Historical HCV Testing Based Only on Risk Factors

1998 CDC Risk-Based HCV Screening Recommendations

In 1998, the Centers for Disease Control and Prevention (CDC) issued recommendations for risk-based hepatitis C testing as part of an overall strategy to prevent and control HCV infection and HCV-related disease. These recommendations categorize groups of persons who should undergo routine testing for hepatitis C virus (HCV) infection based on their risk for infection and based on a recognized exposure (Figure 1).[1]

2002 NIH Guidelines for HCV High-Risk Testing

In 2002, the National Institutes of Health (NIH) recommended testing for HCV in persons considered at high risk of acquiring HCV infection (Figure 2).[2]

Limitations of Use of Risk-Based HCV Screening Alone

Using the well-publicized CDC and NIH recommendations for risk-based screening, 45 to 85% of adults with chronic HCV infection in the United States were unaware of their HCV infection status.[3,4,5] Problems with using risk-based screening were highlighted in the Chronic Hepatitis Cohort Study survey of 4,689 persons living with HCV infection who were asked about their choice of location and reason for their HCV testing.[6] The study analyzed data from 2006 to 2010 and revealed that 60% of persons living with HCV had their initial testing ordered at a physician's office and 45% underwent testing because of clinical indications related to liver disease; fewer than 25% of the persons with HCV infection had identifiable risk factors for acquiring HCV that would have prompted testing using the 1998 CDC Risk-Based HCV Screening Recommendations.[6] In contrast, 78% of those diagnosed with HCV were born during the time period of 1945 to 1965.[6]
Birth-Cohort (1945-1965) Hepatitis C Testing

2012 Birth-Cohort HCV Testing Recommendations

In 2012, the CDC issued a new recommendation that all adults born from 1945 through 1965 should undergo one-time testing without prior ascertainment of HCV risk status.[5] This recommendation is intended to augment risk-based screening; therefore, HCV screening should continue for persons who have identified risk factors for HCV infection.[5] The recommendations based on birth cohort also state that anyone identified with HCV infection should undergo brief alcohol screening, including intervention as clinically indicated.[5] Persons diagnosed with HCV infection should also be referred to a site where they can receive appropriate clinical care and treatment services for their hepatitis C infection and related conditions.[5]

Selection of 1945 to 1965 Birth-Cohort Testing for Hepatitis C

Among all persons living with chronic hepatitis C infection in the United States, approximately 75% were born during 1945 to 1965.[4,7] This 1945 to 1965 birth cohort is often referred to as the “baby boomers” and the prevalence of anti-HCV in this birth cohort is approximately 3.25%, which is approximately 5-fold greater than among adults born in other years (Figure 3).[5,8,9] Most of the individuals in the 1945 to 1965 birth cohort acquired HCV infection in the 1970s and 1980s.[5] In 2007, persons aged 45 to 64 years (which corresponded to persons born from 1943 through 1962) accounted for 73% of all hepatitis C-related deaths. The CDC selected the 1945-1965 birth cohort as the target population based on data from studies related to HCV prevalence, HCV disease burden, and cost-effectiveness analysis of routine screening.[10]

Cost Effectiveness of 1945 to 1965 Birth-Cohort Testing

Investigators used a simulated model to predict the cost effectiveness of one-time HCV antibody testing for a birth cohort of adults born from 1945 to 1965.[10] In the near future, birth-cohort screening will cost more than risk-based screening but this reverses with a longer duration. Compared with risk-based screening, birth-cohort screening would identify an estimated 808,580 additional cases of hepatitis C (86% of all undiagnosed cases in the birth cohort) at a screening cost of $2874 per case identified. In addition, birth-cohort screening followed by treatment with telaprevir plus peginterferon plus ribavirin in this model, an estimated 121,000 fewer deaths would occur at a cost of $35,700 per quality-adjusted life year saved. When using the standards set by the National Committee on Prevention Priorities, the cost-effectiveness of hepatitis C birth-cohort screening is similar to other widely used screening practices, such as screening for hypertension or colorectal cancer.

CDC Educational Campaign

The CDC has initiated a broad educational campaign both for the public and for medical providers to focus attention on the 1945 to 1965 birth-cohort hepatitis C screening recommendations. The Know More Hepatitis campaign is a national education campaign designed to increase awareness related to the HCV epidemic and to encourage people who may have HCV infection to get tested. The Know More Hepatitis campaign has an array of educational resources, including fact sheets, posters, buttons and badges, sample e-mail announcements, and sample radio scripts.
Impact of Birth-Cohort Hepatitis C Testing

Estimation of Impact on Number of Persons Tested

Using a one-time birth-cohort (1945 to 1965) screening performed over a single year, one analysis estimated that approximately 60.4 million persons would undergo HCV antibody testing compared with 14.8 million using traditional risk-based testing.[10] In a separate study, investigators estimated that using a 1946 to 1970 birth cohort and screening over a 5-year period would result in approximately 101 million persons undergoing HCV antibody testing (compared with 13 million using risk-based screening).[11] These models assume full implementation of testing. If implementation of the birth-cohort HCV screening strategy were similar to what has occurred with colorectal cancer screening, then a more realistic estimate of approximately 12 million persons would undergo HCV antibody testing in the first 3 years of implementation of these recommendations.

Impact on Clinical Outcomes Using 1945-1965 Birth Cohort

Investigators from the CDC compared the impact of two screening strategies: (1) birth-cohort screening combined with therapy that consists of peginterferon and ribavirin (plus a direct-acting agent for patients with genotype-1 HCV), and (2) risk-based screening and treatment with peginterferon plus ribavirin.[10] If fully implemented and assuming use of direct-acting antiviral medications, the birth-cohort screening strategy (when compared with risk-based screening) is estimated to result in 203,000 fewer cases of compensated cirrhosis, 74,000 fewer cases of decompensated cirrhosis, 47,000 fewer cases of hepatocellular carcinoma, 15,000 fewer liver transplants, and 121,000 fewer HCV-related deaths (Figure 4).[10]

Impact on Clinical Outcomes Using 1946 to 1970 Birth Cohort

Using a Markov model for HCV diagnosis, treatment, and disease progression, investigators examined the impact of birth-cohort screening strategy for persons born 1946 to 1970 compared with the traditional risk-based screening strategy (note the birth cohort in this analysis is slightly different than the CDC-recommended 1945 to 1965 birth cohort).[11] The impact of birth-cohort screening strategy when compared with risk-based screening strategy is substantial: approximately 166,000 fewer cases of compensated cirrhosis, 84,000 fewer cases of decompensated cirrhosis, 46,000 fewer cases of hepatocellular carcinoma, 10,000 fewer liver transplants, and 78,000 fewer HCV-related deaths (Figure 5).[11] Although the cost of screening and testing using the 1946 to 1970 birth-cohort screening strategy is significantly more expensive than a risk-based screening strategy, the implementation of this birth-cohort screening provides greater health benefit and reduces lifetime costs related to the management of advanced liver disease.[11]
Expanded Screening for All Adults

Since the release of the 2013 birth-cohort testing recommendations, several key factors have changed that could influence testing recommendations.[12,13] First, the direct-acting antiviral therapy regimens have proven extraordinarily effective, with multiple regimens showing an excellent safety profile and cure rates that exceed 90% in most patients.[14] Following the United States Food and Drug Administration approval of multiple, highly-effective regimens, competitive forces have significantly driven down the cost of therapy. Second, with the ongoing opioid epidemic in the United States, a major increase in new HCV cases have occurred in young adults.[15,16] Taken together, these factors have led to the consideration for expanded HCV testing in the United States to include a strategy of one-time HCV testing of all adults. Indeed, several groups have shown cost effectiveness with an expanded recommendation to perform one-time HCV testing for all adults in the United States.[13,17,18] At this time, however, the CDC does not formally endorse routine one-time HCV testing for all adults in the United States.[19]
Current Hepatitis C Testing Recommendations

Several organizations have issued hepatitis C testing recommendations in recent years. In general, these guidelines all recommend routine HCV testing for persons born during the years 1945 to 1965 and risk-based HIV screening.

CDC Testing Recommendations for Chronic HCV Infection

The CDC currently recommends using both birth-cohort and risk-based HCV screening (CDC HCV Testing Recommendations); the CDC guidance lists three categories for HCV testing: (1) persons for whom HCV testing is recommended, (2) persons for whom routine HCV testing is unclear, and (3) persons for whom HCV testing is not recommended, unless they have risk factors for infection (Figure 6).[19]

AASLD/IDSA HCV Testing Guidance

The American Association for the Study of Liver Diseases (AASLD) and Infectious Diseases Society of America (IDSA) guidance for hepatitis C addresses HCV testing in the section HCV Testing and Linkage to Care.[20] The AASLD/IDSA recommendations for testing incorporate birth-cohort screening as well as testing based on risk behaviors, risk exposures, and medical conditions associated with acquisition of HCV (Figure 7).[20] Note the AASLD/IDSA recommendations for routine HCV testing include persons with intranasal drug use and persons who have obtained a tattoo in an unregulated setting.[20] These recommendations differ from CDC recommendations in that the CDC considers HCV testing of uncertain need with these two risk factors.

2013 USPSTF HCV Screening Recommendations

In 2013, the U.S. Preventive Services Task Force (USPSTF) recommended screening for HCV in persons at risk for acquiring HCV infection (USPSTF Hepatitis C: Screening).[21,22,23] The 2013 USPSTF recommendations for HCV screening were given a B recommendation.[22,23] This publication emphasized offering one-time screening for HCV infection to adults born between 1945 and 1965 and performing risk assessment, emphasizing injection drug use as the most important risk factor for acquiring HCV.[21] The 2013 USPSTF publication also notes that intranasal drug use and getting a tattoo in an unregulated setting are risk factors for HCV infection.

Repeat Testing

The AASLD/IDSA guidelines recommend at least annual HCV testing for persons who inject drugs and for MSM who have HIV infection and have condomless sex with other men. The guidelines also recommend that periodic testing should be offered to persons who have ongoing risk factors for exposure to HCV. The USPSTF recommends persons with continued risk for HCV infection, such as injection drug use, should undergo screening for HCV infection periodically, but note that evidence is lacking to guide how often repeat screening should occur in this setting.
Summary Points

- From 1998 until 2012, risk-based screening (based on risk for HCV infection or based on a recognized HCV exposure) served as the recommended hepatitis C screening strategy in the United States.
- Risk-based hepatitis C screening alone has not been very effective and more than 50% of persons with hepatitis C virus infection were unaware of their HCV infection status with this approach.
- In 2012, the CDC issued recommendations to initiate one-time screening for hepatitis C virus infection in all persons born during 1945 to 1965 (in addition to standard risk-based screening).
- Birth-cohort screening is cost effective and similar in cost to other standard screening measures for other common diseases.
- Full implementation of birth-cohort HCV screening could result in more than a 4-fold increase in HCV testing compared with current risk-based screening.
- Birth-cohort screening linked with effective hepatitis C treatment is predicted to markedly reduce future cases of decompensated cirrhosis, hepatocellular carcinoma, liver transplantation, and HCV-related deaths.
- The AASLD/IDSA and the USPSTF have issued HCV testing recommendations that incorporate birth-cohort screening and testing based on risk behaviors, risk exposure, and medical conditions associated with HCV acquisition.
- Given the extremely high cure rates with current direct-acting antiviral therapy and the surge in HCV infections among young adults in the United States, a future HCV screening strategy may warrant an expanded approach to perform one-time HCV testing of all adults age 18 and older.


20. AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. HCV testing and linkage to care. [AASLD-IDSA Hepatitis C Guidance] -


**References**

- Brady JE, Liffrmann DK, Yartel A, et al. Uptake of hepatitis C screening, characteristics of

- Centers for Disease Control and Prevention (CDC). Know More Hepatitis. [CDC and Know More]


## Figures

**Figure 1 CDC 1998 Risk-Based HCV Screening Recommendations.**


<table>
<thead>
<tr>
<th>1998 CDC Risk-Based HCV Screening Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Persons who should be tested routinely for HCV infection based on their risk for infection</strong></td>
</tr>
<tr>
<td>• Persons who ever injected illegal drugs, including those who injected once or a few times many years ago and do not consider themselves as drug users.</td>
</tr>
<tr>
<td>• Persons with selected medical conditions, including</td>
</tr>
<tr>
<td>- persons who received clotting factor concentrates produced before 1987;</td>
</tr>
<tr>
<td>- persons who were ever on chronic (long-term) hemodialysis; and</td>
</tr>
<tr>
<td>- persons with persistently abnormal alanine aminotransferase levels.</td>
</tr>
<tr>
<td>• Prior recipients of transfusions or organ transplants, including</td>
</tr>
<tr>
<td>- persons who were notified that they received blood from a donor who later tested positive for HCV infection;</td>
</tr>
<tr>
<td>- persons who received a transfusion of blood or blood components before July 1992; and</td>
</tr>
<tr>
<td>- persons who received an organ transplant before July 1992.</td>
</tr>
<tr>
<td><strong>Persons who should be tested routinely for HCV infection based on a recognized exposure</strong></td>
</tr>
<tr>
<td>• Healthcare, emergency medical, and public safety workers after needle sticks, sharps, or mucosal exposures to HCV-positive blood.</td>
</tr>
<tr>
<td>• Children born to HCV-positive women.</td>
</tr>
</tbody>
</table>
Figure 2 NIH 2002 HCV Risk-Based Testing Recommendations.


<table>
<thead>
<tr>
<th>2002 NIH Consensus Guidelines HCV High-Risk Testing Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Persons who should be tested routinely for HCV infection if they are in the following high-risk groups:</strong></td>
</tr>
<tr>
<td>• People who had transfusions of blood or blood products before routine blood screening began</td>
</tr>
<tr>
<td>• People receiving dialysis</td>
</tr>
<tr>
<td>• People who may have had intimate contact with anyone infected with hepatitis C</td>
</tr>
<tr>
<td>• Healthcare workers exposed to infected people</td>
</tr>
<tr>
<td>• Current or former injection-drug users</td>
</tr>
<tr>
<td>• People with abnormal liver tests</td>
</tr>
<tr>
<td>• People who are HIV positive</td>
</tr>
</tbody>
</table>
Figure 3 Prevalence of HCV Antibody by Year of Birth.


**Figure 4 Comparison of HCV Testing Strategies using Risk-Based or 1945 to 1970 Birth Cohort Testing.**

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
Figure 5 Comparison of HCV Testing Strategies using Risk-Based or 1946 to 1970 Birth Cohort Testing.

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

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

#### Persons for Whom HCV Testing is Recommended

<table>
<thead>
<tr>
<th>Adults Born During 1945 to 1965</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCV Testing Recommended for those who:</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.
### 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
**Figure 6 (Image Series) - CDC Testing Recommendations for Chronic Hepatitis C Infection**

**Image 6C: Persons for Whom Routine HCV Testing is Not Recommended**

Centers for Disease Control and Prevention

### 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
- Pregnant women
- Household (nonsexual) contacts of HCV-positive persons
- General population
Figure 7 AASLD/IDSA HCV Testing Recommendations

Source: AASLD-IDSA. Recommendations for testing, management, and treating hepatitis C. HCV testing and linkage to care.

### 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*