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Adenovirus-Associated Epidemic Keratoconjunctivitis Outbreaks — Four States, 2008–2010

Epidemic keratoconjunctivitis (EKC) is a highly contagious, severe form of conjunctivitis (*1*). During 2008–2010, six unrelated EKC outbreaks associated with human adenovirus (HAdV) in four states were reported to CDC. In total, 411 EKC cases were identified in Florida, Illinois, Minnesota, and New Jersey. In each outbreak, health-care–associated transmission appeared to occur via ophthalmologic examination; however, community transmission was also documented. These outbreaks resulted in significant morbidity and cost resulting from the number of persons affected, duration of the outbreaks, and the temporary closure of a neonatal intensive-care unit (NICU) and several clinics. Clusters of EKC infections should be reported to the appropriate state or local health department. In settings where ophthalmologic care is provided, routine adherence to basic infection control measures and early implementation of enhanced outbreak control measures are essential to prevent HAdV transmission.

Worldwide, EKC is one of the most common eye infections, occurring in various health-care settings and in the community. Typically, EKC outbreaks last weeks to months and are characterized by a combination of health-care–associated and community transmission. Outbreak investigation, if done, often occurs late in the outbreak. HAdVs, especially serotypes 8 (HAdV-8), 19 (HAdV-19), and 37 (HAdV-37), are common etiologic agents of EKC. Risk factors identified in past outbreaks of EKC include common ophthalmologic procedures such as tonometry, slit lamp examinations, and contact lens placement, as well as contact with infected clinicians (*1–3*). Symptoms usually appear within 14 days after exposure and commonly include a gritty feeling in the eyes, watery discharge, photophobia, and redness. Corneal involvement, including keratitis and subepithelial infiltrates, often develops in patients within days and can persist for months, affecting visual acuity. Clinical illness typically lasts 7–21 days and is usually self-limited. Transmission is predominately through contact with infected eye secretions via contaminated surfaces, instruments, eye drops, or hands. A person can be infectious a few days before developing symptoms to approximately 14 days after symptom onset. Diagnosis is primarily based on clinical findings. Laboratory tests to detect HAdV in conjunctival specimens, such as viral culture or polymerase chain reaction (PCR) assays, are not routinely used in clinics. Currently, no vaccines or antiviral drugs are available, and treatment is supportive.

Florida

In March 2009, the Florida Department of Health initiated an investigation after being informed of an EKC outbreak at an outpatient ophthalmology practice that consisted of two separate clinics that predominately served elderly patients (*4*). During November 2008–March 2009, 37 persons were clinically diagnosed with EKC, including the sole staff physician, who continued to work while symptomatic. Among those patients, 23 (62%) visited the ophthalmology practice within 17 days before onset of their symptoms. Eight (22%) patients developed keratitis requiring long-term topical steroid treatment. Conjunctival specimens collected for viral culture from four patients were all positive for HAdV-8. In March 2009, the practice was closed for 1 day for intensive cleaning. Additional

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interventions included discarding all reusable eye drop vials, reprocessing of tonometers, dedicating an examination room to conjunctivitis patients, cohorting patients in the waiting area, and disinfecting examination room surfaces after each patient visit (Table).

Illinois

In March 2009, two premature infants in a NICU were found through laboratory testing to have EKC caused by HAdV-19. Case finding identified an additional 10 NICU infants with EKC. All 12 patients had been examined by the ophthalmologic team for retinopathy of prematurity (ROP) within the previous 34 days. Reusable scleral depressors and ocular specula were used for ROP examinations and soaked in isopropyl alcohol between use. Further investigation revealed six additional persons with EKC among NICU staff members (n = 2), patient family members (n = 2), and the ophthalmologic team (n = 2), including an ophthalmology resident who continued to work while symptomatic. During the investigation, an ophthalmologic equipment cart used to transport clean and used equipment was disinfected and stored in a closet unused. Nine days after disinfection, HAdV-19 was detected by PCR in eight of nine specimens collected from the cart, three of which were also HAdV-positive by viral culture. The NICU was closed to new admissions for 23 days. Contact and droplet precautions (*5*) were instituted in the unit, restriction of sick staff members and visitors was reinforced, medical and ophthalmologic equipment was cleaned and disinfected, surveillance was instituted, and the ROP examination protocol was updated to mandate the use of disposable ROP equipment to protect against future outbreaks (Table).

Minnesota

In August 2008, the Minnesota Department of Health was contacted by local public health officials about a cluster of EKC patients in a rural setting. An investigation was initiated identifying 70 cases, including eight health-care staff members with EKC from three ophthalmology and optometry outpatient clinics. Symptom onset for these 70 cases occurred during June 28–September 25. Ten cases were laboratory confirmed for HAdV by viral culture or PCR, and three were typed and identified as HAdV-8. Among the infected patients, 33 had visited one of the three clinics within a median of 9 days (range: 3–21 days) before symptom onset. Many of the 70 patients with EKC developed significant morbidity (53% keratitis or corneal erosions, 41% membranous conjunctivitis, 40% decreased visual acuity) requiring additional and prolonged care. In August, all three affected clinics began implementing recommended infection control activities. Those included enhanced surveillance for additional cases, improved equipment reprocessing and environmental cleaning and disinfection, and cohorting of suspected conjunctivitis patients (Table).

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TABLE. Characteristics of six human adenovirus (HAdV)–associated epidemic keratoconjunctivitis (EKC) outbreaks — Florida, Illinois, Minnesota, and New Jersey, 2008–2010

Characteristic	Florida	Illinois	Minnesota	New Jersey
Year	2009	2009	2008	2009–2010
Health-care setting	Outpatient clinics (n = 2)	Neonatal intensive-care unit (n = 1)	Outpatient clinics (n = 3)	Outpatient clinics (n = 7)
No. of outbreaks	1	1	1	3
Total EKC cases	37	18	70	286
HAdV serotype identified	HAdV-8	HAdV-19	HAdV-8	HAdV-8, HAdV-3*
No. of facility-associated cases†	23	16	33	156
No. of health-care workers with EKC§	1	4	8	1
Infection control breach at facility¶	Yes	Yes	Yes	Yes
HAdV detected on medical equipment	Not tested	Yes	Not tested	Yes (in 1 of 3 outbreaks)
Control measures instituted**	Yes	Yes	Yes	Yes

* HAdV-3 was identified in one of the outbreaks, and HAdV-8 was identified in two of the outbreaks.
† Might represent a minimum case number.
§ Signs and symptoms consistent with EKC.
¶ Infection control breaches included poor hand hygiene and lack of cleaning and disinfection of shared medical equipment between patients.
** Control measures included extensive cleaning of the clinic and medical equipment, discarding reusable eye drop vials, replacing reusable eye drop vials with single-use eye drop vials, cohorting suspected conjuntivitis patients, improving hand hygiene techniques, instituting surveillance for EKC, and furloughing staff with suspected EKC.

New Jersey

During December 2009–July 2010, three separate EKC outbreaks involving approximately 300 persons were documented. For all three outbreaks, cases in patients who visited an ophthalmology clinic within 30 days before onset or who were linked to a clinic case were considered facility-associated. The largest outbreak was reported from an ophthalmologic practice (one main clinic and four satellite clinics) where 245 persons with EKC were identified; 55% of those cases were facility-associated. HAdV-8 was detected by PCR in conjunctival swabs from three of four persons tested. The second and third outbreaks were reported in smaller ophthalmologic practices. In the second outbreak, 17 persons with EKC were identified, including one staff optometrist; eight cases were facility associated. HAdV-3 was detected by PCR in the three conjunctival swabs collected. In the third outbreak, 24 persons with EKC were identified; 13 were facility associated, and HAdV-8 was detected by PCR in conjunctival swabs from the six persons tested. Environmental samples collected in the first and second outbreaks were negative. In the third outbreak, HAdV was detected by PCR in three (slit lamp chin rest, slit lamp grab bar, and tonometer tip disinfection container) of nine environmental samples collected 4 days after infection control measures were implemented with the aim of improving hand hygiene and disinfection of equipment and surfaces. Viral culture, to confirm virus viability, was not performed. Recommended interventions for all of the clinics involved in these outbreaks included 1) improved staff hand hygiene, 2) environmental surface disinfection performed after every patient visit, 3) use of smaller eye drop vials to limit administration to multiple patients, 4) a separate examination room for suspected EKC patients, and 5) triaging of EKC patients in the waiting area (Table).

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What is already known on this topic?

Human adenovirus (HAdV)–associated epidemic keratoconjunctivitis (EKC) is a highly contagious, severe form of conjunctivitis. Outbreaks of HAdV-associated EKC can result in significant morbidity through simultaneous health-care–associated and community transmission. HAdVs are viable for long periods in the environment and can be difficult to control.

What is added by this report?

During 2008–2010, six unrelated, HAdV-associated EKC outbreaks were reported to CDC. In total, 411 EKC cases were identified in four states. In each outbreak, health-care–associated transmission appeared to occur via ophthalmologic examination; however, community transmission was also documented. These outbreaks resulted in significant morbidity and cost because of the number of persons affected, duration of the outbreaks, and the temporary closure of health facilities.

What are the implications for public health practices?

In settings where ophthalmologic care is provided, increased awareness of EKC, routine adherence to basic infection control measures, and early implementation of enhanced outbreak control measures are essential to preventing HAdV transmission. Clusters of EKC infections should be reported to the appropriate state or local health department.

Editorial Note

EKC outbreaks are common worldwide. In the United States, the prevalence and incidence of EKC is unknown. Although HAdV-associated EKC is not a reportable condition, most states have general reporting requirements concerning potential outbreaks. Suspected EKC outbreaks should be reported promptly to local and state public health authorities. Delays in identification and reporting of an EKC outbreak or institution of infection control measures can impede timely investigation and prolong transmission (*6*).

Control of EKC outbreaks is made more difficult because of prolonged shedding of HAdV, which can last several days to weeks after symptom resolution, and because of HAdV resistance to desiccation. HAdV is resistant to many common disinfectants and can remain viable for long periods in the environment (*7–10*). HAdV has been detected in ophthalmic solutions and on instruments and other environmental surfaces for >1 week after exposure. In the Illinois outbreak, HAdV was detected and cultured from ophthalmologic equipment >1 week after disinfection. In one of the New Jersey outbreaks, HAdV was detected on high-touch surfaces 4 days after clinic disinfection.

Isopropyl alcohol should not be relied on for disinfection of ophthalmologic instruments that contact mucous membranes or normally sterile body sites; use of 70% isopropyl alcohol has been associated with previous outbreaks of HAdV (*3,10*). Instead, equipment manufacturer's instructions should be followed for disinfection or sterilization of all instruments. Facilities should use single-use disposable instruments whenever possible, especially in settings where adherence to recommended disinfection or sterilization practices cannot be ensured.

Many published health-care–associated EKC outbreaks have had simultaneous community transmission (*1–3*); however, prevention and control efforts have focused on health-care settings. Among the six outbreaks described in this report, five occurred in outpatient settings, health-care providers were likely sources of transmission in four, and infection control breaches were noted in all. Clinicians in all health-care settings are expected to follow basic infection control practices, including standard precautions (*5*). These expectations for outpatient settings are emphasized in a recent summary of CDC guidance.*

Outpatient clinics, hospitals, and other facilities that provide ophthalmologic care should have protocols in place to prevent transmission of EKC. Infection control measures used by the clinics before and after the outbreak varied. Measures that should be followed routinely include 1) strict adherence to hand hygiene among staff members, 2) use of disposable gloves for any potential contact with eye secretions, 3) disinfection of ophthalmic instruments after each use (or use of disposable equipment), 4) cohorting of suspected conjunctivitis patients (separate waiting room, sign-in area, and examination room), and 5) furloughing of staff members who have signs and symptoms consistent with EKC. Dedicating eye drop vials to single patients and increasing the frequency of environmental surface disinfection are strategies that should be used in outbreak situations and should be considered as routine practice to help prevent outbreaks.

* Guidance available at http://www.cdc.gov/hai/settings/outpatient/outpatient-care-guidelines.html.

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Human Rabies — South Carolina, 2011

On December 3, 2011, a South Carolina woman visited a local emergency department (ED) with an overnight history of shortness of breath, diaphoresis, chills, and intermittent paresthesia. The patient was transferred to a referral hospital, where she became comatose and developed multiorgan failure. The patient did not report a history of an animal bite. However, family members subsequently revealed that bats had been observed in the patient's home during the previous summer. Family members also reported that the patient had sought information on bat removal from a local county service, but was not advised of the risk for rabies associated with bat exposures and was not referred for public health consultation. CDC confirmed infection with a rabies virus variant associated with Mexican free-tailed bats (*Tadarida brasiliensis*) on December 14, after which the patient received hospice care. She died on December 19. This report summarizes the patient's clinical course and the associated public health investigation. This case highlights the importance of strong partnerships among public health officials and diverse non–health-care partners to ensure appropriate referral of persons exposed to bats in their homes for prompt and appropriate risk assessment, postexposure prophylaxis (PEP) recommendations, and information on safe, effective, and humane bat exclusion methods.

Case Report

On the morning of December 3, 2011, a woman aged 46 years visited a local ED with a 6-hour history of intermittent shortness of breath, diaphoresis, and chills. She also reported experiencing tingling sensations in both hands, which resolved before she sought care. Her medical history included severe heart disease with coronary artery bypass graft surgery in 2001. She reported no history of animal bite. On admission, she was alert and appropriately oriented; pulse was 94 beats per minute, blood pressure was 216/105 mmHg, and respirations were 20 breaths per minute. A complete blood count was unremarkable. Arterial blood gases showed a mild respiratory alkalosis, and serum chemistries generally were unremarkable. Imaging studies included normal computed tomography scans of the head and chest.

After 5-hours in the ED, the patient was transferred by ambulance to a large referral hospital for assessment by her cardiologist. Within 12 hours of transfer, she suffered respiratory arrest and was intubated. Her pupils became fixed and dilated during arrest. A lumbar puncture performed after resuscitation was unremarkable. The patient was transferred to the intensive-care unit. She remained intubated and sedated over the next several days and developed rhabdomyolysis, autonomic nervous system instability, and signs of multiorgan failure. Vasopressors were necessary to maintain adequate blood pressure, and hemodialysis was begun to manage acute renal failure.

Although there was no history of an animal bite, additional interviews with the family on December 8 revealed that the patient had observed bats in her home on several occasions the previous summer. Family members reported that the patient had awakened to a bat in her bedroom in August. She reportedly removed the bat by shaking it out of curtains through an open window and believed she had no direct contact with the bat. She did not seek medical attention at that time. She subsequently sought information on bat colony removal from a local county service. She was not provided with advice regarding potential rabies risks from bats occupying the home, nor was she referred to public health officials for consultation.

With this additional history, specimens were sent to CDC on December 12, 2011, for rabies virus diagnostic evaluation. Rabies virus antigens were detected in the nuchal skin biopsy by direct fluorescent antibody testing, and viral RNA was detected in both nuchal skin biopsy and saliva samples by reverse transcription–polymerase chain reaction. Sequence analysis of viral RNA was compatible with a rabies virus variant associated with Mexican free-tailed bats (*Tadarida brasiliensis*). Results were reported to the South Carolina Department of Health and Environmental Control (SCDHEC) and the referral hospital on December 14. After receiving a diagnosis of rabies, the patient received hospice care and died on December 19.

An autopsy revealed cerebral edema with uncal herniation, pulmonary edema, bronchopneumonia of the right lung, and hepatic congestion. Rabies virus antigen was detected by immunohistochemistry in multiple postmortem specimens, including brain, salivary glands, phrenic nerve, heart, liver, kidney, and adrenal gland.

Public Health Investigation

On December 14, 2011, SCDHEC staff members met with hospital infection control, employee health, and administrative staffs to discuss rabies virus exposure risk assessments for hospital employees having contact with the patient. SCDHEC staff assessed the patient's family, friends, coworkers, ED staff from the first hospital, and ambulance personnel who transferred the patient between hospitals. The referral hospital infection control staff performed risk assessments for their personnel. Rabies PEP was recommended to persons reporting possible transcutaneous or mucous membrane exposure to the patient's saliva, cerebrospinal fluid, or neural tissue, based

on Advisory Committee on Immunization Practices (ACIP) recommendations (*1*).

PEP was recommended for 22 (12%) of 188 potential contacts, including 18 health-care workers at the referral hospital and four family members. These family members had had potential exposures while caring for the patient in the hospital as well as during visits (some of them overnight) to the patient's home during the previous months. All persons recommended to receive PEP completed the vaccine series. However, one referral hospital employee completed the series 1 week later than the schedule outlined in ACIP guidelines (*1*).

Veterinary public health measures also were taken for two dogs that had two possible rabies virus exposures in the patient's home: 1) exposure to the patient's saliva before illness onset, during the period when she might have been shedding virus, and 2) exposure to bats in the home. Both dogs had documented current rabies vaccinations. Per the Compendium of Animal Rabies Prevention and Control, both dogs were given a booster dose of canine rabies vaccine and then observed for 45 days (*2*). Both dogs were found to be healthy at the end of this observation period and were released from quarantine.

The patient's home was assessed during late February 2012. Evidence of recent bat roosting was observed, including fecal material in attic and cabinet spaces adjacent to the patient's bedroom and staining on internal and external structures near the bedroom. Openings that would allow bat ingress and egress were noted along the posterior rafters. However, no bats were observed during the inspection. The patient's family reported that bats returned to roost in the attic during the spring of 2012. The family employed a private pest removal service to exclude the bats and seal access points. The home remained unoccupied during these remediation efforts.

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Editorial Note

This report describes the first human rabies death reported in South Carolina in more than 50 years. Human rabies has a protean clinical presentation that might be confused with other comorbidities, such as cardiac disease. Therefore, rabies should be considered for any progressive encephalitis of unknown etiology. Although human-to-human transmission has been well documented only in cases of organ or tissue transplantation, rabies virus transmission is considered possible through contamination of wounds or mucus membranes with saliva, tears, or neural tissue from infected patients (*1*). Use of appropriate protective equipment is vital for preventing health-care provider exposure to rabies virus when caring for patients with suspected or confirmed rabies (*3*). This includes use of face shields to protect mucous membranes and gloves or gowns to cover skin cuts when performing procedures, such as suctioning and spinal taps, which entail risk for exposure to infectious saliva or cerebrospinal fluid. Health-care providers should take standard precautions to prevent aerosol transmission during high-risk activities, such as intubation and suctioning (*4*).

Bat exposure in the home was the likely source of infection in this case. Over 90% of domestically acquired human rabies cases reported in United States since 1995 have been linked epidemiologically to bats (*5*). Cryptogenic human rabies (i.e., cases where a definitive history of animal exposure is lacking) constitutes an increasing proportion of these bat-associated cases (*6*). Rabies virus transmission can occur from

What is already known on this topic?

Since 1995, over 90% of domestically acquired human rabies cases in the United States have been linked epidemiologically to bats. So-called "cryptogenic" human rabies (i.e., illness in patients who lack a definitive history of animal exposure) constitutes an increasing proportion of these bat-associated cases.

What is added by this report?

In December 2011, a woman aged 46 years was the first resident of South Carolina to die from rabies in more than 50 years. She had been hospitalized because of shortness of breath, diaphoresis, chills, and intermittent paresthesia; rabies was not suspected until family members revealed that bats had been observed in the patient's home during the previous summer. CDC confirmed infection with a rabies virus variant associated with free-tailed bats. Of 188 family, social, and health-care contacts, 22 persons (12%) were recommended for and received postexposure prophylaxis.

What are the implications for public health practice?

Public health officials at the local, state, and national levels should work closely with non–health-care entities that receive public inquiries concerning wildlife to establish a standard referral process and regularly scheduled training about rabies risks. The diagnosis of rabies should be considered in patients hospitalized with progressive encephalopathy when other causes cannot be found or with a known history of animal exposure. This can lead to earlier adoption of staffing and infection control measures to decrease the number of health-care workers exposed to infectious body fluids or tissue for whom rabies postexposure prophylaxis might subsequently need to be provided.

seemingly minor or unrecognized bites. A complete rabies virus exposure risk assessment is recommended for any person reporting potential exposure to a bat, even in the absence of a documented bite (*1*).

The patient in this case sought information on bat removal but was not advised of the health risks associated with bat exposures. Lack of referral to guidance concerning health risks associated with bats living in the home was possibly a missed opportunity to prevent rabies infection. Because authority over wildlife management and animal bite reporting varies among states (*7*), citizens might reach out to diverse entities, including public health, animal control, law enforcement, or wildlife agencies, as initial points of contact for bat concerns. Provision of training, educational resources, and expert consultation to agencies, institutions, and organizations that provide assistance with wildlife concerns is a valuable public health service. Such service requires strong partnerships and clear communication among public health officials and diverse community partners.

Human rabies is preventable by avoiding contact with animal vectors and by receiving prompt and appropriate wound care and PEP after a suspected rabies virus exposure. Public health officials should work closely with non–health-care partners that receive public inquiries concerning wildlife to establish a standard referral process and regularly scheduled training about rabies risks. The public should also be educated about the risk for rabies from bat exposures, and options for the safe removal and exclusion of bats from human dwellings.

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Locations and Reasons for Initial Testing for Hepatitis C Infection — Chronic Hepatitis Cohort Study, United States, 2006–2010

Chronic hepatitis C virus (HCV) infection causes substantial morbidity and mortality in the United States (*1*). Testing and treatment of asymptomatic persons might avert progression to more advanced disease. In 1998, CDC published guidelines for HCV testing based on risk factors for infection; however, recent studies indicate that at least one half of all persons living with HCV infection in the United States are unaware of their infection status (*2–4*). To increase testing rates, in 2012 CDC recommended one-time testing of all persons born during 1945–1965 (*5*). To better understand where and why persons with chronic HCV infection sought their initial testing, 2006–2010 data were analyzed from a survey conducted as part of the ongoing Chronic Hepatitis Cohort Study (*6*). Of 4,689 patients with HCV infection who responded to the survey, 60.4% reported that their initial HCV test occurred in a physician's office. CDC's risk-based indications (e.g., injection drug use and hemodialysis) were cited by 1,045 (22.3%) of the patients as reasons for testing, whereas clinical indications (e.g., abnormal liver function tests or liver-related symptoms such as jaundice) were cited by 2,121 (45.2%), suggesting that many HCV infections were identified only after the patient had become symptomatic. Promoting U. S. Preventive Services Task Force (*7*) and CDC recommendations for testing (*5*) and identifying strategies that help physicians implement HCV testing in their offices might help facilitate timely identification of HCV infection and reduce morbidity and mortality.

The Chronic Hepatitis Cohort Study follows patients with confirmed chronic HCV or hepatitis B virus infection who receive care at four integrated health-care systems in the United States (*3,6*): Geisinger Health System, Danville, Pennsylvania; Henry Ford Health System, Detroit, Michigan; Kaiser Permanente Hawaii, Honolulu, Hawaii; and Northwest Permanente, Portland, Oregon. Of 12,529 patients aged ≥18 years who met the inclusion criteria for confirmed chronic HCV infection (*6*), 10,380 (82.8%) were sampled randomly for the current analysis. After excluding 1,451 patients who died and 828 who could not be contacted because of an invalid telephone number or address, incarceration, long-term care, or because of a physician's request that contact should not be made, the remaining 8,101 (64.7%) patients were surveyed by U.S. mail or telephone during 2011–2012. Up to eight telephone contact attempts were made; a small incentive was offered to encourage participation. The study protocol was reviewed and approved by an institutional review board approved by the federal Office for Human Research Protections at each participating site.

The survey was designed to collect data regarding the location and reasons for initial HCV testing. Participants were asked to choose from a list of reasons for HCV testing. Their responses were then grouped and analyzed in four categories: 1) CDC risk indications, according to the 1998 guidelines for testing (e.g., injection drug use and hemodialysis); 2) clinical indications (e.g., abnormal liver function tests or liver-related symptoms such as jaundice or abdominal pain); 3) institutional requirements (e.g., from blood banks, insurance or health maintenance organizations, prison, work/school, or the military); and 4) other miscellaneous reasons, including a doctor recommendation, "thought I was exposed," spouse's recommendation, foreign-born (from a country where hepatitis is endemic), and sexual contact with an HCV-infected person. Reasons for testing were not mutually exclusive; patients could choose more than one reason.

Of the 8,101 patients contacted, 4,689 (57.9%) completed the survey. Compared with nonrespondents, survey participants were slightly older (mean age: 57.4 years compared with 56.9 years, p=0.003), more likely to be white (72.8% compared with 61.4%, p<0.001), and more likely to be women (43.9% compared with 38.0%, p<0.001).

Of the 4,689 participants, 3,663 (78.1%) were born during 1945–1965; 87.4% had a high school diploma or its equivalent; 98.1% had insurance; 45.5% were employed; and 23.2% received disability payments (Table 1). Most respondents (60.4%) reported receiving the HCV test in a physician's office (Table 2). For those born during 1945–1965: 62.1% were tested in physicians' offices, 9.4% in blood banks or at blood drives, 7.4% in public health or specialty clinics, and 5.4% in inpatient settings (Table 2). For those born before 1945 or after 1965, a smaller proportion (54.3%) of tests occurred in physicians' offices, whereas testing in clinics (11.9%) and inpatient settings (7.5%) constituted larger proportions.

The 4,689 participants reported 7,649 reasons for their initial HCV test. Of the total, 3,473 responses (45.4%) were "miscellaneous reasons" not included in CDC's risk indications for testing (Table 3).

Among the 4,689 survey participants, clinical indications were reported by 2,121 (45.2%) as a reason for testing and CDC risk indications by 1,045 (22.3%). Among the 1,045 participants citing CDC risk indications, 986 (94.4%) reported injection drug use. Institutional requirements were reported by 781 (16.7%), and doctor-recommended testing was reported by 1,725 (36.8%) participants (Table 3).

TABLE 1. Characteristics of HCV-infected patients (N = 4,689) — Chronic Hepatitis Cohort Study, United States, 2006–2010

Characteristic	No.	(%)*
Birth year		
After 1965	587	(12.5)
1945–1965	3,663	(78.1)
Before 1945	439	(9.4)
Sex		
Men	2,628	(56.1)
Women	2,061	(43.9)
Race		
White	3,328	(72.8)
Black or African American	888	(19.4)
Asian	143	(3.1)
American Indian or Alaska Native	138	(3.0)
Native Hawaiian or Other Pacific Islander	76	(1.7)
Unknown	116	—
Hispanic ethnicity		
Yes	208	(4.6)
No	4,317	(95.4)
Unknown	164	—
Education		
Less than high school diploma	529	(12.6)
High school/General Equivalency Diploma	1,192	(28.5)
Some college/Technical school	1,507	(36.0)
College graduate or higher	961	(22.9)
Unknown	500	—
Health-care coverage		
Private	2,941	(66.0)
Medicare plus	812	(18.2)
Medicaid	459	(10.3)
Medicare only	161	(3.6)
None	86	(1.9)
Employment		
Part-time/Full-time	2,035	(45.5)
Disability	1,090	(23.2)
Retired	897	(20.1)
Unemployed	448	(9.6)
Unknown	219	—

Abbreviation: HCV = hepatitis C virus.
* Missing values were excluded from percentage distributions.

For the 3,663 participants born during 1945–1965, clinical indications were cited by 1,713 (46.8%) participants, with 781 (21.3%) reporting CDC risk indications as a reason for their initial HCV test. Among those born during 1945–1965, institutional requirements were reported as a reason by 638 (17.4%), and 1,319 (36.0%) reported doctor recommendations as a reason for testing (Table 3).

Reported by

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What is already known on this topic?

Since 1998, CDC has recommended testing for viral hepatitis C virus (HCV) infection among persons most likely to be infected. These recommendations have led to significant progress in identifying patients with HCV infection. However, a substantial percentage of patients with HCV infections have not been tested and remain unaware of their infection.

What is added by this report?

An analysis of 2006–2010 data from the Chronic Hepatitis Cohort Study indicated that a substantial proportion of HCV-infected patients were tested only after clinical indications that their infection had progressed and became symptomatic. Of the 4,689 patients with HCV infection who responded to the survey, 45.2% reported clinical indications as a reason for testing, with 78.1% born during 1945–1965, the birth cohort recommended by CDC for one-time HCV testing.

What are the implications for public health practice?

Promoting CDC's risk factor and birth cohort–based recommendations for HCV testing, along with implementing HCV testing in physicians' offices and other venues can allow timely identification of HCV infections and reduce HCV-related morbidity and mortality.

Editorial Note

The Chronic Hepatitis Cohort Study survey data analyzed in this report indicate that most initial HCV tests occurred in a physician's office, and nearly half of those infected with HCV only sought testing after experiencing clinical indications of liver disease. Testing for HCV infection in a location other than a physician's office occurred for about one third of respondents. Other locations included clinics, inpatient settings, and emergency departments. Other studies have shown a greater proportion (50.7%) of testing in locations other than a physician's office or laboratory (*8*). The results in this report suggest that, in addition to increasing testing in physicians' offices, other locations might be important for increasing the number of HCV-infected persons who are tested and referred to care.

Less than one fourth of HCV-infected patients gave CDC risk indications as a reason for testing, but many reported various other reasons (e.g., doctor recommendation, "thought I was exposed," and having many sex partners) that were not included in the 1998 CDC recommendations (*2*). Other reasons for testing (e.g., multiple sex partners) also have been reported (*8,9*). Responses in the study, such as "thought I was exposed" or doctor recommendation, suggest improved patient education could enhance patient's understanding of the risks for HCV infection.

This analysis indicates that approximately four out of five patients in this study of 2006–2010 data were born during 1945–1965, and therefore were within the birth cohort targeted in the 2012 CDC HCV testing guidelines (*5*). Only

21.3% of those born during 1945–1965 gave a reason for testing (injection drug use or hemodialysis) that was included in the earlier 1998 CDC risk indications.

CDC is identifying strategies to help health-care providers implement its new HCV testing guidelines, which target all persons born during 1945–1965. These strategies include simplification of HCV testing algorithms in primary care and public health settings, development of national educational strategies for testing those born during 1945–1965, and supporting evidence-based care models that enhance delivery of high-quality HCV assessment and management (*10*).

The findings in this report are subject to at least three limitations. First, patients surveyed from the four health sites were not from a nationally representative sample, so these results are not generalizable to the U.S. population of persons with HCV infection. Almost

TABLE 2. Locations for testing of HCV-infected patients — Chronic Hepatitis Cohort Study, United States, 2006–2010

	Year of birth							
	Total (N = 4,689)		Before 1945 (n = 439)		1945–1965 (n = 3,663)		After 1965 (n = 587)	
Location	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Physician office	**2,832**	**(60.4)**	276	(62.9)	2,275	(62.1)	281	(47.9)
Blood bank or blood drive	**424**	**(9.0)**	31	(7.0)	345	(9.4)	48	(8.2)
Clinic*	**393**	**(8.4)**	24	(5.5)	271	(7.4)	98	(16.7)
Hospital inpatient†	**275**	**(5.9)**	26	(5.9)	198	(5.4)	51	(8.7)
Insurance exam site	**141**	**(3.0)**	8	(1.8)	122	(3.3)	11	(1.9)
Emergency department	**141**	**(3.0)**	10	(2.3)	100	(2.7)	31	(5.3)
Prison	**71**	**(1.5)**	2	(0.5)	46	(1.3)	23	(3.9)
Army	**20**	**(0.4)**	2	(0.5)	18	(0.5)	0	(0)
Other	**99**	**(2.1)**	8	(1.8)	74	(2.0)	17	(2.9)
Unknown	**293**	**(6.3)**	52	(11.8)	214	(5.8)	27	(4.6)

Abbreviation: HCV = hepatitis C virus.
* Clinics included prenatal/family planning, sexually transmitted disease, infectious disease, tuberculosis, drug treatment, community, school/work, and unspecified clinics.
† Included obstetrics wards.

TABLE 3. Reported reasons for testing* among HCV-infected patients (N = 4,689), by year of birth — Chronic Hepatitis Cohort Study, United States, 2006–2010

	Year of birth							
	Total reasons (N = 7,649)		Before 1945 (n = 645)		1945–1965 (n = 5,926)		After 1965 (n = 1,078)	
Category of reasons	No.	(%)	No.	(%)	No.	(%)	No.	(%)
CDC risk indications	**1,045**	**(13.7)**	39	(6.0)	781	(13.2)	225	(20.9)
Injection drug use	**986**	**(94.4)**	31	(79.5)	736	(94.2)	219	(97.3)
Hemodialysis	**59**	**(5.6)**	8	(20.5)	45	(5.8)	6	(2.7)
Clinical indications	**2,121**	**(27.7)**	219	(34.0)	1,713	(28.9)	189	(17.5)
Abnormal liver function test	**1,497**	**(70.6)**	158	(72.1)	1,212	(70.8)	127	(67.2)
Liver symptoms†	**624**	**(29.4)**	61	(27.9)	501	(29.2)	62	(32.8)
Institutional requirement	**781**	**(10.2)**	57	(8.8)	638	(10.8)	86	(8.0)
Blood donor	**506**	**(64.8)**	38	(66.7)	410	(64.3)	58	(67.4)
Insurance/HMO	**145**	**(18.6)**	9	(15.8)	126	(19.7)	10	(11.6)
Prison	**80**	**(10.2)**	6	(10.5)	57	(8.9)	17	(19.8)
Work/School	**39**	**(5.0)**	2	(3.5)	36	(5.6)	1	(1.2)
Military	**11**	**(1.4)**	2	(3.5)	9	(1.4)	0	—
Miscellaneous	**3,473**	**(45.4)**	294	(45.6)	2,618	(44.2)	561	(52.0)
Doctor recommendation	**1,725**	**(49.7)**	205	(69.7)	1,319	(50.4)	201	(35.8)
"Thought I was exposed"	**639**	**(18.4)**	28	(9.5)	458	(17.5)	153	(27.3)
Sexual contact with HCV	**338**	**(9.7)**	16	(5.4)	243	(9.3)	79	(14.1)
Many sex partners	**228**	**(6.6)**	8	(2.7)	177	(6.8)	43	(7.7)
Household contact with HCV	**200**	**(5.8)**	10	(3.4)	154	(5.9)	36	(6.4)
Spouse recommendation	**76**	**(2.2)**	8	(2.7)	58	(2.2)	10	(1.8)
MSM	**46**	**(1.3)**	0	(0)	31	(1.2)	15	(2.7)
Born in country with endemic HCV	**32**	**(0.9)**	6	(2.0)	22	(0.8)	4	(0.7)
Other	**189**	**(5.4)**	13	(4.4)	156	(6.0)	20	(3.6)
Unknown	**229**	**(3.0)**	36	(5.6)	176	(3.0)	17	(1.6)

Abbreviations: HCV = hepatitis C virus; MSM = men who have sex with men; HMO = health maintenance organization.
* Categories were not mutually exclusive; more than one response was allowed per patient.
† Liver-related symptoms included but were not limited to 1) jaundice/yellowing of the eyes and skin and 2) abdominal pain.

all patients were covered by some form of health insurance, and risk-based behaviors (e.g., injection drug use) were less common in this group than has been observed in surveillance-based studies (*9*). Second, only 57.9% of persons contacted completed the survey, which might have resulted in response bias. Finally, the long interval between initial testing and time of interview and the potential for inconsistency between self-reported reasons for testing and a health-care provider's rationale for testing might have resulted in recall bias.

This survey of patients with HCV infection enrolled in the Chronic Hepatitis Cohort Study indicates that nearly four out of five participants were born during 1945–1965, a cohort for whom CDC recommends HCV testing in its 2012 guidelines (*5*). Because a substantial proportion of HCV infections were identified after testing for clinical indications and few patients reported the 1998 CDC risk indications as a reason for initial testing, these data further support the CDC recommendation for testing all persons in the birth cohort of 1945–1965 in addition to risk-based testing. Physicians' offices and other locations might be important venues for implementing these guidelines to increase HCV testing.

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Notes from the Field

Repeat Syphilis Infection and HIV Coinfection Among Men Who Have Sex With Men — Baltimore, Maryland, 2010–2011

Syphilis diagnoses in the United States have increased substantially over the past decade, and most cases occurred among men who have sex with men (MSM). Nationally, rates of primary and secondary (P&S) syphilis reported among men increased, from 3.0 cases per 100,000 population in 2001 to 8.2 in 2011 (*1*). In 2011, approximately 72% of P&S syphilis cases occurred among MSM* (*1*), among whom new diagnoses of human immunodeficiency virus (HIV) infection have increased in recent years (*2*). Infection with syphilis increases the likelihood of acquiring and transmitting HIV; moreover, the occurrence of syphilis in an HIV-infected person is an indication of behavior that might increase the likelihood of HIV transmission (*3*). The population of Baltimore, Maryland, is particularly affected by syphilis and HIV. In 2011, the Baltimore metropolitan statistical area (MSA) had the second highest rate of reported cases of P&S syphilis (11.4 per 100,000 population) (*1*) and the sixth highest estimated rate of diagnoses of HIV infection (33.8 per 100,000 population) (*2*) compared with other MSAs in the United States. Local public health officials have noted a subpopulation of MSM diagnosed with repeat syphilis infection; they believe that this subpopulation might bear a disproportionate burden of both syphilis and HIV infection and that intensifying syphilis and HIV prevention efforts among this subpopulation might reduce syphilis and HIV transmission overall in the Baltimore area.

The Maryland Department of Health and Mental Hygiene requested assistance from CDC to describe this subpopulation and identify characteristics that could be used to improve the selection and delivery of syphilis and HIV prevention interventions. CDC, the Maryland Department of Health and Mental Hygiene, the Baltimore City Health Department, and the Baltimore County Department of Health and Human Services analyzed data from sexually transmitted disease and HIV surveillance and from interviews conducted by health department staff members for the purpose of contact tracing during 2007–2011. MSM (as determined by risk behaviors reported in surveillance and interview records) aged ≥15 years who resided in Baltimore city or Baltimore County and were diagnosed with repeat syphilis infection were included in this analysis. Persons were considered to have repeat syphilis infection if they were reported to have early (primary, secondary, or early latent) syphilis diagnosed in 2010 or 2011 and had received treatment for a previous syphilis diagnosis during 2007–2011, as documented in electronic sexually transmitted disease surveillance records.

In all, 493 early syphilis cases in 2010 and 2011 were reported among 460 MSM; the number of diagnoses increased 29%, from 215 in 2010 to 278 in 2011. Of these 460 MSM, 92 (20%) were determined to have repeat syphilis infection; 77 of these 92 MSM (84%) had two syphilis diagnoses during 2007–2011, and 15 MSM (16%) had three or more syphilis diagnoses during that period. Median time between the two most recent syphilis diagnoses was approximately 18 months; 26% occurred ≤12 months apart. For the most recent syphilis diagnoses, only 5% were primary syphilis, whereas 41% were secondary syphilis, and 53% were early latent syphilis. Median age was 30.5 years (range: 19–62 years), 83 patients (90%) were black, and 85 (92%) resided in Baltimore city. Seventy-nine (86%) were diagnosed with HIV before or at the time of their most recent syphilis diagnosis.

Syphilis case reports among MSM increased in Baltimore from 2010 to 2011, and one in five MSM with syphilis had repeat infection. A substantial proportion of repeat syphilis infections occurred ≤12 months apart. Also, very few men were diagnosed with primary syphilis, suggesting possible missed opportunities for early diagnosis and longer periods of infectiousness. The majority of MSM in Baltimore with repeat syphilis infection are living with HIV. Because repeat syphilis infection can be an indicator of continued engagement in behaviors associated with acquisition and transmission of HIV and other sexually transmitted diseases, MSM with repeat syphilis should be prioritized for comprehensive prevention services, including risk reduction counseling, increased access to condoms, and increased frequency of syphilis testing (every 3–6 months), with active outreach for missed testing appointments. Testing, educational, and outreach interventions targeted to preventing future syphilis and HIV infections among MSM with repeat syphilis infection might mitigate the spread of syphilis and HIV among MSM overall in Baltimore.

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*Among cases in the 47 jurisdictions that reported the sex of sex partners.

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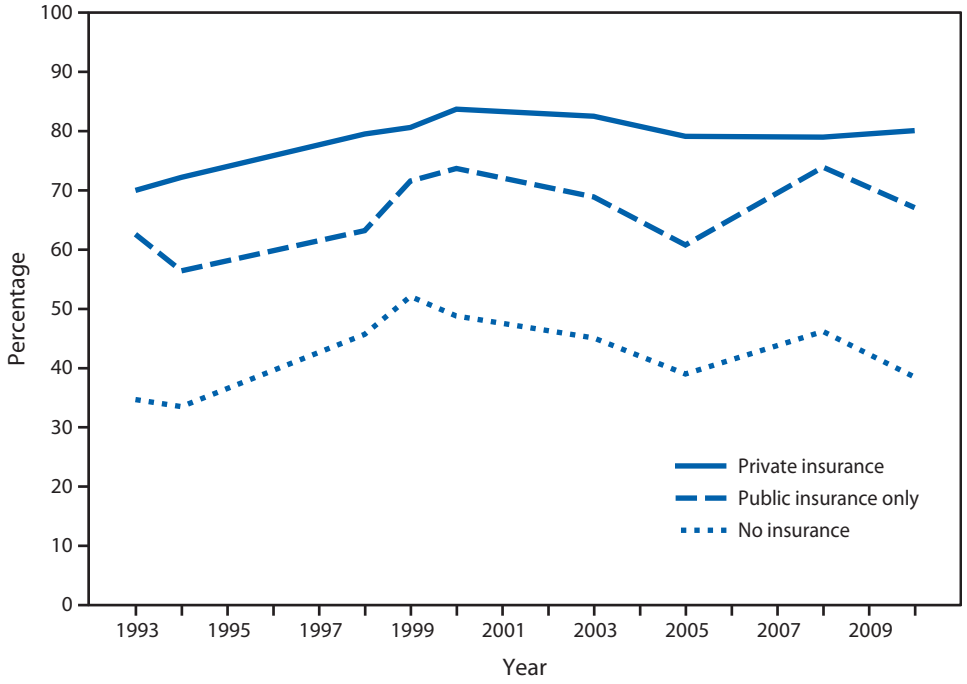
QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Women Aged 50–64 Years Who Reported Receiving a Mammogram in the Past 2 Years, by Health Insurance Status*† — National Health Interview Survey,§ United States, 1993–2010



* Questions concerning mammogram use have differed slightly over the years. Since 2000, respondents were asked for the date of their most recent mammogram; included are women who reported having had a mammogram in the past 2 years. Questions were administered as part of a cancer control supplement conducted in 1993, 1994, 1998, 1999, 2000, 2003, 2005, 2008, and 2010.

† Health insurance status is coverage at the time of interview. Public insurance includes Medicaid, Medicare, Children's Health Insurance Program, military, and other public assistance and government programs. Those with only Indian Health Service coverage are classified as uninsured. Because most women aged ≥65 years are covered by public insurance (Medicare), this figure presents data only for women aged 50–64 years.

§ Data are based on household interviews of a sample of the noninstitutionalized U.S. civilian population.

During 1993–2010, among women aged 50–64 years, insured women were more likely than uninsured women to report having a mammogram in the past 2 years. The percentage of privately insured women reporting a mammogram in the past 2 years rose from 70.0% in 1993 to 83.7% in 2000 and did not change significantly after 2000. Mammogram use among publicly insured and uninsured women aged 50–64 years varied during the period but was at approximately the same level in 1993 and 2010, and generally was lower than mammogram use among privately insured women. In 2010, 80.1% of women with private insurance, 67.1% of publicly insured women, and 38.5% of uninsured women aged 50–64 years had a mammogram in the past 2 years.

Source: National Health Interview Survey data. Available at http://www.cdc.gov/nchs/nhis/nhis_questionnaires.htm.

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