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Human Cases of Highly Pathogenic Avian Influenza A(H5N1) — California, September–December 2024

Sophie Zhu, PhD[1,2]; Kathleen Harriman, PhD[2]; Caterina Liu, MD[2]; Vit Kraushaar, MD[2]; Cora Hoover, MD[2]; Kyoo Shim, MPH[2]; Sharon I. Brummitt, PhD[2]; Jocelyn Limas, MPH[2]; Kathleen Garvey, MHS[2]; Jennifer McNary, MPH[2]; Nina J. Gao, PhD[2]; Rahil Ryder, MS[2]; Brandon Stavig[2]; Jeffrey Schapiro, MD[2]; Christina Morales, PhD[2]; Debra A. Wadford, PhD[2]; Holly Howard, MPH[2]; James Heffelfinger, MD[2]; Rebecca Campagna, DVM[2]; Esmeralda Iniguez-Stevens, PhD[2]; Hamed Gharibi, PhD[2]; Denise Lopez, DrPH[3]; Laura Esbenshade[3]; Paula Ptomey[3]; Kavita K. Trivedi, MD[4]; Jade A. Herrera[4]; Joanna Locke, MD[4]; Nicholas Moss, MD[4]; Paul Rzucidlo, MPH[5]; Kimberly Hernandez, MPH[5]; Minhphuong Nguyen, MPH[6]; Simon Paul, MD[6]; Justin Mateo, MPH[7]; Carlos Del Carmen Luna[7]; Yer Chang[7]; Maria Rangel[8]; Keiryl DeLeon[9]; Aisha Masood[9]; Thea Papasozomenos, MD[10]; Payeng Moua[10]; Katie Reinhart, PhD[11]; Krista Kniss, MPH[11]; C. Todd Davis, PhD[11]; Marie K. Kirby, PhD[11]; Erica Pan, MD[2]; Erin L. Murray, PhD[2], Los Angeles County H5 Response Team; California Department of Public Health H5 Laboratory Response Team

Abstract

Persons who work closely with dairy cows, poultry, or other animals with suspected or confirmed infection with highly pathogenic avian influenza (HPAI) A(H5N1) viruses are at increased risk for infection. In September 2024, the California Department of Public Health was notified of the first human case of HPAI A(H5N1) in California through monitoring of workers on farms with infected cows. During September 30–December 24, 2024, a total of 38 persons received positive test results for HPAI A(H5N1) viruses in California; 37 were dairy farm workers with occupational exposure to sick cows, and one was a child aged <18 years with an undetermined exposure, the first pediatric HPAI A(H5N1) case reported in the United States. All patients had mild illness. The identification of cases associated with occupational exposure to HPAI A(H5N1) viruses on dairy farms highlights the continued risk for persons who work with infected animals. The pediatric case was identified through routine surveillance. Given recent increases in the prevalence of HPAI A(H5N1) viruses among some animal populations, public health agencies should continue to investigate cases of HPAI A(H5N1) in humans as part of control measures, pandemic preparedness, to identify concerning genetic changes, and to prevent and detect potential human-to-human transmission of the virus. To date, no human-to-human transmission of HPAI A(H5N1) virus has been identified in the United States.

Introduction

Novel influenza A virus infection, including highly pathogenic avian influenza (HPAI) A(H5N1) virus, is a reportable condition in California and nationally reportable to CDC.* In 2024, the California Department of Public Health (CDPH), California Department of Food and Agriculture (CDFA), local health departments (LHDs), and farms known to be affected by HPAI A(H5N1) (i.e., dairy or poultry farms with nonnegative [positive or inconclusive] A(H5) test results for cows, bulk milk, or poultry) coordinated to reduce infection risk and monitor HPAI A(H5N1) symptoms† among workers. All farm owners or managers of affected farms were advised

* https://ndc.services.cdc.gov/conditions/novel-influenza-a-virus-infections/
† https://www.cdc.gov/bird-flu/signs-symptoms/index.html

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to conduct daily monitoring of workers and report symptoms consistent with HPAI A(H5N1) infection in workers who were in contact with affected animals to their LHD. When farm owners did not volunteer to do the monitoring, the LHD offered to perform monitoring of symptoms directly with workers through phone calls or text messaging. Symptomatic workers were referred for specimen collection, typically, conjunctival, nasal, nasopharyngeal, or oropharyngeal swabbing, based on symptom presentation. Targeted surveillance, which includes influenza typing and subtyping for A(H5), was performed at either a local or the state public health laboratory (PHL) for all symptomatic workers or persons with epidemiologic linkage (*1*) to HPAI A(H5N1) reported to public health officials. PHLs use the CDC Human Influenza A Subtyping Kit which detects and differentiates hemagglutinin (H) proteins as part of routine influenza surveillance. Selected local PHLs employ the CDC Influenza A(H5) Subtyping Kit to detect A(H5)[§] Asian lineage viruses for suspected HPAI A(H5N1) cases. Presumptive positive or inconclusive A(H5) specimens were sent to CDC for confirmatory testing. This report summarizes information on human HPAI A(H5N1) cases identified in California during September 30–December 24, 2024.

§ CDC Human Influenza A/H5 Subtyping Kit (VER 4) Instructions for Use Package Insert. July 12, 2024.

Investigation and Results

Initial Public Health Notification and Response

On August 30, 2024, CDFA detected, and the National Veterinary Services Laboratories subsequently confirmed, HPAI A(H5N1) virus infections in cows from three dairy farms in the Central Valley region of California. In September 2024, CDPH was notified of the first human case of HPAI A(H5N1) in California through monitoring of workers on farms with infected cows. On October 3, 2024, the first two human HPAI A(H5N1) cases in California were confirmed in workers on two separate farms where infected cows were detected in September. These patients had been identified and reported by their employers to their LHD; both had conjunctivitis, and one also had a fever. Specimens from both patients tested positive for influenza A(H5) virus at a local PHL and were confirmed as HPAI A(H5N1) at CDC. LHD staff members provided guidance on isolation and offered the antiviral oseltamivir to patients and their household members. No known epidemiologic links existed between the two patients.

As of December 24, 2024, the U.S. Department of Agriculture reported 675[¶] dairy herds with infected cows, 92 commercial flocks with infected poultry,[**] and 35 backyard flocks with infected poultry in California. During

¶ https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/hpai-confirmed-cases-livestock

** https://www.aphis.usda.gov/livestock-poultry-disease/avian/avian-influenza/hpai-detections/commercial-backyard-flocks

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August 30–December 24, a total of 5,126 workers were monitored at affected farms; 170 persons from 19 local health jurisdictions received testing for influenza A(H5) through targeted surveillance. One additional patient was reported through routine surveillance and subsequently received testing at a PHL. Of the 171 persons who received testing, CDPH identified 36 confirmed cases and one probable (*1*) case of HPAI A(H5N1) among adult dairy farm workers and one confirmed case in a child aged <18 years without dairy cow or poultry exposure; 37 persons received positive test results confirmed at CDC. This activity was reviewed by CDC and CDPH, deemed research not involving human subjects, and was conducted consistent with applicable federal law and CDC policy.[††]

Description of Human HPAI A(H5) Cases

Human cases with exposure to dairy cows (37). Persons with HPAI A(H5N1) infection (36 confirmed and one probable) worked at 29 unique dairy farms (Table 1). The median interval from first A(H5) virus detection in cows to the first human case on a particular farm was 7 days (range = −7 to 20 days). Worker monitoring was initiated on one unaffected farm because A(H5) virus had been detected in cows on other dairy farms owned by the same person. All patients with occupational exposure to dairy cows were aged 18–64 years (Table 2). Six patients reported underlying medical conditions. A majority (76%) worked as milkers or cared for sick cows. A majority of patients (78%) reported using personal protective equipment (PPE) at work; 25 (68%) wore gloves, 20 (54%) used eye protection (13 reported wearing goggles), 12 (32%) reported wearing boots, and six (16%) wore gowns. No patients specifically reported wearing a respirator (e.g., an N95 mask) as recommended[§§]; however, 12 (32%) reported wearing other face coverings or face masks.

Patients received testing a median of 2 days (range = 0–5 days) after symptom onset. All patients had mild illness. Frequently

[††] 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

[§§] https://www.cdc.gov/bird-flu/prevention/worker-protection-ppe.html

TABLE 1. Characteristics of dairy farms with associated human highly pathogenic avian influenza A(H5N1) cases — California, September–December 2024

Farm	No. of workers monitored	No. of human cases	Days under quarantine* as of December 24, 2024	No. of days from first A(H5) virus detection in cows to first human case
A	Unknown	3	81	6
B	Unknown	2	71	11
C	Unknown	2	60	2
D	40	3	50	10
E	Unknown	1	85	6
F	30	1	95	14
G	Unknown	1	95	13
H	Unknown	1	82	6
I	Unknown	1	85	13
J	10	1	81	6
K	7	1	81	6
L	26	1	81	10
M	Unknown	1	70	7
N	Unknown	1	71	5
O	23	1	70	7
P	80	1	81	20
Q	Unknown	1	60	3
R	14	1	57	6
S	Unknown	1	53	10
T	13	1	53	10
U	Unknown	1	41	−7[†]
V	Unknown	1	39	0
W	Unknown	1	42	12
X	Unknown	1	39	11
Y	11	1	39	12
Z	33	1	39	12
AA	7	3	14	0
BB	Unknown	1	14	5
CC	Unknown	1	11	4

* Farms were quarantined until reporting no cows with signs of infection and three consecutive weekly negative tests of bulk milk; no farms with human cases were released from quarantine through December 24, 2024. Quarantine of sick cows is necessary to reduce farm-to-farm and cow-to-human transmission of highly pathogenic avian influenza A(H5N1) viruses.

[†] Worker monitoring was initiated on farm U because A(H5) virus had been detected in cows on other dairy farms with the same owner. The virus was detected on the farm after the first human case occurred in a farm worker.

TABLE 2. Characteristics and laboratory results of persons with confirmed and probable highly pathogenic avian influenza A(H5N1) virus infection — California, September–December 2024

Characteristic	Confirmed and probable no. (%)
Total	**38***
Confirmed	37 (97.4)
Probable†	1 (2.6)
Median age, yrs (IQR)	43 (32–49)
Race and ethnicity (n = 37)§	
White and Hispanic or Latino	24 (64.9)
Unknown race and Hispanic or Latino	13 (35.1)
Primary language	
Spanish	27 (71.0)
English	3 (7.9)
Unknown	8 (21.1)
Public health laboratory test result	
Presumptive positive	37 (97.4)
Negative	1 (2.6)
CDC confirmatory result by testing site¶	
Conjunctival swab (n = 37)	35 (94.6)
Nasal/Oropharyngeal swab (n = 29)	8 (27.6)
Nasopharyngeal swab (n = 37)	5 (13.5)
Nasal (n = 6)	2 (33.3)
Oropharyngeal (n = 4)	1 (25.0)
Clinical signs and symptoms	
Eye irritation or redness	37 (97.4)
Fever**	11 (28.9)
Muscle aches	13 (34.2)
Headache	10 (26.3)
Sore throat	6 (15.8)
Cough	6 (15.8)
Shortness of breath	4 (10.5)
Vomiting	2 (5.3)
Diarrhea	2 (5.3)
Fatigue	7 (18.4)
Dairy farm exposure	37 (97.4)
Role on dairy farm (n = 37)	
Milker	23 (62.2)
Farmhand	2 (5.4)
Other††	3 (8.1)
Unknown	9 (24.3)
Unique dairy farms where cases occurred	29
Reported use of any personal protective equipment§§ at work (n = 32)	
Yes	29 (78.4)
No	5 (13.5)
Unknown	3 (9.4)
Patient offered oseltamivir	
Accepted	36 (94.7)
Declined	2 (5.3)
Hospitalized	
Yes	0 (—)
No	38 (100)

* Table includes 37 persons with occupational exposure to infected dairy cows and one with an unknown exposure source to influenza A(H5).
† https://cdn.ymaws.com/www.cste.org/resource/resmgr/position_statements_files_2023/24-ID-09_Novel_Influenza_A.pdf
§ Race and ethnicity not described for one person to protect privacy.
¶ Some cases were confirmed with more than one specimen.
** Measured or subjective fever.
†† Farmhands and persons in the "Other" categories were in roles with close contact with sick cows.
§§ Eye protection (including goggles), gloves, gown, or boots.

reported signs and symptoms included eye irritation or redness (97%), muscle aches (34%), and fever (29%). Respiratory symptoms, including sore throat (16%) and shortness of breath (11%) were less commonly reported. No hospitalizations or deaths occurred, and all patients recovered. All 37 patients were offered oseltamivir; two declined (5%). No cases were identified in household contacts of patients with occupational exposure.

Undetermined exposure source (one). One confirmed case was detected through routine influenza surveillance in a previously healthy child who had no known contact with infected animals or humans and had not consumed unpasteurized dairy products. This patient, who had mild respiratory symptoms and otitis media but no conjunctivitis, was not hospitalized. Oseltamivir was prescribed when positive test results were received for influenza A virus. Subtyping was positive for influenza A(H5) virus.¶¶ The patient's three household members also had respiratory symptoms; one developed symptoms a day before the patient, while the two other members developed symptoms concurrently. Four days after the patient's initial testing, respiratory specimens were collected from all household members. All specimens tested negative for influenza A(H5) virus. Specimens from the patient and two household members tested positive for adenovirus and rhinovirus.

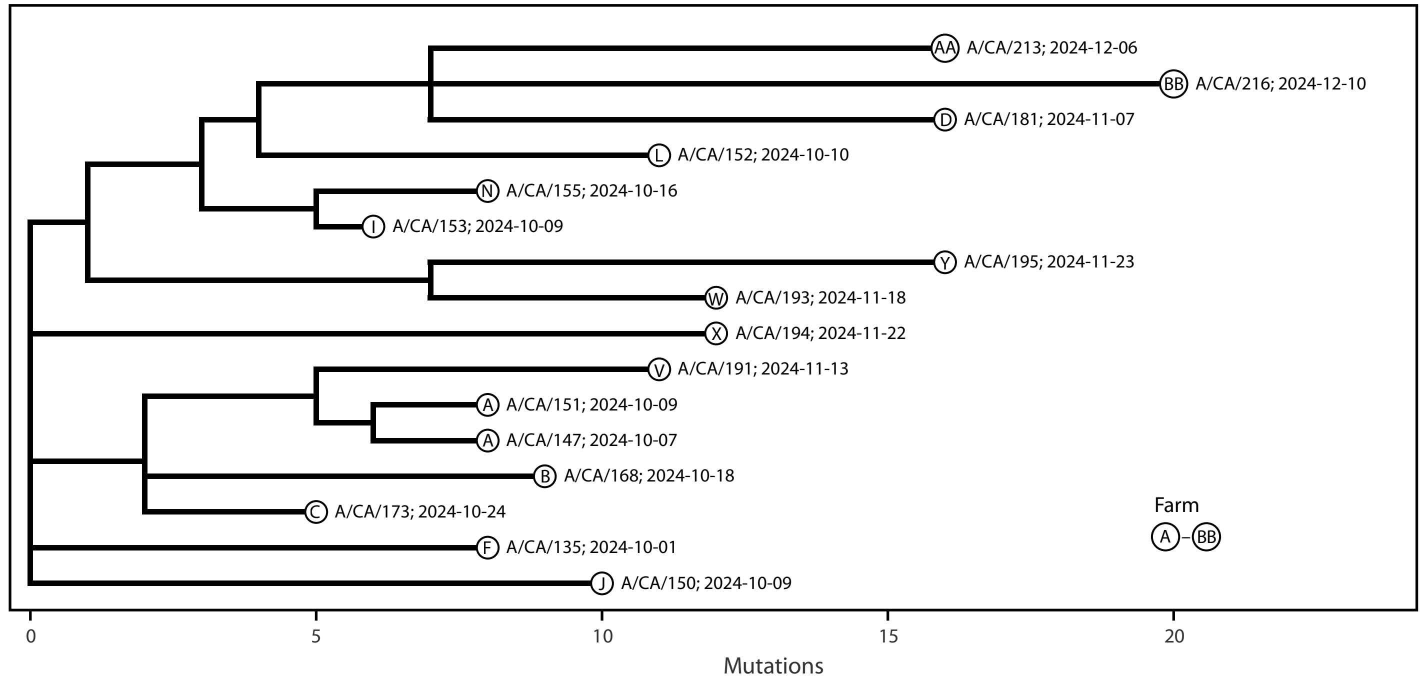
Laboratory results (38). Thirty-five (95%; 37) patients received a positive conjunctival swab result, eight (28%; 29) patients received positive test results for combined nasal and oropharyngeal swabs, five (14%; 37) patients received positive nasopharyngeal swab test results, two (33%; 6) patients received positive nasal swab results, and one (25%; 4) patient received a positive oropharyngeal swab result (Table 2). The majority of patients had either a positive conjunctival or combined nasal/oropharyngeal swab (97%). One patient only received a positive nasal swab result with no other positive sites.

Genetic Sequencing

Genetic sequencing of the viruses was performed from clinical specimens of 30 patients; all were identified as HPAI A(H5N1) clade 2.3.4.4b viruses. All eight gene segments of the viruses were recovered from 16 patients, and partial gene segments were recovered from the other 14. The viruses from the 16 patients with all gene segments sequenced (Figure) were identified as HPAI A(H5N1) clade 2.3.4.4b, genotype B3.13. The pediatric patient (A/California/192/2024) only had five of eight segments sequenced, which was insufficient to classify a specific genotype; however, the neuraminidase and nucleoprotein sequences shared close genetic identity to recent California HPAI A(H5N1) B3.13 genotype viruses from humans, dairy cattle, and poultry. One virus (A/California/150/2024) contained a nucleotide

¶¶ https://www.cdc.gov/bird-flu/spotlights/h5n1-response-12092024.html

FIGURE. Phylogenetic tree* of 16 whole genome highly pathogenic avian influenza A(H5N1) viruses, by identification and collection date, from human cases — California, September–December 2024



* Tree was created with Ultrafast Sample placement on Existing tRee (UShER). https://genome.ucsc.edu/cgi-bin/hgPhyloPlace and Auspice https://auspice.us/

substitution within the polymerase acidic gene (I38M), which is associated with reduced susceptibility to the antiviral baloxavir marboxil.*** No substitutions associated with reduced oseltamivir susceptibility or adaptations for efficient human-to-human transmission were detected.

Discussion

This report describes investigations that led to identification of 38 persons who received positive test results for HPAI A(H5N1) viruses in California; 37 were dairy farm workers with occupational exposure to sick cows, and one was a child aged <18 years with an undetermined exposure. Epidemiologic and clinical characteristics were similar to those in other U.S. human cases (*2*,*3*). In genetic sequencing of 30 of the 38 infected patients, all were identified as HPAI A(H5N1) clade 2.3.4.4b viruses. A substitution associated with reduced baloxavir susceptibility was identified in one virus sequenced from a human case in California. No additional concerning substitutions were identified.

The identification of 37 cases with occupational exposure across 29 dairy farms highlights the ongoing risk for cow-to-human transmission of HPAI A(H5N1) viruses among persons who have close contact with infected cows and their raw milk (*4*). The absence of cases among household contacts is consistent with the absence of viral genetic markers for efficient human-to-human transmission.

*** https://www.cdc.gov/bird-flu/spotlights/h5n1-response-11152024.html

Summary

What is already known about this topic?

Persons with occupational exposure to highly pathogenic avian influenza (HPAI) A(H5N1) virus–infected dairy cattle are at increased risk for infection.

What is added by this report?

During September 30–December 24, 2024, a total of 38 persons received a positive test result for HPAI A(H5N1) viruses in California; 37 were dairy farm workers with occupational exposure to sick cows. One, a person aged <18 years with an undetermined exposure, was the first pediatric patient detected with influenza A(H5) infection in the United States.

What are the implications for public health practice?

Public health agencies should investigate influenza-like illness or conjunctivitis in workers with occupational exposure to animals infected with HPAI A(H5N1) virus. Thorough investigations of all human HPAI A(H5N1) virus infections are necessary to identify potential exposure sources, including monitoring the virus for concerning genetic changes that indicate the potential for person-to-person transmission.

Although a majority of patients reported using PPE at work, use of recommended PPE (i.e., N95 respirators versus face mask) has been previously reported as being low among dairy farm workers with HPAI infection (*5*). Additional education and messaging about the risks of working with infected cows and ensuring worker access to PPE might increase PPE use, particularly if done in collaboration with farm worker organizations and producers.

This report describes the first detection of a pediatric case of influenza HPAI A(H5N1) in the United States. The source of this child's infection remains undetermined. Unlike pediatric patients with HPAI A(H5N1) virus infections in other countries who had severe illness (*6*,*7*), this child had only mild respiratory symptoms and recovered quickly. Other sporadic cases of influenza HPAI A(H5N1) have occurred in persons with no known exposure to potentially infected animals (*8*). To date, human-to-human transmission of HPAI A(H5N1) viruses has not been identified in the United States.[†††]

Limitations

The findings in this report are subject to at least three limitations. First, information about the type of and proportion of time that PPE was worn was unavailable for all patients. Second, access to PPE was not assessed. Finally, some symptomatic persons with exposure to sick animals might not have been reported, in which case some human HPAI A(H5N1) infections might have been missed.

Implications for Public Health Practice

Public health agencies should work with dairy and poultry farms to reduce worker exposure to HPAI A(H5N1) viruses and detect and respond to human cases. Prevention, detection, and response strategies include PPE use guidance, training, and distribution; collaboration with farm managers on worker monitoring; working with LHDs to coordinate worker testing; specimen collection and laboratory testing to distinguish influenza A(H5) from seasonal influenza viruses; and distribution of oseltamivir treatment to HPAI A(H5N1) patients and oseltamivir prophylaxis to close contacts.[§§§] Collaboration among public health, agriculture, animal health, occupational health, environmental health, health care providers, and other state and federal agencies is important for a coordinated One Health[¶¶¶] response and to enable early detection of changes in influenza A(H5) viruses that could facilitate human-to-human transmission. Ongoing monitoring for genetic changes is necessary to assess the likelihood of antiviral resistance or human-to-human transmission of HPAI A(H5N1) viruses.

Expanded subtyping[****] of influenza viruses might record additional cases of HPAI A(H5N1) virus infection with no known exposure (*8*). Health departments should evaluate potential exposures for all HPAI A(H5N1) cases to ascertain the possibility for human-to-human transmission. Surveillance for HPAI A(H5N1) viruses could include expanded subtyping for A(H5) testing in persons who meet epidemiologic and either clinical or public health criteria.

††† https://www.cdc.gov/fluview/surveillance/2025-week-08.html

§§§ https://www.cdc.gov/bird-flu/prevention/hpai-interim-recommendations.html

¶¶¶ https://www.cdc.gov/one-health/php/about/index.html

**** https://www.cdc.gov/han/2025/han00520.html

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Los Angeles County H5 Response Team

Annabelle de St. Maurice, Los Angeles County Department of Public Health; Eric El-Tobgy, Los Angeles County Department of Public Health; Nicole Green, Los Angeles County Department of Public Health; Allison Joyce, Los Angeles County Department of Public Health; Cristin Mondy, Los Angeles County Department of Public Health; Taylor Mundt, Los Angeles County Department of Public Health; Heidi Ransohoff, Los Angeles County Department of Public Health; Shayra Sanchez, Los Angeles County Department of Public Health; Elizabeth Traub, Los Angeles County Department of Public Health.

California Department of Public Health H5 Laboratory Response Team

Matthew Bacinskas, California Department of Public Health; John Bell, California Department of Public Health; Cynthia Bernas, California Department of Public Health; Brandon Brown, California Department of Public Health; Jahara Cayabyab, California Department of Public Health; Alice Chen, California Department of Public Health; Jesse Elder, California Department of Public Health; Shiffen Getabecha, California Department of Public Health; Carol Glaser, California Department of Public Health; Olena Gomez, California Department of Public Health; Bianca Gonzaga, California Department of Public Health; Ydelita Gonzales, California Department of Public Health; Hugo Guevara, California Department of Public Health; April Hatada, California Department of Public Health; Katya Ledin, California Department of Public Health; Deidra Lemoine, California Department of Public Health; Adrienne Macias, California Department of Public Health; Sergio Martinez-Paredes, California Department of Public Health; Blanca Molinar, California Department of Public Health; Tasha Padilla, California Department of Public Health; Chao-Yang Pan, California Department of Public Health; Kiana Pattni, California Department of Public Health; Rolando Ramirez, California Department of Public Health; Kao Saechao, California Department of Public Health; Estela Saguar, California Department of Public Health; Maria Salas, California Department of Public Health; Ioana Seritan, California Department of Public Health; Anthony Tran, California Department of Public Health; Cindy Wong, California Department of Public Health; Chelsea Wright, California Department of Public Health.

Corresponding author: Sophie Zhu, uri0@cdc.gov.

[1]Epidemic Intelligence Service, CDC; [2]California Department of Public Health; [3]Tulare County Department of Health and Human Services, Visalia, California; [4]Alameda County Public Health Department, San Leandro, California; [5]Kern County Public Health, Bakersfield, California; [6]Madera County Department of Public Health, Madera, California; [7]Merced County Public Health, Merced, California; [8]Fresno County Department of Public Health, Fresno, California; [9]San Joaquin County Public Health Services, Stockton, California; [10]Stanislaus County Health Services Agency, Modesto, California; [11]Influenza Division, National Center for Immunization and Respiratory Diseases, CDC.

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Pedestrian and Overall Road Traffic Crash Deaths — United States and 27 Other High-Income Countries, 2013–2022

Rebecca B. Naumann, PhD[1]; Bethany A. West, MPH[1]; Vaughn Barry, PhD[1]; Sarah Matthews, MPH[2]; Robin Lee, PhD[1]

Abstract

Road traffic deaths are preventable but remain a major public health problem. Crashes cause more than 40,000 deaths annually in the United States, and traffic-related pedestrian deaths have increased rapidly. To examine change in pedestrian and overall traffic death rates (deaths per 100,000 population) within an international context, CDC analyzed 2013–2022 data from the United States and 27 other high-income countries in the International Road Traffic and Accident Database, as well as early 2023 U.S. estimates. Between 2013 and 2022, U.S. pedestrian death rates increased 50% (from 1.55 to 2.33 per 100,000 population), while other countries generally experienced decreases (median decrease = 24.7%). During this period, overall U.S. traffic death rates increased 22.5% (from 10.41 to 12.76), but decreased by a median of 19.4% in 27 other high-income countries. Among all countries examined, the United States had the highest pedestrian death rates overall and among persons aged 15–24 and 25–64 years. Projected 2023 U.S. estimates suggest a potential decline in pedestrian (2%) and overall traffic (4%) deaths, compared with those in 2022. Accelerated adoption of a Safe System approach, focused on creating safer roadways and vehicles, establishing safer speeds, supporting safer road users, and improving post-crash care, can help reduce U.S. pedestrian and overall traffic deaths.

Introduction

More than 40,000 lives are lost annually in the United States because of road traffic crashes, and traffic-related pedestrian deaths have increased rapidly over the last several years (*1*). In 2022, pedestrian deaths reached their highest number (7,522) in 41 years (*1*). Examining domestic and international trends in pedestrian and overall road traffic deaths can help guide and prioritize U.S. traffic safety efforts. This study compares pedestrian and overall road traffic death rates in the United States and 27 other high-income countries during 2013–2022 and, given that the data are not yet final, examines projected 2023 U.S. estimates based on crash reports. In addition, CDC examined age-related disparities in pedestrian death rates across countries.

Methods

Data Source

CDC obtained 2013–2022 road traffic death data from the International Transport Forum's International Road Traffic and Accident Database (IRTAD).* IRTAD contains standardized and validated annual road traffic death and population data from 35 participating countries. The United States provides road traffic death data from the Fatality Analysis Reporting System (FARS), a census of crashes on U.S. public roadways that result in a death within 30 days of the crash.† This analysis included data from all 28 high-income countries§ with populations of >1 million persons that provided data to IRTAD and had no major changes in how data were reported during this period.¶,** At the time of this investigation and

* IRTAD data and annual reports are available at https://www.itf-oecd.org/irtad-road-safety-database and https://www.itf-oecd.org/irtad-publications. Data were current with respect to those reported to the International Transport Forum (ITF) as of June 2024. Thirty-five countries report data to IRTAD, and the following 28 are included in this analysis: Australia, Austria, Belgium, Canada, Czechia, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, South Korea, Lithuania, Netherlands, New Zealand, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

† FARS captures information on road traffic crash deaths from a variety of sources, including police crash reports, medical examiner reports, emergency medical services reports, and state vehicle registration and driver's licensing files. https://www.nhtsa.gov/crash-data-systems/fatality-analysis-reporting-system

§ The definition of high-income derives from the World Bank's classification scheme and is based on gross national income per capita. https://datatopics.worldbank.org/world-development-indicators/the-world-by-income-and-region.html

¶ Among the 35 countries that report data to IRTAD, seven were not included in this analysis (with reasons for exclusion in parentheses): Argentina (upper-middle–income), Chile (definition for road traffic crash deaths changed in 2019, which created a trend break), Columbia (upper-middle–income), Costa Rica (upper-middle–income), Iceland (population <1 million), Luxembourg (population <1 million), and Serbia (upper-middle–income).

** Data were supplemented from additional sources to ensure complete 2022 death and population data. Data from other sources included final 2021 and 2022 U.S. overall road traffic, pedestrian, and pedestrian by age group deaths from FARS and 2022 overall road traffic, pedestrian, and pedestrian by age group deaths for Greece from the Hellenic Statistical Authority (https://www.statistics.gr/). 2022 population estimate data were obtained from relevant census sources for Canada (https://www12.statcan.gc.ca/census-recensement/index-eng.cfm), the United Kingdom (https://www.ons.gov.uk/), and the United States (https://www.census.gov/).

publication date, 2023 and FARS data were not yet final, so projected estimates of 2023 U.S. pedestrian and overall road traffic deaths calculated in May 2024 by the U.S. Department of Transportation are included here to provide a more recent description of possible U.S. trends.[††]

Data Analysis

CDC analyzed country-specific pedestrian and overall road traffic[§§] deaths and death rates (deaths per 100,000 population) from 2013 through 2022 and calculated absolute and relative percentage changes in rates by country, as well as mean and median rates and rate changes, with and without the United States included. Country-specific 5-year annual average pedestrian death rates were calculated by age group (0–14, 15–24, 25–64, and ≥65 years) using 2018–2022 data;[¶¶] the 5 most recent years of data (2018–2022) were combined to support estimate stability, given small annual counts and high between-year variability by age group for some countries. Analyses were descriptive and conducted using Excel. This activity was reviewed by CDC, deemed not research, and conducted consistent with applicable federal law and CDC policy.[***]

Results

Pedestrian Road Traffic Crash Deaths

During 2013–2022, U.S pedestrian death rates increased a relative 50.0% (from 1.55 to 2.33 deaths per 100,000 population), while most other countries experienced decreases (median relative decline = 24.7%; IQR = −45.0% to −10.4%) (Figure 1) (Table). By 2022, pedestrian death rates in all other 27 countries were lower than the U.S. rate, with the U.S. pedestrian death rate (2.33) approximately three times the median rate of the 27 other countries (0.73). There were 2,857 more pedestrian deaths in the U.S. in 2022 than in 2013, and 3,071 fewer pedestrian deaths in 2022 than in 2013 in the 27 other countries.

Overall Road Traffic Crash Deaths

During this 10-year period, overall U.S. road traffic death rates increased a relative 22.5%, from 10.41 to 12.76 deaths per 100,000. In the 27 other countries, overall road traffic death rates generally decreased (median decrease = 19.4%; IQR = −30.3% to −5.7%). Projected 2023 estimates obtained from May 2024 U.S. Department of Transportation calculations indicate small relative declines in overall U.S. traffic deaths (4%) and pedestrian deaths (2%) between 2022 and 2023.

Characteristics of Pedestrians Killed in Road Traffic Crashes

During 2018–2022, across most countries examined, the highest pedestrian death rates were observed in adults aged ≥65 years, with the highest rates in South Korea (Figure 2). Compared with other countries, the United States had the highest pedestrian death rates among persons aged 15–24 and 25–64 years, and the second highest rate among children aged 0–14 years.

Discussion

During 2013–2022, U.S. road traffic crash pedestrian death rates increased, while rates in many other high-income countries decreased. In 2022, the U.S. pedestrian death rate was higher than that in all 27 included high-income countries and approximately three times the median rate in these countries. Moreover, whereas the overall U.S. road traffic death rate increased as well during this time, the pedestrian death rate increase was approximately twice as large. These findings update previous surveillance findings indicating that the United States has often lagged behind road safety progress of other high-income countries (*2*,*3*). However, previous work has not analyzed international changes in pedestrian deaths, whose death rates have long been increasing in the United States (*1*).

There are many possible contributors to the increases in U.S. pedestrian and overall road traffic death rates (*4*), including a changing mix of vehicles on U.S. roadways and changing dimensions of these vehicles (*5*). The proportion of taller and heavier vehicles with poor visibility (e.g., sport utility vehicles [SUVs] and pickup trucks) has increased, and the physical characteristics of these vehicles have become larger over time (e.g., heavier overall weight and higher bumpers), making them more likely to be involved in certain types of crashes and to result in death when crashes occur (*5*). SUVs, vans, and pickup trucks accounted for 79% of new U.S. leases and vehicle sales in 2022, while the proportion of smaller vehicles (e.g., sedans) declined from 50% of new vehicles in 2012 to 21% in 2022 (*6*). Compared with passenger cars, SUVs and pickup trucks are more likely to strike pedestrians during certain maneuvers (e.g., turning), and pedestrians are 50%–100% more likely to be killed when they are in a crash involving a SUV or pickup truck (*5*).

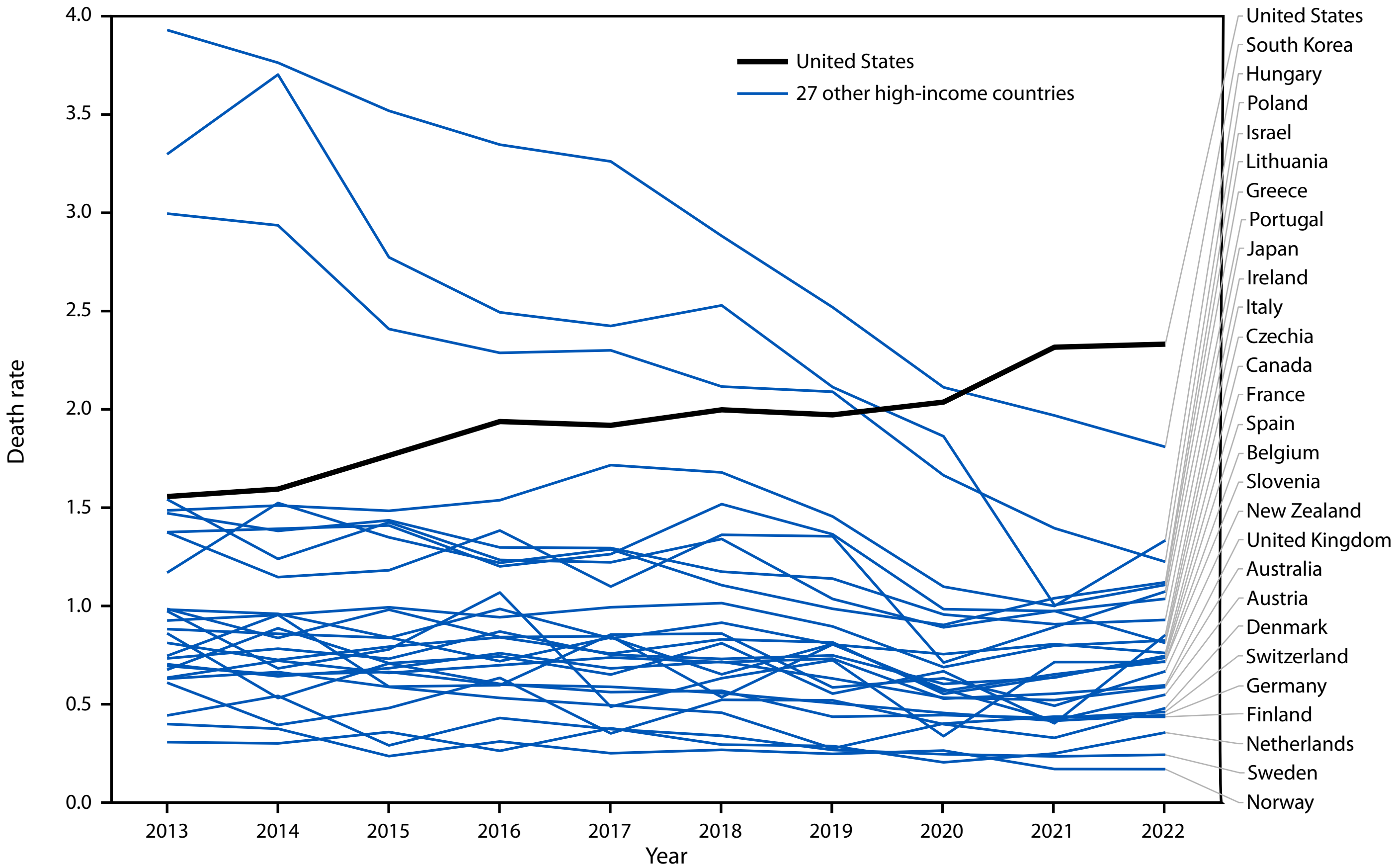
[††] 2023 early estimate data for FARS are provided by the National Highway Traffic Safety Administration data; additional data on estimates are available at https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813581.

[§§] Overall road traffic deaths included deaths to vehicle occupants, motorized two-wheelers, pedestrians, and cyclists, as well as other road user types. Pedestrian deaths in IRTAD include persons on foot or personal conveyances.

[¶¶] Age groups are predetermined by ITF, and pedestrian sex data were not available. In addition, 2022 pedestrian death counts by age group for Canada were unavailable from IRTAD and could not be obtained from country-specific websites; therefore, Canada's pedestrian death rates by age group represent 4-year average rates, using 2018–2021 data.

[***] 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

FIGURE 1. Pedestrian death rates,* by country — United States and 27 other high-income countries, 2013–2022†



* Deaths per 100,000 population.
† Data from the International Transport Forum's International Road Traffic and Accident Database.

High-speed and complex, multilane roadways (e.g., arterial roadways) also are associated with increased U.S. pedestrian deaths (*7*). Many of these roadways are characterized by increased crash risk linked to conflicting goals of providing immediate access to key commercial destinations (e.g., stores and restaurants), while also seeking to move vehicles at high travel speeds (*7*). Several other countries use different roadway design strategies, including prioritizing land use and safe movement by sustainable travel modes (i.e., walking, cycling, and transit) (*8*). Further, the increase in the number of persons living below the poverty line, particularly in U.S. suburban communities with fewer transportation options and less access to safe pedestrian infrastructure, could contribute to higher U.S. pedestrian death rates (*9*).

Certain age groups are disproportionately affected by pedestrian deaths including older adults, who generally experience the highest rates. Several factors, including walking speed, vision impairment, and distance judgement might increase risk among older adults; however, design solutions, such as lengthening pedestrian intervals, narrowing crossing distance, and adequate lighting, could mitigate this risk (*10*). These same strategies can help prevent crashes among pedestrians of all ages, and more widespread adoption of these and other design strategies are needed, given high U.S. pedestrian death rates across age groups. In addition, further research is needed on countries with high pedestrian death rates but notable recent progress. For example, although South Korea had the highest older adult pedestrian death rate, the rate decreased by 61% (from 15.79 to 6.19) during 2013–2022.

The Safe System approach, grounded in public health principles, is a framework for building in layers of evidenced-based prevention strategies to ensure that no crash results in death or serious injury.[†††] The approach also stresses a need to minimize high speeds and impact forces through these layers of protection, a principle particularly important for protecting

††† https://publichealth.jhu.edu/sites/default/files/2023-03/recommendations-of-the-safe-system-consortium.pdf

TABLE. Pedestrian and overall road traffic deaths and death rates,* by country — United States and 27 other high-income countries, 2013 and 2022[†]

	Pedestrian traffic deaths						Overall road traffic deaths					
	2013		2022		10-year change in rate[§]		2013		2022		10-year change in rate[§]	
Country	No. of deaths	Rate*	No. of deaths	Rate*	Absolute change	Relative % change	No. of deaths	Rate*	No. of deaths	Rate*	Absolute change	Relative % change
Australia	162	0.70	152	0.58	−0.12	−16.6	1,185	5.12	1,111	4.27	−0.85	−16.6
Austria	83	0.98	49	0.55	−0.44	−44.4	455	5.38	370	4.12	−1.26	−23.5
Belgium	109	0.98	83	0.71	−0.26	−27.0	764	6.86	540	4.65	−2.21	−32.2
Canada	309	0.88	295	0.76	−0.12	−13.8	1,951	5.55	1,934	4.97	−0.58	−10.5
Czechia	162	1.54	85	0.81	−0.73	−47.5	654	6.22	527	5.01	−1.21	−19.4
Denmark	34	0.61	28	0.48	−0.13	−21.4	191	3.41	154	2.62	−0.79	−23.1
Finland	34	0.63	24	0.43	−0.19	−31.0	258	4.75	189	3.41	−1.35	−28.3
France	465	0.73	488	0.74	0.01	1.8	3,268	5.13	3,267	4.98	−0.15	−3.0
Germany	557	0.69	368	0.44	−0.25	−36.1	3,339	4.15	2,788	3.35	−0.80	−19.2
Greece	151	1.37	112	1.07	−0.30	−22.0	879	7.99	654	6.25	−1.74	−21.7
Hungary	147	1.48	129	1.33	−0.15	−10.3	591	5.96	535	5.52	−0.44	−7.4
Ireland	31	0.67	43	0.85	0.18	26.4	188	4.08	155	3.06	−1.02	−24.9
Israel	94	1.17	108	1.12	−0.05	−4.2	309	3.83	351	3.63	−0.20	−5.3
Italy	551	0.92	485	0.82	−0.10	−11.0	3,401	5.70	3,159	5.35	−0.35	−6.1
Japan	1,871	1.47	1,157	0.93	−0.54	−37.0	5,165	4.06	3,216	2.57	−1.48	−36.6
Lithuania	98	3.30	31	1.10	−2.19	−66.5	258	8.68	120	4.28	−4.40	−50.7
Netherlands	51	0.30	62	0.35	0.05	16.0	476	2.84	655	3.72	0.89	31.3
New Zealand	33	0.74	34	0.66	−0.08	−10.6	252	5.67	375	7.33	1.65	29.2
Norway	20	0.40	9	0.17	−0.23	−58.1	187	3.70	116	2.14	−1.56	−42.2
Poland	1,140	3.00	460	1.22	−1.77	−59.2	3,357	8.82	1,896	5.04	−3.78	−42.9
Portugal	144	1.37	107	1.03	−0.34	−24.7	637	6.07	618	5.97	−0.10	−1.7
Slovenia	20	0.97	15	0.71	−0.26	−26.7	125	6.07	85	4.03	−2.04	−33.6
South Korea	1,982	3.93	933	1.81	−2.12	−54.0	5,092	10.10	2,735	5.30	−4.80	−47.5
Spain	378	0.81	348	0.73	−0.08	−9.3	1,680	3.60	1,746	3.68	0.09	2.4
Sweden	42	0.44	25	0.24	−0.20	−45.5	260	2.72	227	2.17	−0.55	−20.1
Switzerland	69	0.86	40	0.46	−0.40	−46.7	269	3.35	241	2.76	−0.59	−17.6
United Kingdom	405	0.63	401	0.59	−0.04	−6.1	1,770	2.76	1,766	2.61	−0.15	−5.4
United States	4,911	1.55	7,768	2.33	0.78	50.0	32,893	10.41	42,514	12.76	2.35	22.5
Overall Measures												
Mean (incl United States)	502	1.18	494	0.82	−0.36	−22.7	2,495	5.46	2,573	4.48	−0.98	−16.2
Mean (excl United States)	339	1.17	225	0.77	−0.40	−25.4	1,369	5.28	1,094	4.18	−1.10	−17.7
Median (incl United States)	146	0.90	108	0.74	−0.20	−23.3	646	5.26	579	4.20	−0.79	−19.3
Median (excl United States)	144	0.88	107	0.73	−0.20	−24.7	637	5.13	540	4.12	−0.80	−19.4

Abbreviations: excl = excluding; incl = including.
* Deaths per 100,000 population.
[†] Data from the International Transport Forum's International Road Traffic and Accident Database.
[§] Absolute (2022 rate – 2013 rate) and relative % (([2022 rate – 2013 rate] / 2013 rate) x 100) changes displayed are based on unrounded rates and therefore might differ slightly from calculations based on rounded rates.

pedestrians. Application of the Safe System approach includes implementing population-level strategies like creating environments that encourage travel at safe speeds (e.g., lane narrowing), separating different types of road users (e.g., protected walkways), and supporting safe road user behaviors (e.g., ignition interlock devices to prevent impaired individuals from operating vehicles).

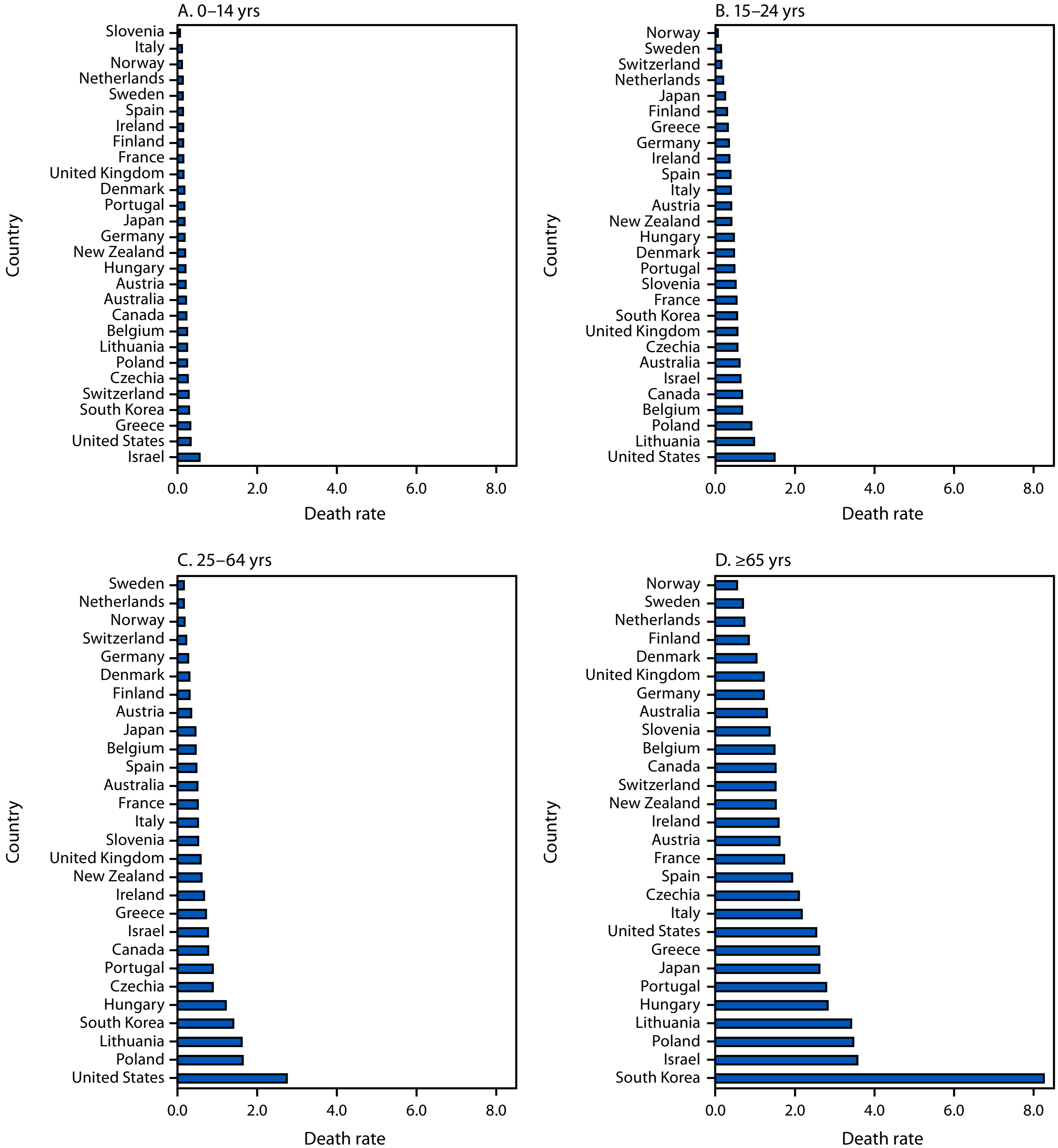
Several countries have reduced road traffic death rates over recent decades with adoption of the Safe System approach.[§§§] The U.S. federal government cemented its adoption of the Safe System approach in the 2022 National Roadway Safety Strategy.[¶¶¶] In addition, the international community has recognized the importance of this approach, calling for increased implementation of a Safe System approach during a second Decade of Action for Road Safety (2021–2030).[****] While projected 2023 estimates demonstrate a small potential reduction in U.S. pedestrian deaths, widespread implementation of a Safe System approach in the United States could help accelerate progress.

Limitations

The findings in this report are subject to at least two limitations. First, population counts were used for rate denominators

[§§§] https://www.roadsafety.unc.edu/wp-content/uploads/2022/09/CSCRS_R3_Final-Report-2022.pdf
[¶¶¶] https://www.transportation.gov/NRSS
[****] https://press.un.org/en/2024/ga12609.doc.htm; https://www.who.int/publications/m/item/global-plan-for-the-decade-of-action-for-road-safety-2021-2030.

FIGURE 2. Five-year annual average pedestrian road traffic crash death rates* among persons aged 0–14 (A), 15–24 (B), 25–64 (C), and ≥65 years (D) — United States and 27 other high-income countries, 2018–2022†,§



Abbreviation: IRTAD = International Transport Forum's International Road Traffic and Accident Database.

* Deaths per 100,000 population.

† Data from IRTAD.

§ 2022 pedestrian death counts by age group for Canada were unavailable from IRTAD and could not be obtained from country-specific websites; therefore, Canada's pedestrian death rates, by age group, represent 4-year average rates, using 2018–2021 data.

Summary

What is already known about this topic?

U.S. road traffic crashes cause more than 40,000 deaths annually. Pedestrians are disproportionately affected.

What is added by this report?

During 2013–2022, U.S. traffic-related death rates increased a relative 50.0% for pedestrians and 22.5% overall, compared with those in 27 other high-income countries, where they declined a median of 24.7% and 19.4%, respectively. Across countries, U.S. pedestrian death rates were highest overall and among persons aged 15–24 and 25–64 years.

What are the implications for public health practice?

Pedestrian and overall road traffic deaths remain higher in the United States than in other high-income countries Increased adoption of evidence-based strategies to reduce these deaths, such as the Safe System approach which focuses on structural and policy changes, such as protected walkways and safe crossings, consistent street lighting, and speed management policies, might help reduce traffic deaths.

in this analysis, rather than an exposure-based measure (e.g., vehicle miles or kilometers traveled). Exposure-based data are not available for pedestrians across all countries. However, given sprawl and land use patterns have been associated with increasing U.S. road traffic death rates,[††††] population-based estimates provide a useful measure that does not adjust for potential contributors to the problem (e.g., sprawl). Second, rates are not age-adjusted, and country-specific population age distributions could influence rankings and comparisons. However, overall findings of disproportionate growth in the U.S. pedestrian death rate, compared with other countries, would not be impacted.

Implications For Public Health Practice

The U.S. pedestrian road traffic death rate has rapidly increased over the last several years, representing a contrast to decreasing trends in many other high-income countries. Whereas 2023 U.S. projections indicate a potential reduction in pedestrian deaths, increased and more widespread application of the Safe System approach could help accelerate and sustain progress. Public health practitioners play a critical role in Safe System implementation through use of health-related data sources and prevention frameworks to guide and prioritize strategy implementation, in building multidisciplinary coalitions to support widespread adoption of population-level road traffic injury prevention strategies, in co-designing interventions with partners and communities, and in rapidly evaluating interventions to guide progress. Numerous strategies exist to create preventive systemwide redundancies, consistent with a Safe System approach, to reduce pedestrian and overall road traffic deaths, including protected walkways and safe crossings, consistent street lighting, and speed management policies.

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Corresponding author: Rebecca B. Naumann, BNaumann@cdc.gov.

[1]Division of Injury Prevention, National Center for Injury Prevention and Control, CDC; [2]Division of Violence Prevention, National Center for Injury Prevention and Control, CDC.

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[††††] https://ajph.aphapublications.org/doi/full/10.2105/AJPH.93.9.1541

Notes from the Field

Neurosyphilis, Ocular Syphilis, and Otic Syphilis — Chicago, January–October 2023

Amy Nham, PharmD[1,2]; Taylor Holly, MPH[2]; John Flores, MD[2,3]; David Kern[2]; Irina Tabidze, MD[2]

The incidence of syphilis, a sexually transmitted infection caused by the bacterium *Treponema pallidum,* has been increasing in the United States since 2001.* Neurosyphilis, ocular syphilis, and otic syphilis (NOO syphilis), caused by *T. pallidum* invading the central nervous system, eyes, and ears, respectively, can occur in the primary, secondary, latent, or tertiary† stages of syphilis. NOO syphilis manifestations are often debilitating and can include meningitis, stroke, motor or sensory deficits, blindness, and hearing loss.

Data from the early to mid-2000s suggested that NOO syphilis was more commonly identified among gay, bisexual, and other men who have sex with men (MSM) and persons with HIV, likely reflecting the syphilis trends at the time these data were collected (*1*–*3*). Data collected from Chicago in 2019 showed that 11 of 16 NOO syphilis cases were diagnosed in MSM, and nine cases in persons with HIV. In 2023, health care providers in Chicago reported an increase in NOO syphilis among heterosexual persons without HIV. To assess whether this increase was consistent citywide, this analysis characterized NOO syphilis cases stratified by HIV status to identify factors associated with diagnosis in Chicago during January 1–October 31, 2023.

Investigation and Outcomes

Data Collection and Analyses

Surveillance data reported to the Chicago Department of Public Health (CDPH) were analyzed to describe NOO syphilis cases diagnosed in 2023. CDPH queried the Chicago Health Information Management System (CHIMS) to identify potential NOO syphilis cases based on 1) cerebrospinal fluid (CSF) test results indicative of neurosyphilis, including reactive CSF Venereal Disease Research Laboratory (VDRL), elevated CSF protein, and elevated CSF leukocyte count, 2) treatment with intravenous penicillin, or 3) any documented NOO syphilis sign or symptom in a Chicago resident during January 1–October 31, 2023. (*4*). CDPH abstracted clinical information from medical records to identify cases that met the 2018 Council of State and Territorial Epidemiologists' verified, likely, or possible case definitions for NOO syphilis (*4*). CDPH matched cases identified from CHIMS to the Enhanced HIV/AIDS Reporting System to obtain data on HIV status and treatment (*5*). Data from the National Electronic Telecommunications System for Surveillance were used to obtain 2019 case data for comparison, excluding COVID-19 pandemic years in which cases were likely underreported. This activity was reviewed by CDC, deemed not research, and was conducted consistent with applicable federal law and CDC policy.§

Outcomes

During January 1–October 31, 2023, a total of 2,611 cases of syphilis (all stages) were reported to CDPH; 689 (26.4%) were among persons with HIV, and 521 (20.0%) were among MSM. Among all 2,611 cases, 40 (1.5%) NOO syphilis cases were reported, including 14 in patients who had more than one type of NOO syphilis (Table). Overall, 28 (70.0%) neurosyphilis cases (19 verified, four likely, and five possible), 24 (60.0%) ocular syphilis cases (17 likely and seven possible), and two (5.0%) otic syphilis cases (both possible) were reported. Patients ranged in age from 23 to 82 years (median = 46.5 years), 29 (72.5%) were male, and 26 (65.0%) were non-Hispanic Black or African American persons. Twenty-seven (67.5%) cases occurred among persons who did not have HIV (compared with less than one half [seven of 16] in 2019), and among 33 patients whose sex and that of their sexual partners were documented, 18 (54.5%) were not MSM (compared with 26.7% [four of 15] in 2019).

Among 28 (70.0%) persons for whom signs or symptoms were reported, decreased vision (60.7%), rash (35.7%), and acute headache (32.1%) were the most commonly reported. Among 14 (35.0%) persons whose signs and symptoms were consistent with primary or secondary syphilis, eight had abnormal CSF tests. Signs and symptoms of NOO syphilis were similar in persons who did and did not have HIV.

Preliminary Conclusions and Actions

During January 1–October 31, 2023, NOO syphilis cases in Chicago were identified more frequently in persons who did not have HIV and who were not MSM compared with cases identified in 2019. Clinicians should consider NOO syphilis even in persons who do not have HIV and who are not MSM. Enhanced surveillance efforts to better understand NOO syphilis trends are needed.

* https://www.cdc.gov/sti-statistics/annual/index.html
† https://www.cdc.gov/syphilis/about/index.html
§ 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. Sect. 241(d); 5 U.S.C. Sect. 552a; 44 U.S.C. Sect. 3501 et seq.

Summary

What is already known about this topic?

High rates of syphilis and HIV coinfection occur among gay, bisexual, and other men who have sex with men (MSM). Neurosyphilis, ocular syphilis, and otic syphilis (NOO syphilis) can occur at any syphilis stage with or without HIV coinfection.

What is added by this report?

During January 1–October 31, 2023, 40 NOO syphilis cases were reported in Chicago, 67.5% of which occurred in persons without HIV infection compared with 43.8% in 2019. Among 33 (82.5%) NOO syphilis patients whose sex and that of their sexual partners were reported, 18 (54.5%) were not MSM compared with four of 15 patients (26.7%) in 2019.

What are the implications for public health practice?

Clinicians should consider NOO syphilis even in persons who do not have HIV and who are not MSM.

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Suzanne Beavers, Lisa Varella, CDC; Katherine Boss, Donna Peace, Kathleen Ritger, Eli Schulman, Divina B. Vargas, Michael Wasz, Chicago Department of Public Health; Syphilis Disease Intervention Specialists, Chicago Department of Public Health Syndemic Infectious Disease Bureau.

Corresponding author: Amy Nham, ovp8@cdc.gov.

[1]Epidemic Intelligence Service, CDC; [2]Chicago Department of Public Health, Chicago, Illinois; [3]University of Chicago Medicine, Chicago, Illinois.

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TABLE. Demographic and clinical presentation characteristics of persons with neurosyphilis, ocular syphilis, or otic syphilis, by HIV status* — Chicago, 2019 and January 1–October 31, 2023

	No. (column %)			
	2019[†]	January 1–October 31, 2023		
Characteristic	Total N = 16[†]	Total N = 40	Persons with HIV n = 13	Persons without HIV n = 27
Type of syphilis				
Neurosyphilis	—	**28 (70.0)**	—	—
Ocular syphilis	—	**24 (60.0)**	—	—
Otic syphilis	—	**2 (5.0)**	—	—
More than one type of NOO syphilis	—	**14 (35.0)**	—	—
Age group, yrs				
20–29	**6 (37.5)**	**8 (20.0)**	2 (15.4)	6 (22.2)
30–39	**6 (37.5)**	**7 (17.5)**	3 (23.1)	4 (14.8)
40–49	**3 (18.8)**	**6 (15.0)**	4 (30.8)	2 (7.4)
50–59	**1 (6.3)**	**8 (20.0)**	2 (15.4)	6 (22.2)
≥60	**0 (—)**	**11 (27.5)**	2 (15.4)	9 (33.3)
Median age, yrs (range)	**33 (21–52)**	**46.5 (23–82)**	43 (29–66)	52 (23–82)
Sex				
Female	**2 (12.5)**	**11 (27.5)**	0 (—)	11 (40.7)
Male	**14 (87.5)**	**29 (72.5)**	13 (100)	16 (59.3)
Race and ethnicity[§]				
Asian or Pacific Islander	**1 (6.3)**	**1 (2.5)**	1 (7.7)	0 (—)
Black or African American	**5 (31.3)**	**26 (65.0)**	9 (69.2)	17 (63.0)
White	**9 (56.3)**	**7 (17.5)**	1 (7.7)	6 (22.2)
Hispanic or Latino	**1 (6.3)**	**6 (15.0)**	2 (15.4)	4 (14.8)
MSM status				
MSM	**11 (68.8)**	**15 (37.5)**	10 (76.9)	5 (18.5)
Non-MSM	**4 (25.0)**	**18 (45.0)**	2 (15.4)	16 (59.3)
Unknown	**1 (6.3)**	**7 (17.5)**	1 (7.7)	6 (22.2)
HIV status				
Positive	**9 (56.3)**	**13 (32.5)**	13 (100)	0 (—)
Negative	**7 (43.8)**	**27 (67.5)**	0 (—)	27 (100)
Previous syphilis diagnosis				
Yes	—	**14 (35.0)**	6 (46.2)	8 (29.6)
No	—	**21 (52.5)**	6 (46.2)	15 (55.6)
Unknown	—	**5 (12.5)**	1 (7.7)	4 (14.8)
NOO syphilis treatment received				
Yes	—	**36 (90.0)**	11 (84.6)	25 (92.6)
No	—	**4 (10.0)**	2 (15.4)	2 (7.4)
Admitted to hospital				
Yes	—	**23 (57.5)**	9 (69.2)	14 (51.9)
No	—	**5 (12.5)**	0 (—)	5 (18.5)
Unknown	—	**12 (30.0)**	4 (30.8)	8 (29.6)

See table footnotes on the next page.

TABLE. (*Continued*) **Demographic and clinical presentation characteristics of persons with neurosyphilis, ocular syphilis, or otic syphilis, by HIV status* — Chicago, 2019 and January 1–October 31, 2023**

	No. (column %)			
	2019†	January 1–October 31, 2023		
Characteristic	Total N = 16†	Total N = 40	Persons with HIV n = 13	Persons without HIV n = 27
Sign or symptom¶				
Acute headache	—	**9 (22.5)**	5 (38.5)	4 (14.8)
Central nervous system deficits	—	**4 (10.0)**	3 (23.1)	1 (3.7)
Decreased vision	—	**17 (42.5)**	4 (30.8)	13 (48.1)
Fever	—	**3 (7.5)**	2 (15.4)	1 (3.7)
Gait difficulty	—	**8 (20.0)**	3 (23.1)	5 (18.5)
Hearing loss	—	**2 (5.0)**	0 (—)	2 (7.4)
Lymphadenopathy	—	**1 (2.5)**	1 (7.7)	0 (—)
Malaise	—	**3 (7.5)**	2 (15.4)	1 (3.7)
Meningismus	—	**1 (2.5)**	0 (—)	1 (3.7)
Optic neuritis	—	**3 (7.5)**	2 (15.4)	1 (3.7)
Photophobia	—	**6 (15.0)**	1 (7.7)	5 (18.5)
Rash	—	**10 (25.0)**	2 (15.4)	8 (29.6)
Retinitis	—	**6 (15.0)**	2 (15.4)	4 (14.8)
Sensory change	—	**5 (12.5)**	1 (7.7)	4 (14.8)
Ulcer or lesion	—	**6 (15.0)**	2 (15.4)	4 (14.8)
Uveitis	—	**7 (17.5)**	2 (15.4)	5 (18.5)
Weakness	—	**7 (17.5)**	4 (30.8)	3 (11.1)
Undetectable HIV viral load**				
Yes	—	**NA**	7 (53.8)	NA
No	—	**NA**	6 (46.2)	NA
CD4†† <200§§				
Yes	—	**NA**	4 (30.8)	NA
No	—	**NA**	9 (69.2)	NA
On HIV antiretroviral therapy¶¶				
Yes	—	**NA**	8 (61.5)	NA
No	—	**NA**	2 (15.4)	NA
Unknown	—	**NA**	3 (23.1)	NA

Source: Chicago Health Information Management System and Enhanced HIV/AIDS Reporting System.
Abbreviations: MSM = men who have sex with men; NA = not applicable; NOO = neuro-, ocular, and otic.
* As of November 6, 2023.
† Data not available for all variables in 2019.
§ Persons of Hispanic or Latino (Hispanic) origin might be of any race but are categorized as Hispanic; all racial groups are non-Hispanic.
¶ Signs and symptoms are not mutually exclusive.
** Most recent viral load test result in 2023 was <200 HIV RNA copies/mL.
†† CD4 is a class of helper T-lymphocytes.
§§ Most recent CD4 count in 2023 was <200 cells/μL.
¶¶ Documentation of HIV antiretroviral therapy in previous 12 months.

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