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Patterns and Characteristics of Methamphetamine Use Among Adults — United States, 2015–2018

Christopher M. Jones, PharmD, DrPH[1]; Wilson M. Compton, MD[2]; Desiree Mustaquim, MPH[3]

Methamphetamine is a highly addictive central nervous system stimulant. Methamphetamine use is associated with a range of health harms, including psychosis and other mental disorders, cardiovascular and renal dysfunction, infectious disease transmission, and overdose (*1*,*2*). Although overall population rates of methamphetamine use have remained relatively stable in recent years (*3*), methamphetamine availability and methamphetamine-related harms (e.g., methamphetamine involvement in overdose deaths and number of treatment admissions) have increased in the United States* (*4*,*5*); however, analyses examining methamphetamine use patterns and characteristics associated with its use are limited. This report uses data from the 2015–2018 National Surveys on Drug Use and Health (NSDUHs) to estimate methamphetamine use rates in the United States and to identify characteristics associated with past-year methamphetamine use. Rates (per 1,000 adults aged ≥18 years) for past-year methamphetamine use were estimated overall, by demographic group, and by state. Frequency of past-year use and prevalence of other substance use and mental illness among adults reporting past-year use were assessed. Multivariable logistic regression examined characteristics associated with past-year use. During 2015–2018, the estimated rate of past-year methamphetamine use among adults was 6.6 per 1,000. Among adults reporting past-year methamphetamine use, an estimated 27.3% reported using on ≥200 days, 52.9% had a methamphetamine use disorder, and 22.3% injected methamphetamine. Controlling for other factors, higher adjusted odds ratios for past-year use were found among men; persons aged 26–34, 35–49, and ≥50 years; and those with lower educational attainment, annual household income <$50,000, Medicaid only or

* https://www.nflis.deadiversion.usdoj.gov/DesktopModules/ReportDownloads/Reports/12568NFLISdrugMethamphetamine.pdf.

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no insurance, those living in small metro and nonmetro counties,† and those with co-occurring substance use and co-occurring mental illness. Additional efforts to build state and local prevention and response capacity, expand linkages to care, and enhance public health and public safety collaborations are needed to combat increasing methamphetamine harms.

Data are from 171,766 adults participating in the 2015–2018 NSDUHs, managed by the Substance Abuse and Mental Health Services Administration.§ NSDUHs collected information about the use of drugs, alcohol, and tobacco through in-person interviews with noninstitutionalized U.S. civilians aged ≥12 years. An independent, multistage area probability sample design for each state and the District of Columbia allows for production of national and state estimates. The average overall weighted response rate for the 2015–2018 NSDUHs was 51%. NSDUH variables included sex, age, race/ethnicity, urbanization status of county, education, annual household income, insurance status, and self-reported substance use, mental illness status, and receipt of substance use treatment. Self-reported substance use in NSDUHs included lifetime and past-year use of methamphetamine; past-year use of cocaine and heroin; past-year misuse of prescription opioids, sedatives, tranquilizers, and stimulants; past-month binge drinking (i.e., drinking five or more [men] or four or more [women] drinks on the same occasion on ≥1 day within the past month); and past-month nicotine dependence as determined using the Nicotine Dependence Syndrome Scale (*6*). NSDUHs assessed past-year substance use disorders for specific substances (e.g., methamphetamine) using self-reported responses to questions based on the individual diagnostic criteria from the *Diagnostic and Statistical Manual of Mental Disorders*, *Fourth Edition* (DSM-IV). Using a predictive model, past-year any mental illness and serious mental illness¶ were determined for each adult NSDUH respondent.

† The Rural-Urban Continuum Codes are hierarchical, mutually exclusive classifications for all U.S. counties created by the U.S. Department of Agriculture. All population counts are from the 2010 Census representing the resident population. Large metro = counties in metro areas with a population ≥1 million persons. Small metro = counties in metros areas with populations between 250,000–1,000,000; counties in metro areas with populations <250,000. Nonmetro = counties with urban populations ≥20,000 adjacent to a metro area; urban populations ≥20,000 not adjacent to a metro area; urban populations 2,500–19,999 adjacent to a metro area; urban populations 2,500–19,999 not adjacent to a metro area; rural or <2,500 urban populations adjacent to a metro area; and rural or <2,500 urban population not adjacent to a metro area. https://seer.cancer.gov/seerstat/variables/countyattribs/ruralurban.html.

§ https://www.samhsa.gov/data/report/2017-methodological-summary-and-definitions.

¶ Any mental illness is defined as currently or at any time within the past year having had a diagnosable mental disorder (excluding developmental disorders and substance use disorder) of sufficient duration to meet DSM-IV diagnostic criteria. Serious mental illness is defined as currently or at any time within the past year having had a mental disorder (excluding developmental disorders and substance use disorder) of sufficient duration to meet DSM-IV diagnostic criteria, which resulted in serious functional impairment substantially interfering with or limiting one or more major life activities. https://www.samhsa.gov/data/report/2017-methodological-summary-and-definitions.

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Using public-use-file data** from combined 2015–2018 NSDUHs, weighted counts, annual average rates per 1,000 adults, and corresponding 95% confidence intervals (CIs) were estimated for lifetime methamphetamine use and past-year methamphetamine use overall and by demographic, substance use, and mental illness variables. Estimates and 95% CIs for frequency of methamphetamine use and prevalence of past-year methamphetamine use disorder, methamphetamine injection, receipt of substance use treatment, other substance use, and mental illness among adults reporting past-year use were determined. Multivariable logistic regression examined characteristics associated with past-year methamphetamine use, controlling for demographic, substance use, and mental illness variables. Results are presented as adjusted odds ratios and 95% CIs. No multicollinearity or potential interaction effects between examined variables in the final model were observed. Restricted access 2017–2018 NSDUH data were used to estimate state rates of past-year methamphetamine use per 1,000 adults. NSDUHs use 2010 census-based population estimates (*3*). Stata (version 15.1; StataCorp) was used to account for the NSDUH complex survey design and sample weights.

During 2015–2018, the estimated annual average rate of lifetime methamphetamine use was 59.7 per 1,000 adults, or 14,686,900 adults on average each year. The estimated rate of past-year use was 6.6 per 1,000, or 1,626,200 adults on average each year (Table 1). Estimated rates of past-year use were 8.7 for men and 4.7 for women. The highest estimated rates were among adults aged 26–34 (11.0), 18–25 (9.3), and 35–49 (8.3) years and among non-Hispanic whites (7.5), Hispanics (6.7), and non-Hispanic other races (5.6). Estimated rates of past-year use also varied by the other demographic, substance use, and mental illness variables assessed. During 2017–2018 rates of past-year methamphetamine use ranged from 2.76 in New York to 13.98 in Nevada; generally, rates were higher in the western United States than in the East (Supplementary Figure, https://stacks.cdc.gov/view/cdc/85704).

Among adults reporting past-year methamphetamine use, an estimated 36.2%, 19.2%, 17.2%, and 27.3% reported using methamphetamine 1–29 days, 30–99 days, 100–199 days, and ≥200 days, respectively; 22.3% reported injecting methamphetamine (Figure). Approximately one half (52.9%) of adults who reported past-year methamphetamine use met diagnostic criteria for past-year methamphetamine use disorder. Among those with past-year methamphetamine use disorder, an estimated 31.5% received any substance use treatment within the past year.

Among adults using methamphetamine within the past year, estimated prevalences of past-year use or misuse of other substances included cannabis use (68.7%), prescription opioid misuse (40.4%), cocaine use (30.4%), prescription sedative or tranquilizer misuse (29.1%), prescription stimulant misuse (21.6%), and heroin use (16.9%). Past-month binge drinking was reported by an estimated 46.4% and nicotine dependence by 44.3%. Mental illness was common also; of persons who used methamphetamine, an estimated 57.7% reported any mental illness, and 25.0% reported serious mental illness during the past year.

Multivariable logistic regression analysis found increased odds of past-year methamphetamine use among men; persons aged 26–34, 35–49, and ≥50 years (versus persons aged 18–25 years); persons with less than a high school diploma, a high school diploma, and some college or associate's degree (versus college graduates); those with annual household income <$20,000 or $20,000–$49,999 (versus ≥$75,000); persons having Medicaid only or being uninsured (versus private or other insurance); persons living in small metro and nonmetro counties (versus large metro counties); persons reporting past-month nicotine dependence; those reporting past-year use of cannabis, cocaine, and heroin; persons reporting misuse of prescription opioids, sedatives, tranquilizers, or stimulants; and persons reporting past-year mental illness but not serious mental illness or past-year serious mental illness (versus no past-year mental illness). Non-Hispanic black race/ethnicity was associated with lower odds of past-year methamphetamine use compared with non-Hispanic white race/ethnicity (Table 2).

Discussion

In the United States during 2015–2018, approximately 1.6 million adults, on average, used methamphetamine each year, and nearly 25% of those reported injecting methamphetamine. In addition, approximately 50% of persons using methamphetamine in the past year met diagnostic criteria for past-year methamphetamine use disorder, yet fewer than one third of adults with past-year methamphetamine use disorder received substance use treatment in the past year. Particularly concerning were high rates of co-occurring substance use or mental illness among adults using methamphetamine.

These findings provide new insights into populations to prioritize for prevention and response efforts, such as men, middle aged adults, and rural residents. Identification of higher rates of methamphetamine use in small metro and nonmetro areas are important given difficulties in delivering services to rural populations who might be disproportionately affected by methamphetamine use. Attention has been drawn to infectious disease transmission associated with opioid injection in these areas (*7*); the long-standing challenges with lower economic resources, prevalent substance use, and limited treatment availability also place these areas at risk for infectious disease

** https://datafiles.samhsa.gov/info/browse-studies-nid3454.

TABLE 1. Methamphetamine use among adults aged ≥18 years by demographic, substance use, and mental health characteristics — United States, 2015–2018

Characteristic	Past-year methamphetamine use: Annual average no. of adults aged ≥18 years (weighted)	Past-year methamphetamine use: Annual average rate per 1,000 adults aged ≥18 years (95% CI)
Overall lifetime use	**14,686,900**	**59.7 (58.1–61.4)**
Overall past-year use	**1,626,200**	**6.6 (6.1–7.1)**
Past-year use by demographic characteristic		
Sex		
Women	598,300	4.7 (4.2–5.2)
Men	1,027,900	8.7 (7.9–9.5)
Age group (yrs)		
18–25	320,000	9.3 (8.3–10.4)
26–34	431,200	11.0 (9.7–12.5)
35–49	507,900	8.3 (7.3–9.5)
≥50	367,100	3.2 (2.8–3.9)
Race/Ethnicity		
White, non-Hispanic	1,180,200	7.5 (6.9–8.2)
Black, non-Hispanic	72,000	2.5 (1.8–3.4)
Other, non-Hispanic	113,000	5.6 (4.4–7.2)
Hispanic	260,900	6.7 (5.5–8.1)
Education level		
Less than high school diploma	394,600	12.4 (10.8–14.3)
High school graduate	563,300	9.2 (8.1–10.4)
Some college or associate's degree	527,300	6.9 (6.1–7.9)
Bachelor's degree or higher	141,000	1.8 (1.3–2.5)
Annual household income		
<$20,000	640,700	15.6 (13.8–17.7)
$20,000–49,999	552,000	7.6 (6.6–8.6)
$50,000–74,999	169,100	4.3 (3.4–5.5)
≥$75,000	264,300	2.9 (2.4–3.4)
Insurance status		
Private or other insurance (including Medicare)	704,900	3.6 (3.1–4.1)
Medicaid only	524,600	20.9 (18.5–23.5)
Uninsured	396,700	16.4 (13.9–19.2)
County type of residence*		
Large metro	711,200	5.2 (4.6–5.8)
Small metro	583,100	7.9 (6.6–9.5)
Nonmetro	331,900	9.5 (8.2–11.0)
Substance use†		
Past-month binge drinking	753,900	11.6 (10.2–13.0)
Past-month nicotine dependence	719,900	39.0 (35.1–43.4)
Past-year marijuana use	1,118,000	30.6 (27.9–33.6)
Past-year cocaine use	493,500	94.7 (83.5–107.1)
Past-year heroin use	275,600	315.7 (267.8–367.8)
Past-year prescription opioid misuse	657,100	63.2 (56.4–70.9)
Past-year prescription sedative/tranquilizer misuse	473,400	74.0 (66.9–81.7)
Past-year prescription stimulant misuse	350,900	69.6 (61.2–79.0)
Mental health		
No past-year mental illness	688,300	3.4 (3.1–3.8)
Past-year mental illness but not serious mental illness§	531,900	15.3 (13.5–17.3)
Past-year serious mental illness¶	406,000	37.6 (32.1–43.9)

Source: National Surveys on Drug Use and Health, 2015–2018, using 2010 U.S. Census–based population estimates.

Abbreviations: CI = confidence interval; DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*.

* The Rural-Urban Continuum Codes are hierarchical, mutually exclusive classifications for all U.S. counties created by the U.S. Department of Agriculture. All population counts are from the 2010 Census representing the resident population. *Large metro* = counties in metro areas with a population ≥1 million persons. *Small metro* = counties in metros areas with populations between 250,000–1,000,000; counties in metro areas with populations <250,000. *Nonmetro* = counties with urban populations ≥20,000 adjacent to a metro area; urban populations ≥20,000 not adjacent to a metro area; urban populations 2,500–19,999 adjacent to a metro area; urban populations 2,500–19,999 not adjacent to a metro area; rural or <2,500 urban populations adjacent to a metro area; and rural or <2,500 urban population not adjacent to a metro area. https://seer.cancer.gov/seerstat/variables/countyattribs/ruralurban.html.

† Among adults engaging in substance use behavior.

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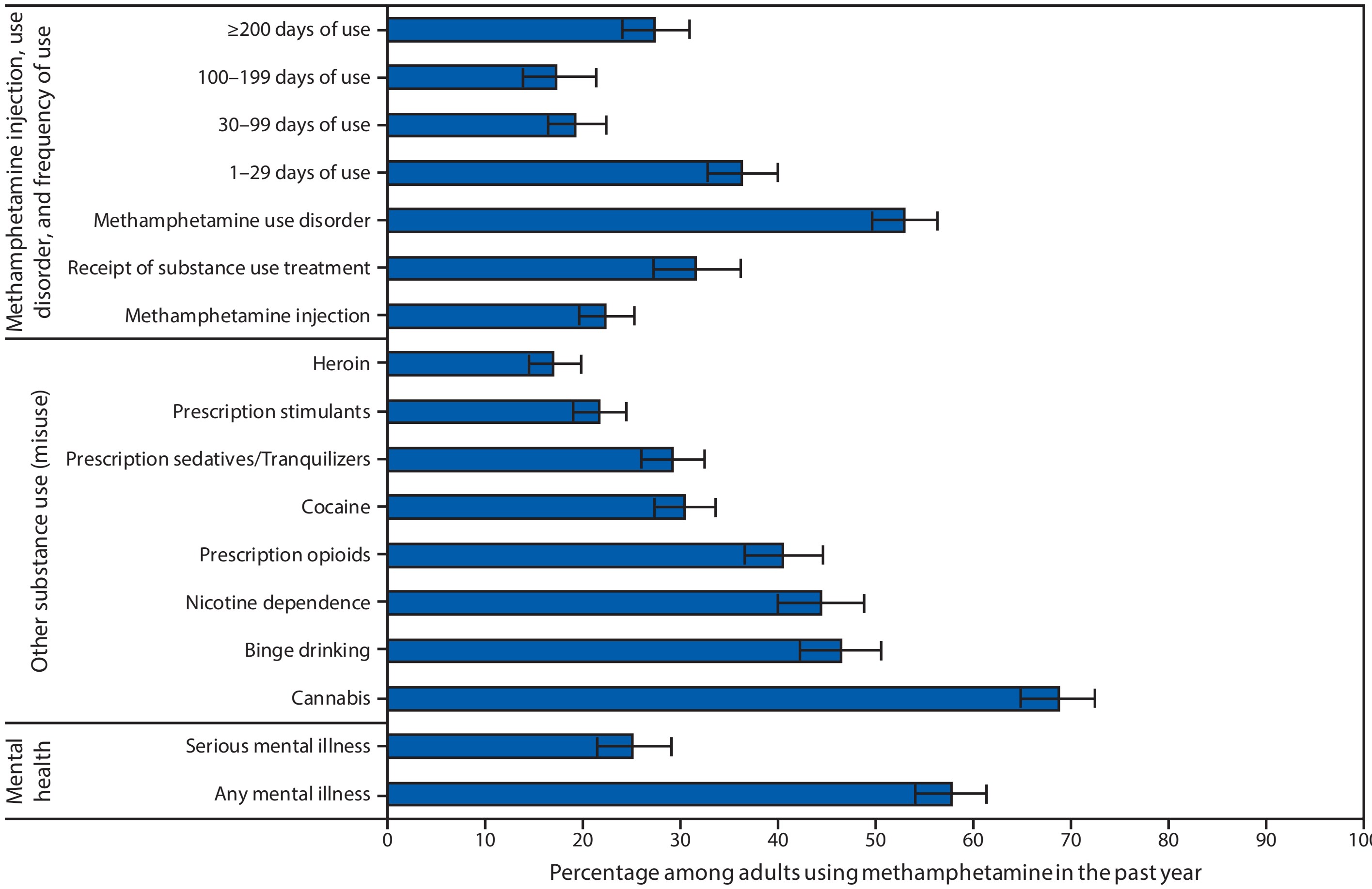
¶ Serious mental illness is defined as currently or at any time within the past year having had a mental disorder (excluding developmental disorders and substance use disorders of sufficient duration to meet DSM-IV diagnostic criteria, which resulted in serious functional impairment substantially interfering with or limiting one or more major life activities). https://www.samhsa.gov/data/report/2017-methodological-summary-and-definitions.

FIGURE. Methamphetamine injection, use disorder, frequency of use, receipt of substance use treatment,* other substance use,† and mental illness among adults aged ≥18 years reporting past-year methamphetamine use — United States, 2015–2018§



Source: National Surveys on Drug Use and Health, 2015–2018, using 2010 U.S. Census–based population estimates.
* Receipt in past year among those with a methamphetamine use disorder; all other percentages are among adults reporting past-year methamphetamine use.
† Binge drinking and nicotine dependence reported within the past month; all other substances are within the past year.
§ Weighted percentages; error bars represent 95% confidence intervals.

outbreaks associated with methamphetamine injection. Expansion of evidence-based substance use treatment, syringe services programs, and other community-based interventions aimed at reducing use, including injection, are needed.

Given the high rates of co-occurring substance use identified, along with trends of increasing opioid-related overdose deaths and treatment admissions that involve methamphetamine (*4*,*5*), prevention and treatment efforts will need to be comprehensive and broad-based. Universal preventive interventions such as Promoting School-Community-University Partnerships to Enhance Resilience (PROSPER) have resulted in lasting protective effects on youth substance use generally, and for methamphetamine use and opioid misuse specifically (*8*). Promising treatment strategies for methamphetamine use disorder are those that use evidence-based psychosocial approaches (e.g., community reinforcement or cognitive-behavioral therapy) combined with contingency management, where rewards are provided to reinforce positive behavior (*9*). The finding of increased odds of methamphetamine use among adults with lower socioeconomic indicators underscores the importance of recovery support services and linkage to social service providers.

The overlap of methamphetamine use with mental illness, especially serious mental illness, suggests an important role for mental health providers to engage in care with this population, in coordination with addiction and other health care providers. Treatment of co-occurring mental and substance use disorders has been a recognized gap in the system of care (*10*) and persons who use methamphetamine might be particularly affected.

The findings in this report are subject to at least four limitations. First, NSDUH data are self-reported and subject to recall and social desirability biases. Second, because the survey is cross-sectional and different persons were sampled

TABLE 2. Characteristics associated with past-year methamphetamine use among adults aged ≥18 years — United States, 2015–2018

Characteristic	Adjusted odds ratios* (95% CI)
Sex	
Women	Reference
Men	1.68 (1.43–1.96)
Age group (yrs)	
18–25	Reference
26–34	1.67 (1.36–2.05)
35–49	2.49 (2.01–3.07)
≥50	1.72 (1.31–2.25)
Race/Ethnicity	
White, non-Hispanic	Reference
Black, non-Hispanic	0.29 (0.20–0.42)
Other, non-Hispanic	1.07 (0.78–1.47)
Hispanic	1.08 (0.85–1.37)
Education level	
Less than high school	3.28 (2.13–5.06)
High school graduate	2.65 (1.78–3.93)
Some college or associate's degree	2.04 (1.38–3.02)
Bachelor's degree or higher	Reference
Annual household income	
<$20,000	2.09 (1.59–2.74)
$20,000–49,999	1.42 (1.11–1.82)
$50,000–74,999	1.06 (0.77–1.46)
≥$75,000	Reference
Insurance status	
Private or other insurance (including Medicare)	Reference
Medicaid only	2.01 (1.55–2.61)
Uninsured	1.70 (1.31–2.22)
County type of residence†	
Large metro	Reference
Small metro	1.32 (1.01–1.72)
Nonmetro	1.54 (1.25–1.90)
Substance use§	
Past-month binge drinking	1.06 (0.86–1.30)
Past-month nicotine dependence	2.14 (1.75–2.62)
Past-year cannabis use	4.61 (3.67–5.80)
Past-year cocaine use	2.72 (2.12–3.50)
Past-year heroin use	5.10 (3.63–7.17)
Past-year prescription opioid misuse	2.17 (1.66–2.84)
Past-year prescription sedative/tranquilizer misuse	1.85 (1.45–2.35)
Past-year prescription stimulant misuse	1.91 (1.43–2.55)
Mental health	
No past-year mental illness	Reference
Past-year mental illness but not serious mental illness¶	2.18 (1.82–2.60)
Past-year serious mental illness**	3.34 (2.53–4.40)

Source: National Surveys on Drug Use and Health, 2015–2018, using 2010 U.S. Census–based population estimates.
Abbreviations: CI = confidence interval; DSM-IV = *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*.
* Odds ratios are adjusted for all other variables in the model.
† The Rural-Urban Continuum Codes are hierarchical, mutually exclusive classifications for all U.S. counties created by the U.S. Department of Agriculture. All population counts are from the 2010 Census representing the resident population. *Large metro* = counties in metro areas with a population ≥1 million persons. *Small metro* = counties in metros areas with populations between 250,000–1,000,000; counties in metro areas with populations <250,000. *Nonmetro* = counties with urban populations ≥20,000 adjacent to a metro area; urban populations ≥20,000 not adjacent to a metro area; urban populations 2,500–19,999 adjacent to a metro area; urban populations 2,500–19,999 not adjacent to a metro area; rural or <2,500 urban populations adjacent to a metro area; and rural or <2,500 urban population not adjacent to a metro area. https://seer.cancer.gov/seerstat/variables/countyattribs/ruralurban.html.
§ Reference group is no use (misuse) within the past month (past year).
¶ Any mental illness is defined as currently or at any time within the past year having had a diagnosable mental disorder (excluding developmental disorders and substance use disorder of sufficient duration to meet DSM-IV diagnostic criteria). https://www.samhsa.gov/data/report/2017-methodological-summary-and-definitions. For this analysis where the variable was defined as past-year mental illness, not serious mental illness, persons meeting criteria for serious mental illness were not included.
** Serious mental illness is defined as currently or at any time within the past year having had a mental disorder (excluding developmental disorders and substance use disorder of sufficient duration to meet DSM-IV diagnostic criteria, which resulted in serious functional impairment substantially interfering with or limiting one or more major life activities). https://www.samhsa.gov/data/report/2017-methodological-summary-and-definitions.

Summary

What is already known about this topic?

Methamphetamine is a highly addictive central nervous system stimulant. In recent years, methamphetamine availability and methamphetamine-related harms have been increasing in the United States.

What is added by this report?

During 2015–2018, an estimated 1.6 million U.S. adults aged ≥18 years, on average, reported past-year methamphetamine use; 52.9% had a methamphetamine use disorder, and 22.3% reported injecting methamphetamine within the past year. Co-occurring substance use and mental illness were common among those who used methamphetamine within the past year.

What are the implications for public health practice?

Efforts to build state and local prevention and response capacity, expand linkages to care, and enhance public health and public safety collaborations are needed to combat rising methamphetamine availability and related harms.

each year, inferring causality from the observed associations between the predictors examined and self-reported past-year methamphetamine use is not possible. Third, NSDUHs do not include homeless persons not living in shelters, active duty military, or persons residing in institutions such as those who are incarcerated; thus, substance use estimates in this study might not be generalizable to the total U.S. population. Finally, NSDUHs provide estimates of persons meeting diagnostic criteria for methamphetamine use disorder based on self-reported responses to the individual questions that make up the DSM-IV diagnostic criteria for methamphetamine use disorder, not estimates of the number of persons receiving a diagnosis from a health care provider; thus, gaps between meeting diagnostic criteria and receiving treatment might be incorrectly estimated.

Methamphetamine use and related harms represent a substantial U.S. public health concern. Additional efforts to support prevention and response capacity in communities, expand linkages to care for substance use and mental health, and enhance collaborations between public health and public safety are needed.

Corresponding author: Christopher M. Jones, fjr0@cdc.gov, 404-498-0756.

[1]Office of Strategy and Innovation, National Center for Injury Prevention and Control, CDC; [2]National Institute on Drug Abuse, National Institutes of Health, Bethesda, Maryland; [3]Division of Overdose Prevention, National Center for Injury Prevention and Control, CDC.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. Wilson M. Compton reports long-term stock holdings in General Electric Co., 3M Companies, and Pfizer, Inc., outside the submitted work. No other potential conflicts of interest were disclosed.

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Nonfatal Violent Workplace Crime Characteristics and Rates by Occupation — United States, 2007–2015

Miriam Siegel, DrPH[1,2]; Candice Y. Johnson, PhD[1]; Christina C. Lawson, PhD[1]; Marilyn Ridenour, MBA, MPH[3]; Daniel Hartley, EdD[3]

Workplace violence can lead to adverse physical and psychological outcomes and affect work function (*1*). According to the U.S. Bureau of Labor Statistics, intentional injury by another person is a leading cause of nonfatal injury requiring missed workdays (*2*). Most estimates of workplace violence include only crimes reported to employers or police, which are known underestimates (*3*,*4*). Using 2007–2015 data from the National Crime Victimization Survey (NCVS), characteristics of self-reported nonfatal violent workplace crimes, whether reported to authorities or not, and rates by occupation were examined. Estimates of crime prevalence were stratified by crime characteristics and 22 occupational groups. Overall, approximately eight violent workplace crimes were reported per 1,000 workers. During 2007–2010, workers in Protective services reported the highest rates of violent workplace crimes (101 per 1,000 workers), followed by Community and social services (19 per 1,000). Rates were higher among men (nine per 1,000) than among women (six per 1,000). Fifty-eight percent of crimes were not reported to police. More crimes against women than against men involved offenders known from the workplace (34% versus 19%). High-risk occupations appear to be those involving interpersonal contact with persons who might be violent, upset, or vulnerable. Training and controls should emphasize how employers and employees can recognize and manage specific risk factors in prevention programs. In addition, workplace violence-reduction interventions might benefit from curricula developed for men and women in specific occupational groups.

Data were analyzed from the Bureau of Justice Statistics' NCVS, a national survey of self-reported victimizations in the United States (*5*).* The U.S. Census Bureau administers NCVS to collect information on nonfatal crimes through in-person or telephone interviews of persons aged ≥12 years from a nationally representative household sample. A sample is identified through a stratified, multistage sampling design; annual response rates typically range from 80% to 90% (*6*). Respondents are asked to report crimes they experienced during the preceding 6 months. The years 2007–2015 represent the most recently available period for which data were collected with comparable sampling strategies.

Incidents included in the analysis were self-reported to have occurred while victims, aged ≥16 years, were working or on duty in the United States. Types of crime analyzed included five mutually exclusive categories: rape/sexual assault, robbery, aggravated assault, simple assault, and verbal threat of assault.† Free-text survey responses on occupation at the time of the workplace crime were categorized by NCVS into 44 nonmilitary occupational groups. These occupations were collapsed into 22 major groups defined by the U.S. Census Bureau.§

To describe violent workplace crimes, weighted prevalence estimates stratified by crime characteristics were calculated along with 95% confidence intervals (CIs) estimated using Taylor series linearization. Estimates were stratified by victim demographics (sex and age group), details of the crime (type of crime, number of offenders, offender sex, offender relationship to the victim, and weapons used by the offender), and victim outcomes (reporting to police, injuries, lost work time, and lost pay because of lost workdays). Because detailed occupational information was only coded for victims reporting a workplace crime, rates of violent workplace crimes per 1,000 workers with 95% CIs were calculated for each of the 22 occupational

* Data used are from Version 1, which has since been revised as Version 3.

† Types of crime included rape/sexual assault (including attempted rape, sexual attack with serious/minor assault, sexual assault without injury, unwanted sexual contact without force, and verbal threat of rape/sexual assault); robbery (including attempted robbery); aggravated assault (attack or attempted attack with a weapon, regardless of whether or not an injury occurred, and attack without a weapon when serious injury resulted, and including aggravated assault with injury, attempted aggravated assault with weapon, and threatened assault with weapon); simple assault (attack without a weapon resulting in no or minor injury, and including simple assault with injury and assault without weapon without injury); and verbal threat of assault.

§ The NCVS classified nonmilitary occupations as one of 22 major groups or 20 minor groups of special interest to the Bureau of Justice Statistics as defined by the U.S. Census Bureau. Analyses further classified the NCVS groups as follows: Management; Business and financial operations; Computer and mathematical; Architecture and engineering; Life, physical, and social science; Community and social services (including social workers); Legal; Education, training, and library (including preschool (prekindergarten and kindergarten), elementary, junior high or middle school, high school, college or university, technical or industrial school, special education facilities); Arts, design, entertainment, sports, and media; Healthcare practitioners and technical (including physicians, nurses, health technicians); Healthcare support (including healthcare aides); Protective services (including police officers, prison or jail guards, security guards); Food preparation and serving related; Building and grounds cleaning and maintenance; Personal care and services; Sales and related (including grocery, convenience, or liquor store clerks, gas station attendants, bartenders); Office and administrative support; Farming, fishing, and forestry; Construction and extraction; Installation, maintenance, and repair; Production; Transportation and material moving (including bus drivers, taxi cab drivers and chauffeurs).

groups using denominator occupation estimates from the U.S. Census Bureau's Current Population Survey.[¶] Occupation coding was only consistent between NCVS and the Current Population Survey during 2007–2010 for currently available data; therefore, rates were calculated only for this period. Estimates with small sample sizes were presented and flagged for reliability.[**] Analyses were conducted using SAS statistical software (version 9.4; SAS Institute).

During 2007–2015, an estimated 10.3 million violent crimes reported by persons aged ≥16 years occurred in the workplace, accounting for 22% of all violent crimes (95% CI = 20%–25%). During this period, approximately eight violent workplace crimes per 1,000 workers (95% CI = 7–9) were reported. During 2007–2010, occupations with the highest rates of violent workplace crimes were Protective services (e.g., first responders) (101 crimes per 1,000 workers); Community and social services (19); Healthcare practitioners and technicians (17), Healthcare support occupations (17); Education, training, and library occupations (eight); and Transportation and material moving occupations (seven) (Table 1).

Most workplace crimes were reported by men (63%) and persons aged 25–34 years (32%) (Table 2). The most frequently reported type of crime was threat of assault (44%), followed by simple assault (37%), aggravated assault (13%), rape/sexual assault (3%), and robbery (3%). Most violent workplace crimes involved male offenders, and approximately one in seven crimes involved a weapon. Fifty-eight percent of crimes were not reported to police. Fourteen percent of violent workplace crimes led to injury.

When stratified by victim sex, the most prevalent type of crime against men was threat of assault (49%) and against women, was simple assault (44%). Women reported higher proportions of crimes committed by offenders known from the workplace than did men (34% versus 19%), including customers/clients/patients (19% [women] versus 7% [men]); 43% of violent workplace crimes reported by men were committed by strangers, compared with 24% reported by women. The proportion of violent workplace crimes leading to lost pay because of lost workdays was higher among women than among men (5% versus 1%).

¶ U.S. Census Bureau's Current Population Survey occupation estimates were obtained from the CDC's Employed Labor Force (ELF) query system (https://wwwn.cdc.gov/wisards/cps/cps_estimates.aspx). Estimates for 2007–2010 were coded in the ELF system according to 2002 U.S. Census Bureau occupational classification.

** Estimates were flagged for reliability if the unweighted frequency was <10 or the weighted frequency's relative standard error was >30% of the weighted frequency, as recommended in a Bureau of Justice Statistics' report, Evaluation of Direct Variance Estimation, Estimate Reliability, and Confidence Intervals for the National Crime Victimization Survey (https://www.bjs.gov/content/pub/pdf/edveercincvs.pdf). The observed values might have occurred because of chance or be unrepresentative of the general population.

TABLE 1. Nonfatal violent workplace crimes among persons aged ≥16 years, by occupation* — National Crime Victimization Survey (NCVS), United States, 2007–2010†

Occupation	Unweighted no.	Weighted no.	Rate§,¶ (95% CI)
Management	83	332,711	5.4 (3.7–7.8)
Business and financial operations	20	109,873**	4.5 (2.2–9.4)**
Computer and mathematical	<5	12,353**	0.9 (0.2–3.5)**
Architecture and engineering	<5	3,346**	0.3 (0.0–2.1)**
Life, physical, and social science	5	15,674**	2.9 (1.0–8.4)**
Community and social services	27	176,749**	19.1 (10.2–35.8)**
Legal	<5	2,999**	0.4 (0.1–3.1)**
Education, training, and library	82	262,633	7.6 (4.7–12.4)
Arts, design, entertainment, sports, and media	6	44,377**	4.0 (1.0–16.3)**
Healthcare practitioners and technical	74	515,456	17.1 (11.0–26.4)
Healthcare support	21	214,557**	16.5 (4.7–58.0)**
Protective services	136	1,274,811	101.4 (68.1– 151.0)
Food preparation and serving related	35	179,684**	5.8 (2.8–12.0)**
Building and grounds cleaning and maintenance	19	94,682**	4.4 (1.9–10.2)**
Personal care and services	11	54,028**	2.7 (1.1–6.8)**
Sales and related	87	338,450	5.3 (3.8–7.3)
Office and administrative support	48	267,987**	3.6 (1.9–6.8)**
Farming, fishing, and forestry	<5	5,532**	1.4 (0.3–5.9)**
Construction and extraction	21	79,159	2.4 (1.4–4.1)
Installation, maintenance, and repair	15	80,414**	4.0 (2.0–7.8)**
Production	23	79,201	2.3 (1.4–3.9)
Transportation and material moving	44	241,703	7.1 (4.1–12.2)

Abbreviation: CI = confidence interval.

* Free-text survey responses on occupation at the time of the workplace crime were categorized by NCVS into 44 nonmilitary occupational groups. These occupations were collapsed into 22 major groups defined by the U.S. Census Bureau.

† Estimates by occupation could only be calculated for years 2007–2010 because this was the only period during which NCVS occupational coding was consistent with the U.S. Census Bureau's Current Population Survey coding in the available data.

§ Crimes per 1,000 workers.

¶ Denominator estimate source is the U.S. Census Bureau's Current Population Survey.

** Estimates were flagged for reliability if the unweighted frequency was <10 or the weighted frequency's relative standard error was >30% of the weighted frequency, as recommended in a Bureau of Justice Statistics' report, Evaluation of Direct Variance Estimation, Estimate Reliability, and Confidence Intervals for the National Crime Victimization Survey (https://www.bjs.gov/content/pub/pdf/edveercincvs.pdf). The observed values might have occurred because of chance or be unrepresentative of the general population.

Discussion

Violent workplace crimes were reported by U.S. workers in all occupational groups during 2007–2010. During 2007–2015, approximately eight nonfatal workplace crimes per 1,000 workers were reported, and 58% of crimes were not reported to police. Highest rates of crime were among Protective services, Community and social services, and Healthcare occupations. More crimes against women than men were reportedly committed by offenders known from the workplace. Findings demonstrated that the prevalence, characteristics, and outcomes of violent workplace crime varied by occupation and victim sex.

A recent NCVS analysis estimated rates of violent workplace crimes by selected occupations only and reported an overall crime rate of approximately four crimes per 1,000 workers in 2009 (*7*). However, the analysis did not include threats of assault, which are categorized by the Occupational Safety and Health Administration (OSHA) as workplace violence and can

TABLE 2. Victim and crime characteristics of nonfatal violent workplace crimes among persons aged ≥16 years, overall and by victim sex — National Crime Victimization Survey, United States, 2007–2015

Characteristic	Overall			Male victims			Female victims		
	Unweighted no.	Weighted no.	Weighted %* (95% CI)	Unweighted no.	Weighted no.	Weighted %* (95% CI)	Unweighted no.	Weighted no.	Weighted %* (95% CI)
Victim sex									
Men	1,141	6,501,414	62.8 (58.4–67.0)	—	—	—	—	—	—
Women	807	3,844,447	37.2 (33.0–41.6)	—	—	—	—	—	—
Age group (yrs)									
16–24	223	1,417,731	13.7 (10.8–17.2)	131	752,834	11.6 (8.4–15.7)	92	664,898	17.3 (12.2–23.9)
25–34	519	3,302,795	31.9 (27.4–36.8)	340	2,358,872	36.3 (30.5–42.5)	179	943,924	24.6 (18.7–31.5)
35–44	484	2,565,956	24.8 (21.4–28.6)	306	1,784,028	27.4 (22.8–32.6)	178	781,928	20.3 (15.3–26.5)
45–54	432	1,895,648	18.3 (15.4–21.6)	220	991,694	15.3 (11.9–19.4)	212	903,954	23.5 (18.5–29.4)
≥55	290	1,163,731	11.2 (9.2–13.7)	144	613,987	9.4 (6.8–12.9)	146	549,744	14.3 (11.0–18.4)
Type of crime									
Threat of assault	828	4,542,664	43.9 (39.5–48.4)	514	3,166,482	48.7 (42.8–54.6)	314	1,376,182	35.8 (30.2–41.8)
Simple assault	706	3,799,570	36.7 (32.7–41.0)	377	2,124,891	32.7 (27.7–38.0)	329	1,674,679	43.6 (37.7–49.7)
Aggravated assault	304	1,390,667	13.4 (11.2–16.0)	190	951,052	14.6 (11.7–18.1)	114	439,615	11.4 (8.7–14.9)
Rape/Sexual assault	51	350,585	3.4 (2.0–5.8)	16	86,953[§]	1.3[§] (0.5–3.3)	35	263,632[§]	6.9[§] (3.6–12.7)
Robbery	59	262,375	2.5 (1.7–3.9)	44	172,036	2.6 (1.8–4.0)	15	90,339[§]	2.3[§] (0.9–5.9)
No. of offenders									
Single	1,681	8,305,957	80.3 (76.5–83.6)	972	5,045,267	77.6 (73.1–81.5)	709	3,260,690	84.8 (79.4–89.0)
Multiple	171	1,321,050	12.8 (9.9–16.3)	101	877,175	13.5 (10.1–17.8)	70	443,875	11.5 (8.0–16.5)
Don't know	13	145,942[§]	1.4[§] (0.6–3.1)	12	142,346[§]	2.2[§] (1.0–4.9)	<5	3,596[§]	0.1[§] (0.0–0.7)
Offender's sex									
Male	1,431	7,323,470	70.8 (66.8–74.4)	940	5,008,418	77.0 (71.4–81.8)	491	2,315,052	60.2 (54.3–65.8)
Female	300	1,432,390	13.8 (11.4–16.7)	79	433,698	6.7 (4.3–10.3)	221	998,691	26.0 (21.8–30.7)
Male and female	45	372,505	3.6 (2.2–5.8)	18	156,792[§]	2.4[§] (1.0–5.6)	27	215,714[§]	5.6[§] (3.2–9.7)
Don't know	24	339,009[§]	3.3[§] (1.8–6.0)	17	265,722[§]	4.1[§] (2.0–8.2)	7	73,287[§]	1.9[§] (0.6–5.5)
Offender relationships[†]									
Work related	511	2,534,104	24.5 (20.8–28.6)	272	1,219,973	18.8 (15.0–23.2)	239	1,314,131	34.2 (27.0–42.2)
Customer/Client/Patient	180	1,178,467	11.4 (8.2–15.5)	79	443,352	6.8 (4.5–10.2)	101	735,116	19.1 (12.7–27.8)
Coworker	254	1,014,531	9.8 (7.8–12.2)	153	646,793	9.9 (7.3–13.5)	101	367,738	9.6 (7.1–12.8)
Supervisor	29	189,779[§]	1.8[§] (0.9–3.9)	5	16,279[§]	0.3[§] (0.1–0.7)	24	173,499[§]	4.5[§] (2.0–9.9)
Employee	48	151,326	1.5 (1.0–2.0)	35	113,549	1.7 (1.2–2.6)	13	37,778	1.0 (0.5–1.8)
Relative or (ex) spouse/partner	32	146,452[§]	1.4[§] (0.7–2.9)	7	21,492[§]	0.3[§] (0.2–0.7)	25	124,960[§]	3.3[§] (1.4–7.4)
Other known relationship	268	1,333,961	12.9 (10.4–15.9)	110	631,760	9.7 (6.9–13.4)	158	702,200	18.3 (13.8–23.8)
Recognized but unknown	254	1,450,801	14.0 (11.1–17.6)	146	961,622	14.8 (10.6–20.3)	108	489,180	12.7 (9.1–17.4)
Stranger	658	3,760,919	36.4 (32.5–40.4)	460	2,826,593	43.5 (38.5–48.6)	198	934,326	24.3 (19.6–29.8)
Weapons									
No weapon	1,518	8,361,178	80.8 (78.0–83.4)	861	5,107,562	78.6 (74.7–82.0)	657	3,253,616	84.6 (80.8–87.8)
Weapon[†]	324	1,489,692	14.4 (12.0–17.2)	208	1,041,583	16.0 (12.8–19.9)	116	448,109	11.7 (8.8–15.2)
Firearm	101	404,761	3.9 (2.8–5.5)	70	311,645	4.8 (3.1–7.3)	31	93,117	2.4 (1.6–3.7)
Knife/Sharp object	92	394,670	3.8 (2.8–5.2)	65	298,854	4.6 (3.2–6.5)	27	95,816[§]	2.5[§] (1.3–4.9)
Blunt object	61	337,323	3.3 (2.3–4.7)	36	225,116	3.5 (2.1–5.6)	25	112,207[§]	2.9[§] (1.5–5.5)
Other	80	436,242	4.2 (2.9–6.1)	44	281,499	4.3 (2.5–7.3)	36	154,743	4.0 (2.6–6.3)
Don't know	106	494,991	4.8 (3.4–6.7)	72	352,268	5.4 (3.5–8.3)	34	142,722	3.7 (2.2–6.2)
Crime reported to police									
No	1,057	5,961,317	57.6 (53.4–61.8)	579	3,521,257	54.2 (48.3–59.9)	478	2,440,061	63.5 (57.3–69.2)
Yes	818	4,021,869	38.9 (34.8–43.1)	517	2,701,320	41.5 (35.9–47.4)	301	1,320,549	34.3 (28.6–40.6)
Don't know	44	273,376	2.6 (1.5–4.6)	33	236,237[§]	3.6[§] (1.9–6.7)	11	37,139[§]	1.0[§] (0.5–1.8)
Injuries									
No	1,689	8,947,068	86.5 (82.9–89.4)	1,006	5,738,080	88.3 (83.6–91.7)	683	3,208,989	83.5 (78.1–87.7)
Yes	259	1,398,793	13.5 (10.6–17.1)	135	763,335	11.7 (8.3–16.4)	124	635,458	16.5 (12.3–21.9)
Any work time lost due to incident									
No	1,758	9,358,340	90.5 (87.8–92.6)	1,045	6,036,906	92.9 (90.2–94.8)	713	3,321,434	86.4 (80.2–90.9)
Yes[†]	190	987,521	9.5 (7.4–12.2)	96	464,508	7.1 (5.2–9.8)	94	523,014	13.6 (9.1–19.8)
Due to injuries	65	289,877	2.8 (1.8–4.3)	30	153,376	2.4 (1.3–4.1)	35	136,501[§]	3.6[§] (1.9–6.5)
Due to police or court activities	63	431,471	4.2 (2.5–6.8)	38	215,965	3.3 (1.9–5.7)	25	215,506[§]	5.6[§] (2.3–12.9)
Due to other reasons	78	347,737	3.4 (2.4–4.7)	37	123,828	1.9 (1.3–2.8)	41	223,909	5.8 (3.6–9.4)
Pay lost from lost workdays[¶]									
No lost pay for missed days	82	502,274	4.9 (3.1–7.4)	41	223,433	3.4 (2.1–5.5)	41	278,841[§]	7.3[§] (3.6–13.9)
Lost pay for missed days	59	274,864	2.7 (1.7–4.1)	22	83,222	1.3 (0.8–2.1)	37	191,642	5.0 (2.8–8.8)

Abbreviation: CI = confidence interval.
* Percentages represent the proportion of all nonfatal violent workplace crimes; percentages might not sum to 100% because of missing values or non–mutually exclusive groups.
† Incidents are not mutually exclusive and might fall into more than one category.
§ Estimates were flagged for reliability if the unweighted frequency was <10 or the weighted frequency's relative standard error was >30% of the weighted frequency, as recommended in a Bureau of Justice Statistics' report, Evaluation of Direct Variance Estimation, Estimate Reliability, and Confidence Intervals for the National Crime Victimization Survey (https://www.bjs.gov/content/pub/pdf/edveercincvs.pdf). The observed values might have occurred because of random chance or be unrepresentative of the general population.
¶ A total of 1,807 respondents who lost time following the crime did not lose at least 1 full day.

Summary

What is already known about this topic?

Workplace violence can lead to adverse health and work outcomes. Few data sources are available for estimating national prevalence of nonfatal workplace violence.

What is added by this report?

Approximately eight nonfatal violent workplace crimes were reported per 1,000 U.S. workers during 2007–2015; 58% of crimes were not reported to police. Highest rates of crime were among Protective services, Community and social services, and Healthcare occupations. More crimes against women than men were reportedly committed by offenders known from the workplace.

What are the implications for public health practice?

The incidence of nonfatal workplace violence varies by worker characteristics. Violence prevention programs might benefit from having different approaches for specific worker groups.

also lead to adverse physical and psychological health outcomes (*1*,*8*). Other national estimates of nonfatal workplace violence often rely on workers' compensation claims, emergency department data, or employer-reported injuries leading to lost work time, which underestimate the actual prevalence of workplace violence (*2*–*4*). Self-reported responses provide information on crimes that might not have been reported to employers or police or that do not lead to injury; most violent workplace crimes in NCVS were not reported to police.

The highest rates of nonfatal workplace violence were found among Protective services; Community and social services; Healthcare; Education; and Transportation occupational groups. These findings are consistent with other studies finding high rates of workplace violence in these groups (*2*,*4*,*7*,*9*). High-risk occupations appear to be those most likely to involve interpersonal contact, especially with persons who might be violent, upset, or vulnerable. This analysis identified some differences between male and female victims of nonfatal workplace violence that have not been evaluated in recent years, including the type of crime, relationship to the offender, and impact on pay. Although few studies have examined sex differences in characteristics of violent workplace crimes, some suggest that inequalities can be partly attributed to sex differences in work hours/shifts, conflict-resolution strategies, and work assignments based on social roles (*3*,*10*).

The findings in this report are subject to at least three limitations. First, only 1,948 violent workplace crimes (unweighted) were reported in NCVS for the years 2007–2015. Small sample sizes yielded many estimates that were flagged for reliability. Second, self-reported crime information can be inaccurate. Stigma or safety issues (e.g., intimate partner violence if the offender was in the household) might have discouraged or prevented persons from accurately reporting victimization. Misclassification might have occurred among offender relationship types if victims reported offenders that were patients/clients/customers as strangers. Finally, the period of recall for crimes was 6 months, which might have led to inaccurate recollection if crimes occurred months before survey administration or the incident was perceived to be relatively minor.

These findings demonstrate that the incidence of nonfatal workplace violence is likely an underreported public health issue that varies by worker and work characteristics. Workplace violence prevention programs might benefit from having different approaches or components for specific worker groups based on different offender relationships. A previous NCVS supplement on workplace violence revealed that only 60% of respondents reported that their employer had written guidelines regarding workplace violence. Fewer than one third of respondents had ever participated in a workplace violence prevention training (*9*). Workplace violence falls under OSHA's General Duty Clause that states all workers have the right to a safe work environment. OSHA recommends engineering controls, administrative controls, employee training, and zero-tolerance policies toward workplace violence (*8*). Training and controls should emphasize how employers and employees can recognize and manage specific risk factors in prevention programs. Future research could investigate underlying reasons for sex differences in workplace violence and effective methods for preventing and managing workplace violence hazards.

Corresponding author: Miriam Siegel, msiegel@cdc.gov, 513-841-4517.

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[1]Division of Field Studies and Engineering, National Institute for Occupational Safety and Health, CDC; [2]Epidemic Intelligence Service, CDC; [3]Division of Safety Research, National Institute for Occupational Safety and Health, CDC.

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Tuberculosis Preventive Treatment Scale-Up Among Antiretroviral Therapy Patients — 16 Countries Supported by the U.S. President's Emergency Plan for AIDS Relief, 2017–2019

Michael Melgar, MD[1,2]; Catherine Nichols, DrPH[3,4]; J. Sean Cavanaugh, MD[1,5]; Hannah L. Kirking, MD[1]; Diya Surie, MD[1]; Anand Date, MD[1]; Sevim Ahmedov, MPA[4]; Susan Maloney, MD[1]; Rena Fukunaga, PhD[1]; CDC Country Offices' Tuberculosis/HIV Advisors; National Ministries and Departments of Health Tuberculosis Program Managers

Tuberculosis (TB) is the leading cause of death among persons living with human immunodeficiency virus (HIV) infection. In 2018, an estimated 251,000 persons living with HIV infection died from TB, accounting for one third of all HIV-related deaths and one sixth of all TB deaths (*1*). TB preventive treatment (TPT) is recommended by the World Health Organization (WHO) for persons living with HIV infection without active TB disease (i.e., adults with a negative clinical symptom screen for cough, fever, night sweats, or weight loss; and children with a negative clinical screen for cough, fever, contact with a person with TB, or poor weight gain) and either without* a tuberculin skin test result or with a known positive result (*2*). TPT decreases morbidity and mortality among persons living with HIV infection, independent of antiretroviral therapy (ART) (*3*); however, in 2017, fewer than 1 million of the estimated 21.3 million ART patients started TPT worldwide. Most patients receiving TPT were treated with 6 months of daily isoniazid (*1*,*4*). This report summarizes data on TB symptom screening and TPT initiation and completion among ART patients in 16 countries supported by the U.S. President's Emergency Plan for AIDS† Relief (PEPFAR) during April 1, 2017–March 31, 2019. During this period, these 16 countries accounted for approximately 90% of PEPFAR-supported ART patients. During April 1, 2017–September 30, 2018, TB symptom screening increased from 54% to 84%. Overall, nearly 2 million ART patients initiated TPT, and 60% completed treatment during October 1, 2017–March 31, 2019. Although TPT initiations increased substantially, completion among those who initiated TPT increased only from 55% to 66%. In addition to continuing gains in initiation, improving retention after initiation and identifying barriers to TPT completion are important to increase TPT scale-up and reduce global TB mortality.

On September 26, 2018, the United Nations General Assembly held the first high-level meeting on TB and committed to providing TPT to 30 million persons by 2022, and the Office of the U.S. Global AIDS Coordinator (OGAC) announced a goal to provide TPT to all 13.6 million ART patients supported by PEPFAR by 2021 (*5*). PEPFAR-supported programs provide semiannual reporting on TPT initiation and completion for performance monitoring and evaluation, and the reporting cycle follows the U.S. government's fiscal year (October 1–September 30). This report summarizes TB symptom screening and TPT data from 16 countries during the four most recent 6-month reporting periods.

Population estimates of persons living with HIV infection were obtained from the Joint United Nations Programme on HIV/AIDS (UNAIDS) public database (*4*). Additional data were submitted by PEPFAR implementing partners to OGAC, including the following required indicators: 1) the total number of ART patients; 2) the number of ART patients who completed TB symptom screening; 3) the number of those who screened negative; 4) the number expected to complete a standard course of TPT§; and 5) the number of those who completed a standard course of TPT (i.e., completion of at least 6 months of daily isoniazid or completion of an alternative regimen). This report describes the changes in these indicators among three groups of ART patients. Group 1 was screened during April 1–September 30, 2017 (period 1) and expected to complete TPT during October 1, 2017–March 31, 2018 (period 2); group 2 was screened during October 1, 2017–March 31, 2018 (period 2) and expected to complete TPT during April 1–September 30, 2018 (period 3); and group 3 was screened during April 1–September 30, 2018 (period 3) and expected to complete TPT during October 1, 2018–March 31, 2019 (period 4).

Of 54 PEPFAR-supported countries, 23 were required to submit annual PEPFAR country operational plans in fiscal years 2018 and 2019 (*6*) and were considered for inclusion in this analysis. Countries were excluded if they did not report data on both the number of ART patients expected to complete a course of TPT and the number who completed treatment during October 1, 2017–March 31, 2019 (periods 2–4). The

* Testing for latent TB infection by tuberculin skin test or interferon-gamma release assay is not a requirement for initiating TPT in persons living with HIV. In resource-limited settings, these tests of infection are rarely accessible.

† Acquired immunodeficiency syndrome.

§ Number of ART patients expected to complete TPT approximates number of TPT initiations. If the patient is prescribed 6 months of daily isoniazid, the patient is expected to complete treatment during the reporting period subsequent to that of initiation. Otherwise, if prescribed a shorter rifamycin-based course, the patient might be expected to complete treatment during the initiation reporting period.

percentage change in TPT completion per 100,000 ART patients from period 2 to period 4 was calculated for all countries except Cameroon and Zimbabwe because of small numbers of patients completing TPT in these countries. Overall, 16 countries, which account for 88% of PEPFAR-supported ART patients worldwide, reported sufficient data for TPT indicators and were included in this analysis.

During April 1, 2017–September 30, 2018 (periods 1–3) across the 16 countries, the number of ART patients increased 11% (Figure 1). The number of these patients screened increased 71%, and the proportion of ART patients who underwent TB symptom screening increased from 54% to 84%; the number who screened negative increased 89%. During the entire study period, reported TB symptom screening among ART patients by country ranged from 35% (Namibia, period 1) to 108% (Vietnam, period 3) (Table). TB symptom screening results were missing for >10% of ART patients screened during one or more reporting periods in the Democratic Republic of the Congo (DRC), Ethiopia, Namibia, Uganda, Vietnam, and Zimbabwe.

Overall, 1,805,148 ART patients initiated TPT, and 1,078,871 (60%) completed treatment. During October 1, 2017–March 31, 2019 (periods 2–4), the number of ART patients who initiated and were expected to complete a course of TPT per period increased by 172,142 (32%), and the number who completed TPT per period increased by 169,011 (56%) (Figure 1). Although Nigeria and Tanzania accounted for <20% of all ART patients across the 16 countries, they accounted for 174,307 (101%) of the net increase in per-period TPT initiations and 155,420 (92%) of the net increase in per-period TPT completions (Table). Nigeria and Tanzania also experienced the largest increases in TPT completion rates per 100,000 ART patients (Figure 2). DRC, Ethiopia, Kenya, Uganda, and Vietnam reported fewer TPT completions per 100,000 ART patients in period 4 than in period 2.

Although TPT initiations increased substantially during October 1, 2017–March 31, 2019 (periods 2–4), completion percentage among those who initiated TPT increased only from 55% to 66% (Table). In Tanzania, however, the percentage who completed TPT increased from 46% to 77%. Although TPT completion percentages increased substantially in Cameroon, Lesotho, and Mozambique, their completion percentages during the most recent reporting period, (along with TPT completion percentage in South Africa) remained <50%.

Summary

What is already known about this topic?

Tuberculosis preventive treatment (TPT) decreases morbidity and mortality among persons living with human immunodeficiency virus infection but remains underutilized. The U.S. President's Emergency Plan for AIDS Relief (PEPFAR) has committed to providing TPT to all eligible persons receiving antiretroviral therapy (ART patients) by 2021.

What is added by this report?

During April 1, 2017–March 31, 2019, TPT implementation improved substantially across 16 countries accounting for approximately 90% of all PEPFAR-supported ART patients. TPT initiations per reporting period increased 32%, and TPT completions increased 56%.

What are the implications for public health practice?

TPT expansion could save hundreds of thousands of lives annually. This will require all PEPFAR-supported countries to estimate the TPT-eligible population, identify barriers to initiation and completion of TPT, and improve data monitoring and reporting.

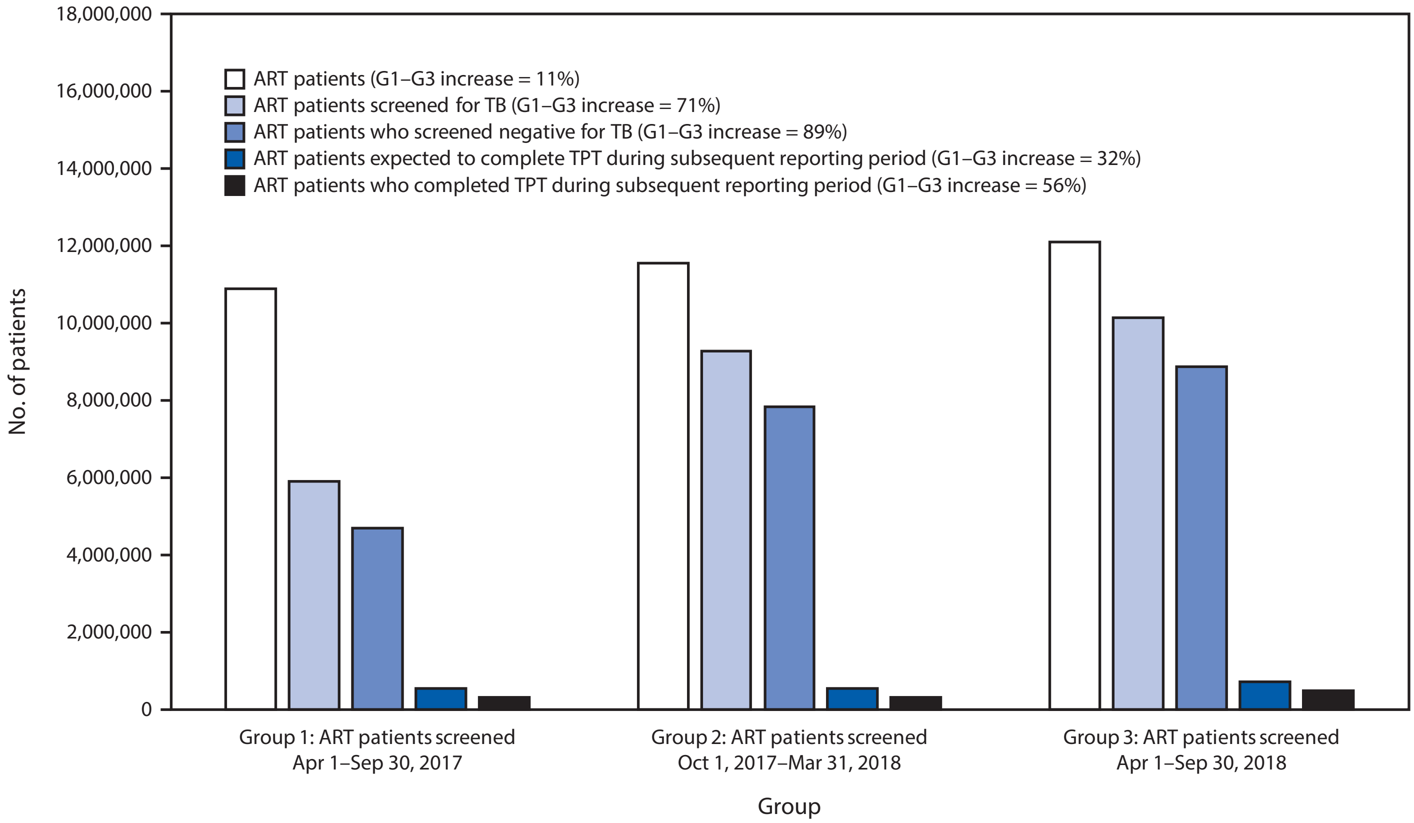
Discussion

These findings represent substantial progress from the last decade, when fewer than 100,000 ART patients initiated TPT annually worldwide (*1*). This progress is likely attributable to increased engagement and collaboration among national TB and HIV programs, resulting in intensified TPT training for ART providers, alignment of national policies with WHO recommendations (*2*), and PEPFAR-led integration of TPT into standard HIV care (*7*). Progress, however, has not been consistent across countries and reporting periods. Nigeria and Tanzania have led the way in TPT scale-up. Driving the overall trend, these two countries made the most progress during the most recent reporting period.

Although TPT initiations have increased, gains in completion have been more modest. Tanzania, where the PEPFAR program intensively trained ART clinics on isoniazid supply chain forecasting and ordering during 2018–2019, is the most notable exception. With completion still <50% in several countries, identifying supply chain and other barriers to TPT completion might improve patient retention after TPT initiation and facilitate scale-up.

In Kenya, TPT initiation and completion decreased from the second to the fourth reporting period. However, Kenya is one of few countries that has tracked TPT coverage; an estimated 80% of all ART patients at PEPFAR-supported sites had received TPT by 2017 (*8*). Therefore, decreased TPT initiation and completion likely reflect decreased TPT demand, with most TPT requirement now among ART patients newly enrolling in care. This might apply to other countries with TPT programs that predate the assessment period, including Ethiopia, South Africa, and Vietnam. To estimate the TPT-eligible population and to set appropriate targets, countries could consider estimating historical TPT coverage and recording future cumulative coverage.

FIGURE 1. Tuberculosis (TB) screening and TB preventive treatment (TPT) indicators*,†,§ for persons living with human immunodeficiency virus (HIV) infection receiving antiretroviral therapy (ART patients) — 16 PEPFAR-supported countries,¶ 2017–2019



Abbreviations: G = group; PEPFAR = U.S. President's Emergency Plan for AIDS Relief.

* Number of ART patients reports a snapshot at the end of the reporting period, accounting for net gains (e.g., new HIV diagnoses) and losses (e.g., deaths and patients lost to follow-up).

† The South African National Department of Health (NDOH) receives PEPFAR support for health system strengthening and other non–patient care activities. NDOH annually reports ART patients in its care but does not report TPT initiation or completion. Therefore, ART patients reported by NDOH were subtracted from South Africa totals in period 1 (779,313) and in period 3 (900,463) to include data reported only by South African partners that received PEPFAR support for delivering health care services.

§ Number of ART patients expected to complete TPT approximates number of TPT initiations. If the patient is prescribed 6 months of daily isoniazid, the patient is expected to complete treatment during the reporting period subsequent to that of initiation. Otherwise, if prescribed a shorter rifamycin-based course, the patient might be expected to complete treatment during the initiation reporting period.

¶ Cameroon, Democratic Republic of the Congo, Eswatini, Ethiopia, Haiti, Kenya, Lesotho, Mozambique, Namibia, Nigeria, South Africa, Tanzania, Uganda, Vietnam, Zambia, and Zimbabwe.

The findings in this report are subject to at least four limitations. First, incomplete reporting of TB symptom-screening results, such as in Namibia, Uganda, and Vietnam, leads to underestimation of the population eligible for TPT. However, in Kenya and Vietnam, TB symptom screening exceeded 100% in the third reporting period, possibly because some ART patients were screened and counted more than once. Along with lack of historical TPT coverage data in some countries, this double-counting leads to overestimation of the TPT-eligible population. Prioritizing data quality reviews, ideally in partnership with PEPFAR implementing partner agencies and national ministries of health, could improve TPT data quality. Second, this analysis did not identify barriers to TPT initiation and completion. Isoniazid stockouts affect many PEPFAR-supported countries (*9*) and might have reduced TPT completion in South Africa during these reporting periods (*10*). Third, this analysis included only ART patients in PEPFAR-supported programs, which do not represent all clinics that provide ART and TPT. Finally, several countries, including Malawi, have begun TPT scale-up but only began reporting initiation and completion of TPT in the two most recent reporting periods and were therefore not included in this report.

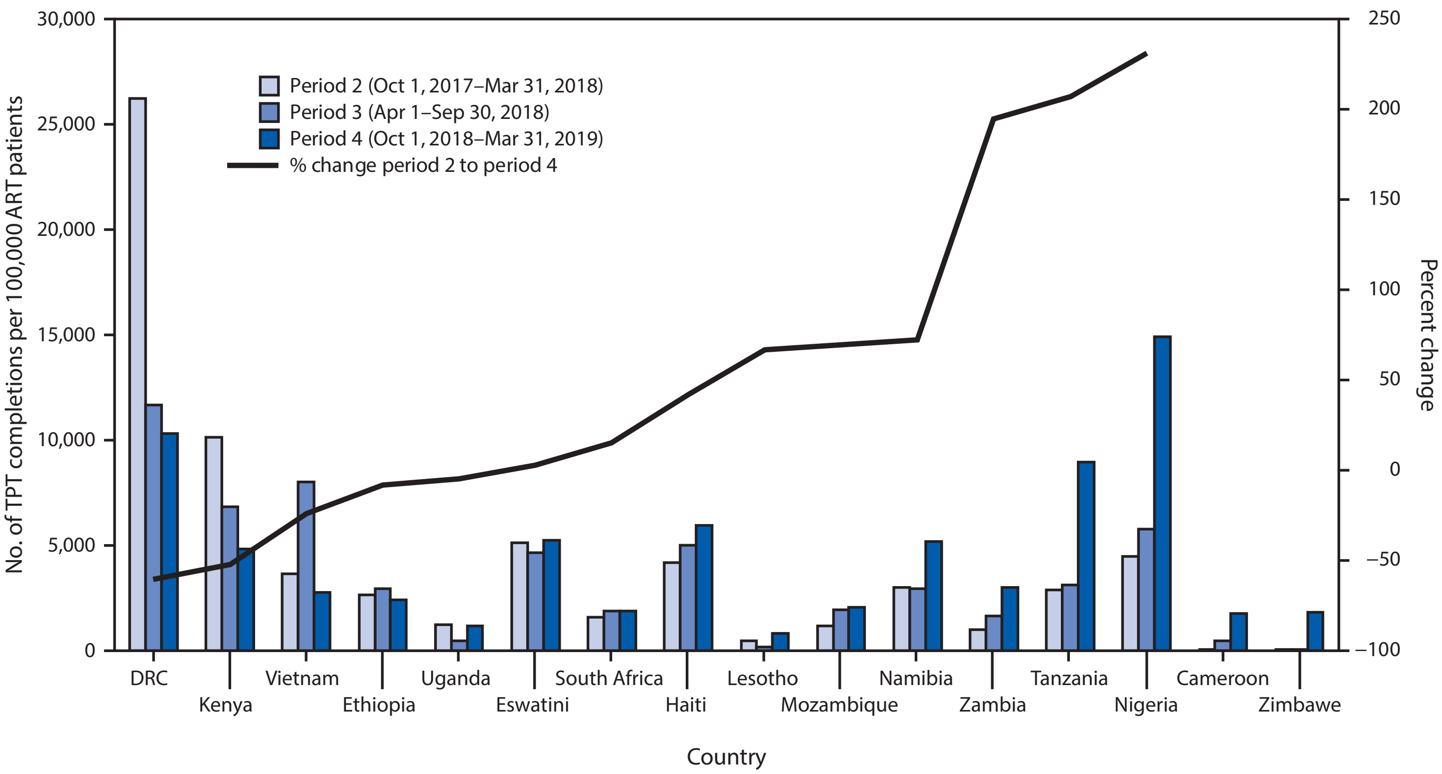
Increases in TPT initiation and completion in some of these 16 PEPFAR-supported countries demonstrate encouraging progress toward TPT scale-up. Continued TPT expansion

TABLE. Tuberculosis (TB) symptom-screening and TB preventive treatment (TPT) outcomes for persons living with human immunodeficiency virus (HIV) infection receiving antiretroviral therapy (ART), by country — 16 countries supported by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), 2017–2019

Country (estimated no. of persons living with HIV infection)	No. of persons living with HIV infection receiving ART through PEPFAR*	No. (%) of ART patients screened for TB	No. of ART patients screened negative for TB	No. expected to complete TPT†	No. (%) completed TPT
Group 1: TB screening during period 1§; TPT completion during period 2¶					
Cameroon (510,000)	176,927	130,795 (74)	126,893	276	41 (15)
DRC (390,000)	65,385	57,938 (89)	55,302	26,402	17,157 (65)
Eswatini (210,000)	150,987	137,590 (91)	134,638	9,394	7,744 (82)
Ethiopia (610,000)	434,897	386,419 (89)	334,407**	14,297	11,490 (80)
Haiti (150,000)	91,845	54,530 (59)	51,662	7,827	3,864 (49)
Kenya (1,500,000)	1,041,326	995,264 (96)	915,577	130,535	105,550 (81)
Lesotho (320,000)	151,799	136,522 (90)	132,230	5,298	765 (14)
Mozambique (2,100,000)	995,547	680,901 (68)	633,787	87,753	12,160 (14)
Namibia (200,000)	165,965	58,318 (35)	57,501	5,944	5,017 (84)
Nigeria (3,100,000)	772,510	660,501 (86)	606,726	45,093	34,840 (77)
South Africa (7,200,000)	3,256,407††	—§§	—§§	121,484	52,958 (44)
Tanzania (1,500,000)	932,425	893,280 (96)	880,954	59,660	27,264 (46)
Uganda (1,300,000)	993,070	960,999 (97)	77,857**	17,609	12,454 (71)
Vietnam (250,000)	87,702	43,173 (49)	30,766**	3,743	3,221 (86)
Zambia (1,100,000)	745,127	382,872 (51)	373,386	10,866	7,582 (70)
Zimbabwe (1,300,000)	849,310	338,535 (40)	287,622**	198	144 (73)
Subtotal, period 1	**10,911,229**	**5,917,637 (54)**	**4,699,308**	**546,379**	**302,251 (55)**
Group 2: TB screening during period 2¶; TPT completion during period 3¶¶					
Cameroon	177,434	148,143 (83)	143,684	1,385	888 (64)
DRC	72,143	65,127 (90)	39,356**	14,714	8,426 (57)
Eswatini	169,272	163,736 (97)	158,348	10,538	7,929 (75)
Ethiopia	451,436	384,226 (85)	262,289**	16,715	13,448 (80)
Haiti	95,697	81,280 (85)	73,622	8,229	4,839 (59)
Kenya	1,066,579	1,022,624 (96)	951,497	98,271	73,462 (75)
Lesotho	190,569	154,029 (81)	149,491	2,926	380 (13)
Mozambique	1,077,726	696,643 (65)	673,895	94,832	21,124 (22)
Namibia	177,062	112,221 (63)	49,317**	5,660	5,276 (93)
Nigeria	799,718	746,588 (93)	697,815	61,817	46,547 (75)
South Africa	3,446,694	2,540,588 (74)	2,440,961	124,520	65,526 (53)
Tanzania	995,953	968,540 (97)	939,591	64,279	31,534 (49)
Uganda	1,031,846	999,492 (97)	185,494**	8,246	5,248 (64)
Vietnam	91,457	74,761 (82)	11,123**	10,601	7,364 (69)
Zambia	801,669	296,204 (37)	289,812	17,225	13,233 (77)
Zimbabwe	939,164	839,120 (89)	766,572	290	134 (46)
Subtotal, period 2	**11,584,419**	**9,293,322 (80)**	**7,832,867**	**540,248**	**305,358 (57)**
Group 3: TB screening during period 3¶¶; TPT completion during period 4* **					
Cameroon	188,979	158,850 (84)	152,459	8,526	3,324 (39)
DRC	88,488	85,026 (96)	54,051**	12,743	9,169 (72)
Eswatini	175,912	167,276 (95)	164,285	12,069	9,281 (77)
Ethiopia	460,565	427,242 (93)	346,031**	13,976	11,239 (80)
Haiti	101,597	87,865 (86)	84,588	10,454	6,095 (58)
Kenya	1,084,100	1,104,679 (102)	981,037	58,452	52,792 (90)
Lesotho	218,493	177,416 (81)	173,572	5,462	1,839 (34)
Mozambique	1,107,749	824,247 (74)	798,227	83,897	23,022 (27)
Namibia	179,844	88,706 (49)	47,487**	10,425	9,388 (90)
Nigeria	807,094	604,596 (75)	575,959	152,528	120,787 (79)
South Africa	3,515,553†††	2,986,266 (85)	2,896,646	139,721	66,045 (47)
Tanzania	1,075,346	1,063,362 (99)	1,041,380	126,352	96,737 (77)
Uganda	1,120,271	1,067,117 (95)	409,084**	19,103	13,419 (70)
Vietnam	122,822	133,101 (108)	28,277**	3,782	3,430 (91)
Zambia	894,090	514,926 (58)	524,954	37,761	26,859 (71)
Zimbabwe	968,690	653,288 (67)	604,467	23,270	17,836 (77)
Subtotal, period 3	**12,109,593**	**10,143,963 (84)**	**8,882,504**	**718,521**	**471,262 (66)**
Total, periods 1–3	**34,605,241**	**25,354,922 (73)**	**21,414,679**	**1,805,148**	**1,078,871 (60)**

Abbreviation: DRC = Democratic Republic of the Congo.
* Snapshot at end of the reporting period accounts for net gains (e.g., new HIV diagnoses) and losses (e.g., deaths and patients lost to follow-up).
† Number of ART patients expected to complete TPT approximates number of TPT initiations. If the patient is prescribed 6 months of daily isoniazid, the patient is expected to complete treatment during the reporting period subsequent to that of initiation. Otherwise, if prescribed a shorter rifamycin-based course, the patient might be expected to complete treatment during the initiation reporting period.
§ April 1–September 30, 2017.
¶ October 1, 2017–March 31, 2018.
** >10% of TB symptom-screening results were missing.
†† The South African National Department of Health (NDOH) receives PEPFAR support for health system strengthening and other non–patient care activities. NDOH annually reports ART patients in its care but does not report TPT initiation or completion. Therefore, ART patients reported by NDOH were subtracted from South Africa totals in period 1 (779,313) and in period 3 (900,463) to include data reported only by South African partners that received PEPFAR support for delivering health care services.
§§ Indicator not reported.
¶¶ April 1, 2018–September 30, 2018.
*** October 1, 2018–March 31, 2019.
††† The number of ART patients in South Africa was adjusted in Period 3 to include only data from sites receiving investment for direct health care service delivery.

FIGURE 2. Number of ART patients (per 100,000 population) who completed tuberculosis preventive treatment (TPT) during three reporting periods,* and percentage change in TPT completion rate†— 16 countries supported by the U.S. President's Emergency Plan for AIDS Relief (PEPFAR), October 2017–March 2019



Abbreviations: ART = antiretroviral therapy; DRC = Democratic Republic of the Congo.

* The South African National Department of Health (NDOH) receives PEPFAR support for health system strengthening and other non–patient care activities. NDOH annually reports ART patients in its care but does not report TPT initiation or completion. Therefore, ART patients reported by NDOH were subtracted from South Africa totals in period 1 (779,313) and in period 3 (900,463) to include data reported only by South African partners that received PEPFAR support for delivering health care services.

† Excluding Cameroon and Zimbabwe because of small numbers.

among persons living with HIV infection has the potential to save hundreds of thousands of lives every year. Reaching all eligible ART patients will require intensified efforts to identify and overcome barriers to TB screening and TPT initiation, as well as to completion of treatment, and to ensure data quality across PEPFAR-supported countries.

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[1]Division of Global HIV and Tuberculosis, Center for Global Health, CDC; [2]Epidemic Intelligence Service, CDC; [3]Interagency Collaborative for Program Improvement, Washington, DC; [4]Bureau for Global Health, Office of HIV/AIDS, USAID; [5]Office of the Global AIDS Coordinator, Washington, DC.

Corresponding author: Michael Melgar, okv5@cdc.gov, 404-476-9487.

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CDC Country Offices' Tuberculosis/HIV Advisors

Ho Thi Van Anh, CDC-Vietnam; Peter R. Kerndt, CDC-Mozambique; Deus Lukoye, CDC-Uganda; Daniel Magesa, CDC-Tanzania; Talent Maphosa, CDC-Zimbabwe; Magdalene M. Mayer, CDC-Cameroon; Katlego Motlhaoleng, CDC-South Africa; Bethrand Odume, CDC-Nigeria; Munyaradzi Pasipamire, CDC-Eswatini; Sarah Porter, CDC-South Africa; Ahmed Saadani Hassani, CDC-Zambia; James Simpungwe, CDC-Zambia; Edwin Sithole, CDC-Namibia; Herman Weyenga, CDC-Kenya.

National Ministries and Departments of Health Tuberculosis Program Managers

Gabriel Ekali, Ministère de la Santé Publique du Cameroun; Clorata Gwanzura, Ministry of Health and Childcare, Zimbabwe; Isaya Jelly, Ministry of Health, Community Development, Gender, Elderly and Children, Tanzania; Muthoni Karanja, Ministry of Health, Kenya; Patrick Lungu, Ministry of Health, Zambia; Gugulethu Madonsela, Ministry of Health, Eswatini; Dorothy Maloboka, Ministry of Health and Social Services, Namibia; Ivan Manhiça, Ministério da Saúde de

Moçambique; Do Thi Nhan, Ministry of Health, Vietnam; Stavia Turyahabwe, Ministry of Health, Uganda; Emperor Ubochioma, Federal Ministry of Health, Nigeria; Kgomotso Vilakazi Nhlapo, National Department of Health, South Africa; Thomas Webhale, Ministry of Health, Community Development, Gender, Elderly and Children, Tanzania.

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Genotyping and Subtyping *Cryptosporidium* To Identify Risk Factors and Transmission Patterns — Nebraska, 2015–2017

Brianna K. Loeck, MPH[1,2]; Caitlin Pedati, MD[1]; Peter C. Iwen, PhD[3,4]; Emily McCutchen, MS[3,4]; Dawn M. Roellig, PhD[5]; Michele C. Hlavsa, MPH[5]; Kathleen Fullerton, MPH[5]; Thomas Safranek, MD[1]; Anna V. Carlson, PhD[1,2]

Cryptosporidium is an enteric pathogen that is transmitted through animal-to-person or person-to-person contact or through ingestion of contaminated water or food. In the United States, *Cryptosporidium* affects an estimated 750,000 persons each year; however, only approximately 11,000 cases are reported nationally (*1*,*2*). Persons infected with *Cryptosporidium* typically develop symptoms within 2 to 10 days after exposure. Common symptoms include watery diarrhea, abdominal cramps, nausea, vomiting, or fever, which can last 1 to 2 weeks. Cryptosporidiosis is a nationally notifiable disease in the United States. Nebraska presents a unique setting for the evaluation of this pathogen because, compared with other states, Nebraska has a greater reliance on agriculture and a higher proportion of the population residing and working in rural communities. *Cryptosporidium* species and subtypes are generally indistinguishable using conventional diagnostic methods. Using molecular characterization, Nebraska evaluated the genetic diversity of *Cryptosporidium* and found a dichotomy in the distribution of cases of cryptosporidiosis caused by *Cryptosporidium parvum* and *Cryptosporidium hominis* among rural and urban settings. Characterizing clusters of *C. hominis* cases revealed that several child care facilities were affected by the same subtype, suggesting community-wide transmission and indicating a need for effective exclusion policies. Several cases of cryptosporidiosis caused by non–*C. parvum* or non–*C. hominis* species and genotypes indicated unique animal exposures that were previously unidentified. This study enhanced epidemiologic data by validating known *Cryptosporidium* sources, confirming outbreaks, and, through repeat interviews, providing additional information to inform cryptosporidiosis prevention and control efforts.

During September 2015–December 2017, a total of 630 *Cryptosporidium*-positive stool specimens were reported to public health agencies by clinical laboratories, which most commonly used culture independent diagnostic testing (CIDT) and enzyme immunoassays (EIAs) for detection; among these 630 positive stool specimens, 149 (24%) were sent to the Nebraska Public Health Laboratory (NPHL), and subsequently to CDC, where genotyping was conducted using nested polymerase chain reaction–restriction fragment length polymorphism analysis and DNA sequencing of the 18S rRNA gene and the gp60 gene (*3*,*4*). Epidemiologic data on cases with genotyped and subtyped *Cryptosporidium* stool specimens were exported from the Nebraska Electronic Disease Surveillance System and linked to molecular data to assess association among species and exposures. Odds ratios (ORs), p-values, and 95% confidence intervals (CIs) were calculated using SAS statistical software (version 9.4; SAS Institute). ArcGIS was used to map cases to depict geographic distribution of cases.

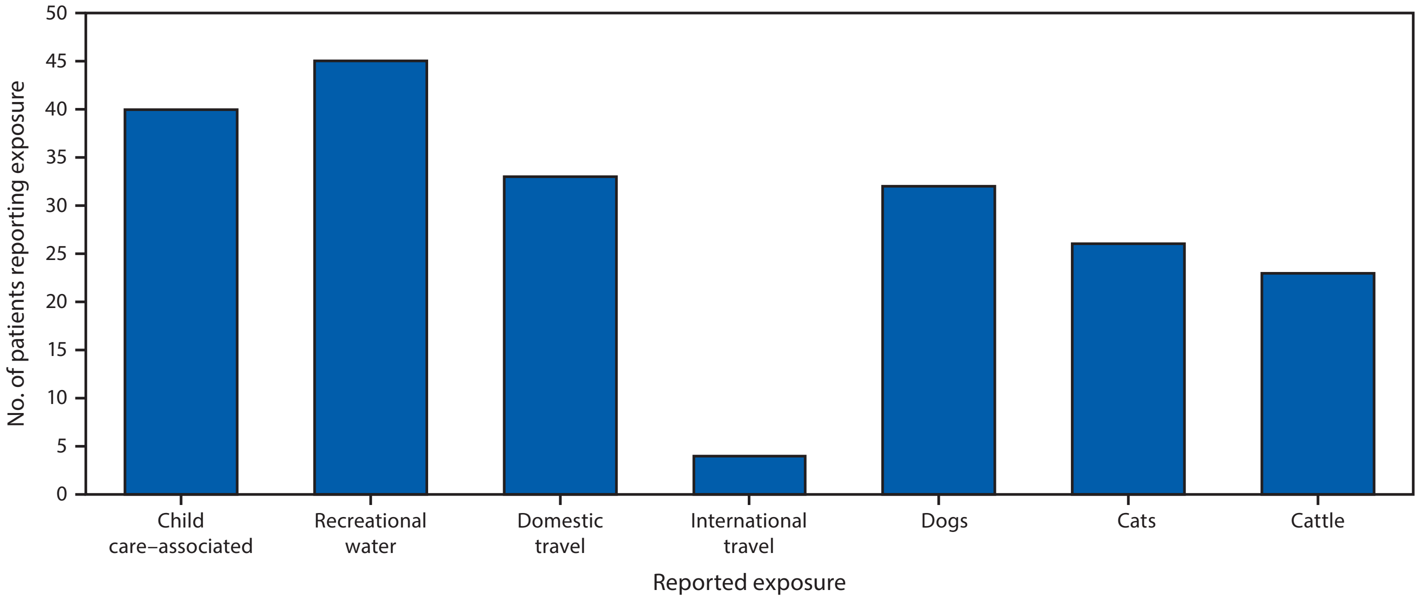
Among 149 patients with a molecularly characterized stool specimen, the median age was 22 years (range = 7 months–79 years); 79 (53%) patients were female. Eight patients (5%) were hospitalized, and no deaths were reported. Species and genotypes were identified in 149 submitted specimens, 80 (54%) of which were positive for *C. hominis* and 58 (29%) for *C. parvum*. Other identified species and genotypes included *Cryptosporidium chipmunk genotype I* and *Cryptosporidium felis* (three each); *Cryptosporidium ubiquitum* (two); and *Cryptosporidium canis*, *Cryptosporidium melargridis*, and *Cryptosporidium skunk genotype* (one each).

The 149 patients reported various exposures; 81 (54%) reported animal exposures, including 32 (40%) who reported exposure to dogs, 26 (32%) who reported exposure to cats, and 23 (28%) who reported exposure to cattle (Figure 1). Follow-up interviews identified specific dog, squirrel, and skunk exposures that previously had not been not mentioned. Overall, 11 *C. hominis* cases were associated with outbreaks. Three outbreaks were identified with the same *C. hominis* subtype within multiple child care facilities: 1) the first involved two cases, one each in two different facilities located in two distant local health department jurisdictions; 2) the second involved three cases, one case and two cases, respectively, in two child care facilities located in two neighboring local health department jurisdictions; and 3) the third involved six cases at one child care facility that is located within two adjoining local health department jurisdictions. *C. parvum* was associated with two outbreaks; however, only one stool specimen was sent to CDC.

Patients with *C. parvum* infection were more likely to report exposure to dogs and cattle than were those infected with other species. Patients with *C. hominis* infection were approximately nine times more likely to have reported a day care or child care exposure than were patients infected with other species (Table). Potential associations among species and recreational water exposure were also examined, but not found to be significant.

Reported cases were mapped by county of patient residence to document the urban and rural distribution of *C. hominis*

FIGURE 1. Exposures*,† commonly reported by cryptosporidiosis patients (N = 149) — Nebraska, September 2015–December 2017



* Patients could report multiple exposures. No patient reporting dog exposure reported cattle exposure.
† Does not include data from follow-up interviews that identified specific dog, squirrel, and skunk exposures not previously mentioned.

cases and *C. parvum* cases in the state. *C. hominis* cases were identified among patients from more highly populated urban counties (nearly half of *C. hominis* cases were reported from Douglas County, the most populous county), whereas *C. parvum* cases were identified among cases from more sparsely populated rural counties (Figure 2).

Discussion

In 2010, CDC launched CryptoNet,* the first such surveillance system in the United States, with the objective of collecting and analyze molecular characterization and epidemiologic data for each nationally notified case of cryptosporidiosis (*5*). Collecting epidemiologic data such as exposures and risk factors and linking those data with molecular data on *Cryptosporidium* from clinical specimens can elucidate the transmission routes of *Cryptosporidium* in the United States. Nebraska has participated in CryptoNet since 2015 and uses molecular characterization data to enhance epidemiologic case investigations and inform prevention and control efforts. Whereas approximately 40 distinct *Cryptosporidium* species and genotypes are known, only approximately 20 have been reported to infect humans; species and genotypes are generally indistinguishable using conventional diagnostic methods, such as an ova and parasite examination (*6*). Testing and analysis in Nebraska identified eight species and genotypes. *C. hominis* and *C. parvum* are known to be the two species of *Cryptosporidium* that most frequently cause community outbreaks (*7*), and Nebraska data were consistent with this pattern and confirmed several known risk factors and distribution patterns by supplementing epidemiologic case investigations with genotyping and subtyping data.

* https://www.cdc.gov/parasites/crypto/cryptonet.html.

TABLE. Associations among exposures and risk of infection with *Cryptosporidium parvum* and *Cryptosporidium hominis* species (N = 149) — Nebraska, 2015–2017

Species	Exposure	OR (95% CI)*
C. parvum	Dogs	3.88 (1.46–10.26)
	Cattle	16.04 (4.50–57.28)
	Recreational water	0.48 (0.21–1.12)
C. hominis	Day care or child care	9.55 (3.38–26.98)
	Recreational water	1.48 (0.68–3.20)

Abbreviations: CI = confidence interval; OR = odds ratio.
* Compared with non–*C. parvum* and non–*C. hominis* species.

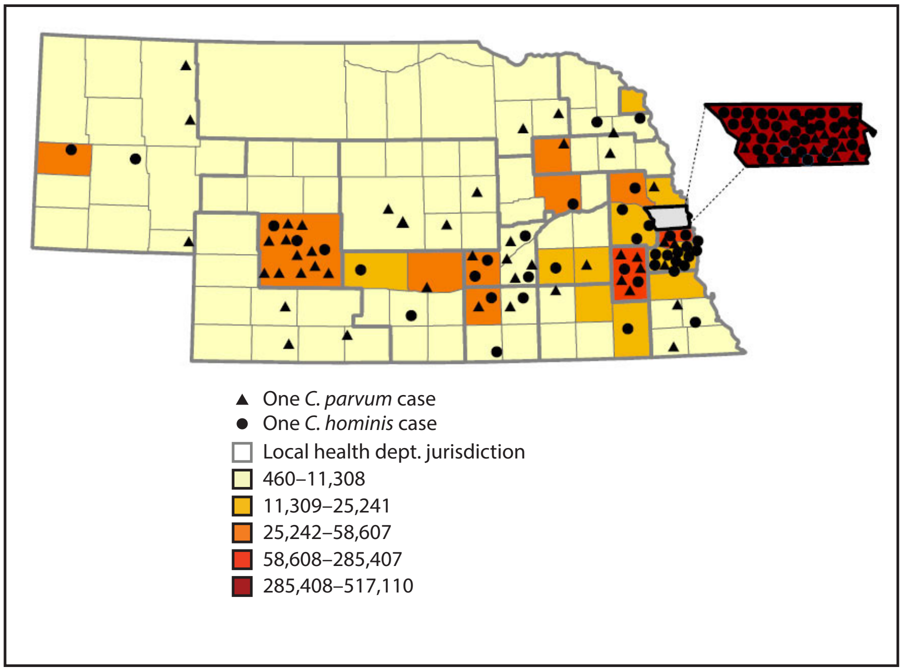
The analysis indicated *C. parvum* cryptosporidiosis cases were associated with animal exposures and occurred more frequently among persons who live in rural settings, whereas *C. hominis* cryptosporidiosis cases were more likely to be reported in residents of urban, populated areas. Contact with cattle and dogs were each significantly associated with *C. parvum* cryptosporidiosis cases. Previous studies of *Cryptosporidium* in dogs have demonstrated varying carriage rates (*8*); species commonly identified include *C. parvum* and *C. canis*. These data can be used to reinforce cryptosporidiosis prevention messages, including hand hygiene following contact with animals or their feces.

This analysis highlighted the association between child care facility exposure and *C. hominis* cryptosporidiosis cases, and clusters of *C. hominis* cases were identified with the same subtype among several child care facilities. This might indicate an unidentified common exposure outside of child care (e.g., swimming pool or waterpark) or the attendance of a child who was excluded from one facility because of gastrointestinal illness at a different child care facility, leading to the introduction of the pathogen in another facility and further community transmission. Such data can be used by local health departments and environmental health partners to inform exclusion policies and educate child care facilities about the person-to-person transmission of these pathogens and to assist facilities with implementing careful screening and assessments of symptomatic children.

Genotype characterizations also serve to inform public health investigations of potential risk factors and unusual exposures. For example, Nebraska's unique cases of non–*C. parvum* or non–*C. hominis* species and genotypes provided the impetus for public health personnel to conduct follow-up interviews, which were able to identify previously unreported dog, squirrel, and skunk exposures. These data will be useful to identify potential geographic regions or populations that are more commonly affected by these less frequently reported species and genotypes.

The findings in this report are subject to at least three limitations. First, cryptosporidiosis might be undiagnosed or underreported. Second, the analysis included approximately one quarter of cases with *Cryptosporidium*-positive specimens that were sent to NPHL. However, this number likely is not representative of all occurrent cases, given that approximately 600 cryptosporidiosis cases were reported to the state public health department during September 2015–December 2017. Finally, stool samples from animals were not tested for *Cryptosporidium,* which could have linked clinical samples to animal samples and ultimately confirmed the source of transmission. The dog-contact risk factor could be confounded by dogs having rural exposure to cattle; however, this cannot be confirmed given that further follow-up on dog exposure was not investigated.

FIGURE 2. Distribution of *Cryptosporidium parvum* and *Cryptosporidium hominis* cases — Nebraska, September 2015–December 2017*



* Placement of symbols within a county is random and does not indicate exact location of cases.

Public health surveillance for cryptosporidiosis is important to increase knowledge about risk factors and transmission patterns and to promote community cryptosporidiosis prevention education. The findings in this report provide insight into the patterns of human *Cryptosporidium* transmission in Nebraska and highlight the importance of collaboration between epidemiologists and laboratorians for improving and protecting the public's health. Nebraska is continuing to explore ways to improve CryptoNet activities, such as further increasing sample submission to NPHL, increasing timeliness of interviews, conducting sequencing methods in real time rather than retrospectively, and reporting results to public health epidemiologists sooner.

Corresponding author: Brianna K. Loeck, brianna.loeck@nebraska.gov, 402-471-9747.

[1]Division of Public Health, Nebraska Department of Health and Human Services; [2]University of Nebraska–Lincoln, Nebraska; [3]Nebraska Public Health Laboratory; [4]University of Nebraska Medical Center, Omaha; [5]Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging and Zoonotic and Infectious Diseases, CDC.

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Summary

What is already known about this topic?

Fecal-oral transmission of *Cryptosporidium* can occur following contact with an infected animal or person or through ingestion of contaminated water or food.

What is added by this report?

Molecular typing of *Cryptosporidium* in Nebraska during 2015–2017 found that *C. parvum* cases were associated with animal exposures in rural settings, whereas *C. hominis* cases were more likely to occur in urban areas. Several child care facilities affected by the same *C. hominis* subtype suggested community-wide transmission and indicated a need for effective exclusion policies.

What are the implications for public health practice?

Characterizing *Cryptosporidium* species, genotypes, and subtypes from urban and rural populations can improve outbreak detection and investigation, identify potential sources, and inform prevention strategies.

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COVID-19 in a Long-Term Care Facility — King County, Washington, February 27–March 9, 2020

Temet M. McMichael, PhD[1,2,3]; Shauna Clark[1]; Sargis Pogosjans, MPH[1]; Meagan Kay, DVM[1]; James Lewis, MD[1]; Atar Baer, PhD[1]; Vance Kawakami, DVM[1]; Margaret D. Lukoff, MD[1]; Jessica Ferro, MPH[1]; Claire Brostrom-Smith, MSN[1]; Francis X. Riedo, MD[4]; Denny Russell[5]; Brian Hiatt[5]; Patricia Montgomery, MPH[6]; Agam K. Rao, MD[3]; Dustin W. Currie, PhD[2,3]; Eric J. Chow, MD[2,3]; Farrell Tobolowsky, DO[2,3]; Ana C. Bardossy, MD[2,3]; Lisa P. Oakley, PhD[2,3]; Jesica R. Jacobs, PhD[3,7]; Noah G. Schwartz, MD[2,3]; Nimalie Stone, MD[3]; Sujan C. Reddy, MD[3]; John A. Jernigan, MD[3]; Margaret A. Honein, PhD[3]; Thomas A. Clark, MD[3]; Jeffrey S. Duchin, MD[1]; Public Health – Seattle & King County, EvergreenHealth, and CDC COVID-19 Investigation Team

On March 18, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

On February 28, 2020, a case of coronavirus disease (COVID-19) was identified in a woman resident of a long-term care skilled nursing facility (facility A) in King County, Washington.* Epidemiologic investigation of facility A identified 129 cases of COVID-19 associated with facility A, including 81 of the residents, 34 staff members, and 14 visitors; 23 persons died. Limitations in effective infection control and prevention and staff members working in multiple facilities contributed to intra- and interfacility spread. COVID-19 can spread rapidly in long-term residential care facilities, and persons with chronic underlying medical conditions are at greater risk for COVID-19–associated severe disease and death. Long-term care facilities should take proactive steps to protect the health of residents and preserve the health care workforce by identifying and excluding potentially infected staff members and visitors, ensuring early recognition of potentially infected patients, and implementing appropriate infection control measures.

On February 27, Public Health – Seattle and King County (PHSKC) was notified by a local health care provider of a patient whose symptom history and clinical presentation met the revised testing criteria† for COVID-19, which included testing of persons with severe respiratory illness of unknown etiology (*1*). The patient was a woman aged 73 years with a history of coronary artery disease, insulin-dependent type II diabetes mellitus, obesity, chronic kidney disease, hypertension, and congestive heart failure, who resided in facility A along with approximately 130 residents who were cared for by 170 health care personnel. Beginning in mid-February, the facility had experienced a cluster of febrile respiratory illnesses. Rapid influenza test results were obtained from several residents; all were negative. The patient had cough, fever, and shortness of breath requiring oxygen for 5 days at facility A. She reported no travel or known contact with anyone with COVID-19. On February 24, she was transported to a local hospital because of worsening respiratory symptoms and hypoxemia.

Upon hospital admission, the patient was febrile to 103.3°F (39.6°C), tachycardic, and was found to have hypoxemic respiratory failure. On February 25, she required intubation and mechanical ventilation. Computed tomography scan showed diffuse bilateral infiltrates; however, multiplex viral respiratory panel and bacterial cultures of sputum and bronchoalveolar lavage fluid were negative. Four days after hospital admission, nasopharyngeal and oropharyngeal swabs and sputum specimens were collected to test for SARS-CoV-2; results were reported positive for all specimens on February 28. The patient died on March 2.

Following notification of the index case of COVID-19, PHSKC and CDC immediately began investigating the cluster of respiratory illness in facility A to collect information on symptoms, severity, comorbidities, travel history, and close contacts to known COVID-19 cases by interviewing patients or a proxy for cases in which the patient could not be interviewed. Diagnostic testing by real-time reverse transcription–polymerase chain reaction (RT-PCR) (*2*–*5*) was performed for patients and staff members meeting clinical case criteria for COVID-19 (*1*). As of March 9, a total of 129 COVID-19 cases were confirmed among facility residents (81 of approximately 130), staff members, including health care personnel (34), and visitors (14). Health care personnel with confirmed COVID-19 included the following occupations: physical therapist, occupational therapist assistant, environmental care worker, nurse, certified nursing assistant, health information officer, physician, and case manager. Overall, 111 (86%) cases occurred among residents of King County (81 facility A residents, 17 staff members, and 13 visitors) and 18 (14%) among residents of Snohomish County (directly north of King County) (17 staff members and one visitor).

Reported symptom onset dates for facility residents and staff members ranged from February 16 to March 5. The median patient age was 81 years (range = 54–100 years) among facility residents, 42.5 years (range = 22–79 years) among staff members, and 62.5 years (range = 52–88 years) among visitors;

* The facility provides inpatient and outpatient rehabilitation and short-term and long-term care. Services include physical therapy, occupational therapy, and speech therapy. The facility, which has a medical director, also provides medication management and post-surgical care.

† https://emergency.cdc.gov/han/2020/han00428.asp.

84 (65.1%) patients were women (Table). Overall, 56.8% of facility A residents, 35.7% of visitors, and 5.9% of staff members with COVID-19 were hospitalized. Preliminary case fatality rates among residents and visitors as of March 9 were 27.2% and 7.1%, respectively; no deaths occurred among staff members. The most common chronic underlying conditions among facility residents were hypertension (69.1%), cardiac disease (56.8%), renal disease (43.2%), diabetes (37.0%), obesity (33.3%), and pulmonary disease (32.1%). Six residents and one visitor had hypertension as their only chronic underlying condition.

As part of the response effort, approximately 100 long-term care facilities in King County were contacted through an emailed survey using REDCap (*6*), and information was requested about residents or staff members known to have COVID-19 or clusters of respiratory illness among residents and staff members. In addition, countywide databases of emergency medical service transfers from long-term care facilities to acute care facilities were reviewed daily for evidence of cases or clusters of serious respiratory illness. Routine active surveillance reports to PHSKC for influenza-like illness clusters from long-term care facilities were employed to identify clusters of illness consistent with COVID-19. All long-term care facilities with evidence of a cluster of respiratory illness were contacted by telephone for additional information, including infection control strategies in place and availability of personal protective equipment (PPE). Based on this information, the long-term care facilities were prioritized by risk for COVID-19 introduction and spread, and highest priority facilities were visited by response personnel for provision of emergency on-site testing and infection control assessment, support, and training. As of March 9, at least eight other King County skilled nursing and assisted living facilities had reported one or more confirmed COVID-19 cases.

Information received from the survey and on-site visits identified factors that likely contributed to the vulnerability of these facilities, including 1) staff members who worked while symptomatic; 2) staff members who worked in more than one facility; 3) inadequate familiarity and adherence to standard, droplet, and contact precautions and eye protection recommendations; 4) challenges to implementing infection control practices including inadequate supplies of PPE and other items (e.g., alcohol-based hand sanitizer)[§]; 5) delayed recognition of cases because of low index of suspicion, limited testing availability, and difficulty identifying persons with COVID-19 based on signs and symptoms alone.

Discussion

These findings demonstrate that outbreaks of COVID-19 in long-term care facilities can have a critical impact on vulnerable older adults. In Washington, local and state authorities implemented comprehensive prevention measures for long-term care facilities (*7–9*) that included 1) implementation of symptom screening and restriction policies for visitors and nonessential personnel; 2) active screening of health care personnel, including measurement and documentation of body temperature and ascertainment of respiratory symptoms to identify and exclude symptomatic workers; 3) symptom monitoring of residents; 4) social distancing, including restricting resident movement and group activities; 5) staff training on infection control and PPE use; and 6) establishment of plans to address local PPE shortages, including county and state coordination of supply chains and stockpile releases to meet needs. These strategies require coordination and support from public health authorities, partnering health care systems, regulatory agencies, and their respective governing bodies (*8–10*).

The findings in this report suggest that once COVID-19 has been introduced into a long-term care facility, it has the potential to result in high attack rates among residents, staff members, and visitors. In the context of rapidly escalating COVID-19 outbreaks in much of the United States, it is critical that long-term care facilities implement active measures to prevent introduction of COVID-19. Measures to consider include identifying and excluding symptomatic staff members, restricting visitation except in compassionate care situations, and strengthening infection prevention and control guidance and adherence (*7,9,10*).[¶] Substantial morbidity and mortality might be averted if all long-term care facilities take steps now to prevent exposure of their residents to COVID-19. The underlying health conditions and advanced age of many long-term care facility residents and the shared location of patients in one facility places these persons at risk for severe morbidity and death. Rapid and sustained public health interventions focusing on surveillance, infection control, and mitigation efforts are resource-intensive but are critical to curtailing COVID-19 transmission and decreasing the impact on vulnerable populations, such as residents of long-term care facilities, and the community at large. As this pandemic expands, continued implementation of public health measures targeting vulnerable populations such as residents of long-term care facilities (*8*) and health care personnel will be critical. As public health measures are continually implemented, public information needs will only grow. To provide information for

[§] Some examples of specific PPE challenges included initial lack of access to eye protection, frequent changing of PPE types as supply chains were disrupted and PPE was provided via various donations or supplies, and a need for ongoing auditing of PPE use to ensure consistent and safe use of PPE by staff members (e.g., not touching or adjusting face protection, primarily facemasks, during extended use).

[¶] https://www.doh.wa.gov/Portals/1/Documents/1600/coronavirus/RecommendationsForLTC-COVID19.pdf.

TABLE. Characteristics of patients with COVID-19 epidemiologically linked to facility A among residents of King and Snohomish counties — Washington, February 27–March 9, 2020

Characteristics	No. (%)			
	Resident (n = 81)	Health care personnel (n = 34)	Visitor (n = 14)	Total (n = 129)
Median age, yrs (range)	81 (54–100)	42.5 (22–79)	62.5 (52–88)	**71 (22–100)**
Sex				
Men	28 (34.6)	7 (20.6)	10 (71.4)	**45 (34.9)**
Women	53 (65.4)	27 (79.4)	4 (28.6)	**84 (65.1)**
Hospitalized				
Yes	46 (56.8)	2 (5.9)	5 (35.7)	**53 (41.1)**
No	3 (3.7)	30 (88.2)	9 (64.3)	**42 (32.6)**
Unknown	32 (39.5)	2 (5.9)	0	**34 (26.4)**
Died				
Yes	22 (27.2)	0	1 (7.1)	**23 (17.8)**
No	59 (72.8)	34 (100.0)	13 (92.9)	**106 (82.2)**
Chronic underlying conditions*,†				
Hypertension§	56 (69.1)	0	2 (14.3)	**58 (45.0)**
Cardiac disease	46 (56.8)	3 (8.8)	2 (14.3)	**51 (39.5)**
Renal disease	35 (43.2)	0	1 (7.1)	**36 (27.9)**
Diabetes mellitus	30 (37.0)	3 (8.8)	1 (7.1)	**34 (26.4)**
Obesity	27 (33.3)	0	3 (21.4)	**30 (23.3)**
Pulmonary disease	26 (32.1)	2 (5.9)	2 (14.3)	**30 (23.3)**
Malignancy	11 (13.6)	0	0	**11 (8.5)**
Immunocompromised	8 (9.9)	0	0	**8 (6.2)**
Liver disease	5 (6.2)	0	0	**5 (3.9)**

* Percentages represent the number with information on the comorbidity, irrespective of missing data.
† Data on chronic underlying conditions were missing for four health care personnel and two visitors with COVID-19.
§ Hypertension was the only reported chronic underlying condition for 6 residents and 1 visitor with COVID-19.

Summary

What is already known about this topic?

Coronavirus disease (COVID-19) can cause severe illness and death, particularly among older adults with chronic health conditions.

What is added by this report?

Introduction of COVID-19 into a long-term residential care facility in Washington resulted in cases among 81 residents, 34 staff members, and 14 visitors; 23 persons died. Limitations in effective infection control and prevention and staff members working in multiple facilities contributed to intra- and interfacility spread.

What are the implications for public health practice?

Long-term care facilities should take proactive steps to protect the health of residents and preserve the health care workforce by identifying and excluding potentially infected staff members, restricting visitation except in compassionate care situations, ensuring early recognition of potentially infected patients, and implementing appropriate infection control measures.

patients and families as well as communicate more broadly to all stakeholders, public officials and other community leaders need to work together to encourage everyone to understand and adhere to recommended guidelines to manage this outbreak.

Public Health – Seattle & King County, EvergreenHealth, and CDC COVID-19 Investigation Team

Meaghan S. Fagalde, Jennifer L. Lenahan, Emily B. Maier, Kaitlyn J. Sykes, Grace Hatt, Holly Whitney, Melinda Huntington-Frazier, Elysia Gonzales, Laura A. Mummert, Hal Garcia Smith, Steve Stearns, Eileen Benoliel, Shelly McKeirnan, Jennifer L. Morgan, Daniel Smith, Michaela Hope, Noel Hatley, Leslie M. Barnard, Leilani Schwarcz, Seattle & King County; Nicole Yarid, King County Medical Examiner's Office; Eric Yim, Sandra Kreider, Dawn Barr, Nancy Wilde, Courtney Dorman, Airin Lam, Jeanette Harris, EvergreenHealth; Hollianne Bruce, Christopher Spitters, Snohomish Health District; Rachael Zacks, Jonathan Dyal, Michael Hughes, Christina Carlson, Barbara Cooper, Michelle Banks, Heather McLaughlin, Arun Balajee, Christine Olson, Suzanne Zane, Hammad Ali, Jessica Healy, Kristine Schmit, Kevin Spicer, Zeshan Chisty; Sukarma Tanwar, Joanne Taylor, Leisha Nolen, Jeneita Bell, Kelly Hatfield, Melissa Arons, Anne Kimball, Allison James, Mark Methner, Joshua Harney, CDC.

Corresponding author: Temet M. McMichael, pgv4@cdc.gov, 206-263-8284.

[1]Public Health – Seattle & King County; [2]Epidemic Intelligence Service, CDC; [3]CDC COVID-19 Emergency Response; [4]EvergreenHealth, Kirkland, Washington; [5]Washington State Public Health Laboratory; [6]Washington State Department of Health; [7]Laboratory Leadership Service, CDC.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Please note: This report has been corrected.

Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) — United States, February 12–March 16, 2020

CDC COVID-19 Response Team

On March 18, 2020, this report was posted as an MMWR *Early Release on the* MMWR *website (https://www.cdc.gov/mmwr).*

Globally, approximately 170,000 confirmed cases of coronavirus disease 2019 (COVID-19) caused by the 2019 novel coronavirus (SARS-CoV-2) have been reported, including an estimated 7,000 deaths in approximately 150 countries (*1*). On March 11, 2020, the World Health Organization declared the COVID-19 outbreak a pandemic (*2*). Data from China have indicated that older adults, particularly those with serious underlying health conditions, are at higher risk for severe COVID-19–associated illness and death than are younger persons (*3*). Although the majority of reported COVID-19 cases in China were mild (81%), approximately 80% of deaths occurred among adults aged ≥60 years; only one (0.1%) death occurred in a person aged ≤19 years (*3*). In this report, COVID-19 cases in the United States that occurred during February 12–March 16, 2020 and severity of disease (hospitalization, admission to intensive care unit [ICU], and death) were analyzed by age group. As of March 16, a total of 4,226 COVID-19 cases in the United States had been reported to CDC, with multiple cases reported among older adults living in long-term care facilities (*4*). Overall, 31% of cases, 45% of hospitalizations, 53% of ICU admissions, and 80% of deaths associated with COVID-19 were among adults aged ≥65 years with the highest percentage of severe outcomes among persons aged ≥85 years. In contrast, no ICU admissions or deaths were reported among persons aged ≤19 years. Similar to reports from other countries, this finding suggests that the risk for serious disease and death from COVID-19 is higher in older age groups.

Data from cases reported from 49 states, the District of Columbia, and three U.S. territories (*5*) to CDC during February 12–March 16 were analyzed. Cases among persons repatriated to the United States from Wuhan, China and from Japan (including patients repatriated from cruise ships) were excluded. States and jurisdictions voluntarily reported data on laboratory-confirmed cases of COVID-19 using previously developed data collection forms (*6*). The cases described in this report include both COVID-19 cases confirmed by state or local public health laboratories as well as those with a positive test at the state or local public health laboratories and confirmation at CDC. No data on serious underlying health conditions were available. Data on these cases are preliminary and are missing for some key characteristics of interest, including hospitalization status (1,514), ICU admission (2,253), death (2,001), and age (386). Because of these missing data, the percentages of hospitalizations, ICU admissions, and deaths (case-fatality percentages) were estimated as a range. The lower bound of these percentages was estimated by using all cases within each age group as denominators. The corresponding upper bound of these percentages was estimated by using only cases with known information on each outcome as denominators.

As of March 16, a total of 4,226 COVID-19 cases had been reported in the United States, with reports increasing to 500 or more cases per day beginning March 14 (Figure 1). Among 2,449 patients with known age, 6% were aged ≥85, 25% were aged 65–84 years, 18% each were aged 55–64 years and 45–54 years, and 29% were aged 20–44 years (Figure 2). Only 5% of cases occurred in persons aged 0–19 years.

Among 508 (12%) patients known to have been hospitalized, 9% were aged ≥85 years, 36% were aged 65–84 years, 17% were aged 55–64 years, 18% were 45–54 years, and 20% were aged 20–44 years. Less than 1% of hospitalizations were among persons aged ≤19 years (Figure 2). The percentage of persons hospitalized increased with age, from 2%–3% among persons aged ≤19 years, to ≥31% among adults aged ≥85 years. (Table).

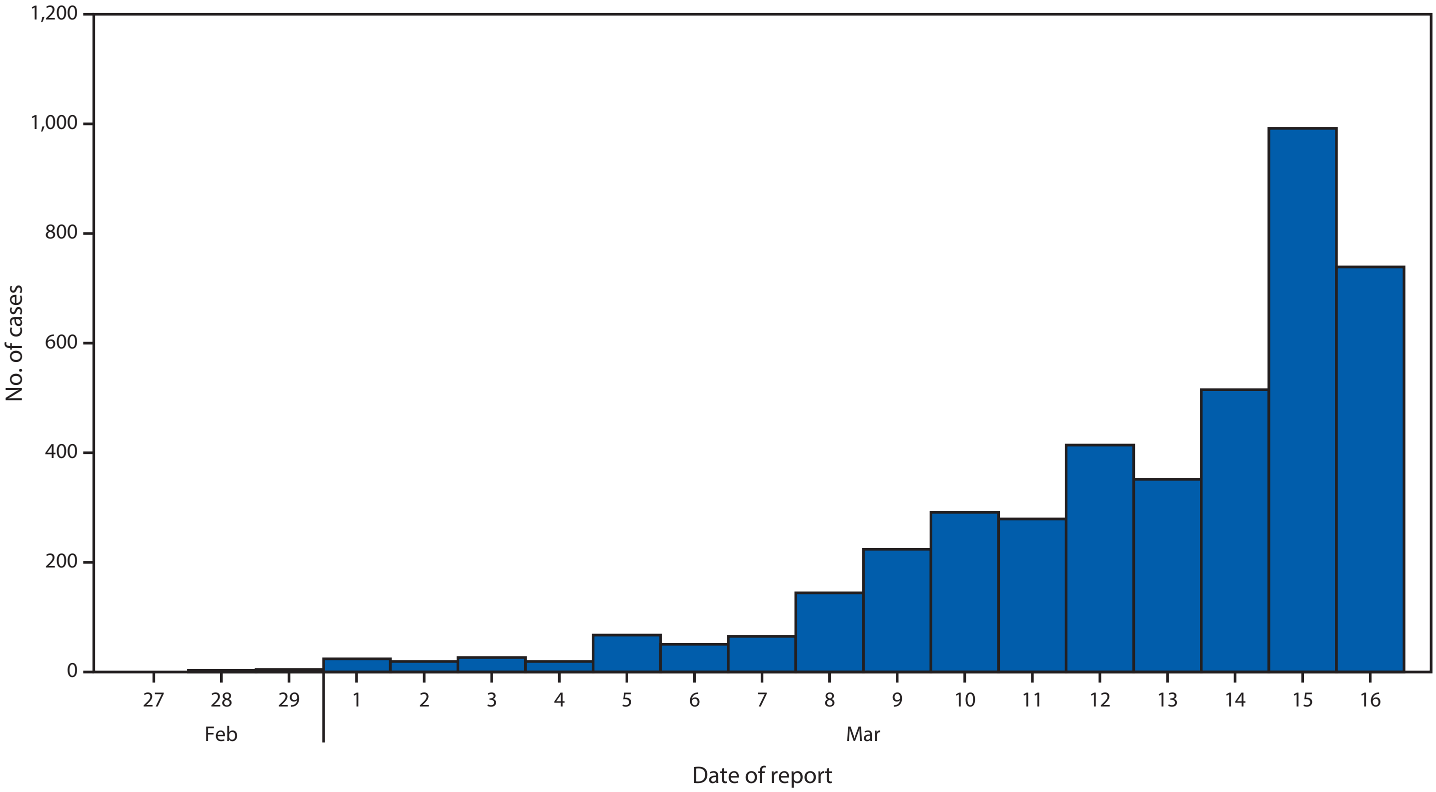
Among 121 patients known to have been admitted to an ICU, 7% of cases were reported among adults ≥85 years, 46% among adults aged 65–84 years, 36% among adults aged 45–64 years, and 12% among adults aged 20–44 years (Figure 2). No ICU admissions were reported among persons aged ≤19 years. Percentages of ICU admissions were lowest among adults aged 20–44 years (2%–4%) and highest among adults aged 75–84 years (11%–31%) (Table).

Among 44 cases with known outcome, 15 (34%) deaths were reported among adults aged ≥85 years, 20 (46%) among adults aged 65–84 years, and nine (20%) among adults aged 20–64 years. Case-fatality percentages increased with increasing age, from no deaths reported among persons aged ≤19 years to highest percentages (10%–27%) among adults aged ≥85 years (Table) (Figure 2).

Discussion

Since February 12, 4,226 COVID-19 cases were reported in the United States; 31% of cases, 45% of hospitalizations, 53% of ICU admissions, and 80% of deaths occurred among adults

FIGURE 1. Number of new coronavirus disease 2019 (COVID-19) cases reported daily*,† (N = 4,226) — United States, February 12–March 16, 2020



* Includes both COVID-19 cases confirmed by state or local public health laboratories, as well as those testing positive at the state or local public health laboratories and confirmed at CDC.

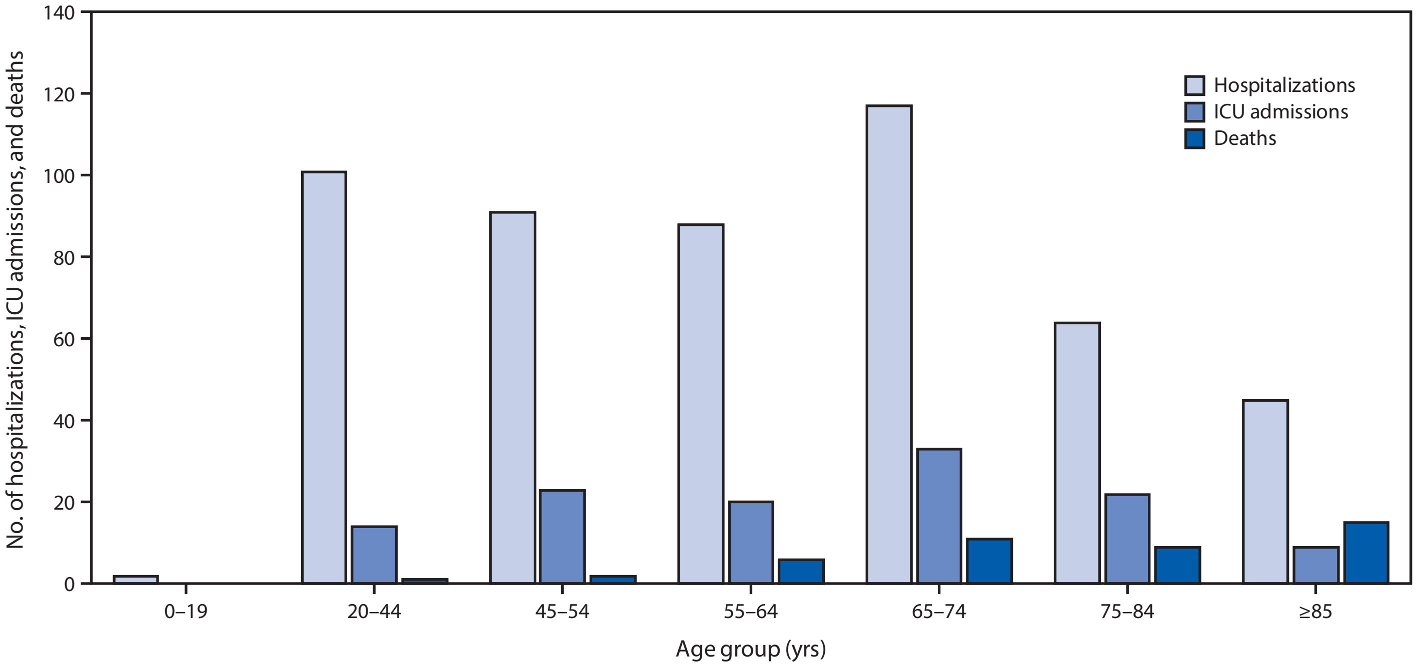
† Cases identified before February 28 were aggregated and reported during March 1–3.

aged ≥65 years with the highest percentage of severe outcomes among persons aged ≥85 years. These findings are similar to data from China, which indicated >80% of deaths occurred among persons aged ≥60 years (*3*). These preliminary data also demonstrate that severe illness leading to hospitalization, including ICU admission and death, can occur in adults of any age with COVID-19. In contrast, persons aged ≤19 years appear to have milder COVID-19 illness, with almost no hospitalizations or deaths reported to date in the United States in this age group. Given the spread of COVID-19 in many U.S. communities, CDC continues to update current recommendations and develop new resources and guidance, including for adults aged ≥65 years as well as those involved in their care (*7*,*8*).

Approximately 49 million U.S. persons are aged ≥65 years (*9*), and many of these adults, who are at risk for severe COVID-19–associated illness, might depend on services and support to maintain their health and independence. To prepare for potential COVID-19 illness among persons at high risk, family members and caregivers of older adults should know what medications they are taking and ensure that food and required medical supplies are available. Long-term care facilities should be particularly vigilant to prevent the introduction and spread of COVID-19 (*10*). In addition, clinicians who care for adults should be aware that COVID-19 can result in severe disease among persons of all ages. Persons with suspected or confirmed COVID-19 should monitor their symptoms and call their provider for guidance if symptoms worsen or seek emergency care for persistent severe symptoms. Additional guidance is available for health care providers on CDC's website (https://www.cdc.gov/coronavirus/2019-nCoV/hcp/index.html).

This report describes the current epidemiology of COVID-19 in the United States, using preliminary data. The findings in this report are subject to at least five limitations. First, data were missing for key variables of interest. Data on age and outcomes, including hospitalization, ICU admission, and death, were missing for 9%–53% of cases, which likely resulted in an underestimation of these outcomes. Second, further time for follow-up is needed to ascertain outcomes among active cases. Third, the initial approach to testing was to identify patients among those with travel histories or persons with more severe disease, and these data might overestimate the prevalence of severe disease. Fourth, data on other risk factors, including serious underlying health conditions that

FIGURE 2. COVID-19 hospitalizations,* intensive care unit (ICU) admissions,† and deaths,§ by age group — United States, February 12–March 16, 2020



* Hospitalization status missing or unknown for 1,514 cases.
† ICU status missing or unknown for 2,253 cases.
§ Illness outcome or death missing or unknown for 2,001 cases.

could increase risk for complications and severe illness, were unavailable at the time of this analysis. Finally, limited testing to date underscores the importance of ongoing surveillance of COVID-19 cases. Additional investigation will increase the understanding about persons who are at risk for severe illness and death from COVID-19 and inform clinical guidance and community-based mitigation measures.*

The risk for serious disease and death in COVID-19 cases among persons in the United States increases with age. Social distancing is recommended for all ages to slow the spread of the virus, protect the health care system, and help protect vulnerable older adults. Further, older adults should maintain adequate supplies of nonperishable foods and at least a 30-day supply of necessary medications, take precautions to keep space between themselves and others, stay away from those who are sick, avoid crowds as much as possible, avoid cruise travel and nonessential air travel, and stay home as much as possible to further reduce the risk of being exposed (*7*). Persons of all ages and communities can take actions to help slow the spread of COVID-19 and protect older adults.†

* https://www.cdc.gov/coronavirus/2019-ncov/downloads/community-mitigation-strategy.pdf.
† https://www.whitehouse.gov/wp-content/uploads/2020/03/03.16.20_coronavirus-guidance_8.5x11_315PM.pdf.

TABLE. Hospitalization, intensive care unit (ICU) admission, and case–fatality percentages for reported COVID–19 cases, by age group — United States, February 12–March 16, 2020

Age group (yrs) (no. of cases)	%*		
	Hospitalization	ICU admission	Case-fatality
0–19 (123)	1.6–2.5	0	0
20–44 (705)	14.3–20.8	2.0–4.2	0.1–0.2
45–54 (429)	21.2–28.3	5.4–10.4	0.5–0.8
55–64 (429)	20.5–30.1	4.7–11.2	1.4–2.6
65–74 (409)	28.6–43.5	8.1–18.8	2.7–4.9
75–84 (210)	30.5–58.7	10.5–31.0	4.3–10.5
≥85 (144)	31.3–70.3	6.3–29.0	10.4–27.3
Total (2,449)	**20.7–31.4**	**4.9–11.5**	**1.8–3.4**

* Lower bound of range = number of persons hospitalized, admitted to ICU, or who died among total in age group; upper bound of range = number of persons hospitalized, admitted to ICU, or who died among total in age group with known hospitalization status, ICU admission status, or death.

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CDC COVID-19 Response Team

Stephanie Bialek, CDC; Ellen Boundy, CDC; Virginia Bowen, CDC; Nancy Chow, CDC; Amanda Cohn, CDC; Nicole Dowling, CDC; Sascha Ellington, CDC; Ryan Gierke, CDC; Aron Hall, CDC; Jessica MacNeil, CDC; Priti Patel, CDC; Georgina Peacock, CDC;

Summary

What is already known about this topic?

Early data from China suggest that a majority of coronavirus disease 2019 (COVID-19) deaths have occurred among adults aged ≥60 years and among persons with serious underlying health conditions.

What is added by this report?

This first preliminary description of outcomes among patients with COVID-19 in the United States indicates that fatality was highest in persons aged ≥85, ranging from 10% to 27%, followed by 3% to 11% among persons aged 65–84 years, 1% to 3% among persons aged 55-64 years, <1% among persons aged 20–54 years, and no fatalities among persons aged ≤19 years.

What are the implications for public health practice?

COVID-19 can result in severe disease, including hospitalization, admission to an intensive care unit, and death, especially among older adults. Everyone can take actions, such as social distancing, to help slow the spread of COVID-19 and protect older adults from severe illness.

Tamara Pilishvili, CDC; Hilda Razzaghi, CDC; Nia Reed, CDC; Matthew Ritchey, CDC; Erin Sauber-Schatz, CDC.

Corresponding author: Hilda Razzaghi for the CDC COVID-19 Response Team, HRazzaghi@cdc.gov, 770-488-6518.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

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Please note: This report has been corrected.

Public Health Responses to COVID-19 Outbreaks on Cruise Ships — Worldwide, February–March 2020

Leah F. Moriarty, MPH[1]; Mateusz M. Plucinski, PhD[1]; Barbara J. Marston, MD[1]; Ekaterina V. Kurbatova, MD, PhD[1]; Barbara Knust, DVM[1]; Erin L. Murray, PhD[2]; Nicki Pesik, MD[1]; Dale Rose, PhD[1]; David Fitter, MD[1]; Miwako Kobayashi, MD, PhD[1]; Mitsuru Toda, PhD[1]; Paul T. Canty, MD[1]; Tara Scheuer, MPH[3]; Eric S. Halsey, MD[1]; Nicole J. Cohen, MD[1]; Lauren Stockman, MPH[2]; Debra A. Wadford, PhD[2]; Alexandra M. Medley, DVM[1,4]; Gary Green, MD[5]; Joanna J. Regan, MD[1]; Kara Tardivel, MD[1]; Stefanie White, MPH[1]; Clive Brown, MD[1]; Christina Morales, PhD[2]; Cynthia Yen, MPH[2]; Beth Wittry, MPH[1]; Amy Freeland, PhD[1]; Sara Naramore, MPH[3]; Ryan T. Novak, PhD[1]; David Daigle, MPH[1]; Michelle Weinberg, MD[1]; Anna Acosta, MD[1]; Carolyn Herzig, PhD[1]; Bryan K Kapella, MD[1]; Kathleen R. Jacobson, MD[2]; Katherine Lamba, MPH[2]; Atsuyoshi Ishizumi, MPH, MSc[1]; John Sarisky, MPH[1]; Erik Svendsen, PhD[1]; Tricia Blocher, MS[2]; Christine Wu, MD[3]; Julia Charles, JD[1]; Riley Wagner, MPH[1]; Andrea Stewart, PhD[1]; Paul S. Mead, MD[1]; Elizabeth Kurylo, MCM[1]; Stefanie Campbell, DVM[1]; Rachel Murray, MPH[1]; Paul Weidle, PharmD[1]; Martin Cetron, MD[1]; Cindy R. Friedman, MD[1]; CDC Cruise Ship Response Team; California Department of Public Health COVID-19 Team; Solano County COVID-19 Team

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An estimated 30 million passengers are transported on 272 cruise ships worldwide each year* (*1*). Cruise ships bring diverse populations into proximity for many days, facilitating transmission of respiratory illness (*2*). SARS-CoV-2, the virus that causes coronavirus disease (COVID-19) was first identified in Wuhan, China, in December 2019 and has since spread worldwide to at least 187 countries and territories. Widespread COVID-19 transmission on cruise ships has been reported as well (*3*). Passengers on certain cruise ship voyages might be aged ≥65 years, which places them at greater risk for severe consequences of SARS-CoV-2 infection (*4*). During February–March 2020, COVID-19 outbreaks associated with three cruise ship voyages have caused more than 800 laboratory-confirmed cases among passengers and crew, including 10 deaths. Transmission occurred across multiple voyages of several ships. This report describes public health responses to COVID-19 outbreaks on these ships. COVID-19 on cruise ships poses a risk for rapid spread of disease, causing outbreaks in a vulnerable population, and aggressive efforts are required to contain spread. All persons should defer all cruise travel worldwide during the COVID-19 pandemic.

During February 7–23, 2020, the largest cluster of COVID-19 cases outside mainland China occurred on the Diamond Princess cruise ship, which was quarantined in the port of Yokohama, Japan, on February 3 (*3*). On March 6, cases of COVID-19 were identified in persons on the Grand Princess cruise ship off the coast of California; that ship was subsequently quarantined. By March 17, confirmed cases of COVID-19 had been associated with at least 25 additional cruise ship voyages. On February 21, CDC recommended avoiding travel on cruise ships in Southeast Asia; on March 8, this recommendation was broadened to include deferring all cruise ship travel worldwide for those with underlying health conditions and for persons aged ≥65 years. On March 13, the Cruise Lines International Association announced a 30-day voluntary suspension of cruise operations in the United States (*5*). CDC issued a level 3 travel warning on March 17, recommending that all cruise travel be deferred worldwide.†

Diamond Princess

On January 20, 2020, the Diamond Princess cruise ship departed Yokohama, Japan, carrying approximately 3,700 passengers and crew (Table). On January 25, a symptomatic passenger departed the ship in Hong Kong, where he was evaluated; testing confirmed SARS-CoV-2 infection. On February 3, the ship returned to Japan, after making six stops in three countries. Japanese authorities were notified of the COVID-19 diagnosis in the passenger who disembarked in Hong Kong, and the ship was quarantined. Information about social distancing and monitoring of symptoms was communicated to passengers. On February 5, passengers were quarantined in their cabins; crew continued to work and, therefore, could not be isolated in their cabins (*6*). Initially, travelers with fever or respiratory symptoms and their close contacts were tested for SARS-CoV-2 by reverse transcription–polymerase chain reaction (RT-PCR). All those with positive test results were disembarked and hospitalized. Testing was later expanded to support a phased disembarkation of passengers, prioritizing testing of older persons, those with underlying medical conditions, and those in internal cabins with no access to the outdoors. During February 16–23, nearly 1,000 persons were repatriated by air to their home countries, including 329 persons who returned to the United States and entered quarantine or isolation.§,¶

* Not including river cruises.

† Warning level 3: avoid non-essential travel due to widespread ongoing transmission: https://wwwnc.cdc.gov/travel/notices/warning/novel-coronavirus-china.

§ Quarantine was used for persons who were exposed; isolation was used for persons who had positive test results for SARS-CoV-2.

¶ Movement for one person with resolved COVID-19 was not restricted.

The remaining passengers who had negative SARS-CoV-2 RT-PCR test results,** no respiratory symptoms, and no close contact with a person with a confirmed case of COVID-19 completed a 14-day ship-based quarantine before disembarkation. Those passengers who had close contact with a person with a confirmed case completed land-based quarantine, with duration determined by date of last contact. After disembarkation of all passengers, crew members either completed a 14-day ship-based quarantine, were repatriated to and managed in their home country, or completed a 14-day land-based quarantine in Japan.

Overall, 111 (25.9%) of 428 U.S. citizens and legal residents did not join repatriation flights either because they had been hospitalized in Japan or for other reasons. To mitigate SARS-CoV-2 importation into the United States, CDC used temporary "Do Not Board" restrictions (*7*) to prevent commercial airline travel to the United States,†† and the U.S. Departments of State and Homeland Security restricted travel to the United States for non-U.S. travelers.

** Based on Japanese testing procedures, which at the time included taking one oropharyngeal swab.

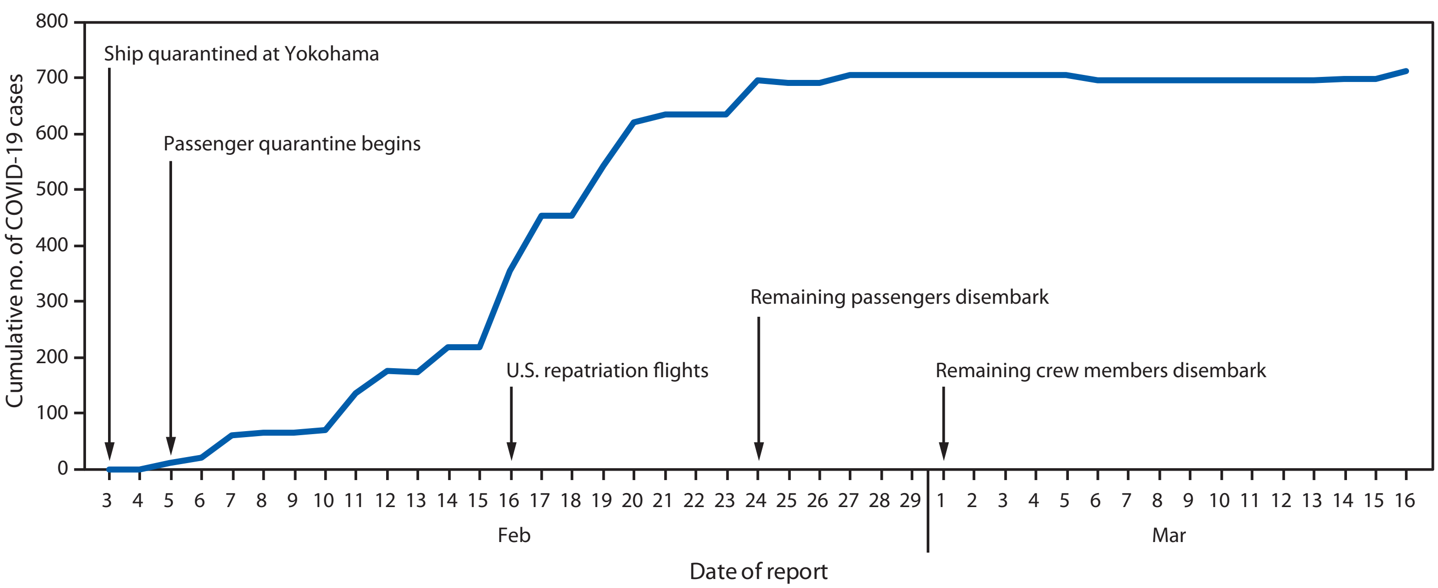
†† Travel restrictions were lifted when persons had either completed a 14-day monitoring period without symptoms or had met clinical criteria for release from isolation. https://japan2.usembassy.gov/pdfs/alert-20200227-diamond-princess.pdf.

Among 3,711 Diamond Princess passengers and crew, 712 (19.2%) had positive test results for SARS-CoV-2 (Figure 1). Of these, 331 (46.5%) were asymptomatic at the time of testing. Among 381 symptomatic patients, 37 (9.7%) required intensive care, and nine (1.3%) died (*8*). Infections also occurred among three Japanese responders, including one nurse, one quarantine officer, and one administrative officer (*9*). As of March 13, among 428 U.S. passengers and crew, 107 (25.0%) had positive test results for COVID-19; 11 U.S. passengers remain hospitalized in Japan (median age = 75 years), including seven in serious condition (median age = 76 years).

Grand Princess

During February 11–21, 2020, the Grand Princess cruise ship sailed roundtrip from San Francisco, California, making four stops in Mexico (voyage A). Most of the 1,111 crew and 68 passengers from voyage A remained on board for a second voyage that departed San Francisco on February 21 (voyage B), with a planned return on March 7 (Table). On March 4, a clinician in California reported two patients with COVID-19 symptoms who had traveled on voyage A, one of whom had positive test results for SARS-CoV-2. CDC notified the cruise line, which began cancelling group activities on voyage B. More than 20 additional cases of COVID-19 among persons who did not travel on voyage B have been identified from Grand Princess voyage A, the majority in California. One death has been reported. On March 5, a response team was transported

FIGURE 1. Cumulative number of confirmed coronavirus disease 2019 (COVID-19) cases* by date of detection — Diamond Princess cruise ship, Yokohama, Japan, February 3–March 16, 2020



Source: World Health Organization (WHO) coronavirus disease (COVID-2019) situation reports. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/.

* Decline in cumulative number of cases on February 13 and February 25 due to correction by WHO for cases that had been counted twice.

by helicopter to the ship to collect specimens from 45 passengers and crew with respiratory symptoms for SARS-CoV-2 testing; 21 (46.7%), including two passengers and 19 crew, had positive test results. Passengers and symptomatic crew members were asked to self-quarantine in their cabins, and room service replaced public dining until disembarkation. Following docking in Oakland, California, on March 8, passengers and crew were transferred to land-based sites for a 14-day quarantine period or isolation. Persons requiring medical attention for other conditions or for symptoms consistent with COVID-19 were evaluated, tested for SARS-CoV-2 infection, and hospitalized if indicated. During land-based quarantine in the United States, all persons were offered SARS-CoV-2 testing. As of March 21, of 469 persons with available test results, 78 (16.6%) had positive test results for SARS-CoV-2. Repatriation flights for foreign nationals were organized by several governments in coordination with U.S. federal and California state government agencies. Following disinfection of the vessel according to guidance from CDC's Vessel Sanitation Program, remaining foreign nationals will complete quarantine on board. The quarantine will be managed by the cruise company, with technical assistance provided by public health experts.

On February 21, five crew members from voyage A transferred to three other ships with a combined 13,317 passengers on board. No-sail orders[§§] were issued by CDC for these ships until medical logs were reviewed and the crew members tested negative for SARS-CoV-2.

Additional Ships

The Diamond Princess and Grand Princess had more than 800 total COVID-19 cases, including 10 deaths. During February 3–March 13, in the United States, approximately 200 cases of COVID-19 were confirmed among returned cruise travelers from multiple ship voyages, including the Diamond Princess and Grand Princess, accounting for approximately 17% of total reported U.S. cases at the time (*10*). Cases linked with cruise travel have been reported to CDC in at least 15 states. Since February, multiple international cruises have been implicated in reports of COVID-19 cases, including at least 60 cases in the United States from Nile River cruises in Egypt (Figure 2). Secondary community-acquired cases linked to returned passengers on cruises have also been reported (CDC, unpublished data, 2020).

Discussion

Public health responses to COVID-19 outbreaks on cruise ships were aimed at limiting transmission among passengers and crew, preventing exportation of COVID-19 to other communities, and assuring the safety of travelers and responders.

[§§] CDC has the authority to institute a no-sail order to prevent ships from sailing when it is reasonably believed that continuing normal operations might subject newly arriving passengers to disease.

TABLE. Demographic characteristics of passengers and crew members on board two cruise ships with COVID-19 outbreaks January 20–March 8, 2020

	Diamond Princess (total 3,711 persons)		Grand Princess, voyage B (total 3,571 persons)	
Characteristic	**Crew**	**Passengers**	**Crew**	**Passengers**
Total no.	**1,045**	**2,666**	**1,111**	**2,460**
Age median (interquartile range), yrs	36 (29–43)	69 (62–73)	36 (30–43)	68 (61–74)
Total nations represented	48	36	44	24
Country of residence of passengers, no. (%)				
Japan	N/A	1,281 (48)	N/A	3 (1)
United States	N/A	416 (16)	N/A	2,008 (82)
Hong Kong	N/A	260 (10)	N/A	0 (0)
Canada	N/A	251 (9)	N/A	231 (9)
Australia	N/A	223 (8)	N/A	1 (0)
United Kingdom	N/A	57 (2)	N/A	113 (4)
Other countries or unknown	N/A	178 (7)	N/A	104 (4)
Country of residence of crew members, no. (%)				
Philippines	531 (51)	N/A	529 (48)	N/A
India	132 (13)	N/A	131 (12)	N/A
Indonesia	78 (7)	N/A	57 (5)	N/A
Other countries or unknown	304 (29)	N/A	394 (35)	N/A
Sex, no. (%)				
Male	843 (81)	1,189 (45)	928 (84)	1,120 (46)
Female	202 (19)	1,477 (55)	183 (16)	1,340 (54)
No. of persons per cabin, mean (range)	1.73 (1–3)	1.98 (1–4)	1.75 (1–4)	1.95 (1–4)

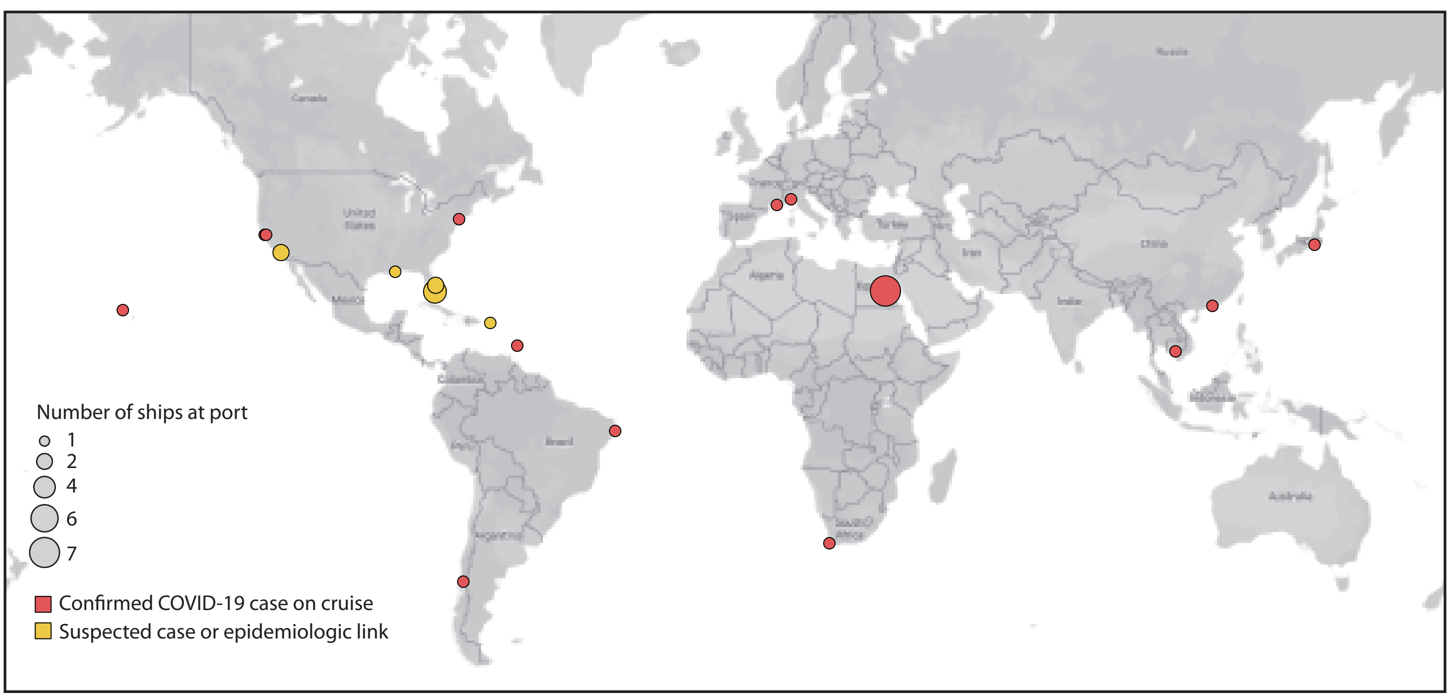
Abbreviation: N/A = not applicable.

These responses required the coordination of stakeholders across multiple sectors, including U.S. Government departments and agencies, foreign ministries of health, foreign embassies, state and local public health departments, hospitals, laboratories, and cruise ship companies. At the time of the Diamond Princess outbreak, it became apparent that passengers disembarking from cruise ships could be a source of community transmission. Therefore, aggressive efforts to contain transmission on board and prevent further transmission upon disembarkation and repatriation were instituted. These efforts included travel restrictions applied to persons, movement restrictions applied to ships, infection prevention and control measures, (e.g., use of personal protective equipment for medical and cleaning staff), disinfection of the cabins of persons with suspected COVID-19, provision of communication materials, notification of state health departments, and investigation of contacts of cases identified among U.S. returned travelers.

Cruise ships are often settings for outbreaks of infectious diseases because of their closed environment, contact between travelers from many countries, and crew transfers between ships. On the Diamond Princess, transmission largely occurred among passengers before quarantine was implemented, whereas crew infections peaked after quarantine (*6*). On the Grand Princess, crew members were likely infected on voyage A and then transmitted SARS-CoV-2 to passengers on voyage B. The results of testing of passengers and crew on board the Diamond Princess demonstrated a high proportion (46.5%) of asymptomatic infections at the time of testing. Available statistical models of the Diamond Princess outbreak suggest that 17.9% of infected persons never developed symptoms (*9*). A high proportion of asymptomatic infections could partially explain the high attack rate among cruise ship passengers and crew. SARS-CoV-2 RNA was identified on a variety of surfaces in cabins of both symptomatic and asymptomatic infected passengers up to 17 days after cabins were vacated on the Diamond Princess but before disinfection procedures had been conducted (Takuya Yamagishi, National Institute of Infectious Diseases, personal communication, 2020). Although these data cannot be used to determine whether transmission occurred from contaminated surfaces, further study of fomite transmission of SARS-CoV-2 aboard cruise ships is warranted.

During the initial stages of the COVID-19 pandemic, the Diamond Princess was the setting of the largest outbreak outside mainland China. Many other cruise ships have since been implicated in SARS-CoV-2 transmission. Factors that facilitate spread on cruise ships might include mingling of travelers from multiple geographic regions and the closed nature of a cruise ship environment. This is particularly concerning for older passengers, who are at increased risk for serious complications of COVID-19 (*4*). The Grand Princess was an example of perpetuation of transmission from crew members across multiple consecutive voyages and the potential introduction of the virus to passengers and crew on other ships. Public health responses to cruise ship outbreaks require extensive resources. Temporary suspension of cruise ship travel during the current phase of

FIGURE 2. Cruise ships with coronavirus disease 2019 (COVID-19) cases requiring public health responses — worldwide, January–March 2020



Summary

What is already known about this topic?

Cruise ships are often settings for outbreaks of infectious diseases because of their closed environment and contact between travelers from many countries.

What is added by this report?

More than 800 cases of laboratory-confirmed COVID-19 cases occurred during outbreaks on three cruise ship voyages, and cases linked to several additional cruises have been reported across the United States. Transmission occurred across multiple voyages from ship to ship by crew members; both crew members and passengers were affected; 10 deaths associated with cruise ships have been reported to date.

What are the implications for public health practice?

Outbreaks of COVID-19 on cruise ships pose a risk for rapid spread of disease beyond the voyage. Aggressive efforts are required to contain spread. All persons should defer all cruise travel worldwide during the COVID-19 pandemic.

the COVID-19 pandemic has been partially implemented by cruise lines through voluntary suspensions of operations, and by CDC through its unprecedented use of travel notices and warnings for conveyances to limit disease transmission (*5*).

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CDC Cruise Ship Response Team

Casey Barton Behravesh, CDC; Adam Bjork, CDC; William Bower, CDC; Catherine Bozio, CDC; Zachary Braden, CDC; Mary Catherine Bertulfo, CDC; Kevin Chatham-Stephens, CDC; Victoria Chu, CDC; Barbara Cooper, CDC; Kathleen Dooling, CDC; Christine Dubray, CDC; Emily Curren, CDC; Margaret A. Honein, CDC; Kathryn Ivey, CDC; Jefferson Jones, CDC; Melissa Kadzik, CDC; Nancy Knight, CDC; Mariel Marlow, CDC; Audrey McColloch, CDC; Robert McDonald, CDC; Andrew Klevos, CDC; Sarah Poser, CDC; Robin A. Rinker, CDC; Troy Ritter, CDC; Luis Rodriguez, CDC; Matthew Ryan, CDC; Zachary Schneider, CDC; Caitlin Shockey, CDC; Jill Shugart, CDC; Margaret Silver, CDC; Paul W. Smith, CDC; Farrell Tobolowsky, CDC; Aimee Treffiletti, CDC; Megan Wallace, CDC; Jonathan Yoder, CDC.

California Department of Public Health COVID-19 Team

Pennan Barry, California Department of Public Health; Ricardo Berumen III, California Department of Public Health; Brooke Bregman, California Department of Public Health; Kevin Campos, California Department of Public Health; Shua Chai, California Department of Public Health; Rosie Glenn-Finer, California Department of Public Health; Hugo Guevara, California Department of Public Health; Jill Hacker, California Department of Public Health; Kristina Hsieh, California Department of Public Health; Mary Kate Morris, California Department of Public Health; Ryan Murphy, California Department of Public Health; Jennifer F. Myers, California Department of Public Health; Tasha Padilla, California Department of Public Health; Chao-Yang Pan, California Department of Public Health; Adam Readhead, California Department of Public Health; Estela Saguar, California Department of Public Health; Maria Salas, California Department of Public Health; Robert E. Snyder, California Department of Public Health; Duc Vugia, California Department of Public Health; James Watt, California Department of Public Health; Cindy Wong, California Department of Public Health.

Solano County COVID-19 Team

Meileen Acosta, Solano County Department of Public Health; Shai Davis, Solano County Department of Public Health; Beatrix Kapuszinsky, Solano County Department of Public Health; Bela Matyas, Solano County Department of Public Health; Glen Miller, Solano County Department of Public Health; Asundep Ntui, Solano County Department of Public Health; Jayleen Richards, Solano County Department of Public Health.

Corresponding author: Leah F. Moriarty, eocevent294@cdc.gov, 770-488-7100.

[1]CDC COVID-19 Response Team; [2]California Department of Public Health; [3]Solano Public Health, Fairfield, California; [4]Epidemic Intelligence Service, CDC; [5]Sutter Medical Group of the Redwoods, Santa Rosa, California.

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Notes from the Field

Ongoing Cluster of Highly Related Disseminated Gonococcal Infections — Southwest Michigan, 2019

William D. Nettleton, MD[1,2]; James B. Kent, MS[3]; Kathryn Macomber, MPH[3]; Mary-Grace Brandt, PhD[3]; Kelly Jones[3]; Alison D. Ridpath, MD[4]; Brian H. Raphael, PhD[4]; Eden V. Wells, MD[3]

Disseminated gonococcal infection is a rare, systemic complication of untreated gonorrhea that occurs after sexual transmission and through hematogenous spread of *Neisseria gonorrhoeae* to distant body sites (*1*). Disseminated gonococcal infection usually manifests as arthritis, dermatitis, and tenosynovitis. In rare cases, endocarditis, meningitis, myositis, and osteomyelitis can occur. On August 12, 2019, the Kalamazoo County Health and Community Services Department (KCHCSD), Michigan, was notified of three persons hospitalized with disseminated gonococcal infection. Given the rarity of disseminated gonococcal infection, severe case presentations, and ongoing case clustering, KCHCSD and the Michigan Department of Health and Human Services (MDHHS) initiated a joint investigation. Actions included health alerts and public notifications, medical record reviews, patient interviews, antimicrobial resistance testing, and whole genome sequencing (WGS) of *N. gonorrhoeae* isolates by MDHHS and CDC laboratories. A review of approximately 27,000 gonorrhea cases from the preceding 18 months revealed no other location or time clustering of disseminated gonococcal infection in Michigan. To better characterize the cluster, case definitions were developed.

A confirmed case was defined as isolation of *N. gonorrhoeae* from any sterile site, including blood, synovial fluid, or cerebrospinal fluid. A probable case was defined as a positive nucleic acid amplification test from nonsterile sites (e.g., urethra, vagina, cervix, rectum, or pharynx) in the presence of signs or symptoms (e.g., tenosynovitis or polyarthralgias). Thirteen confirmed and three probable cases were reported during August 12–December 18, 2019. Fourteen of these 16 patients resided in Kalamazoo County and two in bordering southwestern Michigan counties.

Nine of the 16 patients were male, and patient ages ranged from 16 to 52 years (Table). Patients initially had one or more of the following manifestations: septic arthritis (13 patients), myositis (four), tenosynovitis (three), osteomyelitis (two), and mitral valve endocarditis (one). Only the patient with endocarditis had *N. gonorrhoeae* isolated from blood. Fifteen of the 16 patients were hospitalized, and 13 required invasive surgical intervention. Eleven had laboratory confirmation of *N. gonorrhoeae* from nondisseminated sites on initial evaluation, including eight urogenital, five pharyngeal, and one rectal. Fourteen patients received intravenous or intramuscular ceftriaxone treatment (seven patients received 4–6 weeks' therapy). No underlying immunosuppressive disorders (e.g., human immunodeficiency virus infection or complement deficiency) or use of immunocompromising medications were identified. Four patients were homeless. Thirteen reported or tested positive for drug use (methamphetamine [10], marijuana [six], and opioids [three]), including three who reported injection drug use. Although each patient named from zero to five sex or needle-sharing partners for a total of 27 partners, interviews did not reveal direct sex or needle contact between patients within the cluster. Of 11 isolates recovered from sterile sites, all were sensitive to azithromycin, ceftriaxone, and cefixime. Despite an inability to identify social connections, WGS revealed highly related isolates, differing by 10–48 single nucleotide polymorphisms.

The clinical severity, high relatedness of isolates, and reported methamphetamine use among patients raise unique questions about host and pathogen factors that warrant further

TABLE. Characteristics of patients with disseminated gonococcal infection — southwest Michigan, 2019

Characteristic	No. (%)
Total	**16 (100)**
Median age (yrs) (range)	39 (16–52)
Sex	
Male	9 (56)
Female	7 (44)
Case status	
Confirmed	13 (81)
Probable	3 (19)
Residence	
Kalamazoo County	14 (88)
Other southwest Michigan counties	2 (13)
Homeless	4 (25)
Initial clinical manifestations	
Septic arthritis	13 (81)
Myositis	4 (25)
Tenosynovitis	3 (19)
Osteomyelitis	2 (13)
Mitral valve endocarditis*	1 (6)
Concurrent gonococcal infections	**11 (69)**
Urogenital	8 (50)
Pharyngeal	5 (31)
Rectal	1 (6)
Hospitalized	15 (94)
Parenteral ceftriaxone treatment†	14 (88)
Reported drug use or positive drug test	**13 (81)**
Methamphetamine	10 (63)
Marijuana	6 (38)
Opioids	3(19)
Injection drug use	3 (19)

* This patient had *Neisseria gonorrhoeae* isolated from blood.
† Seven patients received treatment for 4–6 weeks.

investigation. Prompt diagnosis and treatment of disseminated gonococcal infection might prevent severe disease and complications. Outreach continues to ensure case finding, clinician awareness, partner elicitation, and broad distribution of prevention messages. Enhanced surveillance, thorough investigation, and continued partnerships remain crucial for rapid identification, improved understanding, and mitigation of disseminated gonococcal infection cases and clusters identified in Michigan.

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Corresponding author: William D. Nettleton, wdnett@kalcounty.com, 269-373-5261.

[1]Kalamazoo County Health and Community Services Department, Kalamazoo, Michigan; [2]Department of Family and Community Medicine, Western Michigan University Homer Stryker M.D. School of Medicine, Kalamazoo, Michigan; [3]Michigan Department of Health and Human Services; [4]Division of STD Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC.

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Notes from the Field

Nationwide Hepatitis E Outbreak Concentrated in Informal Settlements — Namibia, 2017–2020

Nirma D. Bustamante, MD[1]; Selma Robert Matyenyika[2]; Leigh Ann Miller, PhD[3]; Matthew Goers, MD[1]; Puumue Katjiuanjo, MPH, MSc[2]; Kakehongo Ndiitodino, MSc[2]; Emmy-Else Ndevaetela, MPH[2]; Undjee Kaura[2]; Kofi Mensah Nyarko, MD[2]; Lilliane Kahuika-Crentsil, MD[2]; Bernard Haufiku, MD[2]; Thomas Handzel, PhD[1]; Eyasu H. Teshale, MD[4]; Eric J. Dziuban, MD[3]; Benetus T. Nangombe[3]; Megan G. Hofmeister, MD[4]

In September 2017, Namibia's Ministry of Health and Social Services (MoHSS) identified an increase in cases of acute jaundice in Khomas region, which includes the capital city of Windhoek. Hepatitis E is a liver disease caused by hepatitis E virus, which is transmitted by the fecal-oral route, causing symptoms consistent with acute jaundice syndrome (*1*). Hepatitis E is rarely fatal; however, the disease can be severe in pregnant women, resulting in fulminant hepatic failure and death (*2*).

On December 14, 2017, MoHSS declared a hepatitis E outbreak in Khomas, which subsequently developed into a nationwide protracted epidemic, centered mainly in informal settlements with poor sanitary conditions. During December 14, 2017–February 2, 2020, a total of 7,247 outbreak-associated hepatitis E cases were reported (Figure). Data on cases were obtained through epidemiologic surveillance, active case finding, and review of health care facility records. Cases were categorized as 1) suspected (acute onset of jaundice or dark urine and pale stools preceded by acute "flu-like" illness and at least one of the following: low grade fever (100.4°F–102.2°F[38°C–39°C]), anorexia, fatigue, nausea or vomiting); 2) epidemiologically linked (suspected case in a person with recent travel to a known outbreak-affected region), or 3) confirmed (acute jaundice with detection of hepatitis E virus immunoglobulin M antibody in serum). Among reported cases, 925 (13%) were suspected, 4,500 (63%) were epidemiologically linked, and 1,822 (24%) were confirmed. All of Namibia's 14 regions have now detected hepatitis E cases. The majority of cases (59%) occurred in males, and 72% of cases were in persons aged 20–39 years. Sixty-one deaths (0.8%) were reported nationally, including 24 (39%) in pregnant or postpartum women (maternal case fatality rate = 6%). Among all reported cases, 6,068 (84%) were reported from Khomas and Erongo regions, which have large informal settlements. Specifically, 2,677 (37%) cases were reported from three of Namibia's largest informal settlements, Havana and Goreangab (both in Khomas region), and the Democratic Resettlement Community (in Erongo region). Because of increased rural-urban migration, many low-income workers live in informal settlements with substandard housing and poor sanitation.

CDC has provided technical assistance since the beginning of the outbreak through its Namibia country office. An expanded CDC team was invited to support the national epidemiologic efforts in October 2018. During this response, CDC and international partners helped MoHSS strengthen its surveillance system and data management processes. Activities included standardization of line lists and variables, enhancement of disease-specific surveillance through four national training sessions (totaling 54 staff members), development of effective communication strategies through a reformatted situation report, and supporting implementation of effective outbreak control and prevention measures.

This is the third hepatitis E outbreak described in Namibia since 1983, the largest to date, and the first of nationwide scope (*3*,*4*). The government of Namibia estimates that approximately 40% of households in urban areas are in informal settlements with minimal infrastructure, limited access to latrines and piped water, and poor hygiene (*5*). Although the national population growth rate has been approximately 1.4% per year, in informal settlements the growth rate has been 8%–15% per year (*6*). Improved hand hygiene and sanitation practices and access to safe water are needed to interrupt the transmission of hepatitis E virus in this protracted national outbreak, especially given the high risk of mortality to pregnant women. In Namibia, there are efforts in most affected areas to improve access to and use of latrines through Community-Led Total Sanitation* to address the outbreak.

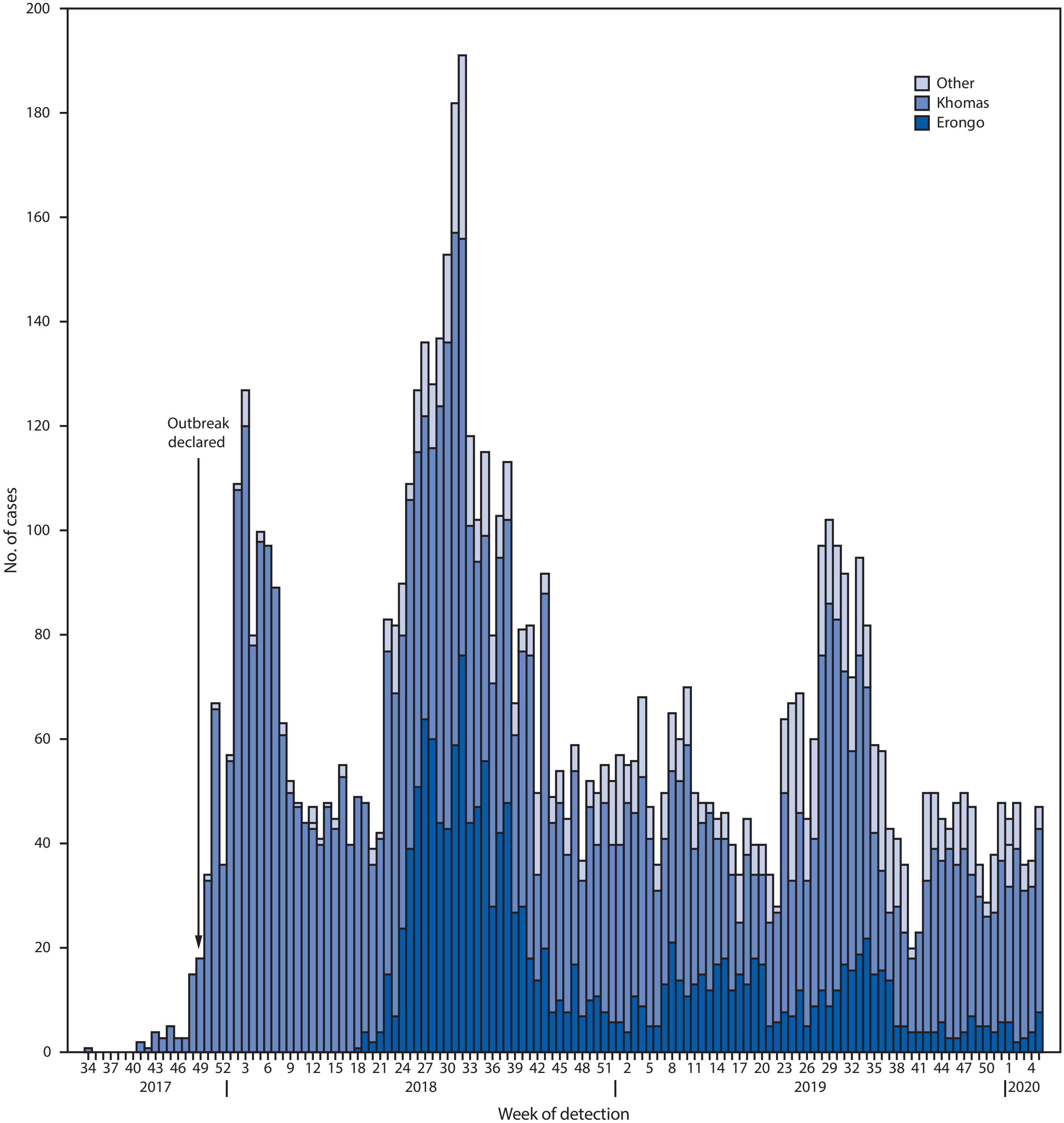
* https://www.na.undp.org/content/namibia/en/home/presscenter/articles/2019/launch-of-the-community-led-total-sanitation-campaign-to-fight-h.html.

Corresponding author: Nirma D. Bustamante, okl6@cdc.gov, 404-498-5958.

[1]Division of Global Health Protection, Center for Global Health, CDC; [2]Ministry of Health and Social Services, Namibia; [3]Division of Global HIV & TB, Center for Global Health, CDC; [4]Division of Viral Hepatitis, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, CDC.

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflicts of interest were disclosed.

FIGURE. Number of hepatitis E cases (N = 7,247), by week of case detection and region of country* — Namibia, 2017–2020



* Khomas and Erongo regions have large informal settlements and have accounted for 6,068 (84%) of the hepatitis E cases.

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Erratum:

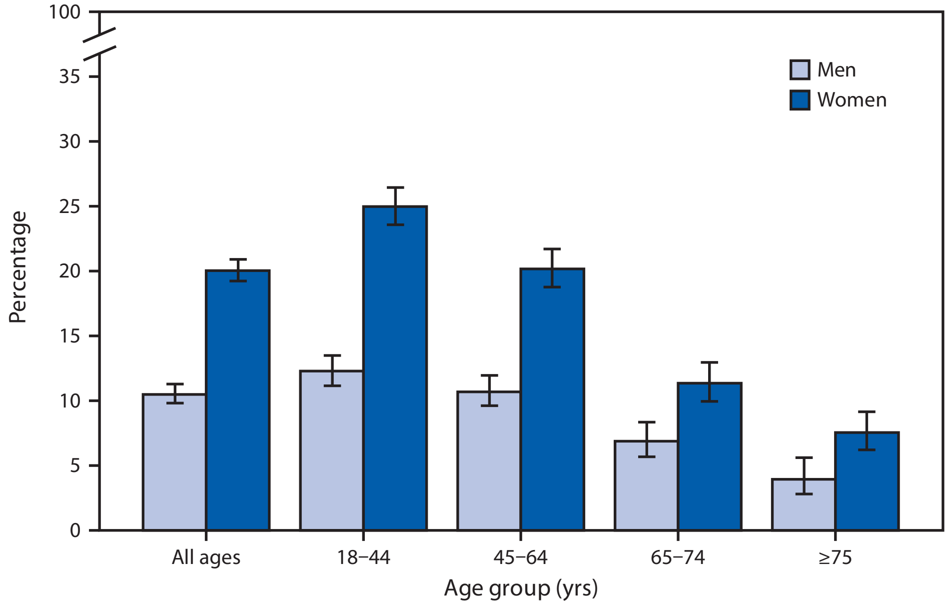
Vol. 69, No. 7

In the report "Interim Estimates of 2019–20 Seasonal Influenza Vaccine Effectiveness — United States, February 2020," on page 182, in the Acknowledgments, Sonny Kim should have been listed as **Seung Jun Kim**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage* of Adults Who Had a Severe Headache or Migraine in the Past 3 Months, by Sex and Age Group — National Health Interview Survey, United States, 2018†,§



* With 95% confidence intervals indicated by error bars.
† Based on a question in the Sample Adult Interview that asks "During the past 3 months, did you have...[a] severe headache or migraine?"
§ Estimates are based on household interviews of a sample of the civilian, noninstitutionalized U.S. population.

In 2018, women were nearly twice as likely as men to have had a severe headache or migraine in the past 3 months (20.1% versus 10.6%), both overall and within each age group. The percentage of persons experiencing severe headache or migraine declined with age for both men and women, from 25.5% among those aged 18–44 years to 7.6% among those aged ≥75 years for women and from 12.3% among those aged 18–44 years to 4.0% among those aged ≥75 years for men.

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

Reported by: Sarah E. Lessem, PhD, slessem@cdc.gov, 301-458-4209; Jacqueline Lucas, MPH.

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