


# HCV Testing and Linkage to Care

## One-Time Hepatitis C Testing

Recommendations for One-Time Hepatitis C Testing	
RECOMMENDED	RATING 
One-time, routine, opt out HCV testing is recommended for all individuals aged 18 years or older.	I, B
One-time HCV testing should be performed for all persons less than 18 years old with activities, exposures, or conditions or circumstances associated with an increased risk of HCV infection (see below).	I, B
Prenatal HCV testing as part of routine prenatal care is recommended with each pregnancy.	I, B
Periodic repeat HCV testing should be offered to all persons with activities, exposures, or conditions or circumstances associated with an increased risk of HCV exposure (see below).	IIa, C
Annual HCV testing is recommended for <a href="#">all persons who inject drugs</a> , for <a href="#">HIV-infected men who have unprotected sex with men</a> , and <a href="#">men who have sex with men taking pre-exposure prophylaxis (PrEP)</a> .	IIa, C
<p><b>Risk Activities</b></p> <ul style="list-style-type: none"> <li>• Injection drug use (current or ever, including those who injected only once)</li> <li>• Intranasal illicit drug use</li> <li>• Use of glass crack pipes</li> <li>• Male engagement in sex with men</li> <li>• Engagement in chem sex (defined as the intentional combining of sex with the use of particular nonprescription drugs in order to facilitate or enhance the sexual encounter [<a href="#">Bourne, 2015</a>])</li> </ul> <p><b>Risk Exposures</b></p> <ul style="list-style-type: none"> <li>• Persons on long-term hemodialysis (ever)</li> <li>• Persons with percutaneous/parenteral exposures in an unregulated setting</li> <li>• Healthcare, emergency medical, and public safety workers after needlestick, sharps, or mucosal exposure to HCV-infected blood</li> <li>• Children born to HCV-infected women</li> <li>• Recipients of a prior transfusion or organ transplant, including persons who:                         <ul style="list-style-type: none"> <li>◦ Were notified that they received blood from a donor who later tested positive for HCV</li> <li>◦ Received a transfusion of blood or blood components, or underwent an organ transplant before July 1992</li> <li>◦ Received clotting factor concentrates produced before 1987</li> </ul> </li> <li>• Persons who were ever incarcerated</li> </ul>	

## Recommendations for One-Time Hepatitis C Testing

### Other Conditions and Circumstances

- HIV or HBV infection
- Sexually active persons about to start pre-exposure prophylaxis (PrEP) for HIV
- Chronic liver disease and/or chronic hepatitis, including unexplained elevated alanine aminotransferase (ALT) levels
- Solid organ donors (living and deceased) and solid organ transplant recipients

Based on the 2013–2016 National Health and Nutrition Examination Survey (NHANES) data among the general noninstitutionalized US population, an estimated 4.1 million people have had HCV exposure (HCV-antibody-positive), including 2.4 million with active HCV infection (HCV-RNA-positive) ([Hofmeister, 2019](#)). Total HCV burden in the US also includes those not accounted for in NHANES data—incarcerated, institutionalized, or unsheltered homeless persons—with estimates ranging from 380,000 to 800,000 additional HCV-antibody-positive persons ([Hofmeister, 2019](#)); ([Edlin, 2015](#)). Approximately 50% of all infected persons are unaware that they have HCV ([Yehia, 2014](#)); ([Holmberg, 2013](#)); ([Denniston, 2012](#)).

HCV screening is recommended because of the known benefits of care and treatment in reducing the risk of decompensated cirrhosis, hepatocellular carcinoma, and all-cause mortality, and the potential public health benefit of reducing transmission through early treatment, viral clearance, and reduced risk behaviors ([Chou, 2020](#)); ([Owens, 2020](#)); ([Schillie, 2020](#)); ([Smith, 2012](#)).

HCV is primarily transmitted through percutaneous exposure to infected blood. Other modes of transmission include mother-to-infant and contaminated devices shared for noninjection drug use. Sexual transmission also occurs but is generally inefficient except among HIV-infected men who have unprotected sex with men ([Pakianathan, 2018](#)).

Injection drug use (IDU) poses the greatest risk for HCV infection, accounting for at least 60% of acute HCV infections in the United States. Healthcare exposures are important sources of transmission, including: the receipt of blood products in the US prior to 1992 (after which routine screening of the blood supply was implemented); receipt of clotting factor concentrates in the US before 1987; receipt of blood or blood products in other countries (risk depends on country prevalence and screening practices); long-term hemodialysis; needlestick injuries among healthcare workers; and patient-to-patient transmission resulting from poor infection control practices. Other risk factors include having been born to an HCV-infected mother, incarceration, and percutaneous or parenteral exposures in an unregulated setting. Examples include tattoos received outside of licensed parlors and medical procedures performed internationally or domestically where strict infection control procedures may not have been followed (eg, surgery before implementation of universal precautions) ([Hellard, 2004](#)).

The importance of these risk factors might differ based on geographic location and population ([Schillie, 2020](#)); ([Owens, 2020](#)). An estimated 12% to 39% of incarcerated persons in North America are HCV-antibody-positive, supporting the recommendation to test this population for HCV infection ([Larney, 2013](#)); ([Allen, 2003](#)); ([Weinbaum, 2003](#)).

Because of shared transmission modes, persons with HIV infection are at risk for HCV. Annual HCV testing is recommended for sexually active HIV-infected adolescent and adult men who have sex with men. The presence of concomitant ulcerative sexually transmitted infections, proctitis related to sexually transmitted infections, or high-risk sexual or drug use practices may warrant more frequent testing. Sexual transmission is particularly a risk for HIV-infected [men who have unprotected sex with men](#) ([Hosein, 2013](#)); ([van de Laar, 2010](#)). Testing sexually active, non-HIV-infected persons for HCV and HBV infection before starting and while receiving pre-exposure prophylaxis (PrEP) for HIV prevention should also be considered ([Hoornenborg, 2020](#)); ([Volk, 2015](#)).

Data also support testing in all deceased and living solid organ donors and all recipients because of the risk of HCV infection posed to the recipient ([Lai, 2013](#)); ([Jones, 2020](#)). Although hepatitis C testing guidelines from the US Centers for

Disease Control and Prevention (CDC) and the US Preventive Services Task Force (USPSTF) do not specifically recommend testing immigrants from countries with a high HCV prevalence (eg, Egypt and Pakistan), such persons 18 years or older are included in the one-time, opt out HCV testing recommendation.

CDC established risk-based HCV testing guidelines in 1998 ([CDC, 1998](#)). These guidelines were expanded in 2012 with a recommendation to offer one-time HCV testing to all persons born from 1945 through 1965 without prior ascertainment of HCV risk factors. This recommendation was supported by evidence demonstrating that persons in this age group had a 6-fold higher prevalence of HCV infection and that a risk-based strategy alone failed to identify >50% of HCV infections, due in part to patient underreporting of their risk and provider limitations in ascertaining risk factor information ([Denniston, 2012](#)). The USPSTF also recommended one-time HCV testing in asymptomatic persons belonging to the 1945 through 1965 birth cohort as well as other individuals based on exposures, behaviors, and conditions or circumstances that increase HCV infection risk.

Since the birth cohort recommendation was adopted, however, there has been an increase in the number of acute and chronic HCV infections reported in individuals born after 1965 ([Zibbell, 2018](#)); ([Ly, 2017](#)); ([Suryaprasad, 2014](#)). The increase in HCV incidence and prevalence among a younger cohort results from the opioid epidemic and increased IDU. This shift in HCV epidemiology and the known failures of risk-based testing warranted an expansion of the recommendation. Accordingly, CDC updated screening recommendations in 2020 to include HCV screening at least once in a lifetime for all adults aged  $\geq 18$  years as well as HCV screening of all pregnant women during each pregnancy, except in settings where the prevalence of HCV infection (ie, HCV-RNA positivity) is  $< 0.1\%$ . Both recommendations were based on extensive literature review and estimates of the cost-effectiveness of screening. In their recommendation, CDC noted that no states have an estimated HCV-RNA prevalence  $< 0.1\%$  ([Schillie, 2020](#)). USPSTF also recently issued recommendations for one-time, routine, opt-out testing of adults aged 18 through 79 years ([Owens, 2020](#)).

For the CDC 2020 testing guidelines, a systematic review included a harm assessment for HCV screening during pregnancy. This review was augmented by input from subject matter experts, studies not captured through the formal literature review, and the peer-review process. Despite several plausible harms (including insurability and employability issues, legal ramifications and potential loss of infant custody, unnecessary cesarean deliveries, and unnecessary avoidance of breastfeeding), CDC concluded that identified or potential harms did not outweigh the benefits of HCV screening ([Schillie, 2020](#)).

Generally, routine HCV testing is cost-effective because of increasing HCV incidence and prevalence among people who inject drugs (PWID) and the decreasing cost of DAA therapy. Many patients at greatest risk for HCV infection and transmission do not readily report their highly stigmatized risk activities. Studies conducted in US urban emergency departments, for example, reveal that 15% to 25% of patients with previously unidentified HCV infection were born after 1965 and/or have no reported history of IDU and are, therefore, missed by even perfect implementation of risk-based testing guidance ([Schechter-Perkins, 2018](#)); ([Hsieh, 2016](#)); ([Lyons, 2016](#)). Reinfection among those actively using drugs is common, but because HCV testing is a low-cost intervention and therapy is both highly effective and cost-effective, routine testing provides good economic value (ie, cost-effectiveness) even when many people need to be tested and treated more than once during their lifetime.

Several cost-effectiveness studies published since release of the birth cohort recommendations have demonstrated that routine, one-time HCV testing among all adults in the US would likely identify a substantial number of HCV cases that would otherwise be missed, and that doing so would be cost-effective. One research group employed simulation modeling to compare several versions of routine guidance, including routine testing for adults aged  $\geq 40$  years,  $\geq 30$  years, and  $\geq 18$  years. The investigators found that routine HCV testing for all adults  $\geq 18$  years was cost-effective compared to risk-based screening guidance, and potentially cost-saving compared to testing only those aged  $\geq 30$  years or  $\geq 40$  years ([Barocas, 2018](#)). The study further demonstrated that routine testing remained cost-effective unless HCV infection had no impact on healthcare utilization and no impact on quality of life. Another research team similarly found that routine HCV testing for all adults aged  $\geq 18$  years is likely cost-effective compared to risk-based screening guidance, provided the HCV prevalence among those born after 1965 is  $> 0.07\%$  ([Eckman, 2019](#)). Notably, these studies reached similar conclusions despite being conducted independently and employing different simulation modeling approaches. Further, a variety of studies have tested the cost-effectiveness of routine HCV testing in specific venues, including correctional settings ([He, 2016](#)), substance use treatment centers ([Schackman, 2018](#)); ([Schackman, 2015](#)), and federally qualified health centers ([Assoumou, 2018](#)). All of these studies demonstrated that routine HCV testing and treatment was cost-effective, even


when linkage to HCV treatment after testing was poor and the rate of HCV reinfection among injection drug users was high.

Analyses focusing on pregnant women have demonstrated similar findings. One analysis calculated an incremental cost-effectiveness ratio (ICER) of \$2,826 per quality-adjusted life-year (QALY) gained for universal screening of pregnant women compared with risk-based screening at an HCV-RNA positivity prevalence of 0.73% ([Chaillon, 2019](#)). Although real-world data informing screening during each pregnancy are lacking, a modeled analysis suggested that hepatitis C screening during each pregnancy would be cost-effective. Using a hepatitis C prevalence of 0.38% among pregnant women, the analysis found that universal hepatitis C screening during the first trimester of each pregnancy compared with the practice of risk-based screening had an ICER of \$41,000 per QALY gained ([Tasillo, 2019](#)). Universal screening reduced HCV-attributable mortality by 16% and increased the proportion of infants identified as HCV-exposed from 44% to 92%. ICER remained  $\leq$  \$100,000 per QALY gained if hepatitis C prevalence was higher than 0.16% ([Schillie, 2020](#)).

Evidence regarding the frequency of HCV testing in persons at risk for ongoing exposures to the virus is lacking. Clinicians should, therefore, determine the periodicity of testing based on the risk of infection or reinfection. Because of the high incidence of HCV infection among [PWID](#) and HIV-infected [men who have unprotected sex with men](#), HCV testing at least annually using an assay that detects HCV RNA (ie, a quantitative HCV-RNA test) if they have been previously exposed, is recommended among such individuals ([Newsum, 2017](#)); ([Aberg, 2014](#)); ([Witt, 2013](#)); ([Bravo, 2012](#)); ([Lin, 2012](#)); ([Wandeler, 2012](#)); ([Williams, 2011](#)).

Implementation of clinical decision support tools or prompts for HCV testing in [electronic health records](#) could facilitate reminding clinicians of HCV testing when indicated ([Hsu, 2013](#)); ([Litwin, 2012](#)).

## Initial HCV Testing and Follow-Up

Recommendations for Initial HCV Testing and Follow-Up	
RECOMMENDED	RATING 
HCV-antibody testing with reflex HCV RNA polymerase chain reaction (PCR) testing is recommended for initial HCV testing.	I, A
Among persons with a negative HCV-antibody test who were exposed to HCV within the prior 6 months, HCV-RNA or follow-up HCV-antibody testing 6 months or longer after exposure is recommended. HCV-RNA testing can also be considered for immunocompromised persons.	I, C
Among persons at risk of reinfection after previous spontaneous or treatment-related viral clearance, HCV-RNA testing is recommended because a positive HCV-antibody test is expected.	I, C
Quantitative HCV-RNA testing is recommended prior to initiation of antiviral therapy to document the baseline level of viremia (ie, baseline viral load).	I, A
HCV genotype testing may be considered for those in whom it may alter treatment recommendations.	I, A
Persons found to have a positive HCV-antibody test and negative results for HCV RNA by PCR should be informed that they do not have evidence of current (active) HCV infection but are not protected from reinfection.	I, A

All persons for whom HCV screening is recommended should initially be tested for HCV antibody ([CDC, 2013](#)); ([Alter, 2003](#)) using an assay approved by the US Food and Drug Administration (FDA). A list of current FDA-approved HCV

screening assays can be found on the [agency website](#). FDA-approved tests include laboratory-based assays and a point-of-care assay (ie, OraQuick™ HCV rapid antibody test [OraSure Technologies]) ([Lee, 2011](#)). The latter is an indirect immunoassay with a sensitivity and specificity similar to those of laboratory-based HCV-antibody assays. Point-of-care assays are valuable in the community setting and allow for sample collection with a finger stick rather than standard phlebotomy. If point-of-care assays are used, reporting of results to the medical record and health authorities should follow protocols used for laboratory-based HCV-antibody tests. When possible, positive point-of-care antibody tests should be followed-up with immediate HCV-RNA confirmatory testing rather than referring the patient to another provider or setting to have the test performed. A study evaluating the performance parameters of the OraQuick™ HCV rapid antibody point-of-care test showed that people with viremia have higher antibody levels (compared with nonviremic persons), leading to a more rapid positive test result. All 227 viremic individuals in the study (from both clinical and real-world testing cohorts) tested positive within 5 minutes ([Smookler, 2020](#)). Based on a sensitivity of 100% (95% CI, 98.4-100%) in this study, if the OraQuick™ HCV rapid antibody test is not showing a positive result by 5 minutes, it is highly unlikely the person has active infection. Additional validation would be valuable, however, utilizing this so-called 5-minute rule may be considered, particularly in populations unable to wait the recommended 20–40 minutes before reading the test, or in high-throughput testing scenarios.

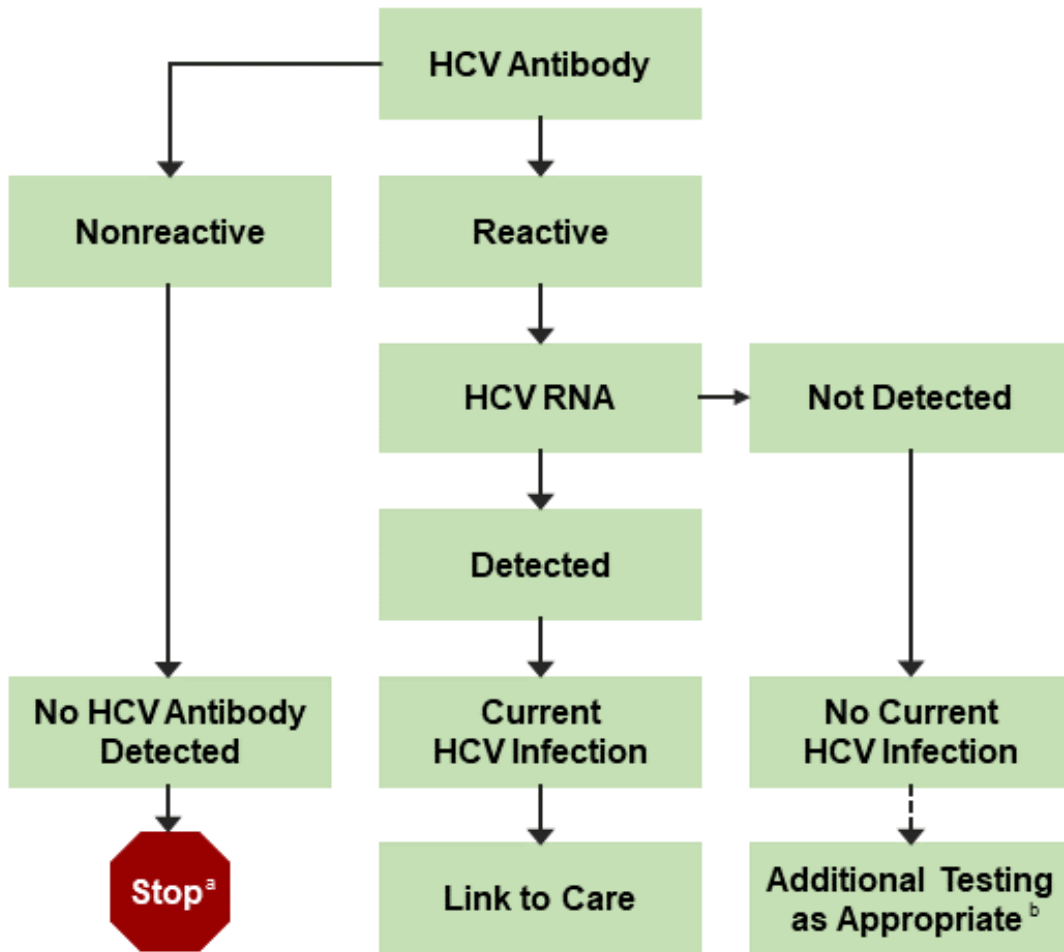
A positive HCV-antibody test indicates current (active) HCV infection (acute or chronic); past infection that has resolved; or a rare false positive ([Pawlotsky, 2002](#)). A test to detect HCV viremia is therefore necessary to confirm active HCV infection and guide clinical management, including initiation of HCV treatment. Many reference laboratories offer HCV-antibody testing that automatically reflexes to HCV-RNA PCR testing if the antibody test is positive. This should be considered the optimal testing approach in a clinical setting because it requires only a single blood draw without the need to bring people back to care for confirmatory testing, a major barrier in the continuum of care ([Mera, 2016](#)). HCV RNA point-of-care tests are also under evaluation (eg, Xpert® HCV viral load and Genedrive® HCV ID), which would allow for a rapid confirmation of viremia and immediate/same day treatment initiation. Point-of-care HCV-RNA tests are not yet FDA approved, as of this writing. Collection of dried blood spot (DBS) samples also allows for assessment of HCV antibodies and reflex HCV-RNA testing by testing spots sequentially. DBS samples can be collected using a finger stick rather than phlebotomy and can be transported without an intact cold chain, making it useful in rural areas and in people for whom phlebotomy may be a testing barrier ([Lange, 2017](#)).

HCV-RNA testing should also be performed in persons with a negative HCV-antibody test who are either immunocompromised (eg, persons receiving chronic hemodialysis) ([KDIGO, 2008](#)) or might have been exposed to HCV within the last 6 months because these persons may be HCV-antibody negative. An HCV-RNA test is also needed to detect reinfection in HCV-antibody-positive persons after previous spontaneous or treatment-related viral clearance.

Detection of HCV core antigen in the blood also indicates active HCV infection. Because the sensitivity of HCV core antigen testing is less than that of HCV-RNA testing, if an HCV core antigen test is used to assess viremia, antibody-positive samples that test negative for HCV core antigen should have a confirmatory HCV-RNA test to exclude a false negative core antigen result ([van Tilborg, 2018](#)).

An FDA-approved quantitative or qualitative HCV-RNA test with a detection level of  $\leq 25$  IU/mL should be used to detect HCV RNA. Figure 1 shows the CDC-recommended HCV testing algorithm.

### Figure 1. CDC-Recommended Testing Sequence for Identifying Current HCV Infection



<sup>a</sup> For persons who might have been exposed to HCV within the past 6 months, testing for HCV RNA or follow-up testing for HCV antibody should be performed. For persons who are immunocompromised, testing for HCV RNA should be performed.

<sup>b</sup> To differentiate past, resolved HCV infection from biologic false positivity for HCV antibody, testing with another HCV-antibody assay can be considered. Repeat HCV-RNA testing if the person tested is suspected to have had HCV exposure within the past 6 months or has clinical evidence of HCV disease, or if there is concern regarding the handling or storage of the test specimen.

Adapted from Centers for Disease Control and Prevention ([CDC, 2013](https://www.cdc.gov)).




Persons who have a positive HCV-antibody test and negative results for HCV RNA by PCR should be informed that they do not have laboratory evidence of current HCV infection, although it is possible that they may have had a previous exposure. Additional HCV testing is typically unnecessary. The HCV-RNA test can be repeated when there is a high index of suspicion for recent infection or in patients with ongoing HCV infection risk. They should also be informed that despite the presence of antibodies, they are not protected from infection/reinfection.

Clinicians (or patients) may seek additional testing to determine whether a positive HCV-antibody test represents a remote, resolved HCV infection or a false positive. For patients with no apparent risk for HCV infection, the likelihood of a false positive HCV-antibody test is related to the HCV prevalence in the tested population. False positive HCV-antibody tests most commonly occur in populations with a low prevalence of HCV infection ([Alter, 2003](#)). If further testing is desired to distinguish between a true positive vs biologic false positivity for HCV antibody, repeat testing may be performed using a different FDA-approved, HCV-antibody assay. A biologic false result should not occur with 2 different assays because they target different regions of the virus, making it highly unlikely that both would falsely detect a cross-reactive antigen ([CDC, 2013](#)); ([Vermeersch, 2008](#)).

Prior to initiation of antiviral therapy, quantitative HCV-RNA testing should be used to determine the baseline level of viremia (ie, viral load), which may affect treatment duration with certain regimens. The degree of viral load decline after initiation of treatment is less predictive of sustained virologic response (SVR) in the era of direct-acting antiviral (DAA) therapy compared with previous interferon-based treatment (see [Pretreatment and On-Treatment Monitoring](#)).

With the advent of pangenotypic HCV treatment regimens, HCV genotyping is no longer required prior to treatment initiation for all individuals. In those with evidence of cirrhosis and/or past unsuccessful HCV treatment, treatment regimens may differ by genotype and thus pretreatment genotyping is recommended (see [Treatment-Naive](#) and [Treatment-Experienced](#) sections). For noncirrhotic treatment-naive patients, although genotyping may impact the preferred treatment approach, it is not required if a pangenotypic regimen is used (see [Simplified Treatment Algorithm](#)).

## Counseling Persons With Active HCV Infection

Recommendations for Counseling Persons With Active HCV Infection	
RECOMMENDED	RATING 
Persons with current HCV infection should receive education and interventions aimed at reducing liver disease progression and preventing HCV transmission.	IIa, B
Abstinence from alcohol and, when appropriate, interventions to facilitate cessation of alcohol consumption should be advised for all persons with HCV infection.	IIa, B
Evaluation for other conditions that may accelerate liver fibrosis, including hepatitis B and HIV infections, is recommended for all persons with active HCV infection.	IIb, B
Evaluation for advanced hepatic fibrosis using noninvasive tests (serum panels, elastography) or liver biopsy, if required, is recommended for all persons with HCV infection to facilitate an appropriate decision regarding HCV treatment strategy, and to determine the need for initiating additional measures for cirrhosis management (eg, hepatocellular carcinoma screening) (see <a href="#">Monitoring</a> section).	I, A
Vaccination against hepatitis A and hepatitis B is recommended for all susceptible persons with HCV infection.	IIa, C

## Recommendations for Counseling Persons With Active HCV Infection

Vaccination against pneumococcal infection is recommended for all patients with cirrhosis.	Ila, C
All persons with HCV infection should be provided education about how to prevent HCV transmission to others.	I, C

In addition to receiving antiviral therapy, HCV-infected persons should be educated about how to prevent further liver damage. Most important is prevention of the potentially deleterious effects of alcohol. Numerous studies have found a strong association between excess alcohol use and the development or progression of liver fibrosis, and the development of hepatocellular carcinoma ([Safdar, 2004](#)); ([Harris, 2001](#)); ([Bellentani, 1999](#)); ([Corrao, 1998](#)); ([Wiley, 1998](#)); ([Poynard, 1997](#)); ([Noda, 1996](#)). Daily consumption of >50 g of alcohol has a high likelihood of worsening fibrosis. Some studies indicate that daily consumption of lesser amounts of alcohol also exerts a deleterious effect on the liver; these data, however, are controversial ([Hagström, 2017](#)); ([Younossi, 2013b](#)); ([Westin, 2002](#)). Persons who abuse alcohol and have alcohol dependence require treatment and consideration for referral to an addiction specialist.

Hepatitis B virus (HBV) and HIV coinfection have been associated with a poorer HCV prognosis in cohort studies ([Puoti, 2017b](#)); ([Kruse, 2014](#)); ([Thein, 2008a](#)); ([Zarski, 1998](#)). Because of overlapping risk factors for these infections and benefits associated with their identification and treatment, HCV-infected persons should be tested for HIV antibody and hepatitis B surface antigen (HBsAg), using standard screening assays ([Moyer, 2013](#)); ([CDC, 2008](#)). See [USPSTF HIV screening recommendations](#) and [CDC hepatitis B screening recommendations](#) for additional information. Persons who test positive for HBsAg require monitoring during HCV treatment because of HBV reactivation risk ([Lee, 2018](#)). Anti-HBV therapy may also be considered (see [reactivation of HBV in the Monitoring section](#)). Persons who test negative for HBsAg but positive for hepatitis B core antibodies (anti-HBc)—with or without hepatitis B surface antibodies (anti-HBs)—have resolved HBV infection in most cases; the risk of clinically significant HBV reactivation with HCV therapy is very low in this scenario and no further workup is required ([Mücke, 2018](#)). Patients should be counseled about how to reduce their risk of acquiring these infections; HBV vaccination is recommended when appropriate.

### Assessment of Liver Disease Severity

The severity of liver disease associated with chronic HCV infection is a key factor in determining the initial and follow-up evaluation of patients. Noninvasive tests using serum biomarkers, elastography, or liver imaging allow for accurate diagnosis of cirrhosis in most individuals (see [pretreatment workup in When and in Whom to Initiate HCV Therapy](#)). Liver biopsy is rarely required but may be considered if other causes of liver disease are suspected.

Noninvasive methods frequently used to estimate liver disease severity include:

- Liver-directed physical exam (normal in most patients)
- Routine blood tests (eg, ALT, AST, albumin, bilirubin, international normalized ratio [INR], and CBC with platelet count)
- Serum fibrosis marker panels
- Transient elastography
- Liver imaging (eg, ultrasound or CT scan)

Simple calculations derived from routine blood tests—such as the serum AST-to-platelet ratio index (APRI) ([Wai, 2003](#)) and FIB-4 score ([Sterling, 2006](#))—as well as assessment of liver surface nodularity and spleen size by liver ultrasound or other cross-sectional imaging modalities can help determine if patients with HCV have cirrhosis and associated portal hypertension. The presence of portal hypertension is associated with a greater likelihood of developing future hepatic complications in untreated patients ([Chou, 2013](#)); ([Rockey, 2006](#)). Elastography provides instant information regarding liver stiffness and can reliably distinguish patients with a high versus low likelihood of cirrhosis ([Bonder, 2014](#)); ([Castera,](#)



[2012](#)). A more detailed discussion regarding fibrosis assessment is found in the [When and In Whom to Initiate Therapy](#) section.


Persons with known or suspected bridging fibrosis and cirrhosis are at increased risk for developing complications of advanced liver disease and require frequent follow-up. They should also avoid hepatotoxic drugs, such as excessive acetaminophen (>2 g/d) and certain herbal supplements. Nephrotoxic drugs, such as nonsteroidal anti-inflammatory drugs, should also be avoided. Ongoing imaging surveillance for liver cancer and gastroesophageal varices is recommended for these patients ([Fontana, 2010](#)); ([Sangiovanni, 2006](#)). Persons with cirrhosis are more susceptible to invasive pneumococcal infection ([Marrie, 2011](#)) and should receive pneumococcal vaccination ([CDC, 2012](#)).

Exposure to infected blood is the primary mode of HCV transmission. HCV-infected persons must be informed of the precautions needed to avoid exposing others to infected blood. This is particularly important for PWID given that HCV transmission in this population primarily results from sharing needles and other contaminated drug injection equipment. Epidemics of acute HCV due to sexual transmission in HIV-infected men who have sex with men have also been described ([Urbanus, 2009](#)); ([van de Laar, 2009](#)); ([Fierer, 2008](#)). Table 1 outlines measures to avoid HCV transmission. HCV is not spread by sneezing, hugging, holding hands, coughing, or sharing eating utensils or drinking glasses, nor is it transmitted through food or water.

**Table 1. Measures to Prevent HCV Transmission**

HCV-infected persons should be counseled to avoid sharing toothbrushes and dental or shaving equipment, and be cautioned to cover any bleeding wound to prevent the possibility of others coming into contact with their blood.
Persons should be counseled about harm reduction related to illicit drug use, including offering medication for opioid use disorder, if appropriate, or referral to a substance use treatment program. Those who continue to inject drugs should be referred to local syringe services programs and counseled to ( <a href="#">Platt, 2017</a> ): <ul style="list-style-type: none"> <li>• Avoid reusing or sharing syringes, needles, water, cotton, and other drug preparation equipment.</li> <li>• Use new sterile syringes and filters, and disinfected cookers.</li> <li>• Clean the injection site with a new alcohol swab.</li> <li>• Dispose of syringes and needles after 1 use in a safe, puncture-proof container.</li> </ul>
Persons with HCV infection should be advised not to donate blood and to discuss HCV serostatus prior to donation of body organs, other tissue, or semen.
Persons with HIV infection and those with multiple sexual partners or sexually transmitted infections should be encouraged to use barrier precautions to prevent sexual transmission. Other persons with HCV infection should be counseled that the risk of sexual transmission is low and may not warrant barrier protection.
Household surfaces and implements contaminated with visible blood from an HCV-infected person should be cleaned using a dilution of 1 part household bleach to 9 parts water. Gloves should be worn when cleaning up blood spills.

## Linkage to Care

Recommendation for Linkage to Care	
RECOMMENDED	RATING 
All persons with active HCV infection should be linked to a healthcare provider who is knowledgeable in and prepared to provide comprehensive management.	Ila, C

Improved identification of active HCV infection and treatment advances will have limited impact on HCV-related morbidity and mortality without concomitant improvement in linkage to care. All patients with current HCV infection and a positive HCV-RNA test should be evaluated by a healthcare provider with expertise in assessment of liver disease severity and HCV treatment. Subspecialty care and consultation may be required for persons with HCV infection who have advanced fibrosis or cirrhosis (Metavir stage  $\geq$ F3), including possible referral for consideration of liver transplantation in those with evidence of hepatic decompensation.

Data do not support exclusion of HCV-infected persons from consideration for hepatitis C therapy based on alcohol intake or use of illicit drugs (see [Identification and Management of HCV in People Who Inject Drugs](#)). Some possible strategies to address HCV treatment barriers are listed in Table 2.

**Table 2. Common Barriers to and Misconceptions Regarding HCV Treatment and Potential Strategies**

Barrier	Strategy
Comorbid conditions (eg, substance use, psychiatric disorders, uncontrolled chronic medical conditions)	<ul style="list-style-type: none"> <li>• Conduct counseling and education.</li> <li>• Refer for services (eg, mental health services, medications for opioid use disorder [MOUDs], and syringe service programs).</li> <li>• Co-localize services (eg, primary care, medical homes, syringe services programs and drug treatment, especially MOUD).</li> </ul>
Competing priorities and loss to follow-up	<ul style="list-style-type: none"> <li>• Conduct counseling and education.</li> <li>• Engage case managers and patient navigators. Consider other strategies such as incentives, peer navigators, and transportation assistance.</li> <li>• Co-localize services (eg, primary care, medical homes, syringe services programs and drug treatment, especially MOUD).</li> </ul>
Treatment adherence and adverse effects	<ul style="list-style-type: none"> <li>• Conduct counseling and education.</li> <li>• Consider other strategies like incentives, peer navigators, and transportation assistance.</li> <li>• Utilize directly observed therapy.</li> </ul>
Lack of access to treatment (eg, out-of-pocket costs, high copays, lack of insurance, geographic distance, and/or lack of specialist availability)	<ul style="list-style-type: none"> <li>• Leverage expansion of coverage through the Patient Protection and Affordable Care Act.</li> <li>• Participate in models of care involving close collaboration between primary care clinicians and specialists.</li> <li>• Liaise with pharmaceutical patient assistance programs and copay assistance programs.</li> <li>• Co-localize services (eg, primary care, medical homes, syringe services programs and drug treatment, especially MOUD).</li> </ul>
Lack of practitioner expertise	<ul style="list-style-type: none"> <li>• Collaborate with specialists (eg, project ECHO-like models and telemedicine).</li> <li>• <a href="#">Use simplified HCV treatment guidelines</a> {Develop electronic health record performance measures (e.g., care cascades) and clinical decision support tools (eg, pop-up reminders and standing orders).</li> </ul>

Co-localization of HCV screening, evaluation, and treatment with other medical or social services (ie, integrated care) is a strategy that addresses several treatment barriers. Co-localization has already been applied to settings with high HCV prevalence (eg, correctional facilities, needle exchange programs, substance abuse treatment centers, and harm reduction programs), but this type of care is not uniformly available ([Burton, 2019](#)); ([Harrison, 2019](#)); ([Morey, 2019](#)); ([Schulkind, 2019](#)); ([Bruggmann, 2013](#)); ([Islam, 2012](#)); ([Stein, 2012](#)). A recent study demonstrated that integrated care—consisting of multidisciplinary care coordination and patient case management—increased the proportion of patients with HCV infection and psychiatric illness or substance use who begin antiviral therapy and achieve SVR without serious adverse events ([Ho, 2015](#)).

A strategy that addresses lack of access to specialists—a primary barrier to HCV care—is participation in models involving close collaboration between primary care practitioners and subspecialists ([Beste, 2017b](#)); ([Rossaro, 2013](#)); ([Miller, 2012](#)); ([Arora, 2011](#)). Such collaborations have used telemedicine and knowledge networks to overcome geographic distances to specialists ([Rossaro, 2013](#)); ([Arora, 2011](#)) or the availability of experienced providers in a methadone or correctional setting ([Morey, 2019](#)); ([Talal, 2019](#)). For example, project ECHO ([Extension for Community Healthcare Outcomes](#)) uses videoconferencing to enhance primary care practitioner capacity in rendering HCV care and treatment to New Mexico's large rural and underserved population ([Arora, 2011](#)). Through case-based learning and real-time feedback from a multidisciplinary team of specialists (gastroenterology, infectious disease, pharmacology, and psychiatry practitioners), project ECHO has expanded HCV treatment access in populations that might have otherwise remained untreated. The short duration of treatment and few serious adverse events associated with DAA therapy present an opportunity to expand the number of primary care providers engaged in HCV management and treatment. This expansion will support the goal of HCV elimination and overcome barriers associated with the need for subspecialty referrals. The ASCEND trial utilized a real-world cohort of patients at urban federally qualified health centers and found that HCV treatment administered by nonspecialist providers was as safe and effective as that provided by specialists ([Kattakuzhy, 2017](#)).

Additional strategies for enhancing linkage to and retention in care could be adapted from other fields, such as tuberculosis and HIV. For example, use of directly observed therapy has enhanced adherence to tuberculosis treatment, and use of case managers and patient navigators has reduced loss of follow-up in HIV care ([Govindasamy, 2012](#)). Recent HCV testing and care programs have identified the use of patient navigators or care coordinators as important interventions in overcoming challenges associated with linkage to and retention in care ([Ford, 2018](#)); ([Coyle, 2015](#)); ([Trooskin, 2015](#)). There are also data suggesting that financial incentives and peer navigation may be useful to support treatment adherence in patients with substance use disorders ([Ward, 2019](#)); ([Wohl, 2017](#)). Ongoing assessment of efficacy and comparative effectiveness of this and additional strategies is a crucial area of future research for patients with HCV infection. Replication and expansion of best practices and new models for linkage to HCV care will also be crucial to maximize the public health impact of newer treatment paradigms.

**Last update:** October 24, 2022

## Related References

Aberg JA, Gallant JE, Ghanem KG, Emmanuel P, Zingman BS, Horberg MA. [Infectious Disease Society of America. Primary care guidelines for the management of persons infected with HIV: 2013 update by the HIV Medicine Association of the Infectious Diseases Society of America.](#) *Clin Infect Dis.* 2014;58(1):e1-34.

Allen SA, Spaulding AC, Osei AM, Taylor LE, Cabral AM, Rich JD. [Treatment of chronic hepatitis C in a state correctional facility.](#) *Ann Intern Med.* 2003;138(3):187-190.

Alter MJ, Kuhnert WL, Finelli L, Finelli L. [Guidelines for laboratory testing and result reporting of antibody to hepatitis C virus.](#) *MMWR Recomm Rep.* 2003;52(RR-3):1-13, 15.

Arora S, Thornton K, Murata G, et al. [Outcomes of treatment for hepatitis C virus infection by primary care providers.](#) *N Engl J Med.* 2011;364(23):2199-2207.

Assoumou SA, Tasillo A, Leff JA, et al. [Cost-effectiveness of one-time hepatitis C screening strategies among adolescents and young adults in primary care settings.](#) *Clin Infect Dis.* 2018;66(3):376-384.

Barocas JA, Tasillo A, Eftekhari-Yazdi G, et al. [Population-level outcomes and cost-effectiveness of expanding the recommendation for age-based hepatitis C testing in the United States.](#) *Clin Infect Dis.* 2018;67(4):549-556.

Bellentani S, Pozzato G, Saccoccio G, et al. [Clinical course and risk factors of hepatitis C virus related liver disease in the general population: report from the Dionysos study.](#) *Gut.* 1999;44(6):874-880.

Beste LA, Glorioso TJ, Ho PM. [Telemedicine specialty support promotes hepatitis C treatment by primary care providers](#)

[in the Department of Veterans Affairs](#). *Am J Med*. 2017;130(4):432-438.e3.

Bonder A, Afdhal NH. [Utilization of FibroScan in clinical practice](#). *Curr Gastroenterol Rep*. 2014;16(2):372.

Bourne A, Reid D, Hickson F, Torres-Rueda S, Weatherburn P. [Illicit drug use in sexual settings \('chemsex'\) and HIV/STI transmission risk behaviour among gay men in South London: findings from a qualitative study](#). *Sex Transm Infect*. 2015;91(8):564-568. doi:10.1136/sextrans-2015-052052.

Bravo MJ, Vallejo F, Barrio G, et al. [HCV seroconversion among never-injecting heroin users at baseline: no predictors identified other than starting injection](#). *Int J Drug Policy*. 2012;23(5):415-419.

Bruggmann P, Litwin AH. [Models of care for the management of hepatitis C virus among people who inject drugs: one size does not fit all](#). *Clin Infect Dis*. 2013;57(Suppl 2):S56-S61.

Burton MJ, Voluse AC, Anthony V. [Integrating comprehensive hepatitis C virus care within a residential substance use disorder treatment program](#). *J Subst Abuse Treat*. 2019;(98):9-14.

Castera L. [Noninvasive methods to assess liver disease in patients with hepatitis B or C](#). *Gastroenterology*. 2012;142(6):1293-1302.

[Centers for Disease Control and Prevention \(CDC\). Recommendations for prevention and control of hepatitis C virus \(HCV\) infection and HCV-related chronic disease](#). *MMWR Recomm Rep*. 1998;47(RR-19):1-39.

[Use of 13-valent pneumococcal conjugate vaccine and 23-valent pneumococcal polysaccharide vaccine for adults with immunocompromising conditions: recommendations of the Advisory Committee on Immunization Practices \(ACIP\)](#). *MMWR Morb Mortal Wkly Rep*. 2012;61(40):816-819.

[Centers for Disease Control and Prevention \(CDC\). Testing for HCV infection: an update of guidance for clinicians and laboratorians](#). *MMWR Morb Mortal Wkly Rep*. 2013;62(18):362-365.

Chaillon A, Rand EB, Reau N, Martin NK. [Cost-effectiveness of universal hepatitis C virus screening of pregnant women in the United States](#). *Clin Infect Dis*. 2019;69(11):1888-1895. doi:10.1093/cid/ciz063.

Chou R, Wasson N. [Blood tests to diagnose fibrosis or cirrhosis in patients with chronic hepatitis C virus infection: a systematic review](#). *Ann Intern Med*. 2013;158(11):807-820.

Chou R, Dana T, Fu R, et al. [US Preventative Services Task Force. Screening for hepatitis C virus infection in adolescents and adults: updated evidence report and systematic review for the US Preventive Services Task Force](#). *JAMA*. 2020. doi:10.1001/jama.2019.20788.

Clark BT, Garcia-Tsao G, Fraenkel L. [Patterns and predictors of treatment initiation and completion in patients with chronic hepatitis C virus infection](#). *Patient Prefer Adherence*. 2012;6:285-295.

Corrao G, Arico S. [Independent and combined action of hepatitis C virus infection and alcohol consumption on the risk of symptomatic liver cirrhosis](#). *Hepatology*. 1998;27(4):914-919.

Coyle C, Viner K, Hughes E, et al. [Identification and linkage to care of HCV-infected persons in five health centers - Philadelphia, Pennsylvania, 2012-2014](#). *MMWR Morb Mortal Wkly Rep*. 2015;64(17):459-463.

Denniston MM, Klevens RM, McQuillan GM, Jiles RB. [Awareness of infection, knowledge of hepatitis C, and medical follow-up among individuals testing positive for hepatitis C: National Health and Nutrition Examination Survey 2001-2008](#). *Hepatology*. 2012;55(6):1652-1661.

Eckman MH, Ward JW, Sherman KE. [Cost effectiveness of universal screening for hepatitis C virus infection in the era of direct-acting, pangenotypic treatment regimens](#). *Clin Gastroenterol Hepatol*. 2019;17(5):930-939.e9.



- Edlin BR, Eckhardt BJ, Shu MA, Holmberg SD, Swan T. [Toward a more accurate estimate of the prevalence of hepatitis C in the United States](#). *Hepatology*. 2015;62(5):1353-1363.
- Fierer DS, Uriel AJ, Carriero DC, et al. [Liver fibrosis during an outbreak of acute hepatitis C virus infection in HIV-infected men: a prospective cohort study](#). *J Infect Dis*. 2008;198(5):683-686.
- Fontana RJ, Sanyal AJ, Ghany MG, et al. [Factors that determine the development and progression of gastroesophageal varices in patients with chronic hepatitis C](#). *Gastroenterology*. 2010;138(7):2321-2331.
- Ford MM, Jordan AE, Johnson N, et al. [Check Hep C: a community-based approach to hepatitis C diagnosis and linkage to care in high-risk populations](#). *J Public Health Manag Pract*. 2018;24(1):41-48. doi:10.1097/PHH.0000000000000519.
- Govindasamy D, Ford N, Kranzer K. [Risk factors, barriers and facilitators for linkage to antiretroviral therapy care: a systematic review](#). *AIDS*. 2012;26(16):2059-2067.
- Hagström H. [Alcohol consumption in concomitant liver disease: how much is too much?](#). *Curr Hepatol Rep*. 2017;16(2):152-157.
- Harris DR, Gonin R, Alter HJ, et al. [The relationship of acute transfusion-associated hepatitis to the development of cirrhosis in the presence of alcohol abuse](#). *Ann Intern Med*. 2001;134(2):120-124.
- Harrison GI, Murray K, Gore R, et al. [The hepatitis C awareness through to treatment \(HepCATT\) study: improving the cascade of care for hepatitis C virus-infected people who inject drugs in England](#). *Addiction*. 2019;114(6):1113-1122.
- He T, Li K, Roberts MS, et al. [Prevention of hepatitis C by screening and treatment in US prisons](#). *Ann Intern Med*. 2016;164(2):84-92.
- Hellard ME, Hocking JS, Crofts N. [The prevalence and the risk behaviours associated with the transmission of hepatitis C virus in Australian correctional facilities](#). *Epidemiol Infect*. 2004;132(3):409-15.
- Ho SB, Brau N, Cheung R, et al. [Integrated care increases treatment and improves outcomes of patients with chronic hepatitis C virus infection and psychiatric illness or substance abuse](#). *Clin Gastroenterol Hepatol*. 2015;13(11):2005-2014.e1-3.
- Hofmeister MG, Rosenthal EM, Barker LK, et al. [Estimating prevalence of hepatitis C virus infection in the United States, 2013-2016](#). *Hepatology*. 2019;69(3):1020-1031.
- Holmberg SD, Spradling PR, Moorman AC, Denniston MM. [Hepatitis C in the United States](#). *N Engl J Med*. 2013;368(20):1859-1861.
- Hoornenborg E, Coyer L, Boyd A, et al. [Amsterdam PrEP project team in the HIV transmission elimination Amsterdam \(H-TEAM\) initiative. High incidence of HCV in HIV-negative men who have sex with men using pre-exposure prophylaxis](#). *J Hepatol*. 2020;72(5):855-864.
- Hosein SR, Wilson DP. [HIV, HCV, and drug use in men who have sex with men](#). *Lancet*. 2013;382(9898):1095-1096.
- Hsieh YH, Rothman RE, Laeyendecker , et al. [Evaluation of the Centers for Disease Control and Prevention recommendations for hepatitis C virus testing in an urban emergency department](#). *Clin Infect Dis*. 2016;62(9):1059-1065.
- Hsu L, Bowlus CL, Stewart SL, et al. [Electronic messages increase hepatitis B screening in at-risk Asian American patients: a randomized, controlled trial](#). *Dig Dis Sci*. 2013;58(3):807-814.
- Islam MM, Topp L, Conigrave KM, et al. [Linkage into specialist hepatitis C treatment services of injecting drug users attending a needle syringe program-based primary healthcare centre](#). *J Subst Abuse Treat*. 2012;43(4):440-445.

- Jones JM, Kracalik I, Levi ME, et al. [Assessing Solid Organ Donors and Monitoring Transplant Recipients for Human Immunodeficiency Virus, Hepatitis B Virus, and Hepatitis C Virus Infection - U.S. Public Health Service Guideline, 2020](#). *MMWR Recomm Rep*. 2020;69(4):1-16. doi:10.15585/mmwr.rr6904a1.
- Kattakuzhy S, Gross C, Emmanuel B. [Expansion of treatment for hepatitis C virus infection by task shifting to community-based nonspecialist providers: a nonrandomized clinical trial](#). *Ann Intern Med*. 2017;167(5):311-318.
- [Kidney disease: improving global outcomes \(KDIGO\). KDIGO clinical practice guidelines for the prevention, diagnosis, evaluation, and treatment of hepatitis C in chronic kidney disease](#). *Kidney Int Suppl*. 2008;(109):S1-S99.
- Khokhar OS, Lewis JH. [Reasons why patients infected with chronic hepatitis C virus choose to defer treatment: do they alter their decision with time?](#). *Dig Dis Sci*. 2007;52(5):1168-1176.
- Kruse RL, Kramer JR, Tyson GL, et al. [Clinical outcomes of hepatitis B virus coinfection in a United States cohort of hepatitis C virus-infected patients](#). *Hepatology*. 2014;60(6):1871-1878.
- Lai JC, Kahn JG, Tavakol M, Peters MG, Roberts JP. [Reducing infection transmission in solid organ transplantation through donor nucleic acid testing: a cost-effectiveness analysis](#). *Am J Transplant*. 2013;13(10):2611-2618.
- Lange B, Roberts T, Cohn J. [Diagnostic accuracy of detection and quantification of HBV-DNA and HCV-RNA using dried blood spot \(DBS\) samples - a systematic review and meta-analysis](#). *BMC Infect Dis*. 2017;17(Suppl 1):693.
- Larney S, Kopinski H, Beckwith CG, et al. [Incidence and prevalence of hepatitis C in prisons and other closed settings: results of a systematic review and meta-analysis](#). *Hepatology*. 2013;58(4):1215-1224.
- Lee SR, Kardos KW, Schiff ER, et al. [Evaluation of a new, rapid test for detecting HCV infection, suitable for use with blood or oral fluid](#). *J Virol Methods*. 2011;172(1-2):27-31.
- Lee SW, Lee TY, Yang SS, Peng YC, Yeh HZ, Chang CS. [Prevalence of hepatitis B reactivation among Chinese individuals with chronic hepatitis C treated with pan-oral direct-acting antivirals](#). *Gastroenterology Res*. 2018;11(2):124-129. doi:10.14740/gr971w.
- Linaz BP, Wong AY, Schackman BR, Kim AY, Freedberg KA. [Cost-effective screening for acute hepatitis C virus infection in HIV-infected men who have sex with men](#). *Clin Infect Dis*. 2012;55(2):279-290.
- Litwin AH, Smith BD, Drainoni ML, et al. [Primary care-based interventions are associated with increases in hepatitis C virus testing for patients at risk](#). *Dig Liver Dis*. 2012;44(6):497-503.
- Ly KN, Jiles RB, Teshale EH, Foster MA, Pesano RL, Holmberg SD. [Hepatitis C virus infection among reproductive-aged women and children in the United States, 2006 to 2014](#). *Ann of Intern Med*. 2017;166(11):775-782.
- Lyons MS, Kunnathur VA, Rouster SD, et al. [Prevalence of diagnosed and undiagnosed hepatitis C in a midwestern urban emergency department](#). *Clin Infect Dis*. 2016;62(9):10-71.
- Marrie TJ, Tyrrell GJ, Garg S, Vanderkooi O. [Factors predicting mortality in invasive pneumococcal disease in adults in Alberta](#). *Medicine*. 2011;90(3):171-179.
- McGowan CE, Monis A, Bacon BR, et al. [A global view of hepatitis C: physician knowledge, opinions, and perceived barriers to care](#). *Hepatology*. 2013;57(4):1325-1332.
- Mera J, Vellozzi C, Hariri S. [Identification and clinical management of persons with chronic hepatitis C virus infection - Cherokee Nation, 2012-2015](#). *MMWR Morb Mortal Wkly Rep*. 2016;65(18):461-466. doi:10.15585/mmwr.mm6518a2.
- Miller L, Fluker SA, Osborn M, Liu X, Strawder A. [Improving access to hepatitis C care for urban, underserved patients](#)

[using a primary care-based hepatitis C clinic](#). *J Natl Med Assoc*. 2012;104(5-6):244-250.

Morey S, Hamoodi A, Jones D, Young T. [Increased diagnosis and treatment of hepatitis C in prison by universal offer of testing and use of telemedicine](#). *J Viral Hepat*. 2019;26(1):101-108.

Morrill JA, Shrestha M, Grant RW. [Barriers to the treatment of hepatitis C. Patient, provider, and system factors](#). *J Gen Intern Med*. 2005;20(8):754-758.

Moyer VA. [Screening for HIV: US Preventive Services Task Force recommendation statement](#). *Ann Intern Med*. 2013;159(1):51-60.

Mücke MM, Backus LI, Mücke VT. [Hepatitis B virus reactivation during direct-acting antiviral therapy for hepatitis C: a systematic review and meta-analysis](#). *Lancet Gastroenterol Hepatol*. 2018;3(3):172-180.

Newsum AM, Stolte IG, van der Meer JTM. [Development and validation of the HCV-MOSAIC risk score to assist testing for acute hepatitis C virus \(HCV\) infection in HIV-infected men who have sex with men \(MSM\)](#). *Euro Surveill*. 2017;22(21):30540. doi:10.2807/1560-7917.ES.2017.22.21.30540.

Noda K, Yoshihara H, Suzuki K, et al. [Progression of type C chronic hepatitis to liver cirrhosis and hepatocellular carcinoma--its relationship to alcohol drinking and the age of transfusion](#). *Alcohol Clin Exp Res*. 1996;20(1 Suppl):95A-100A.

Owens DK, Davidson KW, Krist AH, et al. [US Preventive Services Task Force. Screening for hepatitis C virus infection in adolescents and adults: US Preventive Services Task Force recommendation statement](#). *JAMA*. 2020. doi:10.1001/jama.2020.1123.

Pakianathan M, Whittaker W, Lee M, et al. [Chemsex and new HIV diagnosis in gay, bisexual and other men who have sex with men attending sexual health clinics](#). *HIV Med*. 2018;19(7):485-490. doi:10.1111/hiv.12629.

Pawlotsky JM. [Use and interpretation of virological tests for hepatitis C](#). *Hepatology*. 2002;36(5 Suppl 1):S65-S73.

Platt L, Minozzi S, Reed J, et al. [Needle syringe programmes and opioid substitution therapy for preventing hepatitis C transmission in people who inject drugs](#). *Cochrane Database of Systematic Reviews*. 2017;9(9). doi:10.1002/14651858.CD012021.pub2.

Poynard T, Bedossa P, Opolon P. [Natural history of liver fibrosis progression in patients with chronic hepatitis C. The OBSVIRC, METAVIR, CLINIVIR, and DOSVIRC groups](#). *Lancet*. 1997;349(9055):825-832.

Puoti M, Lorenzini P, Cozzi-Lepri A, et al. [Incidence and progression to cirrhosis of new hepatitis C virus infections in persons living with human immunodeficiency virus](#). Gori A, Mastroianni C, Rizzardini G, et al., eds. *Clin Microbiol Infect*. 2017;23(4):267.e1-267.e4.

Reilley B, Leston J, Redd JT, Geiger R. [Lack of access to treatment as a barrier to HCV screening: a facility-based assessment in the Indian Health Service](#). *J Public Health Manag Pract*. 2014;20(4):420-423.

Rockey DC, Bissell DM. [Noninvasive measures of liver fibrosis](#). *Hepatology*. 2006;43(2 Suppl 1):S113-S120.

Rossaro L, Torruellas C, Dhaliwal S, et al. [Clinical outcomes of hepatitis C treated with pegylated interferon and ribavirin via telemedicine consultation in Northern California](#). Botros J, Clark G, Li CS, Minoletti MM, eds. *Dig Dis Sci*. 2013;58(12):3620-3625.

Safdar K, Schiff ER. [Alcohol and hepatitis C](#). *Semin Liver Dis*. 2004;24(3):305-315.

Sangiovanni A, Prati GM, Fasani P, et al. [The natural history of compensated cirrhosis due to hepatitis C virus: a 17-year cohort study of 214 patients](#). *Hepatology*. 2006;43(6):1303-1310.

- Schackman BR, Leff JA, Barter DM, et al. [Cost-effectiveness of rapid hepatitis C virus \(HCV\) testing and simultaneous rapid HCV and HIV testing in substance abuse treatment programs](#). *Addiction*. 2015;110(1):129-143. doi:10.1111/add.12754.
- Schackman BR, Gutkind S, Morgan JR, et al. [Cost-effectiveness of hepatitis C screening and treatment linkage intervention in US methadone maintenance treatment programs](#). *Drug Alcohol Depend*. 2018;(185):411-420.
- Schechter-Perkins EM, Miller NS, Hall J, et al. [Implementation and preliminary results of an emergency department nontargeted, opt-out hepatitis C virus screening program](#). *Acad Emerg Med*. 2018;25(11):1226. doi:10.1111/acem.13484.
- Schillie S, Wester C, Osborne M, Wesolowski L, Ryerson AB. [CDC recommendations for hepatitis C screening among adults - United States, 2020](#). *MMWR Recomm Rep*. 2020;69(2):1-17.
- Schulkind J, Stephens B, Ahmad F, et al. [High response and re-infection rates among people who inject drugs treated for hepatitis C in a community needle and syringe programme](#). *J Viral Hepat*. 2019;26(5):519-528.
- Smith BD, Morgan RL, Beckett GA, et al, et al. [Recommendations for the identification of chronic hepatitis C virus infection among persons born during 1945-1965](#). Falck-Ytter Y, Holtzman D, Teo CG, et al., eds. *MMWR Recomm Rep*. 2012;61(RR-4):1-32.
- Smookler D, Vanderhoff A, Biondi MJ, et al. [Reducing read time of point-of-care test does not affect detection of hepatitis C virus and reduces need for reflex RNA](#). *Clin Gastroenterol Hepatol*. 2020;S1542-3565(20):31068-5.
- Stein MR, Soloway IJ, Jefferson KS, Roose RJ, Arnsten JH, Litwin AH. [Concurrent group treatment for hepatitis C: implementation and outcomes in a methadone maintenance treatment program](#). *J Subst Abuse Treat*. 2012;43(4):424-432.
- Sterling RK, Lissen E, Clumeck N, et al. [Development of a simple noninvasive index to predict significant fibrosis in patients with HIV/HCV coinfection](#). *Hepatol*. 2006;43(6):1317-1325.
- Suryaprasad AG, White JZ, Xu F. [Emerging epidemic of hepatitis C virus infections among young nonurban persons who inject drugs in the United States, 2006–2012](#). *Clin Infect Dis*. 2014;(59):1411-1419.
- Talal AH, Andrews P, Mcleod A, et al. [Integrated, co-located, telemedicine-based treatment approaches for hepatitis C virus \(HCV\) management in opioid use disorder patients on methadone](#). *Clin Infect Dis*. 2019;69(2):323-331. doi:10.1093/cid/ciy899.
- Tasillo A, Eftekhari-Yazdi G, Nolen S, et al. [Short-term effects and long-term cost-effectiveness of universal hepatitis C testing in prenatal care](#). *Obstet Gynecol*. 2019;133(2):289-300. doi:10.1097/AOG.0000000000003062.
- Thein HH, Yi Q, Dore GJ, Krahn MD. [Natural history of hepatitis C virus infection in HIV-infected individuals and the impact of HIV in the era of highly active antiretroviral therapy: a meta-analysis](#). *AIDS*. 2008;22(15):1979-1991.
- Trooskin SB, Poceta J, Towey CM, et al. [Results from a geographically focused, community-based HCV screening, linkage-to-care and patient navigation program](#). *J Gen Intern Med*. 2015;30(7):950-957.
- Urbanus AT, van de Laar TJ, Stolte IG, et al. [Hepatitis C virus infections among HIV-infected men who have sex with men: an expanding epidemic](#). *AIDS*. 2009;23(12):F1-F7.
- van de Laar T, Pybus O, Bruisten S, et al. [Evidence of a large, international network of HCV transmission in HIV-positive men who have sex with men](#). *Gastroenterology*. 2009;136(5):1609-1617.
- van de Laar TJ, Matthews GV, Prins M, Danta M. [Acute hepatitis C in HIV-infected men who have sex with men: an](#)

[emerging sexually transmitted infection](#). *AIDS*. 2010;24(12):1799-1812.

vanTilborg M, Al-Marzooqi SH, Wong WWL. [HCV core antigen as an alternative to HCV RNA testing in the era of direct-acting antivirals: retrospective screening and diagnostic cohort studies](#). *Lancet Gastroenterol Hepatol*. 2018;3(12):856-864. doi:10.1016/S2468-1253(18)30271-1.

Vermeersch P, Van RM, Lagrou K. [Validation of a strategy for HCV antibody testing with two enzyme immunoassays in a routine clinical laboratory](#). *J Clin Virol*. 2008;42(4):394-398.

Volk JE, Marcus JL, Phengrasamy T, et al. [No new HIV Infections with increasing use of HIV preexposure prophylaxis in a clinical practice setting](#). *Clin Infect Dis*. 2015;61(10):1601-1603.

Wai CT, Greenon JK, Fontana RJ, et al. [A simple noninvasive index can predict both significant fibrosis and cirrhosis in patients with chronic hepatitis C](#). *Hepatology*. 2003;38(2):518-526.

Wandeler G, Gsponer T, Bregenzer A, et al. [Hepatitis C virus infections in the Swiss HIV cohort study: a rapidly evolving epidemic](#). *Clin Infect Dis*. 2012;55(10):1408-1416.

Ward KM, Falade-Nwulia O, Moon J. [Randomized controlled trial of cash incentives or peer mentors to improve HCV linkage and treatment among HIV/HCV coinfecting persons who inject drugs: the CHAMPS Study](#). *Open Forum Infect Dis*. 2019;6(4):ofz166. doi:10.1093/ofid/ofz166.

Weinbaum C, Lyerla R, Margolis HS, Margolis HS. [Prevention and control of infections with hepatitis viruses in correctional settings](#). *MMWR Recomm Rep*. 2003;52(RR-1):1-36.

Weinbaum CM, Williams IT, Mast EE, Mast EE. [Centers for Disease Control and Prevention \(CDC\). Recommendations for identification and public health management of persons with chronic hepatitis B virus infection](#). *MMWR Recomm Rep*. 2008;57(RR-8):1-20.

Westin J, Lagging LM, Spak F, et al. [Moderate alcohol intake increases fibrosis progression in untreated patients with hepatitis C virus infection](#). *J Viral Hepat*. 2002;9(3):235-241.

Wiley TE, McCarthy M, Breidi L, McCarthy M, Layden TJ. [Impact of alcohol on the histological and clinical progression of hepatitis C infection](#). *Hepatology*. 1998;28(3):805-809.

Williams IT, Bell BP, Kuhnert W, Alter MJ. [Incidence and transmission patterns of acute hepatitis C in the United States, 1982-2006](#). *Arch Intern Med*. 2011;171(3):242-248.

Witt MD, Seaberg EC, Darilay A, et al. [Incident hepatitis C virus infection in men who have sex with men: a prospective cohort analysis, 1984-2011](#). *Clin Infect Dis*. 2013;57(1):77-84.

Wohl DA, Allmon AG, Evon D. [Financial incentives for adherence to hepatitis C virus clinical care and treatment: a randomized trial of two strategies](#). *Open Forum Infect Dis*. 2017;4(2):ofx095. doi:10.1093/ofid/ofx095.

Yehia BR, Schranz AJ, Umscheid CA, Lo Re, V 3rd. [The treatment cascade for chronic hepatitis C virus infection in the United States: a systematic review and meta-analysis](#). *PLoS One*. 2014;9(7):e101554.

Younossi ZM, Zheng L, Stepanova M, Venkatesan C, Mir HM. [Moderate, excessive or heavy alcohol consumption: each is significantly associated with increased mortality in patients with chronic hepatitis C](#). *Aliment Pharmacol Ther*. 2013;37(7):703-709.

Zarski JP, Bohn B, Bastie A, et al. [Characteristics of patients with dual infection by hepatitis B and C viruses](#). *J Hepatol*. 1998;28(1):27-33.

Zibbell JE, Asher AK, Patel RC, et al. [Increases in acute hepatitis C virus infection related to a growing opioid epidemic](#)



---

[and associated injection drug use, United States, 2004 to 2014](#). *Am J Public Health*. 2018;108(2):175-181.

---