MMWR™

Morbidity and Mortality Weekly Report

Recommendations and Reports | January 24, 2003 / Vol. 52 / No. RR-1

# Prevention and Control of Infections with Hepatitis Viruses in Correctional Settings

**INSIDE: Continuing Education Examination**

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The *MMWR* series of publications is published by the Epidemiology Program Office, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30333.

**SUGGESTED CITATION**

Centers for Disease Control and Prevention. Prevention and control of infections with hepatitis viruses in correctional settings. MMWR 2003; 52(No. RR-1):[inclusive page numbers].



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The preparers of this report have signed a conflict of interest disclosure form that verifies no conflict of interest.

# Prevention and Control of Infections with Hepatitis Viruses in Correctional Settings

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## Summary

*This report consolidates previous recommendations and adds new ones for preventing and controlling infections with hepatitis viruses in correctional settings. These recommendations provide guidelines for juvenile and adult correctional systems regarding 1) identification and investigation of acute viral hepatitis; 2) preexposure and postexposure immunization for hepatitis A and hepatitis B; 3) prevention of hepatitis C virus infection and its consequences; 4) health education; and 5) release planning. Implementation of these recommendations can reduce transmission of infections with hepatitis viruses among adults at risk in both correctional facilities and the outside community. These recommendations were developed after consultation with other federal agencies and specialists in the fields of corrections, correctional health care, and public health at a meeting in Atlanta, March 5–7, 2001. This report can serve as a resource for those involved in planning and implementing health-care programs for incarcerated persons.*

## Introduction

Persons incarcerated in correctional systems comprise approximately 0.7% of the U.S. population and have a disproportionately greater burden of infectious diseases, including infections with hepatitis viruses and other infections of public health importance (e.g., human immunodeficiency virus [HIV], sexually transmitted disease [STD], and tuberculosis [TB] infections) (*1*). In 2000, >8 million inmates of prisons and jails were released and returned to the community (A. Beck, Ph.D., Bureau of Justice Statistics, personal communication, 2002). Recent estimates indicate 12%–39% of all Americans with chronic hepatitis B virus (HBV) or hepatitis C virus (HCV) infections were releasees during the previous year (*1*) (Table 1).

The significance of including incarcerated populations in community-based disease prevention and control strategies is now recognized by public health and correctional professionals (*2*,*3*). Improved access to medical care and prevention services for incarcerated populations can benefit communities by reducing disease transmission and medical costs (*4*–*8*). Inmates who participate in health-related programs while incarcerated have lower recidivism rates and are more likely to maintain health-conscious behaviors (*4*). Finally, because incarcerated persons have a high frequency of infection with hepatitis viruses, community efforts to prevent and control these infections require inclusion of the correctional population (*9*–*11*). However, implementation of preventive health programs for incarcerated persons has substantial challenges.

Correctional staff are among groups at potential risk for occupationally acquired infections with bloodborne pathogens. Therefore, recommendations are also reviewed for prevention and control of infections with hepatitis viruses among correctional workers.

The material in this report originated in the National Center for Infectious Diseases, James M. Hughes, M.D., Director, and the Division of Viral Hepatitis, Harold S. Margolis, M.D., Director.

## Definitions

*Adolescent:* Person aged ≥10 and <19 years.

*Adult:* Person aged ≥19 years.

*Anti-HAV:* Total antibody to hepatitis A virus (HAV) detected in serum of persons with acute or resolved HAV infection; indicates a protective immune response to infection, vaccination, and passively acquired antibody.

*Anti-HBc:* Antibody to hepatitis B core antigen; positive test indicates past or current infection with HBV.

*Anti-HBs:* Antibody to hepatitis B surface antigen; indicates immunity to HBV infection, either from HBV infection or immunization.

*Anti-HCV:* Antibody to HCV; positive test indicates past or current infection with HCV.

*Arrestee:* Person placed under arrest by law enforcement who has not been formally charged with a crime.

*Body fluids, potentially infectious:* Semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial

**TABLE 1. Estimated chronic infections with hepatitis viruses among inmates and releasees — United States, 1997**

| Chronic infection | Number and percent of jail and prison inmates with condition* | Number and percent among noninmate population with condition | Number among total U.S. population with condition | Number of releasees with condition and percentage of U.S. population† |
|---|---|---|---|---|
| Hepatitis B virus | 34,000 (2%)§ | 1 million–1.25 million (0.5%)¶ | 1.036 million–1.29 million | 155,000 (12%–15%) |
| Hepatitis C virus | 255,000 (15%)** | 2.7 million (1.3%)†† | 2.97 million | 1.3 million (39%) |

**Source:** Adapted from National Commission on Correctional Health Care. The health status of soon-to-be-released inmates: a report to Congress. Chicago, IL: National Commission on Correctional Health Care, 2002. Available at http://www.ncchc.org/pubs_stbr.html.

* Based on 1.7 million inmates in prisons and jails, 1997 (*15*).

† Based on estimated 7.75 million unduplicated released inmates (*2*); A. Beck, Ph.D. Bureau of Justice Statistics, personal communication, 2002.

§ (*31*,*83*,*84*,*85*,*86*,*88*,*89*,*90*,*92*,*94*).

¶ Data from CDC, National Center for Health Statistics, National Health and Nutrition Examination Survey (NHANES III), adjusted to include persons of Asian origin (*76*).

** (*88*,*121*,*122*); L. Wang, Ph.D., New York State Department of Health, personal communication, 2001; D. Lau, M.D., University of Texas Medical Branch—Galveston, personal communication, 2001.

†† Based on data from NHANES III (*107*).

fluid, peritoneal fluid, and amniotic fluid. Potentially infectious body fluids include any body fluid visibly contaminated with blood, and all body fluids in situations where identifying blood contamination is difficult or impossible.

*Detainee:* Person arrested and legally charged with a crime who is held in a correctional facility before trial.

*HAV:* Hepatitis A virus, the infectious agent that causes HAV infection and hepatitis A.

*HBIG:* Hepatitis B immune globulin; sterile preparation of high-titer antibodies (immunoglobulins) to hepatitis B surface antigen obtained from pooled human plasma of immunized persons and which provides protection against HBV infection.

*HBeAg:* Hepatitis B e antigen; positive test correlates with HBV replication and infectivity.

*HBsAg:* Hepatitis B surface antigen; positive test indicates an active HBV infection.

*HBV:* Hepatitis B virus, the infectious agent that causes HBV infection, hepatitis B, and chronic liver disease.

*HBV DNA:* Deoxyribonucleic acid from HBV; positive test indicates active infection.

*HCC:* Hepatocellular carcinoma; a primary liver cancer caused by chronic HBV or HCV infection that is usually fatal.

*HCV:* Hepatitis C virus, the infectious agent that causes HCV infection, hepatitis C, and chronic liver disease.

*HCV RNA:* Ribonucleic acid from HCV; positive test indicates active infection.

*HDV:* Hepatitis D virus, a viroid (incomplete virus) that requires an active (acute or chronic) HBV infection to replicate and cause delta hepatitis virus infection, delta hepatitis, and chronic liver disease.

*IDUs:* Injection-drug users; persons who have ever used needles to inject illicit drugs.

*IgM anti-HAV:* Immunoglobulin M antibody to HAV; positive test indicates acute HAV infection.

*IgM anti-HBc:* Immunoglobulin M antibody to hepatitis B core antigen; positive test indicates acute HBV infection.

*IG:* Immune globulin; sterile preparation of antibodies (immunoglobulins) made from pooled human plasma that contains anti-HAV and provides protection against hepatitis A.

*Infant:* Person aged ≤1 year.

*Inmate:* Incarcerated person.

*Jail:* Locally operated correctional facility that confines persons pending arraignment, awaiting trial and sentencing, or serving their sentences (usually ≤1 year).

*Juvenile:* Person aged <19 years, in custody of the legal system.

*Prison:* Adult correctional facility under the jurisdiction of state or federal authorities that confines persons with a sentence of >1 year.

*Seroconversion:* The change of a serologic test from negative to positive.

*Seroprotection:* Level of antibodies necessary to protect against infection.

## Correctional Populations

### Juveniles

In 1997, approximately 12% of persons aged 16 years reported at least one arrest in their lifetimes (*12*). In 1999, a reported 108,965 juvenile offenders were held in residential placement facilities (*13*). In 1994, the average length of stay in public facilities for juvenile releasees was 2 weeks for those detained and 5 months for those committed; the stay in private facilities (primarily a committed population) averaged 3.5 months (*12*). Of arrested juveniles not incarcerated, the majority are diverted to alternative programs (e.g., teen courts or restorative justice) where they remain under supervision of the juvenile justice system. Approximately 74% of incarcerated juvenile offenders are held in public facilities, and the

rest in facilities operated by private contractors (*14*). Adult jails hold >7,600 juveniles, and approximately 3,100 are held in adult prisons (*15*). Females account for 27% of juveniles arrested and 13% of those in residential placement (*14,16*). Of juveniles arrested in 1999, approximately 72% were white, 25% black, and 3% of other races. However, a disproportionate number of racial and ethnic minorities were detained in residential placement (40% black and 18% Hispanic).

### Adults

At the end of 2001, adult jail and prison populations totaled 1.96 million — a 71% increase from 1990 (*13*). Prior incarceration as juveniles was reported by 9% of adults in federal prisons and by 20% in state prisons (*17*). According to 2000 data, racial/ethnic minorities were overrepresented, with 46% black, 36% white, 16% Hispanic, and 2% other races. Approximately 6.6% of adult inmates are female, a 111% increase since 1990; of incoming women to state prisons, 5% are pregnant (*18*). Among adult U.S. residents, 1 in every 112 men and 1 in every 1,724 women were sentenced to state or federal prisons in 2001 (*13*).

The estimated 12.6 million admissions and 12.6 million releases from local jails, and 625,000 admissions and 606,000 releases from prisons represent annual turnover rates of 1300% and 40%, respectively (*1,15*; A. Beck, Ph.D., Bureau of Justice Statistics, personal communication, 2002).

### Staff

In 2000, >457,000 custody and security officers worked in the U.S. correctional system, including both public and private sectors (*19*). These officers comprise approximately two thirds of all correctional staff, which also includes professional, technical, educational, clerical, maintenance, food service, and administrative workers (*20,21*).

## Health Care in the Correctional System

Upon incarceration, all adults and the majority of juveniles lose access to the usual public and private health-care and disease-prevention services. Their health care becomes the sole responsibility of either the correctional system (federal, tribal, state, or local), or less frequently, the public health system (*22*). For the majority of persons, entry into the correctional system provides an opportunity to access health care. In one series, approximately 78% of newly incarcerated females had abnormal Papanicolaou smears, and >50% had vaginal infections or STDs (*23*). However, the rapid turnover of the incarcerated population, especially in jails, and the suboptimal funding of correctional health and prevention services, often limits the correctional system in providing both curative and preventive care.

Infectious diseases — including acquired immune deficiency syndrome (AIDS), STDs, TB, and viral hepatitis — are more prevalent among correctional inmates than the general population. In 1997, an estimated 46,000–76,000 prison and jail inmates had serologic evidence of syphilis; 8,900 had AIDS (4% of the U.S. AIDS burden); and 1,400 had active TB (4% of the U.S. TB burden) (*1*).

Among incarcerated persons, shared risk factors (e.g., injection-drug use) can result in populations coinfected with HBV, HCV, or HIV. Coinfections can make treatment of chronic viral hepatitis, AIDS, and TB more difficult because of the need to use multiple drugs, which increases the chance of hepatotoxicity and other adverse events. In addition, both TB chemoprophylaxis and HIV postexposure prophylaxis can be complicated by the presence of chronic liver disease (*24,25*).

## Risk Factors for Viral Hepatitis Transmission Among Incarcerated Persons

### Drug Use

During 1990–1999, the rate of arrest for substance abuse violations among persons aged 10–17 years increased by 132% (*12,26*). Injection-drug use is reported by 3.3%–6% of incarcerated juveniles (A. Thomas, M.D., Oregon Health Division; and R. Bair, M.D., Bexar County Juvenile Detention Center, San Antonio, Texas; personal communications, 2001). Among juvenile detainees, 53% of males and 38% of females tested positive for marijuana use at the time of arrest, ≤17% tested positive for cocaine, and ≤18% were positive for methamphetamine (*27*).

Arrested adults also have a high prevalence of illicit drug use. In 2000, 21% of state prisoners and 59% of federal prisoners were incarcerated for drug offenses (*13*). In 1997 inmate surveys, 83% of state prisoners and 73% of federal prisoners reported past drug use, and 57% of state prisoners and 45% of federal prisoners reported using drugs in the month before their offense (*28*). Among jail inmates, drug use in the month before incarceration was reported by 55%, and injection-drug use was reported by 18% (*29*). However, urine testing at entry has indicated drug use might be substantially underreported by jail inmates (*30*). Injection-drug use during incarceration has been reported by 3%–28% of adult inmates (*31–34*). Although certain correctional systems

offer substance-abuse treatment and education programs, demand usually exceeds program capacity (*20*). There appear to be no comprehensive risk-reduction programs available within correctional facilities.

### Sexual Behavior

All states have laws prohibiting sex between adult residents of correctional systems (*35*). Despite these laws, 2%–30% of inmates have sex while incarcerated (*31,36–38*). Outbreaks of syphilis and hepatitis B among inmates reflect sexual activity in correctional facilities (*31,33,39,40*). Although two state prison systems and five city or county correctional systems make condoms available to adult inmates and detainees for use in their facilities (Vermont, Mississippi, New York City, Philadelphia, San Francisco, Washington D.C., Los Angeles), no juvenile correctional systems are known to provide condoms (E. Dunlap, National Juvenile Detention Association, personal communication, 2001).

### Percutaneous Exposures of Uncertain Risk

Percutaneous exposures have the potential to transfer infectious blood and transmit bloodborne pathogens. Tattoos and other percutaneous exposures (e.g., bites and abrasions) are common in correctional facilities and have the potential to expose residents and correctional staff to blood and body fluids (*34,41,42*). Case-control studies indicate tattooing is not a risk factor for acquiring acute hepatitis B or hepatitis C (*43,44*). However, results from seroprevalence studies of noninstitutionalized populations have been variable, and studies of highly select groups might not be generalizable to other populations (*45*). One study of a limited number of IDUs suggested an increased risk for both HBV and HCV infection among those tattooed while in prison (*46*), but limited studies of both adult and juvenile inmate populations have not confirmed this finding (*33*; R. Bair, M.D., Bexar County Juvenile Detention Center, San Antonio, Texas, personal communication, 2001).

### Occupational Exposures

Correctional employees have reported injuries from human bites, needles, and other sharp instruments, as well as skin and mucous membrane exposures to blood and body fluids (*41,42*). Occupational transmission of HBV infection among hospital-based workers has been linked to percutaneous and mucous membrane exposures, and HBV infection has been primarily associated with percutaneous exposure. Transmissions of HBV and HCV infections have not been associated with intact skin exposures (*10,47*). Limited data from correctional workers have indicated 21% reported blood contact with intact skin, and 7% reported a percutaneous exposure (including needle stick, cut with a contaminated object, or bite) or mucus membrane exposure (*48*).

## Epidemiology and Outcome of Infection with Hepatitis Viruses

### Hepatitis A Virus Infection

HAV infection is usually acquired by the fecal-oral route, produces a self-limited disease that does not result in chronic infection or long-term liver disease, and usually produces symptoms of acute viral hepatitis among adolescents and adults after an average incubation period of 28 days (range: 15–50 days). Signs and symptoms usually last <2 months, although 10%–15% of symptomatic persons have prolonged or relapsing disease lasting ≤6 months (*49*). Peak infectivity occurs during the 2-week period before the onset of jaundice or elevation of liver enzymes, when the concentration of virus in stool is highest (*11*). Persons with chronic liver disease who acquire hepatitis A are at increased risk for fulminant hepatitis (*50*).

#### Epidemiology of HAV Infection

In the United States, the majority of cases of hepatitis A occur through person-to-person transmission during communitywide outbreaks (*11,51*). Viral transmission can occur through close personal contact (e.g., household contact, sexual contact, drug use, or children playing), and contaminated food or water (e.g., infected food-handlers or raw shellfish). The most frequently reported source of infection (12%–26%) is household or sexual contact with a person with HAV infection; however, 45%–50% of patients have no identified source for their infection (*51,52*). Historically, the highest rates of disease have occurred in 11 western U.S. states and certain counties, which accounted for approximately 50% of cases during 1987–1997 (*11,52*).

HAV infection is common among IDUs. Injection-drug use has been reported by 5%–19% of hepatitis A patients. In certain communities, hepatitis A outbreaks involving users of injected and noninjected methamphetamine have accounted for approximately 30% of reported cases (*11,51,53,54*). Cross-sectional serologic surveys demonstrate that users of illicit drugs have a higher prevalence of infection than the general U.S. population (*11,55*). Viremia occurs during HAV infection, and transmission has occurred from parenteral blood exposure (e.g., blood transfusion or injection-drug use) on occasion (*56*). However, the majority of transmissions among users of illicit drugs are believed to occur through fecal contamination

of drug paraphernalia and subsequent percutaneous inoculation, as well as from close personal contact (*57*).

Hepatitis A outbreaks among men who have sex with men (MSM) are frequently reported, and cyclic outbreaks occur in urban areas of the United States (*58,59*). HAV-infected MSM report more frequent oral-anal contact, longer duration of sexual activity, and a larger number of sex partners than persons without serologic evidence of infection (*60–63*).

### HAV Infection in Correctional Settings

No hepatitis A outbreaks have been reported from correctional settings, although a substantial proportion of incarcerated persons have risk factors for infection (e.g., drug use or MSM). The prevalence of prior HAV infection among incarcerated persons is estimated at 22%–39%, which is similar to age-adjusted prevalence rates in the general U.S. population (*11*; C. Shapiro, M.D., CDC, personal communication, 2002; T. Lincoln, M.D., Hampden County Correctional Center, Ludlow, Massachusetts; and D. Lau, M.D., University of Texas Medical Branch—Galveston; personal communications, 2001). Employment in a correctional setting has not been identified as a risk factor for HAV infection.

## Hepatitis B Virus Infection

HBV is a bloodborne pathogen, transmitted by percutaneous or permucosal (e.g., sexual) exposure to infectious blood or body fluids (e.g., semen or saliva). HBV circulates in high titers in the blood and lower titers in other body fluids (e.g., semen, vaginal fluid, or saliva), and is approximately 100 times more infectious than HIV and 10 times more infectious than HCV (*47*).

Acute hepatitis B develops in approximately 30%–50% of adults at the time of initial infection and is characterized by anorexia, nausea, vomiting, and often jaundice. The risk of progression to chronic infection varies with age, being highest among young children and infants (30%–90%) and lowest among adolescents and adults (2%–6%) (*64*).

The majority of persons with chronic HBV infection are asymptomatic, and one third have no evidence of liver disease, despite high levels of viral replication in hepatocytes (*65*). The remainder have chronic hepatitis (mild, moderate, or severe) that can lead to cirrhosis and HCC. Persons with chronic HBV infection have a 15%–25% lifetime risk of death from chronic liver disease or HCC (*66–70*). Rates of progression to cirrhosis and HCC vary according to age at acquisition of chronic infection; HBeAg status; coinfection with HDV, HIV, HCV; and alcohol abuse (*69,71–75*). HBV-related liver disease and HCC cause approximately 3,000 deaths in the United States annually (S. Goldstein, M.D., CDC, unpublished data, 2002).

### Epidemiology of HBV Infection

An estimated 5% of the civilian, noninstitutionalized U.S. population has serologic evidence of past or present HBV infection, and 0.4%–0.5% have chronic infection and serve as the primary source of infection for others (*9,76*). Overall prevalence of HBV infection differs among racial/ethnic populations and is highest among persons who have immigrated from areas with a high endemicity of HBV infection (e.g., Asia, Pacific Islands, Africa, and the Middle East) (*77*). Prevalence of infection among blacks is four times prevalence among whites (11.9% compared with 2.6%) (*76*).

During 1987–1998, reported cases of acute hepatitis B declined by 76% (*8*). Nonetheless, an estimated 78,000 persons were infected with HBV in 2001 (G. Armstrong, M.D., CDC, unpublished data, 2002). Disease incidence is highest among blacks, followed by Hispanics and whites, and highest among persons aged 25–39 years (*8,52*). The age of newly infected persons has increased from a median of 27 years during 1982–1988 to 32 years during 1994–1998, probably as a result of vaccination of adolescents and young adults and changes in high-risk behaviors in certain populations (*8*). Before national prevention programs began in 1990, perinatal and early childhood transmission accounted for 30% of chronic HBV infections (*78*).

Sex is the predominant mode of HBV transmission among adults and adolescents, accounting for more than half of newly acquired infections (*8*). Among reported cases of acute hepatitis B, approximately 40% reported heterosexual exposure to an infected partner or multiple partners, and 15% were MSM. In addition, 14% of persons with acute hepatitis B reported injection-drug use. Thirty-three percent of persons with acute hepatitis B cannot identify a risk factor for infection, although approximately 50% of those persons have a history of known risk factors (*8*).

### HBV Infection in Correctional Settings

**Juveniles.** The majority of juvenile offenders have behaviors that place them at risk for HBV infection (e.g., injection-drug use or unprotected sex with multiple partners). The prevalence of past HBV infection among noninstitutionalized high-risk juveniles (e.g., homeless, drug-using, or HIV-positive) ranges from 3.6% to 19% (*79–81*) (B.M. Beech, Ph.D, University of Memphis, Tennessee, 2002), compared with the <3% prevalence of infection among adolescents in the general population (*76,82*). Among incarcerated juveniles, prevalence of past HBV infection ranges from 0% to 6% (*79,82*; A. Thomas, M.D., Oregon Health Division; and R. Bair, M.D., Bexar County Juvenile Detention Center, San Antonio, Texas; personal communications, 2001). HBV

transmission has not been observed in juvenile correctional settings.

**Adults.** The prevalence of serologic markers for current or past HBV infection among prison inmates ranges from 13% to 47%, and varies by region. Prevalence is higher among women (37%–47%) than men (13%–32%) (*31,83–88*) (T. Lincoln, M.D., Hampden County Correctional Center, Ludlow, Massachusetts, 2001). Chronic HBV infection is diagnosed in 1.0%–3.7% of prison inmates, 2–6 times the national prevalence estimate of 0.5% (*31,83,86,88–94*), and comparable to rates of chronic infection among IDUs (5%–10%) (*95–98*), and among MSM (1.5%–6%) (*99*; D. MacKellar, CDC, personal communication, 2002).

Upon release, susceptible inmates are often at increased risk for infection because they resume high-risk behaviors. A study of recidivist women reported an HBV seroconversion rate of 12.2/100 person-years between incarcerations (*100*), compared with an estimated incidence of 0.03/100 person-years for the U.S. population (G. Armstrong, CDC, personal communication, 2002).

The majority of HBV infections among incarcerated persons are acquired in the community. However, infection is also transmitted within correctional settings, and incidence rates have ranged from 0.82% to 3.8%/year (*31,34,84*). After identification of a single case of acute hepatitis B in a state prison, serologic testing identified acute HBV infection in 1.2% of the population (*33,34*). Highest rate of acute infection (8%) was determined in the dormitory of the index case and was associated with sex with another inmate. No other risk factors were associated with infection. Acute infections were also identified in other prison dormitories, and chronic HBV infection was identified in 1% of the inmate population. Serologic testing of susceptible inmates 1 year later identified an additional 3.8% who had become newly infected with HBV.

Among patients with acute hepatitis B reported to CDC's Sentinel Counties Study of Viral Hepatitis, 5.6% have a history of incarceration during the disease incubation period (*8*). HBV transmission in the prison setting can occur through sexual activity, injection-drug use, and percutaneous exposures that are not apparent, as it does in households where persons with chronic HBV infection reside (*101,102*).

Data are lacking regarding the prevalence of HBV infection among short- and long-term residents of jails. However, the demographic and risk factor profiles of jail and prison inmates are similar, and the burden of HBV infection and risk of transmission might be expected to be similar, especially among long-term jail residents (*13,15,28,29*).

**Correctional Staff.** The overall prevalence of HBV infection was 12.6% in the only study performed among correctional workers, a rate not significantly different from that of the general population after adjusting for age and race (*48*). Percutaneous and mucous membrane exposures to blood were relatively infrequent, and the most frequently reported exposure was blood on the skin, which was not associated with HBV infection.

## Hepatitis C Virus Infection

HCV, a bloodborne pathogen, is most efficiently transmitted by direct percutaneous exposure to infectious blood. Of persons newly infected with HCV, only 20%–30% have symptoms of acute hepatitis (*10,103,104*). Chronic infection develops among 75%–85% of persons infected as older adults (aged >45 years) and among 50%–60% of persons infected as juveniles or young adults (*105*).

The majority of persons with chronic HCV infection are asymptomatic, and approximately 30% have no evidence of liver disease. Among chronically infected persons, biochemical evidence of chronic liver disease develops among 70% of those infected as adults, but (on the basis of limited data) in only 10% of those infected as juveniles (*105*). The risk for progression to cirrhosis also varies by age at infection, from 10%–20% among persons infected as older adults to <5% among persons infected as juveniles or younger adults. In addition to age, clinical progression is also accelerated by alcohol intake, chronic coinfection with HBV, and male sex (*105*). Coinfection with HIV increases HCV viral loads, the rate of progression to fibrosis and cirrhosis, and liver-related mortality (*106*). HCC develops among 1%–5% of persons with chronic hepatitis C.

### Epidemiology of HCV Infection

An estimated 3.9 million persons (1.8%) in the civilian, noninstitutionalized U.S. population have been infected with HCV, of whom approximately 2.7 million (1.3%) are chronically infected. In 1990, approximately two thirds of persons infected with HCV were aged 30–49 years (*107*). Blacks had a higher prevalence of HCV infection than whites (3.2% compared with 1.5%), and among black males aged 40–49 years, prevalence was 9.8% (*107*).

The highest prevalence of HCV infection (70%–90%) is reported among those persons with substantial or repeated direct percutaneous exposures to blood (e.g., IDUs, persons with hemophilia treated with clotting factor concentrates that did not undergo viral inactivation, and recipients of transfusions from HCV-positive donors). Moderate infection prevalence (10%) has been reported among long-term hemodialysis

patients, and lower prevalence is reported among persons with high-risk sexual practices (5%) and health-care workers (1%–2%) (*10*). HCV is not transmitted efficiently through occupational exposure. The risk of acquiring HCV infection from a contaminated needle stick is <2%, and transmission rarely has been documented from mucous membrane or nonintact skin exposures (*47*).

The highest incidence of acute hepatitis C is among persons aged 20–39 years (*108,109*). Blacks and whites have a similar incidence of acute disease, and incidence rates are higher among males than females. Although the incidence of acute hepatitis C has declined by >80% since 1989, primarily as a result of a decrease in cases among IDUs, the major risk factor for HCV infection remains injection-drug use, which accounts for 60% of newly acquired cases (*10,110,111*). No association has been determined between newly acquired HCV infection and military service, medical, surgical, or dental procedures, tattooing, acupuncture, ear piercing, or foreign travel (*43,44*). If transmissions from such exposures do occur, the frequency has been too low to detect.

Although the number of cases of acute hepatitis C among IDUs has declined dramatically since 1989, both the incidence and prevalence of HCV infection remain high among this group (*98,112,113*). Among IDUs, HCV is transmitted through the transfer of infected blood by sharing syringes, needles, or other drug paraphernalia contaminated with the blood of an infected person (*114–116*). HCV infection is acquired more rapidly after the initiation of injection-drug use than either HBV or HIV infection, and the rate of HCV infection among juvenile IDUs is four times greater than the rate of HIV infection. In 1980s studies, approximately 80% of newly initiated IDUs were infected with HCV within 2 years (*98,117,118*). This rapid acquisition of HCV infection was probably caused by the high prevalence of chronic HCV infection among IDUs, resulting in a greater likelihood of exposure to an HCV-infected person through sharing of drug paraphernalia. More recent studies report the rate of HCV acquisition has slowed, and only one third of IDUs are infected within 2 years after initiating injection-drug use. Nonetheless, incidence remains high at 10%–15%/year (*112,116,119,120*).

### HCV Infection in Correctional Settings

**Juveniles.** The prevalence of HCV antibody among detained or incarcerated juveniles is estimated at 2%–3.5%. A history of injection-drug use is the predominant risk behavior, and regardless of reported risk behaviors, the prevalence is higher among females than among males (3%–7% versus 2%–3%) (A. Thomas, M.D., Oregon Health Division; and R. Bair, M.D., Bexar County Juvenile Detention Center, San Antonio, Texas; personal communications, 2001). The extent to which HCV infection is transmitted within juvenile correctional institutions is not known.

**Adults.** Among prison inmates, 16%–41% have serologic evidence of HCV infection, and 12%–35% have chronic HCV infection; rates vary by geographic region (*88,107,121,122*; L. Wang, Ph.D., New York State Department of Health; D. Lau, M.D., University of Texas Medical Branch—Galveston; personal communications, 2001). HCV infection is primarily associated with a history of injection-drug use. In a Wisconsin study of 1,148 inmates, among the 310 (27%) with a history of injection-drug use and serologic evidence of HBV infection or biochemical evidence of liver disease, 91% were determined to be anti-HCV–positive (J. Pfister, M.S., Wisconsin State Laboratory of Hygiene, personal communication, 2001). Among HCV-positive entering jail inmates in Massachusetts, 85% reported needle-sharing, prior drug use, or a history of hepatitis (T. Lincoln, M.D., Hampden County Correctional Center, Ludlow, Massachusetts, personal communication, 2001).

The risk of HCV acquisition during incarceration is not well-established. The only published study to examine the incidence of HCV infection among prison inmates reported a rate of 1.1 infections/100 person-years of incarceration among males (*121*).

**Correctional Staff.** No published studies have reported the prevalence of HCV infection among correctional staff. In one unpublished study, among correctional health-care workers the prevalence of HCV infection was 2% (R. Gershon, Dr.P.H., Columbia University, New York, personal communication, 2002) — no higher than in the general population. This finding is similar to that of studies among other occupational groups, including hospital-based health-care workers, surgeons, and public safety workers (*10,123*).

## Preventing and Controlling Viral Hepatitis

Primary prevention of infection with hepatitis viruses can be achieved either through immunization (i.e., HAV or HBV) or through behavioral interventions to reduce risk factors for infection (i.e., HCV). In addition, identification of persons with chronic HBV and HCV infection provides an opportunity to initiate activities (e.g., counseling, treatment, or vaccination) that can prevent further disease transmission and reduce the progression of chronic liver disease. This section summarizes current information and practices to prevent infection with hepatitis viruses, including immunization, antiviral treatment, and risk-reduction counseling.

## Prevention of HAV Infection

### Strategy To Prevent HAV Infection

**Preexposure Immunization.** Vaccination is the most effective means to prevent HAV infection and reduce disease incidence. In the United States, preexposure vaccination is recommended for persons at highest risk for infection and persons for whom infection would result in adverse consequences (Box 1). In addition, routine vaccination is recommended for persons aged 2–19 years living in states and communities with the highest historic rates of disease (*11*) because conditions that contribute to communitywide transmission continue to exist.

**Postexposure Prophylaxis.** Passive immunization with immune globulin IG is >85% effective in preventing hepatitis A after exposure of an unvaccinated person to an infected person, if administered ≤2 weeks after exposure (*11*). Anti-HAV testing is not recommended because it would delay IG administration and is likely not cost-effective. Although limited data indicate hepatitis A vaccine might provide protection when administered soon after exposure, this has not been evaluated in controlled clinical trials, and use of hepatitis A vaccine alone is not recommended for postexposure prophylaxis. However, persons who receive IG postexposure prophylaxis, and for whom hepatitis A vaccine is also recommended, require vaccination (*11*).

**BOX 1. Groups for whom hepatitis A vaccination is recommended**

#### Persons at Increased Risk for Infection

- Travelers to countries with high endemicity for hepatitis A virus infection;
- Men who have sex with men;
- Users of injection and noninjection illegal drugs;
- Persons who receive blood product replacement therapy for clotting factor disorders; or
- Children and adolescents living in states with historically elevated rates of hepatitis A.*

#### Persons at Increased Risk for Adverse Consequences of Hepatitis A

- Persons with chronic liver disease of any etiology.

**Source:** CDC. Prevention of hepatitis A through active or passive immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48(RR-12):1-37.

* Routine vaccination recommended: Alaska, Arizona, California, Idaho, Nevada, New Mexico, Oklahoma, Oregon, South Dakota, Utah, and Washington; routine vaccination should be considered: Arkansas, Colorado, Missouri, Montana, Texas, and Wyoming.

### Detection and Management of Acute HAV Infection

The diagnosis of hepatitis A is based on a positive serologic test for IgM anti-HAV in a person with clinical signs or symptoms of acute viral hepatitis. Serologic confirmation of HAV infection is required because hepatitis A cannot be distinguished from other forms of viral hepatitis on the basis of clinical presentation alone (Box 2). Although management of clinical illness is supportive, progression to acute liver failure can occur (especially in persons with chronic liver disease), and 10%–15% of patients have relapsing illness.

**Contact Tracing.** Cases of acute hepatitis A are reported to the appropriate public health authorities, and a contact investigation is initiated by correctional officials to identify persons who would benefit from postexposure prophylaxis. Cellmates, sexual contacts, and persons having ongoing close personal contact with the index case are administered IG (Box 3) (*11*).

### Current Practices: Prevention of HAV in Correctional Settings

Nationally, the extent to which juvenile correctional systems vaccinate against hepatitis A is unknown. A recent assessment determined that in six of the 17 states where routine childhood vaccination is recommended, vaccination was also being conducted in juvenile detention facilities (CDC, unpublished data, 2002). A limited number of adult correctional systems routinely offer hepatitis A vaccination to all persons at risk for infection, whereas others offer vaccination only to inmates infected with HCV.

## Prevention of HBV Infection

### Strategy To Prevent HBV Infection

Prevention of acute and chronic HBV infection and elimination of HBV transmission in all age groups is most effectively achieved through hepatitis B vaccination (*9*). The national strategy to eliminate HBV transmission has four components: 1) prevention of perinatal HBV infection through maternal screening and postexposure prophylaxis of newborns of HBsAg-positive mothers; 2) hepatitis B vaccination of all infants to prevent infection in childhood and at later ages; 3) vaccination of all adolescents not previously vaccinated to prevent infection in this age group and at later ages; and 4) vaccination of adults and adolescents in groups at increased risk for infection (Box 4) (*9,124*).

Hepatitis B vaccination has been included in routine healthcare visits for adolescents, but not for adults at risk for infection (*9,125*). Although the majority of persons aged <19 years

**BOX 2. Diagnostic testing for infection with hepatitis viruses***

***For persons with acute hepatitis, testing should be performed to differentiate among types of viral hepatitis.***

### Acute Hepatitis A

- Immunoglobulin M antibody to hepatitis A virus (IgM anti-HAV)-positive.

### Acute Hepatitis B

- IgM antibody to hepatitis B core antigen (IgM anti-HBc)-positive; and
- Hepatitis B surface antigen (HBsAg)-positive.

### Acute Hepatitis C

- Serum alanine aminotransferase (ALT) levels >7 times the upper limit of normal;
  and
- Antibody to hepatitis C virus (anti-HCV) positive (repeat reactive) by screening immunoassary, and confirmed by a more specific assay (e.g., recombinant immunoblot assay [RIBA®] for anti-HCV or nucleic acid testing for HCV RNA);
  or
- Anti-HCV–positive (repeat reactive) by screening immunoassay and a signal-to-cutoff ratio predictive of a true positive as determined for the particular assay (e.g., ≥3.8 for screening enzyme immunoassay [EIA]).

***Laboratory tests for diagnosis of chronic hepatitis:***

### Chronic HBV Infection

- HBsAg-positive, total anti-HBc–positive, and IgM anti-HBc-negative, or
- HBsAg-positive two times ≥6 months apart.

### Chronic HCV Infection

- Anti-HCV–positive (as defined above) and HCV RNA-positive ≥6 months apart.

* See Table 2 for interpretations of other markers of HBV infections.

not covered by private insurance are covered under the Vaccines for Children Program,* similar coverage does not exist for adults, and cost reimbursement is a substantial barrier to vaccination of adults (*126*).

* The Vaccines for Children (VFC) Program was established in 1994 for federal purchase of vaccine to be administered by a qualified health provider to juveniles aged <19 years who are American Indian or Alaska Native, uninsured or underinsured, or on Medicaid. VFC supports purchase of hepatitis A and hepatitis B vaccines, and HBIG. The VFC website is available at http://www.cdc.gov/nip/vfc/Default.htm.

**BOX 3. Contact investigation and postexposure prophylaxis after identification of a case of hepatitis A**

- Contact investigation should be coordinated with local and state health departments. If the index patient is a food handler, public health officials should be directly involved in the investigation to evaluate the risk for transmission and the need for postexposure prophylaxis.
- The following persons, if not previously vaccinated, should be considered candidates for postexposure prophylaxis if exposed to an index patient with hepatitis A during the two weeks before onset of symptoms. A single dose of immune globulin (IG) (0.02 mL/kg body weight, intramuscular) should be administered as soon as possible (but not >2 weeks after the last exposure) to
  - — cellmates or dormitory mates,
  - — sex contacts,
  - — other close contacts based on epidemiologic investigation, or
  - — other food handlers if the index patient was a food handler.
- IG is not routinely indicated when an index case occurs in a school, work setting, or temporary housing unit.
- When a person with hepatitis A is admitted to a hospital, standard and contact precautions are indicated. Staff members are at low risk for infection and postexposure prophylaxis is not indicated.

**Source:** CDC. Guidelines for viral hepatitis surveillance and case management. Atlanta, GA: 2002. Available at http://www.cdc.gov/ncidod/diseases/hepatitis/resource/PDFs/revised%20GUIDELINES%20formatted4.pdf

Approximately 56% of persons with hepatitis B have either been treated for an STD (36%) or incarcerated (29%), factors for which routine hepatitis B vaccination is recommended (*8,127*).

Identification of persons with chronic HBV infection through diagnostic testing can reduce risks for chronic liver disease and further transmission of infection; appropriate medical management and antiviral therapy can reduce risks for cirrhosis and HCC. Additional morbidity from other hepatic insults can be reduced through hepatitis A vaccination, alcohol-reduction counseling, and risk-reduction education. The high rate of HBV infection during sex and close contact (including with cellmates) can be prevented through vaccination.

**Box 4. Groups recommended for preexposure hepatitis B vaccination**

### Universal

- All infants, and
- All children and adolescents not previously vaccinated.

### On the Basis of Risk

- Inmates of long-term correctional facilities;
- Injection-drug users;
- Sexually active men who have sex with men;
- Men and women with >1 partner in the previous 6 months, a history of a sexually transmitted disease (STD), or treatment in an STD clinic;
- Household contacts (including cellmates) and sex partners of persons with chronic HBV infection;
- Persons in occupational groups with exposure to blood or body fluids;
- Hemodialysis patients;
- Recipients of clotting factor concentrates;
- Long-term international travelers; and
- Clients and staff of institutions for the developmentally disabled.

**Sources:** CDC. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination—recommendations of the Immunization Practices Advisory Committee (ACIP). MMWR 1991;40(No. RR-13):1–25. CDC. General recommendations on immunization—recommendations of the Advisory Committee on Immunization Practices (ACIP) and the American Academy of Family Physicians (AAFP). MMWR 2002;51(No. RR-2):1–36. CDC. Recommendations for preventing transmission of infections among chronic hemodialysis patients. MMWR 2001;50(No. RR-5):1–43. CDC. Immunization of health-care workers—recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC). MMWR 1997;46(No. RR-18):1–42.

**Prevention of Perinatal HBV Infection.** Perinatal HBV infections can be prevented through routine testing to identify pregnant women who test positive for HBsAg and through timely postexposure immunization (prophylaxis) of their infants (*78,128,129*). Independent of maternal HBsAg status, hepatitis B vaccination is recommended for all infants soon after birth and before their release from the hospital (*130*). Initiating hepatitis B vaccination soon after birth serves as a safety net to prevent HBV infection in infants whose mothers were not tested (*131*).

**Adolescent Vaccination.** Universal vaccination of infants against hepatitis B was first recommended in the United States in 1991 (*9*) and catch-up vaccination of all adolescents was recommended in 1995 to achieve elimination of HBV transmission in a more timely manner (*132–135*). Hepatitis B vaccination is now required by 33 states for entry to middle school or seventh grade. Three states have laws that require vaccination for college entry, and certain colleges require hepatitis B vaccination for matriculation (*136*; S. Ainsworth, American College Health Association, personal communication, 2002).

Juvenile correctional vaccination programs have been established to prevent infections among detained persons at high risk for infection who might not be reached by school requirements. Completion of the vaccination series in these programs has been complicated by population turnover and the need for parental consent in certain jurisdictions. However, recidivism can bring opportunities to offer inmates second and third vaccine doses (*137*; G. Shostak, M.P.H., Massachusetts Department of Youth Services, personal communication, 2001).

**Adult Vaccination.** Routine vaccination of infants, young children and adolescents is expected to eventually eliminate transmission of HBV among adults in the United States. However, decades will pass before vaccinated children become protected adults, and vaccination of adults at increased risk for infection remains essential to reducing their high incidence of disease.

Vaccination coverage among adults at occupational risk for HBV infection has successfully reduced infection incidence by >90% (*138*). This was achieved by requiring employers to provide education and hepatitis B vaccination at no cost to employees (*139*). However, early efforts to vaccinate other adults had limited success, primarily because of a lack of sustained programs and coverage for vaccine cost. More recently, demonstration programs funded by state and local health departments to deliver hepatitis B vaccine in correctional facilities, and STD and substance-abuse–treatment centers, have demonstrated high vaccination coverage can be achieved (*140,141*).

Previously, a major barrier to vaccination of adults at high risk was the practice of offering vaccine only to persons likely to complete the series. Although administration of the complete vaccine series should be the goal of any immunization program, high first-dose and modest second-dose vaccination coverage rates have been achieved when vaccine is offered to all persons in settings that serve populations at high risk (*140*). Protective levels of antibody develop after 1 dose of hepatitis B vaccine among 30%–50% and after 2 doses of vaccine among 75% of healthy young adults (*142–144*).

The transient nature of adult populations in correctional facilities often prevents completion of the full hepatitis B vaccine series. Ensuring follow-up with subsequent doses requires that an immunization record is included in the medical record of all inmates, is transferred among correctional facilities, and is provided to the inmate as part of release planning.

## Testing for HBV Infection

**Pregnant Women.** HBsAg testing is recommended for all pregnant women as soon as the pregnancy is recognized, irrespective of hepatitis B vaccination history or previous test results (*9,145–147*). In addition, women with risk factors for HBV infection during their pregnancy (e.g., intercurrent STDs, multiple sex partners, sex partners and household contacts of HBsAg-positive persons, or clinically apparent hepatitis) need retesting for HBsAg late in pregnancy because of the high risk for HBV infection (*9,147*). Women diagnosed with chronic infection need evaluation for chronic liver disease, and close contacts (e.g., sex, household, prison cell, or dormitory) require vaccination because of their high risk for infection (*9*).

**Prevaccination Testing.** Proof of previous hepatitis B vaccination through an immunization registry, medical records, or vaccination card can be used to determine whether to exclude inmates from vaccination. When inmate vaccination status is unknown, testing for immunity to HBV infection can reduce vaccine cost among populations with high rates for infection or vaccination coverage (Box 5). However, vaccination of a person immune to HBV infection because of prior vaccination or infection does not increase risk for adverse events. Testing is not indicated before vaccination of adolescents or younger children because of the low prevalence of HBV infection in these age groups (*9,148*).

**BOX 5. Method to determine cost-effectiveness of prevaccination screening for hepatitis B vaccination***

The breakeven point for the cost of prevaccination serologic testing, when first vaccine dose is administered at the time of blood draw, is

$$T = P1 \times [P2 + P2(P3)] \times v$$

where

T = cost of serologic test (anti-HBc or anti-HBs);

P1 = prevalence of past infection/immunization;

P2 = percentage of recipients of first dose who actually receive a second dose;

P3 = percentage of recipients of doses 1 and 2 who receive dose 3;

[P2 + P2(P3)] = average number of doses for a person starting the series; and

v = cost per dose of vaccine, including administrative costs.

* Using this formula for hepatitis A vaccination assumes no vaccination is administered at the time of the blood draw. For hepatitis A vaccination, T = cost of serologic test for anti-hepatitis A virus (HAV); T = P1 x v. For more prevaccination information regarding hepatitis A, see Appendix.

As hepatitis B vaccination coverage increases among adolescents, a higher proportion of adults will be immune to HBV infection. Correctional systems should be aware of state hepatitis B vaccination requirements for middle school entry, which typically achieve high vaccination coverage. If adequate immunization records are not routinely available for incoming inmates, periodic serologic surveys are necessary to determine the prevalence of immunity to HBV infection and to guide policies for prevaccination testing.

Among populations with a high prevalence of immunity as a result of vaccination, testing for chronic HBV infection is not warranted. However, among populations with a high prevalence of HBV infection, testing is necessary to identify inmates with chronic HBV infection and initiate medical follow-up and immunization of close contacts.

**Postvaccination Testing.** Testing to determine antibody response to vaccination is not necessary for healthy juveniles and adults (Appendix A). For immunocompromised persons (e.g., hemodialysis patients or HIV-infected) and persons with continued known exposure to HBV infection (e.g., infants born to HBsAg-positive mothers, sex partners of HBsAg-positive persons, or health-care workers), testing is needed to verify response to vaccination and the need for possible revaccination, or to identify HBV infection (*9,149,150*)

## Prevention of HBV Infection After Exposure

Immunization (active, passive, passive-active) within a relatively short period of time after exposure to HBV can effectively prevent acute and chronic infection. Initiation of the hepatitis B vaccine series within 12–24 hours of exposure has been demonstrated 70%–90% effective in preventing HBV infection (*131,151*). The combination of vaccine and HBIG achieves a similar level of efficacy (Box 6) (*128,129*). Among known nonresponders to vaccination, 1 dose of HBIG is 70%–90% effective in preventing hepatitis B when administered within 7 days of a percutaneous HBV exposure. HBIG administered within 2 weeks is also required for protection from sexual exposure to a person with acute hepatitis B (*152–154*).

## Detection of HBV Infection

**Acute HBV Infection.** Acute HBV infection is asymptomatic among 60%–70% of patients, but can have symptoms and signs associated with acute viral hepatitis (e.g., loss of appetite, nausea, vomiting, fever, abdominal pain, or jaundice), and must be confirmed by serologic testing (Table 2, Box 2). Treatment for acute hepatitis B is supportive, consisting of rest, hydration, and symptomatic relief as needed. Identification of an inmate with acute HBV infection, especially one who has been incarcerated >6 months, requires an epidemiologic investigation by correctional officials, in collabora-

**BOX 6. Prophylaxis after exposure to hepatitis B virus (HBV)**

| Type of exposure | Type of immunoprophylaxis |
|---|---|
| Perinatal | Vaccination* + HBIG† |
| Sexual — acute case | Vaccination* + HBIG |
| Sexual — chronic HBV infection | Vaccination |
| Household (e.g., cell or dormitory) contact — to person with chronic HGV infection | Vaccination. If not previously vaccinated, also administer HBIG if known exposure§ |
| Household (e.g., cell or dormitory) contact — acute case | Vaccination. If not previously vaccinated, also administer HBIG if known exposure§ |
| Known percutaneous or permucosal (e.g., occupational) | Vaccination +/- HBIG¶ |

**Source:** CDC. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination—recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1991;40(No. RR-13):1–25.
* See Table 4.
† HBIG = hepatitis B immune globulin. Dosages: perinatal = 0.5 mL intramuscular; all other = 0.06 mL/kg, intramuscular.
§ Identifiable blood exposure to infected contact (e.g., by sharing toothbrushes or razors).
¶ See Table 5.

tion with the appropriate health authorities, to identify the source of infection. Depending upon the results, vaccination of sexual, prison cell, dormitory, and household (e.g., conjugal and other family members) contacts can be indicated.

**Chronic HBV Infection.** Chronic HBV infection can be distinguished from acute infection by serologic testing (Table 2). Inmates identified with chronic HBV infection require evaluation to determine the extent of liver disease, virus replication, indications for antiviral therapy (*64*), and need for vaccination of contacts to prevent HBV transmission.

## Management of Chronic HBV Infection

Initial evaluation of patients with chronic HBV infection includes biochemical tests for liver disease (e.g., alanine aminotransferase [ALT], and aspartate aminotransferase [AST]), for the extent of liver disease (e.g., serum albumin or prothrombin time), and status of HBV replication (e.g., HBeAg, antibody to HBeAg [anti-HBe], and HBV DNA). Alpha interferon, lamivudine, or adefovir dipivoxil are approved by the Food and Drug Administration (FDA) for treatment of chronic hepatitis B (*64,155*). Therapy can be appropriate for patients who have abnormal levels of liver enzymes, active virus replication (HBeAg-positive or high levels of HBV DNA), and a liver biopsy indicating presence of moderate disease activity and fibrosis (*64*).

Treatment with interferon, administered by injection 3 times/week, substantially decreases HBV DNA levels and clears HBeAg among >50% of patients with ALT levels >5 times the upper limit of normal, and among 20%–35% of patients with ALT levels 2–5 times the upper limit of normal. Among patients with ALT levels <2 times the upper limit of normal, response is poor and therapy should be deferred. Long-term follow-up of treated patients indicates remission of chronic hepatitis induced by alpha interferon is of long duration (*64*). Patient characteristics associated with positive response to interferon therapy include low pretherapy HBV DNA levels,

**TABLE 2. Interpretation of hepatitis B virus serologic testing**

| | Serologic markers | | | |
|---|---|---|---|---|
| **Interpretation** | **HBsAg*** | **Total anti-HBc†** | **IgM§ anti-HBc** | **Anti-HBs¶** |
| Susceptible, never infected | – | – | – | – |
| Acute infection, early incubation period** | + | – | – | – |
| Acute infection | + | + | + | – |
| Acute resolving infection | – | + | + | – |
| Past infection, recovered and immune | – | + | – | + |
| Chronic infection | + | + | – | – |
| False positive (i.e., susceptible), past infection, or low-level chronic infection | – | + | – | – |
| Immune from vaccination if antibody concentration ≥10 milli international units per milliliter (mIU/mL) | – | – | – | + |

* Hepatitis B surface antigen.
† Antibody to hepatitis B core antigen.
§ Immunoglobulin M.
¶ Antibody to hepatitis B surface antigen.
** Transient HBsAg positivity (lasting ≤21 days) might be detected in certain patients during vaccination.

high pretherapy ALT levels, short duration of infection, acquisition of disease in adulthood, and histology indicative of active inflammation.

Lamivudine, administered orally daily, has been as effective as interferon at clearing HBeAg. Although a majority of patients taking lamivudine demonstrate improved liver histology, development of lamivudine-resistant HBV mutants is common, especially with prolonged use, and diminishes the effectiveness of treatment. Studies of lamivudine in combination with interferon have not been demonstrated to be superior to monotherapy (*64*).

The newest therapy to be approved is adefovir, which also is administered orally daily. Patients treated with adefovir exhibited substantial improvements in liver histology and decreased levels of HBV DNA; however, durability of the response has not been determined (*156*). Adefovir has been demonstrated to be effective in patients with chronic hepatitis B who have experienced resistance to lamivudine (*156*).

Treatment of persons coinfected with HIV and HBV requires additional monitoring. After initiation of highly active antiretroviral therapy (HAART) for treatment of HIV infection, reactivation of HBV replication with development of acute hepatitis has been observed among persons thought to have resolved HBV infection. Although interferon treatment is not as effective for patients coinfected with HIV, HBV and HIV can be simultaneously treated (*157*).

Inmates identified with chronic HBV infection can benefit from counseling regarding ways to prevent transmitting HBV infection to others. Vaccination of sexual and nonsexual contacts (e.g., cellmates) can also prevent transmission (*9*).

## Current Practices: Prevention of HBV in Correctional Settings

**Juveniles.** Juveniles in the justice system have been determined to have increased risk for HBV infection (*125*). In 2001, a national survey of state juvenile correctional systems reported that 36 (86%) of 42 responding systems had a hepatitis B prevention program in place; 78% used the VFC program to pay for vaccine; and 85% considered vaccination to be a corrections responsibility while a juvenile is in custody. Written hepatitis B prevention policies were in place in 65% of states, and 27% used a vaccine tracking system or immunization registry (CDC, unpublished data, 2002).

In states with immunization registries and VFC participation, vaccination coverage among incarcerated juveniles has reached levels >90% (G. Treder, Wisconsin Department of Corrections, personal communication, 2002). However, where the correctional system does not have legal guardianship of the detained juvenile, the need for parental consent can pose a barrier to vaccination. In states with laws enabling minors to consent to their own STD-related treatment and prevention, hepatitis B has been included, facilitating implementation of vaccination programs (M. Staples-Horne, M.D., Georgia Department of Juvenile Justice, personal communication, 2002).

**Adults.** Hepatitis B vaccination is recommended for adults in correctional settings because of their increased risk for infection, both inside and outside of prisons and jails (*9,33,34,100*). Vaccinating inmates in prisons has been demonstrated feasible and cost-saving from both prison and outside community perspectives (*158*) (CDC, unpublished data, 2002). Approximately 25 state correctional systems and the Federal Bureau of Prisons have implemented hepatitis B immunization programs, which vary in scope and are often limited by funding or staffing resources. System policies include immunization of 1) all incoming inmates; 2) inmates of certain ages; 3) inmates with certain lengths of sentences; 4) inmates with HCV infection; or 5) inmates who request vaccination. In certain correctional systems, inmates must pay for vaccination (*137,159*). Among inmates in three systems (in Massachusetts, Michigan, and Texas) that offer hepatitis B vaccine, 60%–80% accept vaccination (T. Lincoln, M.D., Hampden County Correctional Center, Ludlow, Massachusetts; D. Thelen, Michigan State Department of Corrections; M. Hurie, Michigan State Department of Health; and M. Kelley, M.D., Texas Department of Criminal Justice; personal communications, 2001). Successful hepatitis B vaccination programs, like other successful adult vaccination programs (e.g., influenza) include establishment of policies for vaccination and a source of payment for vaccine (*160–163*). Among states, Hawaii, Michigan, Texas, and Wisconsin have extensive experience in offering vaccine to inmates.

The Texas Department of Criminal Justice has 105 adult facilities with approximately 145,000 inmates. In 1999, funds were appropriated for hepatitis B vaccination of all offenders. A cost analysis indicated prevaccination testing would be cost-effective if prior HBV infection rates were >25%. However, a seroprevalence study identified an HBV prevalence of 17.8% and a history of vaccination among another 5.5%. Medical records are reviewed for a history of hepatitis B vaccination or evidence of HBV infection from prior clinical testing.

All inmates are offered vaccine, and the central pharmacy delivers second and third doses of vaccine to the appropriate housing units on a 0-, 2-, and 4-month vaccination schedule. Scheduled vaccine doses are listed in each inmate's medical record to serve as an additional reminder to complete the vaccination series.

In the first 18 months of the program, 115,627 previously incarcerated inmates initiated the vaccine series, and since November 2001, the program has vaccinated all inmates at

entry — an estimated 35,000/year. The estimated cost for vaccination of 121,000 inmates during the first 18 months of the program was $8 million, with an expected recurring annual cost of $2.6 million to vaccinate incoming inmates (M. Kelley, M.D., Texas Department of Criminal Justice, personal communication, 2001).

## Prevention of HCV Infection

### Strategy To Prevent HCV Infection

CDC's national strategy to prevent HCV infection includes 1) prevention of transmission during high-risk activities (e.g., injection-drug use and unprotected sex with multiple partners) through risk-reduction counseling, testing, and appropriate medical management of infected persons; 2) donor screening and product inactivation procedures to eliminate transmission from blood, blood products, donor organs, and tissue; and 3) improved infection control practices to further reduce risk of transmission during medical procedures † (*10*).

Primary prevention is directed at lowering the incidence of HCV infection. Of the estimated 25,000–40,000 persons newly infected with HCV annually during the past 5 years, approximately 60% acquired their infection through injection-drug use (*45,111*). Because no vaccine exists to prevent HCV infection, prevention must focus on risk reduction through counseling of persons who have admitted to or are at risk for illicit drug use or high-risk sexual practices. Counseling and testing to prevent HCV infection should be conducted in settings where persons at high risk are identified, including correctional health programs, and clinics that treat STDs, HIV/AIDS, and substance abuse (*10*) (Box 7).

The high prevalence of HCV infection and risk associated with HCV infection among inmates requires inclusion of HCV prevention activities in correctional settings. To be effective, risk reduction among this population often requires a multidisciplinary approach to address drug use as well as other medical, psychological, social, vocational, and legal problems (*164*).

Identification of HCV-infected persons is required to initiate secondary and tertiary prevention activities to reduce the risks for HCV transmission and chronic liver disease (*10*). Anti-HCV–positive persons require further evaluation for chronic HCV infection and liver disease, and persons with chronic hepatitis C require evaluation for possible antiviral therapy and the need for further medical management.

Persons with chronic hepatitis C are at risk for increased morbidity from additional hepatic insults. Fulminant hepatitis caused by hepatitis A can be prevented by vaccination (*50*).

† Available at http://www.cdc.gov/ncidod/diseases/hepatitis/c/plan/strategy.pdf.

**BOX 7. Persons for whom routine hepatitis C virus (HCV) testing is recommended***

**On the Basis of Risk for Infection, Persons Who**

- ever injected illegal drugs;
- received clotting factor concentrate produced before 1987;
- ever were on long-term hemodialysis;
- have evidence of chronic liver disease including persistently abnormal levels of alanine aminotransferase (ALT); or
- received a transfusion of blood or blood components or an organ transplant before July 1992.

**On the Basis of a Recognized Exposure,**

- health-care, emergency medical, public safety, and correctional workers after needle sticks, sharps, or mucosal exposure to HCV-positive blood; or
- children born to HCV-positive women.

**Source:** CDC. Recommendations for prevention and control of hepatitis C virus (HCV) infection and HCV-related chronic disease. MMWR 1998;47(No. RR-19):1–39.

* Screening testing for antibody to HCV (anti-HCV) followed by appropriate confirmatory testing for persons found to be screening test positive.

HCV-infected persons often have risk factors for HBV infection; therefore, hepatitis B vaccination is also recommended (*10*). Persons with hepatitis C should be counseled to not use alcohol, because its use (>10g/day for women and >20g/day for men) has been associated with more rapid progression to cirrhosis, which puts patients at higher risk for HCC (*10,165,166*).

Persons at risk for HCV infection or those chronically infected with HCV can benefit from health education on topics including 1) substance-abuse treatment where appropriate, 2) clean needle and syringe use, 3) risks of sharing drug paraphernalia, and 4) condom use (*10*). Counseling and educational materials should include information concerning reducing further liver damage, as well as treatment options for those with chronic liver disease. Release planning should include substance-abuse–treatment referrals for IDUs and medical referrals to specialists for future medical management and treatment (see juvenile and adult sections on health education and release planning).

### Testing for HCV Infection

Anti-HCV testing is recommended to identify infected persons. To prevent reporting of false-positive results, testing should include both an antibody screening assay (e.g., enzyme

immunoassay [EIA]) and supplemental or confirmatory testing with an additional, more specific assay (e.g., recombinant immunoblot assay [RIBA,® Chiron Corporation, Emeryville, California] for anti-HCV or nucleic acid testing for HCV RNA). These tests detect anti-HCV in ≥97% of infected patients but do not distinguish between acute, chronic, or resolved infection (*11*). Substantial variation exists among laboratories regarding the extent to which more specific testing is performed. The level of the screening test signal-to-cut–off ratio has been demonstrated to predict a true antibody-positive result. Use of the signal-to-cut–off ratio limits supplemental testing to those samples for which the ratio is low (*167*).

## Detection of HCV Infection

**Acute Hepatitis C.** Acute HCV infection is usually asymptomatic (80%). However, acute hepatitis C should be included in the differential diagnosis of inmates who have signs and symptoms of acute hepatitis (Box 2). Confirmation of acute hepatitis C requires negative test results for IgM anti-HAV and IgM anti-HBc and a positive screening test result for anti-HCV, verified by supplemental testing or a high signal-to-cut–off ratio. Among a limited number of patients, onset of symptoms may precede anti-HCV seroconversion, and follow-up antibody testing might be necessary to make the diagnosis.

Identification of an inmate with acute hepatitis C, especially a person incarcerated for >6 months, requires initiation of an epidemiologic investigation by correctional officials, in collaboration with the appropriate health authorities, to identify the source of infection. Depending upon the results, testing of contacts might be indicated.

**Chronic HCV Infection.** Anti-HCV alone does not distinguish between acute, chronic, or resolved infection. In persons testing positive for anti-HCV, chronic HCV infection can be distinguished by persistence of HCV RNA for >6 months.

## Management of HCV Infection

HCV-positive persons benefit from evaluation for the presence and severity of chronic liver disease. Antiviral therapy is recommended for persons with persistently elevated ALT levels, detectable HCV RNA, and a liver biopsy that indicates either portal or bridging fibrosis or moderate degrees of inflammation and necrosis. No clear consensus exists on whether to treat patients with persistently normal serum transaminases. Information is available on the National Institute of Health (NIH) website[§] regarding regimens with proven efficacy approved by the FDA for the treatment of chronic hepatitis C (*168*). The FDA has approved three antiviral therapies for treatment of chronic hepatitis C in persons aged >18 years: alpha interferon, pegylated interferon, and alpha or pegylated interferon in combination with ribavirin. All are administered for ≤52 weeks. Among persons with HCV genotype 1, the most common genotype in the United States, the response rate to either of the interferons administered alone is <20%, but the response rate to the combination of alpha interferon and ribavirin is 30%–40%, and to pegylated interferon and ribavirin, 40%–50%. Both the alpha and pegylated interferons are administered by injection; ribavirin is taken orally. All of these drug regimens have side effects, certain of which can be serious. Successful treatment eliminates viremia and the potentials for HCV transmission and further chronic liver disease (*168,169*).

Among persons with both HCV and HIV infection, benefits of therapy for chronic hepatitis C have only recently been evaluated. The decision to treat persons coinfected with HIV must take into consideration concurrent medications and medical conditions (e.g., hyperthyroidism, renal transplant, or autoimmune disease). If CD4 counts are normal or minimally abnormal (>500/mL), treatment responses to interferon monotherapy are similar to non-HIV–infected persons (*106,170,171*). The efficacy of ribavirin/interferon combination therapy among HIV-infected persons has been tested in only a limited number of patients. Ribavirin can have substantial interactions with other antiretroviral drugs (*168*). Each patient should be evaluated by a physician familiar with the treatment of patients with HCV infection and HIV infections when appropriate, and indications for therapy should be reassessed at regular intervals.

## Current Practices: Prevention of HCV in Correctional Settings

Testing populations with high proportions of IDUs is an efficient strategy for identifying HCV-positive persons (*10*). However, in the correctional setting, only a limited number of studies have examined willingness to be tested, treatment options, compliance, and outcomes among those offered therapy (*122,172*). In assessments of other prison screening programs (e.g., for HIV and STDs), a relatively high rate (approximately 50%) of refusal has been reported (*173–175*).

Limited data from studies in Rhode Island and Pennsylvania indicate approximately 7%–27% of all inmates identified with HCV infection ultimately begin treatment (*122,172*; F. Maue, M.D., Pennsylvania State Department of Corrections, personal communication, 2001). The majority of inmates were excluded from treatment because of clinical contraindications, short lengths of prison stay, and drug or alcohol use (*122,172*; F. Maue, M.D., Pennsylvania State Department of Corrections, personal communication, 2001).

[§]Available at http://www.niddk.nih.gov/health/digest/pubs/chrnhepc/chrnhepc.htm.

Less-restrictive criteria might increase the number of inmates eligible for treatment (*168*). However, factors contributing to acceptance and completion of treatment regimens need to be identified to improve outcomes.

## Health Education

Health education directed toward prevention of viral hepatitis includes information related to the disease, routes of transmission, risk factors for infection, methods of prevention, disease outcomes, and treatment options. During incarceration, numerous educational opportunities exist (e.g., at entry, or in HIV-education and other classes). Education can take different forms, including videos, brochures, and formal classroom presentations. However, repeated face-to-face sessions have been determined the most effective means with the highest retention (Box 8) (*176–178*). Model programs use peer health educators in workshops for incoming inmates, and community educators to discuss risk assessment, risk reduction, and referrals for soon-to-be released inmates.[¶]

Health education programs aimed at reducing risk of infection with hepatitis viruses include discussion of hepatitis A prevention, hygiene practices, and the significance of vaccination for persons at risk for infection. Curricula addressing HBV and HCV infections include information concerning the similar modes of transmission and means for prevention, and information about hepatitis B vaccination and risk reduction. Such information can also be incorporated into health-education programs for the prevention of HIV/AIDS.

[¶] Available at http://www.hepprograms.org.

**BOX 8. Elements of viral hepatitis health education**

**Health Education Programs and Curricula Should Include**

- routes of transmission;
- risk factors for infection;
- disease outcomes, the need for medical management and treatment options;
- methods to prevent infection, including immunization and harm and risk reduction;
- the importance of substance abuse treatment, when appropriate;
- sexual precautions including abstinence counseling and condom use;
- risk-reduction counseling, including not sharing drug paraphernalia; and
- resources in the community available to support and sustain a reduction in risk behaviors.

## Release Planning

Release planning is a relatively new component of health-care management for incarcerated persons. The majority of medical release and discharge planning programs in prison facilities have focused on HIV aftercare (*179,180*), but management of other chronic infections can result in the same beneficial outcomes.

Comprehensive release planning includes transitional housing, continued access to discharge medications and immunizations, and coordination and case-management of long-term specialized care for persons with chronic conditions. Persons diagnosed with chronic HBV infection can benefit from counseling related to preventing transmission to household, sexual, and drug-use contacts. Susceptible contacts of persons diagnosed with chronic HBV infection benefit from hepatitis B vaccination. Persons with chronic hepatitis B or chronic hepatitis C can benefit from 1) counseling regarding ways to reduce further liver damage, 2) referrals to substance-abuse–treatment and other IDU programs if indicated, and 3) medical referrals to specialists for future treatment.

# Rationale for Prevention and Control of Viral Hepatitis in Correctional Settings

The high prevalence of chronic HBV and HCV infections and risk factors for their transmission make prevention and control of these infections high priorities for correctional health programs. In addition, because a substantial proportion of releasees to the community continue to acquire or transmit these infections at a high rate, correctional efforts should become part of prevention and control efforts in the broader community.

Highly effective and safe vaccines are available to prevent HAV and HBV infections. Identification of risk factors and infection status, combined with harm- and risk-reduction counseling, and substance-abuse treatment, have the potential to prevent HCV infections in the same manner they have reduced the risk of HIV/AIDS. In addition, identification of persons with chronic HBV and HCV infection provides opportunities for medical evaluation and treatment of chronic liver disease, and measures to prevent further transmission.

The feasibility of including viral hepatitis prevention activities in existing prevention programs has been demonstrated. However, the challenges to integration of a comprehensive viral hepatitis prevention and control program in correctional health settings are substantial. They include budgetary and staffing constraints, priorities that compete with preventive health care,

and lack of communication among correctional health, public health, and private health-care systems.

The recommendations for prevention and control of viral hepatitis that follow are adapted to the correctional setting. The objective of these recommendations is to reduce transmission of hepatitis virus infections both during and after incarceration. Implementation of these recommendations can 1) reduce transmission of HAV infection in the community by immunizing incarcerated persons at highest risk for infection; 2) eliminate transmission of HBV infection among the inmate population through immunization; 3) reduce the number of new HCV infections by testing, harm- and risk-reduction counseling, and substance-abuse treatment and prevention; 4) reduce the burden of viral hepatitis-related chronic liver disease through appropriate medical management; and 5) prevent HBV and HCV infections among correctional employees.

## Rating the Recommendations

The following recommendations are rated, where applicable, on the basis of the strength of evidence indicating changes in outcomes attributable to the interventions. Where formal recommendations previously have been published, they are cited as supporting evidence and can be referred to for the original studies. Ratings have been assigned by using a modification of criteria published by the Guide to Community Preventive Services (*181*). No rating was assigned to a recommendation considered standard practice (i.e., a medical or administrative practice conducted routinely by qualified persons experienced in their fields).

- Strongly recommended (on the basis of >2 consistent, well-conceived, well-executed studies with control groups or longitudinal measurements).
- Recommended (on the basis of >1 well-conceived, well-executed, controlled, or time-series study; or >3 studies with more limited execution).
- Indicated (on the basis of previous scientific observation and theoretic rationale, but case-controlled or prospective studies do not exist).
- Not recommended (on the basis of published literature recommending against a practice).

## Recommendations for Juvenile Correctional Facilities — Hepatitis A Virus Infection

- Hepatitis A vaccination should be administered to all juveniles in those states where routine vaccination is recommended (Box 1) (*11*). Strongly recommended.
- In all other states, hepatitis A vaccination of all juveniles should be considered because of the high prevalence of risk factors for HAV infection among this population (*11*). Indicated.
- Vaccination should be administered to those juveniles with risk factors for HAV infection (Box 1) or for those at risk for severe adverse outcomes of infection (e.g., persons with chronic liver disease) (*11,57*). Strongly recommended.
- Vaccination should be initiated as soon as possible after entry into incarceration or detention using the appropriate dosage and schedule (standard practice) (Table 3).
- Tracking systems to ensure completion of vaccine series within the correctional system should be established, and systems should be established to facilitate completion of the vaccine series in the community (standard practice).
- Vaccination information, including date of administration, dose, and manufacturer should be included in the medical record, and an immunization record should be given to juvenile, or their parents or guardians, upon release (standard practice).
- Routine screening or prevaccination testing of juveniles for markers of HAV infection should not be conducted (*11*). Not recommended.
- Prevaccination testing should be considered for older adolescents (e.g., >15 years) in certain population groups (i.e., American Indians, Alaska Natives, and Hispanics) because of higher prevalence of infection or previous infection (*11*). Indicated.
- Juveniles with signs or symptoms indicative of acute hepatitis should have appropriate diagnostic testing to differentiate acute hepatitis A, hepatitis B, or hepatitis C and to

**TABLE 3. Hepatitis A vaccination dosages and schedule**

| Vaccine and recipient ages (yrs) | Dose | Volume (mL) | No. of doses | Schedule (mos) |
|---|---|---|---|---|
| Havrix®* | | | | |
| 2–18 | 720 EL.U.† | 0.5 | 2 | 0 and 6–12 |
| >18 | 1,440 EL.U.† | 1.0 | 2 | 0 and 6–12 |
| VAQTA®§ | | | | |
| 2–18 | 25 U | 0.5 | 2 | 0 and 6–18 |
| >18 | 50 U | 1.0 | 2 | 0 and 6 |
| Twinrix®¶** | | | | |
| >17 | 720 EL.U.† | 1.0 | 3 | 0, 1, and 6 |

**Sources:** CDC. Notice to readers: FDA approval for a combined hepatitis A and B vaccine. MMWR 2001;50:806–7. CDC. Prevention of hepatitis A through active or passive immunization—recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48 (No. RR–12):1–37.

* Manufactured by GlaxoSmithKline Biologicals, Rixensart, Belgium.
† Enzyme-linked immunosorbent assay (ELISA) units.
§ Manufactured by Merck & Co. Inc., Whitehouse Station, New Jersey.
¶ Manufactured by GlaxoSmithKline Biologicals, Rixensart, Belgium.
** Twinrix also contains hepatitis B vaccine antigen.

determine if the patients have chronic HBV or HCV infection (Box 2) (standard practice).

— Cases of acute hepatitis A should be reported to the appropriate public health jurisdiction (e.g., county or state health department) (standard practice).

— Identification of a case of hepatitis A in a correctional facility should prompt an epidemiologic investigation by correctional officials, in collaboration with the appropriate health authorities, to identify the source of infection and contacts who might have been exposed (standard practice).

— Unvaccinated close contacts of a confirmed case of hepatitis A should be administered postexposure prophylaxis with 1 dose of IG (0.02 mL/kg body weight, intramuscular) as soon as possible, but not >2 weeks after the last exposure. If the contact has indications for hepatitis A vaccination, vaccine should be administered either at the same or a later time (Box 3) (*11*). Strongly recommended.

## Recommendations for Juvenile Correctional Facilities — Hepatitis B Virus Infection

### Preventing Perinatal HBV Infection

- All pregnant incarcerated juveniles should be tested for HBsAg after their pregnancy is recognized, even if previously vaccinated or tested. Because of the high risk of HBV infection among this population, testing should be performed even if the female was tested before incarceration. The HBsAg status of incarcerated pregnant juveniles should be reported to the hospital where the juvenile will deliver her infant, along with other prenatal medical information. HBsAg-positive females should also be reported to the appropriate public health authority (*9*). Strongly recommended.
- Infants born to HBsAg-positive mothers should receive HBIG (0.5 mL) and the first dose of hepatitis B vaccine ≤12 hours of birth (Table 4) (*9*). Strongly recommended.
- Females admitted for delivery without HBsAg test results should have blood drawn for testing. While test results are pending, the infant should receive hepatitis B vaccine without HBIG within 12 hours of birth (Table 4) (standard practice).
  — If the mother is later determined to be HBsAg-positive, her infant should receive HBIG as soon as possible, but ≤7 days after birth. If the infant does not receive HBIG, the second dose of vaccine should be administered at 1 month of age. The final dose should be administered at age 6 months (Table 4) (*9*). Strongly recommended.
  — If the mother is determined to be HBsAg-negative, her infant should continue to receive hepatitis B vaccine as part of the routine vaccination schedule (Table 4) (*9*). Strongly recommended.
  — If the mother is never tested to determine her HBsAg status, the infant should continue to receive hepatitis B vaccine as part of the routine vaccination schedule (Table 4) (*9*). Strongly recommended.
- Case management should be established to ensure appropriate postexposure prophylaxis and follow-up for children born to incarcerated or recently released HBsAg-positive mothers, including completion of the vaccine series at age 6 months and postvaccination testing during ages 9–15 months (*9,182*). Recommended.
- Infants born to HBsAg-negative mothers should receive the first dose of hepatitis B vaccine before release from the hospital (*9,142,143*). Strongly recommended.

**TABLE 4. Recommended dosages of licensed hepatitis B vaccines**

| | Recombivax HB®*† | | Engerix-B®*§ | | Twinrix®¶ | |
|---|---|---|---|---|---|---|
| Age group (yrs) | µg | mL | µg | mL | µg | mL |
| Persons ≤19 (including infants born to HBsAg mothers) | 5 | 0.5 | 10 | 0.5 | — | — |
| Persons 11–15 | 10 | 1.0** | — | — | — | — |
| Persons ≥20 | 10 | 1.0 | 20 | 1.0 | 20†† | 1.0 |
| Dialysis patients and other immunocompromised persons | 40 | 1.0§§ | 40 | 2.0¶¶ | — | — |

* Both vaccines are routinely administered in a 3-dose series, which includes schedules of 0, 1, and 6 months; 0, 2, and 4 months; 0, 2, and 6 months; and, for adolescents, 0, 12, and 24 months.

† Manufactured by Merck & Co. Inc., Whitehouse Station, New Jersey.

§ Manufactured by GlaxoSmithKline Biologicals, Rixensart, Belgium.

¶ Manufactured by GlaxoSmithKline Biologicals, Rixensart, Belgium.

** Administered in a 2-dose schedule at 0 and 4–6 months.

†† Twinrix is only licensed for persons aged >17 years, and contains both hepatitis A and hepatitis B vaccine antigens administered as a 3-dose schedule.

§§ Special formulation.

¶¶ Two 1.0-mL doses administered at one site, in a 4-dose schedule at 0, 1, 2, and 6 months.

- Previously unvaccinated HBsAg-negative pregnant juveniles should be vaccinated; pregnancy is not a contraindication to vaccination (*9,183–185*). Strongly recommended.
- Discharge planning for pregnant HBsAg-positive juveniles should include transfer of appropriate medical records to the hospital where the juvenile plans to deliver her infant, along with other prenatal medical information. Test results should also be provided to the patient and her parent or guardian (standard practice).

## Hepatitis B Vaccination

### Preexposure

- All juveniles who receive a medical evaluation in a correctional facility should be administered hepatitis B vaccine, unless they have proof of completion of the vaccine series or serologic evidence of immunity to infection. The vaccine series should be started for those juveniles who have never been vaccinated, irrespective of their length of stay, and the series should be completed for those incompletely immunized (*9,142,143,186,187*). Strongly recommended.
  - — For juveniles who do not receive medical evaluation upon entry into correctional custody, vaccination should be considered for those who lack proof of previous vaccination (*125*) (standard practice).
  - — Catch-up vaccination of previously unvaccinated, already incarcerated juveniles should be considered in facilities in which routine hepatitis B vaccination of entering inmates is established (*33*) (standard practice).
- An appropriate vaccination dose and schedule should be selected to facilitate completion of the vaccine series while the juvenile is in custody. For previously unvaccinated juveniles held in a correctional facility for <6 months, the vaccine series should be initiated and completed by using a 4-month schedule (0, 1–2, and 4 months) (Table 4) (*186–189*). Recommended.
- Vaccination information, including date of administration, dose, and manufacturer should be included in the medical record, and an immunization record should be given to juveniles, or to their parents or guardians, upon release (standard practice).
- Discharge planning should include transfer of immunization records to the person's medical home to ensure completion of the vaccine series for those juveniles not fully vaccinated while in the correctional facility, and for all fully vaccinated persons as well (standard practice).

### Prevaccination and Postvaccination Testing

- Prevaccination serologic testing is not indicated (*148*). Indicated.
  - — As hepatitis B vaccination coverage among adolescents increases, validation of immunization records or serologic testing might become a cost-effective means to minimize overvaccination. Indicated.
  - — Knowledge of state middle school hepatitis B vaccination requirements and performance of periodic vaccine coverage serologic surveys to determine the proportion of vaccinated or immune adolescents entering juvenile facilities should be used to define prevaccination screening policies (e.g., history or serologic testing) and the need for hepatitis B immunization among specific age groups (standard practice).
- Postvaccination testing should not be conducted for healthy juveniles (*9,142,143,190*). Not recommended.
- For juveniles with special conditions (e.g., immunocompromised or HIV-infected), postvaccination testing for anti-HBs should be conducted 1–2 months after completion of the vaccine series. Nonresponders in this category should be revaccinated (*149,150*). Strongly recommended.

### Postexposure Prophylaxis

- After any percutaneous exposure (e.g., sharing injection-drug equipment or human bite) or mucosal exposure (e.g., sexual) to blood, unvaccinated juveniles should begin the vaccine series, and the exposure incident should be evaluated to determine if additional postexposure prophylaxis (i.e., HBIG) is required (Table 5) (*9,47*). Strongly recommended.
  - — The first dose of hepatitis B vaccine should be administered immediately, and the remaining doses, 1 and 6 months later (standard practice).
  - — For an exposed juvenile who has begun but not completed the vaccine series, subsequent vaccine doses should be administered as scheduled (standard practice).
  - — The person who was the source of the exposure should be tested for HBsAg, even if this person was previously vaccinated. If the source person is HBsAg-positive, HBIG should be administered to the exposed person as soon as possible and ≤7 days after the exposure (standard practice).
  - — Postexposure prophylaxis is not necessary for a fully vaccinated juvenile after exposure to HBV (*9,47*). Not recommended.

**TABLE 5. Postexposure prophylaxis for exposure to hepatitis B virus**

| Vaccination and antibody response status of exposed person* | Treatment when source is found to be | | |
|---|---|---|---|
| | Positive | Negative | Unknown or not available for testing |
| Unvaccinated | HBIG† x 1, and initiate HB vaccine series§ | Initiate HB vaccine series | Initiate HB vaccine series |
| Previously vaccinated | | | |
| Known responder¶ | No treatment | No treatment | No treatment |
| Known nonresponder** | HBIG x 2, or HBIG x 1 and initiate re-vaccination†† | No treatment | If known high-risk source, treat as if source were HBsAg§§ positive. |
| Antibody response unknown | Test exposed person for anti-HBs¶¶<br>1. If adequate, no treatment is necessary.¶<br>2. If inadequate, administer HBIG x 1 and vaccine booster, recheck anti-HBs level in 1 month. | No treatment | Test exposed person for anti-HBs¶¶<br>1. If adequate, no treatment is necessary.¶<br>2. If inadequate, administer HBIG x 1 and vaccine booster, recheck anti-HBs level in 1 month. |

**Source:** CDC. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. MMWR 2001;50 (No. RR-11):1–52.

* Persons who have previously been infected with HBV are immune to reinfection and do not require postexposure prophylaxis.
† Hepatitis B immune globulin; dose is 0.06 mL/kg body weight intramuscularly.
§ Hepatitis B vaccine.
¶ A responder is a person with adequate levels of serum antibody to HBsAg (i.e., anti-HBs ≥10 mIU/mL).
** A nonresponder is a person with inadequate response to vaccination (i.e., anti-HBs <10 mIU/mL).
†† The option of administering one dose of HBIG and reinitiating the vaccine series is preferred for nonresponders who have not completed a second 3-dose vaccine series. For persons who previously completed a second vaccine series but failed to respond, 2 doses of HBIG are preferred.
§§ Hepatitis B surface antigen.
¶¶ Antibody to HBsAg.

## Serologic Testing for Hepatitis B Virus Infection

- Routine testing of juveniles for markers of HBV infection (e.g., HBsAg, anti-HBs, anti-HBc) is not recommended (*5,76,81,148,191*). Not recommended.
- Juveniles with signs or symptoms indicative of viral hepatitis should have appropriate diagnostic testing to differentiate acute hepatitis A, hepatitis B, or hepatitis C and to determine if the patient has chronic HBV or HCV infection (Box 2) (standard practice).
  - — Cases of acute hepatitis B should be reported to the appropriate public health authority (standard practice).
  - — Cases of chronic HBV infection should be reported in those states that require reporting (standard practice).
- Identification of a case of acute hepatitis B should prompt an epidemiologic investigation by correctional officials, in collaboration with the appropriate health authorities, to identify the source of infection and provide appropriate postexposure prophylaxis (Table 5) (Box 6) to nonimmunized contacts at risk for infection (standard practice).

## Chronic Hepatitis B Treatment

- Juveniles identified as having, or who are known to have chronic HBV infection during routine medical screening should be evaluated to determine the presence and extent of chronic liver disease and candidacy for antiviral therapy (*64,192,193*). Recommended.
  - — Lamivudine can be used to treat patients aged >2 years.
  - — The safety and efficacy of interferon and adefovir in pediatric patients has not been established.
  - — Treatment of patients with chronic hepatitis B should be conducted in consultation with a pediatric specialist experienced with these treatment regimens.
- All long-term correctional facilities should establish criteria for identification of inmates who might benefit from treatment, on the basis of the latest treatment guidelines (standard practice).
- Discharge planning for persons with chronic HBV infection should include referral to medical care, risk-reduction programs, and social services necessary to maintain behavior changes; vaccination of contacts should also be arranged before patient discharge (standard practice).

# Recommendations for Juvenile Correctional Facilities — Hepatitis C Virus Infection

## Testing for Hepatitis C Virus Infection

- A history of risk factors for HCV infection should be obtained from juveniles undergoing medical evaluations, and those with risk factors should be tested for anti-HCV

(Box 7). Routine testing of all juveniles for anti-HCV should not be conducted (*10*). Not recommended.
- Juveniles with signs or symptoms indicative of viral hepatitis should have appropriate diagnostic testing to differentiate acute hepatitis A, hepatitis B, or hepatitis C and to determine if the patient has chronic HBV or HCV infection (Box 2) (standard practice).
- Cases of acute hepatitis C should be reported to the appropriate public health authority (standard practice).
- Anti-HCV–positive persons should be reported if required by state laws or regulations (standard practice).
- Identification of juveniles with acute hepatitis C, including those incarcerated for >6 months, should prompt an epidemiologic investigation by correctional officials, in collaboration with the appropriate health authorities, to identify the source of the infection. Depending on the results of the investigation, testing of contacts might be indicated (Box 7) (standard practice).
- Juveniles who are anti-HCV–positive should receive further medical evaluation to determine if they are chronically infected (Box 2) (standard practice).

## Postexposure Management for HCV

- After a percutaneous or permucosal exposure to blood, the source person should be tested for anti-HCV. If the source person is anti-HCV–positive, the exposed person should be tested for anti-HCV and ALT activity at baseline and 4–6 months later. For earlier diagnosis, testing for HCV RNA can be performed in 4–6 weeks (*10*). Recommended.
- IG and antiviral agents are not recommended for postexposure prophylaxis of hepatitis C (*10*). Not recommended.

## Chronic Hepatitis C Treatment

- Juveniles identified as having chronic HCV infection should be evaluated to determine the presence and extent of chronic liver disease. FDA-approved antiviral agents for treatment of hepatitis C are not indicated for persons aged <18 years, although participation in clinical trials might be possible. Although HCV infection in juveniles can result in less severe disease, infected juveniles should be monitored by a specialist familiar with this disease. Discharge planning should also include drug and alcohol abuse treatment, risk-reduction programs, and social services necessary to maintain behavior changes (standard practice).
- Juveniles with chronic hepatitis C should receive hepatitis B vaccination and hepatitis A vaccination if not previously immunized or known to be susceptible to infection (*9–11,50*). Recommended.

# Juvenile Health Education and Release Planning

- Prevention of HAV, HBV, and HCV infections should be incorporated into health education programs (e.g., programs for preventing HIV/AIDS) and include information concerning modes of disease transmission and means for prevention, including risk-reduction and immunization (Box 8) (*17,177*). Indicated.
- An integrated health education and risk reduction program should be established in each facility and include a written plan of health instruction completed by each inmate (standard practice).
- Such instruction should address a range of issues relevant to the diverse developmental and cultural composition of correctional populations, and should include basic skill development, literacy, and home economics, as well as tools needed to avoid behaviors that result in acquisition of HIV, hepatitis, and other bloodborne and sexually transmitted infections (standard practice).
- Teachers should be trained professionals or inmate peers with specific training to teach comprehensive life-skills programs, including health education (standard practice).
- A system for periodic evaluation, updating and improvement should exist (standard practice).
- Documentation of hepatitis A or hepatitis B vaccination should be included in the medical record retained within the correctional system, as well as in any medical record provided to other health-care providers. In addition, vaccinated persons or their parents or guardians should be provided a personal immunization record (standard practice).
- Juvenile correctional health facilities should establish links with community and public health facilities, and where available, with immunization registries, to ensure tracking and completion of hepatitis A and hepatitis B vaccine series (standard practice).
- Juveniles with chronic HBV or HCV infection should be
  - counseled, along with their parent or guardian, regarding preventing transmission to household, sexual, and drug-use contacts;
  - provided referral for hepatitis B vaccination of contacts;
  - counseled regarding ways to reduce further liver damage, including limiting alcohol and drug use, and afforded substance-abuse treatment when appropriate; and

— provided aftercare that includes medical follow-up (standard practices).

## Recommendations for Adult Correctional Facilities — Hepatitis A Virus Infection

- Hepatitis A vaccination should be administered to adults in groups at risk for HAV infection (e.g., MSM or drug users) or who are likely to experience severe adverse outcomes of infection (e.g., persons with chronic liver disease) (Box 1) (*11*). Strongly recommended.
- For persons at risk, the vaccination series should be initiated as soon as possible after incarceration using the appropriate dosage and schedule (Table 3). Tracking systems to ensure completion of the vaccine series within the correctional system should be established, and systems should be developed to facilitate completion of the second vaccine dose for those inmates who return to the community (*11*). Strongly recommended.
- Prevaccination serologic testing to identify susceptible persons should be considered if determined to be cost-effective (Box 5), and it does not compromise initiation of vaccination. Inmates aged >40 years and those from regions of high endemicity (see Appendix) should be considered for prevaccination testing because of the high prevalence of past HAV infection among these groups (*11*). Indicated.
- Routine screening of adults for anti-HAV should not be conducted, except when used to identify susceptible persons for vaccination (*11*). Not recommended.
- Vaccination information, including date of administration, dose, and manufacturer should be included in the medical record, and an immunization record should be given to the inmate upon release (standard practice).
- Adults with signs or symptoms indicative of acute hepatitis should have appropriate diagnostic testing to differentiate acute hepatitis A, hepatitis B, or hepatitis C, and to determine if the patient has chronic HBV or HCV infection (Box 2) (standard practice).
  - — Cases of hepatitis A should be reported to the appropriate public health authority (standard practice).
  - — Identification of a case of hepatitis A in a correctional facility should prompt an epidemiologic investigation by correctional officials, in collaboration with the appropriate health authorities, to identify the source of infection and contacts that might have been exposed (standard practice).
  - — Unvaccinated or known susceptible close contacts of a confirmed case of hepatitis A should be administered postexposure prophylaxis with a single dose of IG (0.02 mL/kg body weight, intramuscular) as soon as possible, but not >2 weeks after the last exposure (Box 3) (*11*). Strongly recommended.

## Recommendations for Adult Correctional Facilities — Hepatitis B Virus Infection

### Preventing Perinatal HBV Infection

- All pregnant women should be tested for HBsAg after their pregnancy is recognized, even if previously vaccinated or tested. Because of the high risk for HBV infection among this incarcerated population, testing should be performed even if the woman was tested before incarceration. The HBsAg status of a pregnant woman should be reported to the hospital where she will deliver her infant, along with other prenatal medical information. HBsAg-positive women should also be reported to the appropriate public health authority (*9*). Strongly recommended.
- Infants born to HBsAg-positive mothers should receive HBIG (0.5 mL) and the first dose of hepatitis B vaccine ≤12 hours after birth (Table 4) (*9*). Strongly recommended.
- Females admitted for delivery without HBsAg test results should have blood drawn for testing. While test results are pending, the infant should receive hepatitis B vaccine without HBIG within 12 hours of birth (Table 4) (standard practice).
  - — If the mother is later determined to be HBsAg-positive, her infant should receive HBIG as soon as possible, but ≤7 days after birth. If the infant does not receive HBIG, the second dose of vaccine should be administered at 1 month of age. The final dose should be given at age 6 months (Table 4). Strongly recommended.
  - — If the mother is determined to be HBsAg-negative, her infant should continue to receive hepatitis B vaccine as part of the routine vaccination schedule (Table 4). Strongly recommended.
  - — If the mother is never tested to determine her HBsAg status, the infant should continue to receive hepatitis B vaccine as part of the routine vaccination schedule (Table 4). Strongly recommended.
- Case management should be established to ensure appropriate postexposure prophylaxis and follow-up for chil-

dren born to incarcerated or recently released HBsAg-positive mothers, including completion of the vaccine series at age 6 months and postvaccination testing during ages 9–15 months (*9,182*). Recommended.
- Infants born to HBsAg-negative mothers should receive the first dose of hepatitis B vaccine before release from the hospital (9,130). Strongly recommended.
- Previously unvaccinated HBsAg-negative pregnant women should be vaccinated; pregnancy is not a contraindication to vaccination (*9,183–185*). Strongly recommended.
- Discharge planning for pregnant HBsAg-positive women should include transfer of appropriate medical records to the hospital where the woman plans to deliver her infant, along with other prenatal medical information. Test results should also be provided to the patient (standard practice).

## Hepatitis B Vaccination

### Preexposure

- All adults who receive a medical evaluation in a correctional facility should be administered hepatitis B vaccine, unless they have proof of completion of the vaccine series or serologic evidence of immunity to infection. The vaccine series should be started for those who have never been vaccinated, irrespective of the length of their stay, and the series should be completed for those incompletely immunized (*9,142,143,190*). Strongly recommended.
  - — For persons who did not receive medical evaluation upon entry into correctional custody, vaccination should be considered for those who lack proof of previous vaccination or immunity (*9,142,143*). Recommended.
  - — Catch-up vaccination of already incarcerated, previously unvaccinated persons, or persons known to be susceptible to infection, should be considered in facilities in which routine hepatitis B vaccination of entering inmates is being established. Priority should be given to vaccination of contacts of known HBsAg-positive persons (e.g., cellmates or persons living in the same cell block or dormitory) (*33,101,102*). Recommended.
- An appropriate vaccination dose and schedule should be selected to facilitate completion of the vaccine series while the person is in custody. For previously unvaccinated persons held in a correctional facility for <6 months, the vaccine series should be initiated and completed by using a 4-month schedule (0, 1–2, and 4 months) (Table 4) (*186–189*). Recommended.
- Vaccination information, including date of administration, dose, and manufacturer should be included in the medical record, and an immunization record should be given to the incarcerated person upon release (standard practice).
- Discharge planning should include transfer of immunization records to the person's medical home to ensure completion of the vaccine series for persons not fully vaccinated while in the correctional facility, and for all fully vaccinated persons as well (standard practice).

### Prevaccination and Postvaccination Testing

- Prevaccination serologic testing should be considered for adult incarcerated populations and is likely to be cost-effective when the prevalence of immunity from prior infection and vaccination exceeds 25%–30% (Box 5) (*148*). Indicated.
  - — To assist correctional facilities in determining whether to conduct prevaccination testing, periodic serologic surveys of incoming inmates can be used to determine the prevalence of markers of immunity to HBV infection (standard practice).
  - — Testing for anti-HBs provides the best measure of immunity to HBV infection, because it detects infection or vaccine-induced immunity (standard practice).
  - — When prevaccination testing is done, the first dose of vaccine should be administered at the same time the blood sample is obtained to ensure optimal vaccination coverage (Box 5) (*9*). Recommended.
- Postvaccination testing is not indicated for healthy adults (*9,142,143*). Not recommended.
- For persons with special conditions (e.g., immunodeficiency, HIV infection, or chronic hemodialysis), or who are likely to be exposed to HBV (e.g., sex partner of HBsAg-positive person or health-care worker), postvaccination testing for anti-HBs is recommended 1–2 months after completion of the vaccination series. Nonresponders in this category should be revaccinated (*149,150*). Strongly recommended.

### Postexposure Prophylaxis

- After any percutaneous (e.g., sharing injection-drug equipment or human bite) or mucosal (e.g., sexual) exposure to blood, an unvaccinated person should begin the vaccine series, and the exposure incident should be evaluated to determine if additional postexposure prophylaxis (i.e., HBIG) is required (Table 5) (*9,47*). Strongly recommended.

— The first dose of hepatitis B vaccine should be administered immediately, and the remaining doses 1 and 6 months later (Table 4) (standard practice).
— For an exposed person who has begun but not completed the vaccine series, subsequent vaccine doses should be administered as scheduled (standard practice).
— The person who was the source of the exposure should be tested for HBsAg, even if that person was previously vaccinated. If the source person is HBsAg-positive, HBIG (0.06 mL/kg body weight intramuscular) should be administered to the exposed person as soon as possible and ≤7 days after the exposure (standard practice).
— Postexposure prophylaxis is not necessary for a fully vaccinated person after exposure to HBV (*9,47,138*). Not recommended.

## Serologic Testing for Hepatitis B Virus Infection

- Correctional facilities should consider routine testing of long-term inmates for chronic HBV infection (Box 2, Table 2), to facilitate rapid vaccination of contacts, direct counseling for preventing secondary transmission, and ensure medical evaluation of infected persons. If routine testing is not performed, testing should be considered for inmates in groups with risk factors for chronic HBV infection (e.g., injection-drug use, MSM or foreign-born persons from countries with high rate of infection). Indicated.
- Residents of any facility with signs or symptoms indicative of viral hepatitis should have appropriate diagnostic testing to differentiate acute hepatitis A, hepatitis B, and hepatitis C and to determine if the patient has chronic HBV or HCV infection (Box 2) (standard practice).
  — Cases of acute hepatitis B should be reported to the appropriate public health authority (standard practice).
  — If an inmate is identified as having chronic HBV infection, the case should be reported in those states where reporting is required (standard practice).
  — Identification of acute hepatitis B should prompt an epidemiologic investigation by correctional officials, in collaboration with the appropriate health authorities, to identify the source of infection and provide appropriate postexposure prophylaxis (Box 6, Table 4) to nonimmunized contacts at risk for infection (standard practice).
  — Persons diagnosed with acute hepatitis B should be observed for progressive liver dysfunction and evidence of acute liver failure (standard practice).

## Chronic Hepatitis B Treatment

- Inmates identified as having chronic HBV infection during medical screening should be evaluated to determine the presence and extent of chronic liver disease and the potential benefit of antiviral therapy. Therapies for treatment of hepatitis B include interferon, alpha, lamivudine, and adefovir. Treatment of patients with chronic hepatitis B should be conducted in consultation with a specialist experienced with these treatment regimens (standard practice).
- All long-term correctional facilities should establish criteria for identifying prisoners who might benefit from treatment, on the basis of the latest treatment guidelines (standard practice).
- Discharge planning for persons with chronic HBV infection should include referral to medical care, risk-reduction programs, and social services necessary to maintain behavior changes; vaccination of contacts should also be arranged before patient discharge (standard practice).

# Recommendations for Adult Correctional Facilities — Hepatitis C Virus Infection

## Testing for Hepatitis C Virus Infection

- All inmates should be asked questions regarding risk factors for HCV infection during their entry medical evaluations, and all inmates reporting risk factors for HCV infection should be tested for anti-HCV (Box 7) (*10*; J. Pfister, M.S., Wisconsin State Laboratory of Hygiene; T. Lincoln, M.D., Hampden County Correctional Center, Ludlow, Massachusetts; personal communications; 2001). Recommended.
- The sensitivity of risk factor-based screening should be periodically determined by seroprevalence surveys, in combination with ascertainment of demographic and risk-factor information. Serologic testing of expanded groups of inmates or all inmates is recommended when
  — self-reported history of risk factors alone identifies <75% of anti-HCV positive inmates; or
  — the prevalence of risk factors for HCV infection, including injection-drug use, is known to be high (>75%), and a high prevalence exists (>20%) of HCV infection among inmates who deny risk factors (standard practices).
- Anti-HCV–positive persons should be reported if required by state regulations (standard practice).

- Adults with signs or symptoms indicative of viral hepatitis should have appropriate diagnostic testing to differentiate acute hepatitis A, hepatitis B, or hepatitis C and to determine if the patient has chronic HBV or HCV infection (Box 2) (standard practice).
  - — Cases of acute hepatitis C should be reported to the appropriate public health authority (standard practice).
  - — Identification of an inmate with acute hepatitis C, including ones who have been incarcerated for >6 months, should prompt an epidemiologic investigation by correctional officials, in collaboration with the appropriate health authorities, to identify the source of the infection. Depending on the results of the investigation, testing of contacts might be indicated (Box 7) (standard practice).
- Adults who test positive for anti-HCV should receive further medical evaluation to determine chronic infection and liver disease (standard practice).

## Postexposure Management for HCV

- After a percutaneous or permucosal exposure to blood, the source person should be tested for anti-HCV. If the source person is anti-HCV–positive, the exposed person should be tested for anti-HCV and ALT activity at baseline and 4–6 months later. For earlier diagnosis, testing for HCV RNA can be performed at 4–6 weeks (*10*). Recommended.
- IG and antiviral agents are not recommended for postexposure prophylaxis of hepatitis C (*10*). Not recommended.

## Chronic Hepatitis C Treatment

- All anti-HCV–positive inmates should be evaluated for evidence of chronic HCV infection, including the presence and extent of chronic liver disease and candidacy for antiviral therapy. Treatment of patients with chronic hepatitis C should be conducted in consultation with a specialist familiar with these treatment regimens (standard practice).
- Inmates with chronic hepatitis C should receive hepatitis B vaccination and hepatitis A vaccination if not previously immunized or known to be susceptible to infection (*9–11,50*). Recommended.
- Correctional facilities or systems should establish criteria based on the latest treatment guidelines for the identification of prisoners who might benefit from antiviral treatment. For HCV-infected patients who are actively abusing substances (e.g., drugs or alcohol), appropriate substance-abuse treatment should be initiated to limit disease transmission, reinfection, and liver disease progression (*10,168,194–197*). Recommended.

## Adult Health Education and Release Planning

- Prevention of HAV, HBV, and HCV infection should be incorporated into health education programs (e.g., programs for preventing HIV/AIDS) and include information concerning modes of disease transmission, methods for prevention, including risk reduction and immunization, disease outcomes, and options for treatment (Box 8) (*176,177*). Indicated.
- An integrated health education and risk reduction program should be established in each facility and include a written plan of health instruction completed by each inmate (standard practice).
- Such instruction should address a range of issues relevant to the diverse developmental and cultural composition of correctional populations, and should include basic skill development, literacy, and home economics, as well as tools needed to avoid behaviors that result in acquisition of HIV, hepatitis, and other bloodborne and sexually transmitted infections (standard practice).
- Teachers should be trained professionals or inmate peers with specific training to teach comprehensive life-skills programs, including health education (standard practice).
- A system for periodic evaluation, updating and improvement should exist (standard practice).
- Documentation of hepatitis A or hepatitis B vaccination should be included in the medical record retained within the correctional system, as well as in any medical record provided to other health-care providers. In addition, the vaccinated person should be provided a personal immunization record (standard practice).
- Correctional health facilities should establish links with community and public health facilities, and where available, with immunization registries, to ensure tracking and completion of hepatitis A and hepatitis B vaccine series (standard practice).
- Persons with chronic HBV or HCV infection should be
  - — counseled regarding preventing transmission to household, sexual, and drug-use contacts, including risk reduction and condom use;
  - — provided referral for hepatitis B vaccination of contacts;
  - — counseled regarding ways to reduce further liver damage, including limiting alcohol and drug use, and afforded substance-abuse treatment when appropriate; and

— provided aftercare that includes medical follow-up (standard practices).

# Preventing and Controlling Hepatitis Virus Infections Among Correctional Staff

## Hepatitis A Virus Infection

- Hepatitis A is not occupationally acquired in the health-care or correctional setting, and neither routine screening nor routine vaccination of staff should be administered (*11*). Not recommended.

## Infection Control Plan for HBV and HCV Prevention

- Measures to prevent occupational exposure to HBV and HCV among correctional workers should be integrated into each facility's bloodborne pathogen and infection control plan according to the requirements of the Occupational Safety and Health Administration (OSHA) or the respective state OSHA. Elements of this plan should be coordinated with the infection control plan for correctional workers for all other infectious agents (e.g., HIV and *Mycobacterium tuberculosis*) (standard practice).
- The plan should cover all employees (including inmates who are assigned work duties at a correctional facility) who could be reasonably anticipated, as the result of job duties, to be exposed to blood, bodily fluids, or other materials that might contain HBV or HCV (standard practice).
- The plan should identify tasks, procedures, and job classifications in which occupational exposure to potentially infectious material occurs — without regard to personal protective clothing and equipment. The plan must be accessible to employees and employee representatives. The employer should review and update the plan at least annually — more often if necessary to accommodate changes or recommendations from appropriate agencies (standard practice).
- The plan should mandate standard (i.e., universal) precautions for all contact with blood or body fluids. This should include procedures used to prevent needle sticks, including use of safer needle devices (*139*), to minimize splashing and spraying of potentially infectious material, and to ensure appropriate disinfection and decontamination of potentially contaminated surfaces and equipment, and appropriate disinfection and disposal of infectious material and contaminated clothing (*198*). As a part of the plan, correctional facilities should require employees to use appropriate personal protective equipment (e.g., gloves, gowns, masks, mouthpieces, and resuscitation bags) that are provided by the employer (standard practice).
- The plan should ensure that all workers are familiar with all aspects of infection control, including bloodborne pathogens and their transmission, the written exposure control plan, engineering and work practice controls, personal protective equipment, hepatitis B vaccine, response to emergencies involving blood, how to handle exposure incidents, the postexposure evaluation and follow-up program, and signs/labels/color-coding to alert persons to potentially infectious material (standard practice).
- Plan administrators should consider strategies to overcome the unique barriers to an effective infection control plan in a correctional environment (*41*). For example, potential inaccessibility of sharps disposal containers might necessitate using specific safe-needle devices and other strategies to minimize needle-stick injuries in correctional health-care settings (standard practice).
- A work practices program should be established that includes standard operating procedures for all activities having exposure potential. No worker should engage in such tasks or activities before receiving training pertaining to the procedures, work practices, and protective equipment required for that task (standard practice).

## Preexposure Hepatitis B Vaccination and Postexposure Management for HBV and HCV

- Hepatitis B vaccination should be administered to all previously unvaccinated persons (e.g., correctional and medical staff) whose work duties involve exposure to blood or other potentially infectious body fluids (*9,138,199*). Strongly recommended.
- Prevaccination serologic screening is not indicated for persons being vaccinated because of occupational risk, unless the hospital or health-care organization considers screening cost-effective. Indicated.
- Staff with continued contact with patients or blood and who are at ongoing risk for percutaneous injuries should be tested for anti-HBs 1–2 months after completion of the 3-dose vaccination series. Staff who do not respond to a primary vaccine series should complete a second 3-dose vaccine series or be evaluated to determine if they are HBsAg-positive (*47,199*) (standard practice).
- For correctional workers who have no contact with inmates and no routine exposure to blood and body fluids in the correctional setting, timely postexposure pro-

phylaxis should be provided if an exposure occurs, rather than routine vaccination (*47,199*) (standard practice).
- Evaluation for appropriate postexposure prophylaxis for an employee who has had an exposure incident should be performed in a timely fashion according to recommendations for HBV and HCV (*47*). Strongly recommended.
- When an exposure to potentially infectious blood or body fluid has occurred, a blood sample from the source person should be tested for HBsAg and anti-HCV. If the source person cannot be identified or tested, the respective postexposure protocol (i.e., HBV or HCV) should be followed to evaluate the need for postexposure prophylaxis or follow-up (standard practice).
- Appropriate postexposure prophylaxis and follow-up for HBV infection after exposure is dependent on the HBsAg status of the source person, as well as the immunization status of the exposed person (Tables 2 and 4) (*47*) (see Recommendations for Adult Inmates) (standard practice).
- If the source person is anti-HCV positive, CDC guidelines for postexposure follow-up should be followed (*10,47*) (see Recommendations for Adult Inmates) (standard practice).

### HBV or HCV Serologic Testing

- Routine testing for HBV or HCV infection is not necessary for correctional workers, except as described for hepatitis B vaccination or postexposure management (*10,48,123,200*). Not recommended.

## Implementation of Recommendations

The unique nature of correctional institution populations necessitates close collaboration with public health personnel at state and local levels for effective implementation of the recommendations in this report. Preventing and controlling viral hepatitis among incarcerated and released persons, and among persons in the communities to which they return, requires defining specific roles for each agency.

- Correctional staff should review these recommendations and develop written policies for their implementation. Policies should include implementation by contractors where correctional health care is provided by the private sector. Correctional staff should also monitor the 1) proportion of inmates (both adults and juveniles) who begin and complete the hepatitis B vaccine series; 2) prevalence of immunity to HBV infection among incoming inmates; 3) vaccine-series–completion rates for released prisoners; 4) proportion of inmates tested for HCV infection and reasons that inmates decline testing; and 5) prevalence of HCV infection among incoming inmates.
- Correctional systems should establish close working relationships with state and local health departments to ensure awareness of viral hepatitis prevention and control activities. Written agreements can better ensure all agencies participate in 1) reporting and investigating acute cases of viral hepatitis among inmates; 2) reporting inmates with chronic HBV and HCV infection in states where this is a requirement; 3) vaccination of contacts of inmates with chronic HBV infection; and 4) follow-up of inmates released before completing the hepatitis A or hepatitis B vaccine series, or before completing treatment for chronic HBV or HCV infection. Correctional staff should also collaborate with health department staff to provide hepatitis education and counseling to inmates and correctional employees.
- Public health departments should work closely with correctional systems to develop community-based strategies for preventing and controlling viral hepatitis. Integration of correctional health care into such strategies can be facilitated through designation of health department personnel to provide epidemiologic and programmatic assistance to correctional facilities. Other activities might include 1) development of record-keeping systems that facilitate hepatitis B vaccination; 2) case management of persons on antiviral therapy for chronic hepatitis C or hepatitis B; 3) substance-abuse treatment where appropriate; and 4) development of training courses for correctional facility staff.
- Public health departments should be considered resources for consultation on all aspects of viral hepatitis prevention and control, including quality assurance of laboratory testing services. Training and educational programs for correctional staff should include topics such as diagnosis of viral hepatitis and interpretation of laboratory test results, vaccination delivery and assessment of vaccination programs, disease reporting, and health education. Health department officials should provide educational information to senior-level prison and jail officials and to county and other elected officials.
- Public health departments should develop mechanisms that encourage reporting of viral hepatitis cases identified in correctional facilities. In addition, mechanisms should be established to provide epidemiologic consultation for investigations of acute disease in the complex setting of the correctional facility. Other areas for

which mechanisms should be established include follow-up of persons with chronic HBV and HCV infection for vaccination of contacts (HBV), and appropriate counseling and referral for medical follow-up and treatment.

## Internet Resources

The following Internet sites provide additional information (listed by source, topic, and website):

- CDC, viral hepatitis, http://www.cdc.gov/hepatitis.
- CDC, immunization, http://www.cdc.gov/nip.
- CDC, public health and IDUs, http://www.cdc.gov/idu.
- CDC, public health and corrections, http://www.nchstp.cdc.gov/correctionalhealth.
- Immunization Action Coalition, immunization resources, http://www.immunize.org.
- Immunization Action Coalition, model prevention programs, http//www.hepprograms.org.
- National Institutes of Health, National Institute of Digestive Diseases (NIH, NIDDK), HCV treatment consensus statement, http://consensus.nih.gov/cons/116/116cdc_intro.htm.
- Federal Bureau of Prisons, treatment guidelines, http://www.nicic.org/services/news/bop-medical.htm.
- National Commission on Correctional Health Care (NCCHC), http://www.ncchc.org.
- American Correctional Association (ACA), http://www.aca.org.
- National Institute of Justice (NIJ), Report on the Health Status of Soon-To-Be-Released Inmates, http://www.ncchc.org/pubs_stbr.html.

## Published Resources

- CDC. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination: recommendations of the Immunization Practices Advisory Committee (ACIP). MMWR 1991;40(No. RR-13):1–25.
- CDC. Recommendations for prevention and control of hepatitis C virus (HCV) infection and HCV-related chronic disease. MMWR 1998;47(No. RR-19):1–39.
- CDC. Prevention of hepatitis A through active or passive immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48(No. RR-12):1–37.
- CDC. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. MMWR 2001;50(No. RR-11):1–52.
- CDC. Immunization of adolescents: recommendations of the Advisory Committee on Immunization Practices, the American Academy of Pediatrics, the American Academy of Family Physicians, and the American Medical Association. MMWR 1996;45(No. RR-13):1–16.
- CDC. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP) and the American Academy of Family Physicians (AAFP). MMWR 2002;51(No. RR-2):1–36.
- CDC. Recommendations of the Immunization Practices Advisory Committee Prevention of Perinatal Transmission of Hepatitis B Virus: prenatal screening of all pregnant women for hepatitis B surface antigen. MMWR 1988;37:341–6.

### References


1. National Commission on Correctional Health Care. Health status of soon-to-be-released inmates: a report to Congress. Vol 1. Washington, DC: National Commission on Correctional Health Care, 2002.
2. Glaser JB, Greifinger RB. Correctional health care: a public health opportunity. Ann Intern Med 1993;118:139–145.
3. Association of State and Territorial Health Officials. Hepatitis C and incarcerated populations: the next wave for correctional health initiatives. Washington DC: Association of State and Territorial Health Officials, 2002.
4. Conklin TJ, Lincoln T, Flanigan TP. Public health model to connect correctional health care with communities. Am J Public Health 1998;88:1249–50.
5. Mast EE, Williams IT, Alter MJ, Margolis HS. Hepatitis B vaccination of adolescent and adult high-risk groups in the United States. Vaccine 1998;16:S27–S29.
6. Silberstein G, Coles FB, Greenberg A, Singer L, Voigt R. Effectiveness and cost-benefit of enhancements to a syphilis screening and treatment program at a county jail. Sex Transm Dis 2000;27:508–17.
7. Kahn RH, Scholl DT, Shane SM, Lemoine AL, Farley TA. Screening for syphilis in arrestees: usefulness for community-wide syphilis surveillance and control. Sex Transm Dis 2002;29:150–6.
8. Goldstein ST, Alter MJ, Williams IT, et al. Incidence and risk factors for acute hepatitis B in the United States, 1982–1998: implications for vaccination programs. J Infect Dis 2002;185:713–9.
9. CDC. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination—recommendations of the Immunization Practices Advisory Committee (ACIP). MMWR 1991;40(No. RR-13):1–25.
10. CDC. Recommendations for prevention and control of hepatitis C virus (HCV) infection and HCV-related chronic disease. MMWR 1998;47(No. RR-19):1–39.
11. CDC. Prevention of hepatitis A through active or passive immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48(No. RR-12):1–37.
12. Snyder HN, Sickmund M. Juvenile offenders and victims: 1999 national report. Washington, DC: US Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention, 1999. Publication no. NCJ 178257.

13. Harrison PM, Beck AJ. Prisoners in 2001 [Bureau of Justice Statistics Bulletin]. Washington DC: US Department of Justice, Office of Justice Programs, 2002. Publication no. NCJ 195189.
14. Office of Juvenile Justice and Delinquency Prevention. OJJDP Research 2000: report. Washington DC: US Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention, 2001. Publication no. NCJ 186732.
15. Beck AJ, Karberg JC, Harrison PM. Prison and jail inmates at midyear 2001 [Bureau of Justice Statistics Bulletin]. Washington DC: US Department of Justice, Office of Justice Programs, 2002. Publication no. NCJ191702.
16. Sickmund M and Wan Y. Census of juveniles in residential placement datebook, 2002. Washington DC: US Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention, 2002.
17. Beck AJ, Gilliard D, Greenfield L, et al. Survey of state prison inmates, 1991. Washington, DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics, 1993. Publication no. NCJ-136949.
18. Greenfield LA, Snell TL. Women offenders [Bureau of Justice Statistics Special report]. Washington DC: US Department of Justice, Office of Justice Programs, 1999. Publication no. 175688.
19. Bureau of Labor Statistics. Occupational outlook handbook: correctional officers. Washington, DC: US Department of Labor, Bureau of Labor Statistics, 2002. Available at http://www.bls.gov/oco/ocos156.htm.
20. Stephan JJ. Census of state and federal correctional facilities, 1995 [Bureau of Justice Statistics Executive summary]. Washington DC: US Department of Justice, Office of Justice Programs. 1997. Publication no. NCJ-166582.
21. Stephen JJ. Census of jails, 1999. Washington DC: US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics, 2001. Publication no. NCJ 186633.
22. National Commission on Correctional Health Care. Third party reimbursement for correctional health care. Chicago, IL: National Commission on Correctional Health Care, 1993. Available at http://www.ncchc.org/oldsite/statements/reimbursement.html.
23. Ingram-Fogel C. Health problems and needs of incarcerated women. Journal of Prison and Jail Health 1991;10:42–50.
24. CDC. Serious adverse events attributed to nevirapine regimens for postexposure prophylaxis after HIV exposures—worldwide, 1997–2000. MMWR 2001;49:1153–6.
25. CDC. Fatal and severe hepatitis associated with rifampin and pyrazinamide for the treatment of latent tuberculosis infection—New York and Georgia, 2000. MMWR 2001;50:289–91.
26. Snyder HN. Juvenile arrests 1999 [Juvenile Justice Bulletin]. Washington, DC: US Department of Justice, Office of Justice Programs, Office of Juvenile Justice and Delinquency Prevention, 2000. Publication no. NCJ 185236.
27. National Institute of Justice. ADAM (Arrestee Drug Abuse Monitoring Program) 1999 annual report on drug use among adult and juvenile arrestees. Washington DC: US Department of Justice, Office of Justice Programs, National Institute of Justice, 2000. Publication no. NCJ 181426.
28. Mumola, CJ. Substance abuse and treatment, state and federal prisoners, 1997 [Bureau of Justice Statistics Special report]. Washington DC: US Department of Justice, Office of Justice Programs, 1999. Publication no. NCJ 172871.
29. Wilson DJ. Drug use, testing, and treatment in jails [Bureau of Justice Statistics Special report]. Washington DC: US Department of Justice, Office of Justice Programs, 2000. Publication no. NCJ 179999.
30. Hser YI, Maglione M, Boyle K. Validity of self-report of drug use among STD patients, ER patients, and arrestees. Am J Drug Alcohol Abuse 1999;25:81–91.
31. Decker MD, Vaughn WK, Brodie JS, Hutcheson RH Jr, Schaffner W. Seroepidemiology of hepatitis B in Tennessee prisoners. J Infect Dis 1984;150:450–9.
32. Zimmerman SE, Martin R, Vlahov D. AIDS knowledge and risk perceptions among Pennsylvania prisoners. Journal of Criminal Justice 1991;19:239–56.
33. CDC. Hepatitis B outbreak in a state correctional facility, 2000. MMWR 2001;50:529–32.
34. Khan A, Simard E, Wurtzel H, et al. The prevalence, risk factors, and incidence of hepatitis B virus infection among inmates in a state correctional facility [Abstract]. In: Program and abstracts of the 130th Annual Meeting of the American Public Health Association, Philadelphia, Pennsylvania, 2002.
35. Gaiter J, Doll LS. Editorial: Improving HIV/AIDS prevention in prisons is good public health policy. Am J Public Health 1996;86:1201–3.
36. Nacci PL, Kane TR. The incidence of sex and sexual aggression in federal prisons. Federal Probation 1983;47:31–6.
37. Tewksbury R. Measures of sexual behavior in an Ohio prison. Sociology and Social Research 1989;74:34–9.
38. Saum CA, Surratt H, Inciardi JA, Bennett RE. Sex in prison: exploring the myths and realities. The Prison Journal 1995;75:413–30.
39. Smith WH. Syphilis epidemic in a southern prison. J Med Assoc State Ala 1965;35:392–4.
40. Wolfe MI, Xu F, Patel P, et al. An outbreak of syphilis in Alabama prisons: correctional health policy and communicable disease control. Am J Public Health 2001;91:1220–5.
41. Gershon RR, Karkashian CD, Vlahov D, et al. Compliance with universal precautions in correctional health care facilities. J Occup Environ Med 1999;41:181–9.
42. Hessl SM. Police and corrections. Occup Med 2001;16:39–49.
43. Alter MJ, Gerety R, Smallwood L, et al. Sporadic non-A, non-B hepatitis: frequency and epidemiology in an urban U.S. population. J Infect Dis 1982;145:886–93.
44. Alter MJ, Coleman PJ, Alexander WJ, et al. Importance of heterosexual activity in the transmission of hepatitis B and non-A, non-B hepatitis. JAMA 1989;262:1201–5.
45. Alter MJ. Prevention of spread of hepatitis C. Hepatology 2002;36 (suppl 1):S93–8.
46. Samuel MC, Doherty PM, Bulterys M, Jenison SA. Association between heroin use, needle sharing and tattoos received in prison with hepatitis B and C positivity among street-recruited injecting drug users in New Mexico, USA. Epidemiol Infect 2001;127:475–84.
47. CDC. Updated U.S. Public Health Service guidelines for the management of occupational exposures to HBV, HCV, and HIV and recommendations for postexposure prophylaxis. MMWR 2001;50(No. RR-11):1–42.
48. Averhoff FM, Moyer LA, Woodruff BA, et al. Occupational exposures and risk of hepatitis B virus infection among public safety workers. J Occup Environ Med 2002;44:591–6.
49. Glikson M, Galun E, Oren R, Tur-Kaspa R, Shouval D. Relapsing hepatitis: review of 14 cases and literature survey. Medicine 1992;71:14–7.

50. Vento S, Garofano T, Renzini C, et al. Fulminant hepatitis associated with hepatitis A virus superinfection in patients with chronic hepatitis C. N Engl J Med 1998;338:286–90.
51. Bell BP, Shapiro CN, Alter MJ, et al. The diverse patterns of hepatitis A epidemiology in the United States — implications for vaccination strategies. J Infect Dis 1998;178:1579–84.
52. CDC. Hepatitis surveillance report no. 57. Atlanta, GA: US Department of Health and Human Services, Public Health Service, 2000.
53. Van Beneden C, Hedberg K, Zimmerman P, Gutelius-Johnson M, Terry J, Fleming D. Epidemic hepatitis A among illicit drug users in Oregon: evidence for adult-to-adult transmission [Abstract]. In: Program and abstracts of the 1st International Conference on Emerging Infectious Diseases. Atlanta, GA: American Society for Microbiology, 1998.
54. Hutin YJ, Bell BP, Marshall KL, et al. Identifying target groups for a potential vaccination program during a hepatitis A communitywide outbreak. Am J Public Health 1999;89:918–21.
55. Villano SA, Nelson KE, Vlahov D, Purcehll, RH, Saah AJ, Thomas DL. Hepatitis A among homosexual men and injection drug users: more evidence for vaccination. Clin Infect Dis 1997;25:726–8.
56. Bower WA, Nainan OV, Han X, Margolis HS. Duration of viremia in hepatitis A viral infections. JID 2000;182:12–7.
57. Hutin YJ, Sabin KM, Hutwagner LC, et al. Multiple modes of hepatitis A virus transmission among methamphetamine users. Am J Epidemiol 1999;152:186–92.
58. Henning KJ, Bell E, Braun J, Barker N. A community-wide outbreak of hepatitis A: risk factors for infection among homosexual and bisexual men. Am J Med 1995;99:132–6.
59. CDC. Hepatitis A vaccination of men who have sex with men—Atlanta, GA. MMWR 1998;47:708–11.
60. Corey L, Holmes KK. Sexual transmission of hepatitis A in homosexual men. N Engl J Med 1980;302:435–8.
61. Coutinho RA, Albrecht-van Lent P, Lelie N, Nagelkerke N, Kuipers H, Rijsdijk T. Prevalence and incidence of hepatitis A among male homosexuals. Br Med J (Clin Res) 1983;287:1743–5.
62. Katz MH, Hsu L, Wong E, Liska S, Anderson L, Janssen RS. Seroprevalence of and risk factors for hepatitis A infection among young homosexual and bisexual men. J Infect Dis 1997;175:1225–9.
63. Stokes ML, Ferson MJ, Young LC. Outbreak of hepatitis A among homosexual men in Sydney. Am J Public Health 1997;87:2039–41.
64. Lok AS, McMahon BJ. Chronic hepatitis B. Hepatology 2001;34:1225–41.
65. Lee WM. Hepatitis B virus infection. N Engl J Med 1997;337:1733–45.
66. Beasley RP, Hwang LY, Lin CC, Chien CS. Hepatocellular carcinoma and hepatitis B virus: a prospective study of 22 707 men in Taiwan. Lancet 1981;2:1129–33.
67. Beasley RP. Hepatitis B virus: the major etiology of hepatocellular carcinoma. Cancer 1988;61:1942–56.
68. Chang MH, Chen CJ, Lai MS, et al. Universal hepatitis B vaccination in Taiwan and the incidence of hepatocellular carcinoma in children. Taiwan Childhood Hepatoma Study Group. N Engl J Med 1997;336:1855–9.
69. McMahon BJ. Hepatocellular carcinoma and viral hepatitis. In: Willson RA, ed. Viral hepatitis: diagnosis, treatment, prevention. New York, NY: Marcel Dekker, Inc., 1997:315–30.
70. McMahon BJ, Holck P, Bulkow L, Snowball M. Serologic and clinical outcomes of 1536 Alaska Natives chronically infected with hepatitis B virus. Ann Intern Med 2001;135:759–68.
71. Rizzetto M. The delta agent. Hepatology 1983;3:729–37.
72. Monto A, Wright TL. The epidemiology and prevention of hepatocellular carcinoma. Semin Oncol 2001;28:441–9.
73. Ockenga J, Tillmann HL, Trautwein C, Stoll M, Manns MP, Schmidt RE. Hepatitis B and C in HIV-infected patients: prevalence and prognostic value. J Hepatol 1997;27:18–24
74. Zarski JP, Bohn B, Bastie A, et al. Characteristics of patients with dual infection by hepatitis B and C viruses. J Hepatol 1998;28:27–33.
75. Gao B. Interaction of alcohol and hepatitis viral proteins: implication in synergistic effect of alcohol drinking and viral hepatitis on liver injury. Alcohol 2002;27:69–72.
76. McQuillan GM, Coleman P, Kruszon-Moran D, Moyer LA, Lambert SB, Margolis HS. Prevalence of hepatitis B virus infection in the United States: the National Health and Nutrition Examination Surveys, 1976 through 1994. Am J Public Health 1999;89:14–8.
77. Coleman P, McQuillan GM, Moyer LA, Lambert SB, Margolis HS. Incidence of hepatitis B virus infection in the United States, 1976–1994: estimates from the National Health and Nutrition Examination Surveys. J Infect Dis 1998;178:954–9.
78. Margolis HS, Alter MJ, Hadler SC. Hepatitis B: evolving epidemiology and implications for control. Semin Liver Dis 1991;11:84–92.
79. Shafer MA, Hilton JF, Ekstrand M, et al. Relationship between drug use and sexual behaviors and the occurrence of sexually transmitted diseases among high-risk male youth. Sex Transm Dis 1993;20:307–13.
80. Rogers AS, Lindsey JC, Futterman DC, et al. Serologic examination of hepatitis B infection and immunization in HIV-positive youth and associated risks. AIDS Patient Care and STDs 2000;14:651–7.
81. Noell J, Rohde P, Ochs L, et al. Incidence and prevalence of chlamydia, herpes, and viral hepatitis in a homeless adolescent population. Sex Transm Dis 2001;28:4–10.
82. CDC. Hepatitis B vaccination of adolescents—California, Louisiana, and Oregon, 1992–1994. MMWR 1994;43:605–9.
83. Koplan JP, Walker JA, Bryan JA. Prevalence of hepatitis B surface antigen and antibody at a state prison in Kansas. J Infect Dis 1978;137:505–6.
84. Hull HF, Lyons LH, Mann JM, Hadler SC, Steece R, Skeels MR. Incidence of hepatitis B in the penitentiary of New Mexico. Am J Public Health 1985;75:1213–4.
85. Smith DA. Hepatitis B in a general psychiatric hospital [Letter]. NEJM 1986;314:1255–6.
86. Tucker RM, Gaffey MJ, Fisch MJ, Kaiser DL, Guerrant RL, Normansell DE. Seroepidemiology of hepatitis D (delta agent) and hepatitis B among Virginia state prisoners. Clinical Therapeutics 1987;9:622–8.
87. Barry MA, Gleavy D, Herd K, Schwingl PJ, Werner BG. Prevalence of markers for hepatitis B and hepatitis D in a municipal house of correction. Am J Pub Health 1990;80:471–3.
88. Ruiz JD, Molitor F, Sun RK, et al. Prevalence and correlates of hepatitis C virus infection among inmates entering the California correctional system. West J Med 1999;170:156–60.
89. Kibby T, Devine J, Love C. Prevalence of hepatitis B among men admitted to a federal prison [Letter]. N Engl J Med 1982;306:175.
90. Bader T. Hepatitis B carriers in the prison population [Letter]. New Engl J Med 1983;308:281.
91. Kaufman ML, Faiver KL, Harness JK. Hepatitis B markers among Michigan prisoners [Letter]. Ann Intern Med 1983;98:558.
92. Bader TF. Hepatitis B in prisons. Biomed Pharmacother 1986;40:248–51.
93. Smith PF, Mikl J, Truman BI, et al. HIV infection among women entering the New York state correctional system. Am J Public Health 1991;81(suppl 1):35–40.

94. López-Zetina J, Kerndt P, Ford W, Woerhle T, Weber M. Prevalence of HIV and hepatitis B and self-reported injection risk behavior during detention among street-recruited injection drug users in Los Angeles County, 1994–1996. Addiction 2001;96:589–95.
95. Kunches LM, Craven DE, Werner BG. Seroprevalence of hepatitis B virus and delta agent in parenteral drug abusers: immunogenicity of hepatitis B vaccine. Am J Med 1986;81:591–5.
96. Zeldis JB, Jain S, Kuramoto IK, et al. Seroepidemiology of viral infections among intravenous drug users in northern California. West J Med 1992;156:30–5.
97. Levine OS, Vlahov D, Koehler J, Cohn S, Spronk AM, Nelson KE. Seroepidemiology of hepatitis B virus in a population of injecting drug users. Am J Epidemiol 1995;142:331–41.
98. Garfein RS, Vlahov D, Galai N, Doherty MC, Nelson KE. Viral infections in short-term injection drug users: the prevalence of the hepatitis C, hepatitis B, human immunodeficiency, and human T-lymphotropic viruses. Am J Public Health 1996;86:655–61.
99. Remis RS, Dufour A, Alary M, et al. Association of hepatitis B virus infection with other sexually transmitted infections in homosexual men. Omega Study Group. Am J Public Health 2000;90:1570–4.
100. Macalino GE, Salas CM, Towe CW, et al. Incidence and community prevalence of HIV and other blood borne pathogens among incarcerated women in Rhode Island [Abstract]. Presented at the National HIV Prevention Conference. Atlanta, GA: US Department of Health and Human Services, CDC, 1999.
101. Peters CJ, Purcell RH, Lander JJ, Johnson KM. Radioimmunoassay for antibody to hepatitis B surface antigen shows transmission of hepatitis B virus among household contacts. J Infect Dis 1976;134:218-23.
102. Bernier RH, Sampliner R, Gerety R, Tabor E, Hamilton F, Nathanson N. Hepatitis B infection in households of chronic carriers of hepatitis B surface antigen: factors associated with prevalence of infection. Am J Epidemiol 1982;116:199–211.
103. Aach RD, Stevens CE, Hollinger FB, et al. Hepatitis C virus infection in post-transfusion hepatitis: an analysis with first- and second-generation assays. N Engl J Med 1991;325:1325–9.
104. Alter HJ, Jett BW, Polito AJ, et al. Analysis of the role of hepatitis C virus in transfusion-associated hepatitis. In: Hollinger FB, Lemon SM, Margolis HS, eds. Viral hepatitis and liver disease. Baltimore, Maryland: Williams and Wilkins Co., 1991, 396–402.
105. Alter HJ, Seeff LB. Recovery, persistence, and sequelae in hepatitis C virus infection: a perspective on long-term outcome. Semin Liver Dis 2000;20:17–35.
106. Sulkowski MS, Mast EE, Seeff LB, Thomas DL. Hepatitis C virus infection as an opportunistic disease in persons infected with human immunodeficiency virus. Clin Infect Dis 2000;30 (suppl 1):S77–84.
107. Alter MJ, Kruszon-Moran D, Nainan OV, et al. The prevalence of hepatitis C virus infection in the United States, 1988 through 1994. N Engl J Med 1999;341:556–62.
108. Alter MJ, Hadler SC, Judson FN, et al. Risk factors for acute non-A, non-B hepatitis in the United States and association with hepatitis C virus infection. JAMA 1990;264:2231–5.
109. Armstrong GL, Alter MJ, McQuillan GM, Margolis HS. The past incidence of hepatitis C virus infection: implications for the future burden of chronic liver disease in the United States. Hepatology 2000;31:777–82.
110. Alter MJ. Epidemiology of hepatitis C. Hepatology 1997;26(suppl 1):62S–65S.
111. Williams IT, Fleenor M, Judson F, et al. Risk factors for hepatitis C virus (HCV) transmission in the USA: 1991–1998 [Abstract 114]. Presented at the 10th International Symposium on Viral Hepatitis and Liver Disease. Atlanta, GA, 2000.
112. Garfein RS, Williams IT, Monterroso ER, Valverde R, Swartzendruber A. HCV, HBV and HIV infections among young, street-recruited injection drug users (IDUs): the collaborative injection drug users study (CIDUS II) [Abstract 115]. Presented at the 10th International Symposium on Viral Hepatitis and Liver Disease. Atlanta, GA, 2000.
113. Murrill CS, Weeks H, Castrucci BC, et al. Age-specific seroprevalence of HIV, hepatitis B virus, and hepatitis C virus infection among injection drug users admitted to drug treatment in 6 US cities. Am J Public Health 2002;92:385–7.
114. Koester SK, Hoffer L. "Indirect sharing": additional HIV risks associated with drug injection. AIDS & Public Policy Journal 1994;9:100–5.
115. Heimer R, Khoshnood K, Jariwala-Freeman B, Duncan B, Harima Y. Hepatitis in used syringes: the limits of sensitivity of techniques to detect hepatitis B virus (HBV) DNA, hepatitis C virus (HCV) RNA, and antibodies to HBV core and HCV antigens. J Infect Dis 1996;173:997–1000.
116. Hagan H, McGough JP, Thiede H, Weiss NS, Hopkins S, Alexander ER. Syringe exchange and risk of infection with hepatitis B and C viruses. Am J Epidemiol 1999;149:203–13.
117. Thomas DL, Vlahov D, Solomon L, et al. Correlates of hepatitis C virus infections among injection drug users. Medicine (Baltimore) 1995;74:212–20.
118. Lorvick J, Kral AH, Seal K,Gee L, Edlin BR. Prevalence and duration of hepatitis C among injection drug users in San Francisco, Calif. Am J Public Health 2001;91:46–7.
119. Thorpe LE, Ouellet LJ, Levy JR, Williams IT, Monterroso ER. Hepatitis C virus infection: prevalence, risk factors, and prevention opportunities among young injection drug users in Chicago, 1997–1999. J Infect Dis 2000;182:1588–94.
120. Diaz T, Des Jarlais DC, Vlahov D, et al. Factors associated with prevalent hepatitis C: differences among young adult injection drug users in lower and upper Manhattan, New York City. Am J Public Health 2001;91:23–30.
121. Vlahov D, Nelson KE, Quinn TC, Kendig N. Prevalence and incidence of hepatitis C virus infection among male prison inmates in Maryland. Eur J Epidemiol 1993;9:566–9.
122. Spaulding A, Greene C, Davidson K, Schneidermann M, Rich J. Hepatitis C in state correctional facilities. Preventive Medicine 1999;28: 92–100.
123. CDC. Hepatitis C virus infection among firefighters, emergency medical technicians, and paramedics—selected locations, United States, 1991–2000. MMWR 2000;49:660–5.
124. American Academy of Pediatrics. Hepatitis B. In: Peter G, ed. 1997 red book: report of the committee on infectious diseases. 24th ed. Elk Grove Village, IL: American Academy of Pediatrics, 1997, 247–60.
125. CDC. Immunization of adolescents: recommendations of the Advisory Committee on Immunization Practices, the American Academy of Pediatrics, the American Academy of Family Physicians, and the American Medical Association. MMWR 1996;45(No. RR-13):1–16.
126. CDC. Vaccine-preventable diseases: improving vaccination coverage in children, adolescents and adults: a report on recommendations from the Task Force on Community Preventive Services. MMWR 1999;48(No. RR-8):1–15.

127. Khan A, Goldstein S, Williams I, Bell B, Mast E. Opportunities for hepatitis B prevention in correctional facilities and sexually transmitted disease treatment settings [Abstract 037]. Presented at the 10th International Symposium on Viral Hepatitis and Liver Disease. Atlanta, GA, 2000.
128. Beasley RP, Hwang LY, Stevens CE, et al. Efficacy of hepatitis B immune globulin for prevention of perinatal transmission of the hepatitis B virus carrier state: final report of a randomized double-blind, placebo-controlled trial. Hepatology 1983;3:135–141.
129. Stevens CE, Toy PT, Tong MJ, et al. Perinatal hepatitis B virus transmission in the United States: prevention by passive-active immunization. JAMA 1985;253:1740–5.
130. CDC. General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP) and the American Academy of Family Physicians (AAFP). MMWR 2002;51(No. RR-2):1–36.
131. Xu ZY, Liu CB, Francis DP, et al. Prevention of perinatal acquisition of hepatitis B virus carriage using vaccine: preliminary report of a randomized, double-blind placebo-controlled and comparative trial. Pediatrics 1985;76:713–8.
132. Cassidy WM, Mahoney FJ. A hepatitis B vaccination program targeting adolescents. J Adolesc Health 1995;17:244–7.
133. American Academy of Family Physicians. Summary of policy recommendations for periodic health examination. [Revision 5.1]. Kansas City, MO, 2001.
134. CDC. Effectiveness of a seventh grade school entry vaccination requirement—statewide and Orange County, Florida, 1997–1998. MMWR 1998;47:711–5.
135. CDC. Notice to readers update: recommendations to prevent hepatitis B virus transmission—United States. MMWR 1999;48:33–4.
136. Immunization Action Coalition. Hepatitis B prevention mandates. St. Paul, MN: Immunization Action Coalition, 2001. Available at http://www.immunize.org/laws/hepb.htm.
137. Charuvastra A, Stein J, Schwartapfel B, et al. Hepatitis B vaccination practices in state and federal prisons. Public Health Rep 2001;116:203–9.
138. Mahoney FJ, Stewart K, Hu H, Coleman P Alter MJ. Progress toward the elimination of hepatitis B virus transmission among health care workers in the United States. Arch Intern Med 1997;157:2601–5.
139. Occupational Safety and Health Standards. 29 CFR § 1910.1030.
140. CDC. Hepatitis B vaccination among high-risk adolescents and adults — San Diego, California, 1998–2001. MMWR 2002;51:618–21.
141. CDC. Hepatitis B vaccination for injection drug users—Pierce County, Washington, 2000. MMWR 2001;50:388–90.
142. Davidson M, Krugman S. Recombinant yeast hepatitis B vaccine compared with plasma-derived vaccine: immunogenicity and effect of a booster dose. J Infect 1986;13(suppl A):31–8.
143. Jilg W, Deinhardt F. Results of immunisation with a recombinant yeast-derived hepatitis B vaccine. J Infect 1986;13(suppl A):47–51.
144. André FE. Summary of safety and efficacy data on a yeast-derived hepatitis B vaccine. Am J Med 1989;87(suppl 3A):14S-20S.
145. Committee on Obstetrics: Maternal and Fetal Medicine. Guidelines for hepatitis B virus screening and vaccination during pregnancy. Washington, D.C.: American College of Obstetrics and Gynecology, 1990.
146. American Academy of Family Physicians: recommendations for hepatitis B preexposure vaccination and postexposure prophylaxis. Revised. Kansas City, MO: American Academy of Family Physicians, 1993.
147. CDC. Sexually transmitted diseases treatment guidelines 2002. MMWR 2002;51(No. RR-6):1–80.
148. Blostein J, Clark PA. Cost-effectiveness of preimmunization hepatitis B screening in high-risk adolescents. Public Health Rep 2001;116:165–8.
149. CDC. Recommendations for preventing transmission of infections among chronic hemodialysis patients. MMWR 2001;50(No. RR-5):1–43.
150. CDC. Guidelines for preventing opportunistic infections among HIV-infected persons—2002: recommendations of the U.S. Public Health Service and the Infectious Diseases Society of America. MMWR 2002;51(No. RR-8):1–46.
151. Lieming D, Mintai Z, YinfuW, Shaochon Z, Weiqin K, Smego RA, Jr. A 9-year follow-up study of the immunogenicity and long-term efficacy of plasma-derived hepatitis B vaccine in high-risk Chinese neonates. Clin Infect Dis 1993;17:475–9.
152. Redeker AG, Mosley JW, Gocke DJ, McKee AP, Pollack W. Hepatitis B immune globulin as a prophylactic measure for spouses exposed to acute type B hepatitis. N Engl J Med 1975;293:1055–9.
153. Grady GF, Lee VA, Prince AM, et al. Hepatitis B immune globulin for accidental exposures among medical personnel: final report of a multicenter controlled trial. J Infect Dis 1978;138:625–38.
154. Hoofnagle JH, Seeff LB, Bales ZB, Wright EC, Zimmerman HJ. Passive-active immunity from hepatitis B immune globulin: reanalysis of a Veterans Administration Cooperative Study of needle-stick hepatitis. Ann Intern Med 1979;91:813–8.
155. Food and Drug Administration. CDER New and Generic Drug Approvals: 1998–2002. FDA/Center for Drug Evaluation and Research, 2002. Available at http://www.fda.gov/cder/approval/.
156. Marcellin P, Chang TT, Lim SG, et al. Baseline ALT predicts histologic and serologic response in patients with HBeAg+ chronic hepatitis B treated with Adefovir Dipivoxil (ADV). [Abstract]. In: the 37th Annual Meeting of the European Association for the Study of the Liver, Madrid, Spain, 2002.
157. Di Martino V, Thevenot T, Colin JF, et al. Influence of HIV infection on the response to interferon therapy and the long-term outcome of chronic hepatitis B. Gastroenterology 2000;123:1812–22
158. Pisu M, Meltzer MI, Lyerla R. Cost-effectiveness of hepatitis B vaccination of prison inmates. Vaccine 2002;21:312–21.
159. American Correctional Association. Inmate Health Care—Part 1. Corrections Compendium 2001;6–18.
160. Lofgren RP, Paul JM, Kefalos SG, Nichol KL. A multifacted influenza vaccination program can be exported successfully to a different clinical site. Clinical Research 1990;38:864A.
161. Crouse BJ, Nichol K, Peterson DC, Grimm MB. Hospital-based strategies for improving influenza vaccination rates. J Fam Pract. 1994;38:258–61.
162. Merkel PA, Caputo GC. Evaluation of a simple office-based strategy for increasing influenza vaccine administration and the effect of differing reimbursement plans on the patient acceptance rate. J Gen Internal Med 1994;9:679–83.
163. Moran WP, Nelson K, Wofford JL, Velez R, Case LD. Increasing influenza immunization among high-risk patients: education or financial incentive? Am J Med 2000;101:612–20.
164. CDC. Substance abuse treatment and public health: working together to benefit injection drug users. [Fact sheet series]. US Department of Health and Human Services, CDC, Academy for Educational Development, 2002. Available at http://www.cdc.gov/idu/facts/WorkingTogether.htm.
165. Koff RS, Dienstag JL. Extrahepatic manifestations of hepatitis C and the association with alcoholic liver disease. Semin Liver Dis 1995;15:101–9.

166. Poynard T, Bedossa P, Opolon P. Natural history of liver fibrosis progression in patients with chronic hepatitis C. Lancet 1997;349:825–32.
167. CDC. Guidelines for laboratory testing and result reporting of antibody to hepatitis C virus. MMWR 2003 (In press).
168. National Institutes of Health. Management of hepatitis C. NIH Consensus Statement Online 1997;15:1–41.
169. Fried MW, Shiffman ML, Reddy KR, et al. Peginterferon alfa-2a plus ribavirin for chronic hepatitis C virus infection. N Engl J Med 2002;347:975–82.
170. Soriano V, Bravo R, Garcia-Samaniego J, et al. CD4+ T-lymphocytopenia in HIV-infected patients receiving interferon therapy for chronic hepatitis C. HIV-Hepatitis Spanish Study Group. AIDS 1994;8:1621–2.
171. Soriano V, Garcia-Samaniego J, Bravo R, et al. Interferon a for the treatment of chronic hepatitis C in patients infected with human immunodeficiency virus. Hepatitis-HIV Spanish Study Group. Clin Infect Dis 1996;23:585–91.
172. Allen SA, Spaulding A, Osei AM, et al. Treatment of chronic hepatitis C in a state correctional facility. Arch Intern Med 2002 (In press).
173. Andrus JK, Fleming DW, Knox C, et al. HIV testing in prisoners: is mandatory testing mandatory? Am J Public Health 1989;79:840–2.
174. Hoxie NJ, Vergeront JM, Frisby HR, Pfister JR, Golubjatnikov R, Davis JP. HIV seroprevalence and the acceptance of voluntary HIV testing among newly incarcerated male prison inmates in Wisconson. Am J Public Health 1990;80:1129–31.
175. Behrendt C, Kendig N, Dambita C, Horman J, Lawlor J, Vlahov D. Voluntary testing for human immunodeficiency virus (HIV) in a prison population with a high prevalence of HIV. Am J Epidemiol 1994;139:918–26.
176. Jemmott JB III, Jemmott LS, Fong GT. Reductions in HIV risk-associated sexual behaviors among black male adolescents: effects of an AIDS prevention intervention. Am J Public Health 1992;82:372–7.
177. Magura S, Kang SY, Shapiro JL. Outcomes of intensive AIDS education for male adolescent drug users in jail. J Adolesc Health 1994;15:457–63.
178. Glanz K, Saraiya M, Wechsler H. Guidelines for school programs to prevent skin cancer. MMWR 2002;51(No. RR-4):1–18.
179. Stephenson B, Wohl D, Kiziah N, et al. Release from prison is associated with increased HIV RNA at time of re-incarceration [Abstract]. Presented at the XIII International AIDS Conference, Durban, South Africa, 2000.
180. Rich J, Holmes L, Salas C, et al. Successful linkage of medical care and community services for HIV-positive offenders being released from prison. J Urban Health 2001;78:279–89.
181. Briss PA, Zaza S, Pappaioanou M. Developing an evidence-based Guide to Community Preventive Services—methods. Am J Prev Med 2000;18(suppl 1):35–43.
182. CDC. Prevention of perinatal hepatitis B through enhanced case management—Connecticut, 1994–95, and United States, 1994. MMWR 1996;45:584–7.
183. Ayoola EA, Johnson AO. Hepatitis B vaccine in pregnancy: immunogenicity, safety and transfer of antibodies to infants. Int J Gynaecol Obstet 1987;25:297–301.
184. Levy M, Koren G. Hepatitis B vaccine in pregnancy: maternal and fetal safety. Am J Perinatol 1991;8:227–32.
185. Ingardia CJ, Kelley L, Steinfeld JD, Wax JR. Hepatitis B vaccination in pregnancy: factors influencing efficacy. Obstet Gynecol 1999;93:983–6.
186. Cassidy WM, Watson B, Ioli VA, Williams K, Bird S, West DJ. A randomized trial of alternative two- and three-dose hepatitis B vaccination regimens in adolescents: antibody responses, safety, and immunologic memory. Pediatrics 2001;107:626–31.
187. Middleman AB, Kozinetz CA, Robertson LM, DuRant RH, Emans SJ. The effect of late doses on the achievement of seroprotection and antibody titer levels with hepatitis b immunization among adolescents. Pediatrics 2001;107:1065–9.
188. Marsano LS, Greenberg RN, Kirkpatrick RB, et al. Comparison of a rapid hepatitis B immunization schedule to the standard schedule for adults. Am J Gastroenterol 1996;91:111–5.
189. Wilkinson SE, Morath M, Bennett DL, Burgess MA, Isaacs D. Accelerated schedule of hepatitis B vaccination in high-risk youth. J Paediatr Child Health 1996;32:60–2.
190. Cassidy WM. Adolescent hepatitis B vaccination [Review]. Minerva Pediatr 2001;53:559–66.
191. Margolis HS, Coleman PJ, Brown RE, Mast EE, Sheingold SH, Arevalo JA. Prevention of hepatitis B virus transmission by immunization: an economic analysis of current recommendations. JAMA 1995;274:1201–8.
192. Brook MG, Karayiannis P, Thomas HC. Which patients with chronic hepatitis B virus infection will respond to a-interferon therapy? A statistical analysis of predictive factors. Hepatology 1989;10:761–3.
193. Lai CL, Chien RN, Leung NW, et al. A one-year trial of lamivudine for chronic hepatitis B. Asia Hepatitis Lamivudine Study Group. N Engl J Med 1998;339:61–8.
194. Prince AM, Brotman B, Huima T, et al. Immunity in hepatitis C infection. J Infect Dis 1992;165:438–43.
195. Jarvis LM, Watson HG, McOmish F, Peutherer JF, Ludlam CA, Simmonds P. Frequent reinfection and reactivation of hepatitis C virus genotypes in multitransfused hemophiliacs. J Infect Dis 1994;170:1018–22.
196. Kao JH, Chen PJ, Wang JT, et al. Superinfection by homotypic virus in hepatitis C virus carriers: studies on patients with post-transfusion hepatitis. J Med Virol 1996;50:303–8.
197. Wyatt CA, Andrus L, Brotman B, Huang F, Lee DH, Prince AM. Immunity in chimpanzees chronically infected with hepatitis C virus: role of minor quasispecies in reinfection. J Virol 1998;72:1725–30.
198. CDC. Recommendations for preventing transmission of human immunodeficiency virus and hepatitis B virus to patients during exposure-prone invasive procedures. MMWR 1991;40(No. RR-8):1–9.
199. CDC. Immunization of health-care workers: recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC). MMWR 1997;46(No. RR-18):1–42.
200. Woodruff BA, Moyer LA, O'Rourke KM, Margolis HS. Blood exposure and the risk of hepatitis B virus infection in firefighters. J Occup Med 1993;35:1048–54.

# Appendix

## Hepatitis A and B Vaccines

### Hepatitis A Vaccine

Long-term protection from hepatitis A virus (HAV) infection can be achieved through active, preexposure vaccination with hepatitis A vaccine. Inactivated hepatitis A vaccines licensed for use in the United States are Havrix® (GlaxoSmithKline Biologicals, Rixensart, Belgium), VAQTA® (Merck & Co., Inc., Whitehouse Station, New Jersey), and Twinrix® (GlaxoSmithKline Biologicals), a combined hepatitis A and hepatitis B vaccine (*1,2*). All are produced from HAV grown in cell culture, inactivated with formalin, and formulated with alum adjuvant in pediatric and adult dosages that are 94%–100% effective in preventing clinical disease among juveniles and adults when administered according to recommended schedules (*1,2*) (Table 3).

Protective levels of antibody to HAV (anti-HAV) develop among 94%–100% of vaccinated persons within 1 month after administration of the first dose. A second dose results in protective levels of antibody among all persons vaccinated, and is considered necessary for long-term protection. Estimates of antibody persistence suggest protective levels of anti-HAV persist for ≥20 years (*1*).

A delay in administration of the second vaccine dose does not result in lowered final antibody levels or seroconversion rates, and restarting the vaccine series if the second dose is delayed is not needed. Vaccination begun with vaccine from one manufacturer can be completed with vaccine from the other (*3,4*). Hepatitis A vaccine can be administered at the same time as other vaccines, including hepatitis B vaccine, without affecting immunogenicity or increasing the frequency of adverse events.

#### Adverse Reactions

The most frequently reported adverse reactions occurring ≤3 days after vaccination are soreness at the injection site (53%–56%), headache (14–16%), and malaise (7%). Reviews of data from multiple sources have not identified any serious adverse events among juveniles or adults associated with hepatitis A vaccination (*1*). Any adverse event occurring after hepatitis A vaccination should be reported to the Vaccine Adverse Events Reporting System (VAERS). Reporting forms can be obtained by calling 1-800-822-7967.

#### Contraindications

Hepatitis A vaccine should not be administered to persons with a history of hypersensitivity reactions to alum, or for Havrix or Twinrix, to the preservative 2-phenoxyethanol. The safety of hepatitis A vaccination during pregnancy has not been determined. However, because this is an inactivated vaccine, the theoretical risk to the developing fetus is low. The risk associated with vaccination should be weighed against the risk for hepatitis A among women who might be at high risk for exposure to HAV infection. No special precautions are needed when vaccinating immunocompromised persons.

#### Serologic Testing for HAV Infection

Antibody produced after HAV infection results in lifelong immunity. Among adult populations with high rates of prior HAV infection, prevaccination testing can reduce costs by avoiding the vaccination of persons with prior immunity. However, the vaccination of an immune person does not increase the risk for adverse events. The decision to test should be based on 1) expected prevalence of immunity; 2) cost of vaccination compared with cost of serologic testing; and 3) likelihood that testing will not interfere with initiating vaccination.

Prevaccination testing of younger juveniles (ages <15 years) is not indicated because of their low prevalence of infection. Prevaccination testing is most likely to be cost-effective for older juveniles and adults born in countries, or who have been residents for extensive periods in countries, with a high endemicity of HAV infection (e.g., Mexico, South and Central America, Africa, and all of Asia except Japan), populations with historically high rates of infection (e.g., American Indians or Alaska Natives), and those engaging in behaviors that place them at high risk for infection (e.g., drug users or men who have sex with men). Because anti-HAV prevalence increases with age, prevaccination testing of any person aged ≥40 years would likely be cost-effective (*1*). Commercially available tests for total anti-HAV can be used for prevaccination testing. Postvaccination testing is not indicated because of high rates of vaccine response among both adults and juveniles. In addition, no Food and Drug Administration (FDA)-approved testing method exists that has the sensitivity to detect low anti-HAV concentrations after vaccination.

## Hepatitis B Vaccine

Vaccines available in the United States use hepatitis B surface antigen (HBsAg) produced in yeast cells by recombinant deoxyribonucleic acid (DNA) technology, and are formulated to contain 5–40 µg HBsAg protein/mL and 0.5 mg/mL aluminum hydroxide as the adjuvant. The two available single antigen hepatitis B vaccines are Recombivax HB® (Merck & Co., Inc., Whitehouse Station, New Jersey) and Engerix-B® (GlaxoSmithKline Biologicals, Rixensart, Belgium) (*5*). A combination hepatitis A and hepatitis B vaccine, Twinrix, is also licensed for persons aged ≥18 years old (*2*) (Table 4).

### Antibody Response to Vaccination

Licensed formulations for both vaccines produce high (≥95%) rates of protective antibody (anti-HBs >10 mIU/mL) when the complete series is administered in different schedules to infants, juveniles, and adults aged <40 years (*5*). Among healthy adults, 30%–50% develop a protective antibody response after the first vaccine dose, 75% after the second dose, and >95% after the third dose (*5–9*). Increasing the interval between the first and second dose of vaccine has little effect on immunogenicity or final antibody titer, although data are limited regarding intervals >2 months among adults (*5,8*). The third dose confers the maximum rate of seroprotection; it primarily acts as a booster and confers optimal long-term protection through the induction of maximum immune memory (*5,9*). Both licensed vaccines administered on a 0-, 1-, and 6-month schedule produce a >95% final seroprotection rate among adolescents and healthy young adults, and studies indicate that vaccination of adolescents and adults on a 0-, 2-, and 4-month, and adolescents on a 0-,12-, and 24-month schedule, achieved final seroprotection rates similar to the 0-, 1-, and 6-month schedule (*8–10*). In addition, a 2-dose vaccination series using Recombivax HB® at the adult dosage has been demonstrated among adolescents aged 11–15 years to produce protective antibody responses equivalent to that of the 3-dose series, although the long-term protection afforded from this schedule is not known (*8,11*).

The duration of vaccine-induced antibody and protection from hepatitis B virus (HBV) infection has been evaluated among vaccinated infants, juveniles, and adults (*5,12–14*). Studies indicate that although loss of detectable anti-HBs has ranged from 13% to 60% by 9–15 years after vaccination, immune memory provides protection from HBV infection, and protection remains intact for ≥15 years, the longest period for which follow-up data are available (*5,12–14*). Because of the long duration of protection afforded by the 3-dose vaccine series, booster doses of vaccine are not needed among vaccinated immunocompetent juveniles or adults.

### Adverse Reactions

Adverse reactions associated with hepatitis B vaccine include pain at the injection site (3%–29%) and a temperature ≥37.7°C (1%–6%), although these effects are reported no more frequently among vaccine recipients than among placebo recipients in controlled trials (*5*). Anaphylaxis has been reported in 1/600,000 vaccine recipients; however, no deaths have been attributed to vaccination. A number of case reports and case series have claimed an association between hepatitis B vaccination and serious adverse health events (e.g., multiple sclerosis) (*15,16*); however, these have not been proven by other epidemiologic studies (*17–22*). Adverse events suspected to be associated with hepatitis B vaccination should be reported to VAERS, and reporting forms can be obtained by calling 1-800-822-7967.

#### References


1. CDC. Prevention of hepatitis A through active or passive immunization—recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999;48 (RR-12):1–37.
2. CDC. Notice to readers: FDA approval for a combined hepatitis A and hepatitis B vaccine. MMWR 2001;50:806–7.
3. Bryan JP, Henry CH, Hoffman AG, et al. Randomized, cross-over, controlled comparison of two inactivated hepatitis A vaccines. Vaccine 2001;19:743–50.
4. Connor BA, Phair J, Sack D, et al. Randomized, double-blind study in health adults to assess the boosting effect of Vaqta or Havrix after a single dose of Havrix. Clin Infect Dis 2001;32:396–401.
5. CDC. Hepatitis B virus: a comprehensive strategy for eliminating transmission in the United States through universal childhood vaccination—recommendations of the Immunization Practices Advisory Committee (ACIP). MMWR 1991;40 (RR-13):1–25.
6. Davidson M, Krugman S. Recombinant yeast hepatitis B vaccine compared with plasma-derived vaccine: immunogenicity and effect of a booster dose. J Infect 1986;13(suppl A):31–8.
7. Jilg W, Deinhardt F. Results of immunisation with a recombinant yeast-derived hepatitis B vaccine. J Infect 1986;13(suppl A):47–51.
8. Cassidy WM, Watson B, Ioli VA, Williams, K, Bird S, West, DJ. A randomized trial of alternative two- and three-dose hepatitis B vaccination regimens in adolescents: antibody responses, safety, and immunologic memory. Pediatrics 2001;107:626–31.
9. Middleman AB, Kozinetz CA, Robertson LM, DuRant RH, Emans SJ. The effect of late doses on the achievement of seroprotection and antibody titer levels with hepatitis B immunization among adolescents. Pediatrics 2001;107:1065–9.
10. Marsano LS, Greenberg RN, Kirkpatrick RB, et al. Comparison of a rapid hepatitis B immunization schedule to the standard schedule for adults. Am J Gastroenterol 1996;91:111–5.
11. CDC. Notice to readers: alternate two-dose hepatitis B vaccination schedule for adolescents aged 11–15 years. MMWR 2000;49:261.
12. Mahoney FJ, Stewart K, Hu H, Coleman P, Alter MJ. Progress toward the elimination of hepatitis B virus transmission among health care workers in the United States. Arch Intern Med 1997;157:2601–5.
13. West DJ, Calandra GB. Vaccine induced immunologic memory for hepatitis B surface antigen: implications for policy on booster vaccination. Vaccine 1996;14:1019–27.

14. Yuen MF, Lim WL, Cheng CC, Lam SK, Lai, CL. Twelve-year follow-up of a prospective randomized trial of hepatitis B recombinant DNA yeast vaccine versus plasma-derived vaccine without booster doses in children. Hepatology 1999;29:924–7.
15. Herroelen L, de Keyser J, Ebinger G. Central-nervous-system demyelination after immunisation with recombinant hepatitis B vaccine. Lancet 1991;338:1174–5.
16. Kaplanski G, Retornaz F, Durand J, Soubeyrand J. Central nervous system demyelination after vaccination against hepatitis B and HLA haplotype [Letter]. J Neurol Neurosurg Psychiatry 1995;58:758–9.
17. Expanded programme on immunization (EPI): lack of evidence that hepatitis B vaccine causes multiple sclerosis. Wkly Epidemiol Rec 1997;72:149–52.
18. Sadovnick AD, Scheifele DW. School-based hepatitis B vaccination programme and adolescent multiple sclerosis. Lancet 2000;355:549–50.
19. Ascherio A, Zhang SM, Hernan MA, et al. Hepatitis B vaccination and the risk of multiple sclerosis. N Engl J Med 2001;344:327–32.
20. Confavreux C, Suissa S, Saddier P, Bourdes V, Vukusic S. Vaccinations and the risk of relapse in multiple sclerosis. N Engl J Med 2001;344: 319–26.
21. MacIntyre CR. Hepatitis B vaccine: risks and benefits of universal neonatal vaccination. J Paediatr Child Health 2001;37:215–7.
22. Stratton K, Almario D, McCormick MC. Immunization safety review: hepatitis B vaccine and demyelinating neurological disorders. Washington, D.C.: The National Academies Press, 2002.

MMWR™

Morbidity and Mortality Weekly Report

Recommendations and Reports | January 24, 2003 / Vol. 52 / No. RR-1

# Continuing Education Activity Sponsored by CDC
## Prevention and Control of Infections with Hepatitis Viruses in Correctional Settings

### EXPIRATION — January 24, 2005

You must complete and return the response form electronically or by mail by **January 24, 2005**, to receive continuing education credit. If you answer all of the questions, you will receive an award letter for 2.25 hours Continuing Medical Education (CME) credit; 0.2 Continuing Education Units (CEUs); 2.0 hours Certified Health Education Specialist (CHES) credit; or 2.5 contact hours Continuing Nursing Education (CNE) credit. If you return the form electronically, you will receive educational credit immediately. If you mail the form, you will receive educational credit in approximately 30 days. No fees are charged for participating in this continuing education activity.

### INSTRUCTIONS

**By Internet**

1. Read this *MMWR* (Vol. 52, RR-1), which contains the correct answers to the questions beginning on the next page.
2. Go to the *MMWR* Continuing Education Internet site at <http://www.cdc.gov/mmwr/cme/conted.html>.
3. Select which exam you want to take and select whether you want to register for CME, CEU, CHES, or CNE credit.
4. Fill out and submit the registration form.
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6. Submit your answers no later than **January 24, 2005**.
7. Immediately print your Certificate of Completion for your records.

**By Mail or Fax**

1. Read this *MMWR* (Vol. 52, RR-1), which contains the correct answers to the questions beginning on the next page.
2. Complete all registration information on the response form, including your name, mailing address, phone number, and e-mail address, if available.
3. Indicate whether you are registering for CME, CEU, CHES, or CNE credit.
4. Select your answers to the questions, and mark the corresponding letters on the response form. To receive continuing education credit, you must answer all of the questions. Questions with more than one correct answer will instruct you to "Indicate all that apply."
5. Sign and date the response form or a photocopy of the form and send no later than **January 24, 2005**, to
   Fax: 404-639-4198 Mail: MMWR CE Credit
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   Epidemiology Program Office, MS C-08
   Centers for Disease Control and Prevention
   1600 Clifton Rd, N.E.
   Atlanta, GA 30333
6. Your Certificate of Completion will be mailed to you within 30 days.

### ACCREDITATION

**Continuing Medical Education (CME).** CDC is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians. CDC designates this educational activity for a maximum of 2.25 hours in category 1 credit toward the AMA Physician's Recognition Award. Each physician should claim only those hours of credit that he/she actually spent in the educational activity.

**Continuing Education Unit (CEU).** CDC has been approved as an authorized provider of continuing education and training programs by the International Association for Continuing Education and Training and awards 0.2 Continuing Education Units (CEUs).

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**Continuing Nursing Education (CNE).** This activity for 2.5 contact hours is provided by CDC, which is accredited as a provider of continuing education in nursing by the American Nurses Credentialing Center's Commission on Accreditation.

## Goal and Objectives

This *MMWR* provides information and recommendations regarding prevention and control of infections with hepatitis viruses in correctional settings. The recommendations were prepared by CDC staff from the National Center for Infectious Diseases, in consultation with external consultants. The goal of this report is to provide information and recommendations for physicians, health-care delivery staff, corrections staff, administrators, and other public health professionals who deliver services to incarcerated persons. After completing this educational activity, the reader should be able to 1) identify the risk factors for transmission of viral hepatitis among incarcerated persons; 2) describe the epidemiology of viral hepatitis in the United States; 3) describe the outcome of infection with hepatitis viruses; 4) describe methods used to prevent and control viral hepatitis in juvenile and adult correctional settings; and 5) identify infection control measures to prevent occupational exposure to hepatitis B and C viruses among correctional workers.

***To receive continuing education credit, please answer all of the following questions.***

**1. Which of the following are risk factors for viral hepatitis among inmates?**

A. Injection-drug use.
B. Sex among inmates and between inmates and staff.
C. Percutaneous exposures.
D. Occupational exposures.
E. All of the above.
F. None of the above.

**2. Chronic hepatitis B virus (HBV) infection might result in . . .**

A. an asymptomatic carrier state.
B. chronic persistent hepatitis.
C. chronic active hepatitis which progresses to cirrhosis.
D. chronic active hepatitis which progresses to liver cancer.
E. all of the above.
F. none of the above.

**3. No association has been found with hepatitis C virus (HCV) infection and military service or exposures resulting from medical, surgical, or dental procedures, tattooing, acupuncture, ear piercing, or foreign travel.**

A. True.
B. False.

**4. Routine HCV testing is recommended for . . .**

A. persons who ever injected illegal drugs.
B. persons who received clotting factor concentrate produced before 1987.
C. persons ever on long-term hemodialysis.
D. persons with persistently abnormal alanine aminotransferase (ALT).
E. prior recipients of transfusions or organ transplants including those who received blood or blood components or received an organ transplant before July 1992.
F. all of the above.

**5. A delay in the administration of the second hepatitis A vaccine dose results in lowered final antibody levels or seroconversion, and if the second dose is delayed, the series should be restarted.**

A. True.
B. False.

**6. Hepatitis B vaccination should be initiated even when completion of a series cannot be ensured, because relatively high levels of immunity are provided by one or two doses of vaccine. Administration of even a partial vaccine series (i.e., 1–2 doses) during incarceration might avert new infections.**

A. True.
B. False.

**7. To prevent false positives, screening for antibody to HCV should be performed with enzyme immunoassay (EIA) testing as well as a more specific assay (e.g., recombinant immunoblot assay [RIBA®]). These tests detect ≥97% of anti-HCV, but do not distinguish among acute, chronic, or resolved infections.**

A. True.
B. False.

**8. Which of the following drugs are currently FDA-approved for treatment of persons with hepatitis C? (*Indicate all that apply.*)**

A. Alpha interferon.
B. Pegylated interferon.
C. Ribavirin.
D. Lamivudine.

**9. Postexposure prophylaxis is necessary for a fully vaccinated juvenile after a percutaneous or sexual exposure that might contain HBV.**

A. True.
B. False.

**10. Juveniles with chronic HBV or HCV infections, and their parents or guardians, should be counseled regarding which of the following? (*Indicate all that apply.*)**

A. Preventing transmission to household, sexual, and drug-use contacts.
B. Referral for hepatitis B vaccination of susceptible contacts.
C. Ways to reduce further liver damage, including limiting alcohol and drug use.
D. Postexposure prophylaxis.

**11. Previously unvaccinated hepatitis B surface antigen-negative pregnant women should not be vaccinated; pregnancy is a contraindication to vaccination.**

A. True.
B. False.

**12. CDC recommends that all persons who receive a medical evaluation in a correctional facility be administered hepatitis B vaccine, unless they have proof of completion of the vaccine series.**

A. True.
B. False.

**13. For which of the following persons is routine testing for HCV infection recommended? (*Indicate all that apply.*)**

A. Persons who have been tattooed.
B. Persons who have a history of sexually transmitted disease.
C. Persons who have ever injected illegal drugs.
D. Persons who have had a transfusion of blood or blood components before July 1992.
E. Persons who have received clotting factor concentrates made before 1987.

**14. Indicate your work setting.**

A. State/local health department.
B. Other public health setting.
C. Hospital clinic/private practice.
D. Managed care organization.
E. Academic institution.
F. Other.

**15. Which best describes your professional activities?**

A. Patient care — emergency/urgent care department.
B. Patient care — inpatient.
C. Patient care — primary-care clinic or office.
D. Laboratory/pharmacy.
E. Public health.
F. Other.

**16. I plan to use these recommendations as the basis for . . . (*Indicate all that apply.*)**

A. health education materials.
B. insurance reimbursement policies.
C. local practice guidelines.
D. public policy.
E. other.

**17. Each month, approximately how many patients do you see who have hepatitis?**

A. None.
B. 1–10.
C. 11–100.
D. 101–1,000.
E. >1,000.

**18. How much time did you spend reading this report and completing the exam?**

A. <2.0 hours.
B. >2.0 hours but <3.0 hours.
C. >3.0 but <4.0 hours.
D. ≥4.0 hours.

**19. After reading this report, I am confident I can identify the risk factors for transmission of viral hepatitis among incarcerated persons.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

**20. After reading this report, I am confident I can describe the epidemiology of viral hepatitis in the United States.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

**21. After reading this report, I am confident I can describe the outcome of infections with hepatitis viruses.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

**22. After reading this report, I am confident I can describe methods used to prevent and control viral hepatitis in juvenile and adult correctional settings.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

***Detach or photocopy.***

## MMWR Response Form for Continuing Education Credit
## January 24, 2003/Vol. 52/No. RR-1
## Prevention and Control of Infections with Hepatitis Viruses in Correctional Settings

***To receive continuing education credit, you must***
***1. provide your contact information;***
***2. indicate your choice of CME, CEU, or CNE credit;***
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*Fill in the appropriate blocks to indicate your answers. Remember, you must answer all of the questions to receive continuing education credit!*

| | | |
|---|---|---|
| 1. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F | 16. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 2. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F | 17. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 3. [ ] A [ ] B | 18. [ ] A [ ] B [ ] C [ ] D | |
| 4. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F | 19. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 5. [ ] A [ ] B | 20. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 6. [ ] A [ ] B | 21. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 7. [ ] A [ ] B | 22. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 8. [ ] A [ ] B [ ] C [ ] D | 23. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 9. [ ] A [ ] B | 24. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 10. [ ] A [ ] B [ ] C [ ] D | 25. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 11. [ ] A [ ] B | 26. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 12. [ ] A [ ] B | 27. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 13. [ ] A [ ] B [ ] C [ ] D [ ] E | 28. [ ] A [ ] B [ ] C [ ] D [ ] E | |
| 14. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F | 29. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F | |
| 15. [ ] A [ ] B [ ] C [ ] D [ ] E [ ] F | | |

*Signature* *Date I Completed Exam*

**23. After reading this report, I am confident I can identify infection control measures to prevent occupational exposure to HBV and HCV among correctional workers.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

**24. The objectives are relevant to the goal of this report.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

**25. The tables and boxes are useful.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

**26. Overall, the presentation of the report enhanced my ability to understand the material.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

**27. These recommendations will affect my practice.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

**28. The availability of continuing education credit influenced my decision to read this report.**

A. Strongly agree.
B. Agree.
C. Neither agree nor disagree.
D. Disagree.
E. Strongly disagree.

**29. How did you learn about this continuing education activity?**

A. Internet.
B. Advertisement (e.g., fact sheet, *MMWR* cover, newsletter, or journal).
C. Coworker/supervisor.
D. Conference presentation.
E. *MMWR* subscription.
F. Other.

**Correct answers for questions 1–13.**
1. E; 2. E; 3. A; 4. F; 5. B; 6. A; 7. A; 8. A, B, and C; 9. B; 10. A, B, and C; 11. B; 12. A; 13. C, D, and E.

## Prevention and Control of Infections with Hepatitis Viruses in Correctional Settings

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