Hepatitis B (HBV) is a global health problem affecting 2 billion people worldwide\(^1\). Of those infected with HBV, 350 million remain chronically infected with an estimated 1 million who die annually of HBV-related liver failure, cirrhosis and liver cancer\(^1\). The incidence of reported HBV peaked in the mid-1980s, with about 26,000 cases reported a year\(^3\). During the 1980s to mid-1990s, hepatitis B declined and fell below 10,000 cases in 1996\(^3\). This decline was generally attributed to reduction of transmission among men who have sex with men (MSM) and injection-drug users (IDU) as a result of HIV prevention efforts\(^3\). From 1990-2004, the incidence in the U. S. of newly acquired HBV infection has declined steadily due to a comprehensive national immunization program\(^3\). The number of reported acute HBV cases has decreased to 3,192 reported cases in 2019\(^4\).

**A. Agent**
HBV is a DNA-containing, 42-nm hepadenavirus\(^2\). HBV contains numerous antigenic components, including hepatitis B surface antigen (HBsAg), hepatitis B core antigen (HbcAg), and hepatitis B e antigen (HBeAg)\(^2\). HBV is classified into eight main genotypes (A-H)\(^3\).

**B. Clinical Description**
Infection with HBV may result in acute or chronic disease, both of which may be asymptomatic\(^2\). If symptoms are present, onset is usually subtle with loss of appetite, vague abdominal discomfort, nausea, vomiting and sometimes arthralgia and rash often progressing to jaundice\(^2\).

**C. Reservoirs**
Humans\(^1\)

**D. Mode of Transmission**
Blood and blood products; saliva (no documented outbreaks through saliva alone); cerebrospinal fluid; peritoneal; pleural; pericardial and synovial fluid; amniotic fluid; semen and vaginal secretions; any other body fluids containing blood; and unfixed tissues and organs are potential sources of HBV. Transmission occurs through percutaneous (IV, IM, SC, intradermal) and mucosal exposure to infective body fluids\(^1\). HBV is stable in the environment for up to 7 days\(^3\).

**E. Incubation Period**
Usually 45-180 days, average 60-120 days\(^1\).

**F. Period of Communicability**
A person is considered infectious as long as hepatitis B surface antigen (HBsAg) is detectable in the blood\(^1\). Most acute persons are infectious from 1-2 months before to 1-2 months after the onset of symptoms. Persons with chronic hepatitis B (i.e. carriers) remain infectious indefinitely. All persons who are HBsAg positive are potentially infectious regardless of HBeAg status\(^1\). Individuals who are both hepatitis B surface antigen (HBsAg) positive and HBeAg positive have increased viremia and are more likely to transmit HBV\(^1\).
G. Susceptibility and Resistance
Protective immunity follows infection if antibody, anti-HBs, develops and HBsAg is negative. Anti-HBs also develops in a person who has been successfully vaccinated against hepatitis B3.
After three intramuscular doses of hepatitis B vaccine, more than 90% of healthy adults and more than 90% of infants, children and adolescents (from birth to 19 years of age) develop adequate antibody responses3. However, there is an age-specific decline in immunogenicity after age 40 years. The vaccine is 80% to 100% effective in preventing infection or clinical hepatitis in those who receive the complete series3.
The recommended immunization schedule for children is a 3 dose set administered at 0, 1, and 6 months of age5. The hepatitis B vaccine is the only vaccine recommended at birth. For complete and updated immunizations schedules:

Individuals at high risk of infection include1:
- Sexual partners and household contacts of persons HBsAg positive
- Injection drug users
- Hemodialysis patients
- Inmates
- Healthcare workers

H. Treatment
Treatment is supportive only during the acute phase. Persons who have chronic HBV infection require medical evaluation and regular monitoring. Treatments are available for chronic HBV (refer to Red Book)2.

I. Clinical Case Definition6
Acute:
An acute illness with a discrete onset of any sign or symptom* consistent with acute viral hepatitis (e.g., fever, headache, malaise, anorexia, nausea, vomiting, diarrhea, and abdominal pain), and either a) jaundice, or b) elevated serum alanine aminotransferase (ALT) levels >100 IU/L.
*A documented negative hepatitis B surface antigen (HBsAg) laboratory test result within 6 months prior to a positive test (either HBsAg, hepatitis B “e” antigen (HBeAg), or hepatitis B virus nucleic acid testing (HBV NAT) including genotype) result does not require an acute clinical presentation to meet the surveillance case definition.

Chronic:
Persons with chronic HBV infection may have no evidence of liver disease or may have a spectrum of disease ranging from chronic hepatitis to cirrhosis or liver cancer. Persons with chronic infection may be asymptomatic.
J. **Laboratory Criteria for Diagnosis**

**Acute:**
- Hepatitis B surface antigen (HBsAg) positive, AND
- Immunoglobulin M (IgM) antibody to hepatitis B core antigen (HBcIgM) positive (if done)

**Chronic:**
- IgM anti-HBc negative AND a positive result on one of the following tests: hepatitis B surface antigen (HBsAg), hepatitis B e antigen (HBeAg), or nucleic acid test for hepatitis B virus DNA (HBV DNA, including qualitative, quantitative and genotype testing), OR
- HBsAg positive or HBV DNA positive or HBeAg positive two times at least 6 months apart (any combination of these tests performed 6 months apart is acceptable.)

<table>
<thead>
<tr>
<th>Case Classification</th>
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<tbody>
<tr>
<td><strong>Acute</strong></td>
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<td><strong>Probable</strong></td>
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<td><strong>Suspect</strong></td>
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<th>Case Classification</th>
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<tr>
<td><strong>Chronic</strong></td>
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<tr>
<td><strong>Confirmed</strong></td>
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<td><strong>Probable</strong></td>
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K. **Classification of Import Status**

N/A

L. **Laboratory Testing**

Laboratory testing for hepatitis B is acceptable from all private laboratories. Specimens are not required to be sent to ADHS.

Serologic antigen tests are available commercially to detect HBsAg and HBeAg. Serologic assays also are available for detection of anti-HBs, anti-HBc (total), IgM anti-HBc, and anti-HBe. In addition, nucleic acid amplification testing, gene-amplification techniques (e.g., polymerase chain reaction assay, branched DNA methods), and hybridization assays are
available to detect and quantify HBV DNA\textsuperscript{2}. Tests to quantify HBsAg and HBeAg currently are being developed but are not yet commercially available\textsuperscript{2}.

M. Assessing Laboratory Results
HBsAg is detectable during acute infection\textsuperscript{2}. If HBV infection is self-limited, HBsAg disappears in most patients within a few weeks to several months after infection, followed by appearance of anti-HBs\textsuperscript{2}. The time between disappearance of HBsAg and appearance of anti-HBs is termed the window period of infection\textsuperscript{2}. During the window period, the only marker of acute infection is IgM anti-HBc, which is highly specific for establishing the diagnosis of acute infection\textsuperscript{2}. However, IgM anti-HBc usually is not present in infants infected perinatally\textsuperscript{2}. People with chronic HBV infection have circulating HBsAg and circulating total anti-HBc; on rare occasions, anti-HBs also is present\textsuperscript{2}. Both anti-HBs and total anti-HBc are present in people with resolved infection, whereas anti-HBs alone is present in people immunized with the HBV vaccine\textsuperscript{2}. Transient HBsAg antigenemia can occur following receipt of HBV vaccine, with HBsAg being detected as early as 24 hours after and up to 2-3 weeks following vaccine administration\textsuperscript{2}. The presence of HBeAg in serum correlates with higher concentrations of HBV and greater infectivity. Tests for HBeAg and HBV DNA are useful in selection of candidates to receive antiviral therapy and to monitor response to therapy\textsuperscript{2}.

Interpreting HBV serology results can be challenging, so CDC has developed a tool to help: https://www.cdc.gov/hepatitis/hbv/pdfs/serologicchartv8.pdf

N. Outbreak Definition
An unexplained, unexpected increase in cases of confirmed HBV infection that is clustered by time, place, or person.

O. Time Frame
All confirmed and probable cases are to be reported within 5 working days and should be investigated as soon as possible\textsuperscript{7}.

P. Forms
Q. Investigation Steps
For a local health agency:

A.A.C. R9-6-344. Hepatitis B and Hepatitis D
A. Case control measures:
A local health agency shall:

a. Evaluate a health care provider identified as the source of hepatitis B virus transmission in the workplace and, if indicated, ensure reassignment of the health care provider to a position where the occupational risk of transmission is eliminated;

b. Conduct an epidemiologic investigation of each reported case or suspect case of hepatitis B or hepatitis B co-infected with hepatitis D; and

c. For each acute case of hepatitis B or hepatitis B co-infected with hepatitis D or case of perinatal hepatitis B, submit to the Department, as specified in Table 2.4, the information required under R9-6-206(D).

The operator of a blood bank, blood center, or plasma center shall notify a donor of a test result with significant evidence suggestive of hepatitis B, as required under A.R.S. § 32-1483 and 21 CFR 630.6.

B. Contact control measures:
A local health agency shall:

a. Refer each non-immune hepatitis B contact to a health care provider for prophylaxis and initiation of the hepatitis B vaccine series, and

b. Provide health education related to the progression of hepatitis B disease and the prevention of transmission of hepatitis B infection to each non-immune hepatitis B contact.

1. Confirm Diagnosis

- Using the case definition and by contacting the physician’s office or medical facility reporting the case, obtain medical records including:
  - Address and phone if not listed on case report
  - History and physical
  - All hepatitis A, B, C, and D tests
  - Liver function tests (serum aminotransferase tests) if done
  - Pregnancy status

- Review all lab results and liver function tests, doctor diagnosis, symptoms, including jaundice, as well as date of illness onset, and correlate to accurately classify the case.

- Categorize the case as acute or chronic

- If the case is pregnant then it is to be transferred to the Perinatal Hepatitis B Program.

- Before contacting the case, try to ascertain what the patient has been told about his/her evaluation for disease. Frequently the medical record will mention discussion with case, but many times case has not been informed of test results.

2. Conduct Case Investigation

All cases of hepatitis B should be routinely investigated to identify potential source of infection and to provide education regarding hepatitis B prevention. Cases should be investigated as soon as possible in order to recommend post-exposure prophylaxis as indicated. For chronic and perinatal hepatitis B
patients, counseling and referral for medical management may be warranted to assess for biochemical evidence of chronic liver disease and eligibility for antiviral treatment.

- Determination of risk factors (e.g., household contacts, occupational, illicit drug use, sexual orientation, positive HBsAg mother/foreign born);
- Vaccination status
- Investigate to identify additional cases and/or contacts of case that would be considered appropriate candidates for PEP and/or vaccine (refer to Red Book).
- For perinatal patients, collect additional immunization information on child, including date and disease of HBIG and hepatitis B vaccine.

3. Conduct Contact Investigation

- Consider the following types of contacts during the contact investigation:
  - Household members (adults and children) of HBsAg positive individuals
  - Sexual or needle-sharing partners of HBsAg positive individuals
  - Individuals with mucosal or percutaneous exposure (e.g., bite, needle stick) to blood or body fluids that contain blood of an HBsAg positive person
  - Infants <12 months of age with household exposure to a primary caregiver with acute hepatitis B
  - Victim of sexual assault/abuse by a perpetrator who is HBsAg positive

4. Initiate Control and Prevention Measures (Acute)

- Provide education that includes basic information about the disease, transmission, complications and need for follow-up with medical care to determine resolution of acute illness or progression to carrier state.
- Advise all acute cases that their blood and other body fluids are infectious to others until the HBsAg is cleared, usually 2-3 months.
- Advise cases that this virus is transmitted through sexual contact and instruct them to practice abstinence, use condoms or other safe sex practices until their partners are fully vaccinated.
- Cover cuts or skin lesions to prevent contact with secretions and blood
- Do not share household articles (e.g., toothbrushes, razors or personal injection equipment) that could be contaminated with blood.
- Surfaces contaminated with saliva and blood should be cleaned and properly disinfected as hepatitis B virus can survive outside the body at least 7 days.
- Educational factsheets can be found here: http://www.cdc.gov/hepatitis/hbv/patienteduhbv.htm
- **Referral for medical evaluation**: Persons with acute hepatitis B should be evaluated for the development of chronic infection. The detection of HBsAg >6 months after illness onset indicates the presence of chronic infection.
- Encourage person with acute symptoms to seek medical treatment promptly or if symptoms worsen to seek immediate medical care.
- Recommend appropriate testing, immunization and/ or PEP for appropriate contacts (household including infant and children, sexual partners, drug-sharing, anyone exposed to the blood or body fluids of case) to acute case of hepatitis B contacts and direct to nearest emergency room if HBIG* is indicated. Immunoprophylaxis should be administered as soon as
possible, preferably within 24 hours after exposure. All exposures should receive the hepatitis B vaccine. Follow the Red Book, recommendations for appropriate recommendations.

- HBIG* and vaccine:
- HBIG* is not recommended for household contacts unless they have had some type of discrete, identifiable exposure (e.g., exposure to the blood of the source case within 14 days). Hepatitis B vaccine is recommended for all household contacts.
- HBIG* and vaccine should be recommended to sexual contacts of an acute case if received within 14 days of the last sexual contact. Condoms should be used to protect non-immune sexual partners until immunity is confirmed. Note: Condoms can reduce the risk of contracting hepatitis B but do not eliminate the risk.
- HBIG* and vaccine should be recommended to those exposed by percutaneous (e.g., bite, needlestick, nonintact skin) or mucosal exposure to HBsAg-positive blood or body fluids.
- Recommend that cases inform all sexual or drug using contacts with potential exposures within the last 6 months. If the case is unable or unwilling to do this, Epidemiology Staff will try to elicit these contacts and may refer them to a HIV/STD program* for contact notification.
- Repeat testing for HBsAg should be recommended to acute cases after 6 months to determine the clearance or continued presence of HBsAg:
  - Persons still HBsAg positive after 6 months are considered confirmed chronic carriers.
- Persons with positive hepatitis B core IgM tests and negative hepatitis B surface antigen tests who are ruled out as acute cases are still to be encouraged to seek further medical evaluation and to consider the possibility that they may be infectious, unless the medical records indicate other illnesses or medical diagnosis that rules out hepatitis B.

* Contact notification is well-established in some but not all county health department HIV/STD programs. The program’s specialists have expertise in reaching the types of contacts identified with HBsAg patients and can contact sexual, illicit-drug using partners in an anonymous, confidential manner.

4b. Initiate Control and Prevention Measures (Chronic)
- Patient Education: Educate chronic carriers on measures to avoid disease transmission including risks to newborns, and measures to protect the liver.

To prevent or reduce the risk for transmission to others, HBsAg-positive persons should be advised to:
- notify their household, sex, and needle-sharing contacts that they should be tested for markers of HBV infection, vaccinated against hepatitis B, and, if susceptible, complete the hepatitis B vaccine series;
- use methods (e.g., condoms) to protect nonimmune sex partners from acquiring HBV infection from sexual activity until the sex partners can be vaccinated and their immunity documented (HBsAg-positive persons should be made aware that use of condoms and other prevention methods also might reduce their risks for HIV infection and other STDs);
- cover cuts and skin lesions to prevent the spread of infectious secretions or blood;
- clean blood spills with bleach solution;
- refrain from donating blood, plasma, tissue, or semen;
refrain from sharing household articles (e.g., toothbrushes, razors, or personal injection equipment) that could become contaminated with blood; and

dispose of blood and body fluids and medical waste properly.

Educational factsheets can be found at: http://www.cdc.gov/hepatitis/hbv/patienteduhbv.htm

**Counseling and referral:** To protect the liver from further harm, HBsAg-positive persons should be advised to:

- seek health-care services from a provider experienced in the management of hepatitis B with routine follow-up;
- avoid or limit alcohol consumption because of the effects of alcohol on the liver, with referral to care provided for persons needing evaluation or treatment for alcohol abuse;
- refrain from taking medications not prescribed by doctor including over the counter and herbal medicines;
- obtain vaccination against hepatitis A (2 doses, 6-18 months apart) if chronic liver disease is present
- HBsAg-positive pregnant women should be advised of the need for their newborns to receive hepatitis B vaccine and hepatitis B immune globulin beginning at birth and to complete the hepatitis B vaccine series according to the recommended immunization schedule.
- When seeking medical or dental care, HBsAg-positive persons should be advised to inform those responsible for their care of their HBsAg status so they can be evaluated and their care managed appropriately.
- Encourage person with symptoms to seek medical treatment promptly or if symptoms worsen to seek immediate medical care.
- Recommend appropriate testing and immunization for contacts to chronic cases of hepatitis B. Refer to primary care doctor or the low-cost community clinics for testing and vaccine.

- Hepatitis B vaccination is recommended for all unvaccinated adults at risk for hepatitis B infection. Acknowledgement of a risk factor should not be a requirement for vaccination.
  - Recommend that cases inform all sexual or drug using contacts with potential exposures within the last 6 months. If the case is unable or unwilling to do this, Epidemiology Staff will try to elicit these contacts and can refer them to the HIV/STD program for contact notification*
  - Chronic HBV infection is a complicated infection with varying types of tests results.
  - The CDC advises that all persons testing HBsAg positive are to consider themselves infectious.
    - The role of the health department is to advise all persons with positive HBsAg tests that they may be infectious to others and educate accordingly.
    - Tests for HBV DNA, HBeAg and anti-HBe can help physicians determine degree of viral replication and may counsel their patients differently about infectiousness based on their medical judgment.
Refugees who are HBsAg positive pose a special challenge due to language and cultural barriers

- Language appropriate hepatitis B materials are available at:
  http://www.cdc.gov/knowhepatitisb/materials.htm
  - Consult with the Arizona Refugee Resettlement Program in the Department of Economic Security through the Arizona Refugee Health Program in the ADHS for refugee services and/or ADHS Arizona Health Disparities Center for language resources.

5. Isolation in a hospital setting:

- Universal precautions to prevent exposures to blood and body fluids. See “Guidelines for Environmental Infection Control in Health-Care Facilities”, https://www.cdc.gov/MMWR/preview/MMWRhtml/rr5210a1.htm
- Hepatitis B vaccine is recommended for all health care workers.

Arizona Administrative Code:

Per A.A.C. R9-6-338, a local health agency shall:

- Evaluate a health care provider identified as the source of hepatitis B virus transmission in the work place and, if indicated, ensure reassignment of the health care provider to a position where the occupational risk of transmission is eliminated;
- Conduct an epidemiologic investigation of each reported case or suspect case of hepatitis B or hepatitis B co-infected with hepatitis D; and
- For each acute case of hepatitis B or hepatitis B co-infected with hepatitis D or case of Perinatal hepatitis B, submit to the Arizona Department of Health Services (ADHS)
- The operator of a blood bank, blood center, or plasma center shall notify a donor of a test result with significant evidence suggestive of hepatitis B, as required under A.R.S. § 32-1483 and 21 CFR 630.6.

6. Case Management

- No specific therapy for acute HBV infection is available. Treatment is supportive. For chronic HBV patients, antivirals have been developed. Chronic HBV patients should discuss potential treatment options with their physician.

7. Contact Management

- Evaluate each contact’s susceptibility and initiate post-exposure prophylaxis as soon as possible (preferably within 24 hours).
- Post-exposure prophylaxis:
  - Post-exposure prophylaxis with hepatitis B immune globulin (HBIG) and hepatitis B vaccine should be given to:
    - Infants born to HBsAg (Hepatitis B surface Antigen)-positive mothers
    - Unvaccinated infants whose mothers or primary caregivers have acute hepatitis B
• Breastfeeding of an HBsAg-positive mother poses no additional risk of acquisition of HBV infection by the infant with appropriate administration of hepatitis B vaccine and HBIG
  ○ Unimmunized and underimmunized household, sexual and needle-sharing contacts should be vaccinated with the complete hepatitis B vaccine series.
  ○ Health care workers after occupational exposure to HBsAg-positive blood depending on their vaccination and vaccine response status.
  ○ Immunization should be provided within 24 hours after exposure and within 7 days of percutaneous exposure. Sexual contacts of persons with acute hepatitis B should begin within 14 days of the last sexual contact or if sexual contact with the infected person will continue.
  ○ Previously immunized household, sexual and needle-sharing contacts of persons with chronic HBV infection do not need prophylaxis with HBIG but should be given an additional booster dose.
  ○ Unimmunized people who were exposed to someone with an unknown HBsAg status should be vaccinated with the complete HBV vaccine series.
  ○ Regimens involving either multiple doses of HBIG alone or the hepatitis B vaccine series alone are 70%–75% effective in preventing HBV infection. HBIG also has been shown to provide an estimated 75% protection from HBV infection when initiated within 1 week of percutaneous exposure to HBsAg-positive blood, or when initiated within 14 days of sexual exposure to an HBsAg-positive partner.
  ○ HBIG and hepatitis B vaccine as prophylaxis 85%–95% effective in preventing HBV infection when administered at birth to infants born to HBsAg-positive mothers.

*Note: A completed hepatitis B series is protective in most people, but without post-vaccination testing, contacts may consider receiving a booster dose depending on type of contact involved.

8. Environmental Measures
• Concurrent disinfection of equipment contaminated with blood or infectious body fluids.
• If a healthcare, long-term care facility, or a facility that provides tattoos, body piercing or cosmetic procedures is implicated in transmission, an inspection of the facility should be coordinated through the proper regulatory agency.

9. Notifications, Data Management, and Reporting:
• All cases: Report data electronically via MEDSIS to include:
  ○ At a minimum, all data collected that helps to confirm or classify a case.
  ○ All information collected on the ADHS investigation form should be entered into the DSO or case detail section of the MEDSIS form.

R. Outbreak Guidelines
Refer to the general outbreak guidelines section for general information on conducting an outbreak investigation.
S. Special Situations

Healthcare Setting:
- Universal precautions for blood and body fluids\(^9\).
- Vaccine to HBV is recommended for all healthcare workers\(^{10,11}\).
- Detailed guidelines for the management of post-exposure prophylaxis for healthcare professionals and other people that are exposed to blood that is or may be HBsAg positive is provided in the recommendations of the Advisory Committee on Immunization Practices of the CDC: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5011a1.htm.

Correctional Institution, Group Home, Congregate Setting
- Universal precautions for blood and body fluids with blood\(^9\).
- Vaccine is recommended for susceptible adults and workers in congregate settings\(^{12}\).
- Unimmunized or underimmunized people in juvenile and adult correctional facilities should be immunized\(^{23}\). If the length of stay is not sufficient to complete the immunization series, the series should be initiated, and follow-up mechanisms with a healthcare facility should be established to ensure completion of the series\(^{23}\).
- Prevention and Control of Infections with Hepatitis Viruses in Correctional Settings: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5201a1.htm
References


11. Immunization of Health-Care Workers: Recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC) [Internet]. MMWR Recommendations and Reports. Centers for Disease Control and Prevention; 1997 [cited 2017Mar9]. Available from: https://www.cdc.gov/mmwr/preview/mmwrhtml/00050577.htm