes among Medicare fee-for-service beneficiaries aged ≥68 years — United States, 2001–2015



data found no difference in diagnosed diabetes between fee-for-service and Medicare Advantage enrollees (*7*). In addition, the study sample might not be representative of the Medicare fee-for-service population because beneficiaries were required to be enrolled in both Part A and Part B for 60 months continuously or, if less than 60 months, then enrolled up until date of death. Also, one study recommends a clean period of ≥3 years for incidence estimations (*2*); thus, the requirement for only a 2-year period without diabetes-related diagnosis codes might have overestimated incidence. Further, diagnoses of diabetes in administrative claims data might be affected by patterns of health care utilization which are known to vary by sex and age (*8*).

Survey-based estimates might also be biased. Previous research has shown that measuring diabetes status from claims data yields higher prevalence rates than do self-reports among the same beneficiaries (*9*). Researchers compared diabetes identification from self-report on the National Health Interview Survey to that from respondents' linked Medicare claims and found that 93.1% of beneficiaries who self-reported diabetes were also identified through their claims. In contrast, only 67.0% of beneficiaries who were identified as having diabetes through their claims also self-reported having diabetes (*9*). This suggests there might be a substantial underestimation in survey-based estimates, possibly because of respondents' misunderstanding of survey questions or health care providers' communication, social desirability, or from simple failures of recall in self-reports. Surveys might underestimate diabetes prevalence because they are subject to selection bias in which very sick persons do not respond. Further, surveys usually sample from noninstitutionalized adults, excluding persons who are in hospitals or nursing homes from the sampling frame while they are included in claims data. Therefore, estimated rates from surveys are expected to be lower than those for the study population.

National surveys are important for understanding the burden of diabetes (*4*), but Medicare claims provide more detailed data on the older population, who experience a higher disease

Summary

What is already known about this topic?

Survey data have been crucial for diabetes surveillance, but administrative claims data from Medicare can also be used to track prevalence and incidence.

What is added by this report?

The prevalence of diabetes among adults aged ≥68 years has plateaued in recent years, and survey data and Medicare claims indicate that incidence has also declined. However, both prevalence and incidence obtained from Medicare fee-for-service claims are higher than those from survey data.

What are the implications for public health practice?

Diabetes prevalence and incidence might be higher among Medicare fee-for-service beneficiaries than that indicated by existing surveillance, which can improve efforts to monitor disease burden over time and assess disease prevention and management activities.

burden from diabetes. These data are an important source for future diabetes surveillance in the older population to monitor disease burden over time and assess disease prevention and management activities.

Corresponding author: Linda J. Andes, landes@cdc.gov, 770-488-5784.

[1]Division of Diabetes Translation, National Center for Chronic Disease Prevention and Health Promotion, CDC; [2]Division of Heart Disease and Stroke Prevention, National Center for Chronic Disease Prevention and Health Promotion, CDC; [3]Imperial College London, England.

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Racial/Ethnic and Age Group Differences in Opioid and Synthetic Opioid–Involved Overdose Deaths Among Adults Aged ≥18 Years in Metropolitan Areas — United States, 2015–2017

Kumiko M. Lippold, PhD[1,2]; Christopher M. Jones, PharmD[3]; Emily O'Malley Olsen, PhD[4]; Brett P. Giroir, MD[1]

Among the 47,600 opioid-involved overdose deaths in the United States in 2017, 59.8% (28,466) involved synthetic opioids (*1*). Since 2013, synthetic opioids, particularly illicitly manufactured fentanyl (IMF), including fentanyl analogs, have been fueling the U.S. overdose epidemic (*1*,*2*). Although initially mixed with heroin, IMF is increasingly being found in supplies of cocaine, methamphetamine, and counterfeit prescription pills, which increases the number of populations at risk for an opioid-involved overdose (*3*,*4*). With the proliferation of IMF, opioid-involved overdose deaths have increased among minority populations including non-Hispanic blacks (blacks) and Hispanics, groups that have historically had low opioid-involved overdose death rates (*5*). In addition, metropolitan areas have experienced sharp increases in drug and opioid-involved overdose deaths since 2013 (*6*,*7*). This study analyzed changes in overdose death rates involving any opioid and synthetic opioids among persons aged ≥18 years during 2015–2017, by age and race/ethnicity across metropolitan areas. Nearly all racial/ethnic groups and age groups experienced increases in opioid-involved and synthetic opioid–involved overdose death rates, particularly blacks aged 45–54 years (from 19.3 to 41.9 per 100,000) and 55–64 years (from 21.8 to 42.7) in large central metro areas and non-Hispanic whites (whites) aged 25–34 years (from 36.9 to 58.3) in large fringe metro areas. Comprehensive and culturally tailored interventions are needed to address the rise in drug overdose deaths in all populations, including prevention strategies that address the risk factors for substance use across each racial/ethnic group, public health messaging to increase awareness about synthetic opioids in the drug supply, expansion of naloxone distribution for overdose reversal, and increased access to medication-assisted treatment.

Drug overdose deaths were identified in the National Vital Statistics System multiple cause-of-death mortality files,* using the *International Classification of Diseases, Tenth Revision* (ICD-10), underlying cause-of-death codes X40–44 (unintentional), X60–64 (suicide), X85 (homicide), or Y10–Y14 (undetermined intent). These underlying cause-of-death codes identify deaths caused by acute toxicity from drugs rather than chronic exposure or adverse effects, including all intents. Among deaths with these underlying cause-of-death codes, the type of opioid involved in the drug overdose death is indicated by the following ICD-10 multiple cause-of-death codes: any opioid (T40.0, T40.1, T40.2, T40.3, T40.4, or T40.6) and synthetic opioids other than methadone (e.g., fentanyl, fentanyl analogs, and tramadol) (T40.4). Some deaths involved more than one type of opioid; these deaths were included in counts and rates for each subcategory. Thus, categories were not mutually exclusive.

Crude death rates per 100,000 population for overdose deaths involving any opioid and those involving synthetic opioids were examined for 2015–2017 by age group stratified by race/ethnicity within metropolitan areas (large central metro, large fringe metro, and medium/small metro). Metropolitan area was based on the 2013 urbanization classification scheme.† Analyses comparing absolute and percentage changes in death rates from 2015 to 2017 used z-tests when deaths were ≥100 and nonoverlapping 95% confidence intervals based on a gamma distribution when deaths were <100.§ Data on synthetic opioid-involved overdose deaths by race/ethnicity and age group within nonmetropolitan areas as well as deaths among non-Hispanic American Indian/Alaska Natives, non-Hispanic Asian Americans, and persons aged <18 years were almost universally suppressed because of small numbers of deaths¶; thus, they were not included in the analysis.

* https://www.cdc.gov/nchs/nvss/mortality_public_use_data.htm.

† Based on 2013 urbanization classification (https://www.cdc.gov/nchs/data_access/urban_rural.htm). Large central metro: counties in metropolitan statistical areas (MSAs) of ≥1 million population that 1) contain the entire population of the largest principal city of the MSA, or 2) have their entire population contained in the largest principal city of the MSA, or 3) contain at least 250,000 inhabitants of any principal city of the MSA (e.g., District of Columbia and New York County, New York). Large fringe metro: counties in the MSAs of ≥1 million population that did not qualify as large central metro counties (e.g., Baltimore County, Maryland, and Austin County, Texas). Medium metro: counties in MSAs of populations of 250,000–999,999 (e.g., Durham County, North Carolina). Small metro: counties in MSAs of populations <250,000 (e.g., Montgomery County, Virginia). For this study, medium and small metros are combined (medium/small).

§ https://www.cdc.gov/nchs/data/nvsr/nvsr63/nvsr63_03.pdf.

¶ Death counts are suppressed when the result is fewer than 10 death because of confidentiality constraints that aid in the protection of personal privacy and prevent identification.

From 2015 to 2017, death rates for drug overdoses involving any opioid and synthetic opioids increased across all racial/ethnic groups in each metropolitan area (Table 1). In large central metro areas, blacks experienced the largest absolute and percentage increases in rates of drug overdose deaths involving any opioid or synthetic opioids, with rates for deaths involving any opioid increasing 103% (from 11.8 to 24.0 per 100,000, absolute increase of 12.2), and for deaths involving synthetic opioids increasing 361% (from 3.6 to 16.6; absolute increase of 13.0). In large fringe metro areas, whites experienced the largest absolute increases rates of overdose deaths involving any opioid (from 17.8 to 26.7, absolute increase of 8.9) and those involving synthetic opioids (from 6.1 to 17.5, absolute increase of 11.4); blacks experienced the largest percentage change in drug overdose death rates involving any opioid (100%, from 7.2 to 14.4) and for overdose deaths involving synthetic opioids (332%, from 2.5 to 10.8). In medium/small metro areas, for overdose deaths involving any opioid, blacks experienced the largest percentage (82%) and absolute increase (6.0; from 7.3 to 13.3) in rates; whites had the largest absolute increase in rates of overdose deaths involving synthetic opioids (from 4.8

TABLE 1. Opioid-involved overdose death rates and synthetic opioid–involved overdose death rates* among adults aged ≥18 years, by urbanization level,† race/ethnicity,§ and age group — National Vital Statistics System, United States, 2015–2017

Urbanization, Race/Ethnicity, Age Group (yrs)	Opioid-involved overdose deaths					Opioid-involved overdose deaths involving synthetic opioids				
	2015 no. (rate)	2016 no. (rate)	2017 no. (rate)	Absolute rate change¶	% Rate change¶	2015 no. (rate)	2016 no. (rate)	2017 no. (rate)	Absolute rate change¶	% Rate change¶
Large central metro										
Black, overall	1,518 (11.8)	2,503 (19.3)	3,161 (24.0)	12.2**	103**	464 (3.6)	1,430 (11.0)	2,186 (16.6)	13.0**	361**
18–24	68 (3.6)	112 (6.0)	113 (6.2)	2.6**	72**	23 (1.2)	54 (2.9)	80 (4.4)	3.2**	267**
25–34	225 (8.6)	368 (13.6)	462 (16.5)	7.9**	92**	79 (3.0)	221 (8.1)	325 (11.6)	8.6**	287**
35–44	255 (11.5)	417 (18.9)	532 (23.9)	12.4**	108**	71 (3.2)	231 (10.5)	354 (15.9)	12.7**	397**
45–54	437 (19.3)	730 (32.5)	934 (41.9)	22.6**	117**	130 (5.7)	451 (20.1)	654 (29.4)	23.7**	416**
55–64	437 (21.8)	706 (34.6)	885 (42.7)	20.9**	96**	139 (6.9)	388 (19.0)	619 (29.8)	22.9**	332**
≥65	96 (5.2)	170 (8.8)	235 (11.6)	6.4**	123**	22 (1.2)	85 (4.4)	154 (7.6)	6.4**	533**
White, overall	6,636 (18.2)	8,251 (22.6)	8,989 (24.6)	6.4**	35**	1,743 (4.7)	3,633 (9.9)	5,038 (13.7)	9.0**	192**
18–24	591 (16.6)	721 (20.7)	703 (20.5)	3.9**	24**	176 (4.9)	324 (9.3)	421 (12.3)	7.4**	149**
25–34	1,736 (24.8)	2,271 (32.2)	2,484 (35.2)	10.4**	42**	531 (7.6)	1,160 (16.4)	1,560 (22.1)	14.5**	191**
35–44	1,360 (24.2)	1,812 (32.4)	2,039 (36.3)	12.1**	50**	378 (6.7)	902 (16.1)	1,253 (22.3)	15.6**	232**
45–54	1,503 (24.1)	1,768 (29.0)	1,908 (32.1)	8.0**	33**	362 (5.8)	726 (11.9)	1,034 (17.4)	11.6**	199**
55–64	1,156 (18.2)	1,369 (21.5)	1,462 (23.0)	4.8**	26**	239 (3.8)	447 (7.0)	657 (10.3)	6.5**	174**
≥65	290 (3.8)	310 (3.9)	393 (4.8)	1.0**	26**	57 (0.7)	74 (0.9)	113 (1.4)	0.7**	100**
Hispanic, overall††	1,176 (6.2)	1,674 (8.8)	1,901 (9.7)	3.5**	57**	238 (1.3)	766 (4.0)	1,058 (5.4)	4.2**	350**
18–24	152 (4.9)	202 (6.5)	234 (7.6)	2.7**	55**	26 (0.8)	82 (2.7)	132 (4.3)	3.5**	438**
25–34	297 (6.8)	440 (9.9)	512 (11.2)	4.4**	65**	68 (1.5)	203 (4.6)	289 (6.3)	4.8**	320**
35–44	287 (7.2)	419 (10.5)	458 (11.3)	4.1**	57**	58 (1.5)	212 (5.3)	271 (6.7)	5.2**	347**
45–54	256 (7.8)	360 (10.8)	420 (12.3)	4.5**	58**	54 (1.7)	173 (5.2)	235 (6.9)	5.2**	306**
55–64	151 (7.0)	219 (9.8)	223 (9.5)	2.5**	36**	26 (1.2)	90 (4.0)	106 (4.5)	3.3**	275**
≥65	33 (1.7)	34 (1.7)	54 (2.5)	0.8	47	—§§	—	25 (1.2)	—	—
Large fringe metro										
Black, overall	519 (7.2)	906 (12.3)	1,086 (14.4)	7.2**	100**	179 (2.5)	499 (6.8)	812 (10.8)	8.3**	332**
18–24	48 (4.4)	87 (8.1)	88 (8.1)	3.7**	84**	20 (1.8)	56 (5.2)	62 (5.7)	3.9**	217**
25–34	102 (7.3)	220 (15.3)	273 (18.2)	10.9**	149**	44 (3.2)	130 (9.0)	205 (13.7)	10.5**	328**
35–44	132 (9.9)	193 (14.4)	249 (18.2)	8.3**	84**	47 (3.5)	108 (8.0)	197 (14.4)	10.9**	311**
45–54	127 (9.3)	232 (16.8)	258 (18.4)	9.1**	98**	36 (2.6)	118 (8.5)	184 (13.1)	10.5**	404**
55–64	99 (9.2)	140 (12.5)	184 (15.8)	6.6**	72**	30 (2.8)	71 (6.3)	137 (11.7)	8.9**	318**
≥65	11 (—**)	34 (3.4)	34 (3.3)	—	—	—	16 (—)	27 (2.6)	—	—
White, overall	7,561 (17.8)	10,179 (23.8)	11,442 (26.7)	8.9**	50**	2,594 (6.1)	5,292 (12.4)	7,486 (17.5)	11.4**	187**
18–24	801 (18.5)	1,106 (25.8)	1,097 (25.9)	7.4**	40**	303 (7.0)	620 (14.5)	778 (18.4)	11.4**	163**
25–34	2,283 (36.9)	3,177 (50.9)	3,658 (58.3)	21.4**	58**	901 (14.6)	1,887 (30.3)	2,666 (42.5)	27.9**	191**
35–44	1,738 (26.9)	2,392 (37.5)	2,699 (42.4)	15.5**	58**	628 (9.7)	1,318 (20.7)	1,874 (29.4)	19.7**	203**
45–54	1,644 (20.2)	2,009 (25.1)	2,274 (29.2)	9.0**	45**	501 (6.1)	925 (11.6)	1,363 (17.5)	11.4**	187**
55–64	911 (11.4)	1,260 (15.6)	1,433 (17.6)	6.2**	54**	223 (2.8)	475 (5.9)	701 (8.6)	5.8**	207**
≥65	184 (1.9)	235 (2.4)	281 (2.8)	0.9**	47**	38 (0.4)	67 (0.7)	104 (1.0)	0.6**	150**
Hispanic, overall††	423 (5.7)	674 (8.9)	790 (10.0)	4.3**	75**	123 (1.7)	362 (4.8)	531 (6.7)	5.0**	294**
18–24	65 (5.2)	94 (7.5)	95 (7.4)	2.2**	42**	21 (1.7)	48 (3.8)	61 (4.7)	3.0**	177**
25–34	128 (7.5)	214 (12.4)	243 (13.6)	6.1**	81**	44 (2.6)	131 (7.6)	165 (9.2)	6.6**	254**
35–44	119 (7.0)	194 (11.2)	210 (11.7)	4.7**	67**	33 (1.9)	106 (6.1)	149 (8.3)	6.4**	337**
45–54	71 (5.4)	129 (9.5)	157 (11.1)	5.7**	106**	20 (1.5)	58 (4.3)	114 (8.0)	6.5**	433**
55–64	33 (4.1)	37 (4.4)	73 (8.1)	4.0**	98**	—	19 (—)	37 (4.1)	—	—
≥65	—	—	12 (—)	—	—	—	—	—	—	—

See table footnotes on next page.

TABLE 1. (*Continued*) Opioid-involved overdose death rates and synthetic opioid–involved overdose death rates* among adults aged ≥18 years, by urbanization level,† race/ethnicity,§ and age group — National Vital Statistics System, United States, 2015–2017

Urbanization, Race/Ethnicity, Age Group (yrs)	Opioid-involved overdose deaths					Opioid-involved overdose deaths involving synthetic opioids				
	2015 no. (rate)	2016 no. (rate)	2017 no. (rate)	Absolute rate change¶	% Rate change¶	2015 no. (rate)	2016 no. (rate)	2017 no. (rate)	Absolute rate change¶	% Rate change¶
Medium and small metro										
Black, overall	553 (7.3)	776 (10.1)	1,036 (13.3)	6.0**	82**	199 (2.6)	387 (5.0)	698 (8.9)	6.3**	242**
18–24	36 (2.6)	57 (4.2)	83 (6.2)	3.6**	139**	21 (1.5)	27 (2.0)	54 (4.0)	2.5**	167**
25–34	111 (7.2)	183 (11.6)	231 (14.2)	7.0**	97**	39 (2.5)	99 (6.3)	176 (10.8)	8.3**	332**
35–44	146 (11.4)	193 (15.0)	267 (20.5)	9.1**	80**	55 (4.3)	100 (7.8)	186 (14.3)	10.0**	233**
45–54	139 (11.0)	154 (12.2)	219 (17.5)	6.5**	59**	48 (3.8)	78 (6.2)	149 (11.9)	8.1**	213**
55–64	99 (8.7)	153 (13.2)	187 (15.8)	7.1**	82**	30 (2.6)	72 (6.2)	110 (9.3)	6.7**	258**
≥65	22 (2.2)	36 (3.4)	49 (4.4)	2.2**	100**	—	11 (—)	23 (2.1)	—	—
White, overall	8,794 (16.4)	10,530 (19.6)	11,767 (21.9)	5.5**	34**	2,547 (4.8)	4,449 (8.3)	6,803 (12.6)	7.8**	163**
18–24	757 (11.7)	943 (14.9)	960 (15.4)	3.7**	32**	260 (4.0)	433 (6.8)	634 (10.2)	6.2**	155**
25–34	2,270 (27.7)	2,963 (35.9)	3,324 (40.2)	12.5**	45**	772 (9.4)	1,454 (17.6)	2,203 (26.6)	17.2**	183**
35–44	2,042 (26.9)	2,552 (33.9)	2,892 (38.3)	11.4**	42**	634 (8.4)	1,188 (15.8)	1,816 (24.1)	15.7**	187**
45–54	2,032 (22.6)	2,228 (25.2)	2,475 (28.7)	6.1**	27**	530 (5.9)	867 (9.8)	1,326 (15.4)	9.5**	161**
55–64	1,349 (14.0)	1,450 (14.9)	1,706 (17.5)	3.5**	25**	292 (3.0)	415 (4.3)	733 (7.5)	4.5**	150**
≥65	344 (2.7)	394 (3.0)	410 (3.1)	0.4	15	59 (0.5)	92 (0.7)	91 (0.7)	0.2**	40**
Hispanic, overall††	709 (7.3)	870 (8.8)	1,012 (9.9)	2.6**	36**	127 (1.3)	321 (3.2)	485 (4.7)	3.4**	262**
18–24	78 (4.2)	110 (5.9)	111 (5.8)	1.6**	38**	20 (1.1)	40 (2.1)	59 (3.1)	2.0**	182**
25–34	196 (8.6)	250 (10.8)	298 (12.5)	3.9**	45**	33 (1.4)	88 (3.8)	159 (6.7)	5.3**	379**
35–44	184 (9.2)	231 (11.4)	270 (12.9)	3.7**	40**	37 (1.9)	103 (5.1)	138 (6.6)	4.7**	247**
45–54	159 (10.2)	166 (10.4)	199 (12.1)	1.9	19	29 (1.9)	57 (3.6)	87 (5.3)	3.4**	179**
55–64	77 (7.3)	93 (8.4)	117 (10.1)	2.8**	39**	—	29 (2.6)	38 (3.3)	—	—
≥65	15 (—)	20 (2.0)	17 (—)	—	—	—	—	—	—	—

* Deaths were classified using the *International Classification of Diseases, Tenth Revision* (ICD-10). Opioid-involved overdose deaths were identified using underlying cause-of-death codes X40–44, X60–64, X85, and Y10–14. Among deaths with overdose as the underlying cause, the type of drug involved in the overdose death was indicated by the following ICD-10 multiple cause-of-death codes: any opioid (T40.0, T40.1, T40.2, T40.3, T40.4, or T40.6) and synthetic opioids other than methadone (T40.4). Totals for deaths by category might involve more than one drug other than synthetic opioids. Rates displayed are age-specific crude rates per 100,000 persons.

† Based on the 2013 urbanization classification (https://www.cdc.gov/nchs/data_access/urban_rural.htm). *Large central metro*: counties in metropolitan statistical areas (MSAs) of ≥1 million population that 1) contain the entire population of the largest principal city of the MSA, or 2) have their entire population contained in the largest principal city of the MSA, or 3) contain at least 250,000 inhabitants of any principal city of the MSA. *Large fringe metro*: counties in the MSAs of ≥1 million population that did not qualify as large central metro counties. *Medium metro*: counties in MSAs of populations of 250,000–999,999. *Small metro*: counties in MSAs of populations <250,000. Because of low numbers of deaths and rate suppression for key populations, micropolitan areas (nonmetropolitan counties) and noncore areas (counties that did not qualify as micropolitan) were not included in this analysis.

§ Blacks and whites are non-Hispanic; Hispanic persons can be of any race.

¶ Absolute rate change is the difference between the 2015 and 2017 rates. Percent change in rate is calculated as the absolute rate change divided by the 2015 rate, multiplied by 100. Statistical significance was determined using nonoverlapping 95% confidence intervals (CIs) based on the gamma method if the number of deaths was <100 in 2015 and 2017, and z-tests were used if the number of deaths was ≥100 in 2015 and 2017. Percent changes were rounded to the nearest whole number. The method of comparing CIs is a conservative method for statistical significance, and caution should be used when interpreting a nonsignificant difference when the lower and upper bounds being compared only slightly overlap.

** $p<0.05$ using z-tests when deaths were ≥100 or when deaths were <100; nonoverlapping 95% CIs based on a gamma distribution.

†† Data for Hispanic origin should be interpreted with caution; studies comparing Hispanic origin on death certificates and on census surveys have indicated that reporting on Hispanic ethnicity is inconsistent. https://www.cdc.gov/nchs/data/series/sr_02/sr02_172.pdf.

§§ Dashes indicate that result is suppressed because <10 deaths, and rates based on <20 deaths are considered unreliable. Absolute and percent changes in rates cannot be calculated for these values.

to 12.6, absolute increase of 7.8), and Hispanics** had the largest percentage increase in rates of drug overdose deaths involving synthetic opioids (262%, from 1.3 to 4.7).

Examining death rates for drug overdose deaths involving any opioid or synthetic opioids by racial/ethnic age groups in large central metro areas found that the highest drug overdose death rates involving any opioid (42.7) and synthetic opioids (29.8) in 2017 were among blacks aged 55–64 years (Table 1).

From 2015 to 2017, blacks aged 45–54 years in large central metro areas experienced the largest absolute increase in death rates involving any opioid (from 19.3 to 41.9, absolute increase of 22.6) and synthetic opioids (from 5.7 to 29.4, absolute increase of 23.7), and blacks aged ≥65 years in these areas had the largest percentage increases in rates of drug overdose deaths involving any opioid (123%; from 5.2 to 11.6) and synthetic opioids (533%; from 1.2 to 7.6).

Among racial/ethnic age groups in large fringe metro areas, in 2017, the highest rates of drug overdose deaths involving any opioid (58.3) and synthetic opioids (42.5) were in whites aged 25–34 years (Table 1); this group also experienced the largest

** Data for Hispanic origin should be interpreted with caution; studies comparing Hispanic origin on death certificates and on census surveys have indicated that reporting on Hispanic ethnicity is inconsistent. https://www.cdc.gov/nchs/data/series/sr_02/sr02_172.pdf.

absolute increases in death rates involving any opioid (from 36.9 to 58.3; absolute increase of 21.4) and synthetic opioids (from 14.6 to 42.5; absolute increase of 27.9) in these areas from 2015 to 2017. The largest percentage increase in rates of drug overdose deaths involving any opioid in large fringe metro areas from 2015 to 2017 occurred among blacks aged 25–34 years (149%; from 7.3 to 18.2), and the largest percentage increase in overdose death rates involving synthetic opioids was in Hispanics aged 45–54 years (433%; from 1.5 to 8.0).

Among racial/ethnic age groups in medium/small metro areas, in 2017, the highest rates of drug overdose deaths involving any opioid or synthetic opioids were in whites aged 25–34 years (40.2 and 26.6, respectively). This group also experienced the largest absolute increases in drug overdose death rates involving any opioid (from 27.7 to 40.2, absolute increase of 12.5) and synthetic opioids (from 9.4 to 26.6, absolute increase of 17.2) in these areas from 2015 to 2017 (Table 1). From 2015 to 2017, blacks aged 18–24 years experienced the largest percentage increase in opioid-involved overdose death rates (139%; from 2.6 to 6.2); the largest percentage increase in synthetic opioid–involved overdose death rates (379%; from 1.4 to 6.7) occurred among Hispanics aged 25–34 years.

The percentage of all opioid-involved overdose deaths involving synthetic opioids increased from 2015 to 2017 across all racial/ethnic age groups in each metropolitan area category (Table 2). By 2017, the greatest level of synthetic opioid involvement in opioid-involved overdose deaths was among blacks in all metro areas and ranged from 67.4% in medium/small metro areas to 74.8% in large fringe metro areas. Among whites, the percentage of opioid-involved overdose deaths involving synthetic opioids ranged from 56.0% in large central metro areas to 65.4% in large fringe metro areas. Among Hispanics, the percentage of opioid-involved overdose deaths involving synthetic opioids ranged from 47.9% in medium/small metro areas to 67.2% in large fringe metro areas.

Discussion

Synthetic opioids are driving the recent increases in opioid-involved overdose deaths in the United States. Previous research has found that synthetic opioids were involved in nearly 60% of opioid-involved overdose deaths in the United States in 2017 (*1*); this study examines the variation in synthetic opioid involvement in these deaths among racial/ethnic age groups across different metropolitan areas. For example, in large central metro areas, among persons aged 45–54 years, synthetic opioids were involved in 70.0% of all opioid-involved overdose deaths among blacks, 54.2% among whites, and 56.0% among Hispanics. These findings underscore the changing demographics and populations affected by the opioid overdose epidemic as the illicit drug supply continues to evolve.

Summary

What is already known about this topic?

Opioid-involved overdose death rates in the United States differ by demographic and geographic characteristics. Illicitly manufactured fentanyl and fentanyl analogs have fueled recent increases in opioid-involved overdose deaths. In 2017, synthetic opioids were involved in nearly 60% of opioid-involved overdose deaths; however, the level of involvement by racial/ethnic age groups in metropolitan areas has not been explored.

What is added by this report?

From 2015 to 2017, nearly all racial/ethnic groups and age groups experienced significant increases in opioid-involved and synthetic opioid–involved overdose death rates, particularly blacks aged 45–54 years (from 19.3 to 41.9 per 100,000) and 55–64 years (from 21.8 to 42.7) in large central metro areas. The increased involvement of synthetic opioids in overdose deaths is changing the demographics of the opioid overdose epidemic.

What are the implications for public health practice?

Culturally competent interventions are needed to target populations at risk; these interventions include increasing awareness about synthetic opioids in the drug supply and expanding evidence-based interventions, such as naloxone distribution and medication-assisted treatment.

Consistent with these findings, a recent report by the New York City Department of Health and Mental Hygiene (*8*) identified high rates of drug overdoses in 2017 involving heroin or fentanyl among middle-aged and older-aged blacks and Hispanics in a large metropolitan area infiltrated by IMF in recent years; these rates have largely eclipsed those among whites of the same age (*9*). The distinct age distributions of opioid-involved overdose deaths between the racial/ethnic age groups and different metropolitan areas highlight the heterogeneity that exists among persons who use drugs, illicit drug markets, and risk factors for overdose. Differences in opioid prescribing rates, underlying rates of opioid and other substance use disorders, access to substance use disorder treatment, and the proliferation of IMF in the illicit drug supply might all underlie the unique patterns of opioid-involved overdose deaths observed in this study. Thus, additional efforts are needed to develop and implement prevention, treatment, and response strategies that are tailored to diverse racial/ethnic and age groups within specific community contexts. In addition, more research is needed to explore the underlying drivers of differing overdose risk among racial/ethnic age groups across metropolitan areas.

The findings in this report are subject to at least four limitations. First, numbers and rates of deaths involving specific drugs might be affected by factors related to death investigations, such as the substances tested for or the circumstances under which these tests are performed. Second, changes in

TABLE 2. Percentage of opioid-involved overdose deaths* involving synthetic opioids among adults aged ≥18 years, by urbanization level, age group, and race/ethnicity, — National Vital Statistics System, United States, 2015–2017

Urbanization level†	Age group (yrs)	Race/Ethnicity§,¶	Year, %			% Increase, 2015–2017**,††
			2015	2016	2017	
Large central metro	All	Black	30.6	57.1	69.2	126
		White	26.1	44.0	56.0	115
		Hispanic	20.2	45.8	55.7	175
	18–24	Black	33.8	48.2	70.8	109
		White	29.8	44.9	59.9	101
		Hispanic	17.1	40.6	56.4	230
	25–34	Black	35.1	60.1	70.3	100
		White	30.6	51.1	62.8	105
		Hispanic	22.9	46.1	56.4	147
	35–44	Black	27.8	55.4	66.5	139
		White	27.8	49.8	61.5	121
		Hispanic	20.2	50.6	59.2	193
	45–54	Black	29.7	61.8	70.0	135
		White	24.1	41.1	54.2	125
		Hispanic	21.1	48.1	56.0	165
	55–64	Black	31.8	55.0	69.9	120
		White	20.7	32.7	44.9	117
		Hispanic	17.2	41.1	47.5	176
	≥65	Black	22.9	50.0	65.5	186
		White	19.7	23.9	28.8	46
		Hispanic	—§§	—	46.3	—
Large fringe metro	All	Black	34.5	55.1	74.8	117
		White	34.3	52.0	65.4	91
		Hispanic	29.1	53.7	67.2	131
	18–24	Black	41.7	64.4	70.5	69
		White	37.8	56.1	70.9	88
		Hispanic	32.3	51.1	64.2	99
	25–34	Black	43.1	59.1	75.1	74
		White	39.5	59.4	72.9	85
		Hispanic	34.4	61.2	67.9	98
	35–44	Black	35.6	56.0	79.1	122
		White	36.1	55.1	69.4	92
		Hispanic	27.7	54.6	71.0	156
	45–54	Black	28.3	50.9	71.3	152
		White	30.5	46.0	59.9	97
		Hispanic	28.2	45.0	72.6	158
	55–64	Black	30.3	50.7	74.5	146
		White	24.5	37.7	48.9	100
		Hispanic	—	—	50.7	—
	≥65	Black	—	—	79.4	—
		White	20.7	28.5	37.0	79
		Hispanic	—	—	—	—

See table footnotes on next page.

fentanyl or other synthetic opioid testing and reporting as well as the percentage of deaths with specific drugs listed on the death certificate have changed over the study period and might have contributed to the observed increases in opioid- and synthetic opioid–involved overdose deaths.†† Third, potential racial or ethnic misclassification might lead to underestimates or overestimates for certain groups. Finally, because of small numbers of synthetic opioid–involved overdose deaths among certain racial/ethnic groups, persons aged <18 years, and in nonmetropolitan areas, data on these populations were not included in this report. Thus, exploration of how synthetic opioids are affecting these populations is beyond the scope of this report.

The changing patterns of the opioid overdose epidemic necessitate a rapid, culturally tailored and multifaceted public health response that appropriately targets and incorporates the needs of evolving populations at risk, including minority populations that historically have been regarded as having low opioid-involved overdose death rates. Curbing the opioid overdose epidemic requires collaborations across all sectors of government, law enforcement, public health, and communities. This study emphasizes the importance of data-informed approaches to addressing the evolving needs of communities and highlights the need for timely data that can be used to

†† In 2016 and 2017, 15 and 12% of death certificates, respectively, did not include mention of the type of specific drug involved in the overdose death. The percentage of death certificates that specified at least one drug varied between states and ranged from 54.7% to 99.7% in 2017.

TABLE 2. (*Continued*) Percentage of opioid-involved overdose deaths* involving synthetic opioids among adults aged ≥18 years, by urbanization level, age group, and race/ethnicity, — National Vital Statistics System, United States, 2015–2017

Urbanization level†	Age group (yrs)	Race/Ethnicity§,¶	Year, %			% Increase, 2015–2017**,††
			2015	2016	2017	
Medium and small metro	All	Black	36.0	49.9	67.4	87
		White	29.0	42.3	57.8	100
		Hispanic	17.9	36.9	47.9	168
	18–24	Black	58.3	47.4	65.1	12
		White	34.3	45.9	66.0	92
		Hispanic	25.6	36.4	53.2	108
	25–34	Black	35.1	54.1	76.2	117
		White	34.0	49.1	66.3	95
		Hispanic	16.8	35.2	53.4	217
	35–44	Black	37.7	51.8	69.7	85
		White	31.0	46.6	62.8	102
		Hispanic	20.1	44.6	51.1	154
	45–54	Black	34.5	50.6	68.0	97
		White	26.1	38.9	53.6	106
		Hispanic	18.2	34.3	43.7	140
	55–64	Black	30.3	47.1	58.8	94
		White	21.6	28.6	43.0	99
		Hispanic	—	31.2	32.5	—
	≥65	Black	—	—	46.9	—
		White	17.2	23.4	22.2	29
		Hispanic	—	—	—	—

* Deaths were classified using the *International Classification of Diseases, Tenth Revision* (ICD-10). Opioid-involved overdose deaths were identified using underlying cause-of-death codes X40–44, X60–64, X85, and Y10–14. Among deaths with overdose as the underlying cause, the type of drug involved in the overdose death was indicated by the following ICD-10 multiple cause-of-death codes: any opioid (T40.0, T40.1, T40.2, T40.3, T40.4, or T40.6) and synthetic opioids other than methadone (T40.4). Totals for deaths by category might involve more than one drug other than synthetic opioids. The percentage of opioid-involved overdose deaths involving synthetic opioids was calculated by dividing the number of opioid-involved overdose deaths involving synthetic opioids by the number of opioid-involved overdose deaths, then multiplying by 100.

† Based on the 2013 urbanization classification (https://www.cdc.gov/nchs/data_access/urban_rural.htm). *Large central metro*: counties in metropolitan statistical areas (MSAs) of ≥1 million population that 1) contain the entire population of the largest principal city of the MSA, or 2) have their entire population contained in the largest principal city of the MSA, or 3) contain at least 250,000 inhabitants of any principal city of the MSA. *Large fringe metro*: counties in the MSAs of ≥1 million population that did not qualify as large central metro counties. *Medium metro*: counties in MSAs of populations of 250,000–999,999. *Small metro*: counties in MSAs of populations <250,000. Because of low numbers of deaths and rate suppression for key populations, micropolitan areas (nonmetropolitan counties) and noncore areas (counties that did not qualify as micropolitan) were not included in this analysis.

§ Blacks and whites were non-Hispanic; Hispanics could be of any race.

¶ Data for Hispanic origin should be interpreted with caution; studies comparing Hispanic origin on death certificates and on census surveys have indicated that reporting on Hispanic ethnicity is inconsistent. https://www.cdc.gov/nchs/data/series/sr_02/sr02_172.pdf.

** Percentage increase in opioid-involved overdose deaths involving synthetic opioids was calculated by subtracting the percentage of deaths that involved synthetic opioids in 2017 from the percentage of deaths involving synthetic opioids in 2015, dividing this value by the percentage of deaths involving synthetic opioids in 2015, and then multiplying by 100.

†† Total percent changes were rounded to the nearest whole number.

§§ Dashes indicate that percent change in synthetic opioid involvement in opioid-involved overdose deaths could not be calculated because of unreliable rates or suppression.

effectively guide public health responses. Prevention and response strategies include public health messaging campaigns to increase awareness about illicit synthetic opioids in the drug supply, naloxone distribution that targets both persons who knowingly use opioids and those who might be exposed to opioids through contamination of other illicit drugs, the expansion of and equitable access to medication-assisted treatment for opioid use disorder, evidence-based treatment for other substance use disorders, and recovery support services for persons with substance use disorders. Importantly, cultural, language, and structural barriers that minority populations might face should be considered as these interventions are being developed and implemented.

Corresponding author: Kumiko M. Lippold, Kumiko.lippold@hhs.gov, 202-205-5815.

[1]Office of the Assistant Secretary for Health, U.S. Department of Health and Human Services, Washington, D.C.; [2]Oak Ridge Institute for Science and Education, Oak Ridge, Tennessee; [3]Office of the Director, National Center for Injury Prevention and Control, CDC; [4]Division of Overdose Prevention, National Center for Injury Prevention and Control, CDC.

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Tobacco Use in Top-Grossing Movies — United States, 2010–2018

Michael A. Tynan[1]; Jonathan R. Polansky[2]; Danielle Driscoll[3]; Claire Garcia[3]; Stanton A. Glantz, PhD[4]

The Surgeon General has concluded that there is a causal relationship between depictions of smoking in movies and initiation of smoking among young persons (*1*). Youths heavily exposed to onscreen smoking imagery are more likely to begin smoking than are those with minimal exposure (*1*,*2*). To assess tobacco-use imagery in top-grossing youth-rated movies (General Audiences [G], Parental Guidance [PG], and Parents Strongly Cautioned [PG-13]),* 2010–2018 data from the Breathe California Sacramento Region and University of California-San Francisco's Onscreen Tobacco Database were analyzed.† The percentage of all top-grossing movies with tobacco incidents remained stable from 2010 (45%) to 2018 (46%), including youth-rated movies (31% both years). However, total tobacco incidents increased 57% from 2010 to 2018, with a 120% increase in PG-13 movies. Tobacco incidents in PG-13 fictional movies declined 57% from 511 in 2010 to an all-time low of 221 in 2018. Although the number of PG-13 fictional movies with tobacco incidents declined 40% during 2010–2018, the number of PG-13 biographical dramas with tobacco incidents increased 233%. In 2018, biographical dramas accounted for most tobacco incidents, including 82% of incidents in PG-13 movies; 73% of characters who used tobacco in these biographical dramas were fictional. Continued efforts could help reduce tobacco incidents in top-grossing movies, particularly in PG-13 biographical dramas, to help prevent youth smoking initiation.

Breathe California counts tobacco incidents, defined as the use or implied use of a tobacco product (i.e., cigarettes, cigars, pipes, hookahs, smokeless tobacco products, or electronic cigarettes), in U.S. top-grossing movies (movies ranking among the top 10 in theatrical gross receipts for at least 1 week), which account for 98% of U.S. movie ticket sales (*3*). Consistent with previous reports on this topic (*3*–*5*), this analysis is based upon assessments of movies for tobacco use by at least two independent monitors; any differences were resolved by a supervisor who independently assessed the movie using the same protocol.§

To calculate the percentage of movies with tobacco incidents, the number of movies with any tobacco incidents was divided by the total number of movies, and the average number of tobacco incidents per movie was calculated for each motion picture company. For each year during 2010–2018, the number of top-grossing movies with tobacco incidents and overall number of tobacco incidents were calculated. Results were also analyzed by Motion Picture Association of America ratings (G, PG, PG-13, and Restricted [R]). To identify movie type, production details in movie industry databases and trade publications were used to classify the top-grossing movies into three main genres: fiction, biographical dramas, and documentaries. The identity of each character using tobacco in biographical dramas was also examined to determine whether the character was fictional or an actual person.

In 2018, among the 139 top-grossing movies, 64 (46%) included tobacco incidents, compared with 62 (45%) of 137 in 2010. Among the 55 top-grossing R-rated movies, 38 (69%) had tobacco incidents in 2018, compared with 35 (71%) of 49 in 2010 (Table 1). Among youth-rated movies (G, PG, or PG-13), 26 (31%) of 84 had tobacco incidents in 2018, compared with 27 (31%) of 88 in 2010. During 2010–2018, the number of top-grossing movies with tobacco incidents was highest in 2013 (76) and lowest in 2014 (58).

The total number of tobacco incidents in top-grossing movies increased by 57%, from 1,824 in 2010 to 2,868 in 2018. The number of tobacco incidents reached a low of 1,743 in 2015 before increasing to a high of 3,163 in 2016. The total number of tobacco incidents in G- or PG-rated movies decreased from 30 in 2010 to 17 in 2018. In contrast, tobacco incidents increased from 564 to 1,241 (120%) in PG-13

* Ratings assigned by the Motion Picture Association of America (a trade organization that represents the major movie studios) include General Audiences (G): all ages admitted; Parental Guidance Suggested (PG): some material may not be suitable for children; Parents Strongly Cautioned (PG-13): some material may be inappropriate for children under 13; and Restricted (R): under 17 requires accompanying parent or adult guardian.

† https://smokefreemovies.ucsf.edu/.

§ Two common methods used to count tobacco use incidents in movies are to count the number of scenes in which tobacco use occurs or to count the number of cuts in which tobacco use occurs. In the second method, a new incident is counted each time 1) a tobacco product went off screen and then came back on screen; 2) a different actor was shown with a tobacco product; or 3) a scene changed and the new scene contained the use or implied use of a tobacco product. Incidents of implied use are rare and occur when a person is handed or is holding, but not necessarily, using a tobacco product. Despite the difference in methods, both yield consistent results and are valid for comparing the results across ratings, years, companies, etc.

TABLE 1. Number and percentage of top-grossing movies with tobacco incidents, number of tobacco incidents, and total number of top-grossing movies, by Motion Picture Association of America (MPAA) rating* and movie company — United States, 2010–2018

Movie company	MPAA rating	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
						Movies with tobacco incidents, no. (%)					
Comcast (Universal)	G or PG	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**0 (0)**
	PG-13	1 (17)	4 (40)	3 (50)	2 (29)	6 (67)	3 (30)	2 (18)	5 (56)	5 (38)	**31 (38)**
	R	6 (86)	6 (86)	8 (73)	10 (77)	5 (71)	5 (50)	2 (22)	6 (75)	3 (38)	**51 (64)**
Disney	G or PG	1 (11)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (2)**
	PG-13	0 (0)	3 (60)	1 (33)	2 (40)	0 (0)	2 (50)	1 (20)	0 (0)	0 (0)	**9 (25)**
	R	0 (0)	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**2 (100)**
Fox	G or PG	0 (0)	2 (29)	1 (17)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**3 (7)**
	PG-13	3 (38)	3 (50)	2 (40)	2 (33)	4 (57)	4 (36)	4 (67)	2 (40)	6 (75)	**30 (48)**
	R	5 (71)	2 (100)	3 (100)	6 (100)	5 (63)	5 (100)	4 (80)	6 (100)	7 (100)	**43 (88)**
Independents†	G or PG	3 (60)	0 (0)	1 (50)	2 (67)	1 (20)	2 (67)	1 (17)	1 (20)	2 (33)	**13 (34)**
	PG-13	6 (55)	6 (46)	12 (52)	10 (50)	9 (47)	10 (59)	6 (38)	13 (54)	6 (40)	**78 (49)**
	R	15 (83)	6 (67)	15 (68)	19 (83)	7 (58)	16 (70)	16 (70)	18 (82)	14 (61)	**126 (72)**
Sony	G or PG	0 (0)	1 (17)	1 (33)	1 (33)	2 (50)	1 (20)	0 (0)	0 (0)	1 (25)	**7 (22)**
	PG-13	8 (67)	7 (58)	6 (60)	4 (57)	5 (71)	3 (50)	3 (33)	3 (50)	3 (50)	**42 (56)**
	R	2 (67)	7 (78)	6 (75)	5 (83)	5 (83)	4 (100)	5 (100)	3 (50)	7 (100)	**44 (81)**
Time Warner (Warner Bros.)	G or PG	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**1 (6)**
	PG-13	2 (22)	4 (33)	4 (44)	3 (27)	2 (25)	4 (50)	2 (20)	3 (43)	3 (30)	**27 (32)**
	R	4 (50)	3 (50)	5 (83)	3 (50)	3 (33)	6 (60)	4 (67)	5 (63)	4 (67)	**37 (57)**
Viacom (Paramount)	G or PG	0 (0)	3 (60)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0	0 (0)	0 (0)	**3 (20)**
	PG-13	3 (75)	3 (50)	2 (40)	1 (25)	2 (25)	2 (67)	5 (56)	4 (80)	0 (0)	**22 (45)**
	R	3 (50)	1 (33)	3 (75)	4 (100)	2 (67)	2 (67)	4 (100)	3 (75)	3 (75)	**25 (71)**
						Subtotals of movies with tobacco incidents, by ratings					
All companies	All G or PG	4 (11)	6 (14)	3 (11)	4 (21)	3 (12)	3 (13)	1 (4)	1 (5)	3 (13)	28 (12)
	All PG-13	23 (43)	30 (47)	30 (49)	24 (40)	28 (46)	28 (47)	23 (35)	30 (60)	23 (38)	239 (44)
	All youth-rated§	27 (31)	36 (37)	33 (37)	28 (35)	31 (36)	31 (38)	24 (26)	31 (38)	26 (31)	267 (34)
	R	35 (71)	26 (70)	40 (74)	48 (81)	27 (60)	38 (69)	35 (67)	41 (76)	38 (69)	328 (71)
Subtotals for all companies	**All ratings**	**62 (45)**	**62 (46)**	**73 (51)**	**76 (55)**	**58 (44)**	**69 (50)**	**59 (41)**	**72 (53)**	**64 (46)**	**595 (48)**
						No. of tobacco incidents					
Comcast (Universal)	G or PG	0	0	0	0	0	0	0	0	0	**0**
	PG-13	19	78	39	53	173	11	266	407	573	**1,619**
	R	35	154	251	398	76	113	50	326	135	**1,538**
Disney	G or PG	10	0	0	0	0	0	0	0	0	**10**
	PG-13	0	148	102	57	0	123	6	0	0	**436**
	R	0	20	0	4	0	0	0	0	0	**24**
Fox	G or PG	0	3	2	0	0	0	0	0	0	**5**
	PG-13	96	174	205	3	101	150	145	90	327	**1,291**
	R	274	36	47	278	210	59	47	150	415	**1,516**
Independents†	G or PG	20	0	19	2	15	5	4	10	9	**84**
	PG-13	132	22	282	315	625	187	124	256	234	**2,177**
	R	582	216	720	511	559	456	887	1,316	572	**5,819**
Sony	G or PG	0	9	2	1	12	83	0	0	8	**115**
	PG-13	198	166	178	26	184	15	144	28	78	**1,017**
	R	33	537	246	155	225	156	579	172	360	**2,463**
Time Warner (Warner Bros.)	G or PG	0	0	0	5	0	0	0	0	0	**5**
	PG-13	4	106	265	309	16	30	40	26	29	**825**
	R	80	62	267	233	343	322	539	123	42	**2,011**
Viacom (Paramount)	G or PG	0	95	0	0	0	0	0	0	0	**95**
	PG-13	115	50	92	12	66	3	86	98	0	**522**
	R	226	4	166	217	34	30	246	139	86	**1,148**
						Subtotals of no. of tobacco incidents, by ratings					
All companies	All G or PG	30	107	23	8	27	88	4	10	17	314
	All PG-13	564	744	1,163	775	1,165	519	811	905	1,241	7,901
	All youth-rated§	594	851	1,186	783	1,192	607	815	915	1,258	8,201
	R	1,230	1,029	1,697	1,796	1,447	1,136	2,348	2,226	1,610	14,519
Subtotals for all companies	**All ratings**	**1,824**	**1,880**	**2,883**	**2,579**	**2,639**	**1,743**	**3,163**	**3,141**	**2,868**	**22,720**
						Total no. of top grossing movies					
All companies	**All ratings**	**137**	**134**	**143**	**138**	**132**	**137**	**143**	**136**	**139**	**1,239**

* MPAA, the trade organization that represents the six major movies studios, assigns ratings: G = General Audiences (all ages admitted); PG = Parental Guidance Suggested (some material may not be suitable for children); PG-13 = Parents Strongly Cautioned (some material may be inappropriate for children under 13); R = Restricted (under age 17 requires accompanying parent or adult guardian).

† Independent movie companies include producer-distributors that are not members of MPAA, but regularly adhere to MPAA ratings and advertising rules.

§ Youth-rated movies include G, PG, and PG-13.

movies and from 1,230 to 1,610 (31%) in R-rated movies, compared with those in 2010.

From 2010 to 2018, changes in the number of tobacco incidents in youth-rated movies varied by movie company. During this period, tobacco incidents dropped from 10 to zero in movies from Disney and from 115 to zero in Viacom movies and declined from 198 to 86 in Sony movies. Tobacco incidents increased approximately 2,900% in Comcast movies (from 19 to 573), 600% in Time Warner movies (from four to 29), 200% in Fox movies (from 96 to 327), and 60% in movies from independent companies (from 152 to 243).

Among the 1,239 top-grossing movies during 2010–2018, 1,110 (90%) were fictional, 114 (9%) were biographical dramas, and 15 (1%) were documentaries. During the same period, 83% of all movies with tobacco incidents were fictional, 16% were biographical dramas, and 1% were documentaries. The number of fictional PG-13 movies with tobacco incidents declined 40%, from 20 in 2010 to a low of 12 in 2018 (Figure). However, PG-13 biographical dramas with tobacco incidents increased 233% during this period, from three in 2010 (13% of PG-13 movies) to 10 in 2018 (43%). In 2018, among 1,241 tobacco incidents in PG-13 movies, biographical dramas accounted for 1,019 (82%).

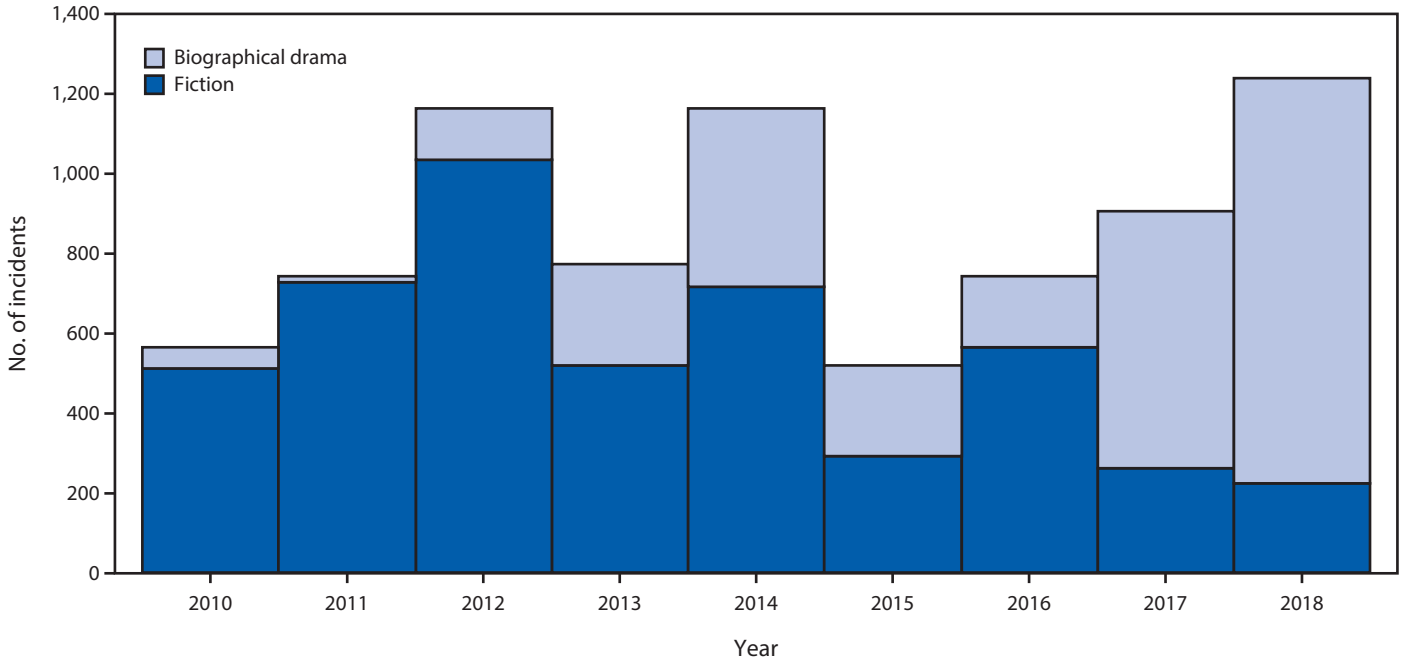
During 2010–2018, across rating categories, most tobacco users in biographical dramas were fictional characters, including 60% (three of five) in G- or PG-rated movies, 70% (213 of 306) in PG-13–rated movies, and 78% (355 of 455) in R-rated movies (Table 2). Biographical dramas accounted for 31% (766 of 2,505) of all characters shown using tobacco; however, 75% (571 of 766) of tobacco users in biographical dramas were fictional characters. In 2018, 73% (82 of 112) of characters who used tobacco in biographical dramas were fictional.

The use of electronic cigarettes, or vaping, appeared in 19 top-grossing movies during 2010–2018 (i.e., 2% of all movies and 3% of movies with tobacco incidents). Among these 19 movies, 15 were R-rated, and four were PG-13–rated.

Discussion

Although the number of movies with tobacco incidents remained stable during 2010–2018, the number of tobacco incidents within these movies increased, including a 120% increase in PG-13 movies. Although the number of PG-13 fictional movies with tobacco incidents declined substantially during 2010–2018, the number of PG-13 biographical dramas with tobacco incidents approximately tripled. The total number of PG-13 movies in both these genres with tobacco incidents approximately doubled since 2010; approximately 80% of all tobacco incidents in 2018 occurred in PG-13 biographical dramas. These findings suggest that the increasing number of youth-rated biographical dramas with tobacco incidents has negated previous progress made in reducing tobacco incidents in youth-rated fictional movies.

FIGURE. Number of tobacco incidents in PG-13–rated* movies, by genre† — United States, 2010–2018



Abbreviation: PG-13 = Parents Strongly Cautioned (some material may be inappropriate for children under age 13 years).
* Ratings are assigned by the Motion Picture Association of America, the trade organization that represents the six major movie studios.
† Production details in movie industry databases and trade publications were used to classify the top-grossing movies as works of fiction or biographical dramas.

TABLE 2. Tobacco incidents and characters who use tobacco in top grossing biographical dramas, by Motion Picture Association of America (MPAA) rating* and movie company — United States, 2010–2018

Movie company	No. of biographical dramas	No. of movies with tobacco incidents (%)	No. of tobacco incidents	No. of characters who used tobacco	No. of fictional characters who used tobacco (%)
		G or PG rating			
Comcast	1	0 (0)	0	0	0 (0)
Disney	3	0 (0)	0	0	0 (0)
Fox	2	0 (0)	0	0	0 (0)
Sony	6	2 (33)	93	3	1 (33)
Time Warner	1	0 (0)	0	0	0 (0)
Viacom	0	0 (0)	0	0	0 (0)
MPAA subtotal	13	2 (15)	93	3	1 (33)
Independents	3	1 (33)	10	2	2 (100)
G or PG subtotal	**16**	**3 (19)**	**103**	**5**	**3 (60)**
		PG-13 rating			
Comcast	11	10 (91)	1,037	65	47 (72)
Disney	3	3 (100)	225	22	13 (59)
Fox	4	4 (100)	443	31	23 (74)
Sony	8	6 (75)	205	34	27 (79)
Time Warner	4	3 (75)	150	9	6 (67)
Viacom	2	2 (100)	71	13	11 (85)
MPAA subtotal	32	28 (88)	2,131	174	127 (73)
Independents	18	18 (100)	838	132	86 (65)
PG-13 subtotal	**50**	**46 (92)**	**2,969**	**306**	**213 (70)**
		Youth-rated (G, PG, and PG-13 combined)			
Comcast	12	10 (83)	1,037	65	47 (72)
Disney	6	3 (50)	225	22	13 (59)
Fox	6	4 (67)	443	31	23 (74)
Sony	14	8 (57)	298	37	28 (76)
Time Warner	5	3 (60)	150	9	6 (67)
Viacom	2	2 (100)	71	13	11 (85)
MPAA subtotal	45	30 (67)	2,224	177	128 (72)
Independents	21	19 (90)	848	134	88 (65)
Youth-rated subtotal	**66**	**49 (74)**	**3,072**	**311**	**216 (69)**
		R rating			
Comcast	9	7 (78)	464	56	48 (86)
Disney	1	1 (100)	4	1	0 (0)
Fox	5	5 (100)	202	25	19 (76)
Sony	1	1 (100)	147	35	30 (86)
Time Warner	9	9 (100)	849	89	63 (71)
Viacom	5	5 (100)	338	46	39 (85)
MPAA subtotal	30	28 (93)	2,004	252	199 (79)
Independents	18	16 (89)	1,276	203	156 (77)
R subtotal	**48**	**44 (92)**	**3,280**	**455**	**355 (78)**
Total	**114**	**93 (82)**	**6,352**	**766**	**571 (75)**

* Ratings are assigned by MPAA, the trade organization that represents the six major movies studios: G = General Audiences (all ages admitted); PG = Parental Guidance Suggested (some material may not be suitable for children); PG-13 = Parents Strongly Cautioned (some material may be inappropriate for children under 13); R = Restricted (under age 17 requires accompanying parent or adult guardian).

All major motion picture companies have policies to reduce tobacco depictions in youth-rated movies¶; however, Disney and Viacom were the only companies with no tobacco use in youth-rated movies in 2018. Paid placement of tobacco brands is prohibited in media such as movies, television, and video games by the 1998 Master Settlement Agreement between states and tobacco companies.** Public health groups have suggested interventions to reduce tobacco imagery in movies, such as the Motion Picture Association of America assigning an R rating to any movie with tobacco imagery, unless it portrays an actual historical figure who used tobacco or depicts the negative effects of tobacco use (*6*–*8*). Research suggests that such an R rating, in coordination with additional interventions, could help eliminate tobacco incidents in youth-rated movies (*6*–*8*) and reduce youth cigarette smoking by an estimated 18% (*6*,*9*).

Establishing the impact of youths' exposure to tobacco imagery through movies (as well as original programming on television, streaming and on-demand services, and social media) and the effects of this exposure on youths' tobacco use is important. A recent survey of streaming content popular with young persons and analysis of two full seasons of 14 programs identified at least one tobacco incident in 86% of

¶ https://smokefreemovies.ucsf.edu/whos-accountable/company-policies.
** https://www.naag.org/assets/redesign/files/msa-tobacco/MSA.pdf.

Summary

What is already known about this topic?

The Surgeon General has concluded that there is a causal relationship between depictions of smoking in movies and the initiation of smoking among young persons.

What is added by this report?

From 2010 to 2018, tobacco incidents in top-grossing movies increased 57%, including a 120% increase in those rated PG-13. In 2018, biographical dramas accounted for most tobacco incidents, including 82% of those in PG-13 movies; 73% of characters who used tobacco in these biographical dramas were fictional.

What are the implications for public health practice?

Continued efforts are needed to reduce tobacco incidents in movies, particularly in PG-13–rated biographical dramas. Giving movies with tobacco incidents an R rating would eliminate tobacco product imagery from youth-rated films.

programs (*10*), even as tobacco incidents have begun to decline in fictional theatrical feature films. Reducing the reach of tobacco incidents in streaming and other media platforms is essential to protect youths from exposures that can normalize tobacco use. Continued research will be necessary to understand how this exposure affects youth tobacco initiation and use (*10*).

The findings in this report are subject to at least two limitations. First, detailed audience composition data are not publicly available, so the number of tobacco-use impressions delivered by a particular movie to specific populations (e.g., children and adolescents) could not be determined. Second, the measure to assess tobacco exposure from movies should be interpreted cautiously because movies can be viewed through other media platforms that do not contribute to the calculation of in-theater impressions (e.g., physical discs, broadcast or cable television, and video-on-demand services).

Tobacco related incidents in youth-rated movies remained common, particularly in biographical dramas. The majority of persons using tobacco in these biographical dramas were fictional, not historical, figures. Studios could limit tobacco use in biographical dramas to real persons who actually used tobacco. Other evidence-based solutions could be implemented by producers and distributors of youth-rated entertainment to reduce the public health risk caused by exposure to on-screen tobacco imagery. For example, assigning all movies with tobacco incidents an R rating could eliminate tobacco product imagery from youth-rated films, which could further reduce initiation of tobacco product use among U.S. youths.

Corresponding author: Michael A. Tynan, mtynan@cdc.gov, 404-498-1202.

[1]Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, CDC; [2]Onbeyond LLC, Fairfax, California; [3]Breathe California Sacramento Region, Sacramento, California; [4]University of California, San Francisco.

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Progress Toward Global Eradication of Dracunculiasis — January 2018–June 2019

Donald R. Hopkins, MD[1]; Adam J. Weiss, MPH[1]; Sharon L. Roy, MD[2]; James Zingeser, DVM[1]; Sarah Anne J. Guagliardo, PhD[2]

Dracunculiasis (also known as Guinea worm disease) is caused by the parasite *Dracunculus medinensis* and is acquired by drinking water containing copepods (water fleas) infected with *D. medinensis* larvae. The worm typically emerges through the skin on a lower limb approximately 1 year after infection, resulting in pain and disability (*1*). There is no vaccine or medicine to treat the disease; eradication efforts rely on case containment* to prevent water contamination and other interventions to prevent infection, including health education, water filtration, chemical treatment of unsafe water with temephos (an organophosphate larvicide to kill copepods), and provision of safe drinking water (*1*,*2*). In 1986, with an estimated 3.5 million cases† occurring each year in 20 African and Asian countries§ (*3*), the World Health Assembly called for dracunculiasis elimination (*4*). The global Guinea Worm Eradication Program (GWEP), led by The Carter Center and supported by the World Health Organization (WHO), CDC, the United Nations Children's Fund, and other partners, began assisting ministries of health in countries with dracunculiasis. This report, based on updated health ministry data, describes progress to eradicate dracunculiasis during January 2018–June 2019 and updates previous reports (*2*,*4*,*5*). With only five countries currently affected by dracunculiasis (Angola, Chad, Ethiopia, Mali, and South Sudan), achievement of eradication is within reach, but it is challenged by civil unrest, insecurity, and lingering epidemiologic and zoologic questions.

In March 2018 and March 2019, The Carter Center hosted the annual GWEP managers meetings in Atlanta, Georgia. WHO's International Commission for the Certification of Dracunculiasis Eradication met in Addis Ababa, Ethiopia, in April 2019, and WHO convened the annual informal meetings of Ministers of Health of current and former endemic dracunculiasis countries during the World Health Assemblies in Geneva, Switzerland, in May 2018 and May 2019. WHO has certified 199 countries, areas, and territories as free from dracunculiasis (*4*); seven countries still lack certification: four with endemic dracunculiasis (Chad, Ethiopia, Mali, and South Sudan), one in the precertification stage (Sudan), and two that were never known to have endemic dracunculiasis (Angola and the Democratic Republic of Congo). While preparing for certification, Angola discovered a case of dracunculiasis in 2018.

In 2018, 28 indigenous human cases were reported from Angola, Chad, and South Sudan, and 1,102 infected animals (mostly dogs) were reported from Chad, Ethiopia, and Mali, compared with 30 human cases and 855 animal infections reported in 2017 (Table 1). During January–June 2019, human cases were reported in Chad (23 cases), Angola (one), and Cameroon (one), with 1,345 infected animals reported, compared with nine human cases and 709 infected animals reported during January–June 2018. During January–June 2019, CDC received 39 specimens from humans, including 16 (41%) that were laboratory-confirmed as *D. medinensis*,¶ compared with 89 specimens received and 38 (43%) confirmed during all of 2018. (Table 2). During the first 6 months of 2019, CDC received seven specimens from animals, five (31%) of which were confirmed, compared with 13 received and nine (18%) confirmed during 2018. *D. medinensis* worms removed from animals are genetically indistinguishable from those removed from humans (*6*).

* Transmission from a patient with dracunculiasis is contained only if all of the following conditions are met for each emerging worm: 1) the infected patient is identified ≤24 hours after worm emergence; 2) the patient has not entered any water source since the worm emerged; 3) a village volunteer or other health care provider has managed the patient properly, by cleaning and bandaging the lesion until the worm has been fully removed manually and by providing health education to discourage the patient from contaminating any water source (if two or more emerging worms are present, transmission is not contained until the last worm is removed); 4) the containment process, including verification of dracunculiasis, is validated by a Guinea Worm Eradication Program supervisor within 7 days of emergence of the worm; and 5) the approved chemical temephos (Abate) is used to treat potentially contaminated surface water if any uncertainty about contamination of the source of drinking water exists, or if such a source of drinking water is known to have been contaminated. Similar criteria are in place for the containment of animal infections.

† A dracunculiasis case is defined as an infection occurring in a person exhibiting a skin lesion or lesions with emergence of one or more worms laboratory-confirmed at CDC as *D. medinensis*. Because *D. medinensis* has a 10- to 14-month incubation period, each infected person is counted as having a case only once during a calendar year.

§ Initially 20 countries, but the former country of Sudan officially separated into two countries (Sudan and South Sudan) on July 9, 2011.

¶ Specimens are laboratory-confirmed as *D. medinensis* at CDC by either morphologic examination under a microscope or polymerase chain reaction assay. Additional information about laboratory identification of parasites is available at https://www.cdc.gov/dpdx/dxassistance.html.

TABLE 1. Number of reported indigenous dracunculiasis cases, by country — worldwide, January 2017–June 2019

Country	No. of cases (% contained) Jan–Dec 2017	No. of cases (% contained) Jan–Dec 2018	% change in no. of cases, Jan–Dec 2017 to Jan–Dec 2018	No. of cases (% contained) Jan–Jun 2018	No. of cases (% contained) Jan–Jun 2019	% change in no. of cases, Jan–Jun 2018 to Jan–Jun 2019
Human cases						
Chad	15 (67)	17 (41)	+13	4 (100)	23 (61)	+475
Ethiopia	15 (20)	0	−100	0	0	0
Mali*	0	0	0	0	0	0
South Sudan	0	10 (30)	NA	4 (0)	0	−100
Angola	0	1 (0)	NA	1 (0)	1 (0)	0
Cameroon†	0	0	0	0	1 (0)	NA
Total	**30 (43)**	**28 (36)**	**−7**	**9 (44)**	**25 (56)**	**+178**
Animal infections§,¶						
Chad	830 (75)	1,065 (75)	+28	696 (74)	1,356 (78)	+95
Ethiopia	15 (40)	17 (41)	+13	10 (70)	6 (0)	−40
Mali*	10 (80)	20 (80)	+100	3 (67)	0	−100
Angola	0	0	0	0	1 (0)	NA
Total	**855 (75)**	**1,102 (75)**	**+29**	**709 (74)**	**1,363 (78)**	**+92**

Abbreviation: NA = not applicable.
* Civil unrest and insecurity resulting from a coup d'état in April 2012 continued to constrain program operations in regions with endemic dracunculiasis (Gao, Kidal, Mopti, and Timbuktu) during January 2017–June 2019.
† Final classification of case origin pending further investigation.
§ In Chad, primarily dogs, some cats; in Ethiopia, dogs, cats, and baboons; in Mali, dogs and cats; in Angola, one dog.
¶ No international importations of animal infections were reported during the 18-month period January 2018–June 2019.

In affected countries, the national GWEP receives monthly reports of cases from supervised volunteers in each village under active surveillance** (Table 3). Villages where endemic transmission of dracunculiasis has ended (i.e., zero human cases or animal infections reported for ≥12 consecutive months) are kept under active surveillance for 2 additional years. WHO certifies a country as dracunculiasis-free after adequate nationwide surveillance for ≥3 consecutive years with no indigenous human cases or animal infections.††

Country Reports

Angola. Before 2018, no case of dracunculiasis was ever reported from Angola. Following the discovery of a case in a girl with no history of foreign travel in Cunene Province in April 2018, Angolan health authorities and WHO investigated, searched nearby communities, and began training local health professionals and community health workers about the disease (*4*), but found no other active cases. Another case in a person with no history of foreign travel was detected in January 2019, and in April 2019 a dog with an emerging Guinea worm was found in the same district as the first case. Provisional DNA analysis of Angola's Guinea worm specimens yielded no clear link to another *D. medinensis* population.

Chad. Chad reported 17 cases in 11 villages in 2018. During the first half of 2019, Chad reported 23 cases in 11 villages, compared with four cases reported during the first half of 2018 (Table 1). Twelve of the 23 cases reported in January–June 2019 were associated with one village in Salamat Region, in Chad's first apparent waterborne outbreak of dracunculiasis in humans since 2010. A Cameroonian woman had a Guinea worm emerge in March 2019 in a village about one mile (1.5 km) from the Chad-Cameroon border; she was likely infected in Chad.

During 2018, 1,040 domestic dog and 25 domestic cat infections were reported, significantly more than the 817 dog and 13 cat infections reported in 2017 (Table 1). During January–June 2019, 93% more infected dogs and 20% more infected cats were reported than were reported during January–June 2018. The Carter Center is helping the Chad Ministry of Health implement active village-based surveillance for animal and human infections in 2,138 at-risk villages (as of June 2019), a 12% increase from 1,895 villages in December 2018. Based on previous investigations, the working hypothesis is that humans and dogs might become infected without drinking contaminated water, perhaps by eating inadequately cooked fish or other aquatic transport or paratenic hosts (intermediate hosts in which the parasite does not develop) (*7*). Since June 2017, approximately 81% of households sampled monthly in at-risk communities were burying fish entrails according to recommendations. Seventy-five percent of infected dogs were tethered (contained) in 2018 and 79%

** Villages under active surveillance are those that have endemic dracunculiasis or are at high risk for importation. Active surveillance involves daily searches of households by village volunteers (supported by their supervisors) for persons or animals with signs of dracunculiasis. An imported human case or animal infection is one resulting from ingestion of contaminated water in a place other than the community where the case or infection is detected and reported. Since 2012, no internationally imported cases or infections have been reported.
†† An indigenous dracunculiasis human case or animal infection is defined as an infection consisting of a skin lesion or lesions with emergence of one or more Guinea worms in a person or animal who had no history of travel outside their residential locality during the preceding year.

TABLE 2. Characteristics of specimens from humans and animals received at CDC for laboratory diagnosis of *Dracunculus medinensis* — January 2018–June 2019

Specimens received at CDC	Jan–Dec 2018	Jan–Jun 2019
Specimens from humans		
No. received	89	39
No. laboratory-confirmed as *Dracunculus medinensis* (%)	38 (43)	16 (41)
Country of origin, no. of specimens (no. of patients)		
Angola	1 (1)	1 (1)
Chad	21 (17)*	15 (15)†
Ethiopia	1 (1)§	—
South Sudan	15 (10)	—
No. ruled out as *D. medinensis* (%)	51 (57)	23 (59)
No. of other laboratory diagnoses (%)		
Mermithid	7 (14)	1 (4)
Onchocerca	5 (10)	2 (9)
Sparganum	5 (10)	10 (43)
Earthworm	3 (6)	—
Dirofilaria	1 (2)	—
Ascarid	1 (2)	—
Eleaophora	—	1 (4)
Worm of unknown species	7 (14)	1 (4)
Connective tissue	13 (25)	6 (26)
Unknown origin	9 (18)	2 (9)
Specimens from animals		
No. received	60	7
No. laboratory-confirmed as *Dracunculus medinensis* (%)	53 (88)	5 (71)
Country/Species of origin, no. of specimens (no. of animals)		
Angola	—	3
Dog	—	3 (1)
Chad	8	—
Cat	2 (2)	—
Dog	6 (6)	—
Ethiopia	25	1
Baboon	6 (1)	1 (1)
Cat	6 (5)	—
Dog	13 (11)	—
Mali	20	1
Cat	2 (2)	—
Dog	18 (18)	1 (1)
No. ruled out as *D. medinensis* (%)	7 (12)	2 (29)
No. of other laboratory diagnoses (%)		
Ascarid	1 (14)	—
Dirofilaria	—	1 (50)
Dipetalonema	1 (14)	—
Physaloptera	1 (14)	—
Sparganum	1 (14)	—
Worm of unknown species	3 (43)	—
Unknown origin	—	1 (50)

* 19 worms from 16 patients in 2018 and two worms from one patient who had emerging worms in 2017.
† 14 worms from 14 patients in 2019 and one worm from one patient in 2018.
§ One worm from one patient in 2017.

in January–June 2019. Temephos application to kill copepod intermediate hosts of the parasite in water reached 24% of 334 villages with dog or human infections as of December 2018 and 79% of villages by May 2019. In December 2018, 71% of villages reporting infected dogs or humans had at least one source of drinking water free from copepods.

In areas under surveillance in Chad, 85% of residents surveyed in 2018 knew of the cash rewards for reporting a human or animal infection, and 59% of those surveyed during January–June 2019 knew of the rewards. Intensified surveillance generated 41,501 rumors of infections in dogs and humans during January–June 2019, compared with 9,287 rumored infections during January–June 2018 (a rumor is a report of any information about a possible Guinea worm infection; a person or dog with compatible signs or symptoms is suspected of having dracunculiasis, pending confirmation).

Ethiopia. Ethiopia reported no human dracunculiasis cases during January 2018–June 2019 (Table 1). During 2018, Ethiopia reported 17 infected animals, including 11 dogs, five cats, and one baboon, all in Gog district of Gambella Region, compared with 15 infected animals (11 dogs and four baboons) in 2017. During January–June 2019, Ethiopia reported no infected dogs or cats, but six infected baboons, all in Gog district, compared with eight infected dogs and two infected cats during January–June 2018.

Since 2017, The Carter Center has supported Ethiopian public health and wildlife authorities in a baboon and dog epidemiology project. The project examined 28 live-captured baboons in January 2019, and none were found to have signs of Guinea worm infection. In June 2019, two of 33 trapped and released baboons were discovered with unemerged Guinea worms and two others with emergent Guinea worms; during the same month, villagers discovered two dead infected baboons, one with emergent Guinea worms and one with unemerged Guinea worms.

The Ethiopia Dracunculiasis Eradication Program (EDEP) has 156 villages under active surveillance. It applied temephos monthly to almost all water sources known to have been used by humans in the at-risk area of Gog district in 2015 and increased coverage to include numerous smaller water sources during 2016–2018. Since April 2018, EDEP has supported villager-initiated, proactive, constant tethering of approximately 1,100 dogs and cats in villages where most infected animals were detected in recent years to prevent their exposure to water sources in adjacent forests where transmission is believed to occur. Enhanced support now includes providing food, shelter, water, veterinary care, and daily exercise for the tethered animals. Ethiopia increased its reward for reporting a human dracunculiasis case from the equivalent of US$100 to US$360 in 2018 and increased the reward for reporting and tethering an infected animal from US$20 to US$40. In 2018, 81% of persons surveyed in areas under active surveillance were aware of the rewards.

Mali. In 2018, Mali reported no human dracunculiasis case for the third successive year, and no case during January–June 2019. During 2018, 18 infected dogs and two

TABLE 3. Reported human and animal dracunculiasis cases, active surveillance, and status of local interventions in villages with endemic disease, by country — worldwide, 2018

Human cases/Surveillance/Intervention status	Country					Total
	Chad*	Ethiopia	Mali†	South Sudan	Angola	
Reported human cases						
No. indigenous, 2018	17	0	0	10	1	**28**
No. imported,§ 2018	0	0	0	0	0	**0**
% contained¶ in 2018	41	0	0	30	0	**36**
% change in indigenous human cases in villages/localities under surveillance, same period, 2017 and 2018	+13	−100	0	NA	NA	**−7**
Reported animal cases						
No. indigenous, 2018	1,065	17	13	0	0	**1,095**
No. imported,** 2018	0	0	7	0	0	**7**
% contained¶ in 2018	75	41	80	0	0	**74**
% change in indigenous animal cases in villages/localities under surveillance, same period, 2017 and 2018	+28	+13	+100	0	0	**+29**
Villages under active surveillance, 2018						
No. of villages	1,895	156	903	2,121	0	**5,075**
% reporting monthly	99	100	99	92	0	**96**
No. reporting ≥1 human case	11	0	0	10	1	**22**
No. reporting only imported** human cases	0	0	0	0	1	**1**
No. reporting indigenous human cases	11	0	0	10	0	**21**
No. reporting ≥1 animal case	335	8	18	0	0	**361**
No. reporting only imported** animal cases	0	0	3	0	0	**3**
No. reporting indigenous animal cases	335	8	12	0	0	**355**
Status of interventions in villages with endemic human dracunculiasis, 2018						
No. of villages with endemic human dracunculiasis, 2017–2018	24	1	—	10	1	**36**
% reporting monthly††	100	100	—	100	—	**100**
% with filters in all households††	100	100	—	100	—	**100**
% using temephos††	55	100	—	100	—	**67**
% with ≥1 source of safe water††	71	0	—	50	100	**64**
% provided health education††	100	100	—	100	100	**100**
Status of interventions in villages with endemic animal dracunculiasis, 2018						
No. of villages with endemic animal dracunculiasis, 2017–2018	442	10	15	—	—	**467**
% reporting monthly††	100	100	100	—	—	**100**
% using temephos††	24	100	100	—	—	**28**
% provided health education††	100	100	100	—	—	**100**

Abbreviation: NA = not applicable.

* Participants at the annual Chad Guinea Worm Eradication Program review meeting in November 2014 adopted "1+ case village" as a new description for villages in Chad affected by human cases of Guinea worm disease and/or dogs infected with Guinea worms and defined it as "a village with one or more indigenous and/or imported cases of Guinea worm infections in humans, dogs, and/or cats in the current calendar year and/or previous year."

† Civil unrest and insecurity resulting from a coup d'état in 2012 continued to constrain Guinea Worm Eradication Program operations (supervision, surveillance, and interventions) in Gao, Kidal, Mopti, Segou, and Timbuktu regions.

§ Imported from another country.

¶ Transmission from a patient with dracunculiasis is contained only if all of the following conditions are met for each emerging worm: 1) the infected patient is identified ≤24 hours after worm emergence; 2) the patient has not entered any water source since the worm emerged; 3) a village volunteer or other health care provider has managed the patient properly, by cleaning and bandaging the lesion until the worm has been fully removed manually and by providing health education to discourage the patient from contaminating any water source (if two or more emerging worms are present, transmission is not contained until the last worm is removed); 4) the containment process, including verification of dracunculiasis, is validated by a Guinea Worm Eradication Program supervisor within 7 days of emergence of the worm; and 5) temephos is used to treat potentially contaminated surface water if any uncertainty about contamination of these sources of drinking water exists, or if a such a source of drinking water is known to have been contaminated.

** Imported from another in-country village with endemic disease.

†† The denominator is the number of villages/localities where the program applied interventions during 2017–2018.

infected cats were reported, compared with nine dogs and one cat in 2017. During the first half of 2019, two infected dogs and no cats were reported, compared with three dogs and no cats during the first half of 2018 (Table 1). Twelve of the 20 infected animals identified in 2018 were detected in Segou Region; the remaining eight dogs were detected in adjacent Djenne District of Mopti Region. Segou Region is accessible to the program, but the dogs were bred and apparently became infected in areas of Mopti Region that have not been accessible to the program since 2012 because of insecurity; the dogs were later taken to Segou and sold for food. The two dogs reported during January–June 2019 were detected in Mopti Region near the presumed source of their infection, which still was not fully accessible to the program. The number of villages under active surveillance increased from 903 at the end of 2018 to 2,802 in 2019. In addition, the reward for reporting a human case was increased to the equivalent of US$340 (from US$100); the reward remains US$20 for reporting and tethering an infected

animal. In areas under active surveillance, 80% of persons queried in 2018 were aware of the rewards for reporting an infected person or animal. A team from WHO conducted an external evaluation of Mali's program in September–October 2018. They found no evidence of recent human infections and recommended improvements in preparation for precertification.

South Sudan. After reporting no cases of dracunculiasis for the first time in 2017, South Sudan reported 10 human cases in 2018. Eight patients were young cattle herders from migratory communities in recently pacified areas that had experienced chronic communal violence and population displacements in recent years. Extreme mobility of cattle herders and others is a special challenge in addition to sporadic insecurity. South Sudan reported no cases in January–June 2019, compared with four cases in January–June 2018 (Table 1). Only one infected animal has ever been reported: a dog in the same household as an infected person in 2015. By December 2018, South Sudan's GWEP had 2,165 villages under active surveillance. In January 2018, the Ministry of Health increased the reward for reporting a case of dracunculiasis to the equivalent of approximately US$400, from US$140. A 2018 survey of 1,694 residents in villages under active surveillance found 72% of the respondents knew of the reward for reporting an infected person.

Summary

What is already known about this topic?

The number of cases of dracunculiasis (Guinea worm disease) has decreased from an estimated 3.5 million in 1986 to 28 in 2018. Emergence of Guinea worm infections in dogs has complicated eradication efforts.

What is added by this report?

During January–June 2019, the number of human dracunculiasis cases reported increased to 25 cases in three countries (Angola, Cameroon, and Chad) and 1,346 infected domestic dogs were reported; Ethiopia, Mali, and South Sudan reported no human cases.

What are the implications for public health practice?

Existence of infected dogs, especially in Chad, and impeded access because of civil unrest and insecurity in Mali and South Sudan are now the greatest challenges to interrupting transmission.

Discussion

During January 2018–June 2019, Chad reported approximately 95% of the world's *D. medinensis* infections, 96% of which were in dogs. After a decade with no reported cases, Chad reported 10 indigenous cases in humans in 2010, and Guinea worm infections in domestic dogs were reported for the first time in 2012, all primarily from communities along the Chari River (*7*). Stopping transmission among dogs in Chad is now the biggest challenge faced by the eradication program, which is being addressed through expanded and innovative interventions, using field and laboratory research supported by The Carter Center and CDC to better understand the unusual epidemiology of dracunculiasis in Chad and assess antihelminthic treatment of dogs to prevent maturation of worms (*8*). In collaboration with researchers from the University of Georgia (Athens, Georgia), this initiative has shown that fish can serve as transport hosts for *Dracunculus* spp. in the laboratory and that *D. medinensis* can use frogs as paratenic hosts; *Dracunculus* larvae have been recovered from multiple wild frogs in Chad (*9*,*10*).

Before 2010, Chad's ministry of health began offering a reward equivalent to US$100 for reporting a confirmed human dracunculiasis case, and the program introduced a reward of US$20 in February 2015 for reporting and tethering an infected dog. The rewards are given only after a case is confirmed; all reports must be corroborated by supervisors. In 2017, Chad launched a nationwide communication campaign to increase awareness of the cash rewards and knowledge about how to prevent Guinea worm infections in humans and dogs. Since October 2013, Chad's GWEP urged villagers to cook their fish well, bury fish entrails, and prevent animals from eating them. In February 2014, health educators also began persuading villagers to tether infected dogs until the worms emerged to prevent contamination of water. Because water treatment with temephos is constrained by the extremely large lagoons used for fishing and as sources of drinking water, application of temephos to cordoned sections of the lagoons at entry points used by infected humans or dogs was introduced to protect villages in 2014. In October 2017, monthly temephos applications began at small ponds in villages with the most infected dogs.

The pattern of transmission to many dogs and few humans in Chad remains peculiar to that country. If the hypothesis that the parasite's life cycle in Chad involves a transport or paratenic host (*10*) is correct, increased active surveillance, containment of infected dogs, application of temephos, and burial of fish entrails should reduce transmission. The dracunculiasis case found in a Cameroonian border village in April 2019 highlights the risks for cases exported from Chad and the need for ongoing active surveillance in neighboring countries, especially Cameroon and Central African Republic.

The surprising discovery of dracunculiasis in Angola is worrisome. Finding only two confirmed cases in humans and one infected dog in one Angolan province to date in 2018–2019 suggests that the problem there is limited, but active surveillance throughout the areas at risk is required to determine its full extent. South Sudan appears poised to recover its zero-case status quickly with strong technical leadership, strong political

support by the government, and without parallel infections in animals, if adequate security can be maintained.

As of June 2019, Mali and Ethiopia had not reported dracunculiasis in a human in 3.5 and 1.5 consecutive years, respectively. Continued endemic transmission of Guinea worm infections among a few dogs and cats in Mali as well as baboons in Ethiopia appears to be geographically limited in each country. The ecologic study of baboons and proactive tethering of dogs in Gog district might help elucidate the unusual dynamics of residual Guinea worm infections in Ethiopia. Insecurity has decreased in some areas of Mali with endemic transmission in 2019 but is still the main obstacle to stopping transmission among dogs in that country. DNA studies show promise for tracing genetic lineages of worms, which will provide another tool for understanding *D. medinensis* transmission dynamics.

Corresponding author: Sharon L. Roy, str2@cdc.gov, 404-718-4698.

[1]The Carter Center, Atlanta, Georgia; [2]Division of Parasitic Diseases and Malaria, Center for Global Health, World Health Organization Collaborating Center for Dracunculiasis Eradication, CDC.

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Update: Characteristics of Patients in a National Outbreak of E-cigarette, or Vaping, Product Use–Associated Lung Injuries — United States, October 2019

Erin D. Moritz, PhD[1]; Lauren B. Zapata, PhD[2]; Akaki Lekiachvili, MD[2]; Emily Glidden, MPH[1]; Francis B. Annor, PhD[3]; Angela K. Werner, PhD[1]; Emily N. Ussery, PhD[2]; Michelle M. Hughes, PhD[4]; Anne Kimball, MD[5,6]; Carla L. DeSisto, PhD[2,5]; Brandon Kenemer, MPH[2]; Mays Shamout, MD[2,5]; Macarena C. Garcia, DrPH[7]; Sarah Reagan-Steiner, MD[8]; Emily E. Petersen, MD[2]; Emily H. Koumans, MD[2]; Matthew D. Ritchey, DPT[2]; Brian A. King, PhD[2]; Christopher M. Jones, DrPH[3]; Peter A. Briss, MD[2]; Lisa Delaney, MS[9]; Anita Patel, PharmD[10]; Kara D. Polen, MPH[4]; Katie Sives, MPH[2]; Dana Meaney-Delman, MD[4]; Kevin Chatham-Stephens, MD[4]; Lung Injury Response Epidemiology/Surveillance Group

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CDC, the Food and Drug Administration, state and local health departments, and other public health and clinical stakeholders are investigating a national outbreak of electronic-cigarette (e-cigarette), or vaping, product use–associated lung injury (EVALI) (*1*). As of October 22, 2019, 49 states, the District of Columbia (DC), and the U.S. Virgin Islands have reported 1,604 cases of EVALI to CDC, including 34 (2.1%) EVALI-associated deaths in 24 states. Based on data collected as of October 15, 2019, this report updates data on patient characteristics and substances used in e-cigarette, or vaping, products (*2*) and describes characteristics of EVALI-associated deaths. The median age of EVALI patients who survived was 23 years, and the median age of EVALI patients who died was 45 years. Among 867 (54%) EVALI patients with available data on use of specific e-cigarette, or vaping, products in the 3 months preceding symptom onset, 86% reported any use of tetrahydrocannabinol (THC)-containing products, 64% reported any use of nicotine-containing products, and 52% reported use of both. Exclusive use of THC-containing products was reported by 34% of patients and exclusive use of nicotine-containing products by 11%, and for 2% of patients, no use of either THC- or nicotine-containing products was reported. Among 19 EVALI patients who died and for whom substance use data were available, 84% reported any use of THC-containing products, including 63% who reported exclusive use of THC-containing products; 37% reported any use of nicotine-containing products, including 16% who reported exclusive use of nicotine-containing products. To date, no single compound or ingredient used in e-cigarette, or vaping, products has emerged as the cause of EVALI, and there might be more than one cause. Because most patients reported using THC-containing products before symptom onset, CDC recommends that persons should not use e-cigarette, or vaping, products that contain THC. In addition, because the specific compound or ingredient causing lung injury is not yet known, and while the investigation continues, persons should consider refraining from the use of all e-cigarette, or vaping, products.

State health departments, the Council of State and Territorial Epidemiologists Vaping Associated Pulmonary Injury Epidemiology Task Force, and CDC developed and disseminated surveillance case definitions* and data collection tools (i.e., patient interview and medical record abstraction forms) to monitor and track cases beginning in August 2019. Some states are using these tools, whereas others elected to use state-specific tools. States and jurisdictions routinely report the number of confirmed and probable EVALI cases to CDC on a voluntary basis and, when available, include data from medical record abstractions and patient interviews. Proxies (e.g., spouses or parents) were interviewed if patients were too ill or if they had died. Most states and jurisdictions report the number of cases to CDC as case status is determined; however, it can take up to several weeks to complete and submit information from interview and medical record abstraction. This report provides updated data on patient demographic characteristics; substances used in e-cigarette, or vaping, products; and characteristics of EVALI patients who died, based on cases reported to CDC with available interview and medical record abstraction data as of October 15, 2019. The median ages of patients were compared across groups using the Wilcoxon rank-sum test. SAS statistical software (version 9.4; SAS Institute) was used for the analysis.

As of October 22, 2019, 49 states, DC, and the U.S. Virgin Islands had reported 1,604 cases of EVALI to CDC, including 34 (2.1%) EVALI-associated deaths in 24 states. Among 1,378 patients with confirmed or probable EVALI reported to CDC by October 15, 2019, with available data, 964 (70%) were male (Table). No cases in pregnant women were reported. Among 1,364 patients with information on age, the median age was 24 years (range = 13–75 years) and was similar among males (23 years) and females (25 years); 737 (54%) patients were aged <25 years, and 1,081 (79%) were aged <35 years. Among 383 EVALI patients with available information on race/ethnicity, 298 (78%) were non-Hispanic white, and 62 (16%) were Hispanic. Among 867 patients with available data on substances used, 749 (86%) reported any use of THC-containing products, and 552 (64%) reported any use of nicotine-containing products in the 3 months preceding symptom onset; 455 patients (52%) reported use of both

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

Summary

What is already known about this topic?

CDC and partners are investigating the ongoing outbreak of e-cigarette, or vaping, product use–associated lung injury (EVALI) in the United States, the District of Columbia, and one U.S. territory.

What is added by this report?

As of October 22, 2019, a total of 1,604 cases of EVALI, including 34 deaths, were reported to CDC. Based on data collected as of October 15, 2019, use of tetrahydrocannabinol (THC)-containing products in the 3 months preceding symptom onset was reported by 86% of patients. The median age of EVALI patients who survived was 23 years, and the median age of EVALI patients who died was 45 years.

What are the implications for public health practice?

Most EVALI patients report using THC-containing products before symptom onset. CDC recommends that persons should not use e-cigarette, or vaping, products containing THC. Because the specific compound or ingredient causing EVALI is not known, persons should consider refraining from use of all e-cigarette, or vaping, products.

THC-containing products and nicotine-containing products, 294 (34%) reported exclusive use of THC-containing products, and 97 (11%) reported exclusive use of nicotine-containing products. Twenty-one (2%) patients reported no use of THC- or nicotine-containing products.

Among the 29 EVALI-associated deaths reported to CDC as of October 15, 2019, 59% (17) were male; the median age was 45 years (range = 17–75 years) overall (Table), 55 years (range = 17–71 years) among males, and 43 years (range = 27–75 years) among females; the age difference between males and females was not statistically significant ($p = 0.5$). Patients who died were older than patients who survived ($p<0.01$). Among 19 EVALI patients who died and for whom data on substance use was available, the use of any THC-containing products was reported by patients or proxies for 84% (16), including 63% (12) who exclusively used THC-containing products. Use of any nicotine-containing products was reported for 37% (seven), including 16% (three) who exclusively used nicotine-containing products. Use of both THC- and nicotine-containing products was reported in four decedents.

Discussion

Cases of EVALI continue to be reported to CDC as part of this national outbreak. Similar to previous reports at the national and state levels (*1–4*), most patients reported use of THC-containing products in the 3 months before symptom onset. Patients were predominantly aged <35 years, non-Hispanic white, and male. Patients with EVALI who died were older than patients who survived. Illnesses and deaths occurred across an age spectrum, from adolescents to older adults. Approximately half of cases, and two deaths, occurred in patients aged <25 years. Older adults were disproportionately represented among patients who died; only 2% of cases, but nearly 25% of deaths, occurred in patients aged >65 years. Further, any use of THC-containing products was reported for 86% of patients who survived and 84% of patients who died; exclusive use of THC-containing products was reported for 63% of EVALI patients who died and for 33% who survived.

Findings from this report, which is the largest analysis of EVALI patients to date, suggest that this outbreak continues to substantially affect young persons, highlighting the need to communicate the dangers of e-cigarette, or vaping, use particularly among youths and young adults. Although 2% of all EVALI patients were aged 65–75 years, 24% of deaths were in this age group; relevant tailored and targeted messaging might also be needed for this age group. Consistent with previously published reports (*1–4*), the data presented here suggest that THC-containing products are playing an important role in this outbreak. Further, reports from Illinois, Utah, and Wisconsin suggest that patients have typically obtained their THC-containing e-cigarette, or vaping, products through informal sources, such as friends or illicit in-person and online dealers, although local and regional differences in illicit THC supply and production might exist (*3,4*).

The findings in this report are subject to at least three limitations. First, data on substances used in e-cigarette, or vaping, products were self-reported or reported by proxies and might be subject to recall bias, as well as social desirability bias because nonmedical marijuana is illegal in many states. Therefore, underreporting might have occurred, particularly for patients who died and others whose information was provided by a proxy. Second, data on some variables, such as race/ethnicity, were missing for many patients, and conclusions based on these data might not be generalizable to the entire patient population. Finally, these data might be subject to misclassification of substance use for multiple reasons. Patients likely did not know the content of the e-cigarette, or vaping, products they used, and methods used to collect substance use data varied across states.

To date, no single compound or ingredient has emerged as the cause of EVALI, and there might be more than one cause. Because most patients report using THC-containing products before the onset of symptoms, CDC recommends that persons should not use e-cigarette, or vaping, products that contain THC. Persons should not buy any type of e-cigarette, or vaping, products, particularly those containing THC, off the street and should not modify or add any substances to

TABLE. Characteristics of patients with electronic cigarette (e-cigarette), or vaping, product use–associated lung injury (EVALI) reported to CDC — United States, August–October 2019*

Characteristic	No. /Total No. (%†)		
	EVALI patients who survived	EVALI–associated deaths	All EVALI patients
Sex			
Male	947/1,349 (70)	17/29 (59)	964/1,378 (70)
Female	402/1,349 (30)	12/29 (41)	414/1,378 (30)
Age group (yrs)			
13–17	735/1,335 (55)§	2/29 (7)§	196/1,364 (14)
18–24			541/1,364 (40)
25–34	339/1,335 (25)	5/29 (17)	344/1,364 (25)
35–44	165/1,335 (12)	7/29 (24)	172/1,364 (13)
45–64	79/1,335 (6)	8/29 (28)	87/1,364 (6)
65–75	17/1,335 (1)	7/29 (24)	24/1,364 (2)
Median age, yrs (range)			
Overall	23 (13–72)	45 (17–75)	24 (13–75)
Male	23 (13–68)	55 (17–71)	23 (13–71)
Female	25 (13–72)	43 (27–75)	25 (13–75)
Race/Ethnicity¶			
White	283/365 (78)	15/18 (83)	298/383 (78)
Black or African American	22/365 (6)**	1/18 (6)**	9/383 (2)
American Indian or Alaska Native			4/383 (1)
Asian, Native Hawaiian, or other Pacific Islander			5/383 (1)
Other			5/383 (1)
Hispanic	60/365 (16)	2/18 (11)	62/383 (16)
Substances used in e-cigarette, or vaping, products††,§§			
THC-containing products, any use	733/848 (86)	16/19 (84)	749/867 (86)
Nicotine-containing products, any use	545/848 (64)	7/19 (37)	552/867 (64)
Both THC- and nicotine-containing products, any use	451/848 (53)	4/19 (21)	455/867 (52)
THC-containing products, exclusive use	282/848 (33)	12/19 (63)	294/867 (34)
Nicotine-containing products, exclusive use	94/848 (11)	3/19 (16)	97/867 (11)
No THC- or nicotine-containing products reported	21/848 (2)	0/19 (0)	21/867 (2)

Abbreviation: THC = tetrahydrocannabinol.
* Reported as of October 15, 2019.
† Percentages might not add up to 100% because of rounding.
§ Data for the 13–17 and 18–24 age groups were combined to protect patient identity.
¶ Whites; blacks or African Americans; American Indians or Alaska Natives; Asians, Native Hawaiians and other Pacific Islanders; and Others were non-Hispanic. Hispanic persons could be of any race.
** Data for persons in the following race/ethnicity groups were combined to protect patient identity: black or African American; American Indian or Alaska Native, Asian, Native Hawaiian, or other Pacific Islander, and Other.
†† In the 3 months preceding symptom onset; categories not mutually exclusive.
§§ Data on both THC- and nicotine-containing product use required to be included.

e-cigarette, or vaping, products that are not intended by the manufacturer, including products purchased through retail establishments. In addition, because the specific compound or ingredient causing lung injury is not yet known, and while the investigation continues, persons should consider refraining from use of all e-cigarette, or vaping, products. E-cigarette, or vaping, products should never be used by youths, young adults, or women who are pregnant. Moreover, persons who do not currently use tobacco products should not start using e-cigarette, or vaping, products (*2*,*5*).

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Feder, Clifford S. Mitchell, Maryland Department of Health; Maine Center for Disease Control and Prevention; Rita Seith, Eden V. Wells, Michigan Department of Health and Human Services; Stacy Holzbauer, Terra Wiens, Minnesota Department of Health; Valerie Howard, George Turabelidze, Missouri Department of Health and Senior Services; Paul Byers, Kathryn Taylor, Mississippi State Department of Health; Kim Bailey, RiverStone Health; William Gavin, Gallatin City-County Health Department; Ariel Christensen, Molly N. Hoffman, North Carolina Division of Public Health; Clint Boots, Tracy Miller, Kodi Pinks, North Dakota Department of Health; Matthew Donahue, Tom Safranek, Nebraska Department of Health and Human Services; Suzann Beauregard, Pascal Kalin, New Hampshire Department of Health and Human Services; Lisa McHugh, Stephen Perez, New Jersey Department of Health; Alex Gallegos, Joseph T. Hicks, New Mexico Department of Health; Ashleigh Faulstich, Victoria LeGarde, Melissa Peek-Bullock, Nevada Department of Health and Human Services; Adam Helman, Kristen Navarette, New York State Department of Health; Courtney Dewart, Kirtana Ramadugu, Ohio Department of Health; Claire B. Nguyen, Tracey Wendling, Oklahoma State Department of Health; Amanda Faulkner, Tasha Poissant, Oregon Health Authority; Joann F. Gruber, Laurel Harduar Morano, Pennsylvania Department of Health; Ailis Clyne, Morgan Orr, James Rajotte, Rhode Island Department of Health; Sharon Biggers, Virginie Daguise, Daniel Kilpatrick, South Carolina Department of Health & Environmental Control; Joshua L. Clayton, Jonathan Steinberg, South Dakota Department of Health; Julie Shaffner, Kelly Squires, Tennessee Department of Health; Emily Hall, Varun Shetty, Texas Department of State Health Services; Esther M. Ellis, U.S. Virgin Islands Department of Health; Nathaniel Lewis, Utah Department of Health; Jonathan Falk, Lilian Peake, Virginia Department of Health; Vermont Department of Health; Michelle Holshue, Cathy Wasserman, Washington State Department of Health; Staff members, Wisconsin Department of Health Services; Shannon McBee, Christy Reed, West Virginia Department of Health and Human Resources; and Melissa Taylor, Wyoming Department of Health.

Corresponding author: Erin D. Moritz, emoritz@cdc.gov.

[1]National Center for Environmental Health, CDC; [2]National Center for Chronic Disease Prevention and Health Promotion, CDC; [3]National Center for Injury Prevention and Control, CDC; [4]National Center on Birth Defects and Developmental Disabilities, CDC; [5]Epidemic Intelligence Service, CDC; [6]National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC; [7]Center for Surveillance, Epidemiology, and Laboratory Services, CDC; [8]National Center for Emerging and Zoonotic Infectious Diseases, CDC; [9]National Institute for Occupational Safety and Health, CDC; [10]National Center for Immunization and Respiratory Disease, CDC.

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Lung Injury Response Epidemiology/Surveillance Task Force

Adebola Adebayo, National Center for Immunization and Respiratory Diseases, CDC; Jennifer Adjemian, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Minal Amin, National Center for Immunization and Respiratory Diseases, CDC; Jose Aponte, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Grace Appiah, National Center for Emerging and Zoonotic Infectious Diseases, CDC; Christina Armatas, California Department of Public Health; Melissa Arons, Epidemic Intelligence Service, Center for Global Health, CDC; Sukhshant Kaur Atti, Agency for Toxic Substances and Disease Registry, CDC; Michelle Banks, National Center for Immunization and Respiratory Diseases, CDC; Vaughn Barry, Epidemic Intelligence Service, National Center for Injury Prevention and Control, CDC; Amy Board, Epidemic Intelligence Service, National Center for Injury Prevention and Control, CDC; Tegan Boehmer, National Center for Environmental Health, CDC; John Bowyer, National Center for Emerging and Zoonotic Infectious Diseases, CDC; Lauren Boyle-Estheimer, National Center for Chronic Disease Prevention and Health Promotion, CDC; Diane Browning, Northrop Grumman; David Bui, Epidemic Intelligence Service, National Center for Environmental, CDC; Jordan Cates, Epidemic Intelligence Service, National Center for Immunization and Respiratory Diseases, CDC; Gyan Chandra, National Center for Chronic Disease Prevention and Health Promotion, CDC; Karen Chang, Epidemic Intelligence Service, National Center for Chronic Disease Prevention and Health Promotion, CDC; Jennifer Chevinsky, Epidemic Intelligence Service, National Center for Chronic Disease Prevention and Health Promotion, CDC; Katelyn Chiang, National Center for Chronic Disease Prevention and Health Promotion, CDC; Pyone Cho, National Center for Chronic Disease Prevention and Health Promotion, CDC; George Cone, National Center for Immunization and Respiratory Diseases, CDC; Matthew Cone, Council of State and Territorial Epidemiologists; Kristen Cowan, National Center for Environmental Health, CDC; Augustina Delaney, G2S Corporation; Lindsey Duca, Epidemic Intelligence Service, National Center for Chronic Disease Prevention and Health Promotion, CDC; Angela Dunn, Utah Department of Health; Shideh Delrahim Ebrahim-Zadeh, National Center for Environmental Health, CDC; Jeff Engel, Council of State and Territorial Epidemiologists; Molly Evans, National Center for Injury Prevention and Control, CDC; Victoria Fields, Epidemic Intelligence Service, National Center on Birth Defects and Developmental Disabilities CDC; Aaron Fleishauer, North Carolina Department

of Health and Human Services; Jennifer Freed, Agency for Toxic Substances and Disease Registry, CDC; Allison Gately, National Center for Injury Prevention and Control, CDC; Isaac Ghinai, Illinois Department of Health; Caitlin Green, National Center on Birth Defects and Developmental Disabilities, CDC; Janet Hamilton, Council of State and Territorial Epidemiologists; Arianna Hanchey, National Center for Environmental Health, CDC; Kathleen Hartnett, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Amy Heinzerling, California Department of Public Health; Dessica Hodges, Mercer University; Brooke Hoots, National Center for Injury Prevention and Control, CDC; Asad Islam, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Mia Israel, Council of State and Territorial Epidemiologists; Yunho Jang, National Center for Immunization and Respiratory Diseases, CDC; Sumera Jiva, Mercer University; Jona Johnson, Agency for Toxic Substances and Disease Registry, CDC; Charlotte Kaboré, National Center for Chronic Disease Prevention and Health Promotion, CDC; Emily Kiernan, Office of the Director, CDC; Uzay Kirbiyik, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Hannah Kisselburgh, National Center for Emerging and Zoonotic Infectious Diseases, CDC; Mimisha Kothari, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Vikram Krishnasamy, National Center for Injury Prevention and Control, CDC; Mohammed Lamtahri, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Michael Landen, New Mexico Department of Health; Jennifer Layden, Illinois Department of Public Health; Mark Layer, National Center for Environmental Health, CDC; Ruth Lynfield, Minnesota Department of Health; Kristen Marshall, Epidemic Intelligence Service, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Keegan McCaffrey, Utah Department of Health; Eva McLanahan, Office of the Director, CDC; Jonathan Meiman, Wisconsin Department of Health; Christina Mikosz, National Center for Injury Prevention and Control, CDC; Maureen Miller, Epidemic Intelligence Service, National Center for Chronic Disease Prevention and Health Promotion, CDC; Roger Mir, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Yousra Mohamoud, National Center for Chronic Disease Prevention and Health Promotion, CDC; Livia Navon, Illinois Department of Public Health; Varsha Neelam, National Center on Birth Defects and Developmental Disabilities, CDC; David Nitschke, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Rashid Njai, Office of the Deputy Director for Non-Infectious Diseases, Office of the Director, CDC; Kevin O'Laughlin, Epidemic Intelligence Service, National Center for Emerging and Zoonotic Infectious Diseases, CDC; Samantha Olson, G2S Corporation; Cria Perrine, National Center for Chronic Disease Prevention and Health Promotion, CDC; Cassandra Pickens, National Center for Injury Prevention and Control, CDC; Mary Pomeroy, Epidemic Intelligence Service, National Center for Emerging and Zoonotic Infectious Diseases, CDC; Aaron Kite Powell, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Ian Pray, Wisconsin Department of Health Services; Tia Rogers, Epidemic Intelligence Service, National Center for Injury Prevention and Control, CDC; Nicole Roth, Eagle Medical Services; Phillip Salvatore, Epidemic Intelligence Service, National Center for Injury Prevention and Control, CDC; Caroline Schrodt, Epidemic Intelligence Service, National Center for Emerging and Zoonotic Infectious Diseases, CDC; Sarah Shafer, National Center for Immunization and Respiratory Diseases, CDC; Dhara Shah, Council of State and Territorial Epidemiologists; Raschelle Smalley, Mercer University; Steven Sumner, National Center for Injury Prevention and Control, CDC; Lauren Tanz, North Carolina Department of Health and Human Services; Mark Tenforde, Center for Surveillance, Epidemiology, and Laboratory Services, CDC; Vilma Thomas, National Center for Chronic Disease Prevention and Health Promotion, CDC; Megan Toe, Council of State and Territorial Epidemiologists; Kate Varela, Epidemic Intelligence Service, National Institute for Occupational Safety and Health; Alana Vivolo, National Center for Injury Prevention and Control, CDC; Jason Wilken, California Department of Public Health; Peter Yang, National Center for Chronic Disease Prevention and Health Promotion, CDC; Anna Yousaf, National Center for Immunization and Respiratory Diseases, CDC.

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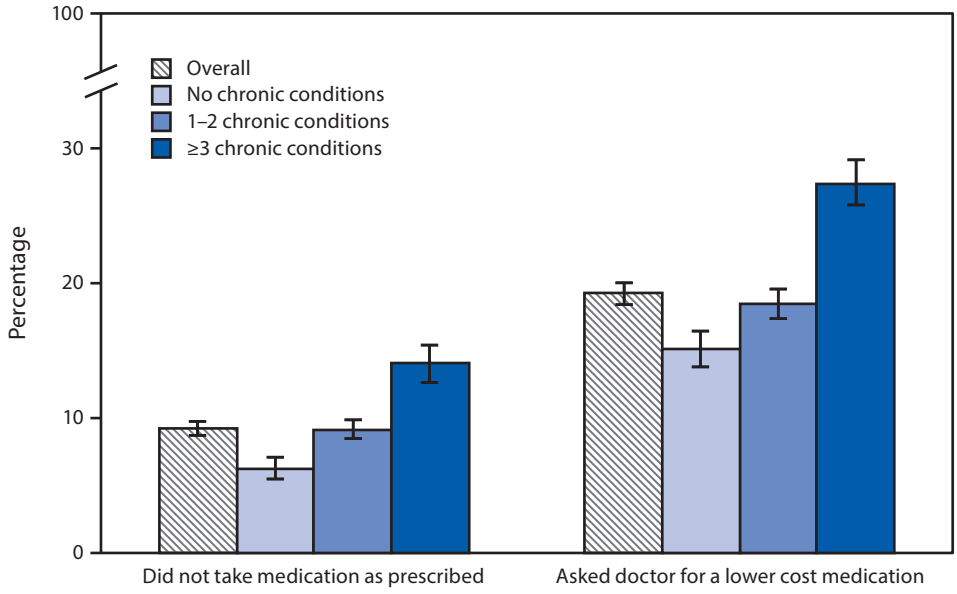
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Aged ≥18 Years Who Did Not Take Their Medication as Prescribed or Asked for Lower-Cost Medication to Save Money Among Those Prescribed Medication in the Past 12 Months,† by Number of Chronic Conditions§ — National Health Interview Survey, 2018¶



* With 95% confidence intervals indicated by error bars.
† Based on the following questions asked of adults prescribed medication in the past 12 months: During the past 12 months, were any of the following true for you? 1) You skipped medication doses to save money, 2) You took less medication to save money, 3) You delayed filling a prescription to save money, or 4) You asked your doctor for a lower-cost medication to save money. The category "Did not take medication as prescribed" includes adults who skipped medication doses, took less medication, or delayed filling a prescription.
§ The number of chronic conditions is based on reporting ever being diagnosed with: hypertension, coronary heart disease, stroke, diabetes, cancer, arthritis, hepatitis, chronic obstructive pulmonary disease (COPD) or asthma, or reporting weak or failing kidneys in the past 12 months. COPD was defined as ever having COPD or emphysema or having chronic bronchitis during the past 12 months.
¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized, U.S. population and are derived from the National Health Interview Survey Sample Adult component.

In 2018, among adults aged ≥18 years who were prescribed medication in the past 12 months, the percentage who did not take their medication as prescribed to save money increased with the number of reported chronic conditions, from 6.2% with no chronic conditions to 9.1% with 1–2 chronic conditions and 14.0% with ≥3 chronic conditions. The percentage who asked their doctor for a lower-cost medication also increased with the number of reported chronic conditions from 15.1% among those with no chronic conditions to 18.4% among those with 1–2 chronic conditions and 27.4% among those with ≥3 chronic conditions.

Source: National Health Interview Survey, 2018 data. https://www.cdc.gov/nchs/nhis.htm.

Reported by: Amy E. Cha, PhD, oty6@cdc.gov, 301-458-4236; Robin A. Cohen, PhD.

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