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Driving Under the Influence of Marijuana and Illicit Drugs Among Persons Aged ≥16 Years — United States, 2018

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In the United States, driving while impaired is illegal. Nonetheless, an estimated 10,511 alcohol-impaired driving deaths occurred in 2018.* The contribution of marijuana and other illicit drugs to these and other impaired driving deaths remains unknown. Data from the Substance Abuse and Mental Health Services Administration's National Survey on Drug Use and Health (NSDUH) indicated that in the United States during 2014, 12.4% of all persons aged 16–25 years reported driving under the influence of alcohol, and 3.2% reported driving under the influence of marijuana (*1*). The impairing effects of alcohol are well established, but less is known about the effects of illicit substances or other psychoactive drugs (e.g., marijuana, cocaine, methamphetamines, and opioids, including heroin). This report provides the most recent national estimates of self-reported driving under the influence of marijuana and illicit drugs among persons aged ≥16 years, using 2018 public-use data from NSDUH. Prevalences of driving under the influence of marijuana and illicit drugs other than marijuana were assessed for persons aged ≥16 years by age group, sex, and race/ethnicity. During 2018, 12 million (4.7%) U.S. residents reported driving under the influence of marijuana in the past 12 months; 2.3 million (0.9%) reported driving under the influence of illicit drugs other than marijuana. Driving under the influence was more prevalent among males and among persons aged 16–34 years. Effective measures that deter driving under the influence of drugs are limited (*2*). Development, evaluation, and further implementation of strategies to prevent alcohol-impaired,† drug-impaired, and polysubstance-impaired driving, coupled with standardized testing of impaired drivers and drivers involved in fatal crashes, could advance understanding of drug- and polysubstance-impaired driving and support prevention efforts.

NSDUH annually collects information about the use of illicit drugs, alcohol, and tobacco among the noninstitutionalized U.S. civilian population aged ≥12 years via household face-to-face interviews using a computer-assisted personal interviewing system.§ Respondents aged <16 years were excluded from this analysis because they are typically too young to drive. Unweighted sample sizes for the 2018 survey cycle included

* https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812826.
† https://www.cdc.gov/motorvehiclesafety/impaired_driving/strategies.html.

§ https://www.samhsa.gov/data/data-we-collect/nsduh-national-survey-drug-use-and-health. Starting in 2016, NSDUH replaced questions regarding driving under the influence of illicit drugs overall with questions about driving under the influence of individual substances, including cocaine, hallucinogens, heroin, inhalants, marijuana, and methamphetamines.

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47,570 respondents aged ≥16 years. Driving under the influence of marijuana was defined as an affirmative response to the question "During the past 12 months, have you driven a vehicle while you were under the influence of marijuana?" Driving under the influence of illicit drugs other than marijuana was defined as an affirmative response to one or more of the questions (each asked separately) that asked about each illicit drug: "During the past 12 months, have you driven a vehicle while you were under the influence of (cocaine, hallucinogens, heroin, inhalants, methamphetamine)"? Public-use NSDUH data on driving under the influence of marijuana and illicit drugs other than marijuana were examined by sex, age group, and race/ethnicity. Data were weighted to provide nationally representative estimates. Statistical analyses were performed using SAS (version 9.4; SAS Institute). Prevalence measures and 95% confidence intervals (CIs) were determined for each response category.

During 2018, the overall prevalence of driving under the influence of marijuana (4.7%) exceeded that of driving under the influence of illicit drugs other than marijuana (0.9%) among persons aged ≥16 years (Table). This pattern persisted when the data were stratified by sex, race/ethnicity, and age group. The prevalences of driving under the influence of marijuana and driving under the influence of illicit drugs other than marijuana were higher among males (6.2%, 1.3%, respectively) than among females (3.2%, 0.5%, respectively). The prevalence of driving under the influence of marijuana was highest among non-Hispanic multiracial persons (9.2%). The prevalence of driving under the influence of marijuana ranged from 0.6% among persons aged ≥65 years to 12.4% among persons aged 21–25 years; the second highest prevalence (9.2%) was reported among persons aged 16–20 years (Figure). The highest reported prevalences of driving under the influence of illegal drugs other than marijuana were among persons aged 21–25 years (1.9%) and 26–34 years (1.9%).

Discussion

Although 4.7% of the U.S. population aged ≥16 years reported driving under the influence of marijuana and 0.9% reported driving under the influence of illicit drugs other than marijuana, these estimates are lower than the 8.0% (20.5 million) who reported driving under the influence of alcohol in 2018 (NSDUH, unpublished data, 2019). The highest prevalence of driving under the influence of marijuana was among persons aged 21–25 years. The second highest was among the youngest drivers (those aged 16–20 years), who already have a heightened crash risk because of inexperience[¶]; thus, their substance use is of special concern. In a study of injured drivers aged 16–20 years evaluated at level 1 trauma centers in Arizona during 2008–2014 (*3*), 10% of tested drivers were simultaneously positive for both alcohol and tetrahydrocannabinol, the main psychoactive component of marijuana. Data from the 2018 NSDUH indicate a high prevalence (34.8%) of past-year marijuana use among young adults aged 18–25 years

[¶] https://www.cdc.gov/motorvehiclesafety/teen_drivers/teendrivers_factsheet.html.

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TABLE. Number and percentage of all persons aged ≥16 years* who reported driving a vehicle while under the influence of marijuana or illicit drugs other than marijuana† in the past year, by demographic characteristics — National Survey on Drug Use and Health, United States, 2018

Characteristic	Marijuana		Illicit drugs other than marijuana	
	No. who reported driving under the influence (x 1,000)	% (95% CI)	No. who reported driving under the influence (x 1,000)	% (95% CI)
Sex				
Male	7,711	6.2 (5.9–6.6)	1,578	1.3 (1.1–1.5)
Female	4,249	3.2 (2.9–3.5)	722	0.5 (0.4–0.7)
Race/Ethnicity§				
White	7,913	4.9 (4.5–5.2)	1,601	1.0 (0.9–1.1)
Black	1,576	5.1 (4.5–5.7)	182	0.6 (0.3–0.9)
American Indian/Alaska Native	72	4.9 (2.7–7.1)	18	1.2 (0.2–2.2)
Hawaiian/Other Pacific Islander	35	3.6 (0.9–6.3)	13	1.4 (0.0–3.3)
Asian	336	2.3 (1.2–3.4)	74	0.5 (0.2–0.9)
Multiracial	427	9.2 (6.3–12.1)	50	1.1 (0.5–1.6)
Hispanic	1,602	3.8 (3.2–4.4)	362	0.9 (0.6–1.1)
Total	**11,960**	**4.7 (4.4–4.9)**	**2,300**	**0.9 (0.8–1.0)**

Abbreviation: CI = confidence interval.
* Numbers and percentages are weighted to represent the 2018 U.S. civilian, noninstitutionalized population and are not mutually exclusive.
† Illicit drugs other than marijuana in this analysis are cocaine, hallucinogens, heroin, inhalants, and methamphetamines.
§ Whites, blacks, American Indian/Alaska Natives, Hawaiian/Other Pacific Islanders, Asians, and multiracial persons were non-Hispanic; Hispanic persons could be of any race.

(*4*). Studies have reported that marijuana use among teenagers and young adults might alter perception, judgement, short-term memory, and cognitive abilities (*5*). Given these findings, states could consider developing, implementing, and evaluating targeted strategies to reduce marijuana use and potential subsequent impaired driving, especially among teenagers and young adults.

Research has determined that co-use of marijuana or illicit drugs with alcohol increases the risk for driving impairment (*5*,*6*). The use of these substances has been associated with impairment of psychomotor and cognitive functions while driving (*6*,*7*). In addition, previous research has demonstrated evidence of a statistical association between marijuana use and increased risk for motor vehicle crashes; however, methodologic limitations of studies limit inference of causation (*8*). Scientific studies have been unable to link blood tetrahydrocannabinol levels to driving impairment (*8*), and the effects of marijuana in drivers likely varies by dose, potency of the product consumed, means of consumption (e.g., smoking, eating, or vaping), length of use, and co-use of other substances, including alcohol. Additional data are needed to clarify the contribution of drug and polysubstance use to impaired driving prevalence and the resulting crashes, injuries, and deaths.

A national roadside survey using biochemical specimens among drivers aged ≥16 years found that during 2013–2014, the percentages of weekend nighttime drivers who tested positive for alcohol, marijuana (i.e., tetrahydrocannabinol) and illicit drugs were 8.3%, 12.6%, and 15.1%, respectively (*9*), although a positive test does not necessarily imply impairment. Collecting and testing biologic specimens (e.g., blood or oral fluids) currently required to test for drugs has challenges, including, in some circumstances, the need for a judge to order collection and testing (which can delay roadside testing, thus allowing drug levels to drop with time); variation in substances tested and methodology used by different toxicology laboratories; and the current state of development of oral fluid testing. The increased use of marijuana and some illicit drugs in the United States (*4*) along with the results of this report, point to the need for rapid and sensitive assessment tools to ascertain the presence of and impairment by marijuana and other illicit drugs. In addition, adoption and application of standards for toxicology testing and support for laboratories to implement recommendations are needed to improve understanding of the prevalence of drug- and polysubstance-impaired driving (*10*).

Summary

What is already known about this topic?

The use and co-use of alcohol and drugs has been associated with impairment of psychomotor and cognitive functions while driving.

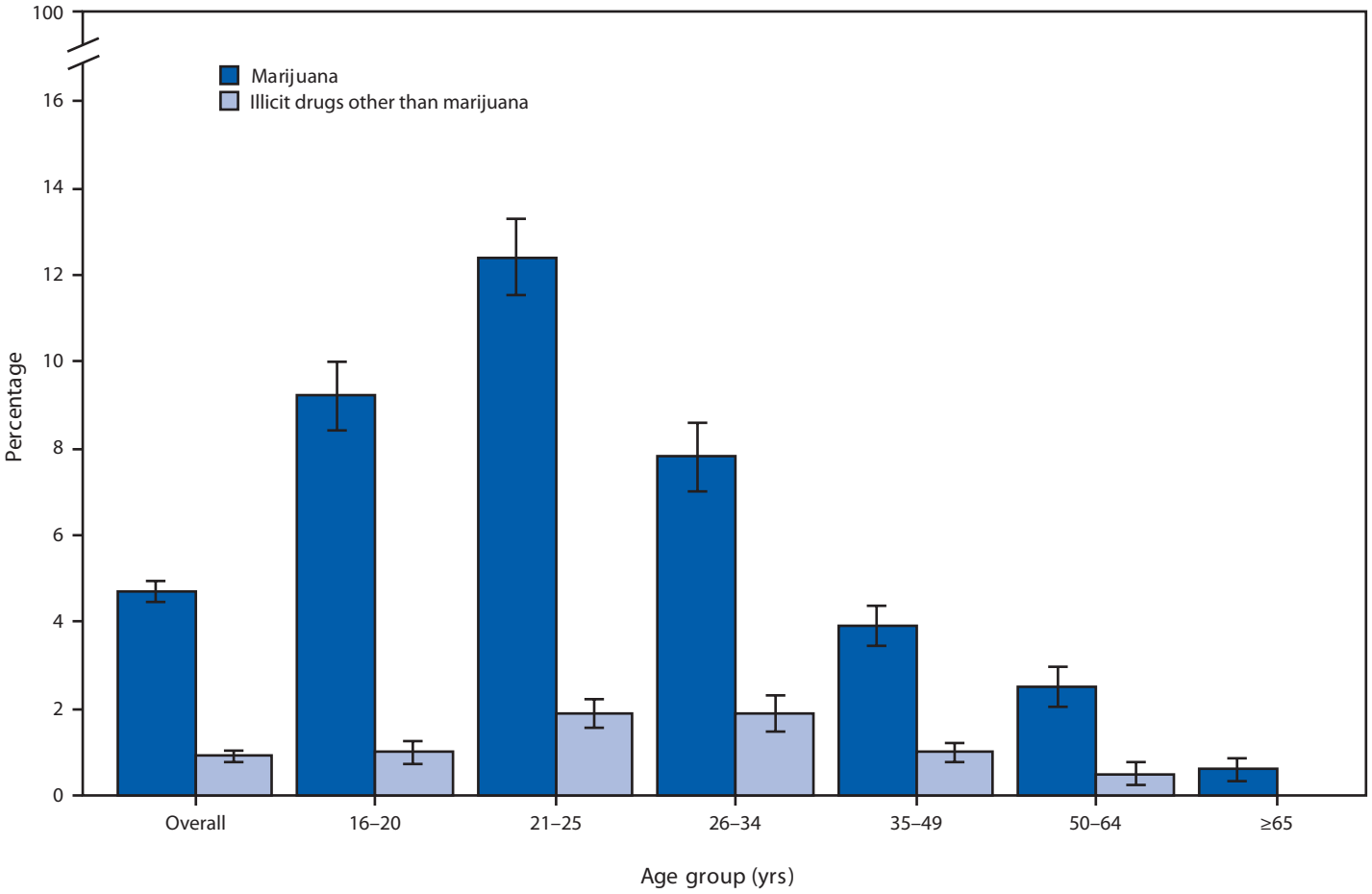
What is added by this report?

During 2018, approximately 12 million (4.7%) U.S. residents aged ≥16 years reported driving under the influence of marijuana, and 2.3 million (0.9%) reported driving under the influence of illicit drugs other than marijuana during the past 12 months.

What are the implications for public health practice?

Development, evaluation, and further implementation of strategies to prevent alcohol-, drug-, and polysubstance-impaired driving coupled with standardized testing of impaired drivers and drivers involved in fatal crashes could advance understanding of drug- and polysubstance-impaired driving and assist states and communities with prevention efforts.

FIGURE. Percentage of all persons aged ≥16 years* who reported driving a vehicle under the influence of marijuana or illicit drugs other than marijuana†,§,¶ in the past year, by age group — National Survey on Drug Use and Health, United States, 2018**



* Percentages are weighted to represent the 2018 U.S. civilian, noninstitutionalized population.
† Illicit drugs other than marijuana in this analysis include cocaine, hallucinogens, heroin, inhalants, and methamphetamines.
§ Not mutually exclusive.
¶ Estimated percentage of adults aged ≥65 years who reported driving under the influence of illicit drugs other than marijuana was <0.02% and thus not shown.
** With 95% confidence intervals indicated by error bars.

The findings in this report are subject to at least five limitations. First, because NSDUH data are self-reported, they are subject to recall and social desirability biases. Second, variations in laws and regulations among states and counties regarding marijuana could have resulted in negative responses to the NSDUH substance use survey questions for fear of legal consequences, leading to an underestimation of the prevalence of the use and driving under the influence in some jurisdictions. Third, the NSDUH questions are not limited to driving under the influence of marijuana only or each illegal substance only; therefore, persons might be driving under the influence of more than one substance at a given time. Fourth, self-reported data are subject to the respondents' interpretations of being under the influence of a drug. Finally, NSDUH does not assess whether all respondents drive; therefore, reported percentages of impaired drivers might be underestimated.

Impaired driving is a serious public health concern that needs to be addressed to safeguard the health and safety of all who use the road, including drivers, passengers, pedestrians, bicyclists, and motorcyclists. Collaboration among public health, transportation safety, law enforcement, and federal and state officials is needed for the development, evaluation, and further implementation of strategies to prevent alcohol-, drug-, and polysubstance-impaired driving (*2*). In addition, standardized testing for alcohol and drugs among impaired drivers and drivers involved in fatal crashes could advance understanding of drug- and polysubstance-impaired driving and assist states and communities with targeted prevention efforts.

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Estimating the Incidence of Influenza at the State Level — Utah, 2016–17 and 2017–18 Influenza Seasons

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The 2017–18 U.S. influenza season was notable for its high severity, with approximately 45 million illnesses and 810,000 influenza-associated hospitalizations throughout the United States (*1*). The purpose of the investigation reported here was to create a state-level estimate of the number of persons in Utah who became ill with influenza disease during this severe national seasonal influenza epidemic and to create a sustainable system for making timely updates in future influenza seasons. Knowing the extent of influenza-associated illness can help public health officials, policymakers, and clinicians tailor influenza messaging, planning, and responses for seasonal influenza epidemics or during pandemics. Using national methods and existing influenza surveillance and testing data, the influenza burden (number of influenza illnesses, medical visits for influenza, and influenza-associated hospitalizations) in Utah during the 2016–17 and 2017–18 influenza seasons was estimated. During the 2016–17 season, an estimated 265,000 symptomatic illnesses affecting 9% of Utah residents occurred, resulting in 125,000 medically attended illnesses and 2,700 hospitalizations. During the 2017–18 season, an estimated 338,000 symptomatic illnesses affecting 11% of Utah residents occurred, resulting in 160,000 medically attended illnesses and 3,900 hospitalizations. Other state or county health departments could adapt similar methods in their jurisdictions to estimate the burden of influenza locally and support prompt public health activities.

Since the 2009 influenza pandemic, CDC has estimated the burden of influenza in the United States each year (*1*,*2*). However, influenza activity can vary widely across the country, making the use of national burden estimates difficult for state or county public health messaging, planning, and responses (*3*). The 2017–18 influenza season was one of high severity, with an estimated 45 million illnesses, 21 million medically attended illnesses, 810,000 hospitalizations, and 61,000 deaths occurring throughout the United States (*1*). At the peak of influenza activity in early 2018, CDC partnered with the Utah Department of Health and the Salt Lake County Health Department to conduct a rapid assessment of the burden of influenza in Utah and to determine the applicability of national methods at a state and county level.

In February 2018, a field investigation was conducted in Utah to rapidly gather local data to estimate the burden of influenza during the 2016–17 influenza season and midway through the 2017–18 season. Updated data from the entire 2017–18 season (rather than midseason data used for real-time estimates) were incorporated into the estimates presented here. To estimate burden, national multipliers were used to extrapolate the rate of influenza-associated hospitalizations to the rates of symptomatic illnesses in the community and medically attended illnesses, as has been previously described (*4*). The analysis was restricted to hospitalizations reported during the 2016–17 and 2017–18 influenza seasons (surveillance weeks 40–20). Hospitalization rates were calculated by five age groups (0–4, 5–17, 18–49, 50–64, and ≥65 years) using contemporary population data obtained from the National Center for Health Statistics bridged-race population estimates. In Utah, hospitalizations with laboratory-confirmed influenza are reportable (*5*); however, surveillance for influenza-associated hospitalizations in Utah depends on clinician-ordered testing and thus underestimates the actual rate of influenza hospitalizations. To adjust reported hospitalization rates for underdetection of influenza, as is done nationally, CDC, the Utah Department of Health, and the Salt Lake County Health Department coordinated with two large health care systems in Utah to extract data on whether a patient hospitalized with a diagnosis of acute respiratory illness (based on *International Classification of Diseases, Tenth Edition* discharge codes) (Supplementary Table 1, https://stacks.cdc.gov/view/cdc/83482) was tested for influenza and what type of influenza test was performed. Data were extracted for acute respiratory hospitalizations occurring during December 2016–April 2017 and December 2017–April 2018. Pooled sensitivity was calculated for influenza tests performed, after assigning sensitivities from a literature review (*6*) and using the most sensitive test result if multiple tests were performed. Adjustments for underdetection were calculated as the inverse of the probability of being tested multiplied by the pooled test sensitivity and were applied to crude hospitalization rates.

To estimate the number of influenza-associated hospitalizations in Utah, the adjusted hospitalization rates were applied to age group–specific population estimates. Using national multipliers, the number of symptomatic illnesses was estimated using previously published age group–specific ratios of the number of illnesses that one hospitalization

represents (*4*). Age-stratified data on national care-seeking behavior from the Behavioral Risk Factor Surveillance System were used to estimate the number of persons with symptomatic influenza-like illnesses who sought medical care (Supplementary Table 2, https://stacks.cdc.gov/view/cdc/83483) (*4*). Age group–specific estimates were summed to obtain the influenza burden in Utah for each season. The 95% confidence intervals around the burden estimates were constructed using a combination of standard error of the hospitalization rate (Poisson distribution), percentage tested (binomial), and pooled test sensitivity (binomial), assuming independence of parameters. Symptomatic illnesses and medically attended illnesses were estimated to three significant figures, and hospitalizations to two significant figures. Analyses were conducted using SAS statistical software (version 9.4; SAS Institute). An analytic tool was provided by CDC to the state and county health departments to facilitate future estimations.

The overall crude rate of influenza-associated hospitalizations in Utah was 47 per 100,000 persons during the 2016–17 influenza season and 71 per 100,000 during the 2017–18 season. Based on influenza testing data, 58% of persons hospitalized with acute respiratory illnesses were tested for influenza during the 2016–17 season, and 63% were tested during the 2017–18 season; this increase was primarily driven by increased testing among children (Table). Across seasons, tests for influenza virus RNA were the most common tests used (91%), followed by rapid antigen tests (8%).

Based on the adjusted influenza hospitalization rates in Utah and using national multipliers, an estimated 265,000 symptomatic illnesses (affecting 9% of Utah residents), 125,000 medically attended illnesses, and 2,700 hospitalizations occurred in Utah during the 2016–17 influenza season (Table). During 2017–18, an estimated 338,000 symptomatic illnesses (among 11% of Utah residents), 160,000 medically attended illnesses, and 3,900 hospitalizations occurred in the state. In both seasons, the majority of symptomatic and medically attended illnesses occurred in persons aged 5–17 and 18–49 years. Adults aged ≥65 years accounted for 47% of estimated hospitalizations during 2016–17 and 52% during the 2017–18 season.

TABLE. Estimated numbers of influenza-associated illnesses, medically attended illnesses, and hospitalizations — Utah, 2016–17 and 2017–18 influenza seasons

Age group (yrs)	Population*	No. of influenza-associated hospitalizations	Unadjusted hospitalization rate†	% Tested	Average % sensitivity	Underdetection multiplier	Adjusted hospitalization rate†	Estimated burden no. (95% CI)§		
								Illnesses	Medically attended illnesses	Hospitalizations
2016–17 influenza season										
0–4	253,338	96	38	42	92	2.56	97	35,300 (25,600–45,000)	23,700 (17,200–30,100)	250 (180–310)
5–17	666,090	59	9	31	92	3.48	31	74,900 (47,400–102,000)	39,000 (24,700–53,300)	210 (130–280)
18–49	1,362,564	233	17	43	94	2.47	42	103,000 (86,900–118,000)	38,000 (32,200–43,800)	580 (490–660)
50–64	441,528	247	56	65	94	1.62	91	37,800 (32,400–43,200)	16,200 (13,900–18,600)	400 (340–460)
≥65	320,801	784	244	76	80	1.63	399	14,100 (12,900–15,300)	7,880 (7,220–8,540)	1,300 (1,200–1,400)
Total	**3,044,321**	**1,419**	**47**	**58**	—	—	**89**	**265,000 (205,000–324,000)**	**125,000 (95,100–154,000)**	**2,700 (2,300–3,100)**
2017–18 influenza season										
0–4	255,200	168	66	55	93	1.95	128	46,900 (38,100–55,800)	31,500 (25,500–37,400)	330 (270–390)
5–17	671,499	129	19	57	93	1.89	36	89,100 (70,000–108,000)	46,300 (36,400–56,300)	240 (190–300)
18–49	1,393,111	292	21	47	93	2.30	48	120,000 (104,000–136,000)	44,300 (38,300–50,300)	670 (580–760)
50–64	446,451	388	87	66	92	1.64	142	60,000 (52,800–67,100)	25,800 (22,700–28,900)	640 (560–710)
≥65	335,572	1,214	362	78	78	1.65	598	22,100 (20,500–23,600)	12,400 (11,500–13,200)	2,000 (1,900–2,100)
Total	**3,101,833**	**2,191**	**71**	**63**	—	—	**125**	**338,000 (285,000–391,000)**	**160,000 (134,000–186,000)**	**3,900 (3,500–4,300)**

Abbreviation: CI = confidence interval.

* Population estimates from Utah's Public Health Indicator Based Information System are vintage 2017 U.S. Census Bureau July 1 estimates based on the 2010 census counts (https://ibis.health.utah.gov/query/result/pop/PopMain/Count.htm). The estimates were produced by the U.S. Census Bureau's Population Estimates Program in collaboration with the National Center for Health Statistics and released in June 2018.

† Hospitalizations per 100,000 population.

§ CIs were calculated from the combined standard error of the hospitalization rate, percentage tested, and pooled test sensitivity, assuming independence. If these parameters are not independent, the assumption will result in an underestimation of the variability and tighter CIs.

Discussion

National methods were adopted to quantify the number of persons in Utah who were ill, sought medical care, or were hospitalized with influenza during the 2016–17 and 2017–18 influenza seasons. Influenza affected an estimated 9% of Utah residents during the 2016–17 season and an estimated 11% during the 2017–18 season; hundreds of thousands of medical visits and thousands of hospitalizations occurred, with higher numbers during the high-severity 2017–18 season (*7*), compared with the 2016–17 season. The Utah Department of Health and the Salt Lake County Health Department used these methods to synthesize influenza surveillance data, and the Salt Lake County Health Department published weekly estimates of state-level influenza burden during the 2018–19 and current influenza seasons (*8*). These timely subnational estimates at the state and county levels are valuable for providing a local understanding of influenza activity given the geographic variation in influenza activity in the United States (*3*).

Beyond those described in this analysis, other methods have also been used to estimate state-specific burden of influenza, including those that use hospital discharge databases, hospital admission logs, and community surveys (*9*,*10*). Various approaches are used to estimate state-level disease incidence, and states can adapt those methods most suitable for the data sets routinely available in their jurisdiction. In Utah, for example, hospitalizations are reportable, and the existing close relationship between public health departments and health systems allows rapid access to information for adjusting hospitalization rates for local influenza testing patterns.

The findings in this report are subject to at least three limitations, all related to the previously described national burden estimation methods (*2*,*4*). First, the hospitalization underdetection multiplier does not account for persons with cases of influenza without an *International Classification of Diseases* code for acute respiratory illness or for recent improvements in influenza-specific assays, which might have increased influenza test sensitivities (*2*). Second, the adjusted hospitalization rates are likely underestimated because the methods did not account for the underreporting of hospitalized influenza illnesses to health departments in Utah. Finally, the multipliers used to extrapolate rates of hospitalization to illnesses and of illnesses to medically attended illness were based on previous seasons' data and were not specific to Utah (*4*).

Nationally, annual estimates of influenza disease burden have been useful for communicating the importance of influenza as a public health concern, describing the variability of influenza from season to season, and assessing the impact of public health interventions such as vaccination (*4*). Other state and county public health officials, policymakers, and health care practitioners might find more geographically targeted burden estimates useful for improved communications, public health response, and resource planning and allocation during seasonal epidemics and pandemics. CDC continues to develop resources to support local assessments of influenza burden by season; interested jurisdictions can contact CDC's Influenza Division (404-639-3727) for more information.

Summary

What is already known about this topic?

Influenza activity can vary widely based on geographic location, and national data on the numbers of persons affected by influenza do not reflect this potential variation.

What is added by this report?

Application of national methods to estimate the burden of influenza at the state level found that influenza affected 9% and 11% of Utah residents during the 2016–17 and 2017–18 influenza seasons, respectively.

What are the implications for public health practice?

Local estimation of influenza disease burden can help public health officials, policymakers, and clinicians tailor influenza messaging, planning, and responses for their jurisdictions. State and county health departments might consider adapting these methods to their jurisdictions in future influenza seasons.

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Ebola Virus Disease Outbreak — Democratic Republic of the Congo, August 2018–November 2019

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On August 1, 2018, the Democratic Republic of the Congo Ministry of Health (DRC MoH) declared the tenth outbreak of Ebola virus disease (Ebola) in DRC, in the North Kivu province in eastern DRC on the border with Uganda, 8 days after another Ebola outbreak was declared over in northwest Équateur province. During mid- to late-July 2018, a cluster of 26 cases of acute hemorrhagic fever, including 20 deaths, was reported in North Kivu province.* Blood specimens from six patients hospitalized in the Mabalako health zone and sent to the Institut National de Recherche Biomédicale (National Biomedical Research Institute) in Kinshasa tested positive for Ebola virus. Genetic sequencing confirmed that the outbreaks in North Kivu and Équateur provinces were unrelated. From North Kivu province, the outbreak spread north to Ituri province, and south to South Kivu province (*1*). On July 17, 2019, the World Health Organization designated the North Kivu and Ituri outbreak a public health emergency of international concern, based on the geographic spread of the disease to Goma, the capital of North Kivu province, and to Uganda and the challenges to implementing prevention and control measures specific to this region (*2*). This report describes the outbreak in the North Kivu and Ituri provinces. As of November 17, 2019, a total of 3,296 Ebola cases and 2,196 (67%) deaths were reported, making this the second largest documented outbreak after the 2014–2016 epidemic in West Africa, which resulted in 28,600 cases and 11,325 deaths.† Since August 2018, DRC MoH has been collaborating with partners, including the World Health Organization, the United Nations Children's Fund, the United Nations Office for the Coordination of Humanitarian Affairs, the International Organization of Migration, The Alliance for International Medical Action (ALIMA), Médecins Sans Frontières, DRC Red Cross National Society, and CDC, to control the outbreak. Enhanced communication and effective community engagement, timing of interventions during periods of relative stability, and intensive training of local residents to manage response activities with periodic supervision by national and international personnel are needed to end the outbreak.

* https://www.cdc.gov/vhf/ebola/history/2014-2016-outbreak/index.html.

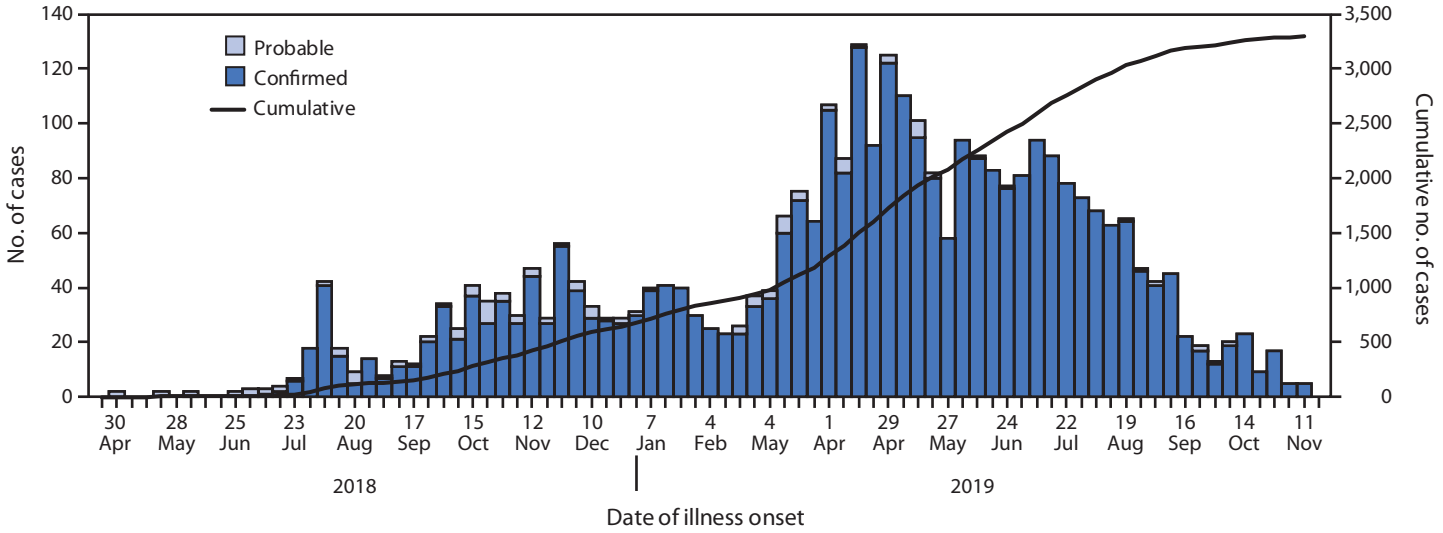
† https://apps.who.int/iris/bitstream/handle/10665/273640/SITREP_EVD_DRC_20180807-eng.pdf?ua=1.

Epidemiology and Laboratory Testing

After declaration of the outbreak on August 1, 2018, rapid response teams that included clinicians, epidemiologists, and local public health officials were deployed to health zones in North Kivu, South Kivu, and Ituri provinces. The response teams interviewed patients and household contacts to identify secondary cases and contacts. Teams used standardized case investigation forms to classify cases as suspected, probable, or confirmed during August 1, 2018–November 17, 2019. A suspected case (in a person who was living or had died) was defined as the acute onset of fever (≥100°F [≥38°C]) and at least three Ebola-compatible clinical signs or symptoms (headache, vomiting, anorexia, diarrhea, lethargy, stomach pain, muscle or joint aches, difficulty swallowing or breathing, hiccups, unexplained bleeding, or any sudden, unexplained death) in a North Kivu, South Kivu, or Ituri resident or any person who had traveled to these provinces during this period and reported signs or symptoms defined above. A patient who met the suspected case definition who had died and from whom no specimens were available was considered to have a probable case. A confirmed Ebola case was defined as a suspected case with at least one positive test for Ebola virus using reverse transcription–polymerase chain reaction (RT-PCR) (*3*) testing. Patients with suspected Ebola were isolated and transported to an Ebola treatment center for confirmatory testing and treatment. Oral swabs were collected from decedents with suspected cases within 24 hours of notification of death and sent to a DRC laboratory for confirmation of Ebola virus. All eight DRC laboratories have Ebola virus diagnostic capacity using GeneXpert (under emergency use authorization) as the primary diagnostic RT-PCR test for qualitative detection of Zaire ebolavirus RNA (*1*).

During April 30, 2018–November 17, 2019, a total of 3,296 Ebola cases (3,178 confirmed and 118 probable) (Figure 1) and 2,196 (67%) deaths were reported by DRC MoH. The five most affected health zones were Beni (697 cases), Katwa (674), Mabalako (416), and Butembo (288) in North Kivu Province and Mandima (344) in Ituri Province. These five health zones accounted for 69% of all cases reported to date (Figure 2). A majority of cases (1,857, 56%) occurred in females, and

FIGURE 1. Confirmed and probable cases of Ebola virus disease, by week of illness onset and cumulative number of cases — Democratic Republic of the Congo, April 30, 2018–November 17, 2019



968 (29%) occurred in persons aged ≤18 years. Health care workers accounted for 163 (5%) cases. Thirty-four percent of cases were community deaths (i.e., Ebola cases not identified until patient death and thus not effectively isolated from the time of infection until death). As of November 17, 2019, approximately 1,492 (45%) of the 3,296 cases and 150,000 contacts of patients with confirmed and probable Ebola had been monitored across all affected health zones for 21 days after their last known exposure. However, contact enumeration was incomplete because insecurity caused by conflict, mistrust toward local authorities, and resistance prevented rapid response teams from entering some communities.

Conflict, including clashes between armed groups and Congolese security forces, has resulted in eruptions of violence targeting civilians and displacement of tens of thousands of residents into neighboring provinces and countries (Rwanda and Uganda). On June 11, 2019, the Uganda Ministry of Health reported a patient with confirmed Ebola who had traveled to DRC for a funeral and then back to Kasese district in eastern Uganda. The patient was a child aged 5 years who had traveled with five family members from Uganda to DRC to attend the funeral of his grandfather, who had died from probable Ebola. The day after the funeral, two additional family members who had traveled from Uganda to DRC were confirmed to have Ebola. All three Ebola patients died after returning to Uganda, and no additional cases have been reported in Uganda since June 12, 2019. The confirmed cases in Uganda are the first cases of Zaire ebolavirus infection in that country and the first cases reported in Uganda since 2013.

On July 14, 2019, a confirmed case of Ebola was reported in a traveler to Goma, a city in DRC with a population of >1 million that is located on the border with Rwanda. The patient traveled by bus from Butembo approximately 190 miles (300 km) north of Goma and died on July 16, 2019; contact enumeration is complete, and 21-day follow-up has been completed. This case was the first reported in a major urban center in the current outbreak, prompting an intensification of response efforts. On July 30, 2019, another confirmed case was also reported in Goma. The patient, who traveled by bus from a community near Bunia in Ituri province, approximately 350 miles (560 km) north of Goma, died at Goma's Ebola treatment center on July 31, 2019. In addition, two secondary confirmed cases in family members who were contacts of the patient received medical care in Goma's Ebola treatment center and contact enumeration has been completed for this transmission chain.

Public Health Response

DRC MoH has established a strategic coordination center in Goma, with an emergency operations center (EOC) that monitors both implementation of the operations through lower administrative level EOCs that report to Goma and direct contacts with the teams in the health zones. In addition, the EOC and DRC MoH commissions (e.g., surveillance, vaccination, and safe and dignified burials) also coordinate the deployment of multidisciplinary rapid response teams to support affected health zones.

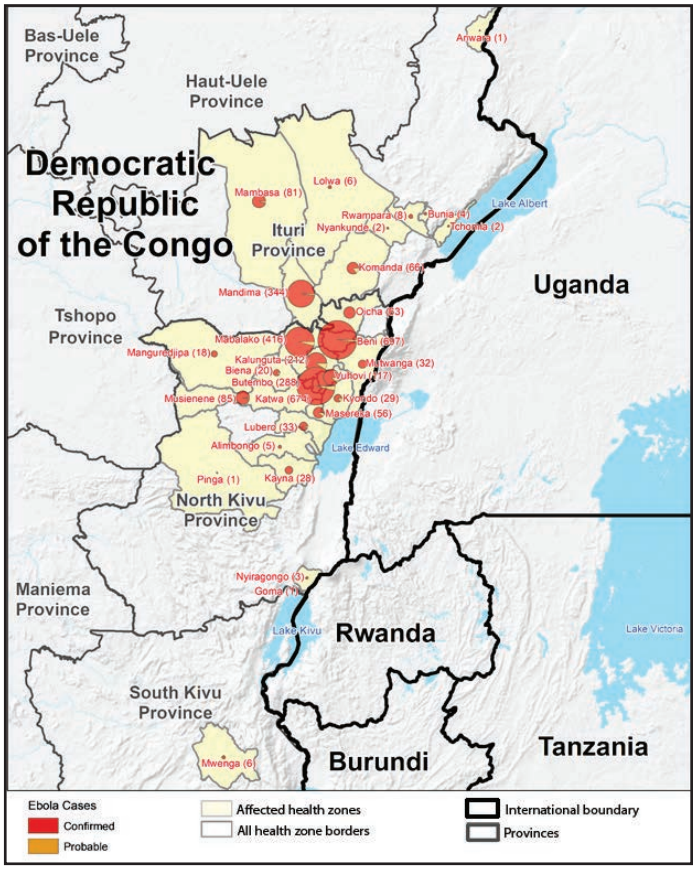
Since August 1, 2018, DRC MoH has been collaborating with several international partners to support response activities and enhance Ebola preparedness. To strengthen surveillance activities, DRC MoH disseminated standardized Ebola case definitions, developed reporting tools and communication

strategies, and began distribution of daily situation reports. Rapid response teams have deployed to affected health zones to strengthen Ebola case management and infection prevention and control in health care facilities and in 14 treatment and transit centers. An experimental single-dose Ebola vaccine licensed by Merck (recombinant vesicular stomatitis virus–Zaire Ebola virus [rVSV-ZEBOV-GP]) (*4*) has been authorized under compassionate use by the World Health Organization and DRC MoH. The vaccine is provided primarily through a ring vaccination strategy that targets contacts of index cases and their contacts. The vaccine is also offered to groups at high risk, such as health care personnel and frontline workers (those whose duties [e.g., case investigation, burial, or vaccination] puts them at high risk for Ebola infection). As of November 17, 2019, approximately 250,000 persons at risk for Ebola have been vaccinated, including approximately 31,000 health care and frontline workers. In addition, regulatory authorities in DRC have approved the use of four therapeutic agents that have been effective in nonhuman primates for compassionate use in patients with Ebola; these include the monoclonal antibodies MAb114, REGN-EB3, ZMapp, and the antiviral remdesivir. The effectiveness of these therapeutic agents was evaluated in a trial using an Ebola virus generated via a reverse genetics system and Ebola virus sequences provided by organizations in DRC (*5*). Preliminary results from the study led the trial's monitoring board to stop the study and randomize all remaining patients to either mAb114 or REGN-EB3 because both of these agents were found to decrease case fatality rates (*5*).

Discussion

The first human Ebola outbreak occurred in Zaire (now DRC) in 1976, and since then approximately 28 known outbreaks of Ebola have occurred in Africa (*6*). Although DRC has successfully contained Ebola outbreaks in the past (*4*,*6*), challenges specific to North Kivu and Ituri provinces have complicated the current outbreak control. Limited infrastructure coupled with armed conflict among rebel groups, DRC's armed forces, and militants attacking civilians have led to insecurity resulting in interruptions in response activities (*2*,*7*). The prolonged conflict has seeded mistrust toward local authorities and international partners, which has impeded effective community collaboration and led to incomplete case ascertainment and contact enumeration, vaccination refusals, and delayed seeking of health care. Nosocomial transmission of disease in local health facilities has further eroded communities' confidence in the health system (*2*,*5*). Hesitant patients have absconded from Ebola treatment centers, and families have resisted taking patients to hospitals, thereby increasing disease transmission in communities. In addition, contact with an infected corpse or body fluids of an infected person, especially after a community death of a patient with suspected Ebola or during unsafe burials (*8*,*9*) has increased community transmission. Intervention strategies to decrease community concerns regarding Ebola intervention measures, such as involvement of local leaders and health education, have been successful and need to be continued to reduce Ebola virus transmission in communities (*2*,*9*). These strategies include 1) educating residents about the signs and symptoms of Ebola and its modes of transmission, 2) emphasizing the importance of seeking medical care and promptly reporting suspected Ebola cases, 3) emphasizing the potential benefit of early diagnosis and treatment with effective Ebola therapeutics (*5*), and 4) trusted local leaders disseminating health communication messages in local languages. These steps can facilitate the isolation and treatment of patients in a reserved ward in local hospitals or in the homes of patients unwilling to seek care at an Ebola treatment center (*9*).

FIGURE 2. Geographic distribution of confirmed and probable cases of Ebola virus disease (Ebola) by health zones — North Kivu, South Kivu, and Ituri provinces, Democratic Republic of the Congo, April 30, 2018–November 17, 2019*



* During April 30, 2018–November 17, 2019, a total of 3,296 Ebola cases (3,178 confirmed and 118 probable) were reported by the Democratic Republic of the Congo (DRC) Ministry of Health. In addition, three persons in Uganda who had traveled from Uganda to DRC to attend the funeral of a DRC Ebola patient became infected and died.

Shortage of response personnel and ongoing strain on limited resources are important issues that need to be addressed to improve data management for the response at the national level. The work of the EOC has improved the ability of DRC MoH to respond to this epidemic and identify targeted intervention strategies for affected health zones. Compared with earlier outbreaks, this outbreak is occurring in a context of armed conflict, and innovative approaches beyond the conventional Ebola response are needed (*10*). These approaches include the building of trust with communities amid insecurity, opportunistically timed intensive interventions during periods of relative stability, and intensive training of local residents to manage response activities, with periodic supervision by national and international personnel as a public health priority.

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All response workers, including those from the Democratic Republic of the Congo Ministry of Health, Uganda Ministry of Health, United Nations agencies, and nongovernmental organizations; laboratory personnel, Institut National de Recherche Biomédicale; World Health Organization; Médecins Sans Frontières; International Federation of Red Cross.

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Summary

What is already known about this topic?

The Democratic Republic of the Congo (DRC) is currently experiencing its tenth outbreak of Ebola virus disease (Ebola), which was designated a public health emergency of international concern by the World Health Organization on July 17, 2019.

What is added by this report?

As of November 17, 2019, a total of 3,296 Ebola cases and 2,196 (67%) deaths have been reported. Challenges to outbreak control include armed conflict between rebel groups and DRC's armed forces, which has interrupted response activities, and community mistrust.

What are the implications for public health practice?

Enhanced communication and effective community engagement, timing of interventions during periods of relative stability, and intensive training of local residents to manage response activities with periodic supervision by national and international personnel would help end the outbreak sooner.

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Notes from the Field

Methylmercury Toxicity from a Skin Lightening Cream Obtained from Mexico — California, 2019

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In July 2019, a Mexican-American woman aged 47 years in Sacramento, California, sought medical care for dysesthesias and weakness of her upper extremities. Over the ensuing 2 weeks of outpatient follow-up, her condition progressed to dysarthria, blurry vision, and gait unsteadiness, leading to hospital admission. While hospitalized, her condition declined rapidly to an agitated delirium. Two weeks into the hospitalization, screening blood and urine tests detected mercury concentrations exceeding the upper limit (UL) of quantification, indicative of abnormally high values of mercury (>160 μg/L [blood] and >80 μg/L [urine]). The hospital notified the California Poison Control System (CPCS) and the California Department of Public Health (CDPH). CPCS recommended oral dimercaptosuccinic acid, 10 mg/kg every 8 hours, which was administered via feeding tube. CDPH interviewed the patient's family and learned that the patient was a long-term user of skin lightening creams obtained from Mexico (applied to the face twice daily for the past 7 years); the cream was analyzed and found to contain 12,000 ppm mercury. Mercury levels from the hospital specimens that initially implicated mercury were 2,620 μg/L blood mercury (reference population UL <1.81 μg/L)* and 110 μg/L urine mercury (UL <0.90 μg/L). A second blood specimen collected 11 days after the hospital initiation of ongoing dimercaptosuccinic acid chelation therapy detected 1,114 μg/L mercury.

The patient was transferred on hospital day 31 to a tertiary care facility, and a toxicology consultation was obtained the following day. Contaminated skin lightening creams typically contain inorganic mercury. Raman spectral analysis of the cream performed at CDPH, however, identified a possible match with methylmercury iodide, an organic mercury compound. Thus, organic mercury poisoning was suspected. The patient's blood iodine level was 3,295 μg/L (UL <92 μg/L) at least 5 weeks after the last application of the cream. CDC confirmed values of blood total mercury 528 μg/L, blood methyl mercury 460 μg/L (UL <1.54 μg/L), urine mercury 1,810 μg/L, and urine iodine 20,100 μg/L (UL <640 μg/L)† on specimens obtained 20 days after the initial specimen collections. The CDC assay for methyl mercury uses a reference method that does not differentiate it from methylmercury iodide (*1*). Despite prolonged chelation therapy, the patient remains unable to verbalize or care for herself, requiring ongoing tube feeding for nutritional support.

This is the first known case of contamination of skin lightening cream with methyl mercury (or any congener, including methylmercury iodide). In contrast, health risks associated with inorganic mercury exposure are well-recognized from such products; levels up to 200,000 ppm (typically mercurous chloride) have been reported (*2*,*3*). The relatively lower 12,000 ppm mercury content of the cream in this case underscores the far higher toxicity of organic mercury compounds. Central nervous system toxicity, the hallmark of organic mercury, typically manifests after weeks to months of exposure, progresses rapidly after onset, worsens despite cessation of further exposure, persists even with chelation (although mercury excretion might increase), and leaves profound residual impairment (*4*). In addition to methyl mercury, multiple congeners are toxic, including methylmercury iodide used in the synthesis of methyl mercury (*5*,*6*).

The original source of the methyl mercury adulterant and its marketing chain remain to be identified. CDPH is actively working to warn the public of this health risk, actively screening other skin lightening cream samples for mercury, and is investigating the case of a family member with likely exposure but less severe illness.

* Upper limits for mercury based on the 95th percentile for the Mexican-American population in the National Health and Nutrition Examination Survey from 2015 to 2016. https://www.cdc.gov/exposurereport/index.html.

† Upper limit for urinary iodine based on the 95th percentile for the Mexican-American population in the National Health and Nutrition Examination Survey from 2005 to 2006. https://www.cdc.gov/nutritionreport/index.html.

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Notes from the Field

First Reported Case of *Shewanella haliotis* in the Region of the Americas — New York, December 2018

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On December 18, 2018, a man aged 87 years was evaluated in a hospital emergency department in Flushing, New York, for right lower abdominal quadrant pain. Evaluation included a computed tomography scan, which showed acute appendicitis with multiple abscesses measuring ≤3 cm. The patient was admitted, a percutaneous drain was placed, and 5 mL of an opaque jelly-like substance was aspirated and sent for culture and testing for antimicrobial sensitivities.

Gram stain of the culture revealed gram-negative rods, and culture revealed monomicrobial 1–2-mm yellowish-brown mucoid colonies.† Sequencing of the isolate's 16S ribosomal RNA revealed >99.8% homology with *Shewanella haliotis* strain DW01 in the GenBank database. Antimicrobial susceptibility testing indicated that the isolate was susceptible to aminoglycosides, fluoroquinolones, certain penicillins, and broad-spectrum cephalosporins (Table). Biochemical tests were performed to characterize isolate (Supplementary Table, https://stacks.cdc.gov/view/cdc/83522). Phylogenetic analysis indicates that *S. haliotis* strain DW01 is the most recent ancestor of this clinical isolate. This is the first documented case of a *S. haliotis* appendix infection.

S. haliotis is an emerging human pathogen, first isolated from abalone gut microflora in 2007 (*1*). The geographic distribution of human infections caused by *S. haliotis* is concentrated in Asia, with most reports coming from China, Japan, South Korea, and Thailand (*2*). No cases of *S. haliotis* human infections had been reported in the World Health Organization's Region of the Americas.

The patient was treated empirically with intravenous piperacillin-tazobactam while in the hospital and was discharged with a prescription for oral amoxicillin-clavulanic acid. At a follow-up visit 13 days later, he was recovering well. Empiric treatment of *Shewanella* spp. can be challenging; limited and varying antibiotic susceptibility profiles have been reported (*2*,*3*). This patient's isolate was susceptible to several classes of antimicrobials, but resistance to certain antibiotics has been observed in this isolate and others (*2*). In a case series of 16 patients from Martinique, *Shewanella* spp. sensitivities to piperacillin-tazobactam and amoxicillin-clavulanic acid were reported to be 98% and 75%, respectively (*3*).

Risk factors for or potential vectors of *Shewanella* spp. infections are unidentified in up to 40%–50% of cases (*4*). *S. haliotis* is ecologically distributed in marine environments, including broad contamination of cultivated shellfish. Although infection following consumption of seafood is seldom reported (*5*), consumption of raw seafood could be an important vehicle for foodborne illnesses and outbreaks. This patient reported consuming raw salmon 10 days before becoming ill but had no other marine exposures or exposure to ill contacts. The time from potential exposure to onset of abdominal pain in this patient is consistent with that reported in the literature on *Shewanella* spp. (3–49 days). The epidemiologic exposure history supports the link between raw fish consumption and infection.

No other organisms were isolated in this patient; in the Martinique case series of *Shewanella* spp., one half of infections were monomicrobial as well (*3*). This case highlights the importance of preventing seafood-associated infections and the need to consider rare human pathogens in elderly or immunocompromised, marine-exposed populations, as well as persons who might consume at-risk food that might have been imported from outside the United States and persons who might have been infected outside the United States when traveling.

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* These authors contributed equally to the report.

† After inoculation of specimen on sheep blood agar, chocolate agar, and MacKonkey agar plates and incubation at 98.6°F (37°C), beta-hemolysis was observed on the blood agar plates.

TABLE. Antimicrobial sensitivity* of an isolate of *Shewanella haliotis* from an intraabdominal abscess — New York, December 2018

Antimicrobial	Drug class	MIC (μg/ml)	Range			Interpretation
			S	I	R	
Amikacin	Aminoglycoside	3	≤16	32	≥64	S
Ampicillin	Penicillin	≤4	≤8	16	≥32	S
Ampicillin-Sulbactam	Penicillin-beta-lactamase inhibitor	>16/8	≤8/4	16/8	≥32/16	I
Aztreonam	Monobactam	>16	≤4	8	≥16	R
Cefazolin	Cephalosporin	>16	≤2	4	≥8	R
Cefepime	Cephalosporin	0.094	≤2	4–8	≥16	S
Cefoxitin	Cephamycin	>16	≤8	16	≥32	I
Ceftazidime	Cephalosporin	≤2	≤4	8	≥16	S
Ceftriaxone	Cephalosporin	≤1	≤1	2	≥4	S
Gentamicin	Aminoglycoside	0.25	≤4	8	≥16	S
Imipenem	Carbapenem	0.5	≤1	2	≥4	S
Levofloxacin	Fluoroquinolone	0.19	≤0.5	1	≥2	S
Meropenem	Carbapenem	0.047	≤1	2	≥4	S
Nitrofurantoin	Nitrofuran	>64	≤32	64	≥128	I
Piperacillin-Tazobactam	Penicillin-beta-lactamase inhibitor	≤2/4	≤16/4	32/4–64/4	≥128/4	S
Polymyxin B	Polymyxins	0.5	≤2	4	8	S
Tetracycline	Tetracycline	≤2	≤4	8	≥16	S
Tigecycline	Glycylcycline	0.38	≤2	4	≥8	S
Tobramycin	Aminoglycoside	0.5	≤4	8	≥16	S
Trimethoprim-Sulfamethoxazole	Dihydrofolate reductase inhibitor	0.5/9.5	≤2/38		≥4/76	S

Abbreviations: I = intermediate; MIC = minimum inhibitory concentration; R = resistant; S = sensitive.
* Quantitative determination of MIC conducted on Vitek 2 and Phoenix 100 testing systems. Sensitivity was interpreted according to Clinical and Laboratory Standards Institute/Food and Drug Administration guidelines.

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Erratum

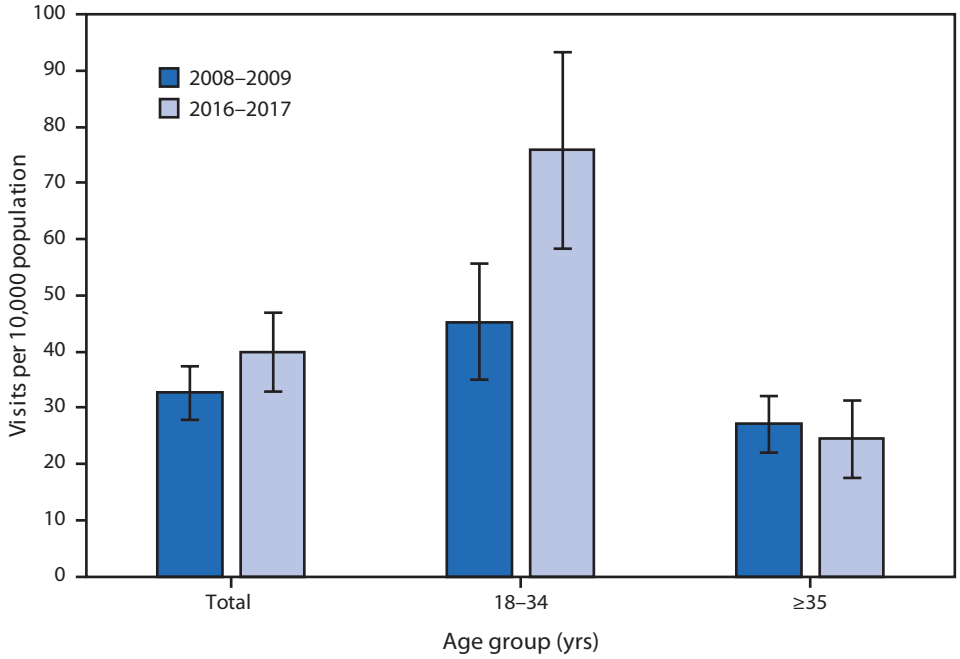
Vol. 68, No. 43

In the report "Update: Characteristics of Patients in a National Outbreak of E-cigarette, or Vaping, Product Use–Associated Lung Injuries — United States, October 2019," on page 989, the list of contributors on the Lung Injury Response Epidemiology/Surveillance Task Force should have included **Samantha J. Lange, National Center for Chronic Disease Prevention and Health Promotion, CDC**

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Number of Emergency Department Visits*,† for Substance Abuse or Dependence§ per 10,000 Persons Aged ≥18 Years, by Age Group — United States, 2008–2009 and 2016–2017



* Visit rates are based on the July 1, 2008–2009 and 2016–2017 estimates of the civilian noninstitutionalized population as developed by the U.S. Census Bureau Population Division; 95% confidence intervals are indicated with error bars.

† Based on a sample of visits to emergency departments (EDs) in noninstitutional general and short-stay hospitals, exclusive of federal, military, and Veterans Administration hospitals, located in the 50 states and the District of Columbia.

§ Defined as ED visits made by patients aged ≥18 years with a primary diagnosis of substance-related disorders or primary complaint of substance abuse or dependence (includes opioid, cannabis, sedative, hypnotic, anxiolytic, cocaine, amphetamine, hallucinogen, inhalant, other stimulant, and other psychoactive substance-related disorders).

The rate of ED visits with a primary diagnosis or primary complaint of substance abuse or dependence by patients aged 18–34 years in the United States increased from 45.4 visits per 10,000 persons in 2008–2009 to 76.0 visits in 2016–2017 but remained stable among patients aged ≥35 years (27.2 in 2008–2009 and 24.6 in 2016–2017). In both periods, persons aged 18–34 years were more likely to visit the ED for substance abuse or dependence than those aged ≥35 years.

Source: National Hospital Ambulatory Medical Care Survey, 2008–2017.

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