

# Nonhospital Health Care–Associated Hepatitis B and C Virus Transmission: United States, 1998–2008

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In the United States, transmission of hepatitis B virus (HBV) and hepatitis C virus (HCV) from health care exposures has been considered uncommon. However, a review of outbreak information revealed 33 outbreaks in nonhospital health care settings in the past decade: 12 in outpatient clinics, 6 in hemodialysis centers, and 15 in long-term care facilities, resulting in 448 persons acquiring HBV or HCV infection. In each setting, the putative mechanism of infection was patient-to-patient transmission through failure of health care personnel to adhere to fundamental principles of infection control and aseptic technique (for example, reuse of syringes or lancing devices).

Difficult to detect and investigate, these recognized outbreaks indicate a wider and growing problem as health care is increasingly provided in outpatient settings in which infection control training and oversight may be inadequate. A comprehensive approach involving better viral hepatitis surveillance and case investigation, health care provider education and training, professional oversight, licensing, and public awareness is needed to ensure that patients are always afforded basic levels of protection against viral hepatitis transmission.

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In the United States, transmission of hepatitis B virus (HBV) and hepatitis C virus (HCV) from health care exposures has been considered uncommon (1–3). However, recent reports of outbreaks of HBV or HCV infections, primarily in settings outside of acute care hospitals, indicate a growing problem. For example, a recent HCV infection outbreak in an endoscopy clinic in Nevada resulted in public health officials notifying more than 40 000 persons that they needed screening for bloodborne infections (4).

Changes in the delivery of health care and increasing outpatient visits and long-term care occupancy have resulted in more patients receiving health care in nonhospital settings (5–7). In these settings, infection control resources and oversight have traditionally been lacking (2, 5). Investigations of viral hepatitis outbreaks in outpatient clinics, long-term care facilities, and hemodialysis centers have revealed fundamental errors that decrease confidence that basic safe-care practices are reliably maintained. Moreover, each state and local health jurisdiction has variable ability to detect, investigate, and prevent such viral hepatitis outbreaks through surveillance and regulatory oversight of nonhospital settings.

We review nonhospital health care–associated viral hepatitis outbreaks that have occurred over the past decade, to assess the contribution of health care exposures and characterize practices associated with HBV and HCV transmission in the United States. The number and size of these outbreaks and the morbidity and personal and monetary costs associated with them have been considerable, indicating that public health and other interventions are essential.

## METHODS

We reviewed all records and reports at the Centers for Disease Control and Prevention (CDC) of outbreaks of HBV and HCV infection in nonhospital health care set-

tings that occurred in the past 10 years, from June 1998 to June 2008. Published articles, internal and external unpublished reports of outbreak investigations, and communications with state and local health officials were examined. We also searched PubMed for published literature on investigations in which the CDC was not an investigative or consultative partner, but none were found.

For the purposes of this review, we only counted outbreaks of HBV and HCV infection that involved 2 or more infected persons and that could be epidemiologically linked to a specific health care facility. Patients were categorized as having health care–associated infection on the basis of evidence that included epidemiologic findings, temporal associations between patients and procedures, documented seroconversion, signs and symptoms of acute viral hepatitis, and absence of traditional risk factors for HBV or HCV infection.

To corroborate the epidemiologic findings of person-to-person transmission, many of the investigations assessed the relatedness of specimens from potential source patients and newly infected patients; laboratory analyses included sequencing of the NS5b or hypervariable region 1 of the HCV genome or the hepatitis B surface antigen gene region of the HBV genome.

In general, persons were considered potentially at risk for infection if they had received health care at the implicated facility when transmission was known to have occurred or when the infection control lapse considered responsible for transmission was present. Typically, these

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**Key Summary Points**

This review identified 33 outbreaks of hepatitis B or C virus infection in nonhospital health care settings in the United States during the past 10 years. This probably underrepresents the true burden of health care–associated viral hepatitis infections.

The trend in health care–associated viral hepatitis outbreak activity parallels the migration of care from acute-care hospitals to nonhospital health care settings.

These outbreaks are preventable, and health care should provide no opportunity for the transmission of bloodborne pathogens.

Standard Precautions includes injection safety and protocols for the use of shared equipment. They apply in all settings that provide health care and represent the foundation of basic safe-care practices.

A comprehensive preventive approach is needed, including augmented viral hepatitis surveillance, health care provider education, training in the appropriate practices and techniques, improved oversight, and more uniform regulation.

persons were notified of their risk and recommended to undergo screening. The persons screened included those potentially at risk for whom the investigating health department was aware of the screening test results.

**RESULTS**

We identified 33 outbreaks of hepatitis B or C virus that were epidemiologically linked to lapses in infection control practices in nonhospital health care facilities (Table) (8–21). Eighteen outbreaks resulting in 173 persons with incident HBV infection and 16 outbreaks resulting in 275 persons with incident HCV infection were identified (1 involved both HBV and HCV infection). No persons with health care–associated HIV infection were identified. During these outbreaks, more than 60 000 persons were estimated to have been at risk for bloodborne infections during the course of their health care.

Twelve outbreaks in 7 states occurred in outpatient settings; these resulted in the identification of 235 incident HCV infections and 76 incident HBV infections. Approximately 16 000 persons had the recommended screening for HBV, HCV, and HIV. Of note, the 3 outbreaks that resulted in the largest number of persons at risk and that required extensive patient notification and screening of potentially infected patients occurred in the past 3 years (Table) (4, 16; New York State Department of Health. Unpublished data.).

Six hemodialysis centers that served ambulatory pa-

tients requiring long-term hemodialysis in 6 states accounted for 40 incident HCV infections. Nearly 500 patients receiving dialysis were potentially exposed and screened for infection.

Fifteen long-term care facilities (nursing homes or assisted living) in 9 states accounted for outbreaks in which 97 residents were identified as having acquired incident HBV infection. Six (6%) of those residents were known to have died of their HBV infection (20, 21). Approximately 1700 residents were considered potentially at risk, and more than 900 residents, primarily those who had regular blood glucose monitoring, were screened for HBV and other bloodborne viruses.

In 7 of the 16 HCV outbreaks described here, person-to-person transmission was confirmed by demonstrating genetic relatedness among viral isolates from HCV-infected patients through analysis of the NS5b and hypervariable region 1 segments of the HCV genome. In 2 outbreak investigations (10, 13), infection with a HCV subgenotype (2a and 3a) uncommon in the United States (22, 23) helped to establish person-to-person transmission. In 5 of the 16 HBV infection outbreaks, gene sequencing of 600–to 1500–base pair segments of the HBV genome was performed.

In the outbreaks involving the outpatient clinics and several hemodialysis centers, the purported mechanism of patient-to-patient transmission was primarily syringe reuse or other infection control lapses that resulted in contamination of injectable medications or flush solutions. In several outbreaks, single-use medication vials (for example, propofol) and bags of saline solution were inappropriately used for multiple patients. Anesthesia delivery was a common factor in 6 outbreaks. In the long-term care facilities, all 15 outbreaks involved patient-to-patient transmission of HBV, primarily through reuse of fingerstick devices meant for individual use on multiple persons (10 outbreaks) and through other shared equipment, such as blood glucose monitors (3 outbreaks).

**DISCUSSION**

We found that many outbreaks of HBV and HCV infections related to the receipt of health care in nonhospital settings have occurred in the United States over the past decade. Breaches of fundamental principles of infection control by health care personnel were responsible for patient-to-patient transmission in all of the outbreaks described. More than 400 persons were infected with either HBV or HCV, and many thousands more were placed at risk for infection unnecessarily. The true number of patients who became infected in these outbreaks was probably underestimated because test results and epidemiologic information were not always available to categorize patients as having health care–associated infections. All of these transmission events could have been prevented through adherence to basic infection control practices (Standard

**Table. Documented Outbreaks of HBV or HCV Transmission in Nonhospital Health Care Settings, United States, 1998–2008**

State	Setting	Year Reported	Type of Hepatitis Virus Infection	Persons Potentially at Risk, <i>n</i>	Persons Screened, <i>n</i>	Persons With Incident Infection, <i>n</i>	Lapse Considered Responsible for Transmission	Reference or Source
<b>Outpatient</b>								
NY	Private physician office	2001	HCV	2192	1315	19	Syringe reuse and contamination of anesthesia medication vials used for multiple patients	8
NY	Private physician office	2001	HBV	1042	222	38	Mishandling of injection equipment; preparation of atropine, dexamethasone, and vitamin B <sub>12</sub> injections in a contaminated environment	8, 9
OK	Pain remediation clinic	2002	HBV and HCV	908	795	31 and 71	Reuse of syringes on multiple patients to deliver midazolam, fentanyl, and propofol through a heparin lock	8, 10
NE	Hematology and oncology clinic	2002	HCV	613	494	99	Reuse of syringes, resulting in contamination of shared saline bags used for multiple patients	8, 11
NY	Endoscopy clinic	2002	HCV	84	78	4	Contamination of anesthesia medication vials used for multiple patients	12
CA	Pain remediation clinic	2003	HCV	52	35	4	Failure to store and prepare medications under aseptic conditions; contamination of lidocaine vials used for multiple patients	13
MD	Nuclear imaging (3 facilities)	2004	HCV	88	75	16	Reuse of syringes used to dilute radiopharmaceuticals, resulting in contamination of technetium-99m sestamibi vial used for multiple patients	14
FL	Chelation therapy	2005	HBV	253	106	7	Mishandling of medication vials and preparation of intravenous infusions in a contaminated environment; poor hand hygiene and glove use	15
CA	Alternative medicine clinic	2005	HCV	15	15	7	Reuse of syringes, resulting in contamination of a shared saline bag used for multiple patients	California State Department of Health Services, unpublished data
NY	Multiple endoscopy and ambulatory surgery clinics	2006	HCV	4490	841	6	Reuse of syringes, resulting in contamination of propofol vials used for multiple patients	16
NY	Anesthesiologist office	2007	HCV	9000	98	3	Reuse of syringes, resulting in contamination of anesthesia medication vials used for multiple patients	New York State Department of Health, unpublished data
NV	Endoscopy clinic	2008	HCV	40 000	>12 000	6*	Reuse of syringes, resulting in contamination of single-dose propofol vials used for multiple patients	4
<b>Hemodialysis</b>								
MD	Hemodialysis center	1998	HCV	51	51	7	Preparation of injections in a contaminated environment; failure to clean environmental surfaces between patients	17
OH	Hemodialysis center	2000	HCV	95	95	5	Preparation of injections in a contaminated environment; failure to clean environmental surfaces between patients; use of mobile cart to transport clean and used supplies among multiple patients	17
WI	Hemodialysis center	2000	HCV	24	24	3	Use of mobile cart to transport clean and used supplies among multiple patients	17

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Table—Continued

State	Setting	Year Reported	Type of Hepatitis Virus Infection	Persons Potentially at Risk, <i>n</i>	Persons Screened, <i>n</i>	Persons With Incident Infection, <i>n</i>	Lapse Considered Responsible for Transmission	Reference or Source
IL	Hemodialysis center	2001	HCV	75	73	11	Preparation of injections in contaminated environment; failure to separate clean and contaminated areas; failure to change gloves and perform hand hygiene after handling contaminated dialysis equipment	Illinois Department of Public Health, unpublished data
NY	Hemodialysis center	2006	HCV	183	183	7	Use of mobile cart to deliver injectable medications to multiple patients; reuse of single-dose epoetin alfa vials on multiple patients; failure to clean dialysis equipment between patients	New York State Department of Health, unpublished data
VA	Hemodialysis center	2006	HCV	64	64	7	Use of mobile cart to deliver injectable medications to multiple patients; reuse of single-dose epoetin alfa vials on multiple patients; failure to clean environmental surfaces between patients	17
<b>Long-term care</b>								
CA	Nursing home	1999	HBV	59	38	4†	Reuse of disposable end-caps on fingerstick device shared by multiple diabetic patients	Los Angeles County Health Department, unpublished data
CA	Nursing home	1999	HBV	269	55‡	5	Shared use of fingerstick devices, and shared use of glucometers without cleaning among multiple diabetic residents	18
TX	Nursing home	2001	HBV	110	110	5	Shared use of fingerstick device among diabetic residents	Harris County Public Health and Environmental Services, unpublished data
CA	Nursing home	2002	HBV	38	24‡	3§	Shared use of glucometers without cleaning among multiple diabetic residents	California State Department of Health Services, unpublished data
CA	Nursing home	2002	HBV	145	46	3	Shared use of glucometers without cleaning among multiple diabetic residents	San Joaquin County Health Department, unpublished data
NC	Nursing home	2003	HBV	192	192	11	Shared use of glucometers without cleaning among multiple diabetic residents	19
MS	Nursing home	2003	HBV	160	160	15†	Shared use of fingerstick devices, and shared use of glucometers without cleaning among diabetic residents; possible contamination of insulin vials	19
CA	Assisted-living facility	2004	HBV	22	22	8	Shared use of fingerstick devices, and shared use of glucometers among diabetic residents, failure to wear gloves or perform hand hygiene	19
VA	Assisted-living facility	2005	HBV	84	39‡	7	Shared use of fingerstick devices, and shared use of glucometers without cleaning among diabetic residents	20
VA	Assisted-living facility	2005	HBV	120	29‡	4§	Shared use of fingerstick devices, and shared use of glucometers without cleaning among diabetic residents	20
NY	Assisted-living facility	2007	HBV	120	44‡	7	Shared use of fingerstick device among diabetic residents	21

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Table—Continued

State	Setting	Year Reported	Type of Hepatitis Virus Infection	Persons Potentially at Risk, <i>n</i>	Persons Screened, <i>n</i>	Persons With Incident Infection, <i>n</i>	Lapse Considered Responsible for Transmission	Reference or Source
IL	Assisted-living facility	2007	HBV	120	108	7	Shared use of glucometers without cleaning among diabetic residents	Illinois Department of Public Health, unpublished data
FL	Assisted-living facility	2007	HBV	6	6	2	Common storage of used and unused blood glucose monitoring equipment (fingerstick devices, glucometers)	Florida Department of Health, unpublished data
IL	Assisted-living facility	2008	HBV	105	21 <sup>†</sup>	7	Failure to use gloves and perform hand hygiene between fingerstick procedures on diabetic residents	Illinois Department of Public Health, unpublished data
PA	Assisted-living facility	2008	HBV	151	25 <sup>‡</sup>	9	Shared use of fingerstick devices, and shared use of glucometers without cleaning among diabetic residents	Pennsylvania Department of Public Health, unpublished data

HBV = hepatitis B virus; HCV = hepatitis C virus.

\* Investigation in progress.

† Two deaths associated with acute HBV infection.

‡ Screening primarily restricted to diabetic residents and persons undergoing blood glucose monitoring.

§ One death associated with acute HBV infection.

Precautions), which are applicable to all health care settings (24).

The viral hepatitis outbreaks reviewed here are only those that were investigated by CDC or state and local health officials and met our inclusion criteria. Because most persons with incident HCV and HBV infections are asymptomatic, many outbreaks go undetected or uninvestigated. Even when symptomatic persons are identified, many health departments do not have the resources to thoroughly investigate all individuals identified to have HBV or HCV infection. Financial, legal, and personnel resource barriers to investigation of a facility can be considerable. In 2006, national viral hepatitis surveillance data revealed that 50% of patients with acute HBV and HCV infection were reported without accompanying risk factor data (3). Among patients for whom risk factor data were reported, 56% with acute HBV infection and 32% with acute HCV infection could not specify a known risk factor for their infection (such as injection drug use, sexual or household contact with another infected person, occupational exposure to blood, or needlestick injury [3]). Viral hepatitis surveillance reports from health departments may contain HBV and HCV infections that were unknowingly acquired in health care settings. These points underscore the inadequacy of current surveillance for viral hepatitis in the United States to detect health care–related HBV or HCV infections. Thus, our report should be considered description of the “tip of the iceberg.”

In hospital settings, comparatively few outbreaks of viral hepatitis—7 in the past decade—were identified that met our inclusion criteria (2, 25–27; CDC. Unpublished data), resulting in 48 persons acquiring HBV or HCV infection. Two outbreaks were attributed to the receipt of infected donor or-

gans or tissues (26; CDC. Unpublished data). Another 2 were associated with provider-to-patient transmission (2, 27); this method of transmission was not identified in nonhospital settings during the period of our review.

Recommendations for infection prevention and control in hospital settings are well established and updated on a regular basis (28, 29), and infection control personnel are employed to conduct surveillance, monitor practices, and provide education and training on appropriate infection control practices. In contrast, specific infection control resources and oversight have traditionally been lacking in nonhospital settings (2, 5, 30–32). Changes in the delivery of health care in the United States have led to ever more patient encounters occurring in nonhospital settings, in which increasingly complex medical care and invasive procedures are being performed (5, 6, 33). Without better adherence to Standard Precautions and aseptic technique, the number of persons who become infected or are placed at risk for bloodborne infections in these settings may continue to increase.

Many of these outbreaks were directly attributable to unsafe injections, caused by failure to practice aseptic technique when preparing and administering parenteral medications. The term *aseptic technique*, in the context of injection safety, refers to handling, preparation, and storage of medications and injection equipment to prevent microbial contamination and applies to the handling of all supplies used for injections and infusions, including medication vials, syringes, needles, and intravenous tubing. These viral hepatitis outbreaks suggest that greater emphasis on aseptic technique in injection safety is needed. Recommendations for safe injection practices are part of Standard Precautions (24) and should be explicit in all health care facility policies

and practice manuals. To help ensure that health care personnel adhere to safe injection practices, review of practices and training should be performed on a regular basis.

Hemodialysis centers are well-recognized venues for hepatitis virus transmission (34, 35) because of the proximity of patients undergoing procedures that require frequent vascular access, the high prevalence of HCV in this setting, and repeated opportunities for contamination of the environment and equipment (17, 35). Prevention recommendations specific to this setting include the use of additional infection control measures, routine hepatitis B vaccination of patients receiving dialysis, and routine screening to detect new HBV and HCV infections (35, 36). These documented outbreaks serve as reminder that patients receiving hemodialysis remain at risk for infection and that hemodialysis-specific recommendations, including guidance on use of parenteral medication vials (37), must be strictly observed.

Preventing HBV infections among residents of long-term care facilities is of particular importance and urgency, as the number of persons in the United States 65 years of age or older is expected to double to more than 70 million by 2030 (7). Outbreak investigations in long-term care settings have repeatedly demonstrated person-to-person transmission of HBV infection, including many deaths, as a consequence of inappropriate blood glucose monitoring practices. This type of transmission serves as an overall indicator of deficiencies in infection control practices that must be corrected. During blood glucose monitoring, such equipment as fingerstick devices and glucometers, or the hands and gloves of health care personnel, can become contaminated with blood (38, 39). Therefore, careful attention to long-standing recommendations against the sharing of fingerstick devices, specific guidance for blood glucose monitoring procedures in long-term care, and related aspects of Standard Precautions (for example, reusable patient care equipment and devices or instruments) is needed (19, 24). In addition, ongoing outbreak activity supports consideration for augmenting hepatitis B vaccination recommendations to include diabetic long-term care residents.

The ability of the health or governmental jurisdiction to inspect and to license or certify nonhospital health care agencies varies. Laws and ability to regulate these health care facilities differ in each state. In New York, for example, facilities that offer office-based surgery will be required to obtain accreditation from a nationally recognized accrediting organization, such as the Joint Commission (40). To facilitate inspection and regulation of these facilities, it would be beneficial if some similar standard-of-care oversight could be achieved throughout the United States.

A limitation of this review is that the viral hepatitis outbreaks reported here probably represent only a portion of the true burden of infection attributable to the receipt of health care in the United States. First, we included only nonhospital health care settings. However, reports of

viral hepatitis outbreaks in hospital settings seem to be infrequent. Second, underascertainment of health care-associated viral hepatitis outbreaks is likely. Linking an outbreak to a single health care venue responsible for transmission is complicated by the long incubation period of HCV and HBV infection (up to 6 months), during which an individual may have multiple health care encounters. Furthermore, many patients with HBV or HCV infection will be asymptomatic or have mild or nonspecific symptoms, resulting in infections that go undetected for many years. Finally, outbreak detection relies on thorough case investigation and successful identification of health care as a risk (2, 41). Few health departments currently have the time, funds, personnel resources, or ability to address legal impediments to investigate viral hepatitis that may be health care-associated.

In summary, these recognized viral hepatitis outbreaks, which were caused by failure to adhere to fundamental infection control practices and aseptic technique, are underascertained and probably represent a much wider problem. Complex and invasive procedures are increasingly performed in nonhospital health care settings, in which routine infection control training and oversight are often inadequate. The prevention of viral hepatitis transmission in all health care settings deserves immediate attention. A comprehensive approach involving better viral hepatitis surveillance and case investigation, health care provider education and training, infection control resources, professional oversight, licensing, and public awareness is needed to assure basic patient protections against health care-associated viral hepatitis transmission.

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