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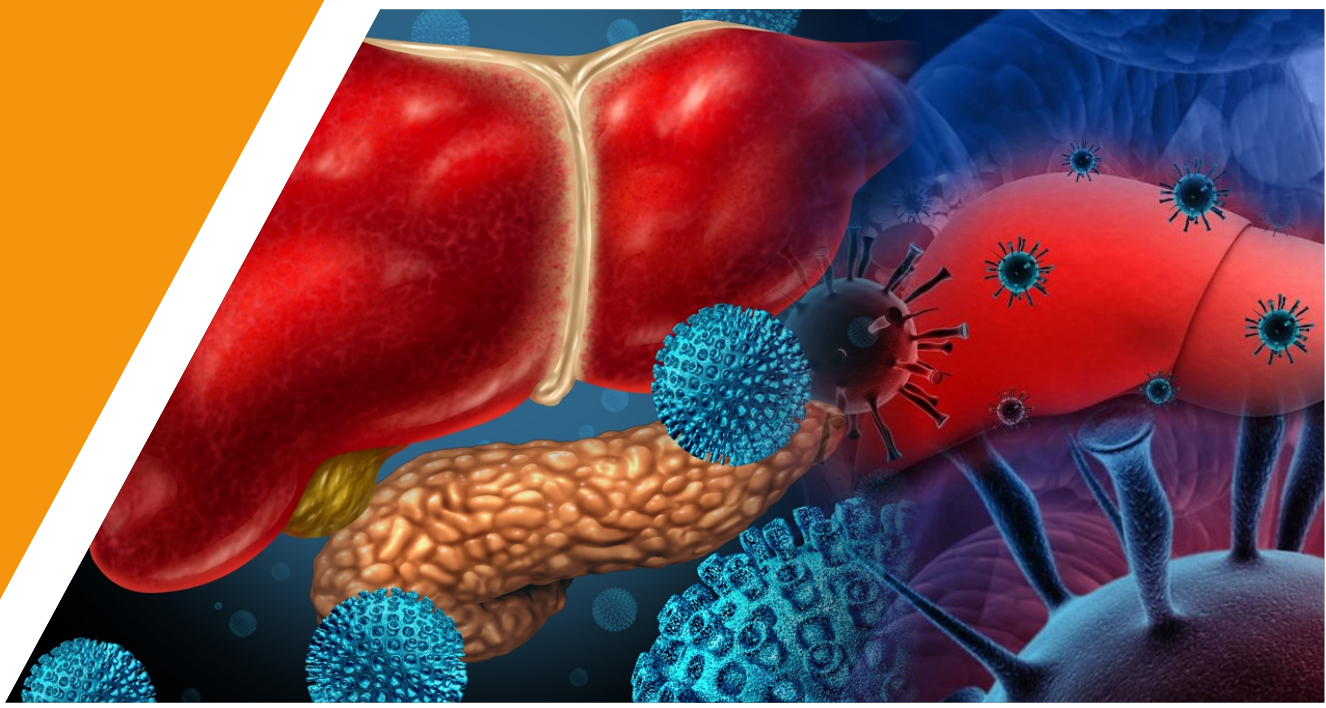
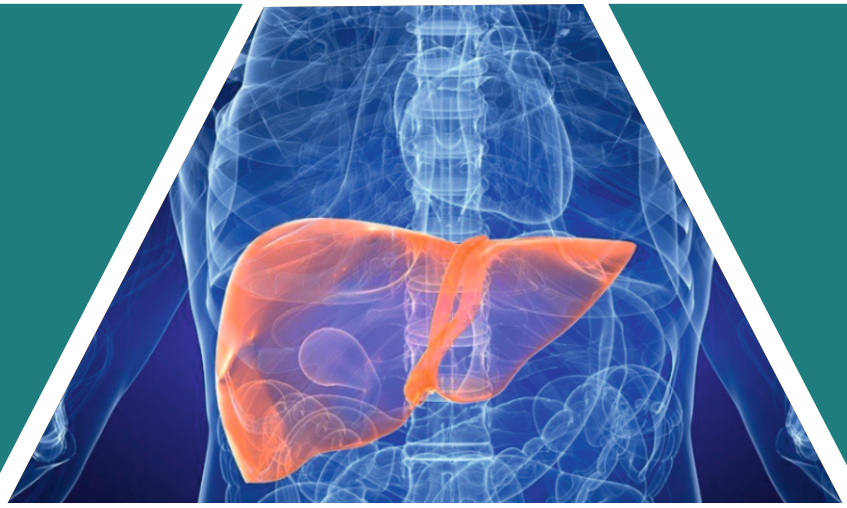
PROJECT PRAKASH

PRogrammed Approach to Knowledge and Sensitization on Hepatitis





TRAINING MODULE FOR NURSES ON VIRAL HEPATITIS

TABLE OF CONTENT

Hepatitis Induction Program

Table of Contents

INTRODUCTION

There are many challenges in prevention and eradication of viral hepatitis in India. The nurses play a vital role in the testing, diagnosis, treatment and care of those at risk of and living with HIV, viral hepatitis and STIs. Health professionals in the country need to join hands to deliver services for viral hepatitis, so that we could achieve the target of viral hepatitis elimination by 2030 which is also the global call for action by WHO. It is being felt that the knowledge of screening, diagnosis and management of viral hepatitis, especially B and C is necessary for our nurses and healthcare workers for better discharge of their duties as well as protecting the patients as well as themselves from these infections. Ensuring nurses have access to high quality and relevant training to enhance their professional development is a priority. Therefore, this course has been conceptualized, so that a comprehensive knowledge sharing among technical experts from ILBS and health professionals in India could be done through a common platform.

Goals of the training program are:

- Building capacity of primary care physicians and paramedical professionals for the management of viral hepatitis in Delhi and other neighbouring states
- Tracking the progress made on the training imparted and to create a model towards awareness and training for healthcare providers.
- To strengthen the role of nurses by supporting the nursing organizations within the sector to develop, deliver and evaluate education on blood-borne viruses as well as health professionals working in the field of viral hepatitis

Course curriculum:

This course is designed in training the nurses and primary care physicians, clinicians and specialists on viral hepatitis with tailored manuals for each cadre of health worker. The course will consist of 2 programs:

- **Hepatitis Induction program (HIP)**
  - This course is designed to cover the following topics on Viral Hepatitis and its consequences:
  - Epidemiology of viral hepatitis
  - Diagnosis and screening of viral hepatitis
  - Management of viral hepatitis
  - Identification and management of consequences of chronic hepatitis (B and C) i.e. cirrhosis and HCC
- **Hepatitis Update program (HUP)**
  - This will include online clinics for regular classes and updates on recent developments in different areas of viral hepatitis.

Learning objectives:

At the end of the training course, the candidate will be able to:

- Understand and interact with specialists about the epidemiology of viral hepatitis and their consequences
- Participants will be able to understand the different serologic tests for Hepatitis A virus (HAV) infection, Hepatitis B virus (HBV) infection, Hepatitis C virus (HCV) infection, Hepatitis D virus (HDV) infection, and Hepatitis E virus (HEV) infection,
- Understand the serological diagnosis of HAV, acute and chronic HBV, acute and chronic HCV, and Hepatitis B and Hepatitis D (HBV/HDV) coinfection, understand the meanings of serologic markers, and understand and interact about the serologic test results
- Identify complications like cirrhosis, portal hypertension and liver cancer
- Refer cases to appropriate referral centres

BACKGROUND OF VIRAL HEPATITIS

Hepatitis is described as an inflammation of the liver. It may be caused by drugs, alcohol use, autoimmune diseases or certain medical conditions. But in most cases, it is caused by a virus. This is known as viral hepatitis. The condition of hepatitis can be self-limiting, or it can cause fibrosis i.e., scarring, cirrhosis or liver cancer.

Viruses that infect hepatocytes are considered hepatotropic viruses. Five hepatotropic viruses known to cause hepatitis, have been described and have been named Hepatitis A, B, C, D, and E in historical order of their recognition. Worldwide, cases of hepatitis presumably caused by viruses other than these five also occur. Hepatitis A virus (HAV) and Hepatitis E virus (HEV) are predominantly enterically transmitted pathogens and are responsible to cause both sporadic infections, epidemics of acute viral hepatitis (AVH) and are occasionally a healthcare infection prevention issue.– Hepatitis B virus (HBV), Hepatitis C virus (HCV) and Hepatitis D virus are blood borne pathogens which predominantly spread via parenteral route and are notorious to cause chronic hepatitis, which can lead to grave complications including cirrhosis of liver and hepatocellular carcinoma (HCC). HBV, HCV and HDV also pose a risk of healthcare-associated transmission or occupational exposure for healthcare personnel (HCP). The infection prevention of each of the viral hepatitis contains specific recommendations.

Viral hepatitis now ranks as the seventh leading cause of mortality worldwide. Although mortality due to communicable diseases has declined globally, the absolute burden and relative ranking of viral hepatitis as a cause of mortality has increased between 1990 and 2013.

In South-East Asia, 100 million people are currently estimated to be living with hepatitis B, and 30 million with hepatitis C. In India, viral hepatitis is now recognized as a serious public health problem. It places a huge disease, social and economic burden on the affected individual, family, as well as the health system. Viral hepatitis is a cause for major health care burden in India and is now equated as a threat comparable to the “big three” communicable diseases – HIV/AIDS, malaria and tuberculosis.– Around 400 million people all over the world suffer from chronic hepatitis and the Asia-Pacific region constitutes the epicentre of this epidemic.

As per WHO and the latest estimates, in India, 40 million people are chronically infected with hepatitis B and six to 12 million people are chronically infected with hepatitis C. HEV is the most important cause of epidemic hepatitis, though HAV is more common among children. Most acute liver failures diagnosed are attributable to HEV.– There are many challenges in prevention and eradication of viral hepatitis in India. Maintaining adequate sanitary and hygienic conditions can help tackle the problem associated with enterically transmitted pathogens like HAV and HEV.– Following a multipronged approach of active screening, adequate treatment, universal vaccination against HBV and educational counselling can help decrease the burden of liver diseases associated with HBV and HCV infection in India.– WHO's Draft Global Health Sector Strategy on Viral Hepatitis gives the much needed roadmap and targets to combat hepatitis. It provides realistic targets and action plans to eliminate hepatitis by 2030– . This is planned to be achieved by building capacities in the existing health care delivery system to reach the desired goal.–

Standard Precautions, which encompass both universal precautions and body substance isolation, are appropriate for prevention and spread of all types of viral hepatitis in the healthcare environment .Vaccines are available for Hepatitis A and Hepatitis B. There is no vaccine available at the present time to protect against infection with the hepatitis C & D virus; however, trials are currently underway. While there is a safe and effective anti-hepatitis E vaccine, at the present time it is only licensed for use in China. Given the recognition of HEV as a global pathogen, there is a need to develop HEV vaccines for use globally. Vaccines remain an important cornerstone in the battle to achieve dominance over hepatitis A, B, C, D, and E and thereby decrease morbidity and mortality from these infections in a cost-effective manner.

HEPATITIS A

Key facts

- Hepatitis A is a viral liver disease that can cause mild to severe illness13,14.
- The hepatitis A virus (HAV) is transmitted through ingestion of contaminated food and water or through direct contact with an infectious person13,14.
- Almost everyone recovers fully from hepatitis A with a lifelong immunity. However, a very small proportion of people infected with hepatitis A could die from fulminant hepatitis.
- The risk of hepatitis A infection is associated with a lack of safe water, and poor sanitation and hygiene (such as dirty hands).
- Epidemics can be explosive and cause substantial economic loss.
- A safe and effective vaccine is available to prevent hepatitis A.
- Safe water supply, food safety, improved sanitation, hand washing, and the hepatitis A vaccine are the most effective ways to combat the disease.

Epidemiology

Description

HAV is assigned its own genus, Hepatovirus, in the family Picornaviridae.15 HAV is a nonenveloped, 27-nm single-stranded RNA virus that can be found by electron microscopy in the faeces of persons with this infection. Humans and primates are the only known natural hosts for HAV. Replication of HAV occurs in the hepatocytes, but the virus is not directly cytopathic.15

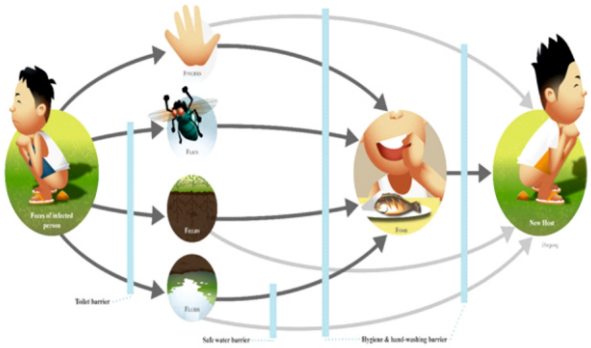
Scenario in India

HAV is responsible for several outbreaks of sporadic viral hepatitis in India.2 However, in the recent times there has been a sero-epidemiological shift in HAV infection in India, with increasing incidence of infection being noted in the adult and adolescent population compared with children.2 Studies have clearly demonstrated the higher seroprevalence of HAV in older children and established a clear link between improved living standard and decreased seropositivity of HAV.2

Transmission of HAV

- HAV is transmitted principally by the fecal-oral route, with the highest level of virus in the faeces found in the 2 weeks prior to onset of jaundice or liver enzyme increase. This is also the period of highest infectivity. 16
- Transmission is usually facilitated by intimate personal contact (household, sexual, etc.), poor hygiene, unsanitary conditions, or contaminated water, milk, or food, especially raw shellfish.16
- Additional risk factors of acquiring HAV16Childcare exposure (children, parents, or attendants) esp. day care workers who don’t wash their hands after changing a diaper
- Men who have sex with men (MSM)
- Occupation (e.g., sewage worker, paediatric nurse)
- Users of both injectable and non-injectable street drugs can get it by using dirty or used needles; Intravenous (IV) drug users
- HAV is rarely transmitted by blood or blood products (e.g., clotting factor concentrates) as a consequence of transient viremia in asymptomatic donors.
- The "F-diagram" (faeces, fingers, flies, fields, fluids, food), showing pathways of fecal–oral disease transmission. The vertical blue lines show barriers: toilets, safe water, hygiene and handwashing.

Fig 1: TRANSMISSION OF HEPATITIS A BY FECO-ORAL ROUTE



Source: UNICEF Philippines and Luis Gatmaitan / 2014 / Gilbert F. Lavides - https://www.flickr.com/photos/gtzecosan/17125224489/in/set-72157648282032913

Who is at risk?

Anyone who has not been vaccinated or previously infected can get infected with hepatitis A virus (HAV). In areas where the virus is widespread (high endemicity), most hepatitis A infections occur during early childhood. Risk factors in intermediate and high endemicity areas include16:

- Poor sanitation;
- Lack of safe water;
- Use of recreational drugs;
- Living in a household with an infected person;
- Being a sexual partner of someone with acute hepatitis A infection; and
- Travelling to areas of high endemicity without being immunized.

Pathogenesis

Infection with HAV occurs in the gastrointestinal tract. HAV is transiently detectable in blood as early as 4 weeks before symptoms17. HAV is detectable in faeces 2 to 4 weeks before and 1 to 3 weeks following the onset of jaundice.17 Infected neonates may shed HAV in faeces for months.17 There is no chronic HAV carrier state. HAV replicates in cytoplasm of hepatocytes, and then is shed in bile, which results in high titre of infectious HAV in faeces. Disease occurs as a result of host immune response, which causes hepatocyte injury. Development of antibodies to HAV confers lifelong immunity.17

Clinical Features

Infection by HAV is generally self-limited and can produce effects that range from a lack of symptoms to death from fulminant hepatitis.17 The likelihood of clinically apparent disease associated with HAV infection increases with age. In children <6 years of age, most infections (70%) are asymptomatic17, and if illness does occur, it is usually anicteric. Among older children and adults, infection is usually symptomatic, with jaundice occurring in >70% of patients17After an average incubation period of 28 days (range, 15 to

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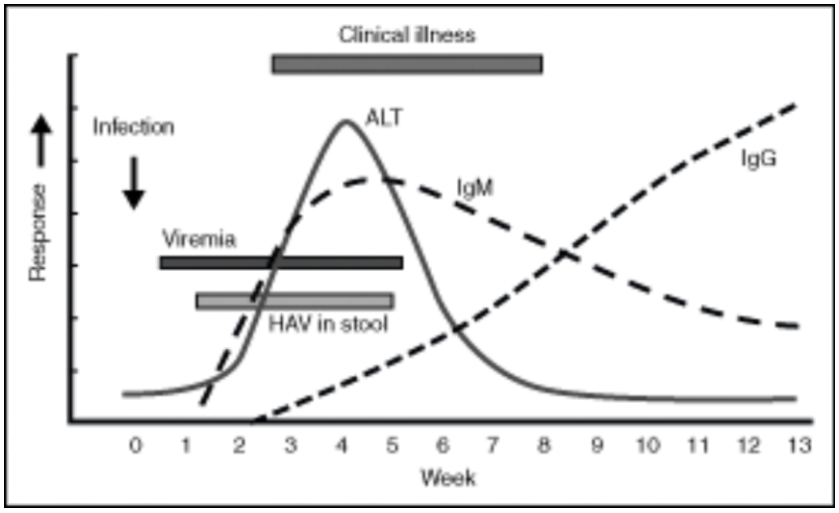
Laboratory Diagnosis

Clinical features of acute hepatitis are not specific for HAV infection, so serological diagnosis is necessary17 (Figure 2). Immunoglobulin M antibodies to HAV (IgM anti-HAV) are used to detect acute HAV infection, are detectable within 3 weeks of exposure, and are present at the onset of jaundice. Titter declines over 4 to 6 weeks and is usually not detectable after 6 to 12 months. Immunoglobulin G anti-HAV (IgG anti-HAV) is also detectable at onset of jaundice and remains positive lifelong, indicating immunity to HAV.23

Molecular Diagnosis

The amplification of HAV RNA by reverse transcription, followed by PCR of the cDNA, is the most sensitive technique for screening clinical specimens. Studies using reverse transcription PCR (RT-PCR) have demonstrated that HAV RNA can be detected in blood earlier than antibodies and that the viremia may be present for a much longer period during the convalescent phase of hepatitis A than was previously thought. Amplification of viral RNA by nested PCR is currently the most sensitive and widely used method for the detection of HAV RNA in different types of samples (serum, plasma, saliva, fecal suspension and environmental samples)24. Different studies have shown that in particular, HAV load is strongly correlated with the severity of hepatitis A. 25

Fig 2: Clinical course of Hepatitis A26



Treatment of HAV

Supportive care (e.g., fluids and nutrition) is the only known management for acute Hepatitis A.27 Recovery from symptoms following infection may be slow and take several weeks or months. Therapy is aimed at maintaining comfort and adequate nutritional balance, including replacement of fluids that are lost from vomiting and diarrhea.27 Liver transplantation should be considered in the course of fulminant hepatic failure.27

Prevention

- Public health and personal hygiene measures, including hand washing or hand sanitizer, may effectively interrupt further transmission. Risk of transmission of HAV is transient and occurs during the prodrome28.
- Standard Precautions are appropriate to prevent healthcare-associated transmission in most instances. With diapered or incontinent patients, the addition of Contact Precautions is recommended.
- Postexposure prophylaxis should be considered in instances such as household or sexual contacts or in outbreak situations such as common source exposure in an infected food handler or a case of HAV in a childcare center. HAV vaccine is recommended for unvaccinated adults aged 40 or younger with recent (within 2 weeks) exposure to HAV. For persons over 40 with recent (within 2 weeks) exposure to HAV, immune globulin (Ig) is preferred over vaccine. A dose of 0.02 mL/kg intramuscular (IM) protects for up to 3 months.
- Improved sanitation and Hepatitis A immunization are the most effective ways to combat the disease
- Adequate supplies of safe drinking water and proper disposal of sewage within communities combined with personal hygiene practices, such as regular hand washing, reduce the spread of HAV.
- Several Hepatitis A vaccines are available internationally. All are similar in terms of how well they protect people from the virus and their side-effects. No vaccine is licensed for children below one year of age

Vaccination

Patients Chronic illness are more likely that they will have serious complications from certain diseases. Immunization provides the best protection against vaccine preventable diseases. Vaccination forms a cornerstone in preventing HAV and both inactivated and live attenuated vaccines are available for use. Active immunization with either licensed single antigen HAV vaccine (HAVRIX, manufactured by GlaxoSmithKline; VAQTA, manufactured by Merck & Co., Whitehouse Station, NJ) or combination TWINRIX (manufactured by GlaxoSmithKline, Rixensart, Belgium), which contains both HAV (in a lower dosage) and HBV antigens, is generally safe and effective.29

Table 1: Havrix and Vaqta vaccine

Vaccine #	Age group	Dose	Volume	# Doses	Schedule
Havrix (GlaxoSmithKline [GSK])	1-18 years	720 El.U.*	0.5 ml	2	0, 6 -12 mos.
	19 years and older	1440 El.U.*	1.0 ml	2	0, 6 -12 mos.
Vaqta (Merck & Co.)	1-18 years	25 U* *	0.5 ml	2	0, 6 -18 mos.
	19 years and older	50 U* *	1.0 ml	2	0, 6 -18 mos.

*Completion of the hepatitis A series with the same product is preferable. However, if the originally used product is not available or not known, vaccination with either product is acceptable.

**The 2 vaccines have similar immunogenicity but local tolerance was better with Vaqta11
Indian Academy of Paediatrics recommends two doses for any of the licensed vaccines which have to be given 6 months apart to children aged 1 year or older30. The dose recommended is 720 ELU for those aged <19 years and 1440 ELU for those above.30 Protective titres of antibodies are seen in almost 100% after the second dose of injection. More than 95 percent of adults generate protective antibodies within a month of HAV vaccination. Adverse reactions are minor and usually include local pain and swelling30. Immunization should be offered to select adult populations that are either at risk for fulminant presentation or at high risk of acquiring HAV. These groups include-29

- Those travelling to countries or areas with recent or ongoing hepatitis A outbreak or epidemics
- Homosexuals (MSM)
- IV drug users
- have a chronic liver disease such as hepatitis B or hepatitis C
- are being treated with clotting-factor concentrates
- Persons who work with HAV in experimental lab settings (not routine medical laboratories), and
- Food handlers when health authorities or private employers determine vaccination to be appropriate.

PRE-EXPOSURE PROPHYLAXIS

- Immune-globulin is recommended for all susceptible travellers to developing countries. IG is especially important for persons who will be living in or visiting rural areas, eating or drinking in settings of poor or uncertain sanitation, or who will have close contact with local persons (especially young children) in settings with poor sanitary conditions31,32,33,34.
- For travellers, a single dose of IG of 0.02 ml/kg of body weight is recommended if travel is for less than 3 months. For prolonged travel or residence in developing countries, 0.06 ml/kg should be given every 5 months.

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POST EXPOSURE PROPHYLAXIS

- For post exposure IG prophylaxis, a single intramuscular dose of 0.02 ml/kg is recommended.
- IG should be given as soon as possible after last exposure; giving IG more than 2 weeks after exposure is not indicated.
- Specific recommendations for IG prophylaxis for hepatitis A depend on the nature of the HAV exposure.
- Close personal contact: IG is recommended for all household and sexual contacts of persons with hepatitis A.
- **Day-care centers:** Day-care facilities attended by children in diapers can be important settings for HAV transmission (18-20). IG should be administered to all staff and attendees of day-care centers or homes if a) one or more children or employees are diagnosed as having hepatitis A, or b) cases are recognized in two or more households of center attendees. When an outbreak (hepatitis cases in three or more families) occurs, IG should also be considered for members of households that have children in diapers.
- **Institutions for custodial care:** Living conditions in some institutions, such as prisons and facilities for the developmentally disabled, favour transmission of hepatitis A. When outbreaks occur, giving IG to residents and staff who have close contact with patients with hepatitis A may reduce the spread of disease.
- **Hospitals:** Routine IG prophylaxis for hospital personnel is not indicated. Rather, sound hygienic practices should be emphasized. Outbreaks of hepatitis A occur occasionally among hospital staff, usually in association with an unsuspected index patient who is fecally incontinent. Large outbreaks have occurred from contact with infected infants in neonatal intensive care units. In outbreaks, prophylaxis of persons exposed to faeces of infected patients may be indicated.
- **Common-source exposure:** IG use might be effective in preventing foodborne or waterborne hepatitis A if exposure is recognized in time. If a food handler is diagnosed as having hepatitis A, common-source transmission is possible. IG should be administered to other food handlers However, IG administration to patrons may be considered if all of the following conditions exist: a) the infected person is directly involved in handling, without gloves, foods that will not be cooked before they are eaten, and b) the hygienic practices of the food handler are deficient or the food handler has had diarrhoea, and c) patrons can be identified and treated within 2 weeks of exposure.

HEPATITIS E

Key facts

- Hepatitis E is a liver disease caused by infection with a virus known as hepatitis E virus (HEV).
- Every year, there are an estimated 20 million HEV infections worldwide, leading to an estimated 3.3 million symptomatic cases of hepatitis E.35
- WHO estimates that hepatitis E caused approximately 44 000 deaths in 2015 (accounting for 3.3% of the mortality due to viral hepatitis).
- The virus is transmitted via the faecal-oral route, principally via contaminated water.
- Hepatitis E is found worldwide, but the prevalence is highest in East and South Asia.

Epidemiology

Hepatitis E is unique among the hepatic viruses in that it carries a particularly high mortality rate among pregnant women36HEV is positive-stranded RNA virus belonging to the family hepeviridae. HEV has 4 genotypes of which genotypes 1 and 2 exclusively infect humans whereas genotypes 3 and 4 also infect several other mammalian species37. HEV is primarily spread via the faecal – oral route and is an enterically transmitted pathogen like HAV2. The incubation period of HEV infection is estimated to be around 2–9 weeks and during an epidemic of HEV, anicteric hepatitis is more common than icteric hepatitis and clinical hepatitis is seemingly more frequent in adults than in children aged <15 years2. Usually the infection is self-limiting and resolves within 2–6 weeks. Occasionally a serious disease, known as fulminant hepatitis (acute liver failure) develops, and a proportion of people with this disease can die38.

HEV infection can also cause, albeit rarely, a chronic hepatitis which occurs when HEV replication persists for at least 6 months. Chronic HEV infection is classically described with HEV genotype 3 and can lead to cirrhosis in immunosuppressed patients and in patients undergoing a solid organ transplantation2

Hepatitis E infection is found worldwide. The disease is common in resource-limited countries with limited access to essential water, sanitation, hygiene and health services.39 In these areas, the disease occurs both as outbreaks and as sporadic cases.39 The outbreaks usually follow periods of faecal contamination of drinking water supplies and may affect several hundred to several thousand persons40. Some of these outbreaks have occurred in areas of conflict and humanitarian emergencies, such as war zones, and in camps for refugees or internally displaced populations (IDP), situations where sanitation and safe water supply pose special challenges.40

Indian Scenario

HEV is responsible for majority of the sporadic and epidemic cases of AVH in India2. During an HEV epidemic, the secondary attack rate among the household contacts is estimated to be about 0.7–2% when compared to 50–75% for HAV. During an outbreak, it is observed that pregnant women have a higher likelihood to get infected (12–20%) with HEV and have a higher propensity to develop acute liver failure(ALF) (10–22%) when compared to non-pregnant females and males (1–2%).2. Hepatitis E infection during pregnancy, especially in the third trimester, is characterized by a more severe infection that sometimes results in fulminant hepatitis, increasing maternal and fetal mortality and morbidity41

Transmission

The Hepatitis E virus is transmitted mainly through the faecal-oral route due to faecal contamination of drinking water.42 This route accounts for a very large proportion of clinical cases with this disease. The risk factors for hepatitis E are related to poor sanitation, allowing virus excreted in the faeces of infected people to reach drinking water supplies.

Other routes of transmission have been identified but appear to account for a much smaller number of clinical cases. These routes of transmission include42:

- Ingestion of undercooked meat or meat products derived from infected animals;
- Transfusion of infected blood products; and via allograft.
- Vertical transmission from a pregnant woman to her foetus.
- Ingestion of raw or uncooked shellfish
- Zoonotic Transmission43–45

Table 2: DIFFERENCE BETWEEN ROUTES OF TRANSMISSION FOR HEPATITIS A and E

S.N.		Hepatitis A	Hepatitis E
1	MODE OF TRANSMISSION	**Faecal oral route:** faeces, serum, contaminated food, water, infected food handlers, utensils, water vegetable grown on contaminated water, Raw shellfish, poor sanitation, over crowding	**Faecal-Oral route:** Faeces, serum, contaminated food, water, hands, utensils, poor sanitation, over crowding
2		**Close personal contact** • Household contact • Homosexual in men • Child day care centers	Rarely from person to person
3		Rarely by blood exposure • Intravenous drug use • Blood transfusion	Possible zoonotic transmission (Fig 3)

Figure 3: Modes of transmission of hepatitis E in India and major outbreaks46

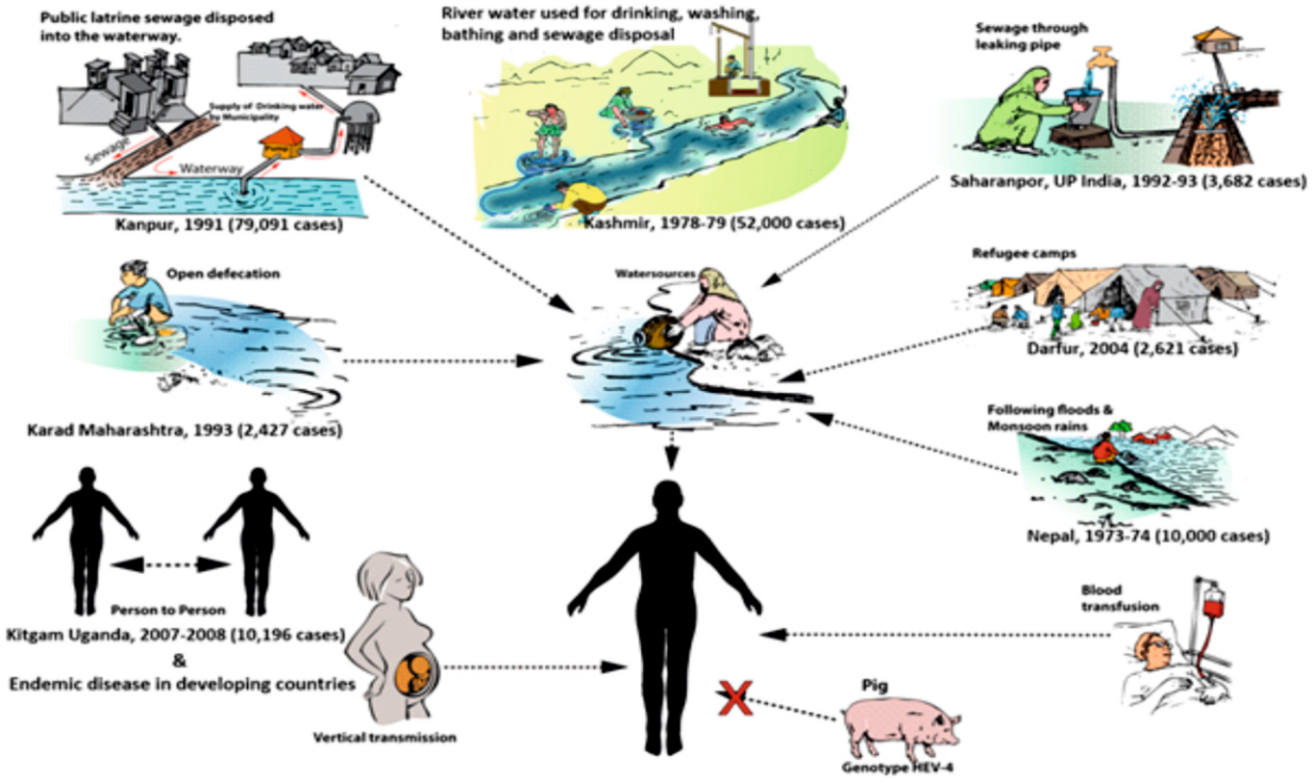
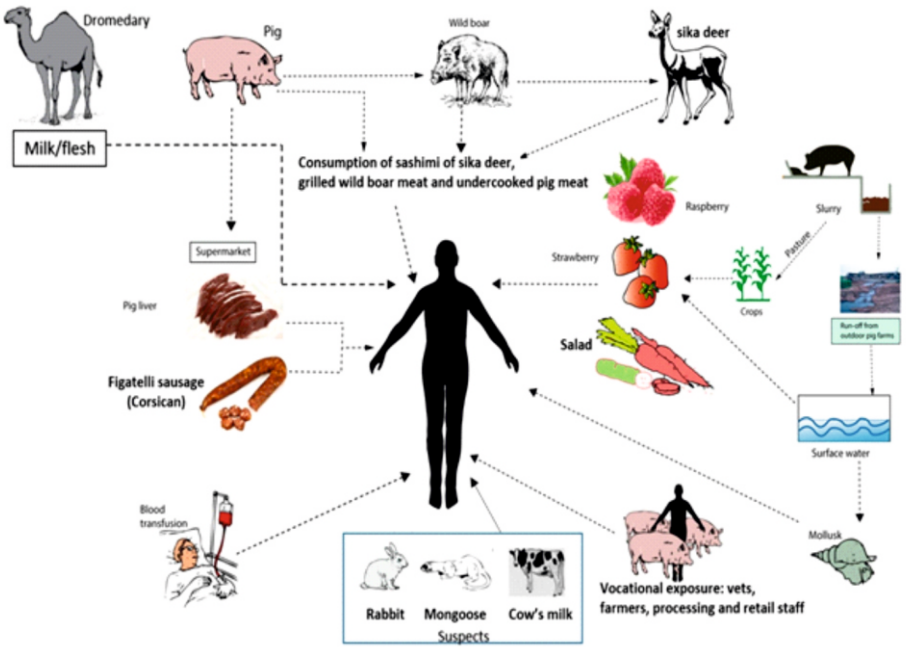


Fig 4: Zoonotic transmission of hepatitis E46



Pathogenesis

Animal studies show replication of HEV in liver, blood cells, and other organs. Early liver damage may result from direct cytopathic effect of HEV, but later pathologic effects are immune mediated47. HEV is transiently present in serum during prodrome, and at the onset of clinical disease it is found in faeces48. Fecal shedding of HEV persists for 1 week to 2 months. Appearance of anti-HEV roughly correlates with cessation of viral replication and beginning resolution of disease48.

Clinical Features

The incubation period of HEV is between 2 and 9 weeks (mean, 45 days), and it is generally a self-limiting disease that is relatively severe compared with HAV42. There is a prodromal (pre-icteric) phase of nonspecific constitutional symptoms followed by an icteric phase that lasts several weeks49. Fulminant HEV is rare (0.5 to 4 percent) except in pregnant women, in whom HEV occurring in the third trimester carriers a 20 percent maternal fatality rate and a 50 percent rate of fetal loss50. Mortality rate of those infected during the third trimester was 100 percent in one study50.

Symptoms

In areas with high disease endemicity, symptomatic infection is most common in young adults aged 15–40 years51. In these areas, although infection does occur in children, they often have either no symptoms or only a mild illness without jaundice that goes undiagnosed.51

Typical signs and symptoms of hepatitis include:

- An initial phase of mild fever, reduced appetite (anorexia), nausea and vomiting, lasting for a few days; some persons may also have abdominal pain, itching (without skin lesions), skin rash, or joint pain38–40.
- Jaundice (yellow discolouration of the skin and sclera of the eyes), with dark urine and pale stools; and a slightly swollen and painful liver (hepatomegaly).
- These symptoms are often indistinguishable from those experienced during other liver illnesses and typically last between 1–6 weeks. In rare cases, acute hepatitis E can be severe, and results in fulminant hepatitis (acute liver failure)52. Fulminant hepatitis occurs more frequently when hepatitis E occurs during pregnancy. Pregnant women with hepatitis E, particularly those in the second or third trimester, are at an increased risk of acute liver failure, fetal loss and mortality52. Cases of chronic hepatitis E infection have been reported in immunosuppressed people, particularly organ transplant recipients on immunosuppressive drugs38.

Diagnosis

- Cases of hepatitis E are not clinically distinguishable from other types of acute viral hepatitis. Diagnosis can often be strongly suspected in appropriate epidemiologic settings53.
- Definitive diagnosis of hepatitis E infection is usually based on the detection of antibodies to the virus in a person's blood42. The commonly used tests for HEV infection include detection of IgM and IgG anti-HEV antibodies and detection of HEV RNA. IgM anti-HEV antibodies can be detected during the first few months after HEV infection, whereas IgG anti-HEV antibodies represent either recent or remote exposure. The presence of HEV RNA indicates current infection, whether acute or chronic41. However, recently developed tests (includes the HEV IgM ELISA and the Rapid Point of Care test) have been shown to be highly sensitive and specific and particularly useful in endemic regions, and does not require advanced laboratory equipment38,42,53.
- Additional confirmatory tests include tests to detect the presence of virus by PCR/molecular methods in blood and/or stool.38,42,53

Treatment

- Supportive care should be provided, as for any acute hepatitis. With fulminant HEV, Hospitalization and liver transplantation is indicated53,54. Ribavirin and interferon-α has been used to treat cases of HEV infection. Most of these cases where antivirals have been used are in the setting of chronic HEV infection in immunosuppressed host. There are anecdotal reports of use of ribavirin in the setting of severe acute HEV infection with worsening liver function and acute on chronic liver failure (ACLF). In vitro experiments have demonstrated activity of sofosbuvir against HEV replication, but there have been no reports of its use in humans55.

Prevention

- At the population level, transmission of HEV and hepatitis E disease can be reduced by56:
  - Maintaining quality standards for public water supplies; Establishing proper disposal systems for human faeces.
- On an individual level, infection risk can be reduced by:
  - Maintaining hygienic practices such as hand-washing with safe water, particularly before handling food; Avoiding consumption of water and/or ice of unknown purity
  - During outbreaks when sanitation has eroded, efforts such as water chlorination may be inadequate. Boiling or other disinfection of the water supply should still be attempted, and avoidance of uncooked fruits, vegetables, and shellfish in these settings is also prudent.
  - Pregnant women should be cautious about travel to endemic regions due to elevated mortality risk.
- Unlike with HAV, passive immunization with IG has not been shown to protect against HEV transmission or disease. Several potentially effective prototype HEV vaccines are being studied but none is yet available57 Two recombinant hepatitis E vaccines developed from HEV genotype 1, by GlaxoSmithKline and Xiamen Innovax Biotech, have had short-term efficacy in clinical trials. The latter vaccine, with the commercial name of Hecolin, has been in use in China since 2012. However, the long-term efficacy of this hepatitis E vaccine has not yet been determined58tandard Precautions are adequate to prevent HEV transmission in healthcare settings59. The finding of asymptomatic carriage of HEV in swine raises concern of xenotransplantation from pigs to humans60.

HEPATITIS D

Hepatitis D is also known as Hepatitis delta agent and was discovered in 197761.

Epidemiology

Description

HDV is an RNA virus with the smallest genome of all known animal viruses62. This genome encodes a single antigen, which is expressed in two forms. HDV resembles plant satellite viruses but no other animal viruses. HDV has some genetic heterogeneity that varies geographically. It depends on simultaneous infection with HBV for its hepatotropism and transmission and is thus considered a parasite of HBV61,62.

Incidence

Approximately 5,000 to 7,500 new HDV infections occur per year in the United States, principally among IV drug users63. The incidence of HDV among patients with haemophilia has declined since the 1980s as a result not only of screening blood and plasma donors for HBV infection but also of solvent-detergent or heat inactivation of viruses in clotting factors and the development of recombinant factors VIII and Ix63.

Prevalence

Approximately 10 percent of HBV-infected individuals worldwide are co-infected with Hepatitis D63–65. HDV is endemic in Italy and other countries in the Mediterranean basin, western Asia, northern South America, and certain Pacific islands64,65. In western Europe and North America, the seroprevalence of HDV in blood donor populations ranges from 1.4 to 8 percent63–65. The highest prevalence in the United States is among injection drug users (20 to 67 percent of HBV-infected persons)63–65. In Taiwan, 91 percent of HBsAg-positive injection drug users are also seropositive for HDV. Historically, 48 to 80 percent of U.S. patients with haemophilia were seropositive for HDV markers, but this rate is declining. Groups at intermediate risk of HDV infection include haemodialysis patients and institutionalized persons. HCP are at risk of acquiring HDV infection via sharps injuries.

Transmission

HDV is transmitted principally by percutaneous exposure, but unlike HBV infection, HDV is inefficiently transmitted by sexual intercourse63,65,66. Perinatal transmission is very rare, and no cases have been documented in the United States65,67. It is not transmitted by the fecal-oral route or casual contact, though routes of transmission in countries in which HDV infection is endemic are not always clear.65

Pathogenesis

HDV infection and hepatotropism depend on simultaneous infection with HBV, as the viral envelope for Hepatitis delta virus is the Hepatitis B surface antigen68. HDV replicates only in hepatocytes and may be cytopathic. HDV and HBV may co-infect a susceptible host; a person who is already a chronic HBsAg carrier can be superinfected with HDV68.

Clinical Features

The incubation period of HDV ranges from 30 to 180 days69. Simultaneous co-infection with HBV and HDV usually manifests much like acute HBV alone, though there may be a biphasic elevation of ALT with HDV infection69. In 90 to 95 percent of cases of acute co-infection, the hepatitis is self-limited, and HBV and HDV are eliminated69.

However, fulminant hepatic failure occurs more frequently than is seen with HBV alone. Approximately 5 percent of co-infections result in chronic HBV and HDV infection, a rate that is similar to that of HBV infection alone69,70. Superinfection with HDV in a patient who is a chronic HBsAg carrier often causes more severe acute hepatitis than is seen with HBV/HDV co-infection. Moreover, HDV superinfection results in chronic HDV in greater than 90

percent of survivors of the acute infection69,70. In 10 to 15 percent of these, especially among IV drug users, hepatic damage may progress to cirrhosis and liver failure within 1 to 2 years71. Most of the others with chronic HDV have more slowly progressive liver disease resembling chronic HBV. HCC is less common in patients with chronic HDV infection than it is with chronic HBV or HCV69–71. The reasons for this are not clear.

Laboratory Diagnosis

A diagnosis of HDV is not tenable unless the patient tests positive for HBsAg. HDV should be suspected when there is a history of percutaneous or sexual exposure in a patient with chronic HDV infection, especially an IV drug user61,65,72,73. It should also be suspected in a patient with acute HBV who has a second rise in ALT level or a patient with chronic HBV who develops an acute exacerbation of hepatitis61,65,72,73.

The diagnosis of HDV can be made by PCR, IgG anti-HDV, or IgM anti-HDV. The first test should be anti-HDV IgG. Co-infection of HBV and HDV is suggested by the simultaneous finding of a positive test for IgM anti-HBc61,65,72,73. The anti-HDV IgG is short-lived in co-infection and is not protective. It may remain elevated as a "serologic scar" in superinfection patients who clear their HDV infection. A positive anti-HDV IgG should be followed up with HDV PCR to evaluate for evidence of active infection61,65,72,73.

Treatment

In acute HDV, supportive care is given. For chronic HDV, high-dose interferon alfa (IFN-a) may induce remission of disease in 40 to 50 percent of selected patients with histologic and biochemical response as well as viral suppression74–76. However, relapse viremia is common, and effects are unlikely to last once therapy is stopped. The side effects of interferon therapy may be a severe limitation to its use. Regarding antiviral medications, lamivudine has been shown to be ineffective, but tenofovir has been shown in a small study to decrease HDV viral loads, particularly when used with interferon. In acute fulminant HDV or end-stage hepatic failure or cirrhosis, liver transplantation is often necessary74–76.

Prevention

General preventive measures for HDV, as for HBV, include modification of high-risk behaviours by individuals. Standard Precautions are used in healthcare settings61,63,65,74. Post-exposure passive immunization with HBIG with HBV vaccine can prevent infection with HBV. By eliminating HBV, co-infection with HDV will not occur. Pre exposure active immunization with HBV vaccine will prevent co-infection with HDV61,63,65,74. No vaccine to prevent HDV super-infection is yet available. Patients with chronic HDV infection should be candidates for HAV vaccine. Needle exchange programs may be effective in preventing the spread of HDV among injection drug users.61,63,65,74

HEPATITIS B

Key facts

- Hepatitis B is a viral infection that attacks the liver and can cause both acute and chronic disease77.
- The virus is transmitted through contact with the blood or other body fluids of an infected person.
- An estimated 257 million people are living with hepatitis B virus infection (defined as hepatitis B surface antigen positive).
- Hepatitis B is an important occupational hazard for health workers.
- However, it can be prevented by currently available safe and effective vaccine.

Hepatitis B is infection of liver by Hepatitis B virus. The infection is called acute when a person first becomes infected with HBV. The infection becomes chronic (long term) when a person has symptoms, such as liver swelling for 6 months or longer. Acute HBV infections are more common in adults. Infants and young children have a higher risk for chronic HBV. Hepatitis B is a potentially life-threatening liver infection caused by the hepatitis B virus (HBV). It is a major global health problem77–79. It can cause chronic infection and puts people at high risk of death from cirrhosis and liver cancer. A vaccine against hepatitis B has been available since 198280. The vaccine is 95% effective in preventing infection and the developmen

Modes of Transmission

HBV is transmitted through contact with infected blood or body fluids across breakages in skin/ mucous membranes and unprotected sexual intercourse77–79. HBV is 100 times more infectious than Human Immunodeficiency Virus (HIV). Unlike HIV, HBV is able to remain active on surfaces (e.g. table tops, razor blades, blood stains etc.) for about a week without losing infectivity77–79.

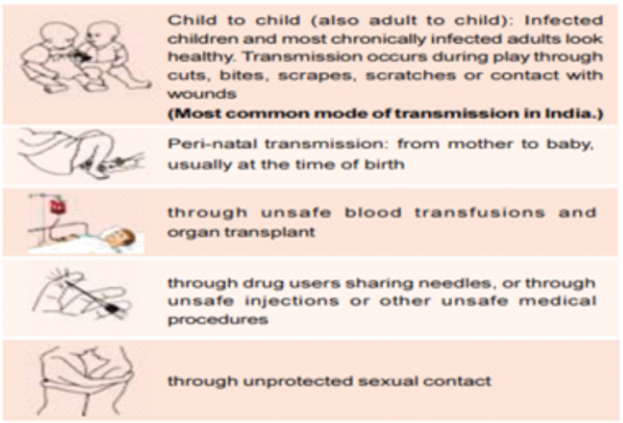


Figure 5: Mode of transmission of HBV Virus Source: Epidemiology of HepB and Hib diseases in India Dr Pradeep Haldar AC(I) SEPIO meeting 18-20 May 2011

OUTCOMES OF HBV INFECTION

Hepatitis B disease is the inflammation of the liver cells caused by HBV. The outcomes of HBV infection are age-dependent and include acute (short term and clinically apparent) hepatitis B and chronic (long-term and mostly unapparent) disease81–83. The infecting dose of virus and the age of the person infected are important factors that correlate with the severity of acute or chronic hepatitis B. Only a small proportion of acute HBV are actually recognized clinically81–83.

ACUTE HEPATITIS B INFECTION

- Acute hepatitis B occurs in approximately 1% of perinatal, 10% of early childhood (1-5 years old) and about30% late (>5 years old)HBV infections84,85. The course of acute hepatitis B is extremely variable and the incubation period ranges from 2-5 months.

Common symptoms include:

- Fever (Mild/ absent)
- Loss of appetite

- Pain in muscles, joints
    - Nausea, diarrhoea, vomiting
    - Pain abdomen
    - Headache
    - Dark urine
    - Pale stools
    - Jaundice
- Most acute cases result in recovery except about 1% of them, progressing to fulminate hepatitis. Fulminant hepatitis has a very high mortality at about 70%84,85.

Figure 6: Clinical outcomes of Hepatitis B infection86

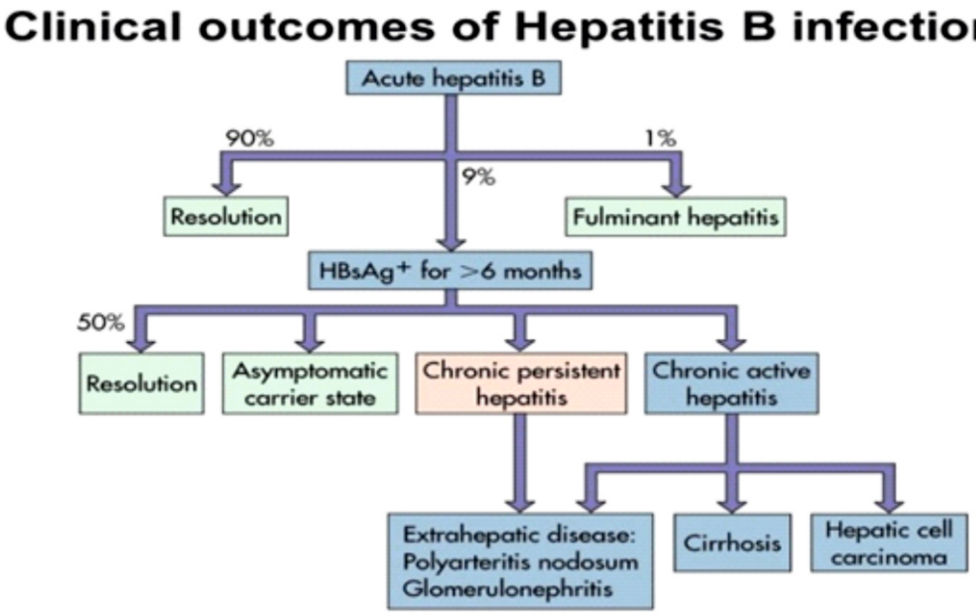
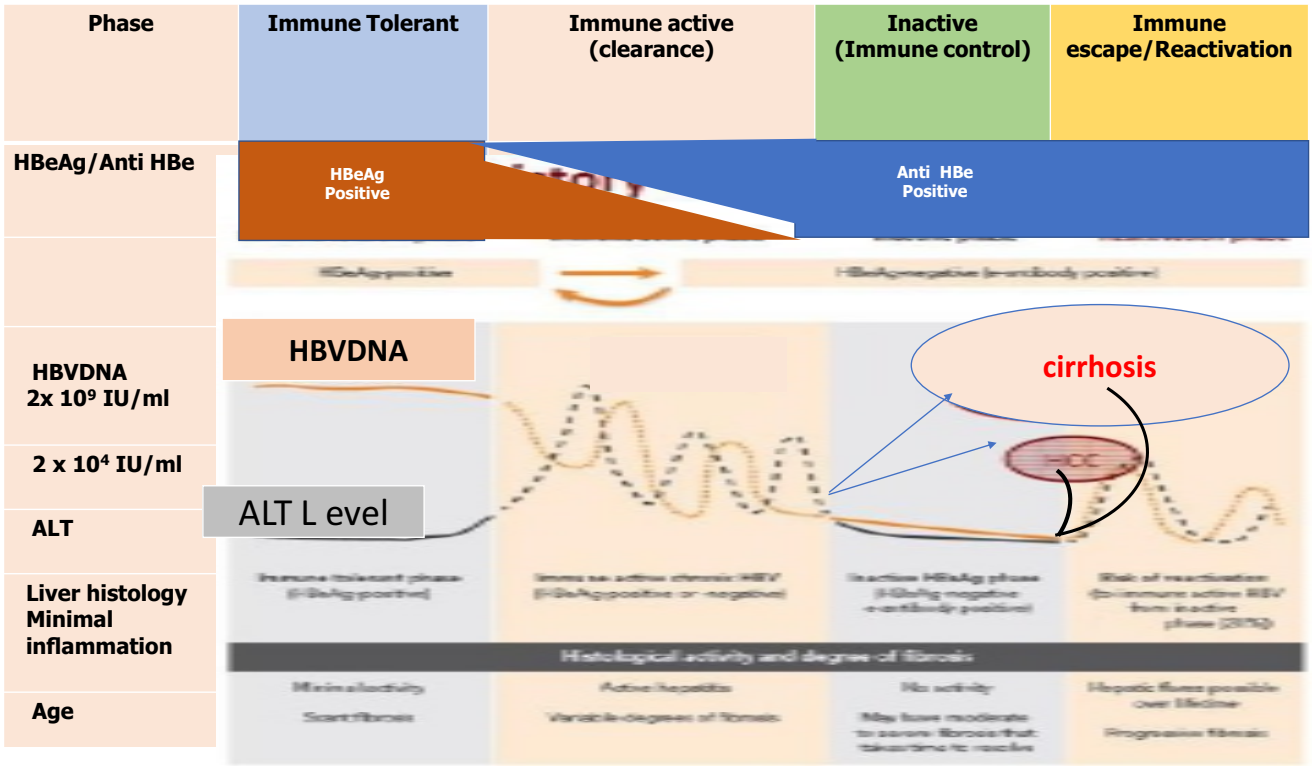


Fig 7: Natural History of Hepatitis B infection



This phase seen in HBV transmission at birth/1-2 years of life. HBeAg +ve and high viral load (10^7 IU/mL) but no elevation of transaminases and minimal activity in liver as there is no immunological response.	With increased immune response HBVDNA level decreases. Liver enzymes fluctuate. Active inflammation in liver ending in HBeAg negative and HBeAb +ve (HBeAg seroconversion) Ongoing activity could progress to fibrosis and liver cirrhosis with HCC.	HBeAg remains negative in 70-85% with low viral load<2 x 10^3 IU/mL with persistently normal liver enzymes but hepatitis activity may continue in some Fibrosis/cirrhosis noted in those who had progressed in immune active phase	Progression from HBeAg negative inactive phase to HBeAg negative hepatitis B with mutation in core or core promoter region of HBV genome resulting in HBeAg negative but with continued HBV replication and progression in liver disease.

Source[87]: Modified from Hepatitis B Virus Infection, Yun-Fan Liaw, Chia-Ming Chu, Lancet 2009; 373 : 582-92

Chronic Hepatitis B infection

Chronic HBV infection is one of the most common and persistent viral infections in humans. If infection occurs in infancy, 99% remain asymptomatic. 90 % of these become chronic carriers88,89. In contrast, 30% of those infected during childhood (1-5 years) and 6% of those infected during adulthood become chronic carriers. Persons with chronic HBV infection have a 15-25% risk of dying prematurely due to HBV related liver cirrhosis and cancer84,88,89. The example in the table below demonstrates, out of 100 persons infected at different ages, the number of persons at risk of developing chronic HBV infection and complications.

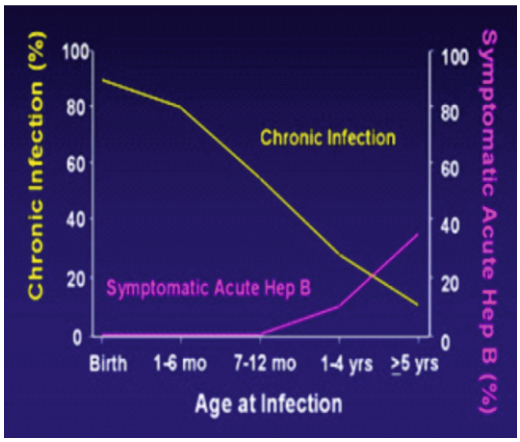


Fig 8 A: Outcome of hepatitis B virus infection by age at infection90,91

Type	IF Infected	THEN chronic HBV infection	AND Cirrhosis/ Carcinoma*
Infant	100	90% = 90	15% of 90 = 14
Child(1-5yrs)	100	30% = 30	15% of 30 = 5
Adult	100	6% = 6	15% of 6 = 1

**assuming the lower rate of 15% complications*

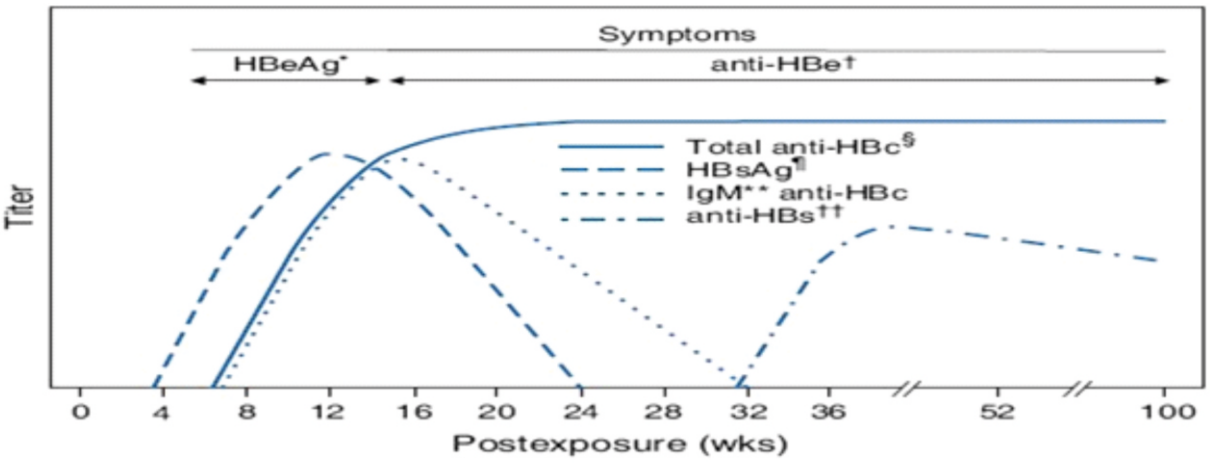
Fig 8 B: Outcome of hepatitis B virus infection by age at infection90,91

In Africa and Asia, liver cancer is second only to tobacco as the most frequent cause of cancer deaths among adult males, most of which are attributed to HBV infection84,88,89

Clinical Features

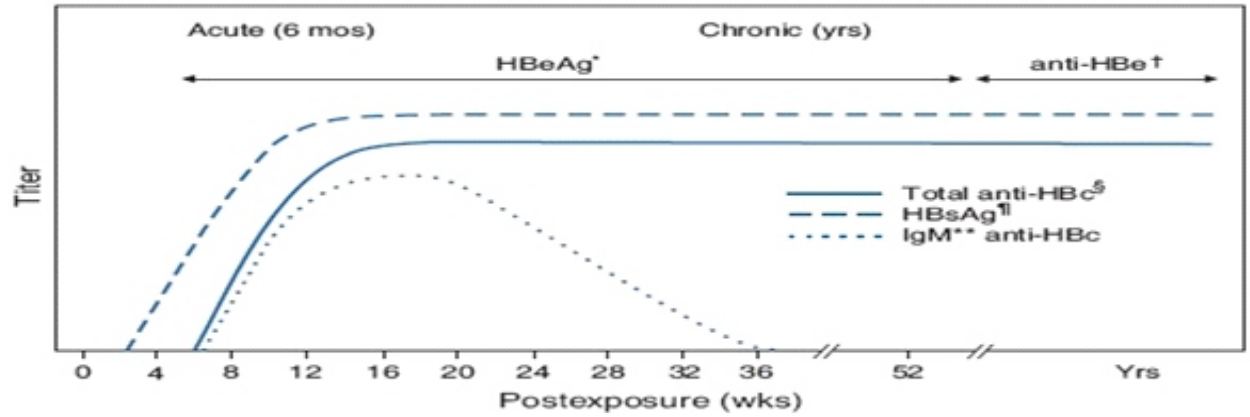
The incubation period ranges from 30 to 180 days (mean, 75 days) 92–95. Prodromal urticarial rash, arthritis, and fever occur in 5 to 10 percent of adults94. Neonates or young children are usually asymptomatic. Acute HBV is more insidious and prolonged than HAV. Fulminant hepatic failure is rare but can be fatal without liver transplantation77,94. Symptoms resemble HAV. In acute HBV (Figure 8), HBsAg, HBeAg, and HBV DNA are detectable in serum 2 to 7 weeks before onset of symptoms77–79,94. When symptoms occur, immunoglobulin M anti-HBV core (IgM anti-HBc) and ALT, aspartate aminotransferase (AST), and bilirubin levels all rise94,96,97. ALT levels generally exceed AST and are usually elevated 10- to 20-fold from normal. Bilirubin elevations vary with severity. Prolonged prothrombin time (international normalized ratio [INR] ≥ 1.5) or hypoalbuminemia imply severe hepatic injury and may portend fulminant hepatic failure. Acute HBV resolves slowly (weeks to months) following detection of immunoglobulin G anti-HBc (IgG anti-HBc), anti-HBe, and anti-HBs, and disappearance of HBeAg and HBsAg. IgM anti-HBc may persist for months then disappear94,96,97.

Fig 9: Typical serologic course of acute hepatitis B virus infection with recovery90,91



* Hepatitis B e antigen.
† Antibody to HBeAg.
§ Antibody to hepatitis B core antigen.
¶ Hepatitis B surface antigen.
** Immunoglobulin M.
†† Antibody to HBsAg.

In chronic hepatitis (Figure 9), HBsAg, HBeAg, and HBV DNA are detected for more than 6 months, and ALT and AST levels fall but do not always return to normal. These persons remain infectious for others; those with HBeAg are highly infectious and are at greatest risk of developing cirrhosis or hepatocellular carcinoma. Persons who have human immunodeficiency virus (HIV) or other forms of immunosuppression (e.g., dialysis patients) and who acquire HBV infection are more likely to develop chronic HBV and associated liver complications than are those without these comorbid conditions.



* Hepatitis B e antigen.
† Antibody to HBeAg.
§ Antibody to hepatitis B core antigen.
¶ Hepatitis B surface antigen.
** Immunoglobulin M.

Figure 10: Typical serologic course of acute hepatitis B virus infection with progression to chronic HBV infection90,91F

Laboratory Diagnosis

In prodromal or preicteric HBV disease, HBsAg, HBeAg, and HBV DNA are detectable in serum (see Figure), with HBsAg becoming positive 1 to 10 weeks after an exposure and before the onset of symptoms98–101. Finding HBeAg and high concentration of HBV DNA signify high rates of HBV replication and heightened infectivity. With onset of symptoms, rise in levels of aminotransferase and bilirubin, IgM anti-HBc becomes positive. This is the ideal test to determine whether an acute hepatitis is due to Hepatitis B, since the titre rises with onset of symptoms and falls below detectable levels after several months, so it is not positive in those with chronic Hepatitis B. As acute illness wanes over a period of weeks, aminotransferase and other biochemical monitors improve. HBeAg, HBV DNA, and HBsAg may disappear. IgG anti-HBc, anti-HBe, and anti-HBs are detectable98–101.

In chronic HBV, biochemical abnormalities may persist, and a positive serum test for HBsAg for more than 6 months is diagnostic of chronic Hepatitis B. IgG anti-HBc remains detectable, but IgM anti-HBc declines. Eventually HBV DNA and HBeAg may disappear, and this signifies an asymptomatic carrier. In active chronic infection, transaminases and HBV DNA remain elevated. These patients can either be HBeAg positive or HBeAg negative. HBeAg positive patients can spontaneously convert to anti-HBe, typically with an acute rise in transaminases, then return to normal, along with a fall in HBV DNA and improved liver inflammation level. IgG anti-HBc persists for life in both chronic active HBV and in persons who have cleared an acute infection. Persons with chronic HBV (particularly HBeAg positive and HBV DNA positive) remain infectious for others98–101

Antigen or antibody	Presence in serum	Inference	Explanation
HBsAg (Hepatitis B surface antigen also known as the Australia antigen is the surface antigen on outer lipoprotein coat)	Yes, 30-60 days after exposure	Infection and infectivity	HBV envelope protein and excess coat particles detectable in the blood in acute and chronic hepatitis B infection. It indicates current hepatitis B infection
HBcAg (Hepatitis B core antigen)	Difficult to detect. Detected in the liver tissues with acute or chronic infection	hepatitis B infection	HBV core protein. The core protein is coated with HBsAg and therefore not found free in serum
HBeAg (Hepatitis B e antigen; core related protein that is secreted out in serum)	Yes, with high virus titres and during rapid replication of virus	high infectivity	Viral protein found in the high replicative phase of hepatitis B. HBeAg is usually a marker of high levels of replication with wild-type virus but is not essential for viral replication
anti-HBs (Hepatitis B surface antibody)	Yes, during convalescence after acute infection or following hepatitis B vaccination	Past infection and immunity	Antibody to HBsAg. Develops in response to HBV vaccination and during recovery from acute hepatitis B, denoting
Anti-HBe	Yes	Low infectivity	Antibody to HBeAg. Detected in persons with lower levels of HBV replication but also in HBeAg-negative disease (i.e. HBV that does not express HBeAg)
anti-HBc (Hepatitis B core antibody)	Yes	both acute and chronic infection	Antibody to hepatitis B core (capsid) protein. Anti-HBc antibodies are not neutralizing antibodies and are detected in both acute and chronic infection
IgM anti-HBc	Yes	Recent infection (≤ 6 Months)	Subclass of anti-HBc. Detected in acute hepatitis B but can be detected by sensitive assays in active chronic HBV
IgG anti-HBc	Yes	Past or current infection with HBV	Subclass of anti-HBc detected in past or current infection. If it and HBsAg are both positive (in the absence of IgM anti-HBc), this indicates chronic HBV infection.

Fig 11: Significance of serological markers102

Treatment of HBV

The goal of treatment is to prevent the disease from getting worse and leading to more serious liver problems. Treatment may help improve the function of your liver and decrease your symptoms of liver disease. HBV may last a short time and go away on its own without treatment. HBV may become chronic, leading to liver damage and disease88,92,103104,105.

Medicines of HBV:

Antiviral medicines: Antiviral medicines may be given to help stop the virus from spreading in your body104,105

Immune-globulin: Hepatitis B immune globulin is medicine given if you have been exposed to HBV. Immune globulin helps your body fight the HBV infection. HBIG is also given to new-born babies who were exposed to HBV while in the womb

Liver transplant: Some patients may need liver transplant if they have severe liver disease or liver failure

Table 3 : Whom to treat and whom to monitor104,105

WHOM TO TREAT	WHOM NOT TO TREAT
As a priority, all adults, adolescents and children with CHB and evidence of compensated or decompensated cirrhosis should be treated, regardless of ALT levels, HBeAg status or HBV DNA levels	Antiviral therapy is not recommended and can be deferred in persons without evidence of cirrhosis, and with persistently normal ALT levels and low levels of HBV replication (HBV DNA <2000 IU/mL), regardless of HBeAg status or age. Where HBV DNA testing is not available: Treatment can be deferred in HBeAg-positive persons aged 30 years or less and persistently normal ALT levels.
Treatment is recommended for adults with CHB who, do not have evidence of cirrhosis, but are aged more than 30 years (in particular), and have persistently abnormal ALT levels and evidence of high-level HBV replication (HBV DNA >20 000 IU/mL), regardless of HBeAg status.	Continued monitoring is necessary in all persons with CHB, but in particular those who do not currently meet the recommended criteria for whom to treat or not treat, to determine if antiviral therapy may be indicated in the future to prevent progressive liver disease. These include persons without cirrhosis aged 30 years or less, with HBV DNA levels >20 000 IU/ mL but persistently normal ALT;

Prevention:

- Getting vaccinated against HBV is the best way to decrease your risk and prevent the disease10,11,94
- The HBV vaccine is given in 3 doses over a period of months
- Some people may not show any response to vaccines. After vaccination, you may need a blood test to check your response
- The following people should be vaccinated against HBV11,80,85:
  - Any person not already vaccinated against HBV Healthcare workers and workers in others care facilities
  - New-born babies born to women with HBV- All new-born babies should be vaccinated shortly after birth and have additional doses as directed by a caregiver
  - People living in care facilities and inmates of correctional facilities

Hepatitis B vaccine schedule

The hepatitis B vaccination schedule in UIP includes Birth dose within 24 hour of delivery, followed by 3 more doses of HepB vaccine along with DPT. Birth dose should be provided for all institutional deliveries, within 24 hrs of birth. Subsequently, 3 doses should be provided at 6, 10 and 14 weeks age along with three doses of DPT and OPV. Prospective of birth dose.

Vaccination Schedule:

Age	Vaccines		
Birth	HepB birth dose	BCG	OPV0 zero dose
6 weeks	HepB1	DPT1	OPV1
10 weeks	HepB2	DPT2	OPV2
14 weeks	HepB3	DPT3	OPV3

Fig 12: Hepatitis B Vaccine Schedule in India[205]

    - People who have decreased liver function or who are infected with hepatitis C, hepatitis D or HIV
    - People who inject illegal drugs
    - People with kidney failure, receiving hemodialysis treatment. More or higher doses of the vaccine may be needed for people with kidney failure
    - People with more than one sexual partner or men having sex with other men
    - People who have had a sexually transmitted disease (STD) before should also be vaccinated
- Those people who are HBV +ve should85,105,106:
- Cover any open cuts/scratches. If blood from a wound gets on a surface, clean the surface with bleach right away
- Dispose of any items with blood or body fluids on them properly
- Do not donate blood, sperm or organs to others
- Do not share items that may have infected blood or body fluids on them (includes toothbrushes, razors or personal injection items, such as needles)
- Tell household and sexual contacts that you have HBV. All close contacts should be vaccinated. If contacts have not had the vaccination, they may need to start treatment to help prevent infection.
- Also tell medical or dental caregivers you have HBV when getting any kind of treatment
- When having sex, always use a condom, even if you have acute HBV and your infection goes away, you can still spread the virus for up to 6 months

Hepatitis B Vaccine:

- Recombinant hepatitis B vaccines of three intramuscular doses of hepatitis B vaccine induces an adequate antibody response in greater than 90% of healthy adults and in greater than 95%of infants, children, and adolescents from birth through 19 years of age107,108.
- The deltoid (arm) is the recommended site for hepatitis B vaccination of adults and children; immunogenicity of vaccine for adults is substantially lower when injections are given in the buttock.
- Larger vaccine doses (two to four times normal adult dose) or an increased number of doses (four doses) are required to induce protective antibody in a high proportion of haemodialysis patients and may also be necessary for other immune compromised persons (such as those on immunosuppressive drugs or with HIV infection).
- Primary vaccination comprises three intramuscular doses of vaccine, with the second and third doses given 1 and 6 months, respectively, after the first.
- Adults and older children should be given a full 1.0 ml dose, while children less than 11 years of age should usually receive half (0.5 ml) this dose.
- An alternative schedule of four doses of vaccine given at 0, 1, 2, and 12 months has been approved for one vaccine for post-exposure prophylaxis or for more rapid induction of immunity.
- Hepatitis B vaccine should be given only in the deltoid muscle for adults and children or in the antero-lateral thigh muscle for infants and neonates.
- For patients undergoing haemodialysis and for other immunosuppressed patients, higher vaccine doses or increased numbers of doses are required.
- Vaccine doses administered at longer intervals provide equally satisfactory protection, but optimal protection is not conferred until after the third dose.
- If the vaccine series is interrupted after the first dose, the second and third doses should be given separated by an interval of 3-5 months. Persons who are late for the third dose should be given this dose when convenient.
- Side effects and adverse reactions: The most common side effect observed following vaccination with each of the available vaccines has been soreness at the injection site.
- Need for vaccine booster doses:
    - Up to 50% of adult vaccines who respond adequately to vaccine may have low or undetectable antibody levels by 7 years after vaccination.

- For adults and children with normal immune status, booster doses are not routinely recommended within 7 years after vaccination, nor are routine serologic testing to assess antibody levels necessary for vaccine recipients during this period.
- For infants born to hepatitis B-carrier mothers, booster doses are not necessary within 5 years after vaccination.
- The possible need for booster doses after longer intervals will be assessed as additional information becomes available.
- For haemodialysis patients, the need for booster doses should be assessed by annual antibody testing, and booster doses should be given when antibody levels decline to less than 10 mIU/ml.

GROUPS RECOMMENDED FOR PREEXPOSURE VACCINATION:

- **With occupational risk:** HBV infection is a major infectious occupational hazard for health-care and public-safety workers. If those tasks involve contact with blood or blood-contaminated body fluids, such workers should be vaccinated.
- Clients and staff of institutions for the developmentally disabled:
- Staffs who work closely with clients should also be vaccinated.
- The risk in institutional environments is associated not only with blood exposure but may also be consequent to bites and contact with skin lesions and other infective secretions.
- Susceptible clients and staff who live or work in smaller (group) residential settings with known HBV carriers should also receive hepatitis B vaccine.
- Staff of non-residential day-care programs (e.g., schools, sheltered workshops for the developmentally disabled) attended by known HBV carriers have a risk of HBV infection comparable to that among health-care workers and therefore should be vaccinated
- Haemodialysis patients
- Sexually active homosexual men
- Recipients of certain blood products: Patients with clotting disorders who receive clotting-factor concentrates.
- Household and sexual contacts of HBV carriers:
- Adoptees from countries of high HBV endemicity: Families accepting orphans or unaccompanied minors from countries of high or intermediate HBV endemicity.
- Other contacts of HBV carriers:
- Sexually active heterosexual persons, with multiple sexual partners:
- International travellers:

POSTEXPOSURE PROPHYLAXIS FOR HEPATITIS B:

- Prophylactic treatment to prevent hepatitis B infection after exposure to HBV should be considered in the following situations: perinatal exposure of an infant born to an HBsAg-positive mother, accidental percutaneous or per mucosal exposure to HBsAg-positive blood, sexual exposure to an HBsAg-positive person, and household exposure of an infant less than 12 months of age to a primary care giver who has acute hepatitis B107–109.
- For an infant with perinatal exposure to an HBsAg-positive and HBeAg-positive mother, a regimen combining one dose of HBIG at birth with the hepatitis B vaccine series started soon after birth is 85%-95% effective.
- For accidental percutaneous exposure, a regimen of two doses of HBIG, one given after exposure and one a month later, is about 75% effective in preventing hepatitis B in this setting.
- For sexual exposure, a single dose of HBIG is 75% effective if given within 2 weeks of last sexual exposure.
- The efficacy of IG for post-exposure prophylaxis is uncertain. IG no longer has a role in post-exposure prophylaxis of hepatitis B because of the availability of HBIG and the wider use of hepatitis B vaccine.

PERINATAL EXPOSURE AND RECOMMENDATIONS:

The following are perinatal recommendations107–109:

- All pregnant women should be routinely tested for HBsAg during an early prenatal visit in each pregnancy.
- This testing should be done at the same time that other routine prenatal screening tests are ordered.
- In special situations (e.g., when acute hepatitis is suspected, when a history of exposure to hepatitis has been reported, or when the mother has a particularly high-risk behaviour, such as intravenous drug abuse), an additional HBsAg test can be ordered later in the pregnancy.
- No other HBV marker tests are necessary for the purpose of maternal screening, although HBsAg-positive mothers identified during screening may have HBV-related acute or chronic liver disease and should be evaluated.
- If a woman has not been screened prenatally or if test results are not available at the time of admission for delivery, HBsAg testing should be done at the time of admission, or as soon as possible thereafter. If the mother is identified as HBsAg-positive greater than 1 month after giving birth, the infant should be tested for HBsAg. If the results are negative, the infant should be given HBIG and hepatitis B vaccine.
- Following all initial positive tests for HBsAg, a repeat test for HBsAg should be performed on the same specimen, followed by a confirmatory test using a neutralization assay. For women in labour who did not have HBsAg testing during pregnancy and who are found to be HBsAg-positive on first testing, initiation of treatment of their infants should not be delayed by more than 24 hours for repeat or confirmatory testing.
- Infants born to HBsAg-positive mothers should receive Hepatitis B vaccine (0.5 ml) intramuscularly once they are physiologically stable, preferably within 12 hours of birth. The first dose should be given concurrently with HBIG but at a different site. If vaccine is not immediately available, the first dose should be given as soon as possible. Subsequent doses should be given as recommended for the specific vaccine. Testing infants for HBsAg and anti-HBs is recommended when they are 12-15 months of age to monitor the success or failure of therapy. If HBsAg is not detectable and anti-HBs is present, children can be considered protected. Breast-feeding poses no risk of HBV infection for infants who have begun prophylaxis.
- Household members and sexual partners of HBV carriers identified through prenatal screening should be tested to determine susceptibility to HBV infection, and, if susceptible, should receive hepatitis B vaccine.
- Obstetric and paediatric staff should be notified directly about HBsAg-positive mothers so that neonates can receive therapy without delay after birth and follow-up doses of vaccine can be given. Programs to coordinate the activities of persons providing prenatal care, hospital-based obstetrical services, and paediatric well-baby care must be established to assure proper follow-up and treatment both of infants born to HBsAg-positive mothers and of other susceptible household and sexual contacts.
- In highly endemic populations, universal vaccination of new-borns with Hepatitis B vaccine is the recommended strategy. HBsAg screening of mothers and use of HBIG for infants born to HBV-carrier mothers may be added to routine hepatitis B vaccination. More extensive programs of childhood hepatitis B vaccination should be considered if resources are available.

ACUTE EXPOSURE TO BLOOD THAT CONTAINS (OR MIGHT CONTAIN) HBsAG

Exposed person has not been vaccinated or has not completed vaccination107–112:

- Hepatitis B vaccination should be initiated.
- A single dose of HBIG (0.06 ml/kg) should be given as soon as possible after exposure and within 24 hours, if possible.
- The first dose of hepatitis B vaccine should be given IM at a separate site (deltoid for adults) and can be given simultaneously with HBIG or within 7 days of exposure.
- Subsequent doses should be given as recommended for the specific vaccine.
- If the exposed person has begun but not completed vaccination, one dose of HBIG should be given immediately, and vaccination should be completed as scheduled.

- Exposed person has already been vaccinated against hepatitis B, and anti-HBs response status is known:
- If anti-HBs level is adequate, no treatment is necessary.
- If anti-HBs level is inadequate, a booster dose of hepatitis B vaccine should be given.
- Exposed person has already been vaccinated against hepatitis B, and the anti-HBs response is unknown:
- The exposed person should be tested for anti-HBs.
- If the exposed person has adequate antibody, no additional treatment is necessary.
- If the exposed person has inadequate antibody on testing, one dose of HBIG (0.06 ml/kg) should be given immediately and a standard booster dose of vaccine given at a different site.

Patient education

- Key points in counselling and preparing the patient prior to initiation of therapy Preparing to start treatment: Patients should be counselled about the indications for treatment, including the likely benefits and side-effects, willingness to commit to long-term treatment, and need to attend for follow-up monitoring both on and off therapy; the importance of full adherence for treatment to be both effective and reduce the risk of drug resistance; and cost implications.
- Measurement of baseline renal function and assessment of baseline risk for renal dysfunction should be considered in all persons prior to initiation of antiviral therapy

- Seek help immediately if:
  - You have a sudden, severe headache and head pressure
  - You have new or increased bruising or red or purple dots on your skin. You may also have bleeding that does not stop easily
  - Your abdomen is swollen
  - You have severe nausea or cannot stop vomiting
  - You see blood in your urine or stool, or you vomit blood
  - You have new or increased yellowing of your skin or the whites of your eyes
  - You have severe pain in your upper abdomen

- Limit or avoid alcohol: Alcohol can increase your liver damage and can damage your brain and heart
- Quit smoking: Smoking harms your lungs, blood and heart. You are more likely to have a heart attack, lung disease and cancer if you smoke. You will help yourself and those around you by not smoking

Monitoring

- The disease is complex and has sequelae, resolution as well as drugs side effects. Hence, three types of monitoring is necessitated9,10,105,113
- Monitoring for disease progression and treatment response in persons with CHB prior to, during and post-treatment9,10,105,113
- Monitoring for tenofovir or entecavir side-effects
- Monitoring for hepatocellular carcinoma

Table 4: Monitoring: Parameters and frequency102

Interval (Months)	3 Months			6 Months			9 Months			12 Months			
HBeAg/Anti HBe		√	√	√	√	√	√	√	√	√	√	√	√
HBVDNA		√	√	√	√	√	√	√	√	√	√	√	√
ALT	√	√	√	√	√	√	√	√	√	√	√	√	√
AST											√		√
CBC (Platelet)											√	√	√
APRI/FIB4/Fibro Scan											√	√	√
USG				√							√	√	√
Serum Creatinine												√	
eGFR												√	
Phosphate												√	
Urine Protein: Creatinine Ratio												√	

	Not on Treatment
	Treatment
	Discontinue Treatment

Note on Treatment:

- Frequent monitoring with monthly ALT and 3 monthly HBeAg/Anti HBeAg and HBV DNA quantitative would be required in those with fluctuating ALT and HBVDNA 2000-20,000 IU/mL, who are as yet not on treatment9,10,105,113.
- In active chronic B with persistently normal ALT and HBVDNA <20,000IU/mL, may be monitored annually

On Treatment:

- More frequent 3-6 monthly assessment is required initially in those with advanced liver disease in the first year.

Discontinued Treatment:

- Careful long-term monitoring for reactivation with serial 3-6 monthly HBeAg, ALT and HBVDNA levels is mandatory in those who have discontinued treatment for consideration of retreatment.

Special Situations

- Care of the pregnant woman
- All pregnant women with HBV should be evaluated for the need of treatment for hepatitis B and any associated liver disease and given advice about prevention of transmission. Only a proportion of those with hepatitis B virus infection (pregnant or otherwise) need treatment9,10,105,113.
- Hepatitis B in a pregnant woman is not a reason for considering termination of pregnancy. Similarly, the need for caesarean delivery should be decided based on obstetric indications, and not on the presence of HBV infection9,10,105,113.
- Administration of hepatitis B vaccine to pregnant women with HBV provides no benefit either to the mother or the baby.

Care of the baby

- Immuno-prophylaxis of hepatitis B virus infection
- The new born baby should be administered a timely first dose (the 'birth dose') of hepatitis B vaccine (monovalent) as soon as possible after birth, ideally within 24 hours. Even within this time duration, the earlier it can be administered, the better. If, for some reason, the birth dose is not administered within 24 hours, it should still be administered as soon as it is possible and not omitted. This dose is administered intramuscularly in the anterolateral thigh. This birth dose must be followed by timely administration of 3-doses of hepatitis B-containing vaccine [e.g. monovalent hepatitis B vaccine, tetravalent combination vaccine with DPT (DPT-Hep B) or a pentavalent vaccine (DPT+HepB+Hib)]. The hepatitis B vaccine birth dose followed by these three doses is the most effective method for prevention of mother-to-child transmission of hepatitis B.
- Hepatitis B immunoglobulin (HBIG) may provide some additional protection in situations where risk of transmission is particularly high – i.e. babies born to mothers with hepatitis B who also have detectable HBeAg and/or high viral load. However, additional benefit provided by it, over properly-administered hepatitis B vaccine (as described above) is small. Also, HBIG is costly and has limited availability. If a decision is taken to administer HBIG (0.5 ml or 100 international units, intramuscular), this should be done as soon after birth as possible (and within 12-24 hours) and in a limb other than the one in which hepatitis B vaccine has been administered.
- Data on benefit and risks of administering anti-hepatitis B drugs to the pregnant women for prevention of mother-to-child transmission are unclear.

Breast feeding

- A mother who has hepatitis B may breast feed her baby, unless there is an exuding injury or disease of the nipple or surrounding skin. The advantages of breast feeding far outweigh the risk, if any, of transmission of hepatitis B to a baby who has received hepatitis B vaccine.

Timing of testing

- If it is felt that the baby needs to be tested for hepatitis B, this should be done only after 1 year of age. Any positivity before this age is difficult to interpret and may resolve spontaneously over time.

Co morbidities

- HIV and Hepatitis B Co-infection
- The natural history of both diseases is affected when a person is co-infected with both HIV and Hep B and this has implications on management of both diseases. Current evidence suggests that human immunodeficiency virus (HIV) infection has an adverse impact on HBV-related liver disease progression, with higher serum HBV DNA polymerase activity, lower rates of loss of serum hepatitis B e antigen, and increased risk of cirrhosis, liver-related mortality, and hepatocellular carcinoma at lower CD4 T-cell counts. HBV infection is more likely to be chronic in those with HIV infection. In some cohorts, liver disease has emerged as a leading cause of death in HIV-infected persons co-infected with either hepatitis B or C, as mortality due to other HIV-related conditions has declined following the introduction of antiretroviral therapy (ART).
- Similarly, the HBV infection also negatively impacts the progression of HIV infection leading to faster immune deterioration and higher mortality. Other studies have suggested that HBV is associated with a rapidly progressive course of HIV infection. A retrospective analysis indicated that the risk of death in 64 individuals co-infected with HIV and HBV was approximately two-fold higher than that in individuals with HIV mono infection. Prospective observational cohort among those with primary HIV infection showed that HBV co-infection is an independent predictor of immunologic deterioration in such group of patients. In another large prospective multicentre cohort by Chun et al among 2352 (PLHIV) with sero-conversion window of less than 3 years, co-infected persons with Hepatitis B were associated with two times higher risk of AIDS/death, higher among HBV co-infected patients compared to HBV mono-infected patients
- The HIV-Hepatitis co-infected persons show faster CD4 decline, slower CD4 recovery following ART, increased incidence of AIDS and non-AIDS events, increased rate of ARV toxicity and increased chances of Immune reconstitution hepatitis. In one of the large cohort studies of more than 5000 co-infected persons, the relative risk of liver related deaths was found to be 17 times higher than those with HBV mono-infected patients.
- Other challenges among co-infected include cross-resistance between HIV and HBV drugs, increased liver injury, either due to direct hepatotoxicity or to ART-related immune-reconstitution hepatitis, with elevation of ALT; if ART does not cover both HIV and HBV infections adequately, fulminant hepatitis is an eventuality.

HEPATITIS C

Key facts

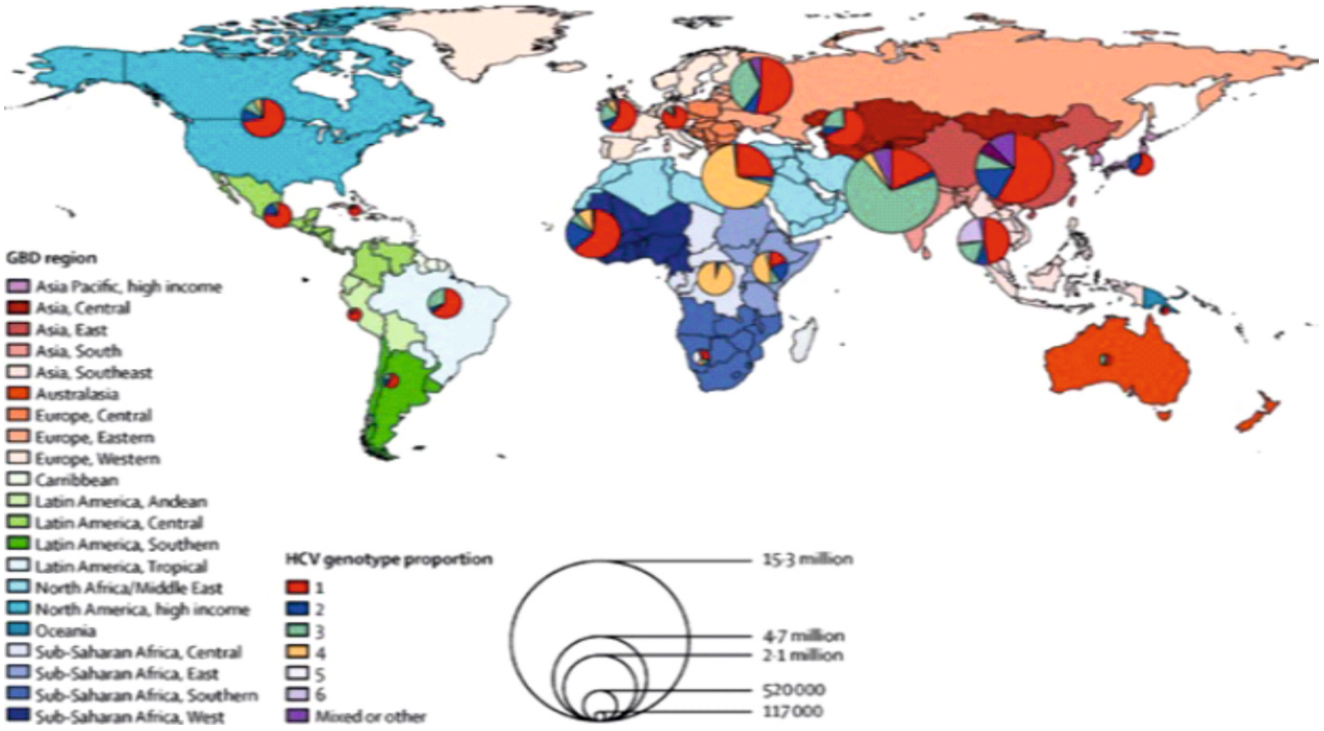
- Hepatitis C is a liver disease caused by the hepatitis C virus: the virus can cause both acute and chronic hepatitis, ranging in severity from a mild illness lasting a few weeks to a serious, lifelong illness102,104.
- The hepatitis C virus is a bloodborne virus and the most common modes of infection are through exposure to small quantities of blood. This may happen through injection drug use, unsafe injection practices, unsafe health care, and the transfusion of unscreened blood and blood products.
- Globally, an estimated 71 million & in India around 12 million people have chronic hepatitis C infection.
- Worldwide, up to 8% of pregnant women are infected with hepatitis C virus (HCV)114. Little is known about hepatitis C virus infection in pregnant women in India. The seroprevalence of anti-HCV antibody in the healthy general population of India was found to be 1.5 per cent each in 234 voluntary blood donors and 65 pregnant women115,116.
- A significant number of those who are chronically infected will develop cirrhosis or liver cancer.
- Approximately 399 000 people die each year from hepatitis C globally, mostly from cirrhosis and hepatocellular carcinoma.
- Antiviral medicines can cure more than 95% of persons with hepatitis C infection, thereby reducing the risk of death from liver cancer and cirrhosis, but access to diagnosis and treatment is low.
- There is currently no vaccine for hepatitis C; however, research in this area is ongoing.

Epidemiology:

Hepatitis C virus (HCV) is a small (55–65 nm in size), enveloped, positive-sense single-stranded RNA virus of the family Flaviviridae. Hepatitis C virus is the cause of hepatitis C and some cancers such as liver cancer (hepatocellular carcinoma, abbreviated HCC) and lymphomas in humans. Hepatitis C is also called non-A or non-B hepatitis. It is the inflammation of the liver caused by hepatitis virus C. Similar to hepatitis A and Hepatitis B virus, hepatitis C virus (HCV) attacks and damages the liver. CDC estimates worldwide there are 3-4 million people infected with HCV every year117.

WHO estimated that in 2015, 71 million persons were living with chronic HCV infection worldwide (global prevalence: 1%) and that 399 000 had died from cirrhosis or hepatocellular carcinoma (HCC)118. Aside from the burden of HCV infection secondary to liver-related sequelae, HCV causes an additional burden through comorbidities among persons with HCV infection, including depression, diabetes mellitus and chronic renal disease. A proportion of these morbidities is directly attributable to HCV and is therefore referred to as extra hepatic manifestations. These manifestations are likely to be affected by treatment. The World Health Assembly recognized that viral hepatitis is a major public health problem and passed two initial resolutions in 2010119 and 2014120. WHO estimated that in 2015, 1.75 million new HCV infections occurred, mostly because of injecting drug use and unsafe health care118. Worldwide, HCV infection may be caused by one of six major HCV genotypes (Fig. 2.1)120. However, in many countries, the genotype distribution remains unknown121.

Hepatitis C virus (HCV) causes both acute and chronic infection. Acute HCV infection is usually asymptomatic and is only very rarely (if ever) associated with life-threatening disease. About 15–45% of infected persons spontaneously clear the virus within 6 months of infection without any treatment122. The remaining 60–80% of persons will develop chronic HCV infection. Of those with chronic HCV infection, the risk of cirrhosis of the liver is between 15–30% within 20 years123,124. The high variability and the limited knowledge of the structure of the hepatitis C virus (HCV) envelope glycoproteins (GP) are challenging hurdles for vaccine design121.



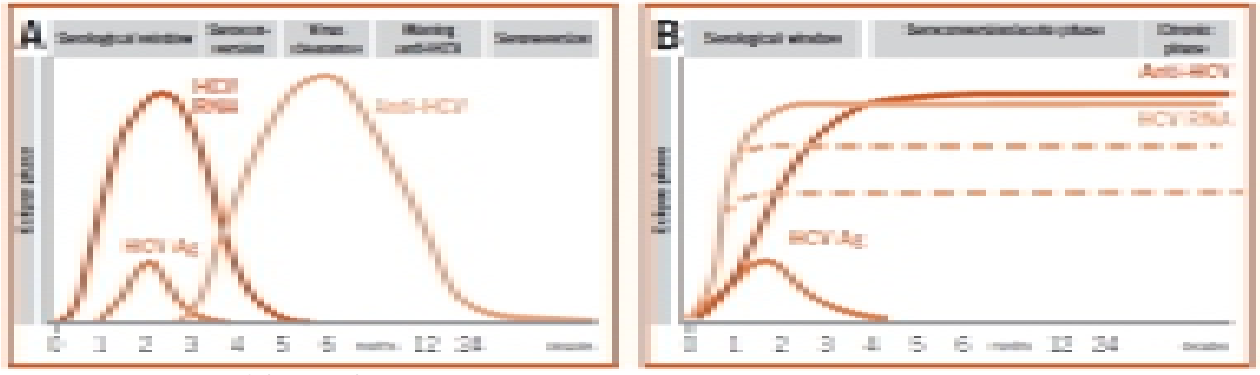
Source: The Polaris Observatory HCV Collaborators. Global prevalence and genotype distribution of hepatitis C virus infection in 2015: a modelling study. Lancet Gastroenterol Heptanol. 2017; 2:161–76. Disclaimer: This map is reproduced as originally published.

Symptoms:

The most common symptom of hepatitis C is fatigue (feeling more tired than usual). The patient may present with one or more of the following125,126:

- Dark orange-coloured urine or clay coloured stool
- Fever
- Itchy skin
- Jaundice (yellowing of the skin or the whites of the eyes)
- Joint pain, body aches or weakness
- Loss of appetite, nausea or vomiting
- Pain in the right side of abdomen
- Extra hepatic manifestations of HCV include cryoglobulinemia, glomerulonephritis, thyroiditis and Sjogren syndrome, insulin resistance, type-2 diabetes mellitus, and skin disorders such as porphyria cutanea tardy and lichen planus.
- Persons with chronic HCV infection are more likely to develop cognitive dysfunction, fatigue and depression. These outcomes may be associated with replication of the virus in the brain; however, the causal link between these manifestations and chronic HCV infection is not certain.

Fig 14: Approximate Time course of virological and immunological markers of HCV infection with (A) Self-resolving HCV infection, and (B) Chronic HCV infection+



Source127: WHO guidelines; Feb. 2017

Complications of HCV:

- Liver cirrhosis
- Liver Cancer
- Liver failure
- Kidney disease

Transmission:

Hepatitis C virus is carried in the blood and other body fluids, such as semen or vaginal fluids. Hepatitis C virus may spread by any of the following117,128:

- Childbirth: passed from a pregnant woman to her baby during delivery
- Needle stick injury
- Long term dialysis
- Blood transfusion or an organ transplant before June 2001
- Sharing items that may have infected blood on them, such as razors, toothbrushes or nail-clippers
- Sharing infected needles to use illegal or street drugs
- Using dirty needles or instruments for tattooing, body piercing or other procedures
- HCV can also be transmitted by sexual route

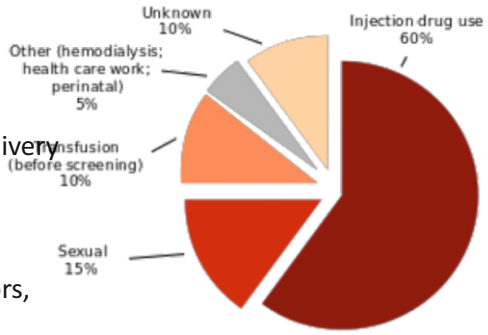


Fig 15: Hepatitis C infection by source (Centers for Disease Control and Prevention. *Viral Hepatitis Surveillance - United States, 2016* .; 2016. https://wwwn.cdc.gov/nndss/conditions/

Vertical transmission of HCV

The overall rate of mother-to-child transmission of HCV from HCV-infected, HIV-negative mothers has been estimated at 3%-5%129–134. However, in an overview of 77 prospective cohort studies with at least 10 mother-infant pairs, the overall rate was 1.7% if the mother was known to be anti-HCV positive. If the mother was known to be viremic, that is HCV-RNA-positive, the rate was 4.3%135. At least one-third of infants acquire HCV infection during the intrauterine period; the perinatal transmission is estimated to be as high as 40%-50%, whereas postpartum transmission is rare136,137. The detection of HCV RNA in the serum of infants in the first 24 h of life suggests that early intrauterine infection may be possible137. The diagnosis of perinatal transmission should be considered in children born to HCV-positive mothers when: HCV RNA is detected in at least two serum samples at least 3 month apart during the first year of life; and/or when testing of antibodies against HCV is positive after 18 month of age137. There is an interesting observation reported by the European Paediatric Hepatitis C Virus Network from a multicentre prospective study of HCV-infected pregnant women and their infants137. In that study girls were twice as likely to be infected as boys. This sex association is an intriguing finding that probably reflects biological differences in susceptibility or response to infection. Co-infection with HIV increases the rate of mother to child transmission up to 19.4%135. The weighted rate of transmission is 8.6% in mothers who are anti-HCV positive and injecting drug users, compared with 3.4% in anti-HCV-positive mothers without known injecting drug use. A meta-analysis including 2382 infants estimated that the risk of HCV vertical transmission was 2.82 from anti HCV+ /HIV+ co-infected mothers compared with anti HCV+ /HIV- mothers138,139. Vertical transmission of HIV and HCV separately is most likely from HIV/HCV-coinfected mothers; however, transmission of both infections is less frequent140. Numerous risk factors for vertical transmission have been studied. In general, high viral load defined as at least 2.5 × 106 viral RNA copies/mL, HIV co-infection, and invasive procedures are the most important factors140. In general, maternal peripheral blood mononuclear cell infection by HCV, membrane rupture > 6 h before delivery, and procedures exposing the infant to maternal blood infected with HCV during vaginal delivery are associated with an increased risk of transmission141. Abnormal ALT levels in mothers in the year before pregnancy may reflect a more severe liver disease and may help in identifying mothers with an increased risk of vertical transmission140. Finally, a Japanese study suggested that maternal liver dysfunction, large blood loss at delivery, and vaginal delivery were potential novel risk factors for mother to child transmission of HCV134.

A consensus for management of HCV-infected pregnant women and their children by the European Paediatric Network has been indicate that although several risk factors for vertical transmission have been identified, none are modifiable and there are currently no interventions available to prevent such transmission142. Based on the current evidence, it would be prudent to avoid amniocentesis, instrumented vaginal delivery, and prolonged rupture of membranes. A recent meta-analysis including 641 mother-infant pairs showed that caesarean section does not decrease perinatal HCV transmission from HCV-RNA+ /HIV- mothers to infants142. Thus, elective

caesarean delivery should not be offered, and breast feeding should not be discouraged. HCV/HIV co-infected women should be offered elective caesarean section to prevent HIV transmission and avoid breastfeeding where safe alternative are available142.

Diagnosis:

- Enzyme immunoassay: This test checks for HCV antibodies
- Genotyping: Blood test that tests the genotype of the hepatitis C virus
- Hepatitis C profile serological test: This checks the number and activity of HCV in the blood
- Liver biopsy: Small piece of liver is removed and sent to a lab for tests
- Liver function tests: to check the enzymes and other substances made in the liver
- **Hepatitis C infection is diagnosed in 2 steps:** Screening for anti-HCV antibodies with a serological test; if the test is positive for anti-HCV antibodies, a different test is needed to confirm chronic infection because about 30% of people infected with HCV spontaneously clear the infection by a strong immune response without the need for treatment102,104,117,143.
- **Window period.** Assays designed solely to detect antibodies to HCV inevitably have a window period of infectivity in early infection, during which antibodies may be undetectable. HCV RNA is typically not used to determine exposure to HCV, in spite of its short window period (1–2 weeks after the onset of acute infection) primarily because of cost. There are some situations with occult HCV infection, i.e. HCV RNA detectable in the absence of any serological markers (i.e. HCV seronegative), which may be due to underlying immunosuppression in, for example, HIV-infected populations102,104,117,143.

Hepatitis C transmission risk by exposure type

Table 5: Hepatitis C transmission risk by exposure type

Exposure		Risk per exposure (unless otherwise stated)
Needle stick	Healthcare setting, source patient (serology) known	0-10%.[144–146] Average 1.8%[147] Increased risk if - hollow needle[145], deep injuries[148], co-infection with HIV[149], high viral load[148].
	Healthcare setting, source patient unknown, or unable to test source patient (serology unknown)	Unknown source – negligible risk[149]. Risk assessment required
	Community setting	Risk not accurately determined[149]. Risk assessment required. If local PWID population has a sero-prevalence of 50-90%, the estimated risk of HCV transmission in a community needle stick injury is 1.62%[150].
Exposure prone procedure by infected healthcare worker		0-3.7%[151–153], Risk may increase to 6% for certain procedures, e.g. open-heart surgery[151]. Risk assessment required.
Non-healthcare related occupational sharp injuries		Risk not accurately determined, but transmission possible[154,155]. Risk assessment required.
Tattoos		Risk not accurately determined. Pooled odds ratio 2.73 (95% CI 2.38-3.15)[156] Risk assessment required. Increased risk if larger tattoos or tattoos in non-professional locations
Mucous membrane exposure to blood		Very low risk. Case reports only[157,158]. Risk assessment required
Intact skin exposed to blood		No recognised risk
Non-intact skin, body fluid exposure		Very low risk. Case report describes transmission of HIV and HCV from co-infected source[159]. Risk assessment required.
Human bite injuries		Very low risk[160]. Case reports only. Risk assessment required. Possible higher risk of transmission of HCV than HIV if the source[161]
Sexual exposures	Heterosexual exposures in general	Inefficient transmission[162], but transmission possible as seen in stable heterosexual relationships[163–165], and in those with history of multiple sexual partners[166,167]. Possible increased risk of transmission if source co-infected with HIV[162]
	MSM	Inefficient transmission[168,169]. Co-infection with HIV increases the risk of transmission[162,170–172]

Treatment:

Whom to Treat

Any individual diagnosed to have infection with hepatitis C virus (viremia +) needs treatment. The duration of treatment will depend on the several situations such as, cirrhosis versus non-cirrhosis, presence of decompensation (ascites, variceal bleeding, hepatic encephalopathy, or infection(s), treatment naïve versus treatment experienced (to pegIFN, DAAs, etc) 102,104,117,143.

Anti-viral medicine:

All patients of Hepatitis C should be initiated on treatment102,104,117. Direct acting antivirals are available for treatment of Hepatitis C and form the backbone of therapy in addition to existing pegylated interferons and ribavirin. The DAAs, target three important regions within the HCV genome: NS3/4A protease, NS5A and NS5B RNA-dependent polymerase. These medicines have led to higher sustained virological responses (SVRs) than interferon-based regimens, are shorter in treatment duration, are orally administered and have fewer side effects. The mechanism of action of the Direct Acting Antivirals (DAAs) are shown in the figure below.

Figure 16: Mechanism of action of the Direct Acting Antivirals (DAAs) on HCV173

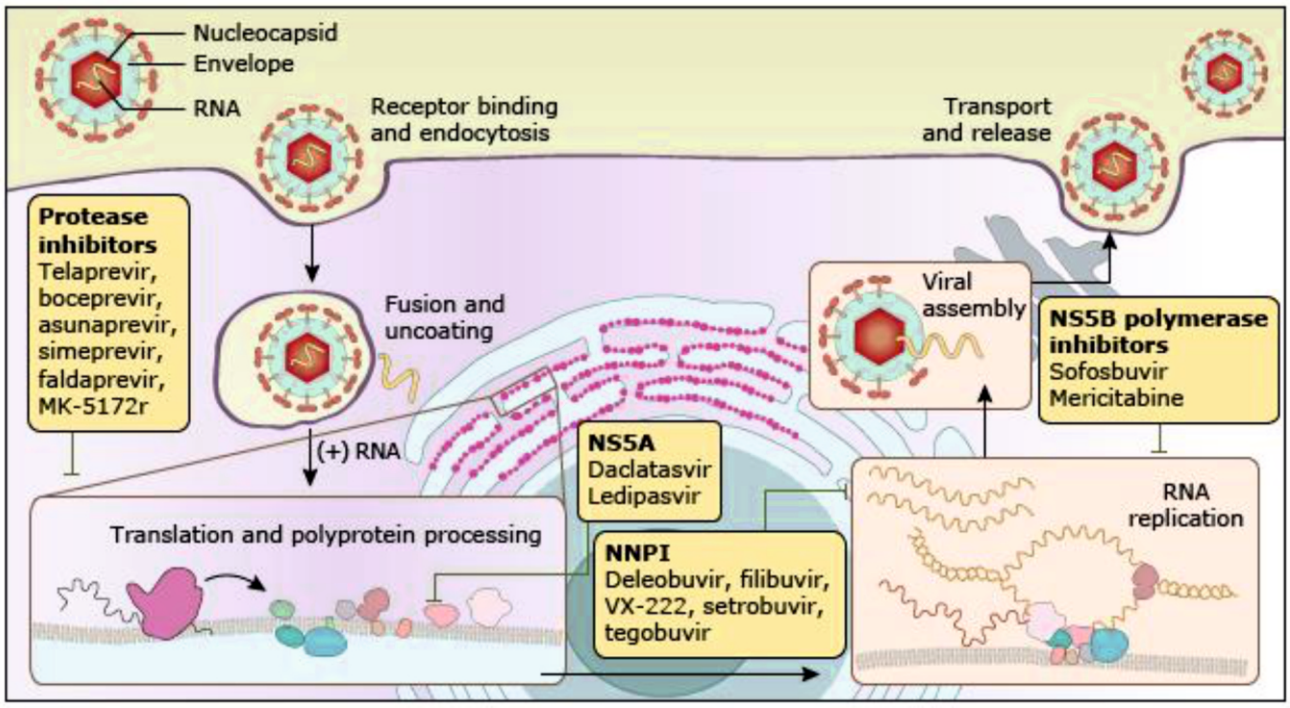


Table 6: List of DAAs licensed for treatment

Protease Inhibitors	NS5A inhibitors	Polymerase inhibitor (NS5B), nucleotide analogue	Polymerase inhibitor (NS5B), nucleoside analogue
Asunaprevir	Daclatasvir	Sofosbuvir	Dasabuvir
Paritaprevir	Ledipasvir		
Simeprevir	Velpatasvir		

Table 7: Treatment options available in the National Program

Regimen Type	Category of patients	Drugs and Dose	Treatment duration
I	Patient without Cirrhosis (uncomplicated)	Sofosbuvir(400mg) & Daclatasvir(60mg)	84 days (12 wks.)
II	Patient with cirrhosis-compensated (Child-Pugh A)	Sofosbuvir(400mg) + Velpatasvir(100mg)	84 days (12 wks.)
III	Patient with cirrhosis-decompensated (Child-Pugh B and C) **	Sofosbuvir(400mg) + Velpatasvir(100mg) & Ribavirin (600-1200mg* *	84 days (12wks)
IV	In Ribavirin intolerant patients - Sofosbuvir(400mg) + Velpatasvir(100mg)		168days (24wks)

Table 8: Monitoring schedule framework for the treatment of patients

Time	Regimen: Only DAAs (non-cirrhotic usually)			Regimen: DAAs and Ribavirin (cirrhotic usually)		
	CBC, S. Creatinine, LFT	Adherence and side effects	HCV RNA	CBC, S. Creatinine, LFT	Adherence and side effects	HCV RNA
Baseline	Yes		Yes	Yes		Yes
Week 1				Yes	Yes	
Week 2				Yes	Yes	
Week 4	Yes	Yes		Yes	Yes	
Week 8				Yes	Yes	
Week 12				Yes	Yes	
Week 12 after completion of treatment (SVR-12)			Yes	Yes		Yes

CBC, complete blood counts; LFT, liver function tests; SVR, sustained viral response

Sustained Virological Response (SVR)

- At the end of treatment, the patient should be checked for HCV RNA and if it is not detectable then SVR is achieved102,104,117.
- If SVR is not achieved, then patient should be referred to a higher centre for further testing (resistance testing) and treatment102,104,117.
- SVR should also be checked at 6 months and 12 months post treatment to look for relapse of infection102,104,117.

Hepatitis C therapy in the era of the newer direct-acting antiviral agents has radically changed our treatment schemes by achieving very high rates of sustained virological response. However, treatment with direct antiviral agents fails in a subgroup of patients. The expressions “difficult-to-cure” and “difficult-to-treat” are used indistinctly in the literature, which renders challenging establishing a reason why some patients cannot be freed from infection175–178. We shall use the term “difficult-to-cure patient” to refer to failures related to virological characteristics, and the term “difficult-to-treat patient” to failures associated with one of the following three reasons: a) poor adherence; b) early therapy discontinuation because of an unlikely side effect or a not so unlikely clinically relevant interaction; and c) loss to follow-up, in close relationship to poor adherence, which precludes the assessment of SVR endpoint attainment (Table I). We usually categorize therapy failure according to the time of its development: within-treatment recurrence (virological rebound or breakthrough), post-treatment recurrence (relapsing infection), and primary absence of response. The virological causes of therapy failure (Table II) may be categorized as: a) genotyping errors; b) genetic recombination phenomena; c) treatment-resistant variants (whether pre-extant or acquired following initial exposure to DAAs); d) persistent infection, usually with the emergence of new predominant isolates; e) reinfection; and f) superinfection.

Table 9: Difficult -to-cure patients

1. Difficult-to-cure patients with IFN-based therapies:	2. Difficult-to-cure patients at present (IFN-free therapy)
➢ Genotype 1 ➢ High viral load ➢ Untoward Il28B polymorphism ➢ Absence of response to prior therapy ➢ Compensated cirrhosis ➢ Coinfection with HIV ➢ Advanced renal failure (grade 4 or 5)	➢ Genotype 3, particularly in previously treated or cirrhotic individuals ➢ Compensated cirrhosis ➢ DAA therapy failure

Table 10: Virological causes of failure

- Genotyping error
- Treatment resistance associated variants (RAVs):
  - Present before treatment onset
  - Developed as a consequence of treatment
- Genetic recombination phenomena
- Persistent infection
- Reinfection
- Superinfection

Surgery:
A liver transplant may be done if the liver stops functioning. The diseased liver is replaced with a whole or a part of a healthy donated liver.

Counselling Messages for Screening Test Results128:
- All patients should be provided information on the meaning of their test results by the attending clinicians/trained health care workers/peer counsellors.
- Providing Pre-test information: through media such as posters, brochures, websites and short video clips shown in waiting rooms. This would include information on viral hepatitis and the benefits of testing for hepatitis B or C; the meaning of a positive and negative test result; a brief description of prevention options; confidentiality of the test result; the practical implications of a positive test result, including the when and where of treatment available.

Post-test information/counselling for a non-reactive hepatitis C screening test:
- Explain the meaning of the non-reactive antibody test, ensuring that the patient understands a negative antibody test does not protect him/her from future infection in the event of risk-taking behaviours.
- Discuss that if the patient was recently exposed (6 months), he/she may be in a window period and recommend repeat screening in 6 months, and provide information on hepatitis C prevention, risk and harm reduction.
- Encourage the patient to make healthy choices and to get vaccinated against hepatitis B, if appropriate.

Post- test counselling and linkages to treatment services for a reactive hepatitis C screening test:
- Explain the meaning of the reactive antibody test and counsel on the need for diagnostic testing (hepatitis C RNA test) to confirm a diagnosis of chronic hepatitis and other tests for staging of liver disease.
- Explain that the patient is most likely chronically infected and provide basic hepatitis C disease and treatment information. Make an active referral to the viral hepatitis treatment units.
- Discuss the importance of minimizing risk behaviours to avoid transmitting hepatitis C infection to others and encourage notification and screening of needle sharing and sexual partners.
- Encourage and offer HBV and HCV testing for family members, including children, and sexual partners.
- Discuss healthy liver practices, including stopping or reducing alcohol intake and getting vaccinated against hepatitis A and B, if appropriate.
- Adherence counselling by trained pharmacist: 1) Pill count: the total number of pills/doses dispensed, and the total number of pills/doses returned at monthly visits for each drug for the entire treatment duration for all patients; 2) Patient self-reports: it helps to determine reasons for non-adherence
- Though the majority of patients can be initiated the treatment for hepatitis C, there are several situations in which it is recommended to refer the patient to a specialized center. These include:
  a. Patients with decompensated cirrhosis
  b. Treatment experienced patients
  c. Patients on chemotherapy with deranged liver enzymes
  d. Patient with impaired renal function
  e. Patient with HCC
  f. Paediatric patients
  g. Thalassaemic patients

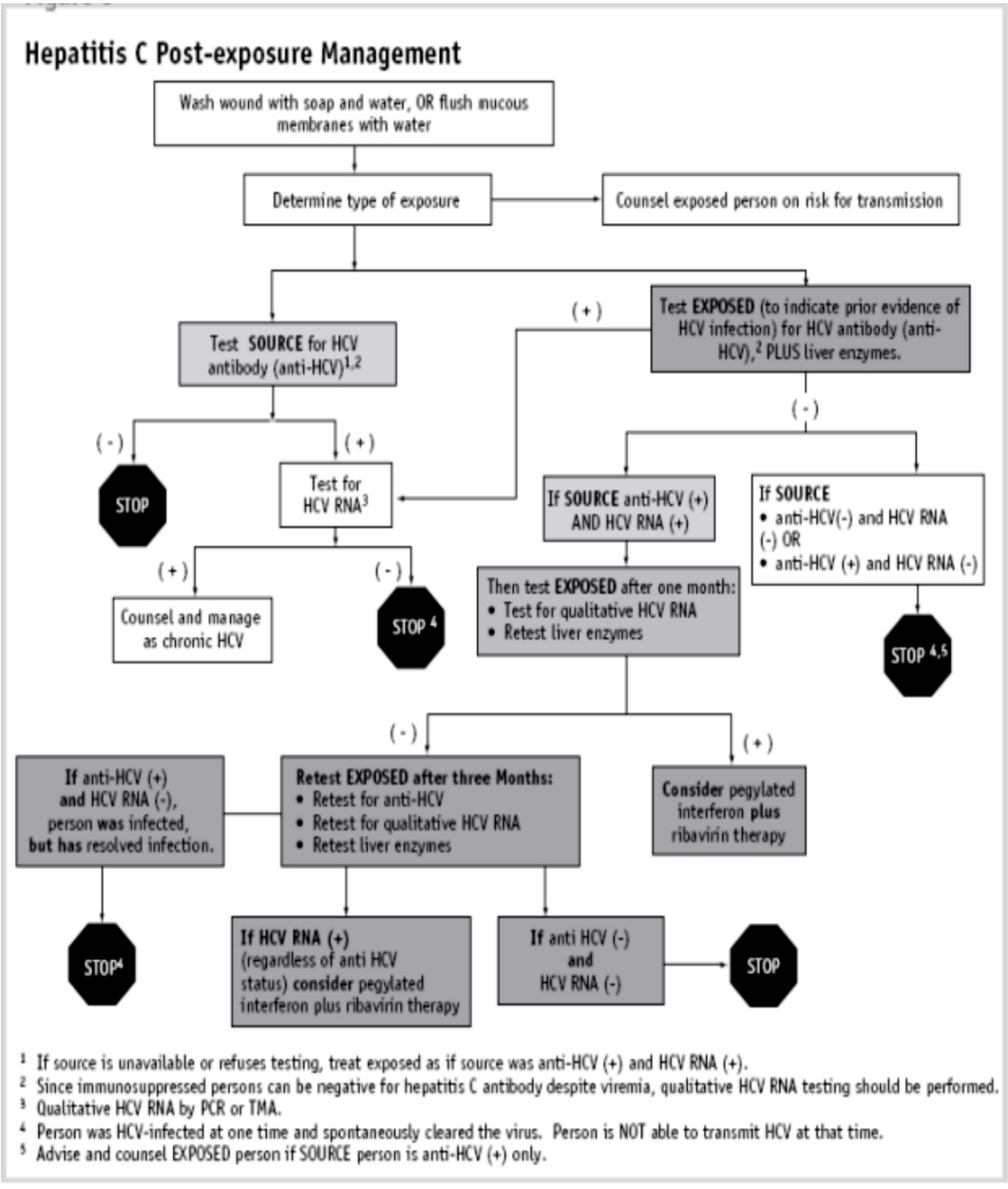
Prevention:

Prevention of Hepatitis C includes179 :

- Caregivers should wear personal protective equipment's (masks, gloves, gowns or safety goggles) when handling blood products and instruments
- Consider the risks of getting hepatitis C before having tattoos or body piercing
- If patients use illegal drugs, never reuse or share needles or syringes
- Do not share toothbrushes, razors or other personal care items
- Mothers infected with hepatitis C should stop breastfeeding if their nipples are cracked or bleeding
- Always use condoms while having sex

Healthcare Personnel Potentially Exposed to Hepatitis C Virus (HCV)

Figure 17: Post exposure management of Hepatitis C180,181



Exposure to viral hepatitis has long been recognized as an occupational risk for healthcare personnel, with recommendations previously established for the management of occupational exposures to hepatitis C virus (HCV). This algorithm, which is based on current laboratory guidance182 , updates the 2001 HCV testing algorithm for healthcare personnel183. Postexposure prophylaxis (PEP) of hepatitis C is not recommended, as outlined in the 2001 MMWR on management of healthcare personnel who have occupational exposure to blood and other body fluids183. After a needlestick or sharps exposure to HCV-positive blood, the risk of HCV infection is approximately 1.8%183. If the healthcare worker does become infected, follow AASLD/IDSA guidelines (www.hcvguidelines.org) for management and treatment of hepatitis C.

* Test the source for HCV RNA: If the source is HCV RNA positive, or if HCV infection status unknown, follow the algorithm. If it is not possible to test source for HCV RNA, then test for antibodies to HCV (anti-HCV) and screen HCW exposed to anti-HCV positive source. Note that persons with acute infection may test HCV RNA positive but anti-HCV negative.

†In a nationally representative population sample with low (1%) HCV infection prevalence, 22% of anti-HCV positive results were determined to be false-positive. An additional 10% had indeterminate results in a confirmatory assay; most were likely to be false-positive. Among the subset of persons testing anti-HCV screening reactive and subsequently HCV RNA negative, 50% of the anti-HCV tests were false-positive.3

‡Anti-HCV testing at >= 6 months with reflex to HCV RNA test, if positive, could also be done.

BASIC PRINCIPLES OF INFECTION PREVENTION PRACTICE IN HEALTH CARE

Infection prevention and control measures aim to ensure the protection of those who might be vulnerable to acquiring an infection both in the general community and while receiving care due to health problems, in a range of settings. The basic principle of infection prevention and control is hygiene10,102,105,184.

STANDARD PRECAUTIONS

Standard Precautions are guidelines that outline the minimum set of interventions that are required for preventing the transmission of microorganisms10,102,105,184. They provide a foundation for infection prevention measures that are to be used for all patients in every healthcare setting. There are many factors that contribute to the consistent use of Standard Precautions within healthcare facilities. Administrative support is necessary to ensure infection prevention is an integral component of the organizational structure. Healthcare personnel must be educated and empowered to be accountable for providing safe care to all patients by incorporating Standard Precautions into the interventions and education they provide.

There are several key components that the Healthcare Infection Control Practices Advisory Committee identifies that constitute the Standard Precautions guidelines. Hand hygiene, respiratory hygiene and cough etiquette, appropriate use of personal protective equipment, safe work and injection practices, and environmental cleaning, as well as patient placement, are all elements essential in breaking the cycle of microorganism transmission.

In today's global society, it is imperative that all facilities and settings that provide healthcare meticulously practice Standard Precautions to prevent transmission of known, as well as unknown threats of emerging pathogens protecting all persons including healthcare personnel, patients, and the community at large.

Key Concepts

- Transmission of infection requires a source of infection, a mode of transmission, and a vulnerable host.
- Application of Standard Precautions is the first step in breaking the cycle and preventing the transmission of microorganisms between healthcare personnel, patients, and the environment.
- Standard Precautions are intended to be utilized for the care of all patients, in all settings in which healthcare services are rendered, even in the absence of a suspected or confirmed infectious process.
- Standard Precautions are utilized to protect both healthcare personnel and patient(s) from infection preventing the spread of microorganisms between hosts (person-to-person, person to environment to person).

HAND HYGIENE:

- Perform hand hygiene by means of hand rubbing or hand washing10,102,105,184.
- Hands should always be washed with soap and water if hands are visibly soiled, or exposure to spore-forming organisms is proven or strongly suspected, or after using the restroom. For other indications, if resources permit, perform hand rubbing with an alcohol-based preparation.

- Ensure availability of hand-washing facilities with clean running water.
- Ensure availability of hand hygiene products (clean water, soap, single use clean towels, alcohol-based hand rub). Alcohol-based hand rubs should ideally be available at the point of care.
- Hand washing (40–60 sec): wet hands and apply soap; rub all surfaces; rinse hands and dry thoroughly with a single use towel; use towel to turn off faucet.
- Hand rubbing (20–30 sec): apply enough product to cover all areas of the hands; rub hands until dry.
- Healthcare personnel need to be educated about when and how to perform hand hygiene.
- Hand washing should be done -
    - Before and after any direct patient contact and between patients, whether or not gloves are worn.
    - Immediately after gloves are removed.
    - Before handling an invasive device.
    - After touching blood, body fluids, secretions, excretions, non-intact skin, and contaminated items, even if gloves are worn.
    - During patient care, when moving from a contaminated to a clean body site of the patient.
    - After contact with inanimate objects in the immediate vicinity of the patient.
- The WHO recognized that the multiple indications for hand hygiene were difficult to remember and sought to simplify the message with the "My 5 Moments for Hand Hygiene," which has become widely adopted. The five moments include10,102,105,184
    - Before patient care
    - Before an aseptic procedure
    - After any contact with blood or other body fluids—even if gloves are worn
    - After patient care
    - After contact with the patient's environment

Hand Hygiene Technique

- When using an alcohol-based hand rub, it is important to check the manufacturer's recommendation for volume of product and ensure that the appropriate amount is dispensed10,102,105,184. If not, enough product is dispensed or if the product is not applied to all parts of the hands, antimicrobial efficacy may be limited. After dispensing the product, personnel should rub all areas of hand surfaces together until they are dry. HCP with larger hands may need to dispense two dollops of product when performing hand hygiene. A good rule is that it should take 15 to 20 seconds of rubbing for the hand sanitizer to dry.
- When using soap and water, hands should be wet with water that is not too hot, then product should be applied per manufacturer's recommendations, and hands should be rubbed together vigorously, covering all skin surfaces and under rings, for at least 15 seconds. Hands should be rinsed thoroughly, so that no product is left, and then dried with a disposable towel. A dry towel is then used to turn off the water faucet.

Respiratory Hygiene/Cough Etiquette

- Respiratory hygiene and cough etiquette interventions are intended to limit the spread of infectious organisms from persons with potentially undiagnosed respiratory infections. In order for respiratory hygiene interventions to be effective, early implementation of infection control measures needs to occur at the first point of entry within a healthcare setting and maintained throughout the duration of the visit. The effort of respiratory hygiene interventions are targeted at patients and accompanying significant others with

respiratory symptoms and applies to any person entering a healthcare setting with signs of respiratory illness including cough, congestion, rhinorrhoea, or increased production of respiratory secretions10,102,105,184.

- The five main elements of an effective respiratory hygiene program include:
    - Education of HCP, patients, and visitors on the signs and symptoms of respiratory illness
    - Posted signs at facility entries with instructions for prevention of transmission of respiratory illness in languages of the local population
    - Easy availability of source control measures (tissues, surgical masks) to enable patient and visitors to cover sneezes and coughs and mask persons with a cough
    - Easy and frequent availability of hand hygiene located close to other source control supplies including the facility entrance and waiting rooms
    - Encourage patients or visitors with respiratory symptoms to sit apart from other people in the waiting room, more than 3 feet apart, or place in a separate area when feasible.
- HCP with respiratory illness should avoid providing direct patient contact. A barrier mask should be worn by HCP who demonstrate signs and symptoms of respiratory illness but need to provide direct patient contact. Barrier masks are also indicated in some instances where the HCP may be infectious prior to the onset of symptoms such as with exposure to varicella or measles.

PERSONAL PROTECTIVE EQUIPMENT (PPE):

- Personal protective equipment (PPE) is designed to protect the wearer's skin, eyes, mucous membranes, airways, and clothing from coming into contact with infectious agents. The selection of PPE is made based on the tasks being performed and anticipated level of exposure the employee expects to encounter10,102,105,184. Components of PPE can be used alone or in combination to provide the desired level of protection. Mucous membranes and skin with compromised integrity are portals of entry that are highly susceptible to infectious agents; therefore, it is important that appropriate protective measures be taken10,102,105,184.
    - Assess the risk of exposure to body substances or contaminated surfaces before any health-care activity. Make this a routine!
    - Select PPE based on the assessment of risk: Clean non-sterile gloves, Clean, non-sterile fluid-resistant gown, Mask and eye protection or a face shield.
    - Gloves:
    - Wear when touching blood, body fluids, secretions, excretions, mucous membranes, nonintact skin.
    - Change between tasks and procedures on the same patient after contact with potentially infectious material.
    - Remove after use, before touching non-contaminated items and surfaces, and before going to another patient.
    - Perform hand hygiene immediately after removal.

Facial protection (Eyes, Nose, and Mouth):

- **Barrier masks or barrier masks with shields** worn when HCP anticipate sprays of blood or body fluids, particularly respiratory secretions. HCP, patients, or visitors in healthcare settings also wear barrier masks to limit the spread of potentially infectious respiratory secretions10,102,184. In some cases, HCP should consider

wearing barrier masks when providing direct patient care if at risk of spreading respiratory illness after unprotected exposure prior to becoming symptomatic such as in the case of influenza10,102,184.

- **Surgical masks:** worn by HCP to protect the patient from infectious agents in the HCP's nose or mouth during sterile procedures such as insertion of catheters or injections into spinal or epidural spaces during lumbar puncture procedures.
- **Goggles/face shields** worn by HCP to protect the eyes and face of the wearer from sprays of respiratory secretions, blood, or body fluids. They should be worn when the HCP anticipate participating in a procedure that has the potential to generate splashes or sprays of blood, body fluids, secretions, or excretions. Personal eyeglasses or contact lenses do not provide adequate protection and are not considered acceptable eye protection. The use of face shields allows HCP to wear their own personal eyeglasses and increase protection to other areas of the face, including the eyes.

Gown:

- Wear to protect skin and prevent soiling of clothing during activities that are likely to generate splashes or sprays of blood, body fluids, secretions, or excretions.
- Remove soiled gown as soon as possible and perform hand hygiene.
- Fluid-resistant gowns worn when HCP anticipate performing patient care activities or procedures in which exposed skin or clothing are likely to be exposed to any patient blood, body fluids, secretions, or excretions.

Safe Work Practices

- In an effort to limit exposure to potentially infectious microorganisms, HCP must take care to keep gloved and ungloved hands from touching their own mucous membranes10,102,105,184. Patients should be positioned to direct any splatters or sprays of patient blood, body fluids, secretions, or excretions away from the face of the HCP. Prior to providing patient care, HCP need to ensure that their PPE is positioned properly and secured to avoid potential contamination during repositioning of PPE. Resuscitation/ventilation masks should be available and easily attainable in all areas where resuscitation may occur, including those where they are needed infrequently. HCP should always use a barrier for resuscitation such as a mouthpiece, resuscitation bag, or other ventilation device to prevent direct contact with secretions from the patient.

Environmental Cleaning

- Cleaning and disinfecting of all surfaces, equipment, and devices in patient care areas are an integral part of Standard Precautions. Cleaning of all medical equipment and devices, including computers and technological devices that enter patient care areas is important to prevent transmission of infectious organisms10,102,105,184. Noncritical patient care equipment should be cleaned and disinfected after each patient use. All soiled medical equipment and devices should be handled in a manner that prevents the transfer of microorganisms to others and the environment. Contaminated equipment that must be cleaned and disinfected must be stored in an area that is separate from clean supplies and equipment. HCP should wear gloves when handling equipment that is contaminated or visibly soiled and perform hand hygiene immediately after removal of gloves. Soiled linen should be handled utilizing a method that prevents microorganisms from being transmitted to other people and the environment.

Patient Placement

- In the event that a patient is determined to be at increased risk for transmission of microorganisms, the patient should be placed in a single-patient room when available10,102,105,184. Those patients that are likely to contaminate the environment, do not maintain appropriate hygiene, or are at increased risk for acquiring infections or developing adverse outcomes following infection should be considered for single room placement. When single patient room is not available, patient spacing should be maintained at a minimum of 3 feet or more. Privacy curtains may be pulled and used as an environmental barrier10,102,105,184.

Conclusions

- Standard Precautions are the primary defence in preventing the transmission of microorganisms between HCP, patients, and the environment. The components of Standard Precautions are aimed at breaking the cycle of infection by interrupting the method in which transmission occurs. While it is the role of the healthcare administration to ensure infection, prevention is an important component of the organizational structure, the value of the interventions remains the responsibility of HCP and their accountability for adhering to these essential guidelines. When Standard Precautions are correctly implemented, the spread of infectious diseases can be prevented, leading to improved health of both HCP and patients.

PREVENTION OF NEEDLE STICK INJURIES

- Safe handling of needles and other sharp devices are components of standard precautions that are implemented to prevent health care worker exposure to blood borne pathogens185,186.
- Use care when:
  - handling needles, scalpels, and other sharp instruments or devices
  - cleaning used instruments
  - Disposing of used needles.
- The safety devices on needles and other sharps should be activated immediately after use.
- Used needles should be discarded immediately after use and not recapped, bent, cut, removed from the syringe or tube holder, or otherwise manipulated.

- Any used needles, lancets, or other contaminated sharps should be placed in a leak-proof, puncture-resistant sharps container that is either red in colour or labelled with a biohazard label.
- Do not overfill sharps containers. Discard after 2/3 full or when contents are at the ‘full’ line indicated on the containers.
- Used sharps containers may be taken to a collection facility such as an area pharmacy, hospital, or clinic that provides this service.

ENVIRONMENTAL CLEANING:

- Use adequate procedures for the routine cleaning and disinfection of environmental and other frequently touched surfaces.

WASTE DISPOSAL:

- Ensure safe waste management.
- Treat waste contaminated with blood, body fluids, secretions and excretions as clinical waste, in accordance with local regulations.
- Human tissues and laboratory waste that is directly associated with specimen processing should also be treated as clinical waste.

PATIENT CARE EQUIPMENT:

- Handle equipment soiled with blood, body fluids, secretions, and excretions in a manner that prevents skin and mucous membrane exposures, contamination of clothing, and transfer of pathogens to other patients or the environment.
- Clean, disinfect, and reprocess reusable equipment appropriately before use with another patient.
- An organization's culture may need to shift from thinking that only infection preventionists are accountable for infection prevention and presents all healthcare workers with an infection prevention opportunity. All caregivers are accountable and to encourage infection prevention protocols, healthcare professionals should show appreciation for all the people who help keep infections at bay.

INJECTION SAFETY

Fig 18: Safe Injection Practices (Source: CDC/Safe injection practices coalition)

- Injections are one of the most common health-care procedures. Every year at least 16 billion injections are administered worldwide. The vast majority – around 90% – are given in curative care. Immunization injections account for around 5% of all injections, with the remaining covering other indications, including transfusion of blood and blood products, intravenous administration of drugs and fluids and the administration of injectable contraceptives187,188.
- Injection practices worldwide and especially in low- and middle-income countries (LMICs) include multiple, avoidable unsafe practices that ultimately lead to large scale transmission of blood-borne viruses among patients, health-care providers and the community at large.
- Recent investigations undertaken by state and local health departments and the Centre for Disease Control and Prevention (CDC) have identified improper use of syringes, needles, and medication vials during routine healthcare procedures, such as administering injections.
- These practices have resulted in one or more of the following:
- Transmission of blood borne viruses, including hepatitis C virus to patients
- Notification of thousands of patients of possible exposure to blood-borne pathogens and recommendation that they be tested for HCV, HBV, and HIV
- Referral of providers to licensing boards for disciplinary action
- Malpractice suits filed by patients
- Unsafe practices include, but are not limited to the following prevalent and high-risk practices:
- Reuse of injection equipment to administer injections on more than one patient including reintroduction of injection equipment into multi-dose vials, reuse of syringes barrels or of the whole syringe, informal cleaning with reuse and other practices.
- Accidental needle-stick injuries (NSIs) in health-care workers (HCWs) which occur while giving an injection or after the injection, including handling infected sharps before and after disposal.

- Overuse of injections for health conditions where oral formulations are available and recommended as the first line treatment. Demand for and prescriptions of injectable medicines that are inappropriate include overuse of antibiotics, use of unnecessary injectable products such as certain vitamins, moving directly to second line injectable treatments and others.
- Unsafe sharps waste management putting health-care workers, waste management workers and the community at large at risk of needle-stick injuries and subsequent blood-borne infections. Unsafe management of sharps waste includes incomplete incineration, disposal in open pits or dumping sites, leaving used injection equipment in hospital laundry and other practices that fail to secure infected sharps waste

SAFE INJECTION PRACTICES:

- Safe injection practices are essential to ensuring both patient and HCP safety187,188.
- Injection safety, or safe injection practices, is a set of measures taken to perform injections in an optimally safe manner for patients, healthcare personnel, and others. A safe injection does not harm the recipient, does not expose the provider to any avoidable risks, and does not result in waste that is dangerous for the community (e.g., through inappropriate disposal of injection equipment).
- HCP should always use a sterile, single-use disposable syringe and needle for each injection given.
- Care needs to be taken to ensure that all injection equipment and medication vials remain free from contamination.
- Sterile packaging should only be opened immediately prior to use and the vial access diaphragm should be disinfected with an approved antiseptic immediately prior to accessing.
- It is highly recommended that single dose vials be used over multiple dose vials, especially when the medications will be administered to multiple patients. This decreases the risk of the solution becoming contaminated from multiple accesses to the vial.
- Used needles should never be recapped, bent, or broken and any safety device present should be engaged immediately after use. If recapping is necessary, only a one-handed technique should be used.
- All used sharps should be placed immediately in an approved puncture-resistant container that is designated for sharps disposal. Injection safety includes practices intended to prevent transmission of infectious diseases between one patient and
- another, or between a patient and healthcare provider, and also to prevent harms such as needlestick injuries.

SAFETY MEASURES DURING MEDICATION PREPARATION:

- Parenteral medications should be accessed in an aseptic manner. This includes using a new sterile syringe and sterile needle to draw up medications while preventing contact between the injection materials and the non-sterile environment187,188.
- Proper hand hygiene should be performed before handling medications and the rubber septum should be disinfected with alcohol prior to piercing it.
- Medications should be drawn up in a designated clean medication area that is not adjacent to areas where potentially contaminated items are placed. Examples of contaminated items that should not be placed in or near the medication preparation area include: used equipment such as syringes, needles, IV tubing, blood collection tubes, needle holders (e.g., Vacutainer® holder), or other soiled equipment or materials that have been used in a procedure.
- Any item that could have come in contact with blood or body fluids should not be in the medication

preparation area.

- A needle should never be left inserted into a medication vial septum for multiple uses. This provides a direct route for microorganisms to enter the vial and contaminate the fluid.
- The safest practice is to always enter a medication vial with a sterile needle and sterile syringe. In multiple multi-dose vials for the purpose of combining their contents into a single syringe, if one vial becomes contaminated, this practice can spread contamination to the others, prolonging presence of the pathogen and increasing the potential for disease transmission.

SAFETY MEASURES DURING MEDICATION ADMINISTRATION:

- Once used, the syringe and needle are both contaminated and must be discarded. Use a new sterile syringe and needle for each patient187,188.
- A small amount of blood can flow into the needle and syringe even when only positive pressure is applied outward. The syringe and needle are both contaminated and must be discarded.
- All of the components are directly or indirectly exposed to the patient's blood and cannot be used for another patient. A syringe that intersects through ports in the IV tubing or bags also becomes contaminated and cannot be used for another patient. Separation from the patient's IV by distance, gravity and/or positive infusion pressure does not ensure that small amounts of blood are not present in these items.
- The safest practice is to always enter a medication vial with a sterile needle and sterile syringe, even when obtaining additional doses of medication for the same patient.
- This adds an extra layer of safety in case, for some reason, the medication vial is not discarded at the end of the procedure as it should be and is inadvertently used on a subsequent patient.

SINGLE-DOSE/SINGLE-USE VIALS:

- A single-dose or single-use vial is a vial of liquid medication intended for parenteral administration (injection or infusion) that is meant for use in a single patient for a single case/procedure/injection187,188.
- Even if a single-dose or single-use vial appears to contain multiple doses or contains more medication than is needed for a single patient, that vial should not be used for more than one patient nor stored for future use on the same patient.
- Medication vials should always be discarded whenever sterility is compromised or questionable. In addition, the following recommendations are made for handling of single-dose or single-use vials:
- If a single-dose or single-use vial has been opened or accessed (e.g., needle-punctured) the vial should be discarded according to the time the manufacturer specifies for the opened vial or at the end of the case/procedure for which it is being used, whichever comes first. It should not be stored for future use.
- If a single-dose or single-use vial has not been opened or accessed (e.g., needle-punctured), it should be discarded according to the manufacturer's expiration date.

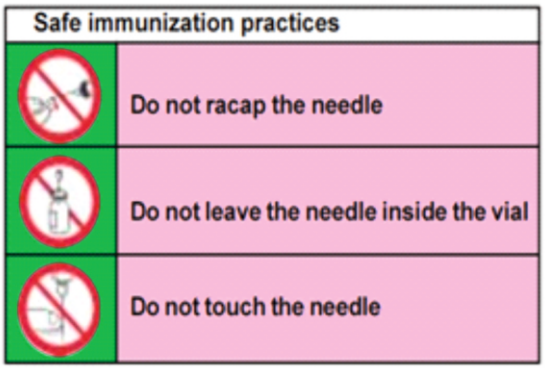
MULTI-DOSE VIALS:

- A multi-dose vial is a vial of liquid medication intended for parenteral administration (injection or infusion) that contains more than one dose of medication187,188.
- Multi-dose vials should be dedicated to a single patient whenever possible.
- If multi-dose vials must be used for more than one patient, they should not be kept or accessed in the

immediate patient treatment area. This is to prevent inadvertent contamination of the vial through direct or indirect contact with potentially contaminated surfaces or equipment that could then lead to infections in subsequent patients.

- If a multi-dose has been opened or accessed (e.g., needle-punctured) the vial should be dated and discarded within 28 days unless the manufacturer specifies a different (shorter or longer) date for that opened vial.
- If a multi-dose vial has not been opened or accessed, it should be discarded according to the manufacturer's expiration date.

PREPARATION FOR VACCINE ADMINISTRATION:



- Do not open a single-dose vial until ready to use187,188.
- Once the protective cap is removed the vaccine should be used or discarded at the end of the workday187,188.
- Multidose vials can be used until the expiration date printed on the vial unless contaminated, compromised, or there is a "beyond use date" (BUD) noted in the package insert187,188.
- NEVER use partial doses from two or more vials to obtain a full dose of vaccine187,188.
- Once a manufacturer-filled syringe is activated (i.e., syringe cap removed or needle attached), the vaccine should be used or discarded at the end of the workday.
- Diluents are NOT interchangeable unless specified by manufacturer. (e.g., diluent for MMR).
- If vaccine must be reconstituted, use only diluent supplied by manufacturer for that vaccine. NEVER use a stock vial of sterile water or normal saline to reconstitute vaccines.
- Always check expiration dates on both diluent and vaccines to make sure neither has expired.
- Refer to manufacturer's product information/package insert for instructions on reconstituting specific vaccines. CDC recommends that providers draw up vaccines only at time of administration.
- If not used by the end of the workday, vaccines should be discarded.
- You should only administer vaccines that you have prepared.

INFECTION PREVENTION DURING BLOOD GLUCOSE MONITORING AND INSULIN ADMINISTRATION:

- Unsafe practices during assisted monitoring of blood glucose and insulin administration have put persons at risk for infection includes187,188:
- Using finger stick devices for more than one person
- Using a blood glucose meter for more than one person without cleaning and disinfecting it in between uses
- Using insulin pens for more than one person
- Failing to change gloves and perform hand hygiene between fingerstick procedures
- Finger stick devices should never be used for more than one person
- Whenever possible, blood glucose meters should not be shared. If they must be shared, the device should be cleaned and disinfected after every use, per manufacturer's instructions. If the manufacturer does not specify how the device should be cleaned and disinfected, then it should not be shared.

- Insulin pens and other medication cartridges and syringes are for single-patient-use only and should never be used for more than one person.
- Single-use, auto-disabling finger stick devices: These are devices that are disposable and prevent reuse through an auto-disabling feature. In settings where assisted monitoring of blood glucose is performed, single-use, auto-disabling fingerstick devices should be used.

BLOOD GLUCOSE METERS:

- Blood glucose meters are devices that measure blood glucose levels187,188.
- Whenever possible, blood glucose meters should be assigned to an individual person and not be shared.
- If blood glucose meters must be shared, the device should be cleaned and disinfected after every use, per manufacturer's instructions, to prevent carry-over of blood and infectious agents. If the manufacturer does not specify how the device should be cleaned and disinfected, then it should not be shared.

INSULIN ADMINISTRATION:

- Insulin can be administered using an insulin pen that is designed for reuse on a single patient. It can also be administered using a needle and syringe after drawing up contents from an insulin vial187,188.
- Insulin pens are designed to be safe for a single person to use a single pen multiple times, with a new needle for each injection.
- Insulin pens should be assigned to individual persons and labelled appropriately. They should never be used for more than one person.
- Multi-dose vials of insulin should be dedicated to a single person whenever possible.
- If the vial must be used for more than one person, it should be stored and prepared in a dedicated medication preparation area outside of the patient care environment and away from potentially contaminated equipment.
- Insulin vials should always be entered with a new needle and new syringe.
- Needles and syringes should never be used to administer insulin to more than one person and should be disposed of immediately after use in an approved sharps container.

SUMMARY:

- Injection safety and other basic infection control practices are central to patient safety. All healthcare providers are urged to carefully review their infection control practices and the practices of all staff under their supervision. In particular, providers should ensure that staff:
- Never administer medications from the same syringe to more than one patient, even if the needle is changed
- Do not enter a vial with a used syringe or needle.
- Never administer medications from the same syringe to more than one patient, even if the needle is changed or you are injecting through an intervening length of IV tubing.
- Do not enter a medication vial, bag, or bottle with a used syringe or needle.
- Never use medications packaged as single-dose or single-use for more than one patient. This includes ampoules, bags, and bottles of intravenous solutions.
- Always use aseptic technique when preparing and administering injections.
- 1 needle + 1 syringe + 1 time = 0 infections.

NUTRITIONAL NEEDS FOR VIRAL HEPATITIS

Everything we eat and drink passes through our liver. A patient suffering from acute infectious hepatitis will experience severe loss of appetite or anorexia, nausea, vomiting, abdominal pain, taste changes, fever and jaundice189–191. All these symptoms complicate food intake and make it difficult to ensure that the patient is well nourished at a time when it is essential to provide the patient with a highly nutritious diet to prevent liver damage.

DIET FOR ACUTE HEPATITIS:
The diet used during acute hepatitis infection must provide the following189–191:

1) Appetite stimulation:

- Appetite stimulation to overcome anorexia - this is probably one of the most difficult challenges facing anyone who is assisting a hepatitis patient who flatly refuse to eat.
- Offer the patient his or her favourite fat-free or low-fat foods, for example, fruit juices, energy drinks, fat-free milk shakes or smoothies, low-fat ice cream, clear soups, rusks, bland porridges with fat-free milk and sugar to boost energy intake, hard or boiled sweets, and any other food that the patient is prepared to eat.
- Tips to improve food intake:
- Serve the above-mentioned foods and beverages chilled as this helps to overcome nausea.
- Ask the patient to eat a dry biscuit or rusk before eating other foods as this can assist with food aversion.
- Add slightly more flavouring to milk shakes, smoothies and custard to overcome loss of taste sensation.
- Serve patient with small quantities more often so that they don't get discouraged if they are only able to drink or eat small portions at a time.

2) Use of liquid meal replacements:
Nowadays there are many high-energy, high-protein meal replacement products available.

3) Foods to exclude:
Avoid giving the patient the following foods:
Full-cream milk, yoghurt, cream, cream cheese and fatty cheeses
Biscuits, cakes, pies, tarts, etc with a high-fat content
Chocolate
Not more than three eggs a week
Fatty salad dressings, mayonnaise, sour cream
Avocado
Fatty, fried meats, fatty fish, poultry skin, all processed meats and sausages, bacon, fatty gravies, fish canned in oil (buy tuna or pilchards canned in water or tomato sauce)
Nuts, peanut butter, nut spreads
Potato chips, vegetables smothered in butter or white/cheese sauces
Fatty snacks or very spicy snacks
All food preparation that increases the amount of fat contained in meals, such as frying in butter, margarine or oil. Rather boil, poach, grill, cook in a non-stick pan with Spray and Cook, and cook stews and soups the day before, chill and skim off all the coagulated fat before serving.

4) Vitamin, mineral and electrolyte supplements:
Patients suffering from dehydration because of repeated vomiting need to drink an electrolyte mixture. In serious cases the patient may have to be put on a drip to replenish body water and electrolytes.

Monitor the patients' liquid intake and if you suspect dehydration, contact the doctor immediately.

DIET FOR SPECIAL CASES:

- If you have hepatitis, you usually don't need a special diet. Just trying to eat healthy and not being overweight and avoid alcohol is all that is needed. There are special cases, however, when hepatitis can affect the diet189–191:
-
- Patients being treated with interferon: Hepatitis C treatment can cause side effects that make it difficult to eat. Side effects include loss of appetite, sore mouth and throat, metallic tastes, nausea, and vomiting.
- **Patients with cirrhosis:** As liver disease progresses, patients may lose their appetite and become so tired they have a hard time eating. They may become very thin and poorly nourished and be less able to fight off disease. They may need to limit salt in their diet to prevent their body from putting fluid into their legs and abdomen.
- Other medical conditions and diet: Conditions that warrant specific dietary restrictions include high blood pressure, heart disease, diabetes mellitus, high cholesterol, celiac sprue or chronic kidney disease.

GENERAL DIETARY ADVICE:

- Eat regular, balanced meals
- Maintain healthy calorie intake
- Eat whole-grain cereals, breads, and grains
- Eat lots of fruits and vegetables
- Get adequate protein
- Go easy on fatty, salty, and sugary foods
- Drink enough fluids
- Reach and maintain a healthy weight
- **Eat regular, balanced meals:** Eating regularly means eating at least 3 meals a day. One way to keep your energy level up is to eat small meals or snacks at least every 3 to 4 hours.
- Eat lots of fruits and vegetables: Fruits and vegetables are important sources of many nutrients, including potassium, fiber, vitamin C, beta-carotene (a form of vitamin A), and folic acid. Some of these substances are antioxidants that can fight cell damage. As a bonus, most fruits and vegetables are naturally low in fat, sodium, and calories.
- **Get enough protein:** Protein is needed to fight infection and to heal damaged liver cells. Protein helps rebuild and maintain muscle mass and it aids in healing and repair of body tissues.
- **Dairy products:** Besides providing protein, dairy products are the richest source of calcium and one of the few sources in the diet of vitamin D. Choose dairy products that are low-fat or fat-free.
- Go easy on fatty, salty, and sugary foods
- Drink plenty of fluids: Drink at least 6 to 8 glasses of fluid a day.
- Reach and stay at a healthy weight: Weighing either too much or too little can allow hepatitis C to progress more quickly in your body. Being overweight also can make your hepatitis C treatment less effective. But people who lose weight slowly can reverse these changes. Keeping off extra weight can improve the liver enzymes and fibrosis, even though the hepatitis C virus is still in the body. Avoid fad diets, because losing weight too fast can put strain on the liver.
- **Avoid alcohol:** Alcohol is a strong toxin to the liver, even in people without hepatitis
- Be careful with dietary supplements: Some supplements in high amounts can be dangerous. Here are some special concerns:
- **Caution about iron:** Some people with hepatitis C have above-average iron levels in their body. If you have too much iron, your doctor may ask you to eat fewer iron-rich foods, such as red meats, liver, and iron-fortified cereals. Avoid cooking with iron-coated cookware because the iron from the pots gets absorbed into food.

- Vitamin C: People also should avoid taking large doses of vitamin C because vitamin C helps the body absorb iron.
- **Vitamin A:** Vitamin A, if taken in doses larger than the recommended 10,000 IU, can harm the liver. Vitamin A is even more toxic in someone who drinks alcohol.
- **Wheat and Gluten:** Gluten is highly inflammatory, because we were not really designed to digest it. Most wheat is exposed to pesticides and climate stressors. These strains are very hard to digest and, therefore, inflammatory.
- **Tap Water:** Tap water may contain more than you bargained for, including heavy metals, chlorine, fluoride, inorganic chemicals and compounds that the liver is not able to process. Even the shower you take every day has toxins in it which are absorbed through the skin and inhaled through the lungs. Filtered water is of course better than tap water.
- Avoid junk foods: Stay away from junk food which provides only fats, sugars, empty calories, chemicals and additives.
- **Hydrogenated Oils:** Hydrogenated (they are refined) oils are another product that is hard for the liver to handle. This includes any type of oil or fat that hardens when cold. A better choice would be flaxseed oil or virgin olive oil.
- Patients with chronic hepatitis and liver damage require special diets that need to be worked out for the individual patient so that further liver damage and long-term malnutrition can be prevented.

SAFETY PRECAUTIONS FOR PATIENTS, FAMILY AND HEALTH PROFESSIONALS

- Training of HCWs in proper infection-control technique should begin in professional schools and continue as an ongoing process. Institutions should provide all HCWs with appropriate in-service education regarding infection control and safety and should establish procedures for monitoring compliance with infection-control policies. Avoiding occupational exposure to blood is the primary way to prevent transmission of blood-borne illnesses among health care personnel. All health care personnel should adhere to Standard Precautions9,10.

INSTRUMENT / EQUIPMENTS SAFETY:

- As part of standard infection-control practice, instruments and other reusable equipment used in performing invasive procedures should be appropriately disinfected and sterilized as follows:
  - Equipment and devices that enter the patient's vascular system or other normally sterile areas of the body should be sterilized before being used for each patient.
  - Equipment and devices that touch intact mucous membranes but do not penetrate the patient's body surfaces should be sterilized when possible or undergo high-level disinfection if they cannot be sterilized before being used for each patient.
  - Equipment and devices that do not touch the patient or that only touch intact skin of the patient need only be cleaned with a detergent or as indicated by the manufacturer.
  - All health care personnel should adhere to Standard Precautions . Depending on the medical procedure involved,
  - Standard Precautions may include the appropriate use of personal protective equipment (e.g., gloves, masks, and protective eyewear).
  - Compliance with infection control protocols by healthcare professionals (HCP),
  - Performing viral serological tests periodically, and
  - Continuing training courses for personnel.
  - The main practical points to be considered are cleaning the rooms and patients' area, disinfection of instruments, correct drug preparation, and regular hand hygiene.
  - Appropriate staff training and regular monitoring for hepatitis viruses are also mandatory.

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ROLE OF NURSES AND HEALTH ASSOCIATES

Viral Hepatitis Nurses work with patients in the community, GP or hospital setting. They provide a link between public hospital specialist services and general practice, and give specialised support to GPs to assist in the management of patients with hepatitis B or hepatitis C31,33,34,107–112. With advanced knowledge and skills in testing, management and treatment of viral hepatitis, they assist with the management of patients on antiviral medications, and work in shared care arrangements with GPs

Hepatology nursing is a recognized specialized area of nursing that focuses on the promotion of health, the prevention of illness, the care and support of clients experiencing liver-related diseases, and research. Key components include:

Promotion of health – hepatology nurses perform activities that include providing educational sessions for the general public, marginalized populations and other health care professionals, as well as promoting harm-reduction initiatives such as safe needle disposal.

Prevention of illness – activities include immunization, education regarding the prevention of the spread of disease and the needle exchange program.

Care, support and treatment – nurses educate patients and their families; provide emotional support and advocacy; counsel both before, during and after treatment on benefits, risks, side effects, coping strategies and adherence to treatment; interpret results; and liaison with the family, support groups and other health professionals (i.e., psychiatrist, ophthalmologist, social worker, etc).

Research – nurses are active in clinical trials (industry and/or pharmaceutical), monitoring adherence to treatment, their own nurse-initiated studies, quality of life and continually incorporate new research- and evidence-based findings into their practice.

Viral Hepatitis Nurses are located across all the areas and can also provide care to people in country areas. Viral Hepatitis Nurses can provide:

General information

Advice and assistance to GPs with patient work-up

Education and support for patients diagnosed with viral hepatitis

Streamlining of referrals and supporting patients when attending tertiary treatment centres.

Support and guidance during shared care treatment management.

Support and information post treatment.

The hepatology nursing roles incorporate the activities of clinical practice, education, advocacy, counselling, collaboration, community support, leadership, administration and research.

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ROLE OF VIRAL HEPATITIS NURSE SPECIALIST

This specialist role involves192,193:

- Screening clients at risk of hepatitis infection
- Educating clients and partners/relatives/friends about Hepatitis after a positive diagnosis
- Taking a thorough medical history, which includes assessing pre-existing conditions and looking for signs of extra-hepatic manifestations of viruses and cirrhosis or decompensated liver disease
- Liasoning with other health professionals involved in clients' care, which is particularly important for managing side effects.
- Closely monitoring treatment efficacy and side-effects according to a treatment protocol
- Providing education to other health professionals (such as GPs, general nurses and midwives) to increase awareness of the disease.
- She acts as a direct care provider, collaborator, team leader, educator, primary care practitioner, referral service provider etc.

ROLE OF A NURSE AS PATIENT ADVOCATE

Role of a nurse as patient advocate includes194–197:

- KEEP PERSONAL RECORDS such as a copy of the medical chart if the patient moves or change doctors. When hospitalized, keep a daily log of who did what, when, where, how and why.
- KNOW the MEDICATION(S) and learn both the brand and generic names. Consult for the drug's actions, side effects, adverse reactions, contraindications, proper dosing and what to avoid - such as alcohol, other drugs, certain foods or sunlight.
- KEEP A PAPER TRAIL of billing slips, insurance forms, encounter slips (those papers left with the doctor's office), pharmacy receipts and the insurance company's EOBs (explanation of benefits).
- GET EDUCATED if the patient has a serious or chronic disease or disorder. Research the condition thoroughly to work as a team.
- USE INFORMATION WISELY and don't stop or change medications or treatments, no matter how compelling.
- ASSERT YOURSELF and be the best health advocate possible. Become an educated patient, make informed decisions and play an active role in protecting the patient health.

NURSE AS A COUNSELLOR

Role of nurse as a counsellor includes195,198,199:

- Counselling patients with hepatitis infections is often the most difficult aspect of patient management for a number of reasons. Despite the limitations, important, useful, and relevant information can be transmitted to most patients within the final three to five minutes of the patient visit for consistency.

- **KEY COUNSELLOR GOALS:**
  - ✓ Ensuring the safety of clients.
  - ✓ Providing reliable information to clients and their families.
  - ✓ Building the therapeutic relationship with clients.
  - ✓ Helping clients understand their diagnoses.
  - ✓ Incorporating client needs in substance abuse treatment planning.
  - ✓ Developing a prevention plan.
  - ✓ Using motivational interviewing.
  - ✓ Confronting the social ramifications of hepatitis.
  - ✓ Addressing relapse issues.
  - ✓ Building support.
  - ✓ Providing case management.

- **PATIENT COUNSELLING TOPICS:**
  - ✓ Disease itself: prevalence, natural history, treatment
  - ✓ Impact of Disease on Patient: daily activities, exercise/rest, food, alcohol, further investigations
  - ✓ Transmission: general, sexual/intimate, children, blood/organ donation
  - ✓ Family Screening: indications, explanations.

- **SPECIFIC ADVICES:** Patients are advised
  - ✓ Not to share any injecting equipment such as needles and syringes
  - ✓ Not to donate blood nor carry a donor card
  - ✓ Not to share razors, toothbrushes or anything else that may possibly be contaminated with blood
  - ✓ To use condoms when having sex. The risk of passing on the hepatitis C virus during sex is small but is reduced even further by using condoms. However, partners in regular monogamous relationships may accept the small risk of having sex without condoms.

HEPATITIS NURSING CARE PLAN (NCP)

Hepatitis Nursing care plan (NCP) includes 200–202:

- **Nursing Priorities:**
  - ✓ Reduce demands on liver while promoting physical well-being.
  - ✓ Prevent complications.
  - ✓ Enhance self-concept, acceptance of situation.
  - ✓ Provide information about disease process, prognosis, and treatment needs.

- **Discharge Goals:**
  - ✓ Meeting basic self-care needs.
  - ✓ Complications prevented/minimized.
  - ✓ Dealing with reality of current situation.
  - ✓ Disease process, prognosis, and therapeutic regimen understood.
  - ✓ Plan in place to meet needs after discharge.

Nursing Diagnosis Imbalanced Nutrition

- Risk factor includes imbalanced nutrition, less than body requirements May be related to
  - ✓ Insufficient intake to meet metabolic demands: anorexia, nausea/vomiting
  - ✓ Altered absorption and metabolism of ingested foods: reduced peristalsis (visceral reflexes), bile stasis
  - ✓ Increased calorie needs/hyper metabolic state: Possibly evidenced by Aversion to eating/lack of interest in food; altered taste sensation, Abdominal pain/cramping, Loss of weight; poor muscle tone

- **Desired Outcomes**
  - ✓ Initiate behaviours, lifestyle changes to regain/maintain appropriate weight.
  - ✓ Demonstrate progressive weight gain toward goal with normalization of laboratory values and no signs of malnutrition.
  - ✓ Nursing Interventions:
  - ✓ Monitor dietary intake and caloric count.
  - ✓ Suggest several small feedings and offer “largest” meal at breakfast.
  - ✓ Encourage mouth care before meals.
  - ✓ Recommend eating in upright position.
  - ✓ Encourage intake of fruit juices, carbonated beverages, and hard candy throughout the day.
  - ✓ Consult with dietitian, nutritional support team to provide diet according to patient’s needs, with fat and protein intake as tolerated.
  - ✓ Monitor serum glucose as indicated.
  - ✓ Administer medications as indicated: Antiemetics, Antacids, Vitamin Supplements Etc.
  - ✓ Provide supplemental feedings and TPN if needed.
  - ✓ Deficient Fluid Volume

Nursing Diagnosis: Risk for Deficient Fluid Volume

- **Risk factors may include:** Excessive losses through vomiting and diarrhoea, third-space shift, Altered clotting process
- **Possibly evidenced by:**
  - ✓ Not applicable. A risk diagnosis is not evidenced by signs and symptoms, as the problem has not occurred, and nursing interventions are directed at prevention.

- **Desired Outcomes**
  - ✓ Maintain adequate hydration, as evidenced by stable vital signs, good skin turgor, capillary refill, strong peripheral pulses, and individually appropriate urinary output.
  - ✓ Be free of signs of haemorrhage with clotting times WNL.

- **Nursing Interventions:**
  - ✓ Monitor I & O, compare with periodic weight. Note enteric losses: vomiting and diarrhoea.
  - ✓ Assess vital signs, peripheral pulses, capillary refill, skin turgor, and mucous membranes.
  - ✓ Check for ascites or oedema formation. Measure abdominal girth as indicated.
  - ✓ Use small-gauge needles for injections, applying pressure for longer than usual after venepuncture.
  - ✓ Have patient use cotton or sponge swabs and mouthwash instead of toothbrush or use soft bristled toothbrush.
  - ✓ Observe for signs of bleeding: haematuria, melena, ecchymosis, oozing from gums, puncture sites
  - ✓ Monitor periodic laboratory values: Hb/Hct, Na, albumin, and clotting times.
  - ✓ Provide IV fluids (usually glucose), electrolytes. Protein hydrolysates.
  - ✓ Administer medications as indicated: Vitamin K, Antacids or H2-receptor antagonists.
  - ✓ Infuse fresh frozen plasma, as indicated.

Nursing Diagnosis: Fatigue

- **May be related to**
  - ✓ Decreased metabolic energy production
  - ✓ States of discomfort
  - ✓ Altered body chemistry (e.g., changes in liver function, effect on target organs)

- **Possibly evidenced by**
  - ✓ Reports of lack of energy/inability to maintain usual routines.
  - ✓ Decreased performance
  - ✓ Increase in physical complaints

- **Desired Outcomes**
  - ✓ Report improved sense of energy.
  - ✓ Perform ADLs and participate in desired activities at level of ability.
  - ✓ Nursing Interventions:
  - ✓ Institute bed red or chair rest during toxic state. Provide quiet environment; limit visitors as needed.
  - ✓ Recommend changing position frequently. Provide and instruct caregiver in good skin care.
  - ✓ Do necessary tasks quickly and at one time as tolerated.
  - ✓ Determine and prioritize role responsibilities and alternative providers and possible community resources available
  - ✓ Identify energy-conserving techniques: sitting to shower and brush teeth, planning steps of activity so that all needed materials are at hand, scheduling rest periods.
  - ✓ Increase activity as tolerated, demonstrate passive or active ROM exercises.
  - ✓ Encourage use of stress management techniques: progressive relaxation, visualization, guided imagery. Discuss appropriate diversional activities: radio, TV, reading.
  - ✓ Monitor for recurrence of anorexia and liver tenderness or enlargement.
  - ✓ Administer medications as indicated: sedatives, antianxiety agents
  - ✓ Monitor serial liver enzyme levels.

Nursing Diagnosis: Risk for Impaired Skin Integrity

- **Risk factors may include**

Chemical substance: bile salt accumulation in the tissues

- **Possibly evidenced by**
  - ✓ Not applicable. A risk diagnosis is not evidenced by signs and symptoms, as the problem has not occurred, and nursing interventions are directed at prevention.

- **Desired Outcomes**
  - ✓ Display intact skin/tissues, free of excoriation.
  - ✓ Report absence/decrease of pruritus/scratching.

- **Nursing Interventions:**
  - ✓ Encourage use of cool showers and baking soda or starch baths. Avoid use of alkaline soaps. Apply calamine lotion as indicated.
  - ✓ Provide diversional activities
  - ✓ Suggest use of knuckles if desire to scratch is uncontrollable. Keep fingernails cut short, apply gloves on comatose patient or during hours of sleep. Recommend loose-fitting clothing. Provide soft cotton linens.
  - ✓ Provide a soothing massage at bedtime.
  - ✓ Observe skin for areas of redness, breakdown.
  - ✓ Avoid comments regarding patient's appearance
  - ✓ Administer medications as indicated: Antihistamines, Antilipemics: cholestyramine
  - ✓ Knowledge Deficit

Nursing Diagnosis: Knowledge Deficit

- **May be related to**
  - ✓ Lack of exposure/recall; information misinterpretation
  - ✓ Unfamiliarity with resources

- **Possibly evidenced by**
  - ✓ Questions or statements of misconception; request for information
  - ✓ Inaccurate follow-through of instructions; development of preventable complications

- **Desired Outcomes**
  - ✓ Verbalize understanding of disease process, prognosis, and potential complications.
  - ✓ Identify relationship of signs/symptoms to the disease and correlate symptoms with causative factors.
  - ✓ Verbalize understanding of therapeutic needs.
  - ✓ Initiate necessary lifestyle changes and participate in treatment regimen.
  - ✓ Nursing Interventions:
  - ✓ Assess level of understanding of the disease process, expectations and prognosis, possible treatment options.
  - ✓ Provide specific information regarding prevention and transmission of disease: contacts may require gamma-globulin; personal items should not be shared; observe strict hand washing and sanitizing of clothes, dishes, and toilet facilities while liver enzymes are elevated. Avoid intimate contact, such as kissing and sexual contact, and exposure to infections, especially URI.
  - ✓ Plan resumption of activity as tolerated with adequate periods of rest. Discuss restriction of heavy lifting, strenuous exercise and/or contact sport.
  - ✓ Help patient identify appropriate diversional activities.

- ✓ Identify ways to maintain usual bowel function: adequate intake of fluids and dietary roughage, moderate activity and exercise to tolerance.
- ✓ Discuss the side effects and dangers of taking OTC and prescribed drugs (acetaminophen, aspirin, sulphonamides, some anaesthetics) and necessity of notifying future healthcare providers of diagnosis.
- ✓ Discuss restrictions on donating blood.
- ✓ Emphasize importance of follow-up physical examination and laboratory evaluation
- ✓ Review necessity of avoidance of alcohol
- ✓ Refer to community resources, drug/alcohol treatment program as indicated.
- ✓ Low Self-Esteem

Nursing Diagnosis: Situational Low Self-Esteem

- **May be related to**
  - ✓ Annoying/debilitating symptoms, confinement/isolation, length of illness/recovery period

Possibly evidenced by
- ✓ Verbalization of change in lifestyle; fear of rejection/reaction of others, negative feelings about body; feelings of helplessness
- ✓ Depression, lack of follow-through, self-destructive behaviour

- **Desired Outcomes**
  - ✓ Verbalize feelings.
  - ✓ Identify feelings and methods for coping with negative perception of self.
  - ✓ Verbalize acceptance of self in situation, including length of recovery/need for isolation.
  - ✓ Acknowledge self as worthwhile; be responsible for self.

Nursing Diagnosis: Risk for Infection

- **Risk factors may include**
  - ✓ Inadequate secondary defences (e.g., leukopenia, suppressed inflammatory response) and immunosuppression
  - ✓ Malnutrition
  - ✓ Insufficient knowledge to avoid exposure to pathogens

- **Desired Outcomes**
  - ✓ Verbalize understanding of individual causative/risk factor(s).
  - ✓ Demonstrate techniques; initiate lifestyle changes to avoid reinfection/transmission to others.

Other Possible Nursing Diagnoses:
- Fatigue—generalized weakness, decreased strength/endurance, pain, imposed activity restrictions, depression.
- Home Maintenance, impaired—prolonged recovery/chronic condition, insufficient finances, inadequate support systems, unfamiliarity with neighbourhood resources.
- Nutrition: imbalanced, less than body requirements—insufficient intake to meet metabolic demands: anorexia, nausea/vomiting; altered absorption and metabolism of ingested foods; increased calorie needs/hypermetabolic state.
- Infection, risk for—inadequate secondary defences; malnutrition; insufficient knowledge to avoid exposure to pathogens.

VIRAL HEPATITIS OUTBREAK- CONTROL AND PREVENTION MEASURES

Outbreak

- The official definition of the word outbreak from the World Health Organization (WHO) is203,204: The occurrence of cases of disease in excess of what would normally be expected in a defined community, geographical area or season. It may last for a few days or weeks, or for several years. A single case of a communicable disease long absent from a population or caused by an agent (e.g. bacterium or virus) not previously recognised in that community or area, or the emergence of a previously unknown disease, may also constitute an outbreak and should be reported. (WHO, 2013)
- In healthcare settings, the general definition of an outbreak is 'an incident in which two or more people experiencing a similar illness are linked in time or place' (HPA, 2012). Nursing or medical staff may be the first to spot signs of illness or infections amongst their patients, such as rashes, chest infections, diarrhoea and/or vomiting, and signs of post-operative surgical site infection. These can all be an early indication of an impending outbreak, and if the Infection Prevention and Control Team (IP&CT) are alerted swiftly enough, control measures can be implemented more or less immediately and outbreak investigations initiated, and a full-blown outbreak may be avoided. Laboratory-based surveillance of microbiology results or notifications of infectious diseases may also indicate an outbreak.

Key Concepts

- Outbreaks should be suspected when healthcare-associated infections, recovery of specific pathogens, or other adverse events occur above the background rate or when an unusual microbe or adverse event is recognized203,204.
- Outbreaks in healthcare settings may be due to a variety of factors, including lapses in infection prevention or clinical practices, contaminated or defective products or devices, and colonized or infected healthcare personnel.
- Outbreaks in healthcare are often multifactorial.
- Epidemiological investigations of a possible outbreak must be conducted in a standardized way that assesses the possible contributing factors.
- Ending an outbreak involves modifying one or more of the contributing factors.
- The goals of an outbreak investigation are to identify contributing factors to control the outbreak and prevent similar outbreaks in the future.

Outbreak Investigation

- Recognition of a Potential Outbreak
- Epidemics or outbreaks are defined as an increase over the expected occurrence of an event203,204. Given that definition, it is important to note that a single case of an unusual disease may constitute an outbreak. In some instances, small outbreaks are referred to as "clusters," but both outbreaks and clusters require prompt investigation. The term "pseudo-outbreak" is generally applied to situations in which there is a rise in test results (e.g., positive microbiology cultures) without actual clinical disease.
- Surveillance for HAIs and adverse events can be a great aid in the recognition of outbreaks in healthcare settings because it provides both a baseline rate and ongoing monitoring. However, because outbreaks often occur in areas that are not under surveillance, most healthcare-associated outbreaks are recognized by observant HCP and infection preventionists.
- Although local and state health department requirements may differ, most require reporting of possible healthcare-associated outbreaks as soon as they are suspected. Public health officials may also be able to assist in arranging or providing epidemiological and/or laboratory support. When a contaminated or defective product (including blood and human tissues), device, or medication is suspected as the cause of an outbreak, it should be notified.

Conducting an Outbreak Investigation

- Although outbreaks are generally divided into steps for the purposes of teaching and explanation, it is important to remember that outbreaks generally do not unfold in a linear or orderly manner. Thus, it is possible that not all of the steps described in the following discussion will be applicable in all settings and it is possible, if not likely, that many steps might have to occur simultaneously and be repeated multiple times in the course of the investigation. In general, outbreak investigations can be divided into two major sections, the initial investigation and the follow-up investigation, each with multiple components.

Primary Prevention

- Advocate and raise awareness of all types of viral hepatitis infections to reduce transmission in the community.
- Ensure vaccines are available for the prevention of HBV infections through the heath system.
- Ensure Implementation of blood safety strategies, including blood supplies based on voluntary non-remunerated blood donations, effective public education on blood donation, donor selection, and screening (Quality-assured screening of all donated blood and blood components used for transfusion can prevent transmission of HBV and HCV).
- Implement necessary infection control precautions in health care and community settings to prevent transmission of viral hepatitis as well as many other diseases.
- Ensure safe injection practices and safer sex practices, including minimizing the number of partners and using barrier protective measures (condoms), to protect against HBV and HCV transmission.
- Introduce harm reduction practices for injecting drug users prevent HBV and HCV transmission.
- Strictly follow the occupational safety measures prevent transmission of viral hepatitis to health care workers.
- Supervise and ensure safe food handling, water and sanitation facilities to protect against HAV and HEV infections.

Secondary and Tertiary Prevention

- Early diagnosis provides the best opportunity for effective medical support and prevention of further spread. It also allows the infected persons to take steps to prevent transmission of the disease to others. Early diagnosis of those with chronic infection also allows people to take precautions to protect the liver from additional harm, specifically by abstaining from alcohol and tobacco consumption and avoiding certain drugs that are known to be toxic to the liver.
- Both the introduction of confirmatory testing and the notification and counselling of blood donors who have reactive results detected during screening of donated blood provide unique opportunities for early diagnosis and medical support to asymptomatic individuals who come to donate blood.
- Antiviral agents against HBV and HCV exist. However, drugs active against HBV or HCV are not widely accessible.
- Although HCV can be treated, access to treatment remains an issue in many countries. Therapeutic advances and intense research have led to the development of many new oral antiviral drugs for HCV infection. A number of HCV-specific oral drugs have been recently registered.

Health education and behavioural change

- Behaviour is the way in which a person behaves and responds to a particular situation or living environment. This is determined by several factors, among them pre-emptive perception of the situation and the sense of experience are much influential. If we wanted to make aware of viral hepatitis and the mode of spread of the diseases; we have to spread the knowledge of preventive measures through simple and culturally acceptable mode or media.
- This can be made through child hood or community education or dramas, songs or posters and Media programs and announcements from respectable sources like community leaders.

- Once the knowledge is repeatedly spread through appropriate Medias among the community it will process into attitude change in the community.
- If the environment is conducive for practicing the knowledge it would make a change in their practice and behaviour. (E.g. Outbreaks of diseases and adequate availability of clean water supply and sanitation facilities, adequate syringe needle and condom supply might improve appropriate personal protective habits)
- Children, women and sensible community members will follow the practice first, and ultimately majority will adopt the healthy habits
- To encourage the community on water sanitation, safe sex and universal precaution of patient care; we have selected some very important messages regarding the above primary preventive steps and formulate them into attractive messages/posters/songs/dramas and publish among right people at right time.
- Right message through right media at right place among right people at right time will make a reasonable behavioural change

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