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Nonfatal Assaults and Homicides Among Adults Aged ≥60 Years — United States, 2002–2016

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Since interpersonal violence was recognized as a public health problem in the 1970s, much attention has focused on preventing violence among young persons and intimate partners (*1*). Violence directed against older adults (≥60 years) has received less attention, despite the faster growth of this population than that of younger groups (*2*). Using data from the National Electronic Injury Surveillance System–All Injury Program (NEISS-AIP) and the National Vital Statistics System (NVSS), CDC analyzed rates of nonfatal assaults and homicides against older adults during 2002–2016. Across the 15-year period, the nonfatal assault rate increased 75.4% (from 77.7 to 136.3 per 100,000) among men, and from 2007 to 2016, increased 35.4% (from 43.8 to 59.3) among women. From 2010 to 2016, the homicide rate increased among men by 7.1%, and a 19.3% increase was observed from 2013 to 2016 among men aged 60–69 years. Growth in both the older adult population and the rates of violence against this group, especially among men, suggests an important need for violence prevention strategies (*3*). Focusing prevention efforts for this population will require improved understanding of magnitude and trends in violence against older adults.

In 2017, older adults accounted for 22% of the U.S. population, surpassing children and adolescents aged 0–14 years (19%); this percentage is expected to reach 28% by 2050 (*2*). Many older adults require care and are vulnerable to violence perpetrated by a caregiver or someone they trust (*4*).

To assess nonfatal assault trends, data from the NEISS-AIP system, operated by the U.S. Consumer Product Safety Commission in collaboration with CDC, were analyzed. NEISS-AIP collects data on approximately 500,000 nonfatal injury–related visits annually from a nationally representative sample of hospital emergency departments (EDs), and data are weighted by the inverse probability of selection to produce national estimates (*5*). Trained coders classify injuries into categories by intent (i.e., unintentional, assault, self-inflicted, and legal intervention) (*6*). Nonfatal assault injuries were limited to those resulting from physical violence by one or more persons; sexual assaults and injuries from legal intervention were excluded. Rates were based on weighted data from 11,373 nonfatal assault–related injuries among older adults treated during 2002 to 2016.

NVSS data were used to analyze homicide trends. NVSS receives information on manner and cause of death and decedent demographics from death certificates provided by vital statistics registration systems across the United States. Homicides were limited to injury deaths with *International Classification of Diseases, Tenth Revision* underlying cause of death codes X85–Y09, Y87.1, and U01–U02.*

Trends were analyzed using SAS (version 9.4; SAS Institute) and were stratified by 10-year age groups (60–69, 70–79, and

* https://icd.who.int/browse10/2016/en.

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≥80 years). Crude rates per 100,000 population per year were calculated using U.S. Census bridged-race resident population estimates.[†] The estimated overall average annual nonfatal assault rate and the observed average annual homicide rate, as well as rates by sex and age group, were computed. Joinpoint[§] (version 4.6.0; National Cancer Institute) regression was used to model rates[¶] and test trend significance. Annual percentage change estimates indicate magnitude and direction of trends across the study period. Mechanisms of nonfatal injury and homicide reported by NEISS-AIP and NVSS are also described.

From 2002 to 2016, an estimated 643,191 nonfatal assault victims were treated in EDs, and 19,059 homicides occurred (Table). Compared with women, men experienced higher rates of both nonfatal assaults (107.8 versus 50.4 per 100,000) and homicides (3.16 versus 1.53). On average, the highest rates of nonfatal assaults (147.4) and homicides (3.58) were perpetrated against men aged 60–69 years. The nonfatal assault rate was lowest among women aged 70–79 years (36.0), and the homicide rate was lowest among women aged 60–69 years (1.40).

Nonfatal assault rates among older adults did not change from 2002 to 2008 but increased 53.1% from 2008 to 2016 in the overall sample (Table) (Figure 1). For the entire 15-year period, the nonfatal assault rate increased 75.4% (from 77.7 to 136.3) among men, and from 2007 to 2016, 35.4% (from 43.8 to 59.3) among women. Among adults aged 60–69 years, the nonfatal assault rate against men increased 89.2% (100.5 to 190.1) and against women, increased 37.5% (55.0 to 75.6) from 2002 to 2016.

From 2002 to 2014, the overall estimated homicide rate declined 12.8% (from 2.42 to 2.11) (Table) (Figure 2) and declined 9.9% among women across the entire study period. The rate among men declined 16.7% from 2002 to 2010, but then increased 7.1% (from 2.95 to 3.16) from 2010 to 2016. From 2013 to 2016, an increase of 19.3% (from 3.31 to 3.95) was observed among men aged 60–69 years (Table). Homicide rates declined in all other age groups of men, and among women aged ≥80 years the rate declined 11.6% from 2002 to 2016.

Nonfatal assaults and homicides differed with respect to mechanisms used in assaults. Most (86.6%) nonfatal assaults were related to being intentionally struck or hit (e.g., with hand, foot, or object). Firearms were the most common weapons used in homicides (42.2%). Other homicide mechanisms included cutting/piercing (14.8%) and suffocation (6.4%).

Discussion

During this study period, the older adult population (persons aged ≥60 years) in the United States grew nearly 3% annually, approximating global projections (*2*); in addition, the nonfatal assault rate among this group grew approximately 4% annually on average. The estimated number of nonfatal assaults nearly doubled during this period, and the number could double

[†] https://www.cdc.gov/nchs/nvss/bridged_race.htm.
[§] https://surveillance.cancer.gov/joinpoint/.
[¶] Reported rates during joinpoint ranges and percent rate changes are based on models from joinpoint regression analysis.

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TABLE. Number and rate of estimated* nonfatal assaults and actual fatal assaults (homicides) among persons aged ≥60 years, by sex and age group — United States, 2002–2016

Sex/Age group (yrs)	No. of sample cases	No. of injuries†,§ (%)	Average annual rate† (95% CI)	No. of joinpoints	Joinpoint year range	APC	Modeled rate¶ range	Overall % change in modeled rate range¶
Nonfatal assault								
Total, ≥60	**11,373**	**643,191 (100.0)**	**75.9 (60.6–91.2)**	**1**	**2002–2008**	**0.26**	**63.8–64.8**	**1.6**
					2008–2016	**5.47****	**64.8–99.2**	**53.1**
Men, ≥60	7,452	405,527 (63.0)	107.8 (81.3–134.4)	0	2002–2016	4.10**	77.7–136.3	75.4
Women, ≥60	3,921	237,664 (37.0)	50.4 (43.2–57.7)	1	2002–2007	−2.74	50.4–43.8	−13.1
					2007–2016	3.41**	43.8–59.3	35.4
Men, 60–69	5,629	296,789 (73.2)	147.4 (107.9–186.9)	0	2002–2016	4.66**	100.5–190.1	89.2
Men, 70–79	1,353	80,939 (20.0)	70.6 (54.4–86.7)	0	2002–2016	2.06**	60.5–80.5	33.1
Men, ≥80	470	27,799 (6.9)	46.3 (38.0–54.7)	0	2002–2016	1.12	42.0–49.0	16.7
Women, 60–69	2,478	147,685 (62.1)	66.3 (56.1–76.6)	0	2002–2016	2.29**	55.0–75.6	37.5
Women, 70–79	858	51,430 (21.6)	36.0 (30.1–41.9)	0	2002–2016	−0.53	38.0–35.3	−7.1
Women, ≥80	585	38,550 (16.2)	36.5 (31.0–42.0)	0	2002–2016	−0.86	38.8–34.4	−11.3
Fatal assault (homicide)								
Total, ≥60	**N/A**	**19,059 (100.0)**	**2.25 (2.22–2.28)**	**1**	**2002–2014**	**−1.14****	**2.42–2.11**	**−12.8**
					2014–2016	**4.66**	**2.11–2.31**	**9.5**
Men, ≥60	N/A	11,872 (62.3)	3.16 (3.10–3.22)	1	2002–2010	−2.26**	3.54–2.95	−16.7
					2010–2016	1.17**	2.95–3.16	7.1
Women, ≥60	N/A	7,187 (37.7)	1.53 (1.49–1.57)	0	2002–2016	−0.76**	1.61–1.45	−9.9
Men, 60–69	N/A	7,216 (60.8)	3.58 (3.50–3.66)	1	2002–2013	−1.32**	3.83–3.31	−13.6
					2013–2016	6.16**	3.31–3.95	19.3
Men, 70–79	N/A	3,167 (26.7)	2.76 (2.66–2.86)	0	2002–2016	−2.17**	3.23–2.38	−26.3
Men, ≥80	N/A	1,489 (12.5)	2.48 (2.35–2.61)	0	2002–2016	−2.00**	2.89–2.18	−24.6
Women, 60–69	N/A	3,108 (43.2)	1.40 (1.35–1.45)	0	2002–2016	−0.52	1.46–1.35	−7.5
Women, 70–79	N/A	2,107 (29.3)	1.47 (1.41–1.53)	0	2002–2016	−0.65	1.55–1.42	−8.4
Women, ≥80	N/A	1,972 (27.4)	1.87 (1.79–1.95)	0	2002–2016	−0.86**	1.99–1.76	−11.6

Abbreviations: APC = annual percentage change; CI = confidence interval; N/A = not applicable.
* Based on injuries treated in emergency departments. Excludes nonfatal sexual assault cases.
† The nonfatal estimate of injuries was generated from the sample of cases in the National Electronic Injury Surveillance System–All Injury Program. Data are weighted by the inverse probability of sample case selection to produce national estimates. The fatal national estimate of injuries is the actual total homicide cases reported to the National Vital Statistics System in the U.S. This total is not estimated from a sample.
§ Estimates might not sum to total because of rounding.
¶ Rate per 100,000 population.
** Statistically significant regression results ($p<0.05$).

again by 2030 if both of the growth rates continue. Men aged 60–69 years are at highest risk for nonfatal assaults and homicide victimization, and rates in this group are climbing. The homicide rate remained relatively unchanged or declined for all other older adult demographic groups.

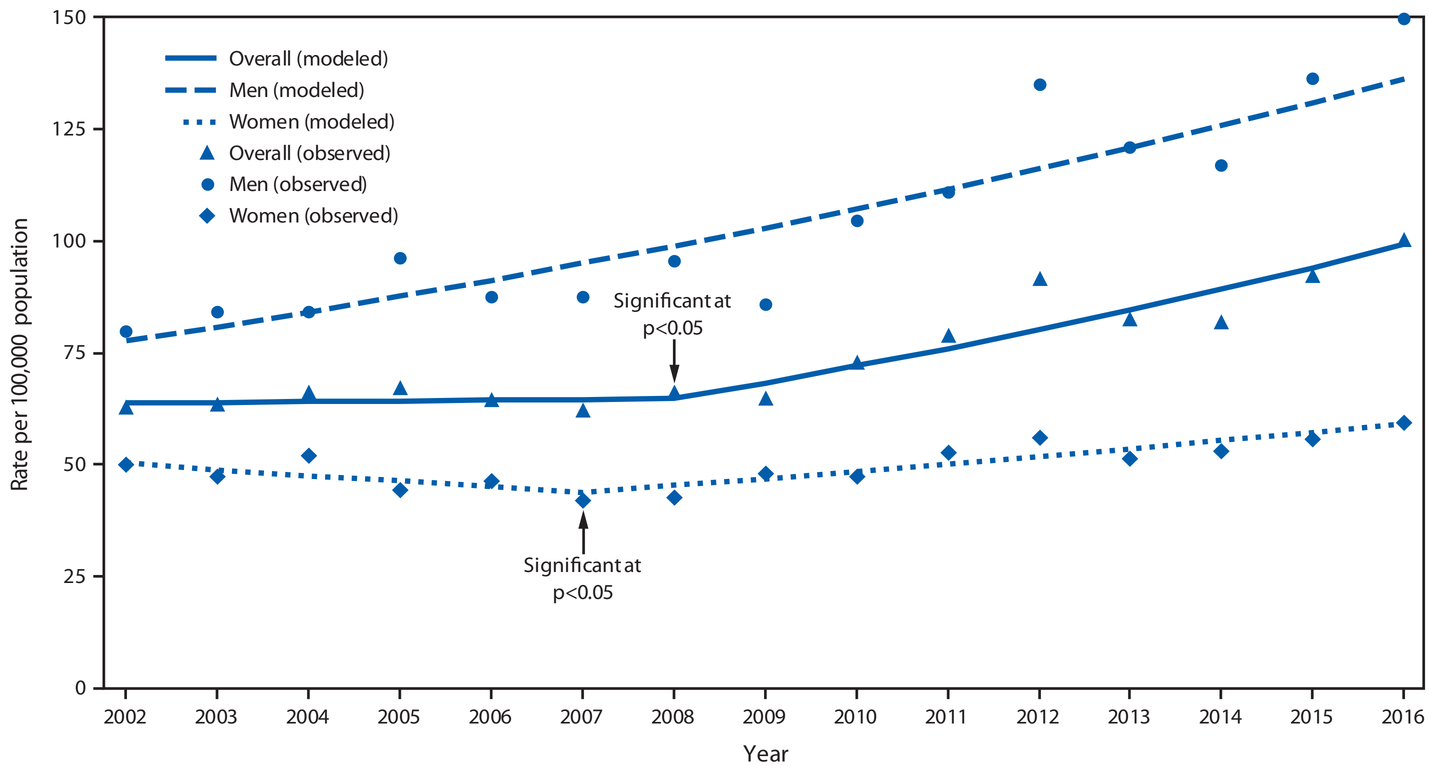
A study examining victim-perpetrator relationships in nonfatal assaults among older adults using NEISS-AIP data found an estimated 58% of perpetrators had a relationship (e.g., familial, acquaintance) with the victim (*7*). Findings on victim-perpetrator relationships among older adults experiencing homicide incidents (excluding homicide-suicide incidents) collected in 32 states provided by the National Violent Death Reporting System for 2016 indicated approximately half (46%) of homicides were perpetrated by a spouse/intimate partner, parent, child, other relative, or friend/acquaintance.** These cases potentially meet CDC's definition of elder abuse (*4*), suggesting a need for prevention and support services for older adults faced with family- or acquaintance-perpetrated assault.

High rates of nonfatal assaults and homicides among men aged 60–69 suggest this group might be particularly vulnerable to violence. Research is needed to understand why assault and homicide rates are highest among the youngest, and presumably healthiest, group of older adult men. Further exploration of mechanism of assault, perpetrators involved, and incident circumstances by age group might illuminate findings.

Collectively, these findings highlight the need to strengthen violence prevention among older adults. Unfortunately, few strategies have been rigorously evaluated (*8*). Emergency medical services and ED providers are positioned to identify assault cases among older adults and refer victims to support services to prevent subsequent violence (*3*). However, one study found that many ED providers either missed or did not respond to cases of older adult abuse because they lacked knowledge or time required to conduct assessments or were uncertain about

** https://www.cdc.gov/injury/wisqars/nvdrs.html.

FIGURE 1. Nonfatal observed and modeled assault injury rates*,†,§ among adults aged ≥60 years treated in hospital emergency departments, by sex — United States, 2002–2016



* Excluding sexual assault.
† Joinpoint regression analysis was used to determine annual percentage change (APC) with statistically significant trend and significant joinpoints.
§ Overall: APC = 5.47 (2008–2016); men: APC = 4.10 (2002–2016); women: APC = 3.41 (2007–2016).

how to respond (*9*). Incorporating geriatric specialists in EDs might help link clinical care to service referrals.

The findings in this report are subject to at least four limitations. First, nonfatal injury rates are underestimated because this study only included persons treated in EDs. Second, nonfatal injury data were coded by trained abstractors, and details of injuries can vary across medical records, resulting in coding inaccuracies. However, NEISS-AIP ED visit findings were consistent with those from other large databases such as the Healthcare Cost and Utilization Project.[††] Third, descriptive characteristics of precipitating and preceding circumstances, victim-perpetrator relationships, and mechanisms used were limited in NEISS-AIP and NVSS. Finally, trends in nonfatal assault cases could not be examined by race/ethnicity because of substantial missing race/ethnicity data in NEISS-AIP. However, homicide rates by race/ethnicity are available online.[§§] Among older adults, 2002–2016 average crude homicide rates were highest among non-Hispanic blacks, non-Hispanic American Indian/Alaskan Natives, and Hispanics. Racial/ethnic minorities experience a disparate prevalence of violent injury and homicide (*10*). Inequities start early in life and can result from disproportional exposure to residential segregation,

†† https://www.hcup-us.ahrq.gov/.
§§ Homicide data, as well as nonfatal assault data provided by NEISS-AIP, can be accessed using CDC's Web-based Injury Statistics Query and Reporting System (WISQARS). https://www.cdc.gov/injury/wisqars/dataandstats.html.

Summary

What is already known about this topic?

The older adult U.S. population is growing faster than are younger populations, yet violence against older adults has received little attention.

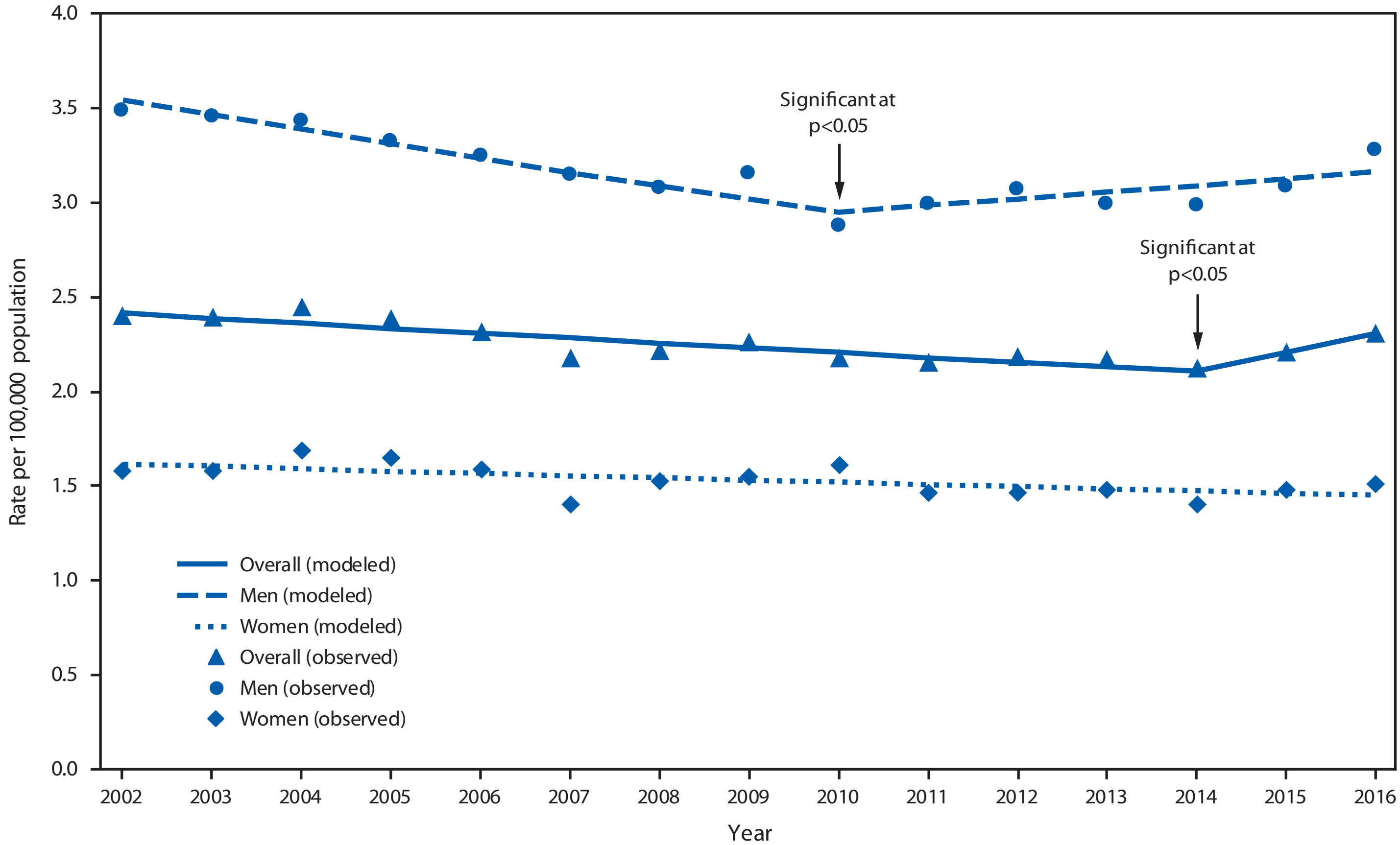
What is added by this report?

Fifteen-year trends in nonfatal assaults and homicides among adults aged ≥60 years were examined using National Electronic Injury Surveillance System–All Injury Program and National Vital Statistics System data. The estimated nonfatal assault rate increased 75.4% among men (2002–2016) and 35.4% among women (2007–2016). The estimated homicide rate for men increased 7.1% from 2010 to 2016.

What are the implications for public health practice?

Violence against older adults is a growing problem, particularly among men. Emergency departments might be positioned to help prevent violence among this group.

FIGURE 2. Observed and modeled homicide rates*,† among adults aged ≥60 years, by sex — United States, 2002–2016



* Joinpoint regression analysis was used to determine annual percentage change (APC) with statistically significant trend and significant joinpoints.
† Overall: APC = −1.14 (2002–2014); Men: APC = −2.26 (2002–2010), APC = 1.17 (2010–2016); Women: APC = −0.76 (2002–2016).

concentrated disadvantage, limited educational and employment opportunities, and other conditions that amplify the risk of experiencing violence (*10*). Reductions in systemic inequities could diminish violence against persons of all ages and races, including older adults.

Violence against older adults is an emerging and underreported public health problem. EDs might be promising settings to identify older adults at risk for violence and treat and support those already affected (*3*). Additional information on types, signs, and circumstances of violence among older adults, as well as resources to help victims, is available at https://www.cdc.gov/violenceprevention/pdf/em-factsheet-a.pdf.

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Chronic Obstructive Pulmonary Disease Prevalence Among Adults Who Have Never Smoked, by Industry and Occupation — United States, 2013–2017

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Tobacco smoking is a major risk factor for chronic obstructive pulmonary disease (COPD), a debilitating respiratory condition with high mortality and morbidity (*1*,*2*). However, an estimated 24% of adults with COPD have never smoked (*3*,*4*). Among these persons, 26%–53% of COPD can be attributed to workplace exposures, including dust, fumes, gases, vapors, and secondhand smoke exposure (*4*–*6*). To assess industry-specific and occupation-specific COPD prevalence among adults aged ≥18 years who have never smoked and who were employed any time during the past 12 months, CDC analyzed 2013–2017 National Health Interview Survey (NHIS) data. Among an estimated 106 million workers who had never smoked, 2.2% (2.4 million) have COPD. Highest prevalences were among workers aged ≥65 years (4.6%), women (3.0%), and those reporting fair/poor health (6.7%). Among industries and occupations, the highest COPD prevalences were among workers in the information industry (3.3%) and office and administrative support occupations (3.3%). Among women, the highest prevalences were among those employed in the information industry (5.1%) and in the transportation and material moving occupation (4.5%), and among men, among those employed in the agriculture, forestry, fishing, and hunting industry (2.3%) and the administrative and support, waste management, and remediation services industry (2.3%). High COPD prevalences in certain industries and occupations among persons who have never smoked underscore the importance of continued surveillance, early identification of COPD, and reduction or elimination of COPD-associated risk factors, such as the reduction of workplace exposures to dust, vapors, fumes, chemicals, and exposure to indoor and outdoor air pollutants.

NHIS data are collected annually from a nationally representative sample of the civilian noninstitutionalized U.S. population through a personal interview. To improve the precision and reliability of estimates, data collected during 2013–2017 were combined. Survey response rates ranged from 61.2% in 2013 to 53.0% in 2017.* Respondents were considered to be employed if they were "working for pay at a job or business," or "with a job or business but not at work," or "working, but not for pay, at a family-owned job or business" any time during the 12 months preceding the interview. Information on participants' current industry and occupation was categorized into 21 industry groups and 23 occupation groups.[†] Participants with COPD were identified by a positive response to any of the following three questions: 1) "Have you ever been told by a doctor or other health professional that you had chronic obstructive pulmonary disease, also called COPD?"; 2) "Have you ever been told by a doctor or other health professional that you had emphysema?"; or 3) "During the past 12 months, have you been told by a doctor or other health professional that you had chronic bronchitis?" Persons were considered to have never smoked if they had never smoked or smoked <100 cigarettes during their lifetime. Persons were considered to have ever smoked if they had smoked >100 cigarettes during their lifetime and includes both current cigarette smokers and former cigarette smokers. Respondent self-reported health status at the time of interview and the number of physician office visits, emergency department (ED) visits, and lost work days in the past 12 months resulting from any illness or injury were assessed.[§]

Data were analyzed using SAS (version 9.4; SAS Institute) and were adjusted for nonresponse and weighted to be nationally representative, and variance estimates were calculated to account for the clustered survey design. The proportions of workers who reported emphysema, chronic bronchitis, and COPD diagnosis were assessed separately among those who never smoked and those who ever smoked. Prevalence estimates with relative standard error (standard error of the estimate divided by the estimate) ≥30% were not reported. Participants with unknown or missing information for COPD were excluded from the analysis. Two-sided t-tests were used to determine statistically significant (p<0.05) differences between point estimates.

During 2013–2017, among an estimated 164 million U.S. adults aged ≥18 years who were working any time during the 12 months preceding the interview, COPD prevalences were 6.0% (3.4 million) among those who ever smoked and 2.2% (2.4 million) among those who never smoked. The proportions of workers who reported an emphysema, chronic bronchitis, or COPD diagnosis were 1.1%, 3.8%, 2.5%, respectively for those

* ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2017/srvydesc.pdf.

† ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2017/samadult_layout.pdf.

§ ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2017/english/qadult.pdf.

who ever smoked (35% of workers), and 0.1%, 1.9%, and 0.4%, respectively for those who never smoked (65% of workers).

Among workers who never smoked, the highest COPD prevalences were among women (3.0%), adults aged ≥65 years (4.6%), and those reporting fair/poor health (6.7%), more than three physician office visits in past 12 months (4.2%), more than three ED visits in past 12 months (10.3%), and >7 days of work lost because of any illness or injury (6.6%). By sex, race, and ethnicity, COPD prevalences were highest among non-Hispanic white men (1.7%) and non-Hispanic black women (3.7%) (Table 1). Among persons who never smoked, those with COPD missed an average of 14.9 work days (15.6 days for women and 13.6 days for men) because of any illness or injury compared with persons who did not have COPD, who missed an average of 5.4 work days (6.4 days for women and 4.4 days for men).

Among workers who never smoked, COPD prevalences exceeded 3.0% among those in the information (3.3%) and mining (3.1%) industries and in the office and administrative support occupation (3.3%) (Table 2). Sex differences in COPD prevalence were observed by industry and occupation. Among men, the highest COPD prevalences were among those employed in agriculture, forestry, fishing, and hunting (2.3%), the administrative and support, waste management, and remediation services (2.3%), the arts, entertainment, and recreation (2.3%) industries, and protective services occupation (2.3%); among women, the highest prevalences were among those employed in the information industry (5.1%) and transportation and material moving occupation (4.5%).

Discussion

An estimated 24% of U.S adults with COPD have never smoked (*3*,*4*). Among persons who never smoked, an estimated 26%–53% of COPD can be attributed to occupational exposures (*4*–*6*). Previous studies have shown that occupational exposures to dust and toxins, as well as biologic and social differences, and genetic factors were associated with increased risk for COPD among persons who never smoked (*1*,*3*,*5*,*7*). Therefore, identifying occupational risk factors is needed for preventing and reducing COPD among workers. This study, which provides industry- and occupation-specific COPD prevalence estimates among 106 million persons who never smoked and were employed any time in the past 12 months, found that two thirds of those with COPD were women. Women who had never smoked had higher COPD prevalences than did men regardless of their sociodemographic characteristics. Within-group variations were observed among sex, race, and ethnicity, with the highest prevalences among non-Hispanic black women and non-Hispanic white men.

National surveys have shown that exposure to vapors, gas, dust, fumes, grain dust, organic dust, inorganic dust, ammonia, hydrogen sulfide, diesel exhaust, environmental tobacco smoke, and chemicals increases the risk for COPD morbidity and mortality among persons who have never smoked (*4*–*6*). For example, exposure to coal mine dust or respirable crystalline silica among workers in the mining industry has been associated with COPD and other pulmonary diseases.[¶] In this study, office and administrative support workers (including secretaries, administrative and dental assistants, and clerks), protective service workers, and information industry workers (including publishing, telecommunications, broadcasting, and data processing workers) had the highest COPD prevalences. Workers in these industries can be exposed to organic and inorganic dusts, isocyanates, irritant gases, paper dust and fumes from photocopiers, chemicals, oil-based ink, paints, glues, isocyanates, toxic metals, and solvents, all of which are known respiratory irritants and have been associated with bronchitis, emphysema, and COPD.[**,††] In addition, workplace exposures to environmental tobacco smoke can be associated with COPD (*8*).

In this report, although the pattern of responses to all three COPD-related questions among those who ever smoked and those who never smoked was similar (i.e., highest proportions with COPD were among those who were diagnosed with chronic bronchitis), chronic bronchitis was 19 times more frequently reported than emphysema among those who never smoked, compared with 3.5 times among those who ever smoked. These results are similar to those previously reported that a substantial proportion of COPD among the nonsmoker population might be explained by chronic bronchitis (*9*).

The findings in this report are subject to at least five limitations. First, information on COPD was self-reported and not validated by medical records review or pulmonary function tests. Second, no work history, secondhand smoke exposure, or workplace exposure information was available to assess associations with COPD. Third, only workers employed at some time in the past 12 months were included in this study. Those with severe COPD might have left the workforce, and COPD prevalence might be underestimated. Fourth, despite combining data for multiple years, small sample sizes in certain groups resulted in unreliable estimates. Finally, the survey collected information on any physician office visits or ED visits in the past 12 months and lost workdays because of any illness or injury, and these visits might not be associated with COPD.

¶ https://www.cdc.gov/niosh/docs/2011-172/pdfs/2011-172.pdf.
** http://www.ilocis.org/en/contilo.html.
†† https://www.labour.gov.hk/text_alternative/pdf/eng/GN_Printing.pdf.

TABLE 1. Prevalence of chronic obstructive pulmonary disease (COPD)* among employed persons who never smoked, by sex and selected characteristics — National Health Interview Survey, United States, 2013–2017

	Men		Women		All workers
Characteristic	**Employed adults† (x 1,000)**	**% (95% CI)**	**Employed adults† (x 1,000)**	**% (95% CI)**	**% (95% CI)**
Total	**52,084**	**1.5 (1.3–1.7)**	**54,075**	**3.0 (2.7–3.2)**	**2.2 (2.1–2.4)**
Age group (yrs)					
18–24	8,670	1.2 (0.7–1.8)	8,978	2.1 (1.5–2.8)	1.7 (1.3–2.1)
25–44	22,662	0.9 (0.7–1.1)	23,252	2.2 (1.9–2.5)	1.6 (1.4–1.8)
45–64	18,401	2.0 (1.7–2.4)	18,992	3.9 (3.5–4.3)	3.0 (2.7–3.3)
≥65	2,351	3.9 (2.7–5.1)	2,853	5.2 (4.1–6.3)	4.6 (3.8–5.4)
Race/Ethnicity					
Hispanic	10,196	1.3 (1.0–1.7)	9,643	2.1 (1.7–2.6)	1.7 (1.4–2.0)
White, non-Hispanic	31,921	1.7 (1.4–1.9)	31,864	3.2 (2.9–3.5)	2.5 (2.2–2.7)
Black, non-Hispanic	6,175	1.2 (0.7–1.6)	7,989	3.7 (3.1–4.4)	2.6 (2.2–3.0)
Other	3,793	1.1 (0.5–1.7)	4,580	1.6 (1.1–2.1)	1.3 (1.0–1.7)
Education					
≤High school/GED	15,273	1.7 (1.4–2.0)	13,681	3.3 (2.8–3.8)	2.5 (2.2–2.7)
>High school	36,646	1.4 (1.2–1.6)	40,260	2.9 (2.6–3.1)	2.2 (2.0–2.3)
Unknown	165	—§	135	—	—
Poverty status¶					
Poor	3,902	1.5 (1.0–2.0)	5,122	3.1 (2.4–3.7)	2.4 (2.0–2.8)
Near poor	6,460	1.8 (1.3–2.3)	7,695	3.6 (2.9–4.3)	2.8 (2.3–3.2)
Not poor	38,474	1.5 (1.3–1.7)	37,858	2.8 (2.5–3.0)	2.1 (2.0–2.3)
Unknown	3,249	1.0 (0.5–1.5)	3,401	3.3 (2.4–4.3)	2.2 (1.6–2.8)
Health insurance status					
Not insured	6,754	1.2 (0.8–1.6)	5,547	2.9 (2.1–3.8)	2.0 (1.6–2.4)
Insured	45,006	1.5 (1.3–1.7)	48,211	3.0 (2.7–3.2)	2.3 (2.1–2.4)
Unknown	324	—	317	—	—
U.S. Census region**					
Northeast	9,284	1.6 (1.1–2.1)	9,480	2.3 (1.8–2.8)	2.0 (1.6–2.3)
Midwest	11,406	1.6 (1.2–2.0)	11,656	3.3 (2.7–3.8)	2.5 (2.1–2.8)
South	18,205	1.4 (1.2–1.7)	19,759	3.2 (2.9–3.6)	2.4 (2.2–2.6)
West	13,189	1.4 (1.1–1.8)	13,180	2.7 (2.3–3.2)	2.1 (1.8–2.4)
Self–rated health††					
Excellent/Very good/Good	49,697	1.3 (1.2–1.5)	51,142	2.7 (2.5–2.9)	2.0 (1.9–2.2)
Poor/Fair	2,379	5.3 (3.9–6.7)	2,909	7.8 (6.4–9.2)	6.7 (5.7–7.7)

See table footnotes on next page.

The findings of high COPD prevalences among workers who never smoked corroborates findings that occupational exposures, in addition to smoking, might be associated with development of COPD. Higher COPD prevalences in certain industries and occupations underscore the importance of continued surveillance, identification of potential workplace exposures, collection of detailed occupational history, performance of pulmonary function testing, and assessment of environmental tobacco smoke exposure for early diagnosis and treatment of COPD among workers (*10*). Efforts to reduce adverse workplace exposures (including exposure to dust, vapors, fumes, chemicals, and indoor and outdoor air pollutants) and promote research to characterize the many contributing risk factors in COPD are needed to reduce the prevalence of COPD.§§

§§ https://www.nhlbi.nih.gov/health-topics/education-and-awareness/COPD-national-action-plan.

Summary

What is already known about this topic?

Approximately 25% of adults with chronic obstructive pulmonary disease (COPD) have never smoked, and workplace exposures likely contribute to much of their disease.

What is added by this report?

During 2013–2017, an estimated 2.4 million (2.2%) U.S. working adults aged ≥18 years who never smoked had COPD. The highest COPD prevalences among persons who never smoked were in the information (3.3%) and mining (3.1%) industries and office and administrative support occupation workers (3.3%). Women had higher COPD prevalences than did men.

What are the implications for public health practice?

Efforts to reduce adverse workplace exposures and promote research to characterize the many contributing risk factors for COPD are needed to improve efforts to prevent and reduce risk for COPD among nonsmoking workers.

TABLE 1. (*Continued*) Prevalence of chronic obstructive pulmonary disease (COPD)* among employed persons who never smoked, by sex and selected characteristics — National Health Interview Survey, United States, 2013–2017

	Men		Women		All workers
Characteristic	Employed adults† (x 1,000)	% (95% CI)	Employed adults† (x 1,000)	% (95% CI)	% (95% CI)
Physician office visits§§					
None	13,632	0.8 (0.5–1.1)	7,058	1.4 (0.8–2.0)	1.0 (0.7–1.3)
1–3	27,135	1.2 (1.0–1.4)	26,795	2.2 (1.9–2.5)	1.7 (1.5–1.9)
>3	10,671	3.3 (2.7–3.8)	19,566	4.7 (4.2–5.1)	4.2 (3.8–4.5)
Emergency department visits¶¶					
None	45,561	1.2 (1.0–1.4)	44,728	2.4 (2.1–2.5)	4.1 (3.8–4.4)
1–3	5,697	3.4 (2.6–4.2)	8,122	5.7 (4.9–6.5)	4.8 (4.2–5.4)
>3	268	12.1 (6.1–18.1)	697	9.6 (6.1–13.1)	10.3 (7.3–13.3)
Lost work days* **					
None	32,497	1.1 (0.9–1.3)	30,264	2.0 (1.8–2.3)	1.5 (1.4–1.7)
1–7	16,771	1.8 (1.5–2.2)	20,074	3.4 (3.0–3.8)	2.7 (2.4–3.0)
>7	2,692	4.5 (3.3–5.8)	3,532	2.0 (1.8–2.3)	6.6 (5.7–7.5)

Abbreviations: CI = confidence interval; GED = General Educational Development certificate.

* Proportion of workers who positively answered the question "Have you ever been told by a doctor or other health professional that you had chronic obstructive pulmonary disease, also called COPD?" Proportion of workers who positively answered the question "Have you ever been told by a doctor or other health professional that you had emphysema?" Proportion of workers who were solely identified as having COPD by a positive answer to the question "During the past 12 months, have you been told by a doctor or other health professional that you had chronic bronchitis?" For this report survey respondents with COPD were those who positively answered to any of these three questions.

† Adults who reported "working at a job or business"; "with a job or business but not at work"; or "working, but not for pay, at a family–owned job or business" during the last 12 months of the survey interview and have never smoked. Estimates are weighted to provide national estimates for current employment and are presented in thousands.

§ Dashes indicate estimates suppressed because relative standard error for the estimate was ≥30%.

¶ Poverty status is based on family income and family size using the U.S. Census Bureau's poverty thresholds for the previous calendar year. In National Health Interview Survey, "poor" persons are defined as having incomes below the federal poverty level (FPL), "near poor" are defined as having incomes of 100% to <200% of the FPL, and "not poor" are defined as having incomes that are ≥200% of the FPL. https://www.cdc.gov/nchs/data/nhis/SHS_Tech_Notes.pdf.

** https://www2.census.gov/geo/pdfs/maps–data/maps/reference/us_regdiv.pdf.

†† Based on the response to "Would you say your health in general is excellent, very good, good, fair, or poor?"

§§ Based on the response to "During the past 12 months, how many times have you seen a doctor or other health care professional about your own health at a doctor's office, a clinic, or some other place?"

¶¶ Based on the response to "During the past 12 months, how many times have you gone to a hospital emergency room about your own health (This includes emergency room visits that resulted in a hospital admission.)?"

*** Based on the response to "During the past 12 months, about how many days did you miss work at a job or business because of illness or injury (do not include maternity leave)?"

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TABLE 2. Prevalence of chronic obstructive pulmonary disease (COPD)* among employed persons who never smoked by sex, industry, and occupation — National Health Interview Survey, United States, 2013–2017

	Men		Women		All workers
Industry/Occupation	**No.† x1,000**	**% (95% CI)**	**No.† x1,000**	**% (95% CI)**	**% (95% CI)**
Industry groups					
Agriculture, forestry, fishing, and hunting	1,068	2.3 (1.3–3.3)	459	—§	2.4 (1.4–3.3)
Mining	408	—	92	—	3.1 (0.4–5.9)
Utilities	666	—	204	—	1.6 (0.4–2.9)
Construction	4,811	1.2 (0.7–1.7)	577	3.9 (1.7–6.1)	1.5 (1.0–2.0)
Manufacturing	6,247	1.3 (0.8–1.8)	3,234	3.4 (2.0–4.7)	2.0 (1.5–2.6)
Wholesale trade	1,502	1.7 (0.7–2.8)	854	4.6 (2.5–6.7)	2.8 (1.7–3.8)
Retail trade	5,027	1.0 (0.7–1.4)	5,844	2.8 (2.1–3.6)	2.0 (1.6–2.5)
Transportation and warehousing	2,841	1.4 (0.9–2.0)	1,011	4.3 (2.6–5.9)	2.2 (1.6–2.8)
Information	1,244	1.9 (0.6–3.3)	917	5.1 (2.8–7.3)	3.3 (2.0–4.5)
Finance and insurance	2,249	1.7 (0.7–2.8)	2,923	3.4 (2.4–4.4)	2.7 (2.0–3.4)
Real estate and rental and leasing	1,050	—	924	3.3 (1.6–5.1)	1.7 (0.8–2.5)
Professional, scientific, and technical services	4,977	1.5 (0.9–2.0)	3,787	1.9 (1.2–2.5)	1.6 (1.2–2.1)
Management of companies and enterprises	27	—	35	—	—
Administrative and support, waste management, and remediation services	2,448	2.3 (1.4–3.2)	1,832	3.3 (2.2–4.4)	2.7 (2.0–3.4)
Education services	3,825	1.9 (1.0–2.8)	8,067	3.3 (2.7–3.8)	2.8 (2.3–3.3)
Health care and social assistance	3,042	1.8 (0.9–2.7)	12,046	2.8 (2.3–3.3)	2.6 (2.2–3.0)
Arts, entertainment, and recreation	1,369	2.3 (0.9–3.7)	1,185	2.6 (1.4–3.9)	2.5 (1.5–3.4)
Accommodation and food services	2,977	1.7 (0.9–2.5)	3,937	2.2 (1.6–2.8)	2.0 (1.5–2.5)
Other services (except public administration)	2,241	1.1 (0.5–1.6)	2,837	2.8 (1.9–3.7)	2.0 (1.5–2.6)
Public administration	2,893	1.5 (0.8–2.2)	2,376	3.4 (2.3–4.5)	2.3 (1.7–3.0)
Armed forces	133	—	33	—	—
Refused, not ascertained, don't know	1,040	—	901	—	—
Occupation groups					
Management	2,054	1.5 (0.9–2.0)	4,347	2.6 (1.9–3.3)	2.0 (1.5–2.4)
Business and financial operations	1,257	1.8 (0.8–2.8)	3,305	2.6 (1.8–3.5)	2.3 (1.6–2.9)
Computer and mathematical	371	1.7 (0.9–2.5)	1,128	2.3 (0.9–3.6)	1.9 (1.1–2.6)
Architecture and engineering	131	1.1 (0.5–1.7)	410	1.4 (0.2–2.6)	1.2 (0.6–1.7)
Life, physical, and social science	179	—	611	2.8 (1.0–4.7)	2.0 (0.9–3.1)
Community and social services	531	—	1,402	3.0 (1.8–4.3)	2.5 (1.5–3.4)
Legal	268	—	680	—	1.8 (0.6–3.0)
Education, training, and library	1,639	2.2 (0.9–3.4)	5,877	3.1 (2.5–3.8)	2.9 (2.3–3.5)
Arts, design, entertainment, sports, and media	467	—	1,212	3.0 (1.7–4.4)	1.7 (1.0–2.4)
Health care practitioners and technical	1,795	—	5,024	2.0 (1.5–2.6)	1.9 (1.4–2.4)
Health care support	1,111	—	2,274	2.7 (1.7–3.8)	2.7 (1.7–3.7)
Protective service	226	2.3 (1.2–3.4)	505	—	2.4 (1.4–3.4)
Food preparation and serving related	1,771	1.7 (0.7–2.6)	3,176	2.4 (1.6–3.2)	2.1 (1.5–2.7)
Building and grounds cleaning and maintenance	963	2.0 (1.1–2.9)	1,835	2.9 (1.8–3.9)	2.4 (1.7–3.1)
Personal care and service	1,396	—	3,099	3.3 (2.4–4.3)	2.8 (2.0–3.6)
Sales and related	2,603	1.0 (0.5–1.4)	5,635	2.5 (1.8–3.3)	1.8 (1.4–2.2)
Office and administrative support	4,762	1.5 (1.0–2.1)	9,218	4.0 (3.3–4.6)	3.3 (2.8–3.8)
Farming, fishing, and forestry	88	2.1 (0.7–3.5)	301	—	1.8 (0.7–2.9)
Construction and extraction	125	1.6 (0.9–2.2)	139	—	1.6 (1.0–2.2)
Installation, maintenance, and repair	81	1.7 (0.8–2.6)	129	—	1.8 (0.9–2.7)
Production	950	1.0 (0.5–1.5)	1,823	4.4 (2.0–6.8)	2.2 (1.3–3.1)
Transportation and material moving	645	1.9 (1.2–2.6)	1,037	4.5 (2.1–6.8)	2.4 (1.7–3.1)
Military	14	—	37	—	—
Refused, not ascertained, don't know	246	—	901	—	1.1 (0.4–1.7)

Abbreviation: CI = confidence interval.

* Proportion of workers who positively answered the question "Have you ever been told by a doctor or other health professional that you had chronic obstructive pulmonary disease, also called COPD?" Proportion of workers who positively answered the question "Have you ever been told by a doctor or other health professional that you had emphysema?" Proportion of workers who were solely identified as having COPD by a positive answer to the question "During the past 12 months, have you been told by a doctor or other health professional that you had chronic bronchitis?" For this report survey respondents with COPD were those who positively answered to any of these three questions.

† Adults who reported "working at a job or business"; "with a job or business but not at work"; or "working, but not for pay, at a family–owned job or business" during the last 12 months of the survey interview and have never smoked. Estimates are weighted to provide national annual estimates for current employment and is presented in thousands.

§ Dashes indicate estimates suppressed because relative standard error for the estimate was ≥30%.

Outbreak of Cyanide Poisoning Caused by Consumption of Cassava Flour — Kasese District, Uganda, September 2017

Phoebe H. Alitubeera, MSc[1]; Patricia Eyu, MPH[1]; Benon Kwesiga, MPH[1]; Alex R. Ario, MD[1]; Bao-Ping Zhu, MD[2,3]

Cassava (*Manihot esculenta*), an edible tuberous root that is resistant to drought, diseases, and pests, is a major source of carbohydrates in tropical areas, the second most widely grown and consumed food in Uganda after bananas, and a staple in the diet for approximately 57% of the Uganda population (Figure 1) (*1*). On September 5, 2017, a funeral was held in Kasese District in western Uganda. Following the funeral, 33 persons with symptoms that included diarrhea, vomiting, and abdominal pains were admitted to Bwera Hospital in Kasese District. On September 8, the Uganda Ministry of Health received notification from the Kasese District health team regarding this outbreak of suspected food poisoning. An investigation to determine the cause of the outbreak and recommend control measures revealed that the outbreak resulted from consumption of a cassava dish made by combining hot water with cassava flour. The implicated batch of cassava flour was traced back to a single wholesaler and found to contain high cyanogenic content. Informed by the investigation findings, police confiscated all cassava flour from retailers identified as the patients' source of the flour. Health education about cyanide poisoning from cassava and the need to adequately process cassava to reduce cyanogenic content was conducted by public health officials.

Epidemiologic Investigation

An investigation into the outbreak was conducted by fellows of the Uganda Public Health Fellowship Program and their supervisors. A probable case was defined as sudden onset of vomiting or diarrhea with one or more of the following signs or symptoms in a resident of one of three Kasese District subcounties during September 1–9, 2017: myalgia, tachycardia, tachypnea, headache, dizziness, lethargy, convulsions, or syncope. Medical records at Bwera Hospital, which has a catchment area covering the three subcounties, were systematically reviewed. Active case-searching was conducted with the help of community leaders.

The investigation identified 98 probable cases, with two deaths (case-fatality rate = 2%). The median patient age was 10 years (range = 11 months–75 years). Reported signs or symptoms included vomiting (95%), diarrhea (87%), malaise (60%), dizziness (48%), tachypnea (27%), syncope (16%), and tachycardia (10%); 6% of patients reported fever. These signs and symptoms suggested cyanide poisoning (*3*). Although the recommended treatment for acute cyanide toxicity is hydroxocobalamin (injectable vitamin B12) (*4*), persons who went to health care facilities were managed on intravenous antibiotics and oral rehydration salts.

The outbreak affected all age groups; the attack rate was similar in males and females, and in all three subcounties, but was lower in persons aged 19–44 years (5.5 per 10,000 population) than in younger or older persons (≤18 years, 15.1 and ≥45 years, 12.1) ($p = 0.003$) (Table 1). Illness onset began a few hours after the funeral on September 5, and continued through September 8 (Figure 2). Among funeral attendees, a peak in cases occurred a few hours after the evening meal at the funeral; among nonattendees, three successively diminishing peaks occurred, each a few hours after the evening meals on September 6, 7, and 8 (Figure 2).

A case-control study was conducted to identify the likely source of the outbreak. Two age-matched (within 5 years) controls for each case-patient were selected from among neighbors of case-patients who had eaten cassava during September 1–9 but did not develop vomiting or diarrhea. A total of 88 case-patients and 176 controls were interviewed in person regarding potential exposures. To account for the matched design, Mantel-Haenszel odds ratios (ORs) and the associated 95% confidence intervals (CIs) were computed, where the stratification variable was the match-set. Analyses were performed using CDC's Epi Info software.

Case-patients were more likely than were controls to have attended the funeral (OR = 40; 95% CI = 5.4–298) and to have purchased their cassava flour from retailers that were supplied by wholesaler A (OR = infinity; 95% CI = 5.6–infinity) (Table 2). When the data were stratified by funeral attendance, all funeral attendees were noted to have eaten cassava purchased from a retailer supplied by wholesaler A. Among nonattendees, 100% of case-patients and 79.2% of controls bought cassava flour from retailers supplied by wholesaler A during the outbreak period (OR = infinity; Fisher's exact 95% CI = 4.3–infinity).

Traceback and Laboratory Investigations

The Uganda Public Health Fellowship Program investigators conducted interviews with area retailers and wholesalers regarding their sources of cassava, and the implicated product was further traced back to its source. Two primary sources

FIGURE 1. Approximately 600 million tropical residents, half of whom live in Africa, rely on cassava as their main food source

Photo/Uganda Public Health Fellowship Program

TABLE 1. Attack rates of cyanide poisoning, by age group, sex, and subcounty during an outbreak caused by eating a cassava flour dish that contained high cyanogenic content — Kasese District, Uganda, September 2017

Characteristic	No. of cases	Population*	Attack rate (per 10,000 population)
Total	**98**	**84,032**	**11.7**
Age group (yrs)†			
0–5	23	15,464	14.9
5–18	49	32,134	15.2
19–44	15	27,321	5.5
≥45	11	9112	12.1
Sex§			
Male	43	41,092	10.5
Female	55	42,940	12.8
Subcounty§			
Bwera	25	17,883	13.7
Ihandiro	19	13,881	14.0
Mpondwe Lubiriha Trading Centre	54	52,268	10.3

* Projected 2017 population based on the 2014 census.
† Differences were statistically significant by Chi-square test ($p = 0.003$).
§ Differences were not statistically significant by Chi-square test ($p>0.05$).

were identified. Farmers grew their own cassava, known as "sweet" cultivars. Residents also bought cassava from retailers, especially for serving at communal gatherings when a large quantity was needed. The retailers bought their cassava flour from wholesalers, who mainly bought from cassava mills in Kasese town, approximately 31 miles (50 km) away. During the outbreak period, wholesaler A was the main supplier to retailers in the three subcounties. Wholesaler A reportedly bought the implicated batch from a town bordering Uganda and Tanzania, approximately 174 miles (280 km) from Kasese; the implicated batch was further traced back to Tanzania. Because this batch cost less than other batches for sale at the time, investigators speculated that it might have been from "wild" cultivars. This suspicion was corroborated by funeral attendees, who described the cassava flour dish served at the funeral as pure white, which is typical of flour from wild cultivars, instead of the creamy-colored flour from sweet cultivars.

Cassava flour samples were obtained for visual inspection and spectrophotometric cyanide testing by the Government Analytical Laboratory in Uganda. The five samples obtained from the implicated batch were pure white in color and contained cyanogenic glycoside that was equivalent to an average of 88 ppm of cyanide (range = 85–90), more than eight times the recommended safe level of 10 ppm (*2*).

Informed by findings of this investigation, police in Kasese District confiscated all sacks of cassava flour from retailers where affected families had purchased the product. Health education was conducted in the communities about cyanide poisoning from cassava and the need to adequately process cassava to reduce the cyanide content.

Discussion

The epidemiologic, traceback, and laboratory investigations indicated that this outbreak of cyanide poisoning resulted from eating cassava with a high cyanogenic content. Patients' signs and symptoms included dizziness, vomiting, tachypnea, syncope, and tachycardia and were consistent with acute cyanide poisoning (*3*,*5*); the absence of fever made infectious etiology unlikely. Symptoms occurred a few hours after meals during which a cassava flour dish was served. This finding was consistent with previous reports, with symptoms typically starting 4–6 hours after ingesting a meal, as the cyanide is released upon digestion of the cyanogenic glycosides (*6*). The case-control study strongly linked the outbreak to cassava flour supplied by wholesaler A, and the traceback investigation suggested that the implicated cassava might have originated in Tanzania. The laboratory investigation found high levels of cyanogenic glycosides in the implicated cassava flour.

Cassava crops are resistant to drought, pests, and diseases, making cassava invaluable for food security, especially in areas plagued by food shortages (*7*). Approximately 600 million tropical residents, half of whom live in Africa, rely on cassava as their main food source (*8*). Acute cyanide poisoning, often with fatal consequences, can occur after eating a large amount of cassava, especially in communities dependent on a monotonous cassava diet (*9*). Recurrent exposure to nonlethal concentrations through a monotonous cassava-based diet leads to long-term effects, including paralytic diseases such as tropical ataxic neuropathy and konzo, a neurologic disease characterized by sudden onset of irreversible, nonprogressive spastic

FIGURE 2. Number of cases of cyanide poisoning from eating a cassava flour dish, by date and 4-hour interval of symptom onset, among funeral attendees and nonattendees — Kasese District, Uganda, September 5–8, 2017

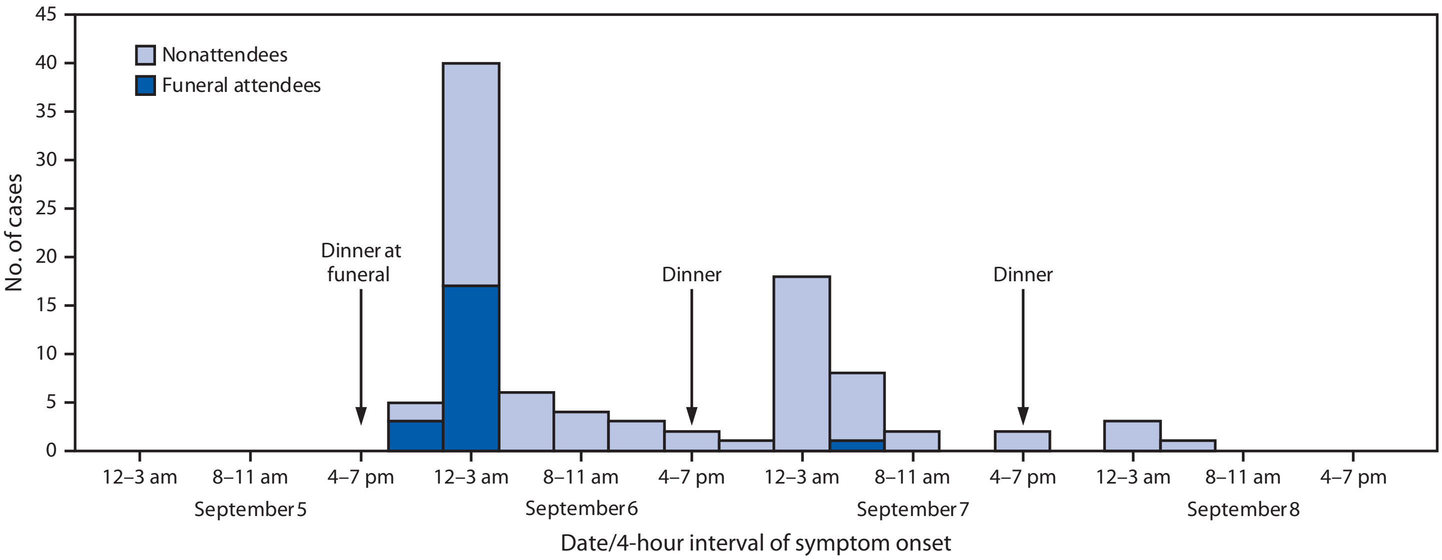

TABLE 2. Exposure factors among case-patients and controls during a cyanide poisoning outbreak caused by eating a cassava flour dish that contained high cyanogenic content — Kasese District, Uganda, September 2017

Exposure factors	Case-patients (N = 88) No. (%)	Controls (N = 176) No. (%)	OR (95% CI)
Attendance at September 5 funeral			
Yes	21 (23.9)	3 (1.7)	40 (5.4–298*)
No	67 (76.1)	173 (98.3)	Referent
Source of cassava during outbreak period			
Ever purchased cassava from retailers supplied by wholesaler A	88 (100.0)	141 (80.1)	Infinity (5.4–infinity*)
Never purchased cassava from retailers supplied by wholesaler A	0 (0)	35 (19.9)	Referent
Among funeral nonattendees†,§			
Ever purchased cassava from retailers supplied by wholesaler A	67 (100.0)	137 (79.2)	Infinity (4.3–infinity¶)
Never purchased cassava from retailers supplied by wholesaler A	0 (0)	36 (20.8)	Referent

Abbreviations: CI = confidence interval; OR = odds ratio.
* Mantel-Haenszel OR and CI.
† 67 case-patients and 173 controls.
§ Association between eating cassava from wholesaler A and illness could not be assessed among attendees at funeral because all funeral attendees ate cassava from wholesaler A.
¶ Fisher's exact OR and CI.

paralysis (*2*). In sub-Saharan Africa, particularly Uganda, Tanzania, and the Democratic Republic of the Congo, thousands of persons might have experienced cyanide poisoning from cassava (*7*,*8*), but the full extent of the problem remains unknown because reliable data are lacking.

Summary

What is already known about this topic?

Cassava, an edible tuberous root often made into flour, contains cyanogenic glycosides, which can result in fatal cyanide poisoning if not properly detoxified by soaking, drying, and scraping before being consumed. Acute cassava-associated cyanide poisoning outbreaks are rarely described.

What is added by this report?

In September 2017, an outbreak of suspected cyanide poisoning, involving 98 cases with two deaths, occurred in western Uganda. Epidemiologic and laboratory investigation identified consumption of a cassava flour dish made from wild cultivars of cassava with high cyanogenic content as the cause of the outbreak.

What are the implications for public health practice?

Education of farmers and consumers about the importance of strict adherence to established methods of degrading cyanogenic glycosides in cassava is essential to prevent cyanide poisoning.

Although wild cassava cultivars have greater yield, higher resistance to pests, and longer storability in the soil than do sweet cultivars, they are bitter, and hence, have a lower market value. In addition, the cyanogenic content of wild cultivars is as high as 2,000 ppm of dry weight (*1*), 200 times the safe level (<10 ppm) recommended by the World Health Organization (*2*). Therefore, wild cultivars are not recommended for human consumption. However, some farmers still plant wild cultivars because of their resilience and high yield (*1*).

Although the cyanogenic content of sweet cassava is substantially less than that of wild cultivars (up to 100 ppm) (*1*), the sweet cassava cultivars still require detoxification before they are consumed; this involves peeling the tubers, soaking them in water for 4–6 days, and sun-drying or roasting them. The outer layer is then scraped off and the remainder ground into flour. This process promotes enzymatic degradation of cyanogenic glycosides. If the soaking or drying time is too short, enzymatic degradation will be inadequate, and cyanogenic glycosides remain high (*5*). During droughts, cassava traders sometimes fail to follow recommended procedures, which can result in a product with high levels of cyanogenic glycosides that can lead to cyanide poisoning (*1*).

A rapid, semiquantitative, colorimetric test that is free to workers in developing countries can be used by relatively untrained persons to quickly determine the cyanogenic potential of cassava flour (*10*). Wholesalers and government food inspectors can use this method to routinely measure cyanogenic content of commercial cassava flour. Farmers and consumers in areas that depend upon cassava should be warned about cyanide poisoning caused by eating improperly processed or wild-cultivar cassava, and instructed to strictly adhere to the established processing methods to degrade cyanogenic glycosides.

Acknowledgments

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Surveillance to Track Progress Toward Polio Eradication — Worldwide, 2017–2018

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When the Global Polio Eradication Initiative (GPEI) began in 1988, cases of poliomyelitis were reported from 125 countries. Since then, only Afghanistan, Nigeria, and Pakistan have experienced uninterrupted transmission of wild poliovirus (WPV). The primary means of detecting poliovirus is through surveillance for acute flaccid paralysis (AFP) among children aged <15 years with testing of stool specimens for WPV and vaccine-derived polioviruses (VDPVs) in World Health Organization (WHO)–accredited laboratories of the Global Polio Laboratory Network (GPLN) (*1*,*2*). AFP surveillance is supplemented by environmental surveillance for polioviruses in sewage at selected locations. Analysis of genomic sequences of isolated polioviruses enables assessment of transmission by time and place, potential gaps in surveillance, and emergence of VDPVs (*3*). This report presents 2017–2018 poliovirus surveillance data, focusing on 31 countries* identified as high-priority countries because of a "high risk of poliovirus transmission and limited capacity to adequately address those risks" (*4*). Some of these countries are located within WHO regions with endemic polio, and others are in regions that are polio-free. In 2018, 26 (84%) of the 31 countries met AFP surveillance indicators nationally; however, subnational variation in surveillance performance was substantial. Surveillance systems need continued strengthening through monitoring, supervision, and improvements in specimen collection and transport to provide sufficient evidence for interruption of poliovirus circulation.

Acute Flaccid Paralysis Surveillance

Two surveillance performance indicators assess the quality of AFP surveillance. The first is the nonpolio AFP (NPAFP) rate (the number of NPAFP cases per 100,000 children aged <15 years per year); an NPAFP rate ≥2 is considered sufficiently sensitive to detect circulating poliovirus. The second indicator is the collection of adequate stool specimens (i.e., two stool specimens collected ≥24 hours apart and within 14 days of paralysis onset) and arrival at a WHO-accredited laboratory by reverse cold chain and in good condition (i.e., without leakage or desiccation) from ≥80% of persons with AFP, which ensures sensitivity and provides the specificity to track poliovirus circulation (*2*).

Among the 47 countries in the WHO African Region (AFR), the NPAFP rate in 2017 was 7.0 per 100,000 children aged <15 years, and 92% of AFP cases had adequate stool specimens; in 2018, the NPAFP rate was 5.4 per 100,000 children aged <15 years, and 89% of the AFP cases had adequate stool specimens. Among the 18 high-priority AFR countries assessed, 15 (83%) met both surveillance indicators nationally in 2018, compared with 13 (72%) in 2017 (Table 1). However, national indicators obscure subnational underperformance (Figure). During 2017–2018, no WPV cases were reported in AFR; however, circulating VDPV type 2 (cVDPV2) cases were reported in four countries. In 2017, the Democratic Republic of the Congo accounted for all 22 reported cVDPV2 cases in AFR; in 2018, 65 cVDPV2 cases were reported in the region, including 20 in the Democratic Republic of the Congo, one in Mozambique, 10 in Niger, and 34 in Nigeria (Table 1).

Among the 21 WHO Eastern Mediterranean Region (EMR) countries, the NPAFP rates in 2017 and 2018 were 8.4 and 9.5 per 100,000 children aged <15 years, respectively, and the respective percentages of AFP cases with adequate stool specimens in 2017 and 2018 were 88% and 90%. In the two countries with endemic WPV transmission, the number of WPV1 cases increased in Afghanistan (from 14 in 2017 to 21 in 2018) and Pakistan (from eight in 2017 to 12 in 2018). In 2017, Syria accounted for all 74 reported cVDPV2 cases in EMR. In 2018, 12 cVDPV cases were reported in Somalia, including five cVDPV2 cases, six cVDPV type 3 (cVDPV3) cases, and one coinfection of both cVDPV type 2 and type 3. Among the 11 high-priority EMR countries evaluated, nine (82%) countries in 2017 and 10 (91%) countries in 2018 met both surveillance indicators nationally; however, as in AFR, national indicators masked subnational underperformance (Table 1) (Figure).

In the WHO Western Pacific Region, 26 cVDPV type 1 (cVDPV1) cases were reported in Papua New Guinea in 2018. Papua New Guinea did not meet either surveillance indicator nationally in 2017, and although the NPAFP rate improved in 2018 (mainly related to implementation of enhanced AFP surveillance as part of the outbreak response), collection of adequate stool specimen remained low. In the WHO South-East Asia Region, one cVDPV1 case was reported in Indonesia

* Afghanistan, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Ethiopia, Guinea, Guinea Bissau, Indonesia, Iraq, Jordan, Kenya, Lebanon, Liberia, Libya, Mali, Mozambique, Niger, Nigeria, Pakistan, Papua New Guinea, Sierra Leone, Somalia, South Sudan, Sudan, Syria, and Yemen.

TABLE 1. National and subnational acute flaccid paralysis (AFP) performance surveillance indicators and number of confirmed wild poliovirus (WPV) and circulating vaccine-derived poliovirus (cVDPV) cases, by country — 31 Global Polio Eradication Initiative 2018–2020 high-priority countries, World Health Organization (WHO) African, Eastern Mediterranean, South-East Asia, and Western Pacific regions, 2017–2018[*]

WHO region/ Country/Year	No. of AFP cases (all ages)	Regional/ National NPAFP rate[†]	Subnational areas with NPAFP rate ≥2 (%)[§]	Regional or national AFP cases with adequate specimens (%)[¶]	Subnational areas with ≥80% adequate specimens (%)	Population living in areas meeting both indicators (%)**	No. of confirmed WPV cases*	No. of confirmed cVDPV cases[*,††]
2017								
African Region	**31,538**	**7**	**N/A**	**92**	**N/A**	**N/A**	**—[¶¶]**	**22**
Burkina Faso	309	3.6	92	85	77	58	—[¶¶]	—[¶¶]
Burundi	145	2.8	53	83	65	11	—[¶¶]	—[¶¶]
Cameroon	970	9.0	100	86	90	75	—[¶¶]	—[¶¶]
Central African Republic	167	8.0	100	80	43	0	—[¶¶]	—[¶¶]
Chad	703	10.0	100	79	52	56	—[¶¶]	—[¶¶]
Democratic Republic of the Congo	2,148	5.1	100	79	42	32	—[¶¶]	22
Equatorial Guinea	12	2.5	57	17	14	0	—[¶¶]	—[¶¶]
Ethiopia	1,096	2.6	73	86	100	49	—[¶¶]	—[¶¶]
Guinea	452	8.4	100	88	100	86	—[¶¶]	—[¶¶]
Guinea Bissau	83	10.6	100	82	67	35	—[¶¶]	—[¶¶]
Kenya	479	2.3	66	83	68	36	—[¶¶]	—[¶¶]
Liberia	81	4.0	100	81	60	63	—[¶¶]	—[¶¶]
Mali	259	2.9	100	86	89	91	—[¶¶]	—[¶¶]
Mozambique	385	2.8	82	85	55	39	—[¶¶]	—[¶¶]
Niger	682	6.2	100	70	0	0	—[¶¶]	—[¶¶]
Nigeria	16,468	19.6	100	98	100	100	—[¶¶]	—[¶¶]
Sierra Leone	78	2.5	100	77	75	57	—[¶¶]	—[¶¶]
South Sudan	388	7.3	90	84	60	67	—[¶¶]	—[¶¶]
Eastern Mediterranean Region	**19,192**	**8.4**	**N/A**	**88**	**N/A**	**N/A**	**22**	**74**
Afghanistan	3,094	20.0	100	94	100	97	14	—[¶¶]
Djibouti	4	1.3	17	100	17	0	—[¶¶]	—[¶¶]
Iraq	699	4.5	95	87	79	74	—[¶¶]	—[¶¶]
Jordan	116	3.3	100	100	100	100	—[¶¶]	—[¶¶]
Lebanon	75	5.3	100	80	83	90	—[¶¶]	—[¶¶]
Libya	88	4.9	100	97	100	100	—[¶¶]	—[¶¶]
Pakistan	10,330	15.0	100	85	100	99	8	—[¶¶]
Somalia	345	5.0	100	99	100	100	—[¶¶]	—[¶¶]
Sudan	570	3.5	100	96	100	100	—[¶¶]	—[¶¶]
Syria	364	4.3	79	76	50	38	—[¶¶]	74
Yemen	713	6.3	100	82	70	68	—[¶¶]	—
South-East Asia Region	**43,390**	**8.1**	**N/A**	**86**	**N/A**	**N/A**	**—[¶¶]**	**—**
Indonesia	1,740	2.4	71	82	47	22	—[¶¶]	—
Western Pacific Region	**6,634**	**2.0**	**N/A**	**90**	**N/A**	**N/A**	**—[¶¶]**	**—**
Papua New Guinea	28	0.9	10	46	15	0	—[¶¶]	—

See table footnotes on next page.

in 2018. Although Indonesia met both surveillance indicators nationally in 2017 and 2018, subnational weaknesses in surveillance were substantial (Table 1) (Figure).

Environmental Surveillance

Environmental surveillance (testing of sewage samples) supplements AFP surveillance by identifying poliovirus transmission in the absence of detected AFP cases (*3*). The number of environmental surveillance sites increased in Afghanistan, Nigeria, and Pakistan from 143 in 2017 to 185 in 2018. Environmental surveillance detected no WPV or cVDPV in Nigeria in 2017; however, 46 cVPDV2 isolates were detected in 2018. Some had been isolated weeks before cases were confirmed. In 2017, four genetic clusters (isolates with ≥95% genetic relatedness) of WPV1 were detected in sewage samples from five provinces in Afghanistan, and seven genetic clusters were detected from 19 districts in Pakistan. In 2018, three WPV1 genetic clusters were detected in sewage samples from seven provinces in Afghanistan and in five clusters from 27 districts in Pakistan. In Pakistan, 16% of sewage samples from 19 districts tested positive for WPV1 in 2017, and 20% from 27 districts tested positive in 2018. Also in 2018, environmental surveillance detected one cVDPV2 isolate in Kenya as well as 19 cVDPV2 and 11 cVDPV3 isolates in Somalia. In Papua New Guinea, environmental surveillance detected

TABLE 1. (*Continued*) National and subnational acute flaccid paralysis (AFP) performance surveillance indicators and number of confirmed wild poliovirus (WPV) and circulating vaccine-derived poliovirus (cVDPV) cases, by country — 31 Global Polio Eradication Initiative 2018–2020 high-priority countries, World Health Organization (WHO) African, Eastern Mediterranean, South-East Asia, and Western Pacific regions, 2017–2018[*]

WHO region/ Country/Year	No. of AFP cases (all ages)	Regional/ National NPAFP rate[†]	Subnational areas with NPAFP rate ≥2 (%)[§]	Regional or national AFP cases with adequate specimens (%)[¶]	Subnational areas with ≥80% adequate specimens (%)	Population living in areas meeting both indicators (%)**	No. of confirmed WPV cases*	No. of confirmed cVDPV cases[*,††]
2018								
African Region	**24,849**	**5.4**	**N/A**	**89**	**N/A**	**N/A**	**—[¶¶]**	**65**
Burkina Faso	357	4.0	100	86	77	58	—[¶¶]	—[¶¶]
Burundi	123	2.4	53	89	71	11	—[¶¶]	—[¶¶]
Cameroon	778	7.2	100	83	80	73	—[¶¶]	—[¶¶]
Central African Republic	133	6.5	86	68	14	0	—[¶¶]	—[¶¶]
Chad	650	9.0	96	90	78	56	—[¶¶]	—[¶¶]
Democratic Republic of the Congo	2,742	6.6	96	78	58	29	—[¶¶]	20
Equatorial Guinea	30	6.2	86	93	71	0	—[¶¶]	—[¶¶]
Ethiopia	1,083	2.5	73	83	55	49	—[¶¶]	—[¶¶]
Guinea	232	4.2	100	89	88	81	—[¶¶]	—[¶¶]
Guinea Bissau	96	12.0	100	78	44	35	—[¶¶]	—[¶¶]
Kenya	644	3.1	85	87	74	36	—[¶¶]	—[¶¶]
Liberia	72	3.6	100	85	67	43	—[¶¶]	—[¶¶]
Mali	292	3.2	100	87	78	91	—[¶¶]	—[¶¶]
Mozambique	463	3.4	91	87	73	39	—[¶¶]	1
Niger	973	8.5	100	81	75	0	—[¶¶]	10
Nigeria	9,400	10.9	100	95	100	100	—[¶¶]	34
Sierra Leone	114	3.5	100	83	75	57	—[¶¶]	—[¶¶]
South Sudan	430	8.0	100	83	60	67	—[¶¶]	—[¶¶]
Eastern Mediterranean Region	**21,834**	**9.5**	**N/A**	**90**	**N/A**	**N/A**	**33**	**12**
Afghanistan	3,376	21.6	100	94	97	98	21	—[¶¶]
Djibouti	0	0	N/A	N/A	N/A	N/A	—[¶¶]	—[¶¶]
Iraq	1,023	6.5	100	90	95	78	—[¶¶]	—[¶¶]
Jordan	115	3.3	100	100	100	100	—[¶¶]	—[¶¶]
Lebanon	89	6.5	100	97	100	94	—[¶¶]	—[¶¶]
Libya	122	6.8	100	96	100	100	—[¶¶]	—[¶¶]
Pakistan	12,190	17.5	100	87	88	99	12	—[¶¶]
Somalia	354	4.9	100	98	100	100	—[¶¶]	12
Sudan	579	3.4	100	97	100	100	—[¶¶]	—[¶¶]
Syria	362	5.5	93	85	86	44	—[¶¶]	—[¶¶]
Yemen	730	6.4	100	92	100	66	—[¶¶]	—[¶¶]
South-East Asia Region	**40,493**	**7.6**	**N/A**	**85**	**N/A**	**N/A**	**—[¶¶]**	**1**
Indonesia	1,636	2.3	62	82	44	22	—[¶¶]	1
Western Pacific Region	**6,828**	**2.0**	**N/A**	**88**	**N/A**	**N/A**	**—[¶¶]**	**26**
Papua New Guinea	282	8.1	82	46	18	0	—[¶¶]	26

Abbreviations: N/A = not applicable; NPAFP = nonpolio acute flaccid paralysis.

* Data as of February 21, 2019.

† Per 100,000 children aged <15 years per year.

§ For all subnational areas regardless of population size.

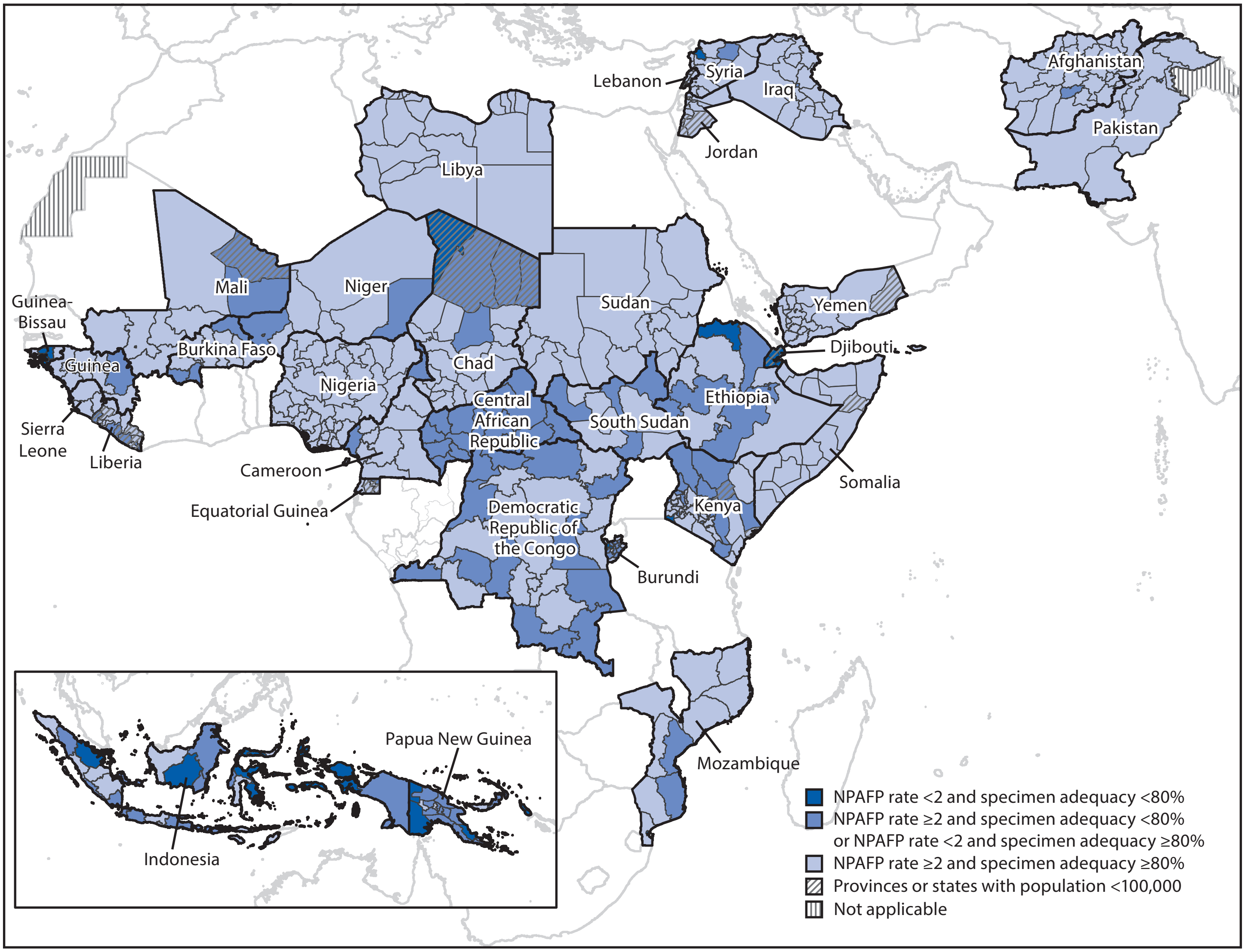
¶ Standard WHO target is adequate stool specimen collection from ≥80% of AFP cases, assessed by timeliness and condition. For this analysis, timeliness was defined as two specimens collected ≥24 hours apart (≥1 calendar day in this data set) and within 14 days of paralysis onset. Good condition was defined as arrival of specimens in a WHO-accredited laboratory with reverse cold chain maintained and without leakage or desiccation.

** Percentage of the country's population living in subnational areas that met both surveillance indicators (NPAFP rates ≥2 per 100,000 children aged <15 years per year and ≥80% of AFP cases with adequate specimens).

†† cVDPV was associated with at least one case of AFP with evidence of community transmission and genetically linked. Guidelines for classification of cVDPV can be found at http://polioeradication.org/wp-content/uploads/2016/09/Reporting-and-Classification-of-VDPVs_Aug2016_EN.pdf.

¶¶ Dashes indicate that no confirmed cases were detected.

FIGURE. Combined performance indicators for the quality of acute flaccid paralysis surveillance in subnational areas of 31 countries identified as Global Polio Eradication Initiative high-priority countries during 2018–2020 — World Health Organization African, Eastern Mediterranean, South-East Asia, and Western Pacific regions, 2018



Abbreviation: NPAFP = nonpolio acute flaccid paralysis.

seven cVDPV1 isolates from two provinces in 2018. As part of the GPEI's global environmental surveillance expansion plan,[†] environmental surveillance is conducted in 44 countries without active WPV transmission, including 24 in AFR.

Global Polio Laboratory Network

GPLN consists of 146 quality-assured poliovirus laboratories in the six WHO regions. GPLN laboratories implement standardized protocols to 1) isolate and identify polioviruses; 2) conduct intratypic differentiation (ITD) to identify WPV, Sabin (vaccine) poliovirus, and VDPV; and 3) conduct genomic sequencing. Poliovirus transmission pathways are monitored through analysis of the viral capsid protein (VP1) coding region sequences from isolates. Standard timeliness indicators specify that laboratories should report ≥80% of poliovirus culture results within 14 days of specimen receipt, ≥80% of ITD results within 7 days of isolate receipt, and ≥80% of sequencing results within 7 days of ITD result. The combined field and laboratory performance indicator is to report ITD results for ≥80% of isolates within 60 days of paralysis onset in AFP cases. The accuracy and quality of testing at GPLN laboratories are monitored through an

[†] http://polioeradication.org/wp-content/uploads/2016/07/9.6_13IMB.pdf.

TABLE 2. Number of poliovirus isolates from stool specimens of persons with acute flaccid paralysis (AFP) and timing of results, by World Health Organization (WHO) region — 2017 and 2018*

WHO region/Year	No. of specimens	No. of poliovirus isolates			% Poliovirus isolation results within 7 days of receipt at laboratory	% ITD results within 7 days of receipt of specimen	% ITD results within 60 days of paralysis onset
		Wild†	Sabin§	cVDPV¶			
African Region							
2017	65,245	0	1,663	22	97	80	98
2018	51,292	0	2,547	65	94	98	96
Americas Region							
2017	1,755	0	14	0	83	100	100
2018	1,866	0	47	0	86	100	100
Eastern Mediterranean Region							
2017	35,602	22	2,521	74	98	99	97
2018	40,419	33	1,749	12	92	99	97
European Region							
2017	3,480	0	73	0	83	92	90
2018	3,274	0	71	0	84	92	62
South-East Asia Region							
2017	82,292	0	2,251	0	91	96	99
2018	79,566	0	1,970	1	97	100	99
Western Pacific Region							
2017	13,370	0	140	0	96	97	90
2018	13,638	0	348	26	97	99	68
Total**							
2017	**201,546**	**22**	**6,662**	**96**	**94**	**91**	**98**
2018	**190,055**	**33**	**6,732**	**104**	**95**	**99**	**95**

Abbreviations: cVDPV = circulating vaccine-derived poliovirus; ITD = intratypic differentiation; VP1 = viral capsid protein.
* Data as of March 4, 2019.
† Number of AFP cases with wild poliovirus isolates.
§ Either 1) concordant Sabin-like results in ITD test and vaccine-derived poliovirus screening or 2) ≤1% VP1 nucleotide sequence difference compared with Sabin vaccine virus (≤0.6% for type 2).
¶ For poliovirus types 1 and 3, ≥10 VP1 nucleotide differences from the respective poliovirus; for poliovirus type 2, ≥6 VP1 nucleotide differences from Sabin type 2 poliovirus.
** For the last three indicators, total represents weighted percentage of regional performance.

annual accreditation program of onsite reviews and proficiency testing (*5*). An accreditation checklist was implemented in 2017 for laboratories testing sewage samples.

GPLN tested 201,546 stool specimens from AFP cases in 2017 and 190,055 in 2018 (Table 2). WPV1 was isolated in specimens from 22 AFP patients in 2017 and 33 patients in 2018. cVDPVs were isolated from 96 patients in 2017 and 104 patients in 2018. GPLN laboratories in all regions met timeliness indicators for poliovirus isolation and ITD. All regions met the overall timeliness indicator for onset to ITD results in both years except the European and Western Pacific Regions in 2018.

In 2018, South Asia genotype (the only WPV1 genotype circulating globally since 2016) was detected in Afghanistan and Pakistan, with frequent cross-border transmission between the two countries. Compared with the previous report (*1*), sequence analysis indicates a reduction in the number of orphan WPV1 isolates (those with less genetic relatedness [≤98.5% in VP1] to other isolates) from AFP patients, from three in 2017 to zero in 2018, indicating that gaps in AFP surveillance might be closing; sensitive surveillance identifies AFP cases with isolates that are closely related. However, the net genetic diversity of WPV1 isolates in Afghanistan and Pakistan has remained constant for the last 3 years because of the persistent circulation of many poliovirus lineages in the reservoirs of these countries. In 2018, cVDPVs, most with extended divergence from the Sabin strain (genetic relatedness = 94%–98.5% identity), were isolated from stool specimens of AFP patients and from sewage samples, identifying nine cVDPV emergences during 2018 in seven countries (Democratic Republic of the Congo, Indonesia, Mozambique, Niger, Nigeria, Papua New Guinea, and Somalia) (*6*,*7*).

Discussion

Although most of the 31 GPEI high-priority countries evaluated met national-level AFP performance indicators, considerable variation and deficiencies existed at subnational levels. No substantial improvements were noted in surveillance indicators for these 31 countries from 2017 to 2018. For most of the evaluated AFR countries, the primary deficiency was the low percentage of AFP cases with adequate specimens, which is most often the result of delayed case detection after paralysis onset.

Summary

What is already known about this topic?

Sensitive acute flaccid paralysis surveillance is the cornerstone of polio eradication programs.

What is added by this report?

This report presents 2017–2018 poliovirus surveillance data, focusing on 31 countries identified as high-priority countries by the Global Polio Eradication Initiative. In 2018, 26 (84%) of the 31 countries met acute flaccid paralysis surveillance indicators nationally; however, subnational variation in surveillance performance was substantial, and no improvements were noted from 2017 to 2018.

What are the implications for public health practice?

Surveillance systems need continued strengthening through monitoring, supervision, and improvements in specimen collection and transport to provide sufficient evidence for interruption of poliovirus circulation.

In the three countries with endemic WPV transmission, subnational surveillance performance indicators have been high for several years, even at the district level. In Nigeria, no WPV1 was detected during August 2014–July 2016; however, during August–September 2016, WPV1 cases were detected in Borno State. Effective AFP surveillance did not take place in vast insurgent-held areas of Borno during 2013–2016. Since 2016, more areas have become accessible, and Nigeria has enhanced case detection and reporting by community-based informants residing in currently inaccessible areas (*8*). AFR will be considered for WPV-free certification in early 2020, and careful examination of the extent of quality surveillance will be needed to certify the region WPV-free.

Genomic analyses indicated that the cVDPV1s in Indonesia and Papua New Guinea were circulating several years before detection. Papua New Guinea has experienced chronic national and subnational deficiencies in AFP case detection and adequate specimen collection and transport. Subnational surveillance gaps in Indonesia have been identified previously (*9*). cVDPV outbreaks in regions with endemic polio and those that are polio-free underscore the need to maintain sensitive poliovirus surveillance everywhere to rapidly detect and respond to outbreaks.

AFP surveillance has been complemented by environmental surveillance in high-risk areas, which has allowed detection of cVDPVs before identification of paralyzed patients, as well as documentation of continued circulation of WPV1 in the reservoir areas of Afghanistan and Pakistan despite low-level WPV1 case confirmation. In the long term, continued environmental surveillance will be needed to monitor for poliovirus circulation in high-risk areas.

The findings in this report are subject to at least two limitations. First, issues relating to security, hard-to-reach populations, and other factors could affect AFP surveillance indicators and limit their interpretation. Second, high NPAFP rates do not necessarily indicate highly sensitive surveillance because not all cases reported as AFP cases meet the AFP definition and some actual AFP cases might not be detected by weak surveillance systems.

Strong AFP surveillance, which is essential for global certification of polio eradication, includes timely case detection, notification, and investigation as well as adequate stool collection and transport (*10*). External technical and financial support to enhance surveillance has been provided to all seven countries with cVDPV outbreaks and to the other 24 high-priority countries. The Global Polio Surveillance Action Plan, 2018–2020 (*4*), specifies which tasks are to be undertaken at the country level; support is tailored to countries' needs. Routine monitoring of AFP surveillance performance indicators at subnational levels and supervision of active surveillance by field personnel are critical to achieving sensitive poliovirus surveillance. Leading up to certification of WPV eradication, integrating AFP surveillance with surveillance for other vaccine-preventable and outbreak-prone diseases will have the advantage of maximizing field surveillance capacity and performance (*10*).

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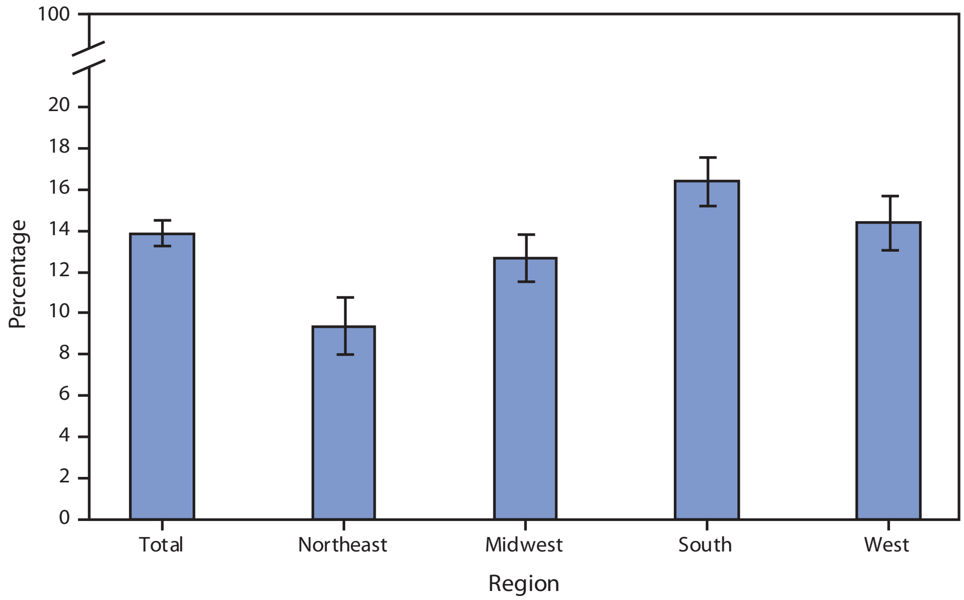
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age-Adjusted Percentages* of Adults Aged ≥18 Years Without a Usual Place of Health Care,† by Region§ — National Health Interview Survey, 2017¶



* With 95% confidence intervals indicated with error bars.

† Based on a survey question that asked respondents, "Is there a place that you usually go to when you are sick or need advice about your health?" Persons who responded with a "yes" or "there is more than one place" were considered to have a usual place of health care, and persons who said "there is no place" were considered to be without a usual place of health care. Respondents who refused to answer or said they didn't know were considered unknown and excluded from the analysis.

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

¶ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population, are shown for sample adults aged ≥18 years, and are age-adjusted using the projected 2000 U.S. population as the standard population and using four age groups: 18–44, 45–64, 65–74, and ≥75 years.

Among adults aged ≥18 years, 13.9% were without a usual place of health care in 2017. Adults in the South (16.4%) were more likely be without a usual place of health care compared with adults in the West (14.4%) and Midwest (12.7%). Adults in the Northeast (9.4%) were least likely to be without a usual place of health care.

Source: Tables of Summary Health Statistics, 2017. https://ftp.cdc.gov/pub/Health_Statistics/NCHS/NHIS/SHS/2017_SHS_Table_A-16.pdf.

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