Hepatitis B (Chronic Carrier)

Case Definition

Confirmed Chronic Carrier

Laboratory confirmation of infection:

- Persistence of confirmed Hepatitis B surface antigen (HBsAg) positivity for more than 6 months in the context of a compatible clinical history of probable exposure

OR

- HBsAg positive and immunoglobulin M antibody to hepatitis B core antigen (anti-HBc IgM) negative

OR

- Total antibody to Hepatitis B core antigen (anti-HBc total) positive and HBV DNA positive
  AND
  - HBsAg negative and Antibody to Hepatitis B Surface Antigen (anti-HBs) negative

Probable Chronic Carrier

Laboratory confirmation of infection:

- HBsAg positive in the context of compatible clinical history and/or appropriate epidemiologic exposure, e.g., self reported past history of Hepatitis B, born in Hepatitis B endemic country

Reporting Requirements

1. **Physicians/Health Practitioner and others**
   Physicians, health practitioners and others listed in Section 22 of the *Public Health Act* shall notify the Medical Officer of Health (MOH) (or designate) of all confirmed and probable chronic carriers in the prescribed form by mail, fax or electronic transfer within 48 hours (two days)

2. **Laboratories**
   All laboratories [including the Canadian Blood Services (CBS) Laboratory, insurance company laboratories, regional laboratories and the Provincial Laboratory of Public Health (PLPH)] shall report all positive laboratory results by mail, fax or electronic transfer within 48 hours (two days) to the:
   - Chief Medical Officer of Health (CMOH) (or designate),
   - MOH (or designate), and
   - attending/ordering physician.

   When reporting positive tests, laboratories shall include the following:
   - name of individual,
   - date of birth,
   - personal health number,
   - address of the individual,
   - phone number of the individual,
   - date of test, and
   - name of laboratory performing test.

3. **Alberta Health Services**
   - The MOH (or designate) shall forward the preliminary NDR of all confirmed and probable chronic carriers to the CMOH (or designate) within two weeks of notification and the final NDR within six weeks of notification.
   - For out-of-zone reports, the MOH (or designate) first notified shall notify the MOH (or designate) where the individual resides by mail, fax or electronic transfer and fax a copy of the positive laboratory report within 48 hours (two days).
   - For out-of-zone contacts, the MOH (or designate) first notified shall notify the MOH (or designate) where the contact resides by mail, fax or electronic transfer including:
     - name,
     - date of birth,
     - personal health number, and
     - contact information i.e., address and phone number.
   - For out-of-province and out-of-country case reports and/or contact, the following information should be forwarded to the CMOH (or designate) by phone, fax or electronic transfer within 48 hours (two days) including:
     - name,
     - date of birth,
     - out-of-province health care number,
     - out-of-province/country address and phone number,
     - attending physician (locally and out-of-province), and
     - positive laboratory report (faxed).

4. Additional Reporting Requirements

- Canadian Blood Services (CBS): All persons testing positive must be reported by the MOH (or designate) to CBS within two working days if they have ever had a history of donating or receiving blood in Canada. (CBS policy, November 23, 2007)
  - A copy of the positive test result must accompany the report, and all information should be sent to Lookback/Traceback Coordinator, CBS:
    - for Red Deer north via confidential fax number (780) 433-1907 or phone (780) 431-8712.
    - for south of Red Deer via confidential fax number (403) 410-2797 or phone (403) 410-2711.
  - For donors the following information is required:
    - where and when donated blood,
    - all names (first and surnames) used, and
    - date of birth.
  - For blood recipients (when blood transfusion is the only risk factor identified), the following additional information is required:
    - year of transfusion, and
    - hospital of transfusion.
- Citizenship and Immigration Canada (CIC): There are currently no guidelines for immigrants as hepatitis B testing is not required as part of the immigration process.

NOTE: *The remainder of this guideline (with the exception of the Occurrence section) is up-to-date as of January 2011.*

Etiology(2,3)

The hepatitis B virus (HBV) is a DNA virus, composed of a nucleocapsid core (HBcAg), surrounded by an outer lipoprotein coat containing the surface antigen (HBsAg). The distribution of subtypes varies geographically. There are multiple subtypes and because of the common "a" determinant, protection against one subtype appears to confer protection against the other subtypes. No differences in clinical features have been related to subtypes.
The third hepatitis B antigen, the "e" antigen (HBeAg), has been identified as a soluble antigen, whose sequences are a subset of those in the core antigen, but without cross-reactivity.

Clinical Presentation(2,3)

Only a small proportion of acute hepatitis B cases may be clinically recognized. Less than 10% of children and 30–50% of adult acute cases will have icteric disease. Hepatitis B in children is most often milder and often anicteric. In infants, this disease is typically asymptomatic.

In persons with clinical illness, the onset is usually insidious with anorexia, vague abdominal discomfort, nausea and vomiting, sometimes arthralgias and rash, often progressing to jaundice. Fever may be absent or mild. Severity ranges from inapparent cases detectable only by liver function tests to fulminating, fatal cases of acute hepatic necrosis. The case-fatality rate in hospitalized patients is about 1% and is higher in those over 40 years of age.

Chronic HBV infection is found in 0.5% of North American adults and in 0.1–20% of people from other parts of the world. Persons with chronic infection may or may not have a history of clinical hepatitis. About one-third have an elevated aminotransferase. Biopsy findings range from normal to chronic active hepatitis, with or without cirrhosis. The prognosis of the liver disease in such persons is variable.

Following acute HBV infection, the risk of developing chronic infection varies inversely with age. Infants infected with HBV at birth will have a 90% chance of becoming chronic HBV carriers. Twenty-five per cent to 50% of children infected between one and five years of age and about 1–10% of persons infected as older children and adults will become chronic HBV carriers.

Chronic HBV infection is also common in persons with immunodeficiency. An estimated 15–25% of persons with chronic HBV infection will die prematurely of either cirrhosis or hepatocellular carcinoma. HBV may be the cause of up to 80% of all cases of hepatocellular carcinoma worldwide, second only to tobacco among known human carcinogens.

Diagnosis

Three serologic tests are commonly used to determine if a person is a chronic or acute case of hepatitis B. They are:

- HBsAg,
- anti-HBc IgM and
- anti-HBc total (total antibody to hepatitis B core antigen).

HBsAg can be detected in the serum from several weeks before onset of symptoms to days, weeks or months after onset in acute cases but persists in chronic cases. In acute and chronic cases that resolve, HBsAg declines, disappears and is followed by the appearance of antibody to hepatitis B surface antigen (anti-HBs). See Annex 1 - Characteristics of hepatitis B.

Testing for anti-HBc total includes the detection of both anti-HBc IgM and anti-HBc IgG. Thus anti-HBc total is positive at the onset of illness and persists indefinitely. Demonstration of anti-HBc total in serum indicates either current or past HBV infection. Anti-HBc IgM is present in high titre in acute cases and usually disappears within six months, although rarely, it can reactivate in chronic cases, thus a positive anti-HBc IgM does not reliably diagnose an acute case. In resolving cases, anti-HBc total may be present while HBsAg and anti-HBs are both absent. This is known as the "window period".

Testing for HBV DNA is not routinely performed but may be done in individuals on treatment, those being monitored by hepatitis specialist, patients with unusual HBV serologic markers, and to assess the degree of infectivity. It is recommended for those who are anti-HBc total "only" (HBsAg negative and anti-HBs negative) for clarification of their status.

Hepatitis B Serological Markers(2-5)

Marker	Interpretation
Anti-HBs + Antibody to hepatitis B surface antigen	Immunity either from infection or vaccine.
Anti-HBc IgM+ Immunoglobulin M (IgM) antibody to hepatitis B core antigen	Recent acute infection and rarely during exacerbations of chronic infection.
Anti-HBc total + Total antibody to hepatitis B core antigen	Current acute infection, chronic carrier, or past infection. Not present after immunization.
HBeAg+ Hepatitis B e antigen	Highly infectious. Can be present during both acute and chronic infections.
HBsAg+ Hepatitis B surface antigen	Current acute infection or chronic carrier if persists beyond 6 months.
HBV DNA+	Measures level of circulating DNA and is a marker of infectivity.

Interpretation of Serologic Test Results for HBV(4,6,7)

HBsAg	Anti-HBc IgM	Anti-HBc Total	Anti-HBs	HBV DNA	Interpretation
+	**-**	**-**	**-**	**n/a**	Early HBV infection before anti-HBc response.
+	**+**	**+**	**-**	**n/a**	Early HBV infection. Because anti-HBc IgM is positive, the onset is within 6 months. IgG antibody usually appears shortly after IgM; therefore, both are usually positive when IgM is positive.(Acutely infected)
-	**+**	**+**	**- or +**	**n/a**	Recent acute HBV infection (within four to six months) with resolution; i.e., HBsAg has already disappeared. Anti-HBs usually appears within a few weeks or months of HBsAg disappearance.
+	**-**	**+**	**-**	**n/a**	HBV infection onset at least six months earlier because anti-HBc IgM has disappeared. Probable chronic HBV infection. (Chronically infected)
-	**-**	**-**	**+**	**n/a**	Response to hepatitis B vaccine. No evidence of infection.
-	**-**	**+**	**-**	**+**	Chronic HBV infection.
-	**-**	**+**	**+**	**n/a**	Past HBV infection, recovered. (Immune due to natural infection).
-	**-**	**+**	**-**	**-**	Past HBV infection, recovered. Anti-HBs below detectable levels. (Immune due to natural infection).

n/a = not routinely performed as part of public health follow-up

Epidemiology(3,8)

Reservoir

Humans. Chimpanzees are susceptible, but an animal reservoir in nature has not been recognized. Infected pet monkeys have been documented.

Transmission

The principal routes of transmission for HBV are percutaneous (injection drug use, exposure to blood or body fluid), sexual (heterosexual or MSM), vertical (mother to infant), and horizontal (between children and household contacts through skin lesions or sharing of blood-contaminated toothbrushes and razors). Infections also occur in settings of close personal contact through unrecognized contact with infectious bodily fluids. Because HBV is stable on environmental surfaces for up to and including seven days, indirect inoculation of HBV can also occur via inanimate objects.

Blood and all body fluids that are visibly contaminated with blood can transmit HBV. Semen, vaginal secretions, and saliva as well as other body fluids (pleural, amniotic, pericardial, peritoneal, synovial, and cerebrospinal) may contain the virus. Transmission from breast milk is unlikely. Feces, nasal secretions, sputum, sweat, tears, urine and vomitus are not implicated unless they are visibly contaminated with blood.

The risk of transmission from screened and donated blood, manufactured blood products, and transplanted organs is minimal due to donor screening and processing of blood products.

Perinatal transmission is common in endemic areas of Southeast Asia and the Far East, especially when HBsAg carrier mothers are also HBeAg positive with high HBV DNA levels. Infection may also be transmitted between household members and between sexual partners, either homosexual or heterosexual, and in groups of toddler-aged children with high HBsAg carrier rates.

Communally used razors and toothbrushes have been implicated as occasional vehicles of HBV transmission causing percutaneous and mucosal inoculation. Fecal-oral or vector-borne transmission has not been demonstrated. In about 35% of HBV infections no transmission source can be identified.

Incubation Period

The incubation period is 45 to 180 days, with an average of 60 to 90 days. It may be as short as two weeks to the appearance of HBsAg, and rarely as long as six to nine months. The variation is related in part to the amount of virus in the inoculum, the mode of transmission, and host factors.

Period of Communicability

The communicability is while HBsAg is present in blood and is highest during the acute phase of illness. Persons in the “window period” and those rare persons who are concurrently HBsAg and anti-HBs positive should be considered infectious. In the latter case, if HBsAg disappears and anti-HBs remains, persons can be considered non-infectious. The presence of “e” antigen or high levels of viral DNA indicate high virus titres and higher infectivity, while the presence of “e” antibody and low levels of viral DNA indicate reduced infectivity.

Host Susceptibility

Susceptibility is general. Protective immunity follows infection if antibody to HBsAg (anti-HBsAg) develops and HBsAg becomes negative. Persons with Down Syndrome, lymphoproliferative

disease, HIV infection, and those on hemodialysis appear to be more likely to develop chronic infection.

An infant infected with HBV in the first few months of life has a 90% risk of becoming a chronic carrier if not provided with hepatitis B post exposure prophylaxis (i.e. administration of HBIG and hepatitis B vaccine to the infant which can prevent the development of the carrier state in 85– 95%).

Occurrence

General(3,8)

Hepatitis B occurs worldwide and is endemic with little seasonal variation. In areas of Africa and Asia, widespread infection may occur in infancy and in childhood. In North America, infection is most common in young adults. In the United States and Canada, serologic evidence of previous infection varies depending on age and socioeconomic class. Overall, 5% of the adult population in the US has anti-HBc total, and 0.5% is HBsAg positive. Among those from some areas of Asia, 10–15% may be HBsAg positive.

In developed countries, exposure to HBV may be more common in certain groups. These include IDUs, people with multiple sexual partners, MSM, clients and staff in institutions for the developmentally disabled, employees in hemodialysis centres, and persons in certain healthcare and public safety occupations.

Percutaneous and permucosal exposure to blood or serous fluids are associated with occupationally acquired HBV infections. Surgeons, dentists, oral surgeons, pathologists, operating room and emergency room staff, and clinical laboratory workers who handle blood are at highest risk of exposure, however, the majority should be immune to infection if they have received hepatitis B vaccine.

Until 1985, recipients of blood products were at risk of contracting hepatitis B. In the many countries in which pre-transfusion screening of blood donors for HBsAg is required, and where pooled blood-clotting factors (especially antihemophilic factor) are processed to destroy the virus, this risk has been virtually eliminated. The risk is still present in many developing countries.

Contaminated and inadequately sterilized syringes and needles have resulted in outbreaks of hepatitis B among patients in clinics and physicians' offices. This has been a major mode of transmission worldwide. Occasionally, outbreaks have been traced to tattooing and acupuncture. Transmission to patients from HBsAg positive healthcare workers has also been documented.

Canada(9,10)

Chronic hepatitis B is not reportable in many jurisdictions in Canada and as such there is no surveillance data available for chronic hepatitis B.

Alberta

In the past chronic hepatitis B has not been reportable in Alberta except in pregnant women. The data on pregnant women shows that 216 pregnant females screened positive for HBsAg in 2004 out of 48,570 prenatal specimens. For 2005, 205 screened positive.

Key Investigation

Single Case/Household Cluster

- Contact the physician, if possible, before contacting the client to determine:
  - acute or chronic infection,
  - reason for the test,
  - possible source,
  - client symptoms,
  - relevant laboratory results e.g., Liver Function Tests, and
  - if testing of relevant contacts has occurred.
- Assess risk factors for acquisition of hepatitis B infection including:
  - immigration from or travel to a known endemic country,
  - living with, or attending daycare with a known hepatitis B carrier,
  - having sexual contact with a known hepatitis B carrier,
  - practicing unsafe sex,
  - IDU/needle sharing,
  - recent incarceration,
  - receipt of blood/tissue/organ prior to 1985,
  - receipt of blood/tissue/organ at any time in a developing country,
  - frequent receipt of blood or blood products,
  - skin piercing procedures e.g., tattooing, body piercing, acupuncture,
  - workplace or non-occupational exposure,
  - recent invasive medical or dental procedures e.g., hemodialysis, and
  - resident or staff of institution for the developmentally challenged.
  - MSM
- Assess sexual relationships and unsafe sex practices.
- Ascertain co-infection with other blood borne viral infections (BBVIs).
- Determine hepatitis B immunization history.
- If female, determine pregnancy status.
- Determine donation of blood, tissue, or organs.
- Identify household and other intimate contacts of the case for potential blood exposure (significant contacts).
  - For chronic carriers, include current contacts as well as those within the last six months. This cutoff should be extended further back if contact was frequent and after infection developed (when this can be estimated).
  - Contacts include:
    - persons living in the household,
    - needle sharing partners,
    - persons who share personal care items e.g., razors, toothbrushes,
    - long term and short term sexual partners, and
    - persons with other blood or body fluid exposures e.g., unprotected first aid.

Control

Management of a Carrier

- Public health personnel should contact physicians to make them aware of usual public health follow-up such as:
  - acquisition of additional epidemiological information,
  - possibility for testing for infection with other BBVIs,
  - possible referral to a medical liver specialist, and
  - follow-up of susceptible contacts.

- Provide education about the modes of transmission for the purpose of reducing infection risk to others.
- Promote a healthy lifestyle to minimize liver damage e.g., avoid intake of alcohol and hepatotoxic drugs, eating a well balanced diet, and having regular medical checkups.
- Provide information about community support agencies.
- Persons who are hepatitis B chronic carriers are eligible for provincially funded hepatitis A vaccine. Assess the need for hepatitis A vaccine as per the current *Alberta Immunization Manual.*
- Medical follow-up
  - Chronic carrier management should be done in consultation with a specialist.
  - Further testing may be required to determine extent of liver involvement.

Treatment of a Carrier

- Details concerning treatment should be obtained by physician in consultation with a hepatologist.

Management of Contacts(12,13)

- Assess for a history of prior hepatitis B immunization or disease.
  - Serology (HBsAg and anti-HBs) may be required to determine status and is generally recommended for the following individuals to rule out past history of immunization and/or disease:
    - persons at high risk of past infection,
    - household members who may have been previously immunized through a universal program (e.g., grade 5, 12 or Endemic Programs) prior to immunization, and
    - individuals from endemic countries. See current *Alberta Immunization Manual* for a list of endemic countries. See also Annex 2 – Geographical distribution of chronic hepatitis B virus infection.
  - Recommend follow-up based on results of serology.
    - If anti-HBs positive, client immune, thus no further follow-up.
    - If HBsAg positive, follow-up required to determine case status (case or carrier). Public Health follow up done as appropriate.
    - If HBsAg negative and anti-HBs negative recommend:
      - HBIG, when indicated,
      - hepatitis B vaccine series, and
  - Vaccinated persons who are non-responders (refer to the current *Alberta Immunization Manual*).
    - If after one series, anti-HBs is negative initiate a second series.
    - Offer post-vaccination serology after the fourth dose.
    - If anti-HBs negative, complete the series.
    - Offer post-vaccination serology.
    - If anti-HBs negative after completion of second series and a significant exposure occurs, offer two doses of HBIG one month apart. If exposure is ongoing, assess on a case by case basis. Consult with regional MOH.
- **Community exposures to blood and/or body fluids.**
  - Refer to the current *Alberta Guidelines for Post-exposure Prophylaxis (PEP) in Non-occupational Settings (nPEP)*.(14)
- **Significant contacts of a chronic carrier**
  - Spouse or sexual partners and needle-sharing partners.
  - Request pre-vaccination serology for HBsAg and anti-HBs.

- In addition to HBsAg and anti-HBs, request serology for anti-HBc total on individuals from endemic countries.
- If the contact is susceptible, initiate a hepatitis B vaccine series,
  - Recommend post-vaccination serology.
  - If the contact is a new sexual partner within the past 14 days HBIG should also be offered.
- Newborns at birth when the mother is HBsAg positive.
  - Pre-vaccination serology is not required.
  - Refer to Post-exposure Prophylaxis and Follow-up for Infants of Carrier Mothers table**.
- Infants less than 12 months of age whose mother is a chronic carrier should receive HBIG and hepatitis B vaccine series.(12)
  - Pre-vaccination serology is generally not required. Should be assessed on a case by case basis.
  - Recommend post-vaccination serology.(12)
- Newborns and infants less than 12 months of age who are significant contacts of chronic carriers (not including the birth mother) should receive hepatitis B vaccine series.
  - Pre-vaccination serology is generally not required. Should be assessed on a case by case basis.
  - Recommend post-vaccination serology.(12)
- Household contacts 12 months of age and older:
  - Recommend pre-vaccination serology.(4) This should be done prior to, or at the time of the first dose of hepatitis B vaccine.
  - If the contact is susceptible, initiate a hepatitis B vaccine series,
  - Recommend post-vaccination serology.(12)
- Refer to Annex 3 – Household and Sexual Contact of Hepatitis B Chronic Carrier Algorithm.

****Post-exposure Prophylaxis and Follow-up for Infants of Carrier Mothers**

Prophylaxis	Indication
HBIG	• The dose for newborns is 0.5 ml intramuscularly. • Ideally it should be given within 12 hours of birth, with efficacy decreasing significantly after 48 hours. (7)
Hepatitis B vaccine	• Dose is 0.5 ml intramuscularly and should be given at the same time as HBIG, but in different sites. • Second and third doses given as per the current *Alberta Immunization Manual*. • Newborns born to hepatitis B infected mothers who weigh less than 2000 grams at birth should receive an additional dose of vaccine two months after the third dose.
Follow-up	• Infants born to HBsAg positive mothers should be screened for anti-HBs and HBsAg following series of hepatitis B vaccine. Ideally testing should be done at least one month following and within 6 months of completion of series. (12)

Preventive Measures(13-16)

- All occupational exposures to potentially infectious material should be managed according to the OH&S guidelines for the workplace where the incident occurred, or their personal physician.
- Routinely screen for HBV:
  - adopted children from countries or family situations in which there is high prevalence of infection,
  - males or females with multiple sexual partners, or with a recent history of a sexually transmitted disease,
  - injection drug users,
  - blood donors, and
  - all donations of blood, blood products, tissues, organs, and semen.
- After a blood spill, removal of organic material must occur followed with appropriate disinfection (usually 1:10 dilution of household bleach).(15)
- Ensure adequate sterilization of instruments used in invasive procedures, including personal care services (e.g., ear/body piercing, tattooing).
- All pregnant women should be routinely tested for HBsAg at the first prenatal visit and repeat testing before delivery may be considered in uninfected and unimmunized women with continuing high-risk behavior to prevent the transmission of HBV to newborns.(3,12)
  - In the case where a prenatal woman has not been screened, screening is recommended to occur as soon as possible, even if delivery has occurred.
    - The mother's lifestyle risks may be taken into consideration when assessing
    - When results can be obtained within 12 hours, the first dose of hepatitis B vaccine should be given, with the decision to give HBIG awaiting results.
    - When results will not be available within 12 hours, the first dose of vaccine should be given and administration of HBIG should be considered, taking into account the presence or absence of maternal risk factors for infection.

        - When hepatitis B vaccine is initiated the series should be completed regardless of maternal status.
- Universal immunization program for grade five students.
- Pre-exposure vaccine should be offered to the following groups see the current *Alberta Immunization Manual* for eligibility and vaccine type.
    - Healthcare and emergency service workers, and others with an occupational risk of exposure.
    - Others at increased risk including:
        - residents and staff of institutions for the developmentally disabled,
        - MSM,
        - heterosexual males and females with multiple sexual partners, or with a recent history of a sexually transmitted disease,
        - hemophiliacs and others receiving repeated infusions of blood or blood products,
        - hemodialysis patients,
        - inmates of long term correctional facilities,
        - populations or communities in which HBV is highly endemic,
        - children less than seven years of age whose families have immigrated to Canada from areas where there is a high prevalence of hepatitis B,
        - children in child care settings in which there is a known HBV infected child, and
        - persons with hepatitis C or other chronic liver disease.
        - persons who use illicit drugs resulting in blood/bloody body fluid exposure.
- Post Immunization Serology.(12) Post immunization testing is recommended if it is important to ensure protection against a continual known or repeated potential exposure to HBV. This includes:
    - infants born to chronically infected mothers,
    - sexual partners and household contacts of chronic carriers, and
    - those who have been immunized because of occupational exposure).
    - HCW and students in healthcare disciplines,
        - Ideally, this testing should be done at least one month but no later than six months after the last dose of vaccine.
    - individuals who are immuno-compromised should be tested after vaccine series.(3)
        - If antibody protection is not present the series should be repeated.
        - If antibody still not present the person should be counseled on the need for passive immunization after potential exposure to HBV.
    - Travellers to hepatitis B endemic countries should be advised to confirm their need for vaccine with the appropriate clinic before travelling and receiving the vaccine.
        - AHW does not fund hepatitis B vaccine for travellers.
- Health Care Workers
    - In any situation in which a worker who is HBV positive, is uncertain about the potential transmission risks of HBV or proper practices to minimize the risk to clients, he or she should consult with employee health or an infection control practitioner or patient safety group responsible for the quality of care for the clients.
    - In addition, HCWs who are HBV positive should contact the Zone MOH or designate to discuss the potential risks of transmission to clients. Upon assessment by the Zone MOH, a worker may or may not be referred to the Alberta Expert Review Panel for Blood Borne Viral Infections in Health Care Workers for further assessment services, if indicated.
    - The Panel is established to review circumstances of HCWs who are found to have a blood borne viral infectious disease. The panel may receive referrals from MOHs regarding HCWs who perform exposure-prone procedures when there is uncertainty as to whether continued or modified professional practice is indicated.

Annex 1: Characteristics of hepatitis B: Acute with recovery (L) and Chronic (R)

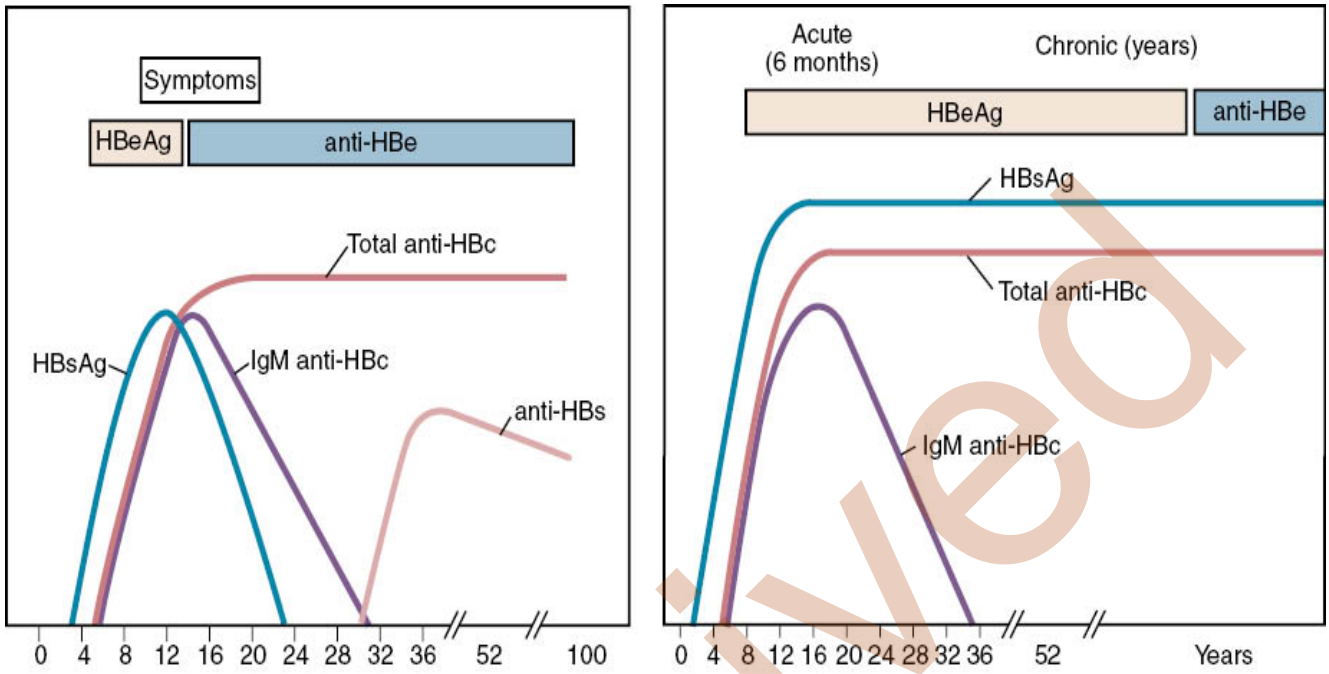


Figure 146-8 Typical course of hepatitis B. Left, Typical course of acute hepatitis B. **Right,** Chronic hepatitis B. HBc, hepatitis B core; HBe, hepatitis B early; HBsAg, hepatitis B surface antigen; IgM, immunoglobulin M.

Annex 2 – Map of Hepatitis B Endemic Countries

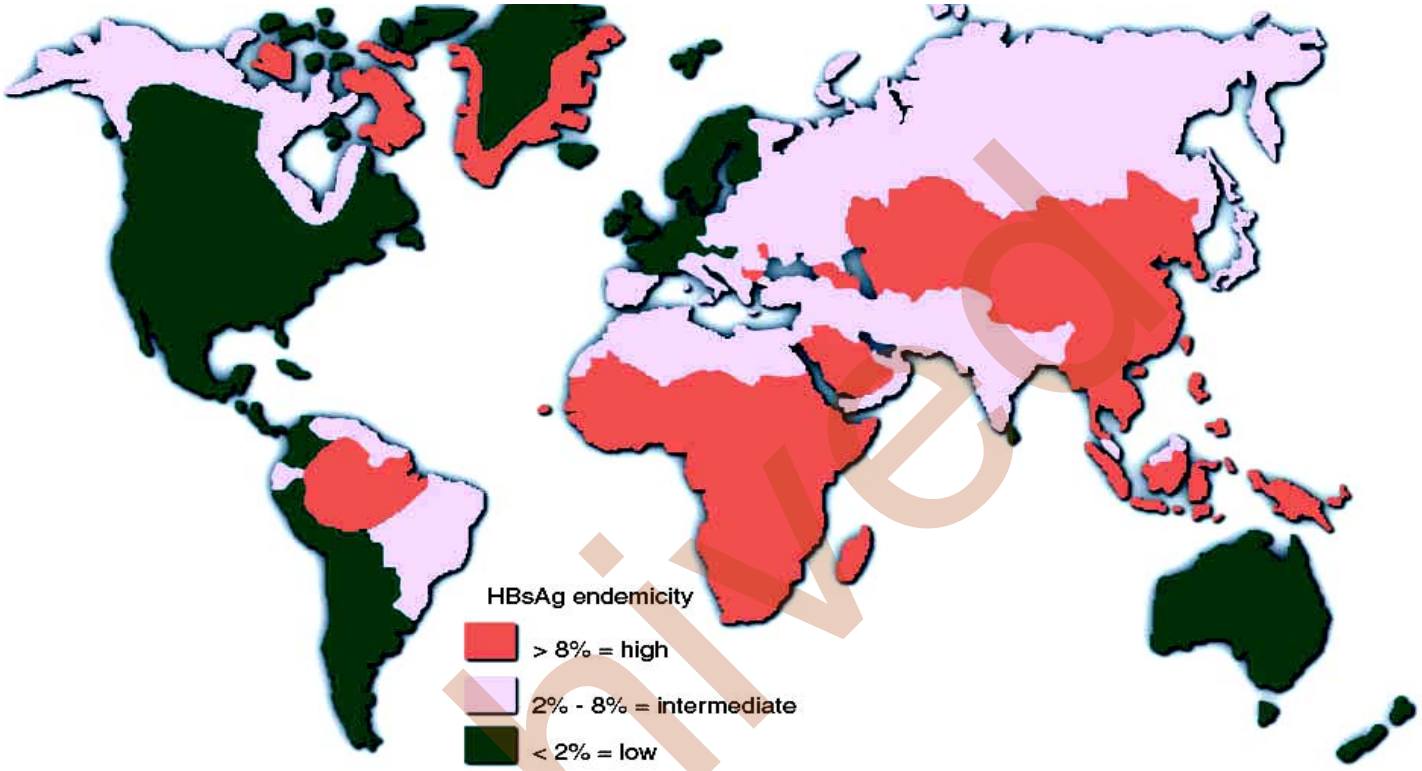
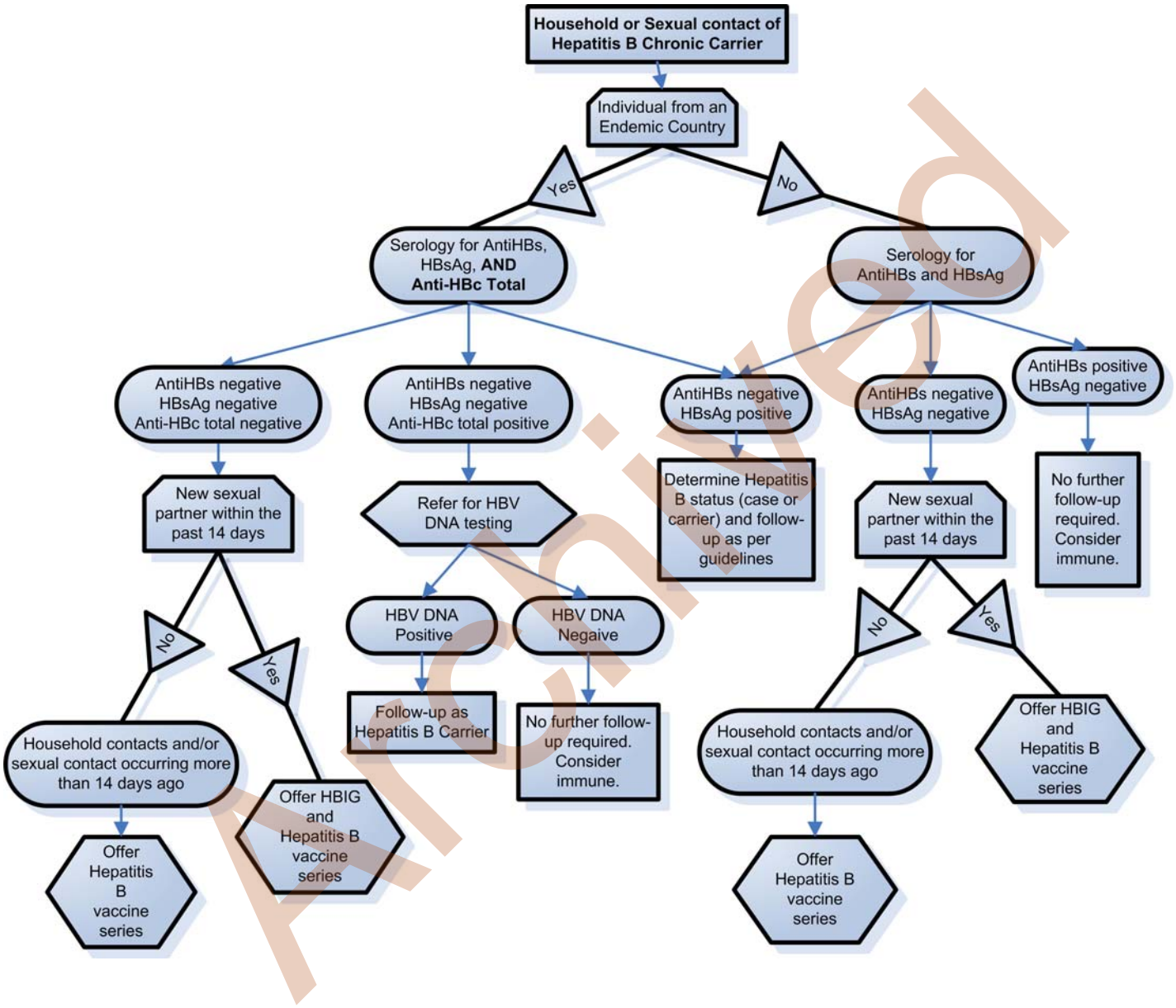
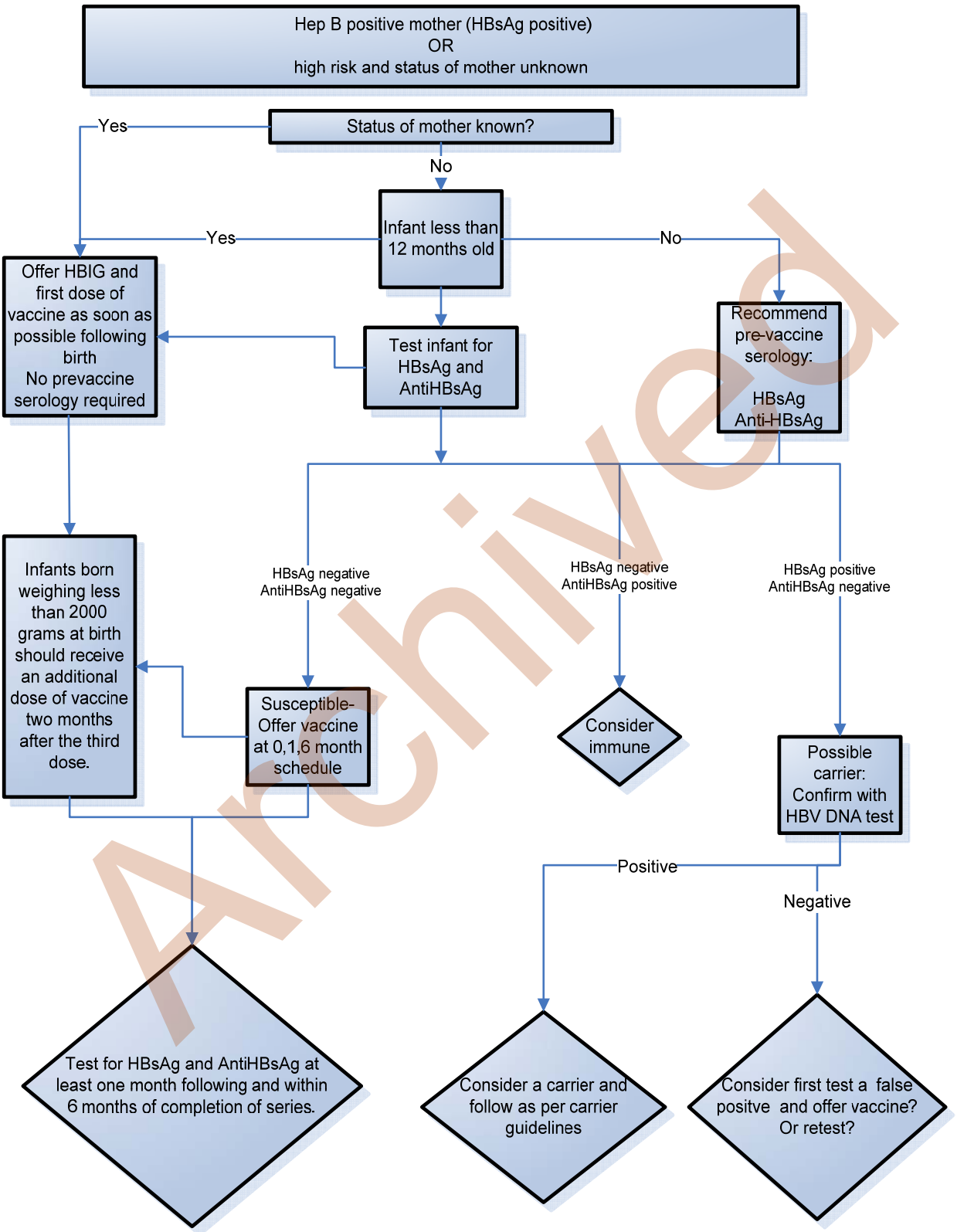


Figure 146-9 Global prevalence of hepatitis B surface antigenemia.

(From World Health Organization. Introduction of Hepatitis B Vaccine into Childhood Immunization Services. Geneva: WHO; 2001. WHO/V and B/01.31. Available at http://www.who.int/csr/disease/hepatitis/whocdscrlyo20022.)

Annex 3 – Household and Sexual Contact of Hepatitis B Chronic Carrier Algorithm





References

(1) Mandel G et al. Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases. Elsevier Churchill, Livingstone pub. 7 edition, 2010.

(2) American Academy of Pediatrics. *Hepatitis B.* In: Pickering, L.K.ed. *Red Book: 2006 Report of the Committee on Infectious Diseases.* 28th edition. Elk Grove Village, Illinois: American Academy of Pediatrics, 2008: pages 337-356.

(3) Centers for Disease Control and Prevention. *Hepatitis B*. In: Atkinson W, Hamborsky J, McIntyre L, Wolfe S, eds. *Epidemiology and Prevention of Vaccine-Preventable Diseases.* 19th edition. Washington DC: Public Health Foundation, 2007: pages 211-34.

(4) Grob P et al. *Serological Pattern "Anti-HBc Alone": Report on a Workshop.* Journal of Medical Virology 2000: 62:450-455.

(5) Mahoney FJ. *Update on diagnosis, management, and prevention of hepatitis B virus infection*. Clin Microbiol Rev 1999:351-366.

(6) Plotkin S, Orenstein W. *Vaccines.* 4rd ed. Philadelphia: W. B. Saunders Company, 2004.

(7) American Public Health Association. *Hepatitis B*. In: Heymann, D.L. ed. *Control of Communicable Diseases Manual*. 19th edition. Washington, DC: American Public Health Association, 2008:284-293.

(8) Public Health Agency of Canada. *Hepatitis B in Canada*. Ottawa: CCDR 2001;27S3. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/01vol27/27s3/27s3e_e.thml

(9) Public Health Agency of Canada. *Notifiable Diseases On-Line – Hepatitis B.* 2004 http://dsol-smed.phac-aspc.gc.ca/dsol-smed/ndis/diseases/hepb_e.html

(10) Alberta Health and Wellness, Disease Control and Prevention. *Communicable Disease Reporting System*. January 2011.

(11) Public Health Agency of Canada. *Canadian Immunization Guide*. Seventh Edition 2006. http://www.phac-aspc.gc.ca/publicat/cig-gci/index.html

(12) Alberta Health and Wellness, Disease Control and Prevention. *Alberta Immunization Manual.*

(13) Alberta Health and Wellness, Disease Control and Prevention. *Alberta Guidelines for Post-exposure Prophylaxis (PEP) in Non-occupational Settings (nPEP) interim Guideline.* Jan 2010

(14) Public Health Agency of Canada. *Infection control guidelines-hand washing, cleaning, disinfection and sterilization in healthcare*. Ottawa: CCDR 1998;24S8. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/98pdf/cdr24s8e.pdf

(15) Public Health Agency of Canada. *Preventing the transmission of bloodborne pathogens in healthcare and public service settings*. Ottawa: CCDR 1997;23S3. http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/97vol23/23s3/index.html

