Is Elimination of Hepatitis C Possible?

JORGE MERA, MD
CHEROKEE NATION
The presenter has nothing to disclose.
Outline

- Scope of the problem
- Definitions
- Is elimination of HCV needed?
- Conditions needed for elimination
- Steps needed in elimination
- Myths and Facts PWID
- Conclusions

PWID: People who inject drugs
Hepatitis C

PWID

Abuse
Poverty
Education
Inequalities
Psychiatric Disorders

PWID: People Who Inject Drugs
HCV: Transmission

- **Blood**
  - IVDU is the leading cause in the United States
  - Blood transfusion (Before 1992)
  - Percutaneous/mucosal
    - Needle stick
    - Tattoo
    - Dentist

- **Sexual contact**
  - Rare in heterosexual
  - More frequent in MSM

- **Mother-to-child**
  - The rate is 1.7% - 4.3%

*Nosocomial; Health-care work; Perinatal
80% of HCV Transmission Occurs in PWID
Epidemic of Nonmedical Opioid Use in the United States

Hepatitis C Incidence in United States, 1982-2010

Adapted from Hepatitis Web Study & the University of Washington Hepatitis C Online Course

Source: CDC Division of Viral Hepatitis. Statistics and Surveillance.
HCV Incidence:
Oklahoma 2008 - 2010

Cases of Confirmed Acute Hepatitis C

50 % are 25-34 years old
54 % are females
Highest rates are in Native Americans

OSHD Website
Trends in Incidence of Acute Hepatitis C Among Young Persons Reported to the CDC

“All available information indicates that early prescription opioid abuse and addiction, followed by initiation to IDU, is fueling increases in HCV infection among young PWID”
## HCV Prevalence by Race and Sex

### United States\(^1,\(^2\)

<table>
<thead>
<tr>
<th>Race</th>
<th>Sex</th>
<th>Anti-HCV Positive (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td>H</td>
<td></td>
<td>1.3</td>
</tr>
<tr>
<td>M</td>
<td></td>
<td>2.1</td>
</tr>
<tr>
<td>F</td>
<td></td>
<td>1.1</td>
</tr>
</tbody>
</table>

*\(P < .005\) for H compared to B and W,
*\(P < .05\) for M compared to W.*

### Cherokee Nation\(^3\)

- **07/2012 – 07/2013:** 5.6%

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HCV-Infected Persons in the US: Estimated Rates of Detection, Referral to Care and Cure

CDC & USPSTF recommend 1-time testing of baby boomers (born 1945-1965)

Cherokee Nation HCV Cascade of Care:

- **HCV infected**: 4000 patients
- **HCV confirmed**: 13% (528 patients)
- **HCV engaged in care**: 4% (22% of infected, 228 patients)
- **HCV retained in care**: 9% (936 patients)
- **HCV treated**: 4% (374 patients)
- **HCV cured**: 2% (111 patients)

**Number of HCV Positive Patients**

Jorge Mera, Personal Communication
Stratification of the HCV Cascade of Care?

CURRENT PWID

<table>
<thead>
<tr>
<th>Status</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated</td>
<td>350</td>
</tr>
<tr>
<td>Confirmed</td>
<td>76</td>
</tr>
<tr>
<td>Engaged in</td>
<td>23</td>
</tr>
<tr>
<td>Treated</td>
<td>10</td>
</tr>
<tr>
<td>Cured</td>
<td>7</td>
</tr>
</tbody>
</table>

BABY BOOMERS

<table>
<thead>
<tr>
<th>Status</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated</td>
<td>2341</td>
</tr>
<tr>
<td>Confirmed</td>
<td>1500</td>
</tr>
<tr>
<td>Engaged in Care</td>
<td>1000</td>
</tr>
<tr>
<td>Cured</td>
<td>750</td>
</tr>
</tbody>
</table>

Number of patients
Goals of HCV Treatment

- **Decreasing the HCV related morbidity and mortality**
  - Baby boomer screening and treatment

- **Decreasing the transmission of HCV**
  - Screen and treat PWID
  - Screen and treat other potential high risk groups
    - Unprofessional tattooing
    - Pregnancy screening?
    - HIV + MSM
    - Prescribed opioid abusers?
Prioritization: Liver Disease Burden vs Infection Prevention

Greatest Impact in the Decrease of Transmission

Greatest impact in Mitigation of Liver Disease

Adapted from Grebley J et al: CID 2013
Definitions

• **Control:**
  - The reduction of disease incidence, prevalence, morbidity or mortality to a *locally acceptable level* as a result of deliberate efforts; continued intervention measures are required to maintain reduction. *Example:* diarrheal diseases

• **Elimination:**
  - Reduction to zero of the incidence of infection caused by a specific agent in a *defined geographical area* as a result of deliberate efforts; continued measures to prevent re-establishment of transmission are required. *Example:* measles, poliomyelitis.

• **Eradication**
  - *Permanent reduction to zero of the worldwide* incidence of infection caused by a specific agent as a result of deliberate efforts; *intervention measures are no longer needed.* *Example:* Smallpox

• **Extinction:**
  - The specific infectious agent *no longer exists in nature or in the laboratory.* *Example:* none

Miller M. et al. In Disease Control Priorities in Developing Countries: 2nd Edition 2006
Is HCV Elimination Needed?`

HCV-Associated US Deaths From 1999 to 2007

Projected Cirrhosis in Patients Infected With HCV


Trends in Incidence of Acute Hepatitis C Among Young Persons Reported to the CDC

“All available information indicates that early prescription opioid abuse and addiction, followed by initiation to IDU, is fueling increases in HCV infection among young PWID”

Adapted from Suryaprasad AG et al. CID 2014:59 (15 November) • 1411-19
Criteria for Eradication to be Technically Feasible

- No non-human reservoir and the organism cannot multiply in the environment
- There are simple and accurate diagnostic tools
- Practical interventions to interrupt transmission
- The infection can in most cases be cleared from the host

Hopkins DR NEJM 2013. 368;1
Criteria for Eradication to be Technically Feasible

<table>
<thead>
<tr>
<th>In General¹</th>
<th>Hepatitis C Virus</th>
</tr>
</thead>
<tbody>
<tr>
<td>No non-human reservoir and the organism can not multiply in the environment</td>
<td>✔</td>
</tr>
<tr>
<td>There are simple and accurate diagnostic tools</td>
<td>Rapid screening available</td>
</tr>
<tr>
<td>Practical interventions to interrupt transmission</td>
<td>Needle exchange programs</td>
</tr>
<tr>
<td>The infection can in most cases be cleared from the host</td>
<td>Treatment is 90% curative</td>
</tr>
</tbody>
</table>

¹ Hopkins DR NEJM 2013. 368;1
<table>
<thead>
<tr>
<th>Problems in HCV Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most Infections are chronic</td>
</tr>
<tr>
<td>- Are potential transmitters</td>
</tr>
<tr>
<td>- Long asymptomatic period</td>
</tr>
<tr>
<td>- Most are unaware of their infection</td>
</tr>
<tr>
<td>Treatment is costly</td>
</tr>
<tr>
<td>No Vaccine</td>
</tr>
<tr>
<td>Few clinicians have experience in its management</td>
</tr>
<tr>
<td>The populations most affected are burdened by</td>
</tr>
<tr>
<td>- Severe stigma</td>
</tr>
<tr>
<td>- Social marginalization</td>
</tr>
<tr>
<td>- Not represented</td>
</tr>
</tbody>
</table>

Edlin BR, Winkelstein ER/ Antiviral Research 110 (2014) 79-93
## Solutions for the Elimination of HCV

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most Infections are chronic</td>
<td>Will need widespread screening</td>
</tr>
<tr>
<td>- Are potential transmitters</td>
<td></td>
</tr>
<tr>
<td>- Long asymptomatic period</td>
<td></td>
</tr>
<tr>
<td>- Most are unaware of their infection</td>
<td></td>
</tr>
<tr>
<td>Treatment is costly</td>
<td>Patient assistance programs</td>
</tr>
<tr>
<td></td>
<td>Pharma – Insurance -Government</td>
</tr>
<tr>
<td>No Vaccine</td>
<td>Research stage</td>
</tr>
<tr>
<td>Few clinicians have experience</td>
<td>ECHO model</td>
</tr>
<tr>
<td>The most affected are burdened by</td>
<td>Mitigate Stigma (decriminalize)</td>
</tr>
<tr>
<td>- Severe stigma</td>
<td>Address social Issues</td>
</tr>
<tr>
<td>- Social marginalization</td>
<td>Advocacy</td>
</tr>
<tr>
<td>- Not represented</td>
<td></td>
</tr>
</tbody>
</table>

1. Edlin BR, Winkelstein ER/ Antiviral Research 110 (2014) 79-93
Progress in Eradication/Elimination

- 4/5 of the WHO diseases targeted for eradication/elimination do not have a vaccine available
  - Guinea Worm (Dracunculiasis)
    - Cases of guinea worm are down from 3.5 million in 1986 to 148 cases in 2013 despite the lack of vaccines or curative therapy
  - Lymphatic filariasis
  - Onchocerciasis (River blindness)
  - Malaria
- Poliomyelitis: No treatment available

Hopkins DR NEJM 2013. 368;1
Critical Steps Towards HCV Elimination

- Epidemiology and Surveillance
- Prevention
- Treatment as prevention
- Policy
- Research
- Reevaluate Strategy

HCV Elimination
Epidemiology

- Determine HCV incidence and prevalence.
  - PWID
  - PWUD
  - Tattooing?
  - HIV MSM?
  - Other

- Identify geographic hot spots

- Determine dynamics of transmission
  - Mathematical modeling

Martin NK et al. J Hepatol 2011; 54:1137–4
Edlin BR, Winkelstein ER/ Antiviral Research 110 (2014) 79-93
Can antiviral therapy for HCV reduce the prevalence of HCV among injecting drug user populations?

Considering a baseline HCV prevalence of 20%:

<table>
<thead>
<tr>
<th>Number Needed to treat per 1000 PWID every year</th>
<th>% Reduction in prevalence in 10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>20</td>
<td>62</td>
</tr>
<tr>
<td>40</td>
<td>72</td>
</tr>
</tbody>
</table>

Martin NK et al. J Hepatol 2011; 54:1137–44.
## Modelling Indicates If Elimination May Be Feasible in PWID

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Edinburgh</th>
<th>Melbourne</th>
<th>Vancouver</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCV prevalence in PWID</td>
<td>25% (n= 4240)</td>
<td>50% (n= 25,000)</td>
<td>65% (n= 13,500)</td>
</tr>
<tr>
<td>Baseline treatment rate per 1000 PWID/year</td>
<td>8</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Prevalence reduction if treatment is scaled up to 40 PWID/1000 PWID per year</td>
<td>95 %</td>
<td>54 %</td>
<td>22 %</td>
</tr>
</tbody>
</table>

Gore: CROI 2015, Martin N et al Hepatology 2013:581598-1609

PWID: People Who Inject Drugs
12% of PWID will be incarcerated each year
33% of PWID are on OST clinics
Incidence of HCV in PWID is around 15% per year

Gore: CROI 2015
Surveillance

- Accurate incidence and prevalence measures are critical

- For elimination the “real Incidence/prevalence” needs to be measured in PWID
  - Usually difficult to access populations

- Evaluate emerging risk groups
  - Prescription opioid users
  - HIV + MSM
  - Unprofessional tattooing?

Prevention

- **Prevention of Drug Use**
  - Address poverty, inequalities, education, abuse etc.

- **Prevention of IVDU**
  - Education
  - Opioid substitution programs

- **Treatment as prevention**

- **Harm reduction strategies in combination**

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**A Cost Effective Prevention Method for HCV Transmission**


A Sterile Syringe and Needle
# Myths and Facts about HCV in PWID

<table>
<thead>
<tr>
<th>Myths</th>
<th>Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCV treatment is not as effective in PWID</td>
<td>HCV treatment is as effective in PWID compared to people who don’t inject drugs&lt;sup&gt;1,2&lt;/sup&gt;</td>
</tr>
<tr>
<td>PWID do not want treatment</td>
<td>Willingness to be treated in PWID increased to 93% when offered appropriately&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Reinfection rates in PWID are extremely high</td>
<td>Reinfection rates are 1% -5% per year&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

1. Aspina; et al, 2013  
2. Dimova et al, 2013  
3. Doab et al, 2005
<table>
<thead>
<tr>
<th>Myths</th>
<th>Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>To achieve HCV elimination every PWID needs to be treated</td>
<td>A small portion of PWID needs to be treated per year to achieve elimination¹</td>
</tr>
<tr>
<td>HCV treatment in PWID is not cost effective</td>
<td>HCV treatment of active PWID may be more cost-effective²</td>
</tr>
</tbody>
</table>

¹ Grebely et al 2013  ² Martin et al 2012
What are we doing at the individual level to decrease the burden of liver disease at CN?

- Escalate the screening, engagement in care and treatment of baby boomers
  - EHR reminder
  - Consider expanding age targeted screening to people 20 years and older?
  - Use of rapid tests
  - Incorporating primary care providers in the treatment of HCV through the ECHO Project
  - Incorporating Pharmacists in the delivery and follow-up of treatments of patients with HCV

CN: Cherokee Nation   EHR: Electronic health record   ECHO: Extended community health outcomes
<table>
<thead>
<tr>
<th>Genotype</th>
<th>Providers (n)</th>
<th>% of Total HCV Patients</th>
<th>Total Nº of Patients</th>
<th>Nº of Patients to Treat per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1 Treatment Naïve/Non Cirrhotic</td>
<td>PCP (56)</td>
<td>42 %</td>
<td>2100</td>
<td>5 years: 8; 3 years: 12</td>
</tr>
<tr>
<td>G2 and G3 Treatment Naïve/Non Cirrhotic</td>
<td>Pharmacist (28)</td>
<td>20 %</td>
<td>1000</td>
<td>5 years: 7; 3 years: 12</td>
</tr>
<tr>
<td>G1/2/3 Treatment experienced or Cirrhotic or Acute HCV</td>
<td>HCV Experienced Providers (7)</td>
<td>38 %</td>
<td>1900</td>
<td>5 years: 54; 3 years: 90</td>
</tr>
</tbody>
</table>

Based on the expected number of patients with HCV n= 5000
What Are we doing at the population level to decrease transmission at CN?

- Partnered with the CDC, OUHSC and OHSD to
  - Develop strategies to detect acute HCV and contact follow-up
  - Perform a seroprevalence study in PWID/ED/UC/GP/pregnant patients
  - Evaluating PWID to determine the dynamics of transmission of HCV

- Partnering with Yale University to
  - Develop mathematical models based on the dynamics of transmission
  - Plan interventions based on the mathematical models

- Evaluating the most efficient way of reaching PWID for treatment
  - Prison ?, Rehab centers ? Hospital ? Behavioral Health ?

- Need to discuss with authorities the need and feasibility of implementing and or expanding needle exchange programs and opioid substitution programs

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PWID: People Who Inject Drugs, ED: Emergency Department, UC: Urgent Care, GP: General population
OU: Oklahoma University Health Science Center, OSHD: Oklahoma State Health Department
Conclusions

• Elimination of HCV in Native Americans is possible but not effortless

• The tools for elimination are available

• HCV elimination will need the involvement of political leaders, policy makers, public health officials, medical providers, scientists, epidemiologist and activists from the community
“Eradication and elimination are laudable goals, they are the ultimate goals of public health. These goals carry great responsibility and there is no room for failure. The question is whether these goals are to be achieved in the present or some future generation”

Walter R. Dowdle “The Principles of disease Elimination and Eradication”
MMWR December 31, 1000/48(SU01);23-7
Hepatitis C Free Cherokee Nation