Epidemiology of HCV

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More than 150 million people worldwide are infected with the hepatitis C virus (HCV), and HCV-related complications cause up to 500,000 deaths each year.
US Distribution of HCV Genotypes

HCV genotypes 1, 2 and 3 are the most prevalent genotypes in the U.S., representing over 98% of all infections.

Acute HCV

- 2015: 2,436 cases of HCV reported from 41 states
- 0.8 cases/100,000 in U.S.
- TN: 2.6 cases/100,000
- 10 states accounted for about 60% of the cases
- ACTUAL acute cases estimated to be 13.9 times that rate in any given year
- Estimated 33,900 new cases in 2015

### Acute Hepatitis C: 2016 Case Definition

#### Clinical Criteria
An illness with discrete onset of any sign or symptom consistent with acute viral hepatitis (e.g., fever, headache, malaise, anorexia, nausea, vomiting, diarrhea, and abdominal pain),

AND

(a) jaundice, OR

(b) a peak elevated serum alanine aminotransferase (ALT) level >200 IU/L during the period of acute illness.

#### Laboratory Criteria for Diagnosis
- A positive test for antibodies to hepatitis C virus (anti-HCV)
- Hepatitis C virus detection test:
  - Nucleic acid test (NAT) for HCV RNA positive (including qualitative, quantitative or genotype testing)
  - A positive test indicating presence of hepatitis C viral antigen(s) (HCV antigen)*

* When and if a test for HCV antigen(s) is approved by FDA and available.

https://www.cdc.gov/hepatitis/
How many?

Figure 4.1. Reported number of acute hepatitis C cases — United States, 2000–2015

Source: CDC. National Notifiable Diseases Surveillance System.

Hepatitis C Incidence in United States, 1982-2014

FIGURE 1. Acute hepatitis C virus infection incidence rate ratios* — United States, † 2015

* The national rate (0.8 per 100,000 population) is the denominator.
† Seven states have rates at least twice the national average: Indiana, Kentucky, Maine, Massachusetts, New Mexico, Tennessee, and West Virginia. Ten states have rates above the national average (but not twice the national average): Alabama, Montana, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, Utah, Washington, and Wisconsin.

https://www.cdc.gov/hepatitis
Local epidemiology

FIGURE 2. Rate of hepatitis C infection among pregnant women per 1,000 live births, by county — Tennessee, 2014
It’s a rural thing

What age groups?

Figure 4.2. Incidence of acute hepatitis C, by age group — United States, 2000–2015

Source: CDC, National Notifiable Diseases Surveillance System.
Men or women?

Figure 4.3. Incidence of acute hepatitis C, by sex — United States, 2000-2015

Source: CDC, National Notifiable Diseases Surveillance System.
What are the risk factors?

- Injection drug use: 60%
- Sexual: 15%
- Transfusion (before screening): 10%
- Other (hemodialysis; health care work; perinatal): 5%
- Unknown: 10%
Figure 4.5. Availability of information on risk exposures/behaviors associated with acute hepatitis C — United States, 2015

Source: CDC, National Notifiable Diseases Surveillance System.
*Includes case reports indicating the presence of at least one of the following risks 2 weeks to 6 months prior to onset of acute, symptomatic hepatitis C: 1) using injection drugs; 2) having sexual contact with suspected/confirmed hepatitis C patient; 3) being a man who has sex with men; 4) having multiple sex partners concurrently; 5) having household contact with suspected/confirmed hepatitis C patient; 6) having had occupational exposure to blood; 7) being a hemodialysis patient; 8) having received a blood transfusion; 9) having sustained a percutaneous injury; and 10) having undergone surgery.
Figure 4.6a. Acute hepatitis C reports*, by risk exposure/behavior† — United States, 2015

<table>
<thead>
<tr>
<th>Risk Exposure/Behavior</th>
<th>Yes</th>
<th>No</th>
<th>Missing§</th>
</tr>
</thead>
<tbody>
<tr>
<td>Injection-drug use</td>
<td>759</td>
<td>423</td>
<td>1,254</td>
</tr>
<tr>
<td>Men who have sex with men</td>
<td>23</td>
<td>249</td>
<td>1,062</td>
</tr>
<tr>
<td>Sexual contact</td>
<td>6</td>
<td>37</td>
<td>2,393</td>
</tr>
<tr>
<td>Multiple sex partners</td>
<td>213</td>
<td>507</td>
<td>1,716</td>
</tr>
</tbody>
</table>

Source: CDC, National Notifiable Diseases Surveillance System.
*A total of 2,436 case reports of acute hepatitis C were received in 2015.
† More than one risk exposure/behavior may be indicated on each case report.
§ No risk data reported.
¶ A total of 1,334 acute hepatitis C cases were reported among males in 2015.
Locally...

Figure 3.
Estimated rate of people living with diagnosed HIV infection (PLWH) per 10,000 population in and around each vulnerable county at year-end 2012. The weighted average rate of people living with diagnosed HIV infection in the vulnerable county (inset A) and 20 miles beyond the vulnerable county border (inset B) was calculated using the area proportion of each adjacent county within the 20 mile buffer zone and the number of PLWH and county population estimates at year-end 2012. Map produced by the Geospatial Research, Analysis, and Services Program (GRASP).
Hepatitis C

Acute Hepatitis

Chronic Hepatitis 85%

Cirrhosis 20%

Decompensation 6%

HCC* 4%

Death 3.6%

Factors affecting natural history

- HLA type
- Male gender
- Age of onset
- Alcohol
- Interferon

Hepatitis B*
- Alcohol
- Interferon*

Transplantation
HCV in the U.S.

- 2.7-3.9 million in the U.S. with chronic HCV
- Estimated 19,659 deaths in 2014
- HCV is the leading indication for liver transplants in the U.S.

Chronic Hepatitis C: 2016 Case Definition

Clinical Criteria

• No available evidence of clinical and relevant laboratory information indicative of acute infection.

• Most hepatitis C virus (HCV)-infected persons are asymptomatic; however, many have chronic liver disease, which can range from mild to severe.

Laboratory Criteria for Diagnosis

• A positive test for antibodies to hepatitis C virus (anti-HCV)

• Hepatitis C virus detection test:
  ◆ Nucleic acid test (NAT) for HCV RNA positive (including qualitative, quantitative or genotype testing)
  ◆ A positive test indicating presence of hepatitis C viral antigen(s) (HCV antigen)*

* When and if a test for HCV antigen(s) is approved by FDA and available.
Mortality

*Mortality Rates = HBV, HCV, HIV listed as cause of death. Because of decedent can have multiple causes of death, a record listing more than 1 type of infection was counted for each type of infection.

Mortality Estimates going forward

### CDC Testing Recommendations for Chronic Hepatitis C Virus Infection

<table>
<thead>
<tr>
<th>Persons for Whom HCV Testing is Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adults Born During 1945 to 1965</strong></td>
</tr>
<tr>
<td><strong>HCV Testing Recommended for those who:</strong></td>
</tr>
<tr>
<td>• Currently inject drugs</td>
</tr>
<tr>
<td>• Ever injected drugs, including those who injected once or a few times many years ago</td>
</tr>
<tr>
<td>• Persons with selected medical conditions, including persons</td>
</tr>
<tr>
<td>• who received clotting factor concentrates produced before 1987</td>
</tr>
<tr>
<td>• who were ever on long-term hemodialysis</td>
</tr>
<tr>
<td>• with persistently abnormal alanine aminotransferase (ALT) levels</td>
</tr>
<tr>
<td>• who have HIV Infection</td>
</tr>
<tr>
<td>• Were prior recipients of transfusions or organ transplants, including persons who</td>
</tr>
<tr>
<td>• were notified they received blood from a donor who later tested positive for HCV infection</td>
</tr>
<tr>
<td>• received a transfusion of blood, blood components, or organ transplant before July 1992</td>
</tr>
</tbody>
</table>

| **HCV Testing Based on a Recognized Exposure is Recommended for:** |
| • Healthcare, emergency medical, and public safety workers after needle sticks, sharps, or mucosal exposures to HCV-positive blood |
| • Children born to HCV-positive women       |

Note: 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 is recommended.

This model estimated the impact of risk-based HCV testing in conjunction with peginterferon plus ribavirin therapy with the 1945 to 1965 birth cohort testing in conjunction with peginterferon plus ribavirin plus a direct-acting antiviral (DAA).


<table>
<thead>
<tr>
<th>Outcome</th>
<th>Difference (Birth Cohort compared with Risk Based)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cirrhosis Cases Averted</td>
<td>203,238</td>
</tr>
<tr>
<td>Decompensated Cirrhosis Cases Averted</td>
<td>73,689</td>
</tr>
<tr>
<td>Hepatocellular Carcinoma Cases Averted</td>
<td>47,189</td>
</tr>
<tr>
<td>Liver Transplantation Averted</td>
<td>15,484</td>
</tr>
<tr>
<td>Deaths Averted</td>
<td>120,879</td>
</tr>
</tbody>
</table>

**Abbreviations**

PR = peginterferon and ribavirin; DAA = direct-acting antiviral
This model estimated the impact of risk-based HCV testing with the 1946 to 1970 birth cohort testing over a 5-year period. In this model all eligible patients received treatment with peginterferon and ribavirin (and those with genotype 1 also received a direct-acting antiviral).


**Cases Averted with Birth Cohort HCV Testing versus Risk Based HCV Testing**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compensated Cirrhosis</td>
<td>-166,333</td>
</tr>
<tr>
<td>Decompensated Cirrhosis</td>
<td>-83,534</td>
</tr>
<tr>
<td>Hepatocellular Carcinoma</td>
<td>-45,930</td>
</tr>
<tr>
<td>Liver Transplant</td>
<td>-9,580</td>
</tr>
<tr>
<td>HCV-Related Deaths</td>
<td>-77,505</td>
</tr>
</tbody>
</table>
CDC Testing Recommendations for Chronic Hepatitis C Virus Infection

Persons for Whom Routine HCV Testing is of Uncertain Need

- Recipients of transplanted tissue (e.g. corneal, musculoskeletal, skin, ova, sperm)
- Intranasal cocaine and other non-injecting illegal drug users
- Persons with a history of tattooing or body piercing
- Persons with a history of multiple sex partners or sexually transmitted diseases
- Long-term steady sex partners of HCV-positive persons
# CDC Testing Recommendations for Chronic Hepatitis C Virus Infection

## Persons for Whom Routine HCV Testing is Not Recommended
(unless they have risk factors for HCV infection)

- Healthcare, emergency medical, and public safety workers after needle sticks, sharps, or mucosal exposures to HCV-positive blood
- Health-care, emergency medical, and public safety workers
- Pregnant women
- Household (nonsexual) contacts of HCV-positive persons
- General population
Figure 7 AASLD/IDSA/IAS-USA HCV Testing Recommendations


AASLD/IDSA HCV Testing Recommendations

One-time HCV testing is recommended for persons born between 1945 and 1965, without prior ascertainment of risk (and regardless of country of birth)

*Rating: Class 1, Level B*

Other persons should be screened for risk factors for HCV infection, and one-time testing should be performed for all persons with behaviors, exposures, and conditions associated with an increase risk of HCV infection.

1. **Risk behaviors**
   - Injection-drug use (current or ever, including those who injected once)
   - Intranasal illicit drug use

2. **Risk exposures**
   - Long-term hemodialysis (ever)
   - Getting a tattoo in an unregulated setting
   - Healthcare, emergency medical, and public safety workers after needlesticks, sharps, or mucosal exposures to HCV-infected blood
   - Children born to HCV-infected women
   - Prior recipients of transfusions or organ transplants, including persons who:
     - were notified they received blood from a donor who later tested positive for HCV infection
     - received transfusion of blood or blood components, or underwent organ transplant before July 1992
     - received clotting factor concentrates produced before 1987
   - Persons who were ever incarcerated

3. **Other**
   - HIV infection
   - Unexplained chronic liver disease and chronic hepatitis including elevated alanine aminotransferase levels
   - Solid organ donors (deceased and living)

*Rating: Class 1, Level B*