Hepatitis C Virus Infection among Persons who Inject Drugs

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HCV in the United States

- 4.1 million anti-HCV infected persons, with 75% of these chronic infections (3.2 million)
- 45-85% of those infected are unaware of infection
- The most common bloodborne infection in the United States
- HCV-related deaths doubled from 1999-2007 to over 17,000/year
  - Expected to increase to 35,000/year without intervention
- Leading cause of liver transplants and liver cancer [hepatocellular carcinoma (HCC)]
  - HCC fasting rising cause of cancer-related death

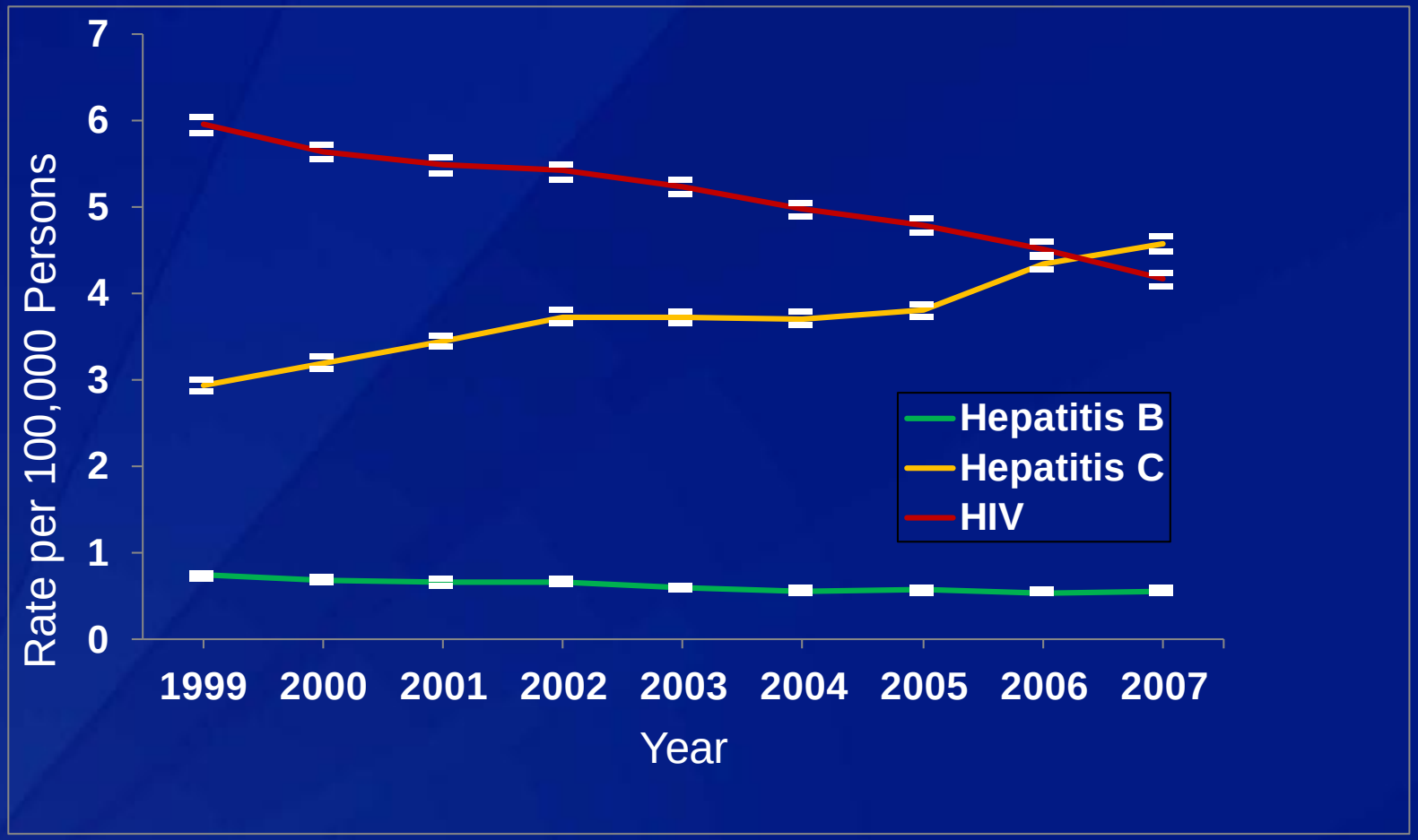
Armstrong et al. *Ann Intern Med*, 2006

HCV Infections among PWID

- **Injection drug use** (IDU) is the principle "motor" of HCV incidence[1]
- HCV antibody (anti-HCV) **prevalence** between 30% and 70%[2]
- anti-HCV prevalence among **young injectors** (18—29 yo.) between 10% and 36%[3]
- anti-HCV **incidence** between 16% and 42% per year[4]

[1]Hagan et al. 2010; Garfein et al. 1998; [2]Armstrong et al. 2006, Amon et al. 2008; [3]Klevens et al. 2013 Daniels et al. 2007; [4] Amon et al. 2008

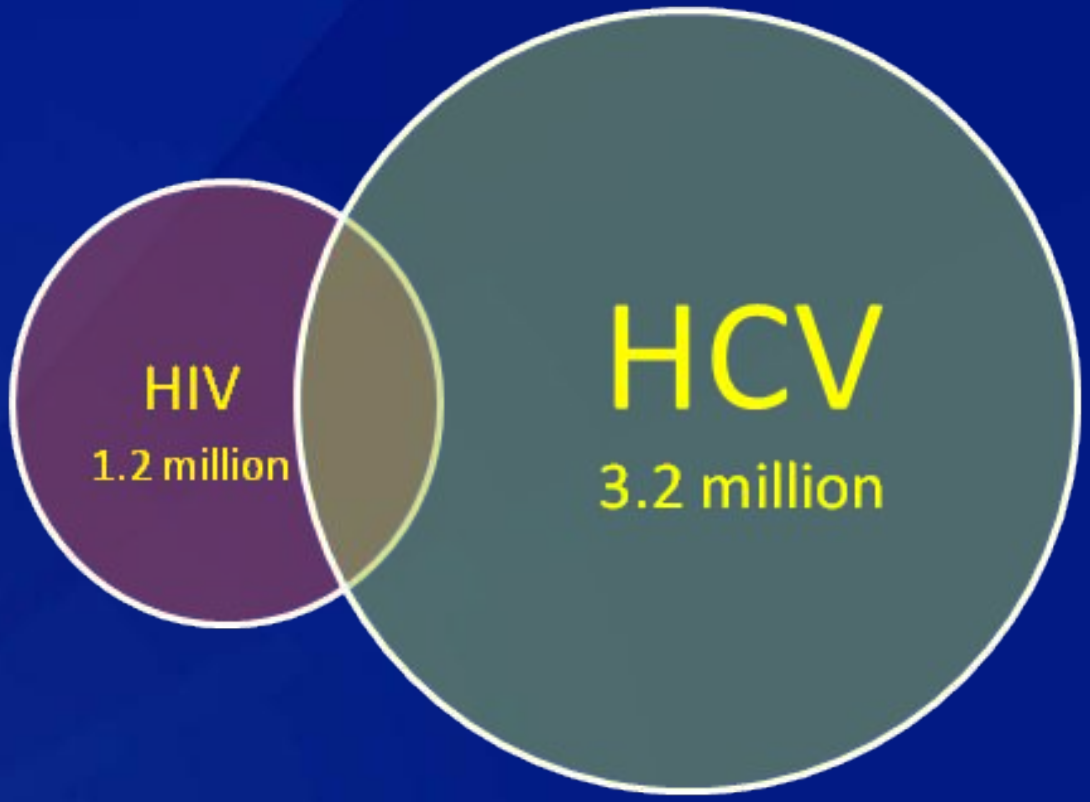
Age-Adjusted Rates of Mortality: Hepatitis B, Hepatitis C, and HIV, United States, 1999–2007*



- In 2007, > 70% of registered deaths in HCV-infected were aged 45-64 years old

*Ly et al. The increasing burden of mortality from viral hepatitis in the United States between 1999 and 2007. Ann Intern Med. 2012, June 5: 156(4):271-8

HIV/HCV Co-infection



HCV's Behavioral Risk Profile

Viral Infectivity of HCV persists for:

--Up to 63 days in syringe barrel and dead space

--Up to 21 days in H2O in plastic container

--Up to 14 days on inanimate faces (cookers and inj. surfaces)

--Up to 24 hours in filter; and 48 hours when foil-wrapped

HCV-contaminated solution needs to be heated for almost a 90 seconds and reach temperatures of 144°F for infectivity to be at undetectable levels.

Doerrbecker et al. Inactivation and survival of hepatitis C virus on inanimate surfaces. *JID*, 2011

Doerrbecker et al. Transmission of Hepatitis C Virus Among PWID: Viral Stability and Association With Drug Preparation Equipment, *JID*, 2012

Paintsil et al. Survival of Hepatitis C Virus in Syringes: Implication for Transmission among Injection Drug Users. *JID*, 2010

HCV presents a unique set of behavioral risks for PWID

HCV's protracted infectivity and environmental stability has the potential to transform the entire injection episode into a substantial risk factor since the setting itself contains a plethora of mandatory equipment that can harbor and transmit HCV.

These viral characteristics transform **every** piece of injecting equipment —syringes, cookers, filters, rinse water, mixing water, alcohol swabs, tourniquets and injecting surfaces— into a *primary* transmission vector.

Preparation Equipment

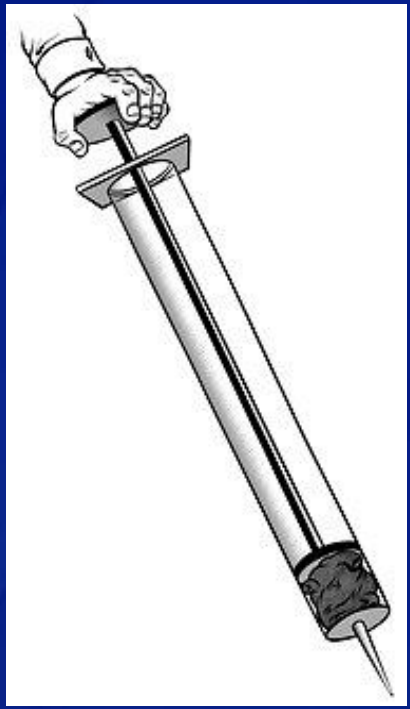
Filters

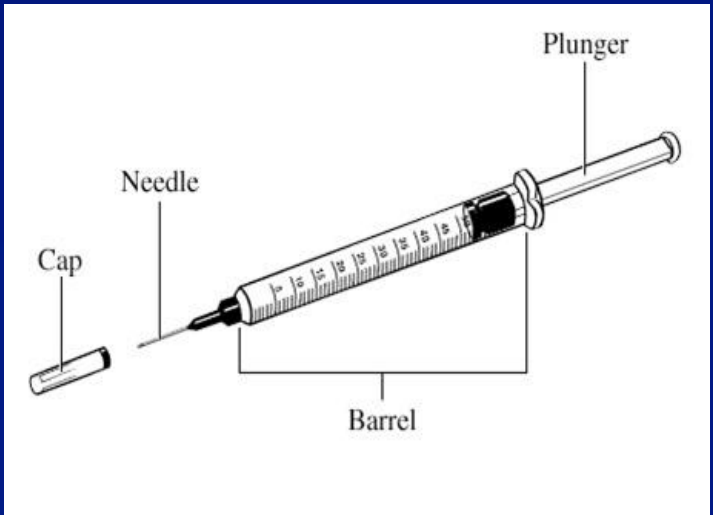
Cookers

Water

Surfaces

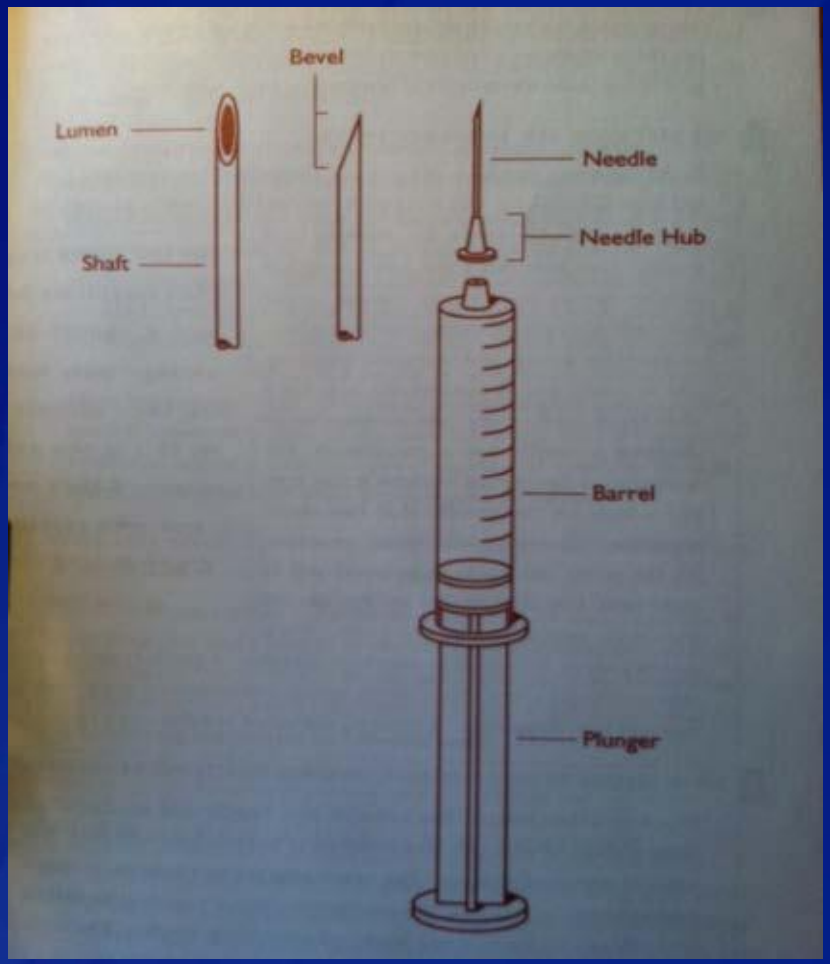
Needles and Syringes





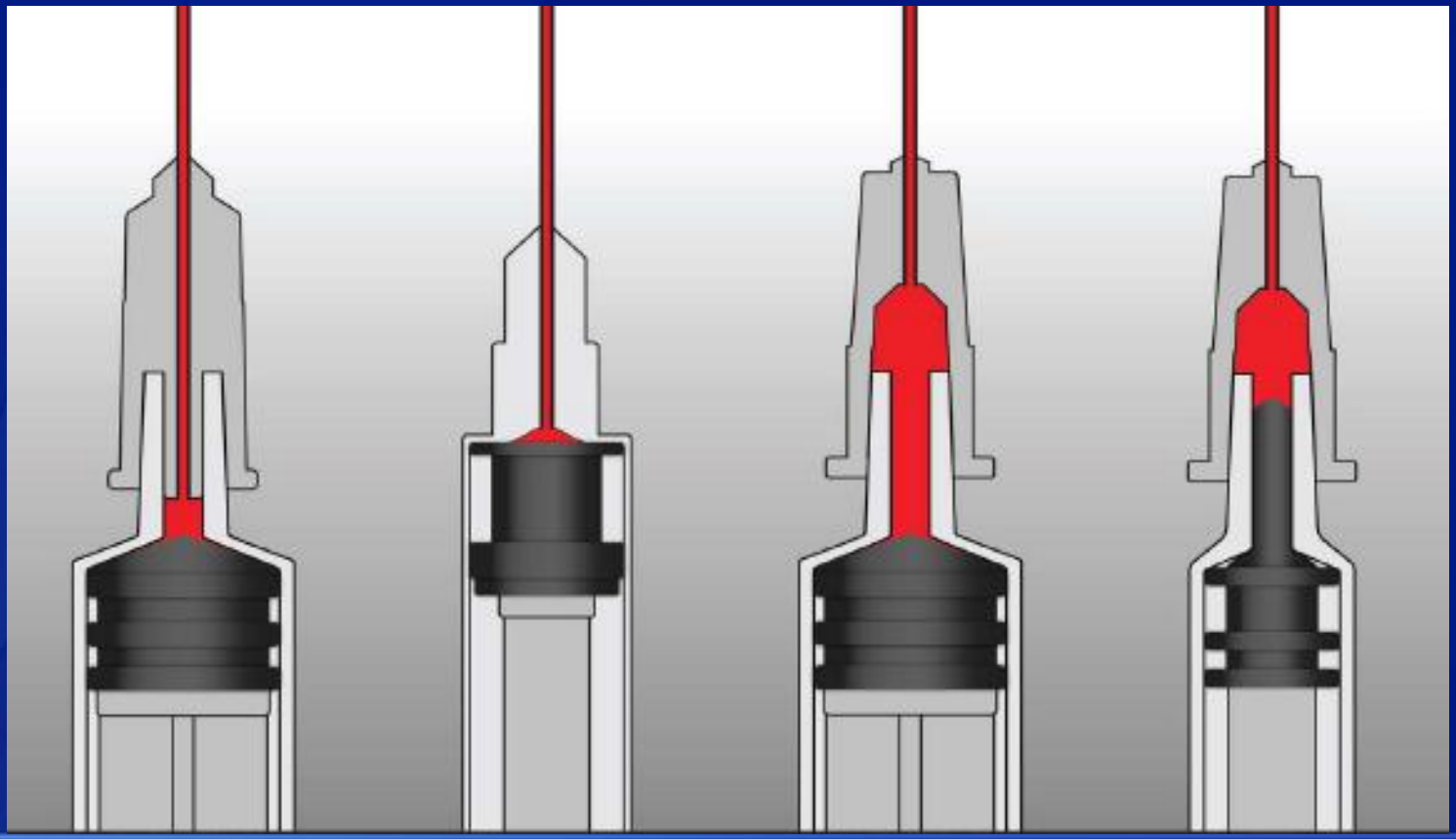
Fixed (i.e. Integrated) Needles

Detachable Needles

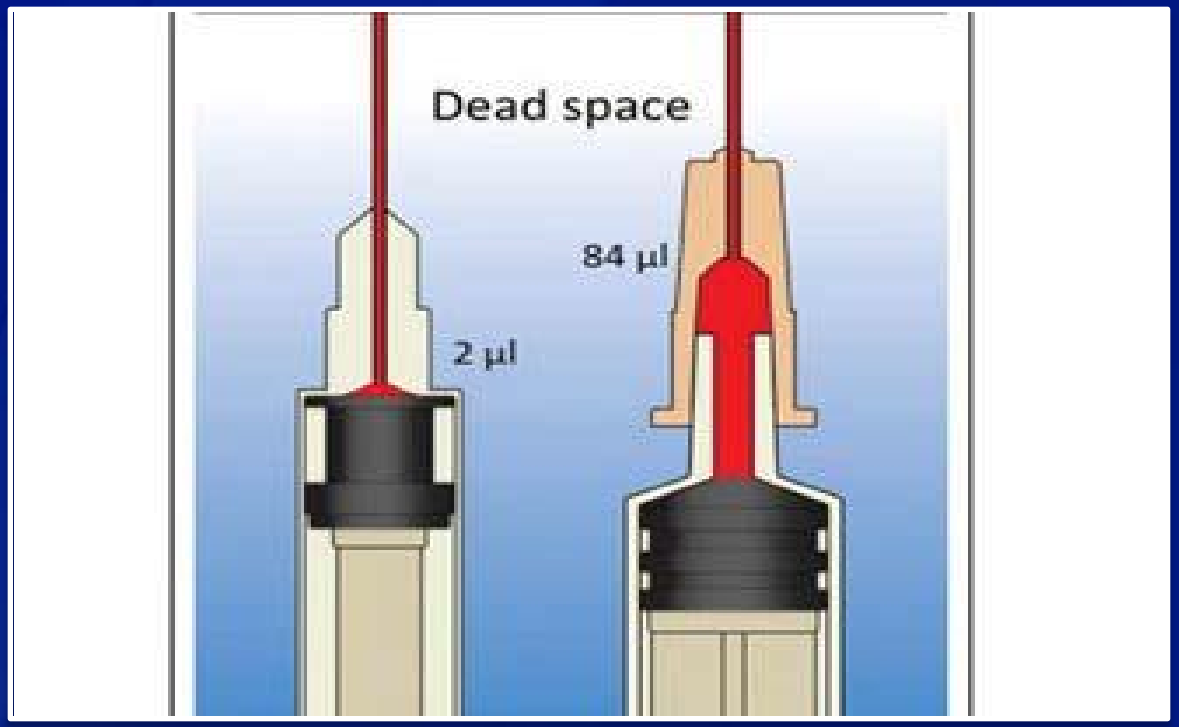


Dead Space – all syringes have it

The space between the tip of the syringe —i.e. the hub of the needle— and the needle itself contains small amounts of solution when the plunger is fully depressed



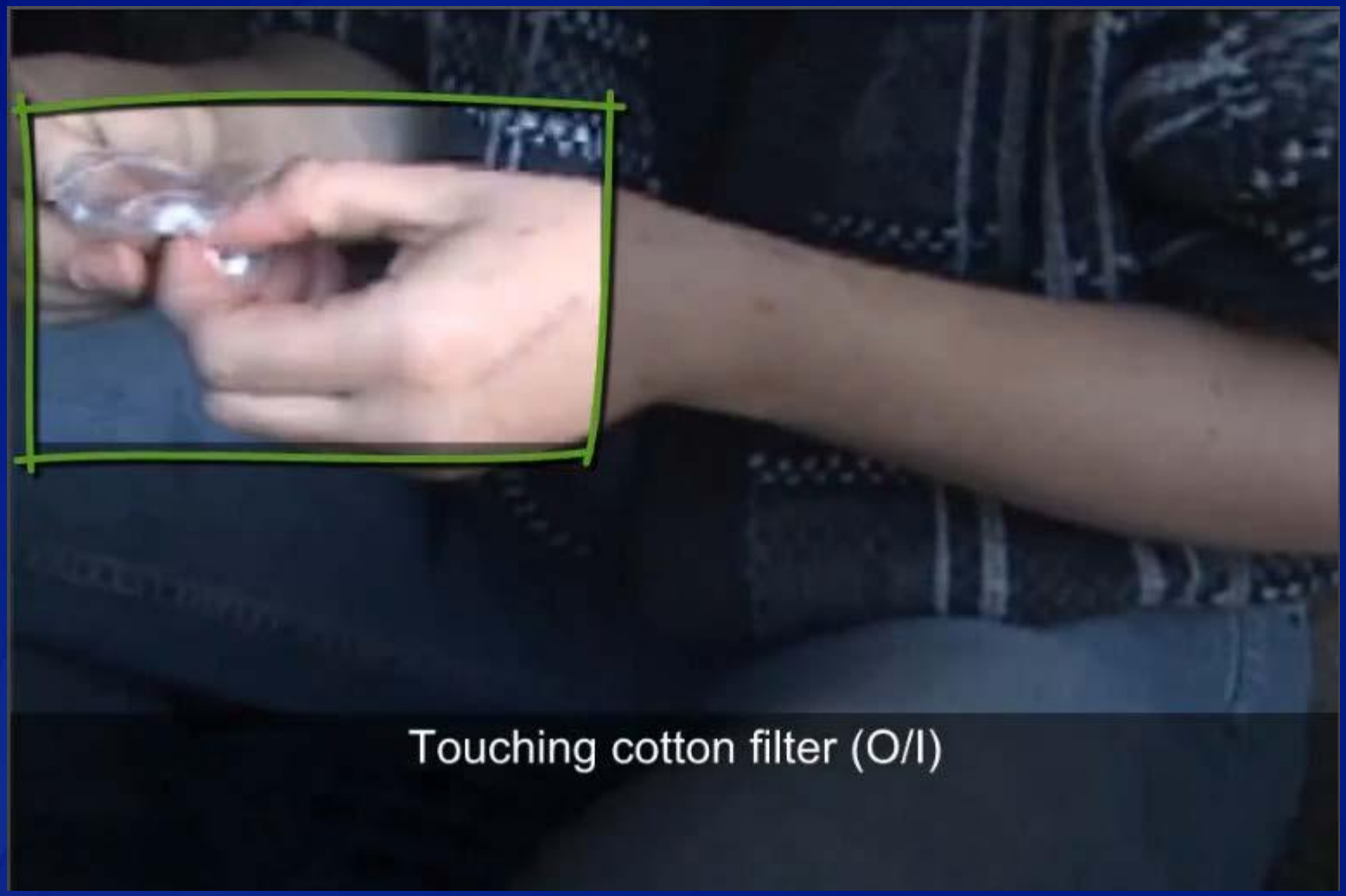
Mean volume of fluid retained with plunger depressed

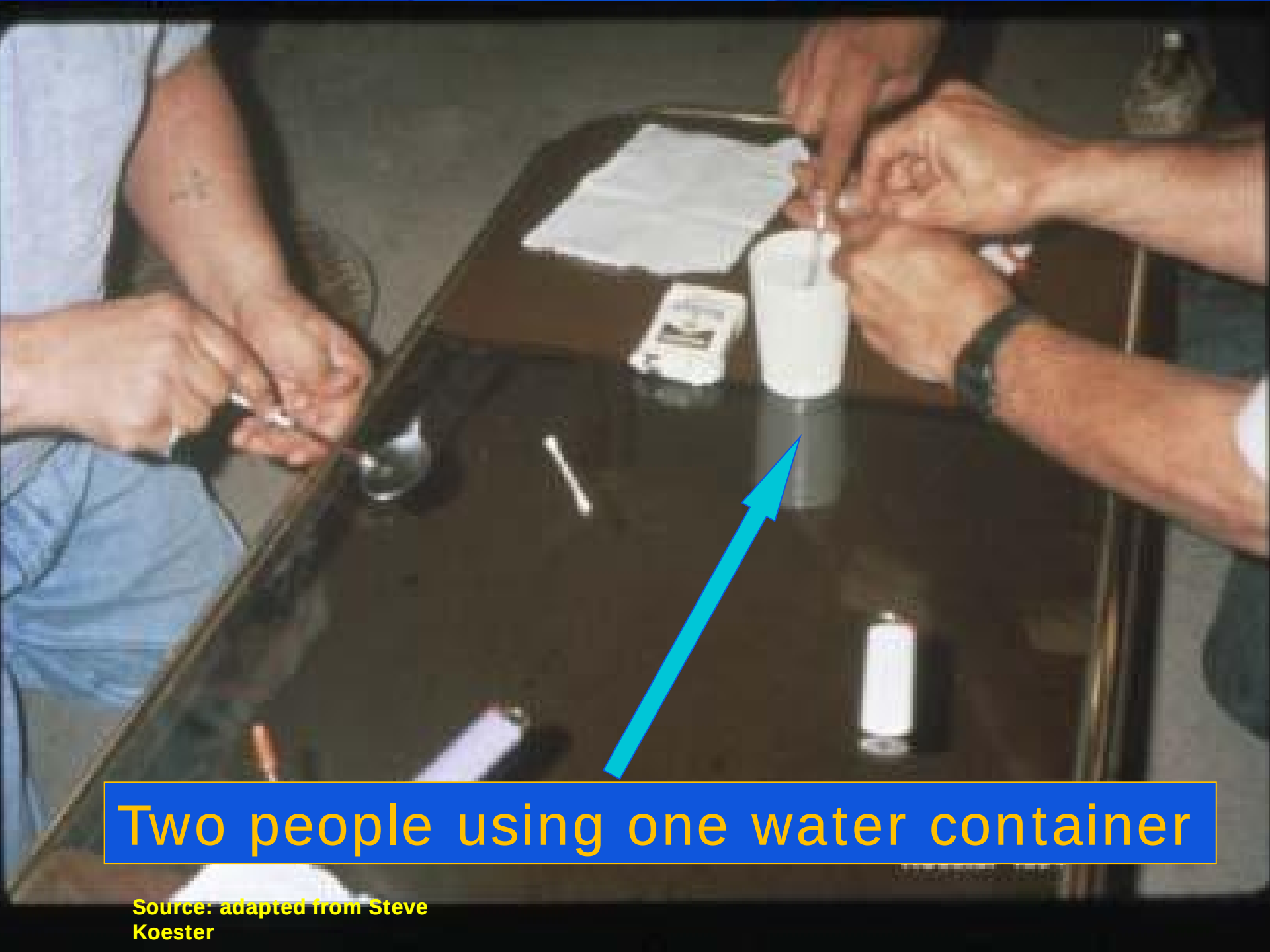


HDSS are able to retain 40 times more blood after rinsing than LDSS

Bloody Fingers

fingers on cooker and in solution


Touching cotton filter (O/I)



Two people using one water container

Source: adapted from Steve Koester

“Fishing” for a Vein

A New Kit for Every Hit!

Increasing reports of injection-related HCV infections among persons under 30

- **Massachusetts**

MMWR, Hepatitis CVirus Infection Among Adolescents and Young Adults – Massachusetts, 2002—2009, May 6, 2011 / 60(17);537-541

- **Upstate New York**

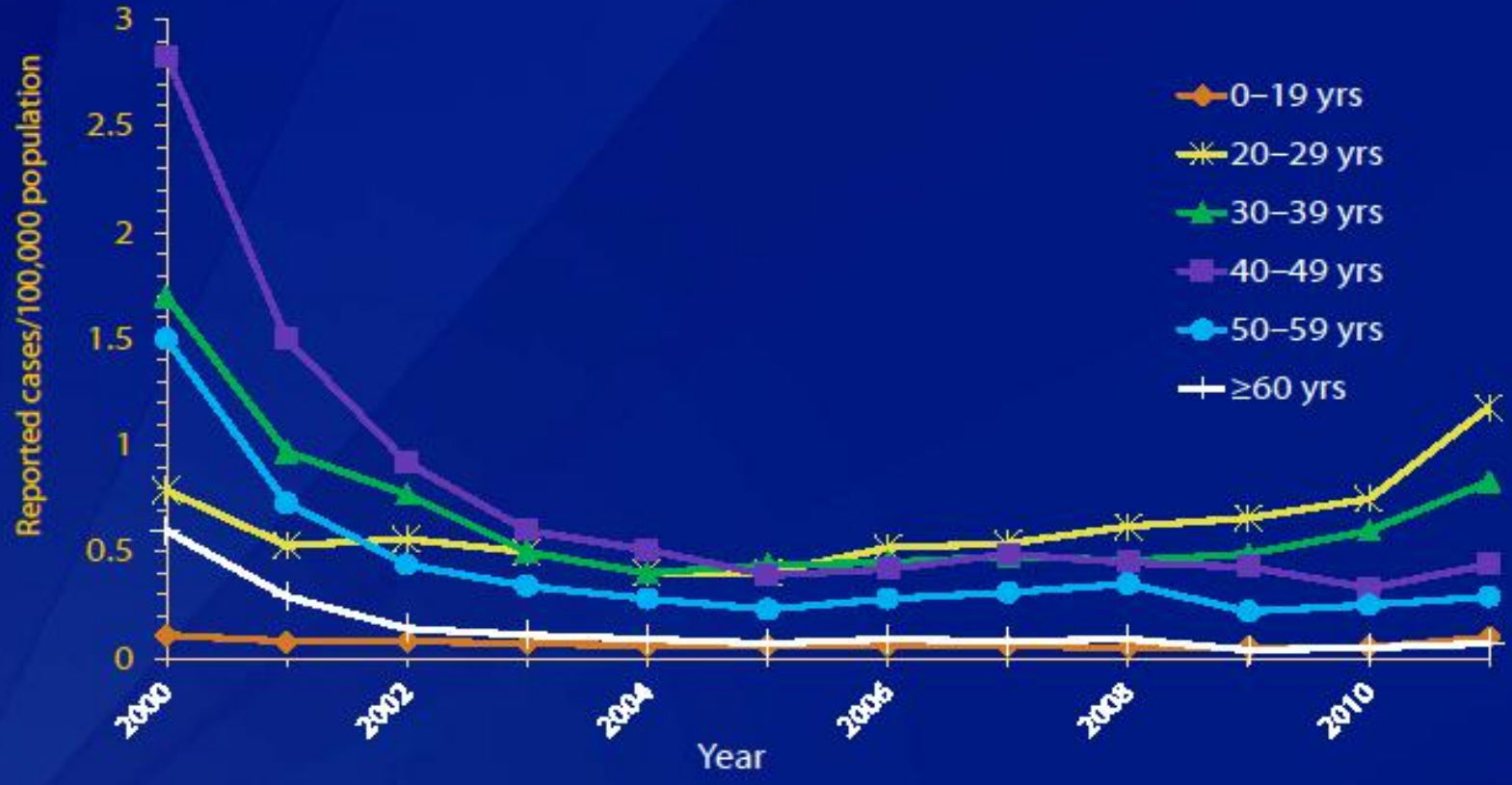
MMWR. Use of enhanced surveillance for hepatitis C virus infection to detect a cluster among young injection drug users---New York, November 2004—April 2007. 2008; 57:517—21.

- **Wisconsin**

MMWR, Notes from the Field: Hepatitis CVirus Infections among young adults – rural Wisconsin, 2010, May 18, 2012 / 61(19);358-358

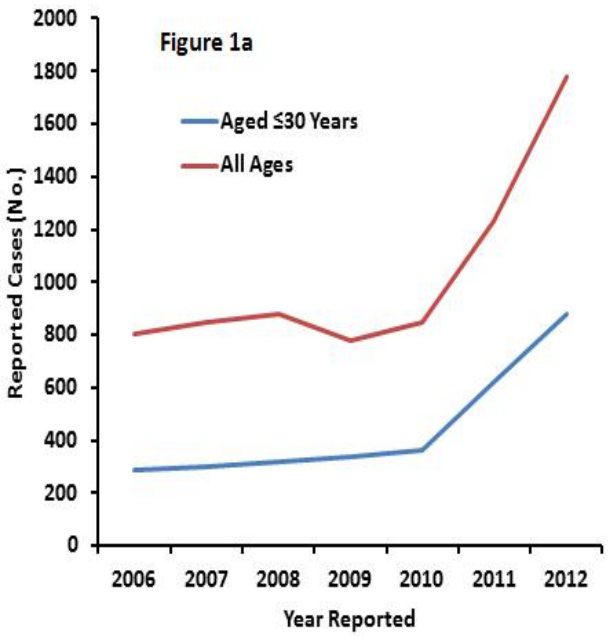
- Additional states reporting increases in HCV cases: Alabama, Colorado, Connecticut, Georgia, Indiana, Kentucky, Maine, Maryland, Montana, New Mexico, North Carolina, Oregon, Tennessee, Washington and West Virginia

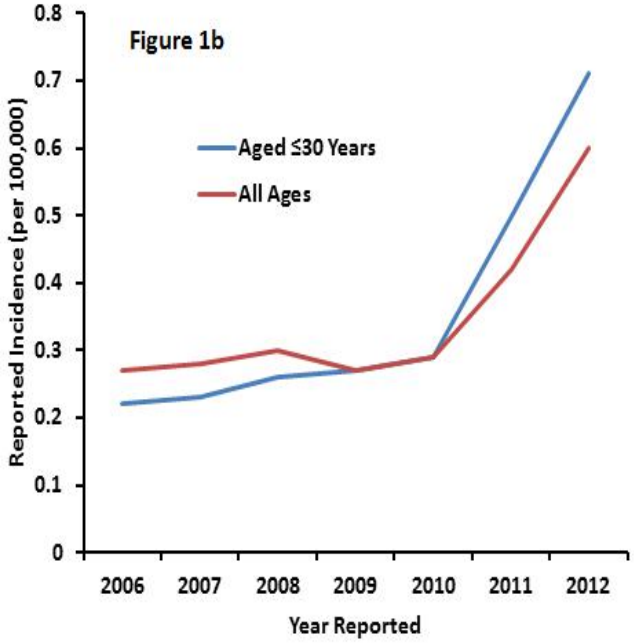
Figure 4.2. Incidence of acute hepatitis C, by age group — United States, 2000–2011



Source: National Notifiable Diseases Surveillance System (NNDSS)

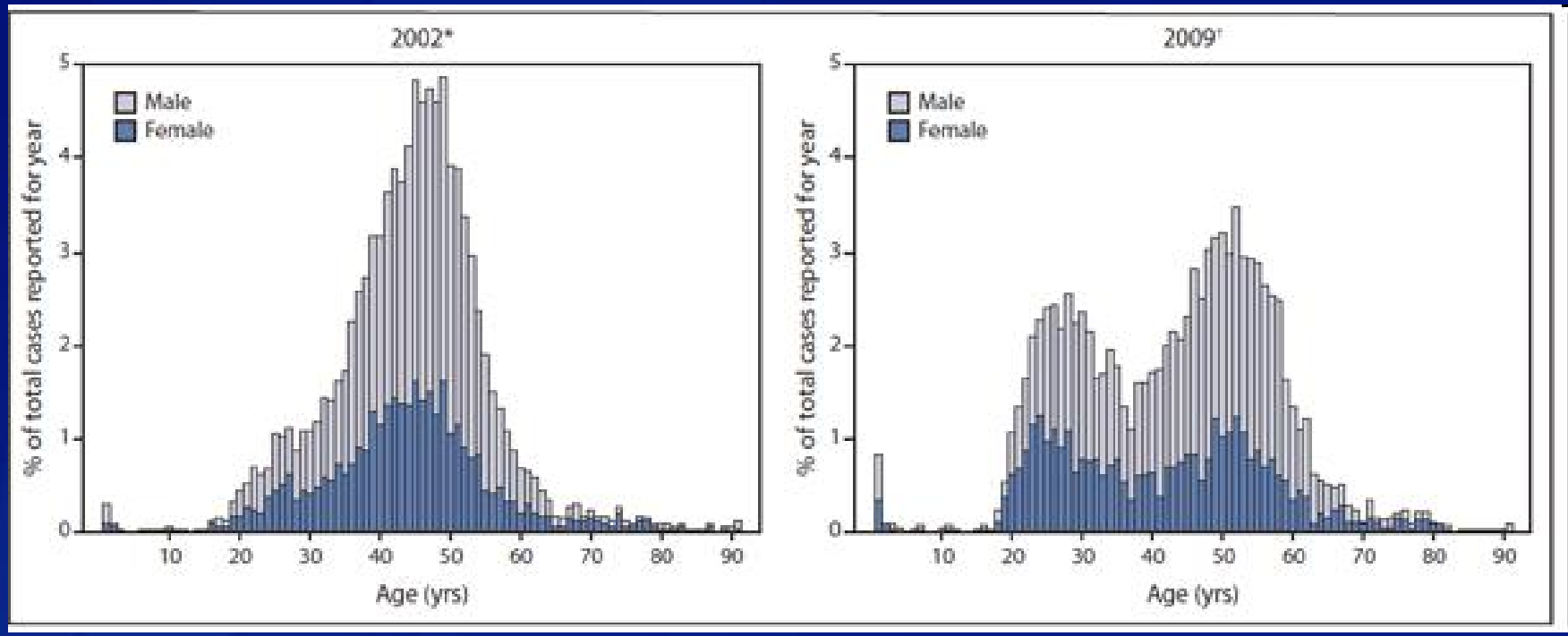
National Acute HCV Cases (2006—2013)





Suryaprasad et al., *Clin Infect Dis.*, forthcoming

Age Distribution of Confirmed Hepatitis C Cases- Massachusetts, 2002–2009*

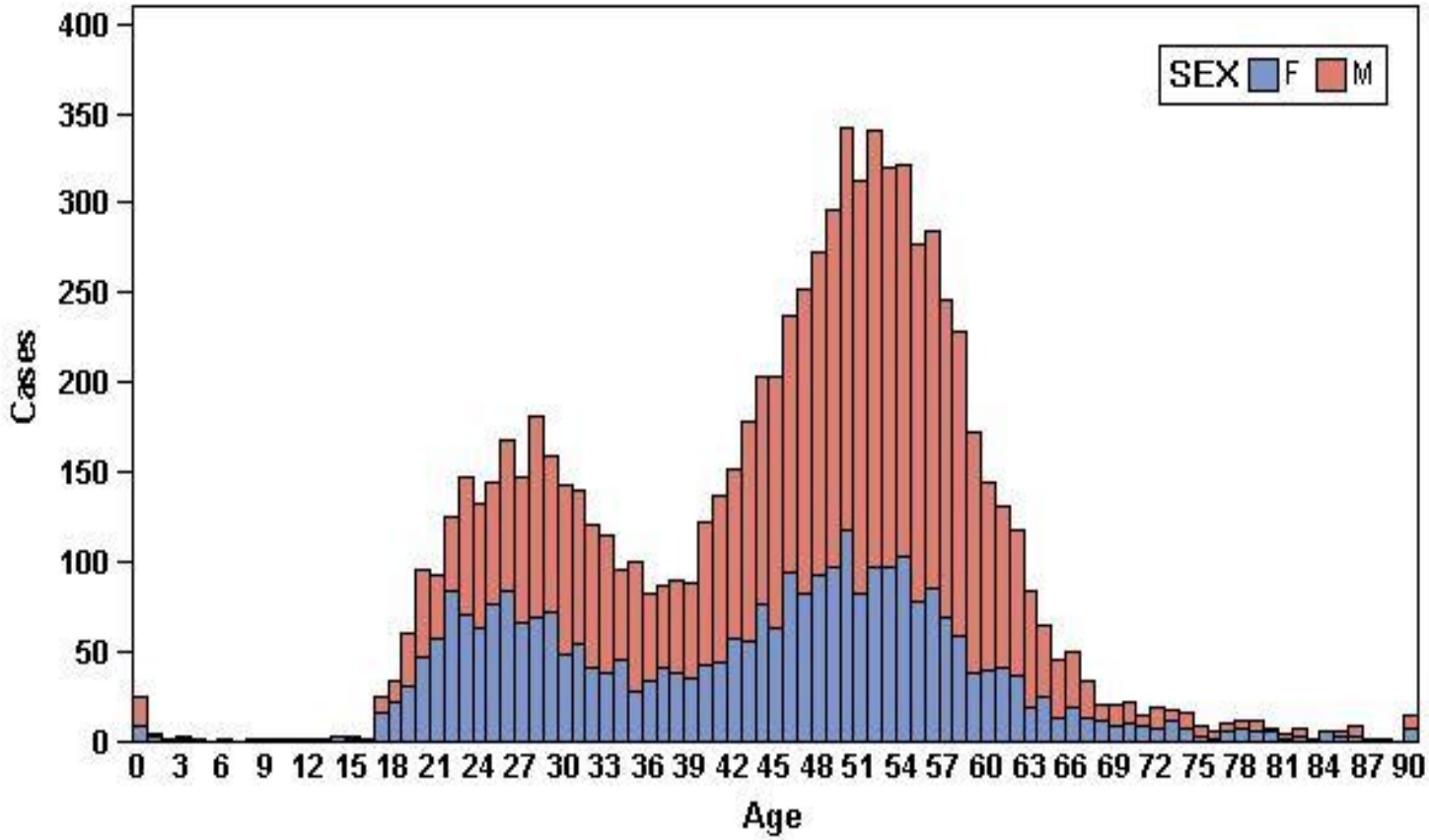


- 1,925 reports of HCV among persons 15-24 yrs
- Cases from all areas of state; equally male:female, mostly white
- 72% past or current IDU, 84% injectors in past 12 mos
- Other states are reporting similar increases

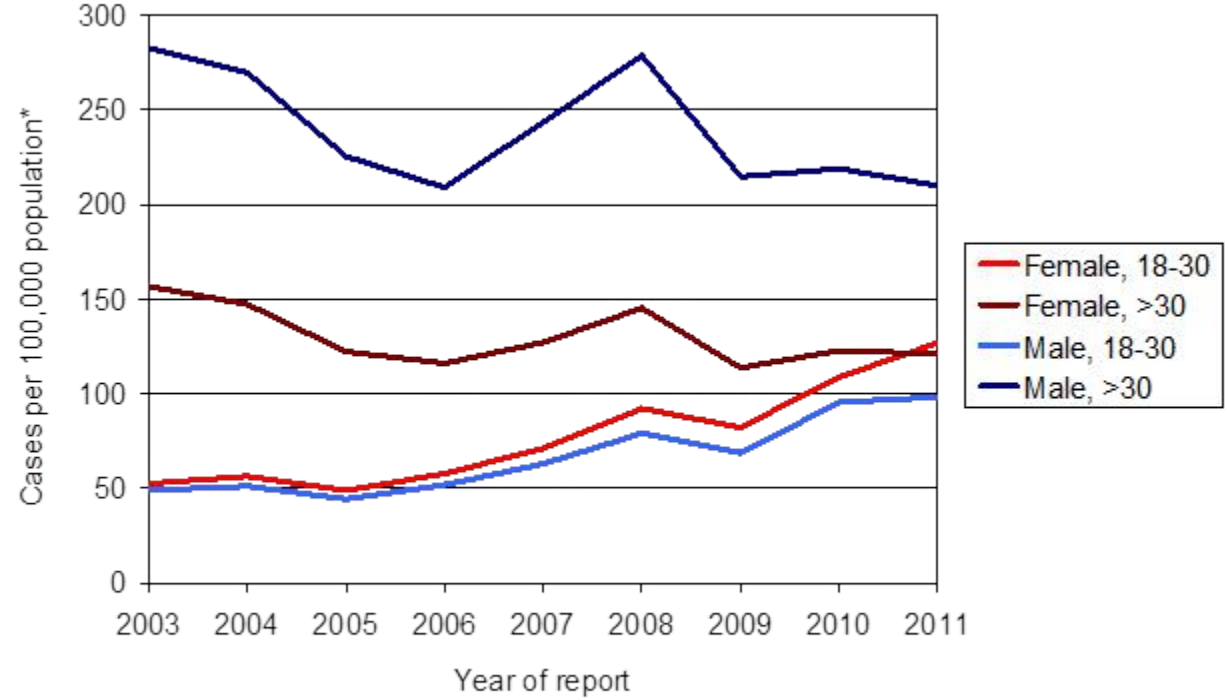
Division of Viral Hepatitis

*MMWR 2011:60(17);537-541

Hepatitis Case Counts by Age
Pennsylvania, 2010



Rate of Newly Identified Chronic Hepatitis C by Sex and Age Group, Florida, 2003-2011

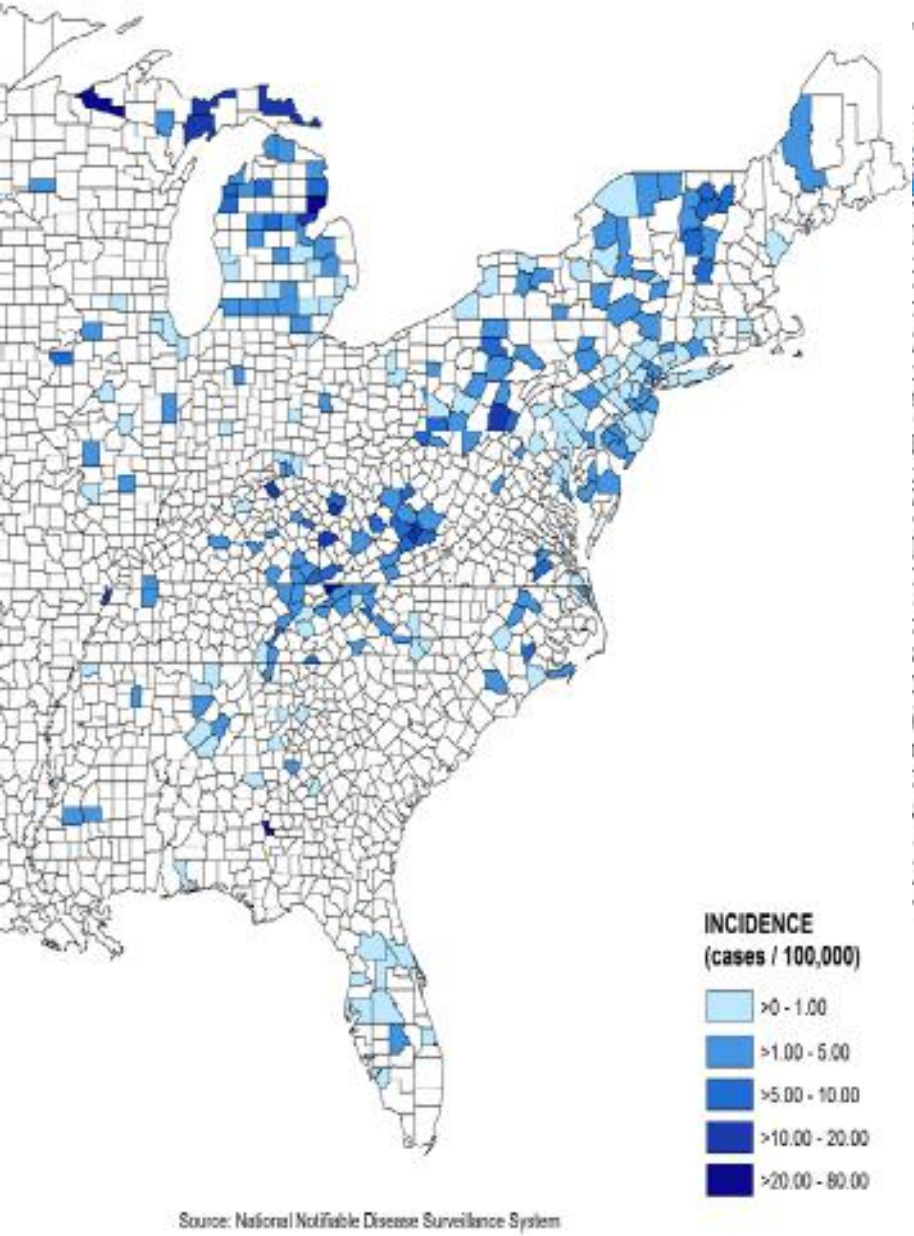


*Reported cases of confirmed, probable and suspect chronic hepatitis

Recent CDC, State, or Local Public Health Investigations of Young PWID

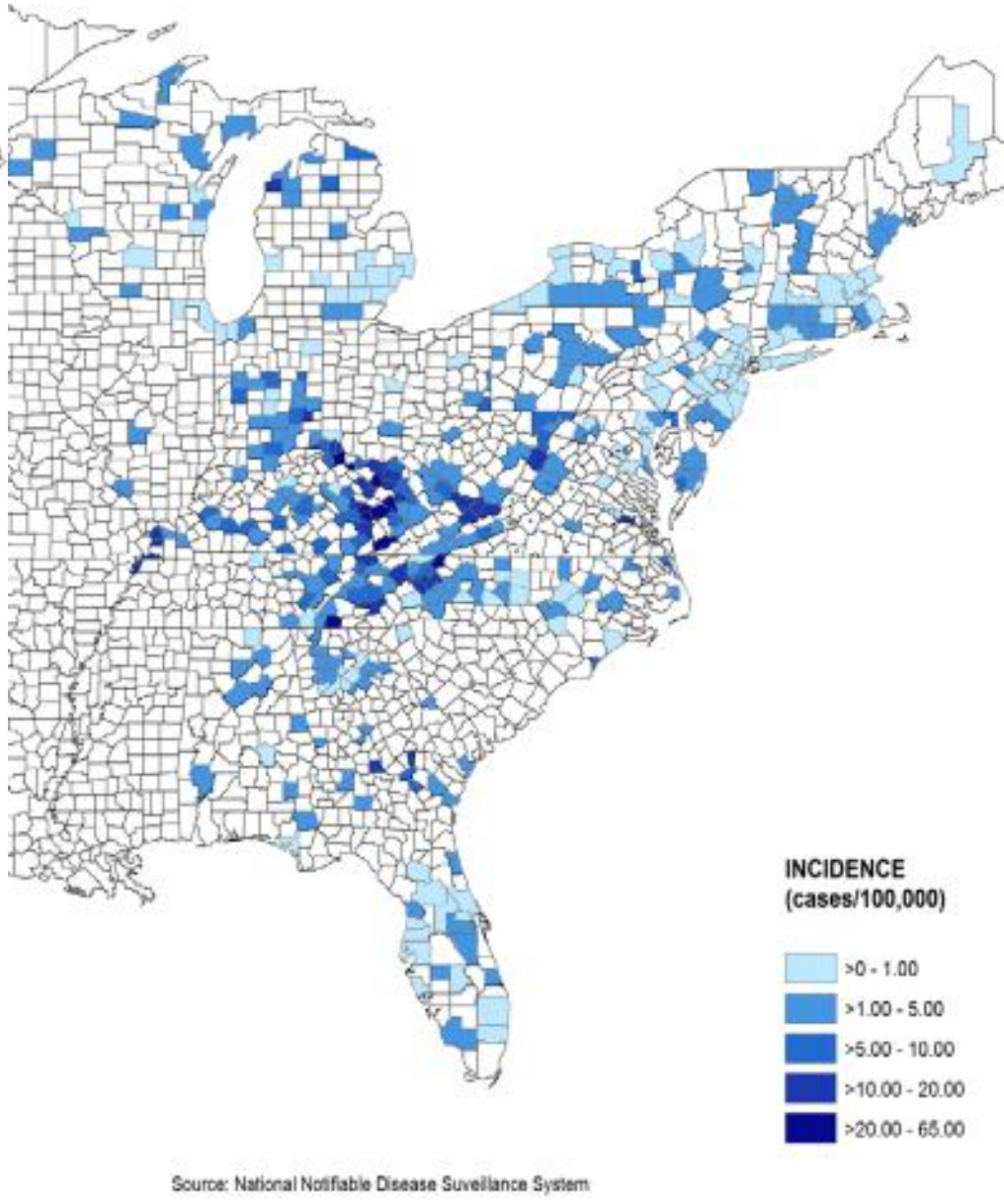
Location	Year	Predominant Race/Ethnicity	Predominant Setting	Virus
Northern Plains	2008	American Indian	Rural	HCV
Eerie County, PA	2004-2007	White	Suburban	HCV
Massachusetts	2011	White	Suburban	HCV
Wisconsin	2011	White	Rural	HCV
Indiana	2011	White	Rural	HCV
Virginia	2012	White	Rural	HBV +/- HCV

HCV Incidence by Eastern US County, 2006



Source: National Notifiable Disease Surveillance System

HCV Incidence by Eastern US County, 2011



Source: National Notifiable Disease Surveillance System

Changing Demographics of HCV Incidence

- During 1990s anti-HCV prevalence was higher among men, African Americans, urban residents and persons 40-49 years aged.
- New cases largely involve males and females equally; mostly white, rural and suburban residents; persons 18-29 years aged.
- Key difference is the non-medical use of prescription opioids

An Emerging Syndemic?

Prescription Opioids // Heroin

∞

Hepatitis C Virus Infection

Occurring amongst young, mostly white PWID from rural and suburban states/regions of U.S.

From: **The Changing Face of Heroin Use in the United States: A Retrospective Analysis of the Past 50 Years**

JAMA Psychiatry. 2014;():. doi:10.1001/jamapsychiatry.2014.366

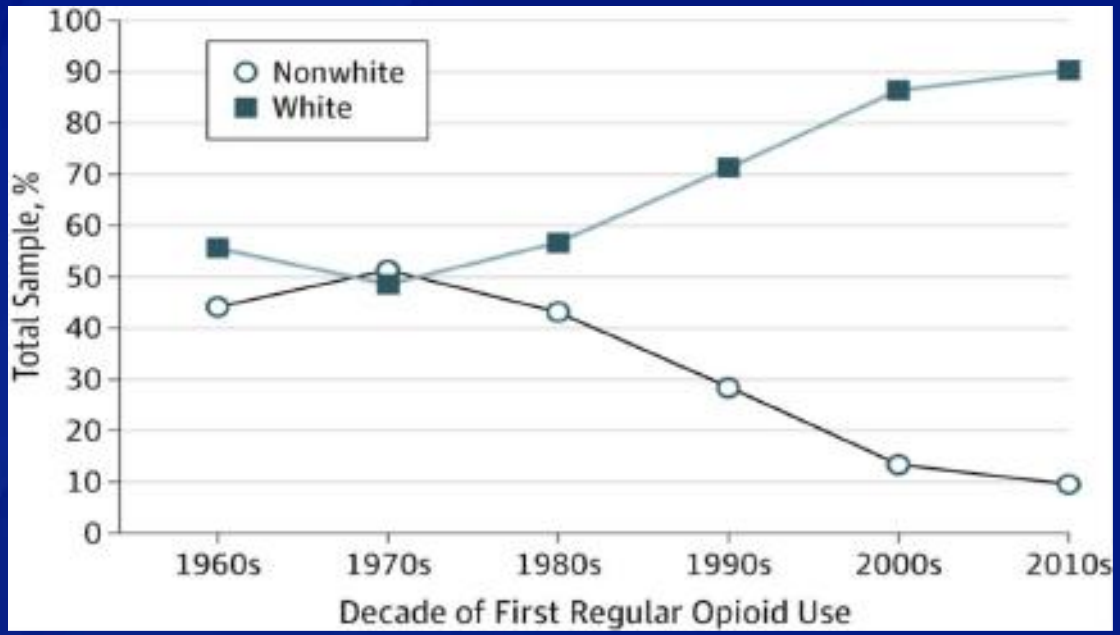
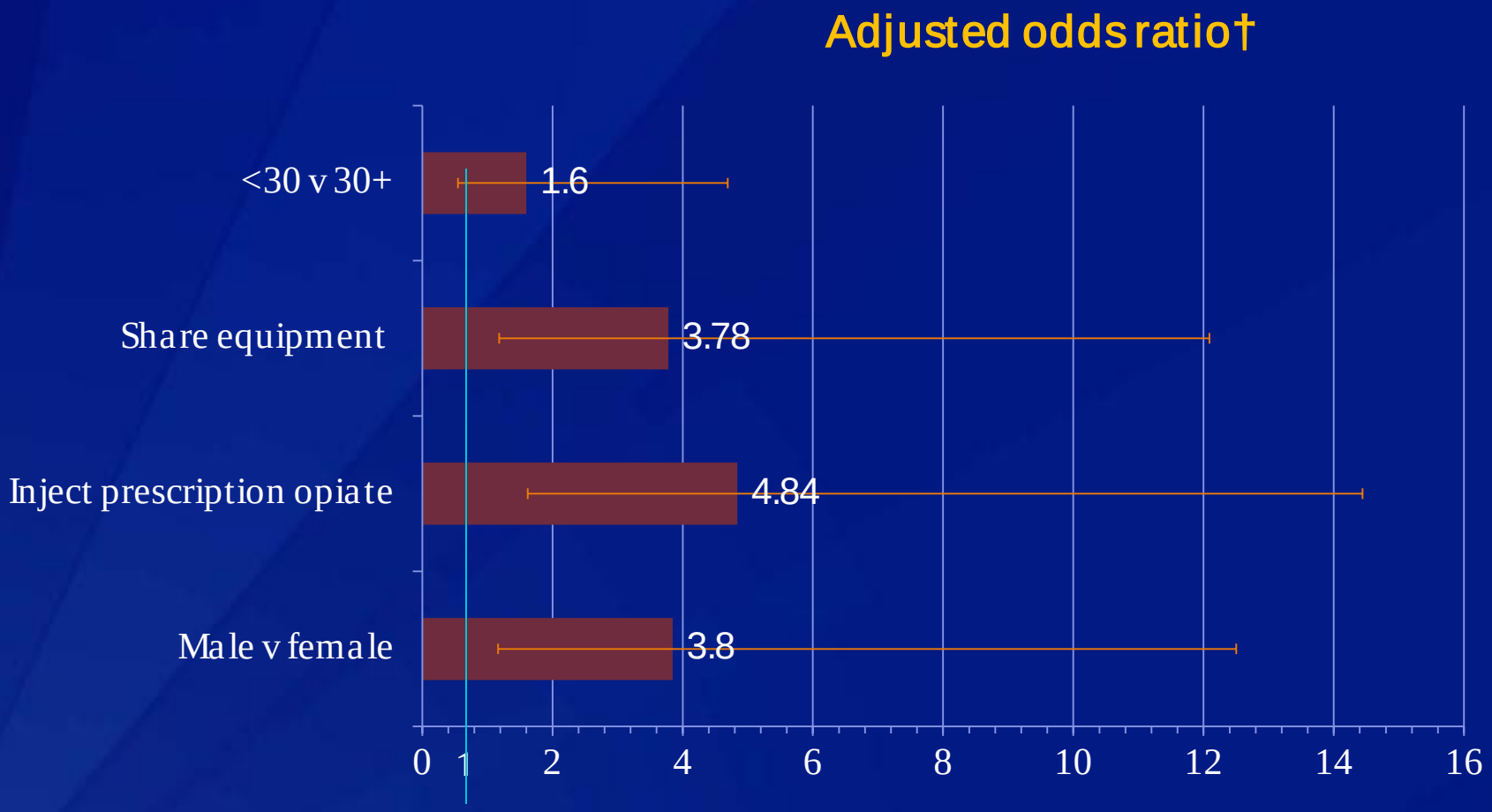


Figure Legend:

Racial Distribution of Respondents Expressed as Percentage of the Total Sample of Heroin UsersData are plotted as a function of decade in which respondents initiated their opioid abuse.

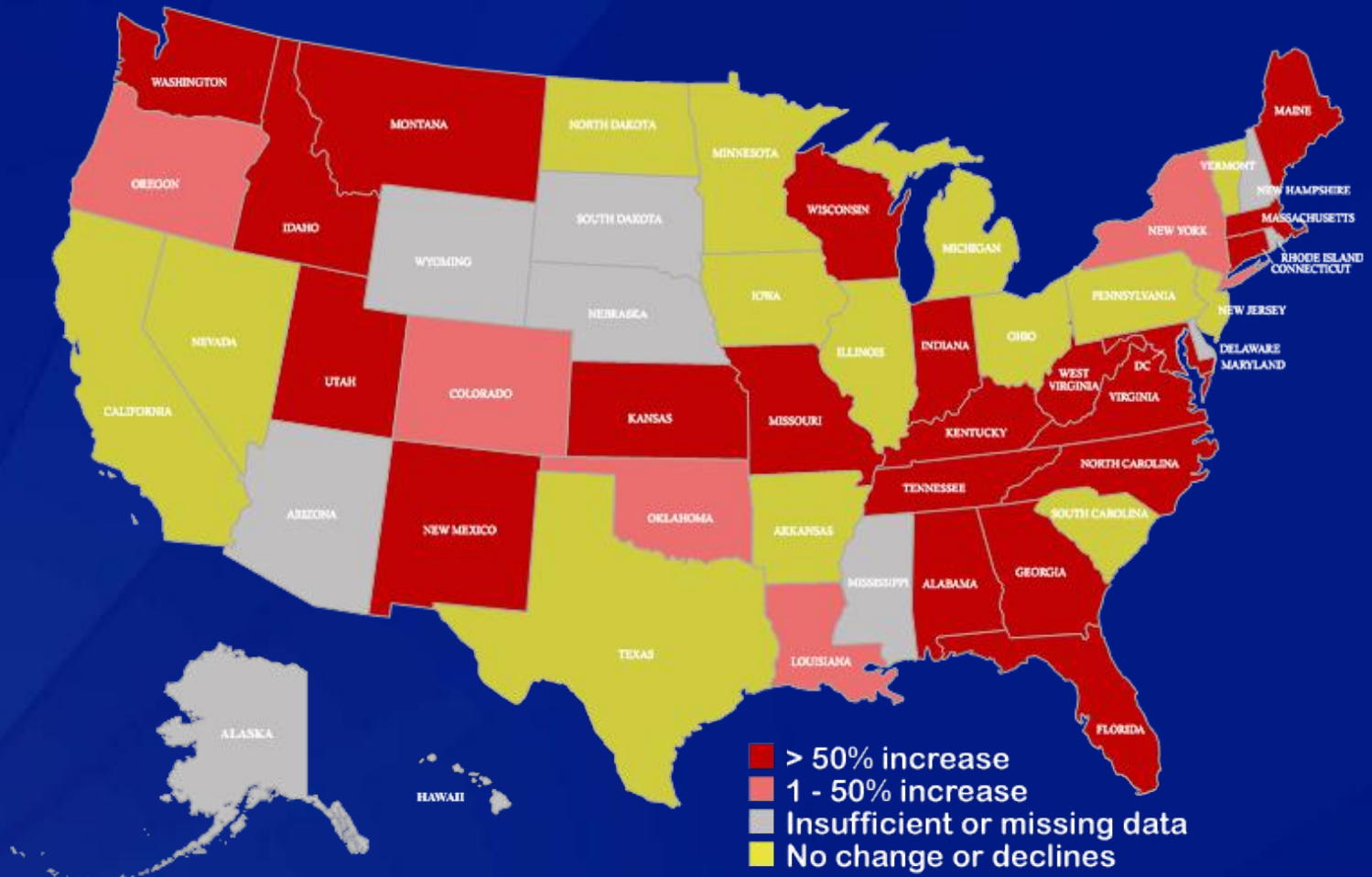
Multivariate Associations with HCVab positivity*



*Equipment sharing, injecting prescription opiate , fishing for a vein, and using an SEP are all measured for within the past 12 months. Prescription opiates respondents reported injecting Opana (n=58), Oxycontin (n=21), Dilaudid (n=7), Roxycontin (n=3), Morphine (n=4); Vicodin (n=1), Percocet (n=1) (categories not mutually exclusive)

† p-value <0.05

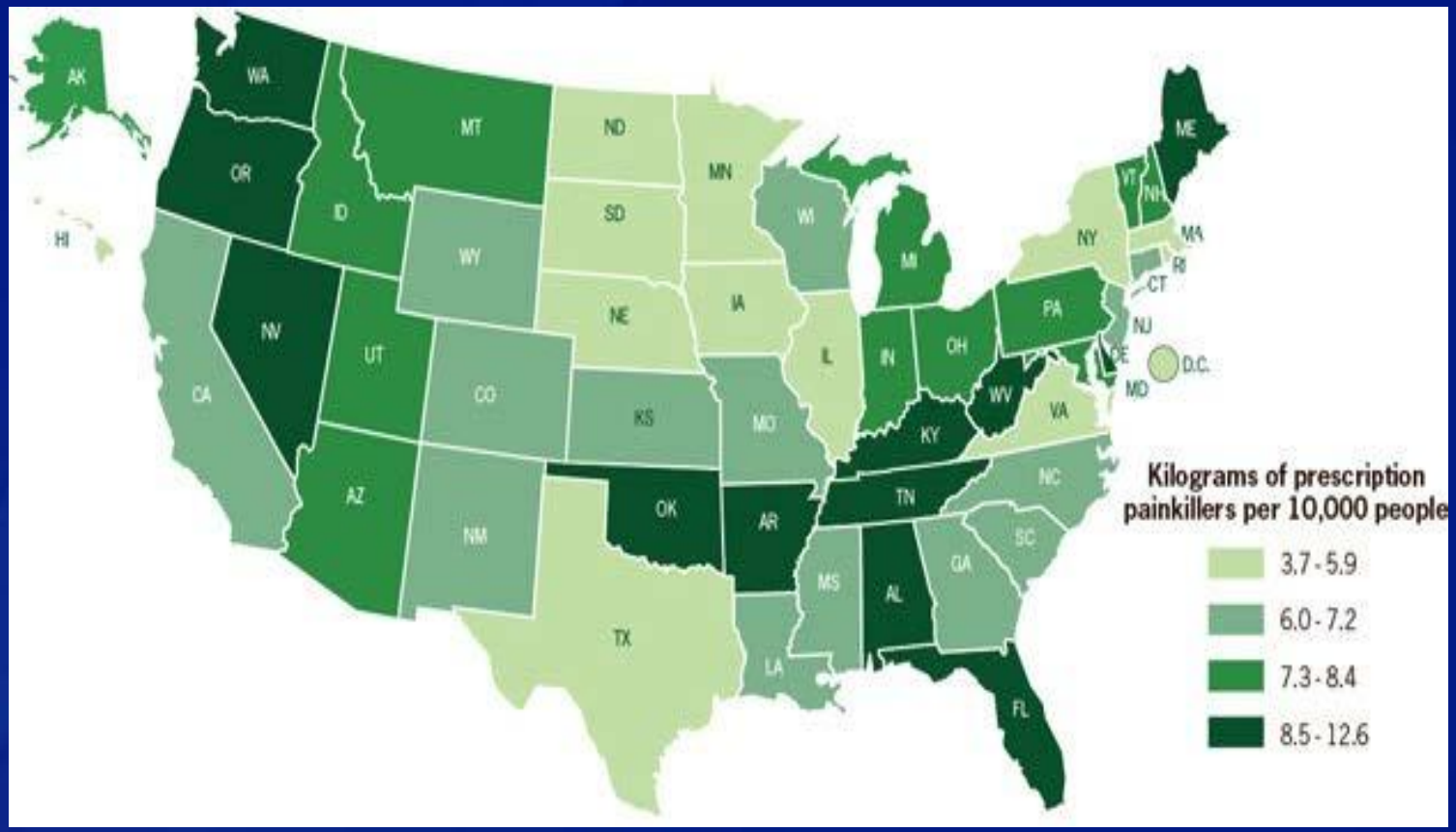
Increases in Reports of New HCV Infection
HCV Case Reports- 2007-2011



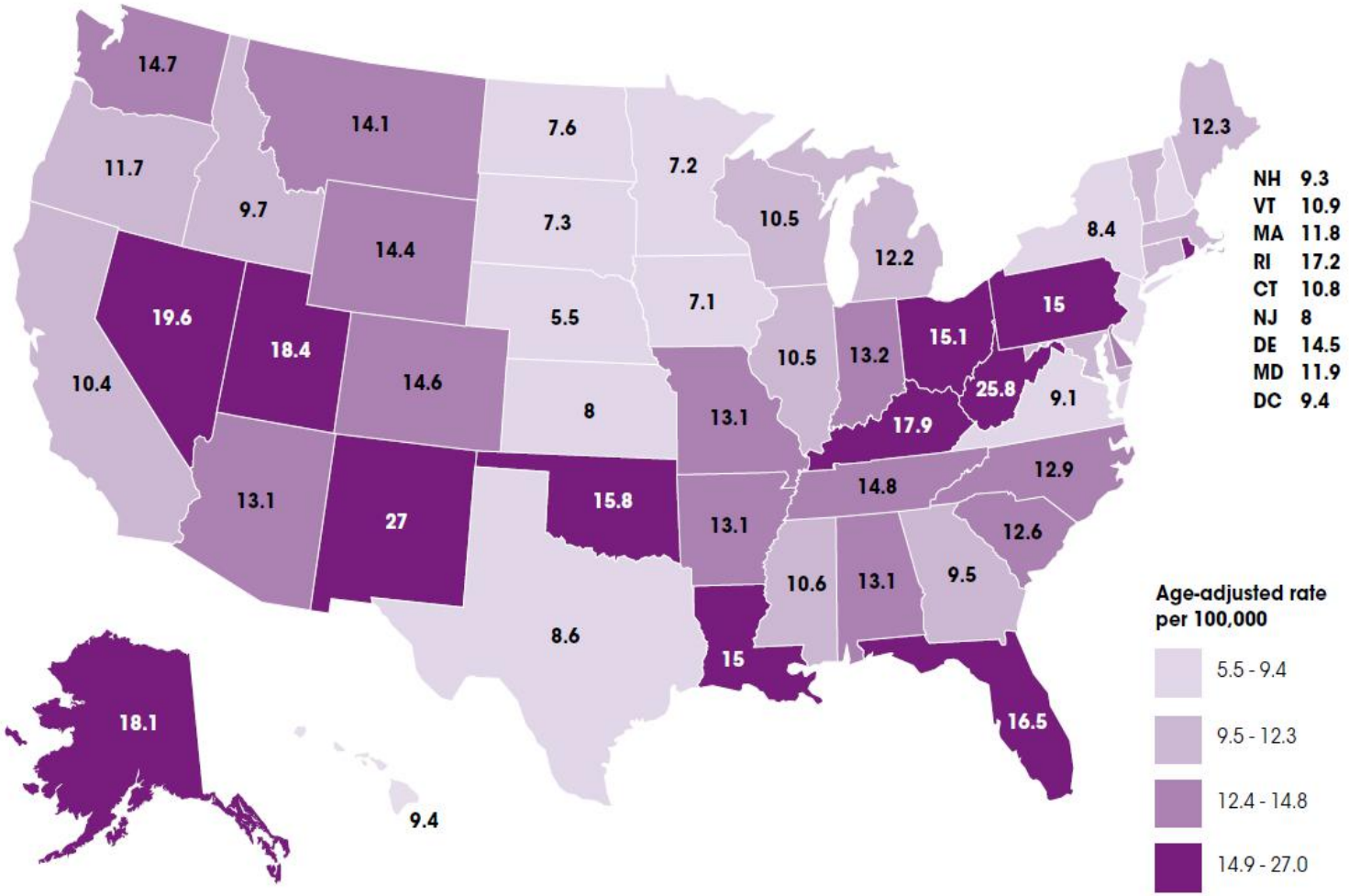
Division of
Viral Hepatitis

Prescription Opioids (PO)

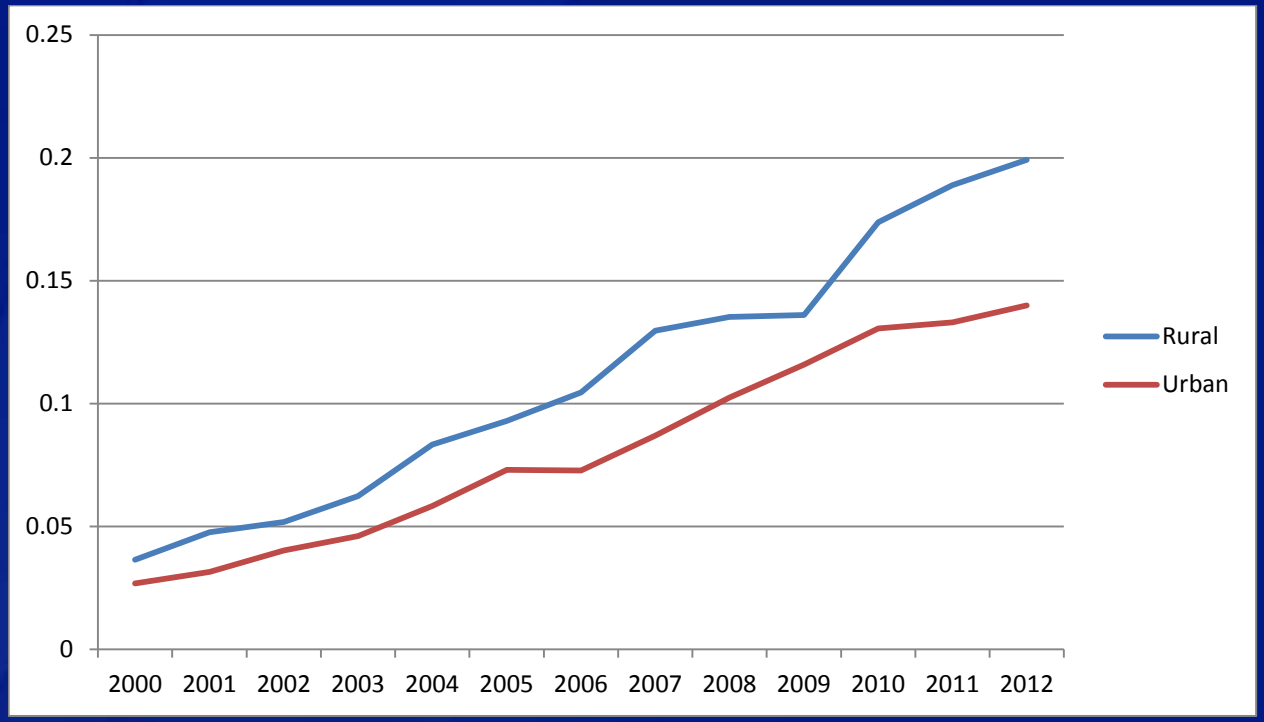
(kilograms of opioid analgesics prescribed *per 10,000 persons*)



Drug overdose death rates by state, 2008[4]

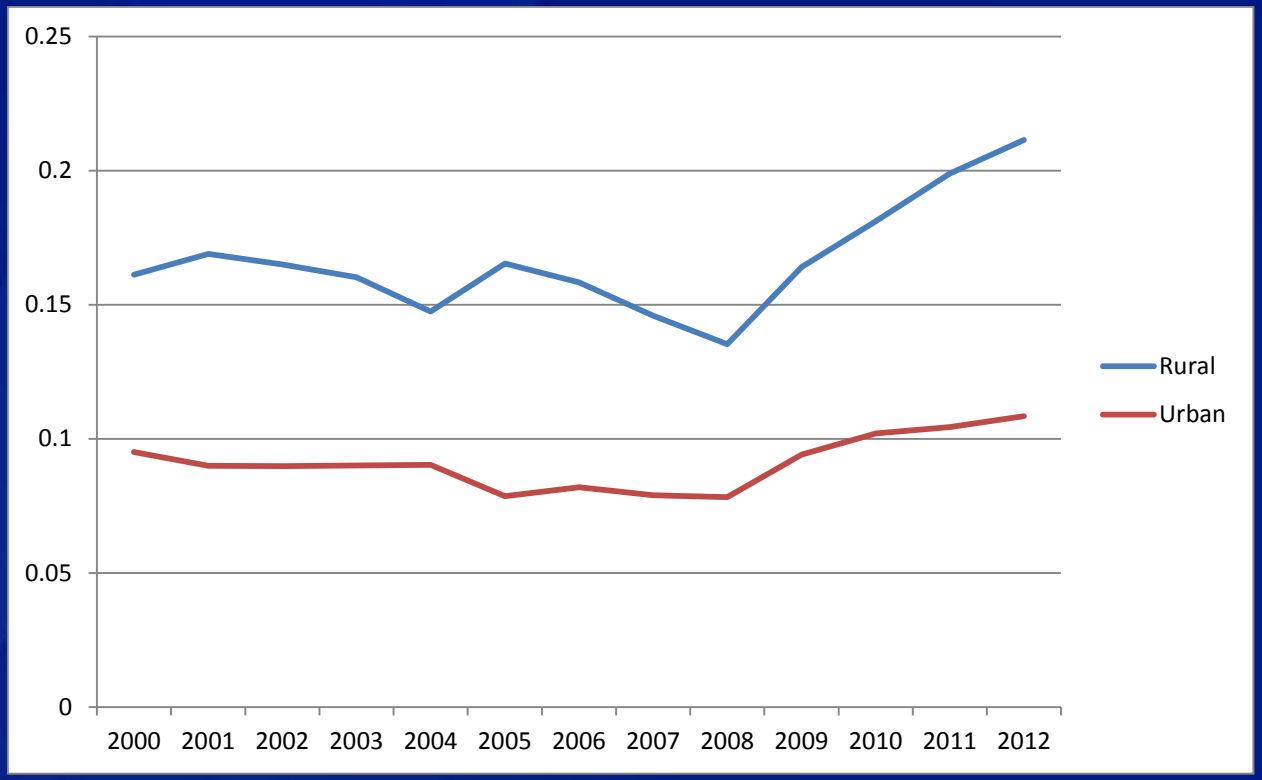


Treatment Admissions for Prescription Opioid Abuse (National Portrait)



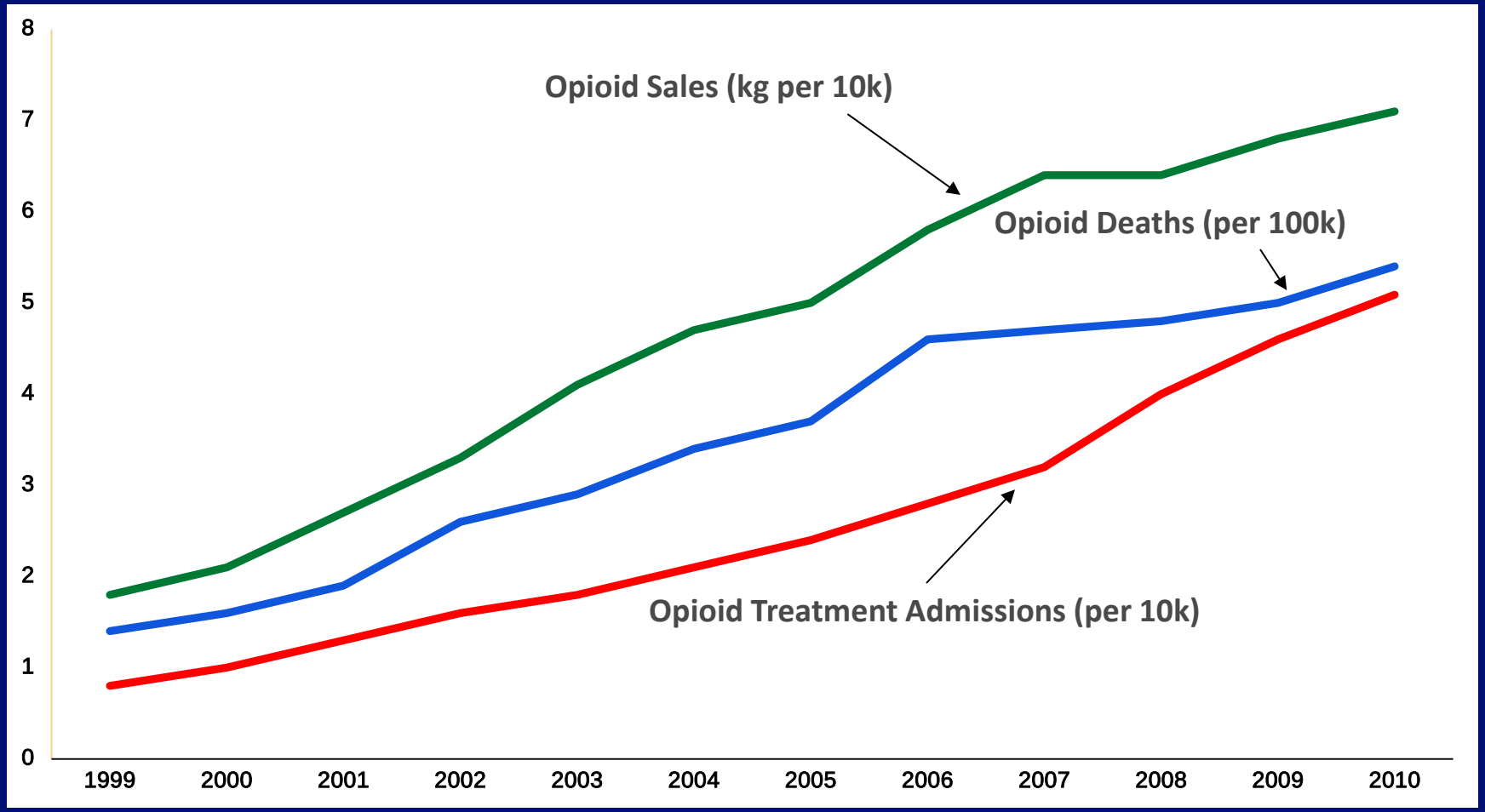
SAMSA, 2014, Treatment Episode Data Set (TEDS)

Injection of Prescription Opioids (National Portrait)



SAMSA, 2014, Treatment Episode Data Set (TEDS)

Opioid deaths, sales, and treatment admissions have increased in lock step



National Vital Statistics System, DEA's Automation of Reports and Consolidated Orders System, SAMHSA's TEDS: National Center for Injury Prevention and Control

OPANA©
(oxymorphone hydrochloride)

Bioavailability: 10% oral; 40% intranasal; 100% IV/IM (compared to 87% oral bioavailability of oxycodone)

Because of its low bioavailability —10% when taken orally— a 10 mg tablet represents 10 times the average IV dose in a single tablet.

In 2012, Opana IR was changed to the INTAC platform of extended release and abuse deterrent—similar to the changed Oxycontin platform using Polyethylenoxide under pressure and heat for extruding pills.

Opana (instant release) crushed by Mortar/Pistil

TimerX
(Anti-Diversion Mechanism)

Dual Matrix of hydroxythyl cellulose and polyethylene glycol

Opana ER with TimerX turns gelatinous when H_2O is added

Oxycontin

Abuse-Deterrent Formula

Old Formula

New Formula

OXYCONTIN

(Time-released Oxycodone)

DIVERTING DIVERSION

How to Inject OPANA ER

Taken From Drugs-Forum.com

A friend of Mine has been prescribed 40mg Opana ER. He say's it works we'll to relieve his back pain but it has such a bad bioavailability when taken orally. He has been trying very hard to find a method to IV it and has finally done it. For those unfamiliar with Opana ER, Endo Pharmaceuticals, the company that makes Opana ER, has spent millions to develop TimerX, a time release mechanism designed to make the pill abuse-resistant. After much trial and error I watched him successfully prepare and inject Opana ER and with GREAT results to. Here's how they did it:

1. scrape or pick off the color coating of the pill. Don't use water to wash it off, you don't want to get your pill wet. It will form a layer of gel due to the TimerX

2. Crush the pill as finely as possible

3. Take a shot glass and fill it up about half way with alcohol. Add the crushed Opana to the glass of alcohol stir it we'll let it sit for at least 2 min. Stirring it every minute or so

4. Filter out all the particles left in the alcohol. Get two 3cc syringes with the needles pulled out. Take out the plunger on one syringe and pack it with a large clump of dry cotton. use enough so there's about a 1/3 to 1/2 inch layer of packed cotton. Take the other syringe and begin drawing up the alcohol and spraying it into the other syringe once full. Put the plunger back on the cotton packed syringe and spray the alcohol though filtering it. Continue doing this until all the alcohol has been filtered

6. Take the shot glass of filtered alcohol and place it on an electric stove turn the heat on medium high and slowly boil off the alcohol. Once it has all boiled off there will be a layer of Oxymorphone and part of the TimerX

7. Use your needle to add 1cc H_2O to the glass and stir up the solution. There will be a film that forms and clumps together - this is good. Let it sit in the water for 10-15 min. Add a piece of cotton to the mix for a filter and draw it up into your rig. Adding a little citric acid or sour salt to the water helps break it down.

Sorry for the long post, but it's a long but we'll worth it process

DO I REALLY NEED 3 MLs OF WATER?

The more water you use, the better the opioid will dissolve into the mix, the more effective the filtration will be and the more of the opioid will end up in your shot.

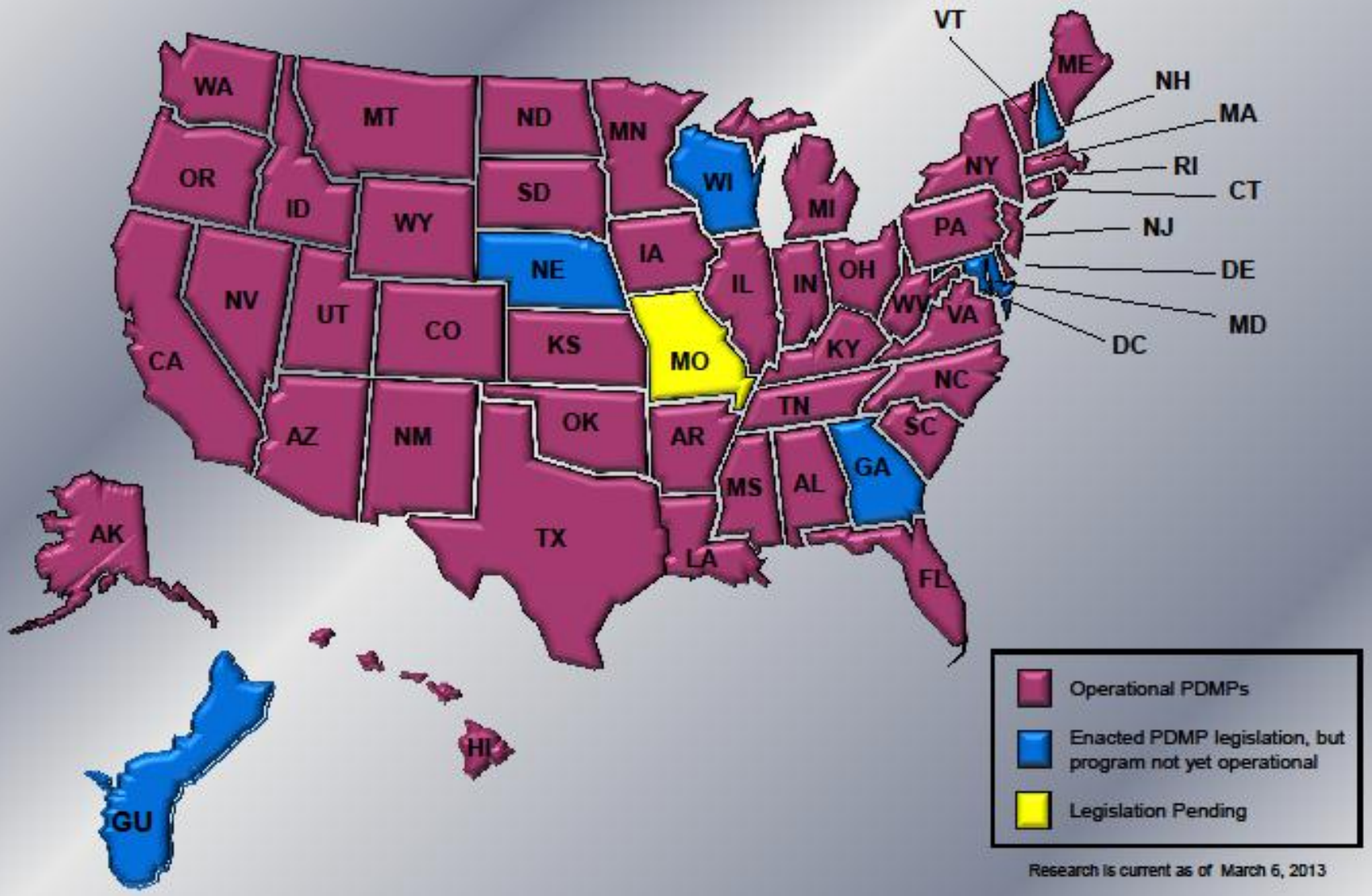
MY MIX IS GLUGGY. WHAT DO I DO?

Some pills, like MS Contin, contain a lot of microcellulose. The only way to deal with gluggy mixes is to add more water and repeat the coarse filtration with fresh cotton wool as you draw up. You may need a larger barrel and more water, and a coarser wheel filter (red). Microcellulose can easily get into your lungs and organs, causing severe damage over time, so be careful.

PDMP Training & Technical Assistance Center

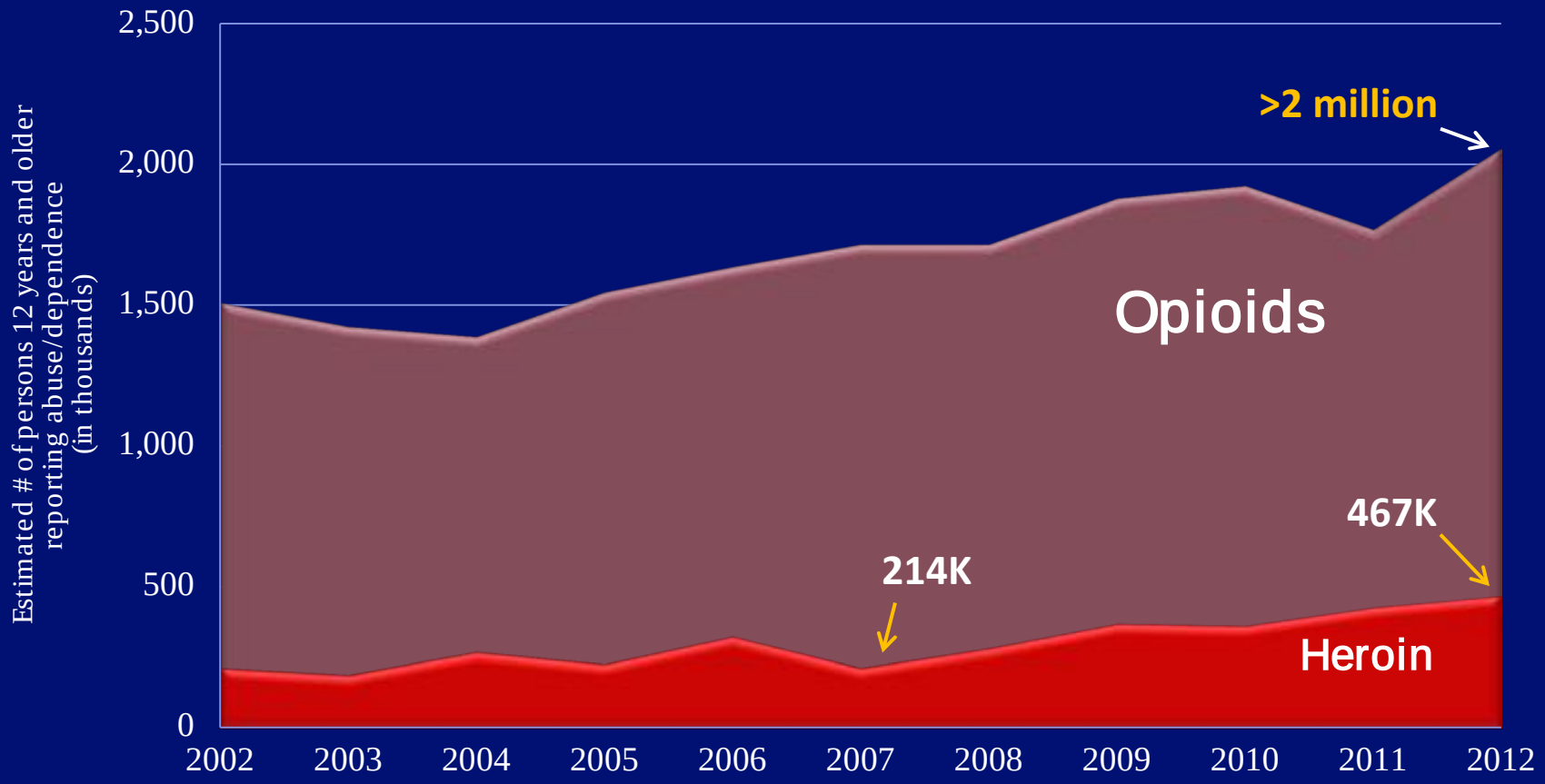
Status of Prescription Drug Monitoring Programs (PDMPs)

** To view PDMP Contact information, hover the mouse pointer over the state abbreviation*



Research is current as of March 6, 2013

Heroin use and dependence is also increasing

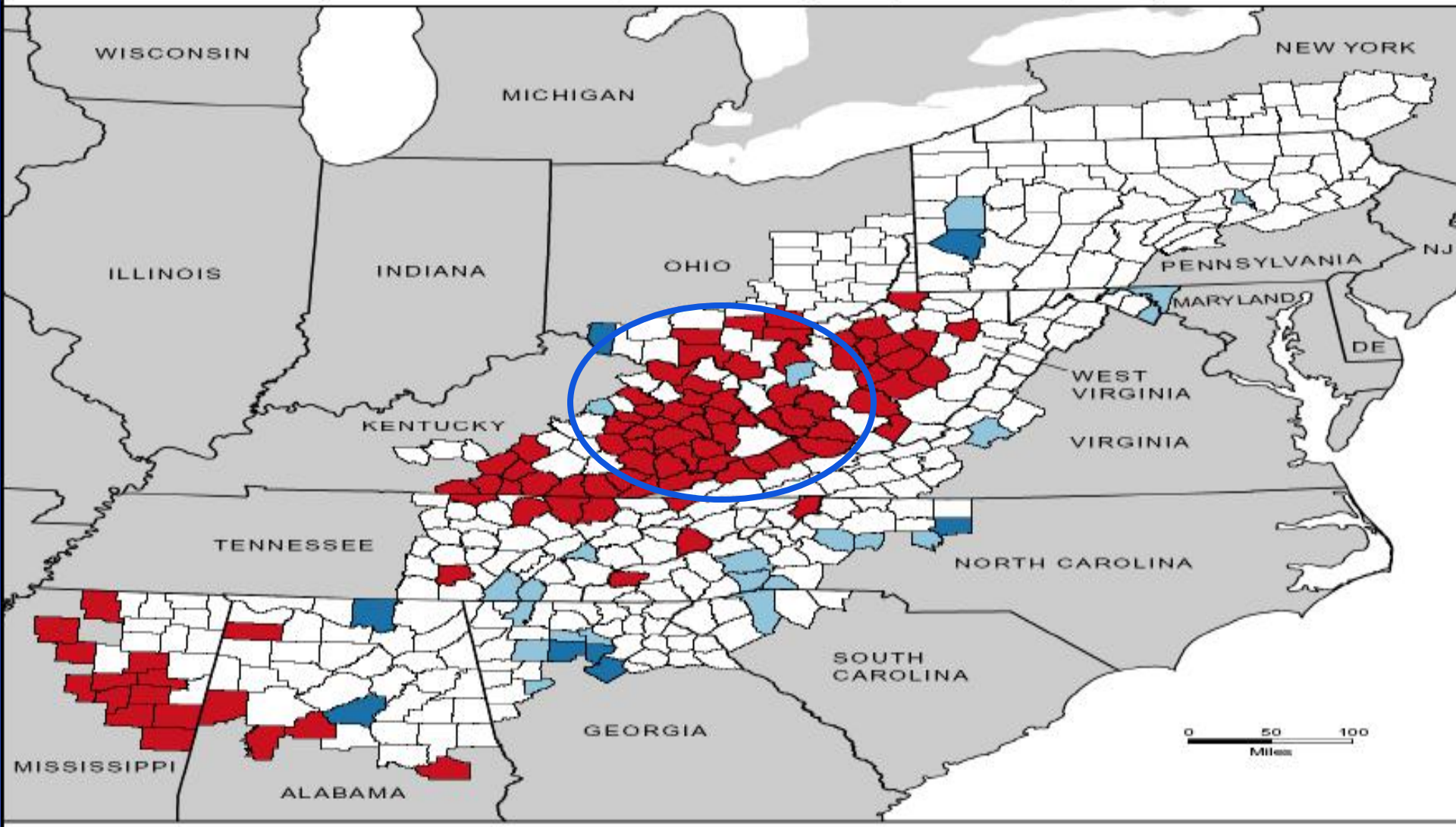


SAMHSA NSDUH 2012

What's the Matter with Kentucky?

County Economic Status in Appalachia, Fiscal Year 2004

(Effective October 1, 2003 through September 30, 2004)



Each fiscal year the Appalachian Regional Commission classifies each county into one of four economic levels based on the comparison of three county economic indicators (three-year average unemployment, per-capita market income, and poverty) to their respective national averages. See the reverse side for a description of each economic level.

County Economic Levels

- Distressed (91)
- Transitional (289)
- Competitive (22)
- Attainment (8)

ARC Appalachian Regional Commission

Map Created: October 2003.
Data Sources: U.S. Bureau of Labor Statistics, LAUS, 1999-2001;
U.S. Bureau of Economic Analysis, REIS, 2000;
U.S. Census Bureau, 2000 Census, SF3.

Mining Industry Lay-offs

- Statewide, coal-mining employment reached 18,600 in a March 2009 survey. The number was down to 15,600 in May — before more layoffs were announced — with Eastern Kentucky accounting for most of the drop.
- Fifty-two people at Enterprise Mining's surface operation in Knott County on Feb. 3. Two weeks later, 109 at Xinergy Corp.'s Straight Creek mine in Bell County. In April, 160 at Sapphire Coal in Letcher County.
- June brought the crippling announcements that Alpha Natural Resources and Arch Coal Inc. would lay off more than 850 employees in Pike, Martin, Knott, Perry, Breathitt and Floyd counties.

New York Times, 29 June 2014

The Decline of Coal Mining

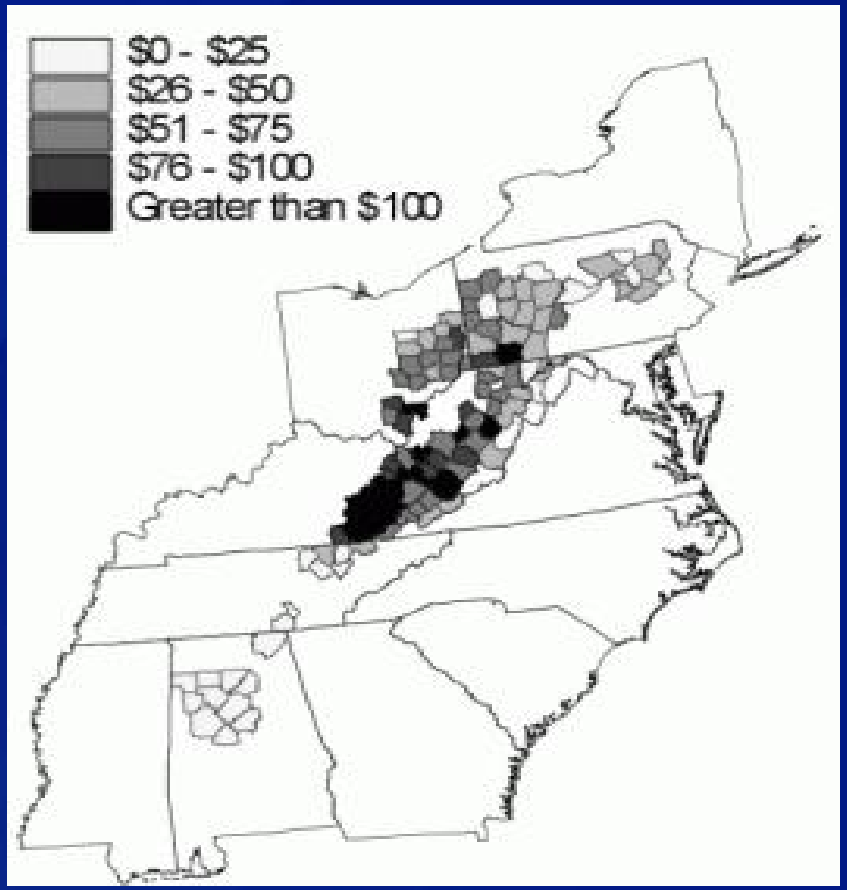
Coal mining industry offers relatively high paying jobs to workers with low general skill levels. These workers have developed industry-specific skills for use in coal mining. Losses in coal mining earnings in these counties thus often leads to increased poverty and dependence on social welfare programs

Clay County: 2.5 million tons of coal in 1980

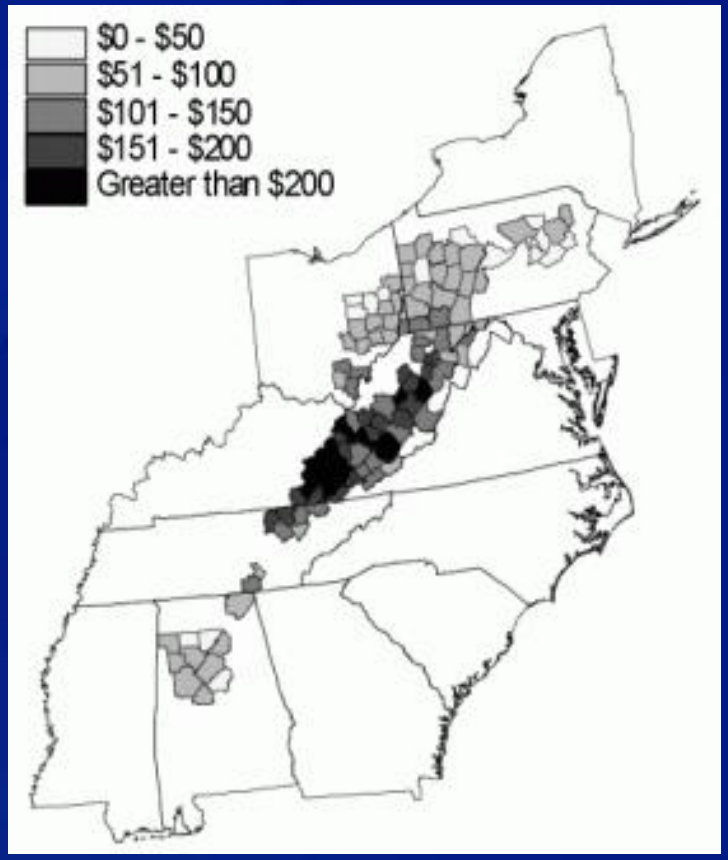
Just over 38,000 tons in 2013.

Adjusting for inflation, median income was higher in Clay County in 1979 than it is now, in 2014, even though the American economy has more than doubled in size.

TANF Payments per Capita by County in the ARC Region



Food Stamp Payments per Capita by County in the ARC Region



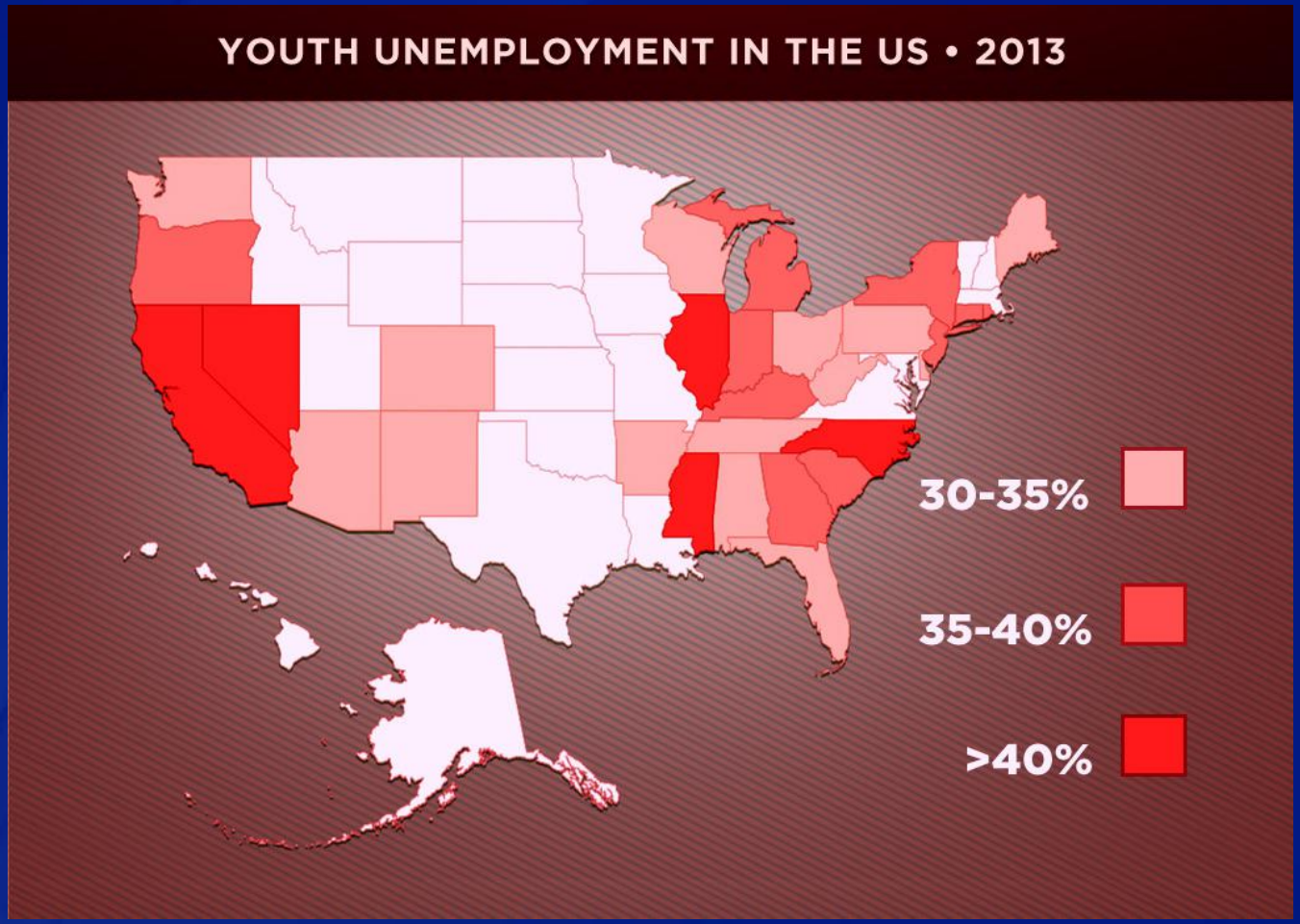
Families Leaving the State for Work

"There's just very limited opportunity for the people who were working in the region, and I've helped 220 families move out of the area in recent years, despite many workers' understandable resistance. That's a really hard pill to swallow. People are really connected to place here. For a lot of people, it's the last thing they're doing. They're holding off until they have no other choice."

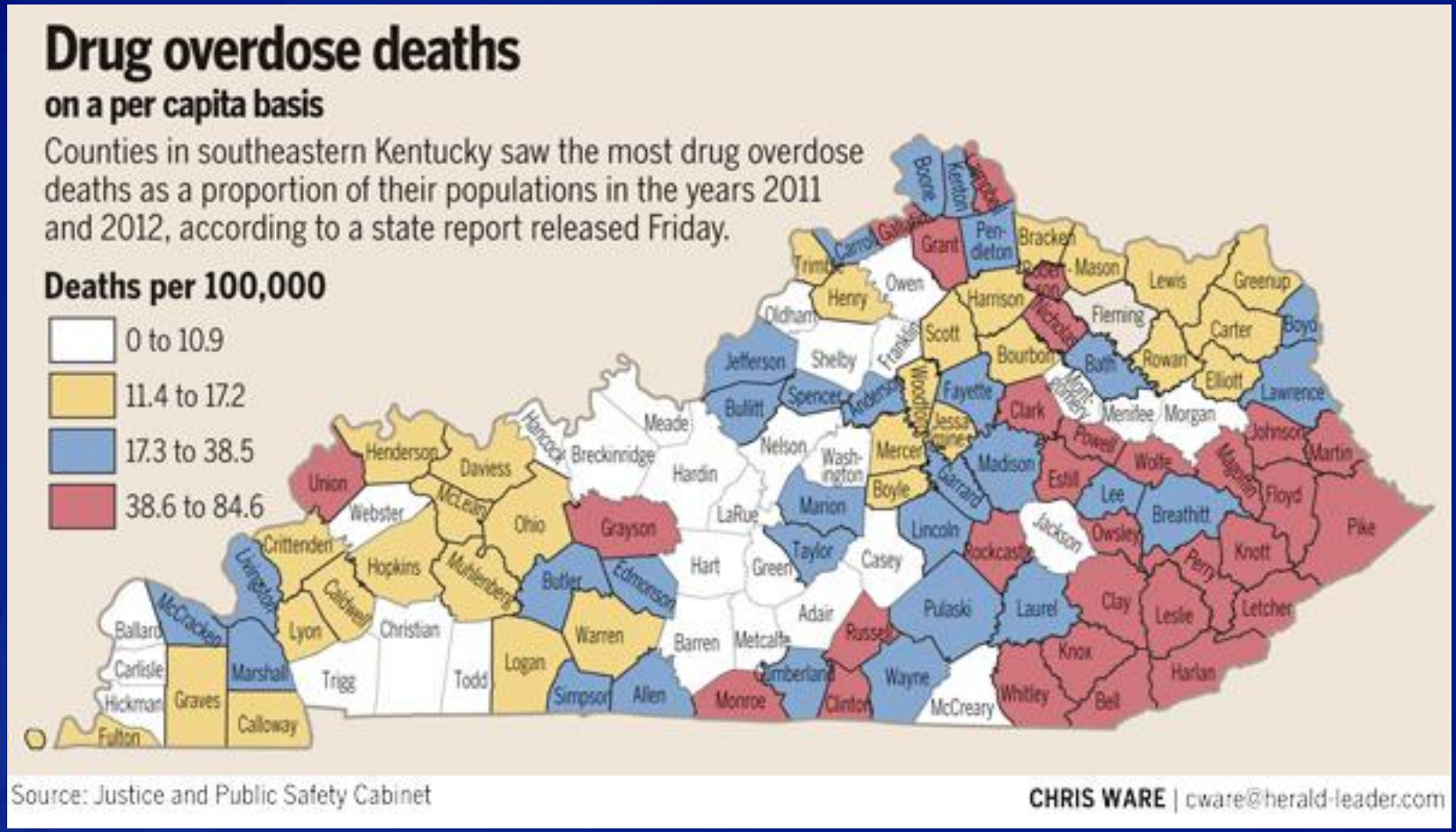
--Jeff Whitehead

Eastern KY Concentrated Employment Program

Youth Unemployment in the U.S.



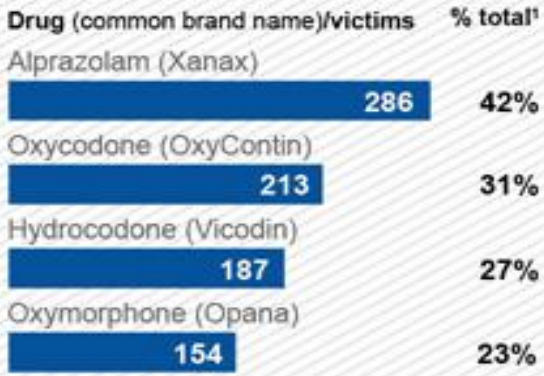
Drug Overdose Deaths in Kentucky



Case study: Kentucky

Oxymorphone, the active ingredient in Opana, has become one of the most common drugs found in the blood of overdose victims in Kentucky, where abuse has spiked.

Drugs most frequently found in overdose victims in 2011

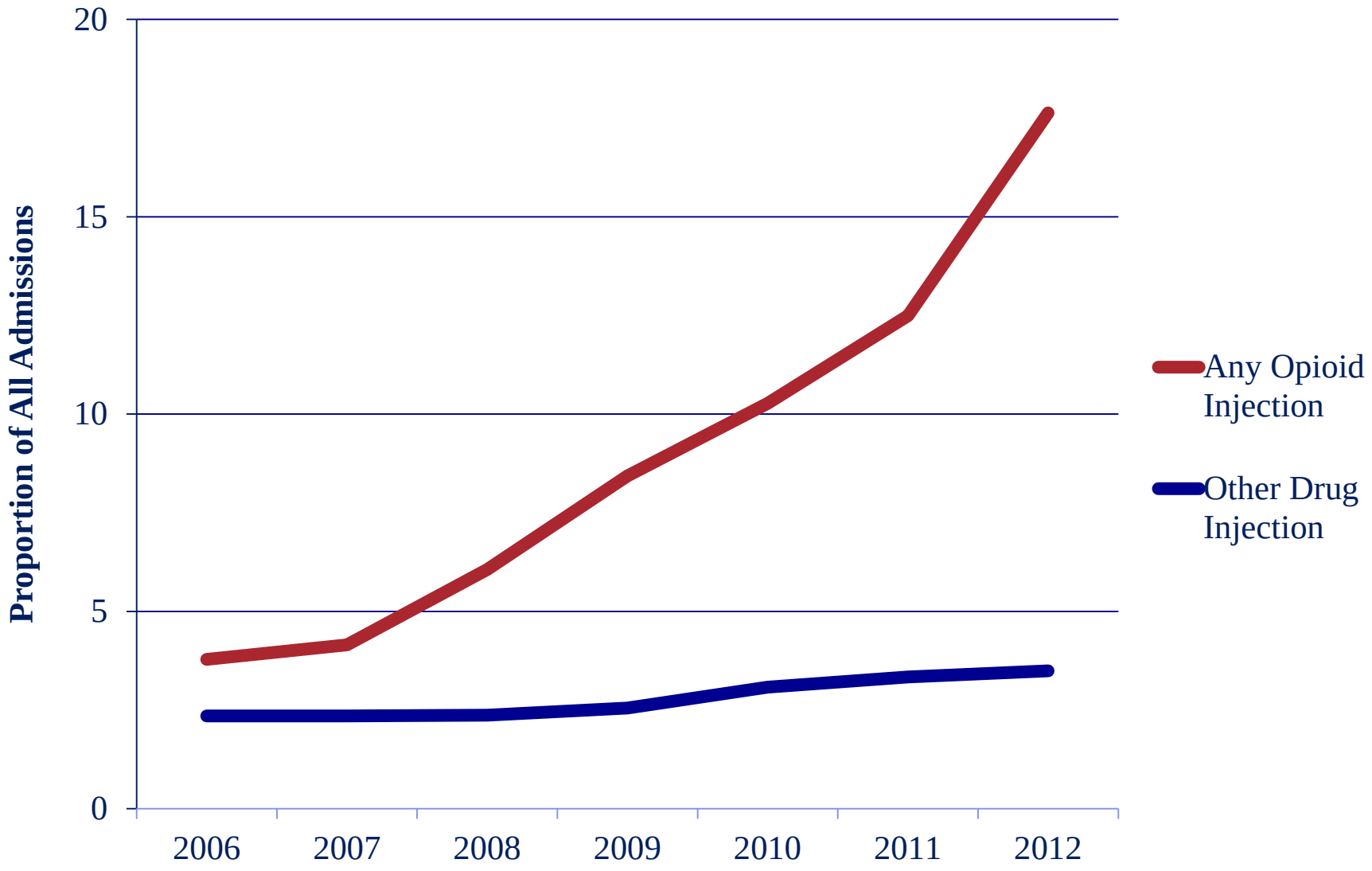


1 – Percentages add up to more than 100% because of more than one drug present in many decedents.

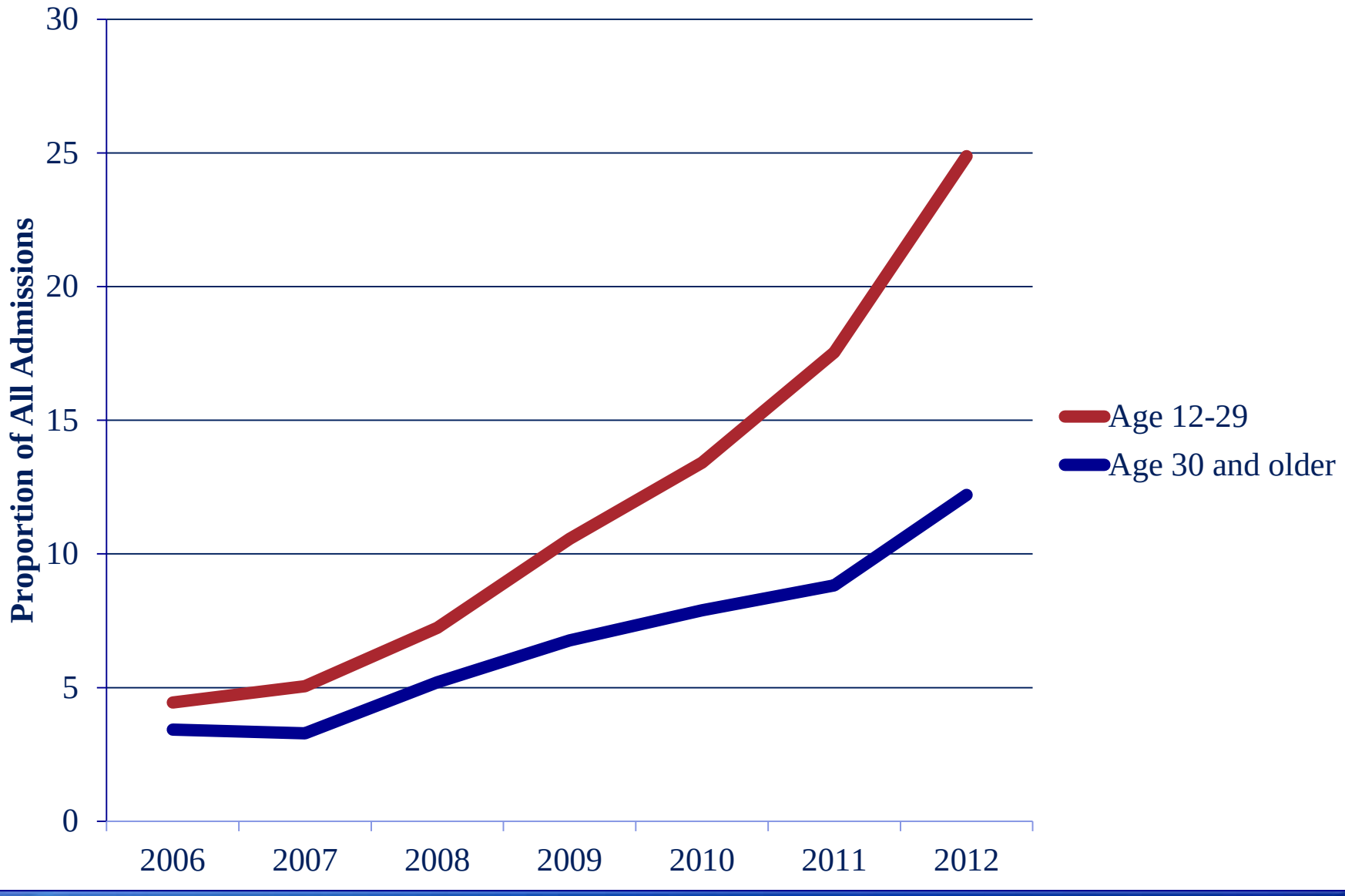
Source: Kentucky Medical Examiner's Office, Kentucky Justice & Public Safety Cabinet Annual Report

By Janet Loehrke, USA TODAY

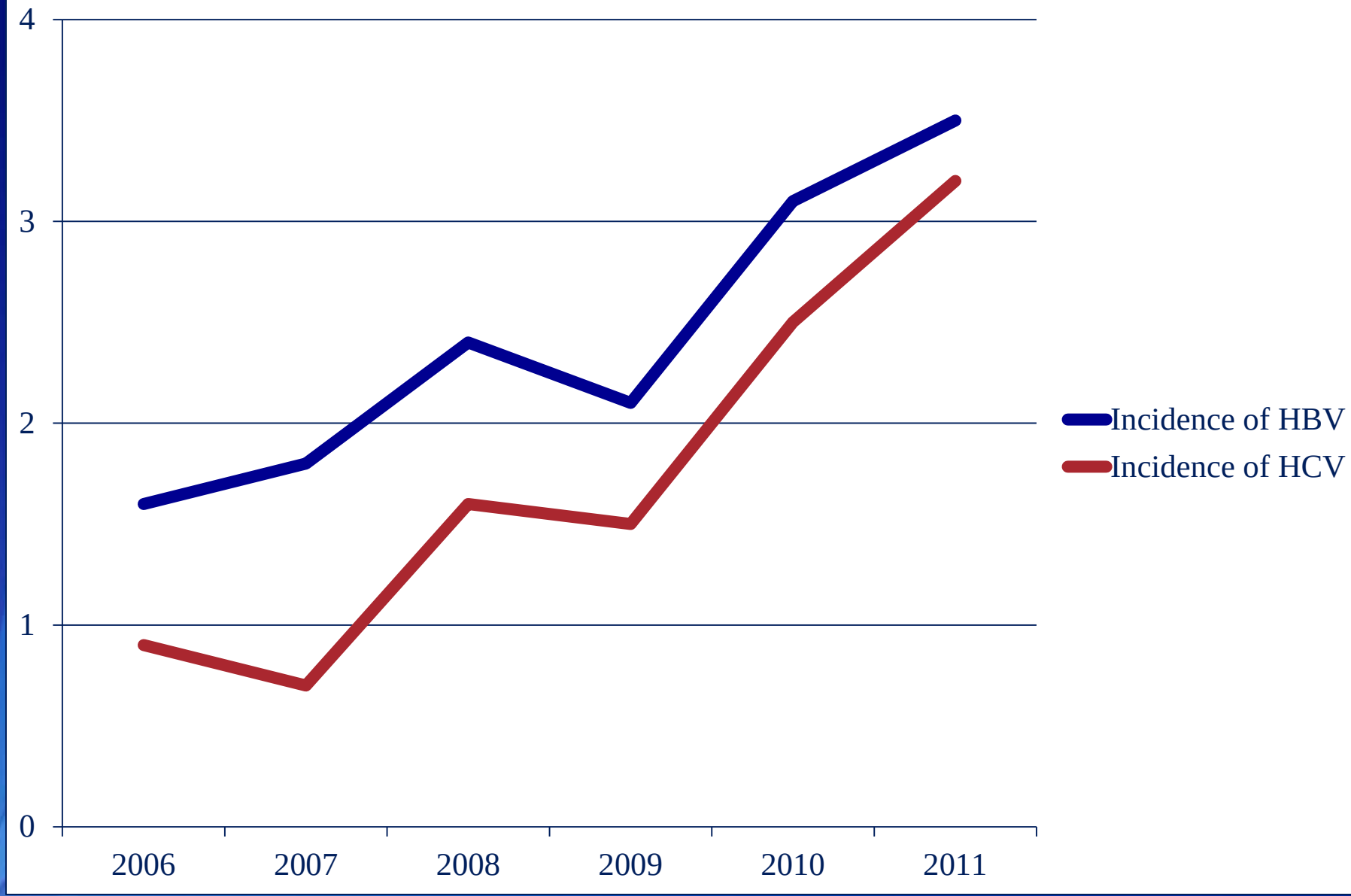
Trends in Any Opioid and Other Drug Injection, Kentucky, 2006-2012



Trends in Young vs. Older Opioid Drug Injection, Kentucky, 2006-2012

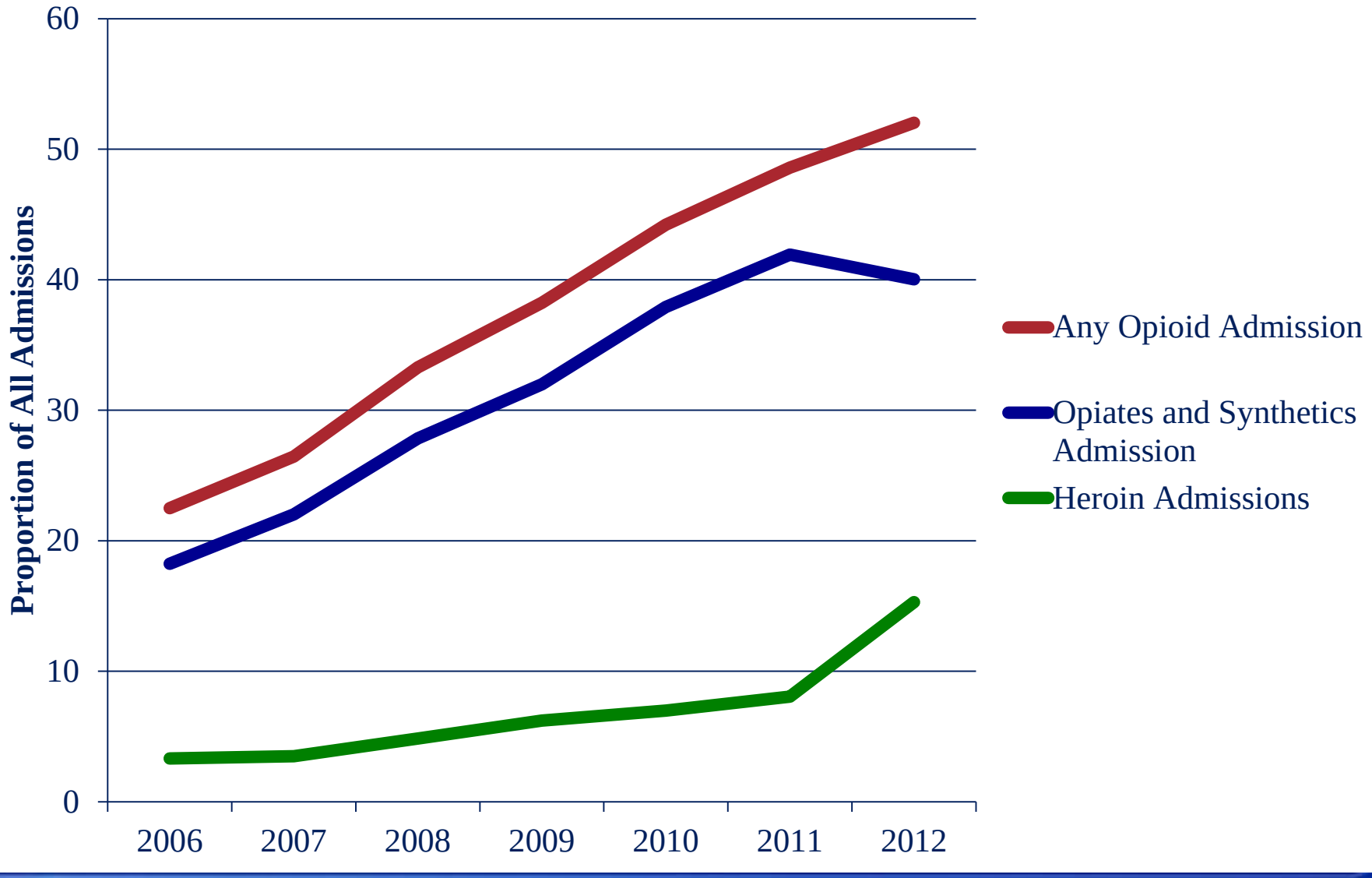


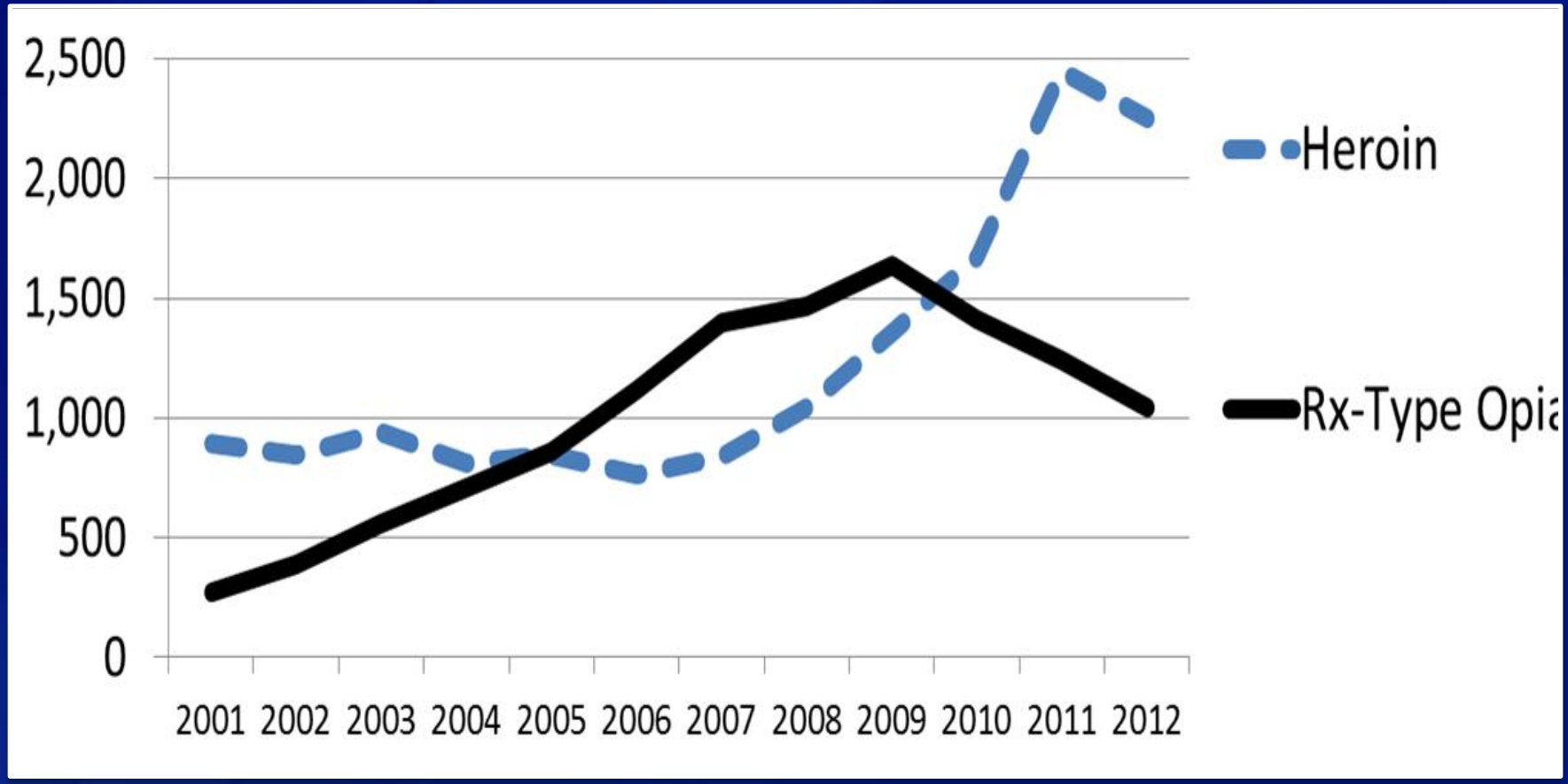
Incidence of HBV and HCV, Kentucky, 2006-2011



*Rate per 100,000 population.

Trends in Opioid Admissions, Kentucky, 2006-2012





Police Evidence, WA, 2001-2012

(x axis = # pieces of evidence)

Transformation of the Opiate Addict* (1895—1935)

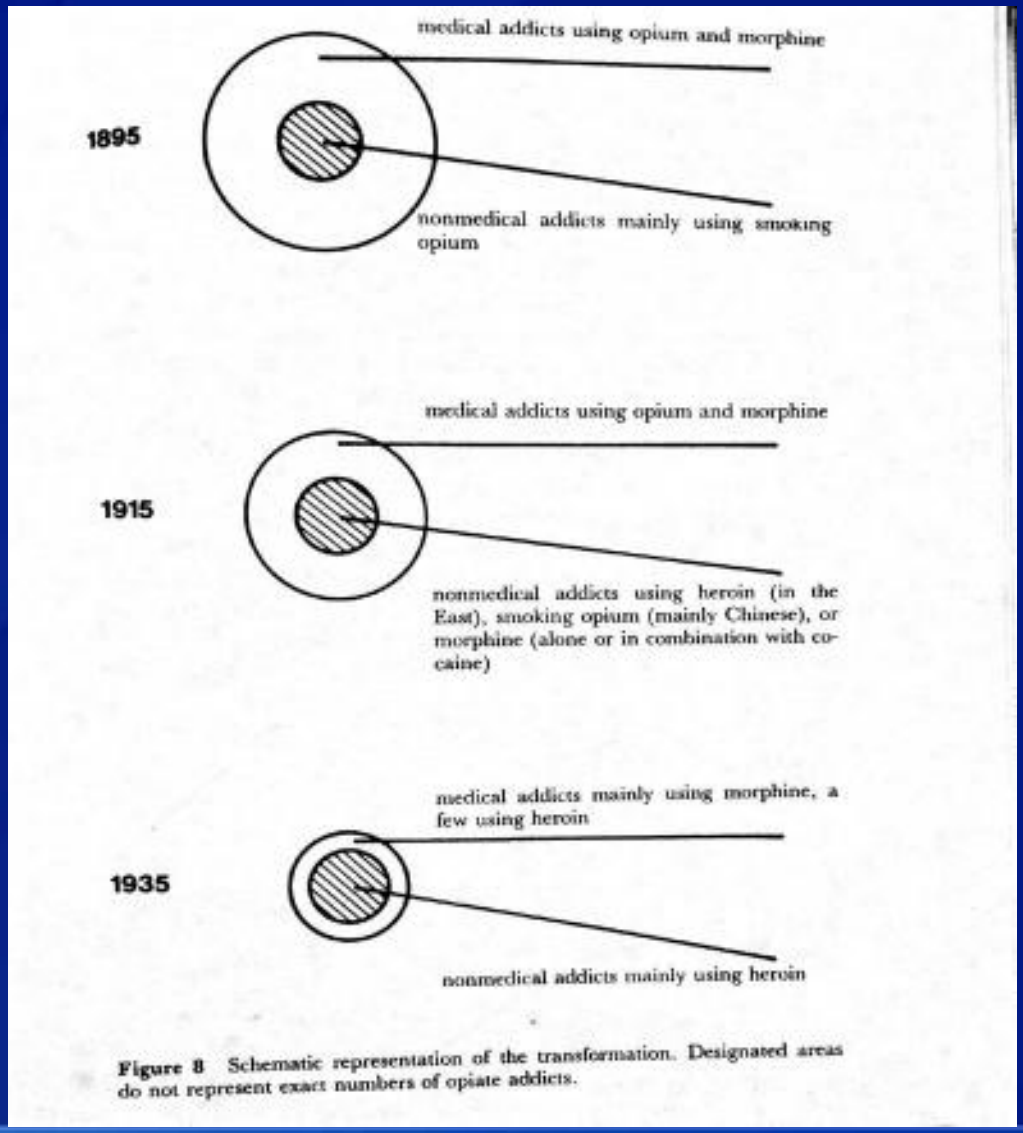


Figure 8 Schematic representation of the transformation. Designated areas do not represent exact numbers of opiate addicts.

*Courtwright, 1982, *Dark Paradise*

Special Thanks To:

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Strategies to Prevent HCV among Persons who Inject Drugs

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Rural Particularities

- Drug treatment options extremely limited in rural areas -- especially for youth
- IDU rare in Appalachia KY in 1997[1]; in 2007 IDU prevalence <40% among Appalachian drug users[2]
- Lack of syringe exchange programs; reduced access to injection-related health education
- HCV treatment is limited, difficult to access, and expensive
- Little known about drug using trends in rural Appalachia
- Few empirical reports on IDU and the sequelae of drug use

[1] Leukefeld et al., *SUMS*, 1997; [2] Havens et al., *D & A Dep*, 2007

Rural Needs Assessment

- outreach strategies to reach young persons
- kinship involvement
- recruitment portals
- abstinence-based drug treatment
- opioid agonist therapy
- overdose prevention (with Naloxone access)
- sterile injection equipment
- safer injection education
- HCV testing (both anti-HCV and HCV-*RNA*);
- HCV treatment

Characteristics of Neophyte Injectors

- Social relations based on trust and sharing[1]
- More likely to use drugs with a partner or group[1]
- More likely to share injection equipment with peers[1]
- Higher odds of employing riskier injection practices[2]
- Less experience injecting and less injection competency[3]
- Less awareness of the dangers involved with drug injecting[4]
- Less knowledgeable of risk reduction techniques[4]
- Less experience in preparing and injecting abuse-deterrent tablet formulations[4]

Overall, a younger age at the time of initiation of injection is associated with the development of high risk injection techniques that tend to persist with duration[5]

1. Vidal-Trecan et al. 2002; 2. Surrat et al. 2011; 3. Doherty et al. 2000; 4. Katz et al. 2011; 5. Novelli et al. 2005

To reduce drug injection initiation

Source: adapted from Neil Hunt, UK,
http://www.exchangesupplies.org/publications/Rtmanual/briefing.html

Increase HCV Screening and Testing

Survey of 197 PWID in *Denver*: HCV-aware engaged in fewer HCV risk behaviors[1]

Survey of 337 PWID in *Seattle*: Participants who knew their HCV status were more likely to share injection equipment with persons of concordant HCV status; i.e. they are more likely to "serosort" injection equipment[2]

National Survey of 9690 PWID: N.H.B.S. participants who knew their HCV status and the HCV status of their last injection partner were more likely to "serosort" injection equipment[3]

[1]Kwiatkowski et al. *Addiction* 2002; [2]Burt et al. *Drug & Alc Dep* 2009; [3]Smith et al. *CID*, 2013

Increase Syringe Access

- Syringe Exchange Programs (state-sanctioned)
  - Secondary exchange
  - Extra-legal programs
  - Peer-driven access
- Pharmacy sales w/out prescription (pharmacy access)
- Physician Prescription
- Other models outside of the U.S. include vending machines, supervised injection sites

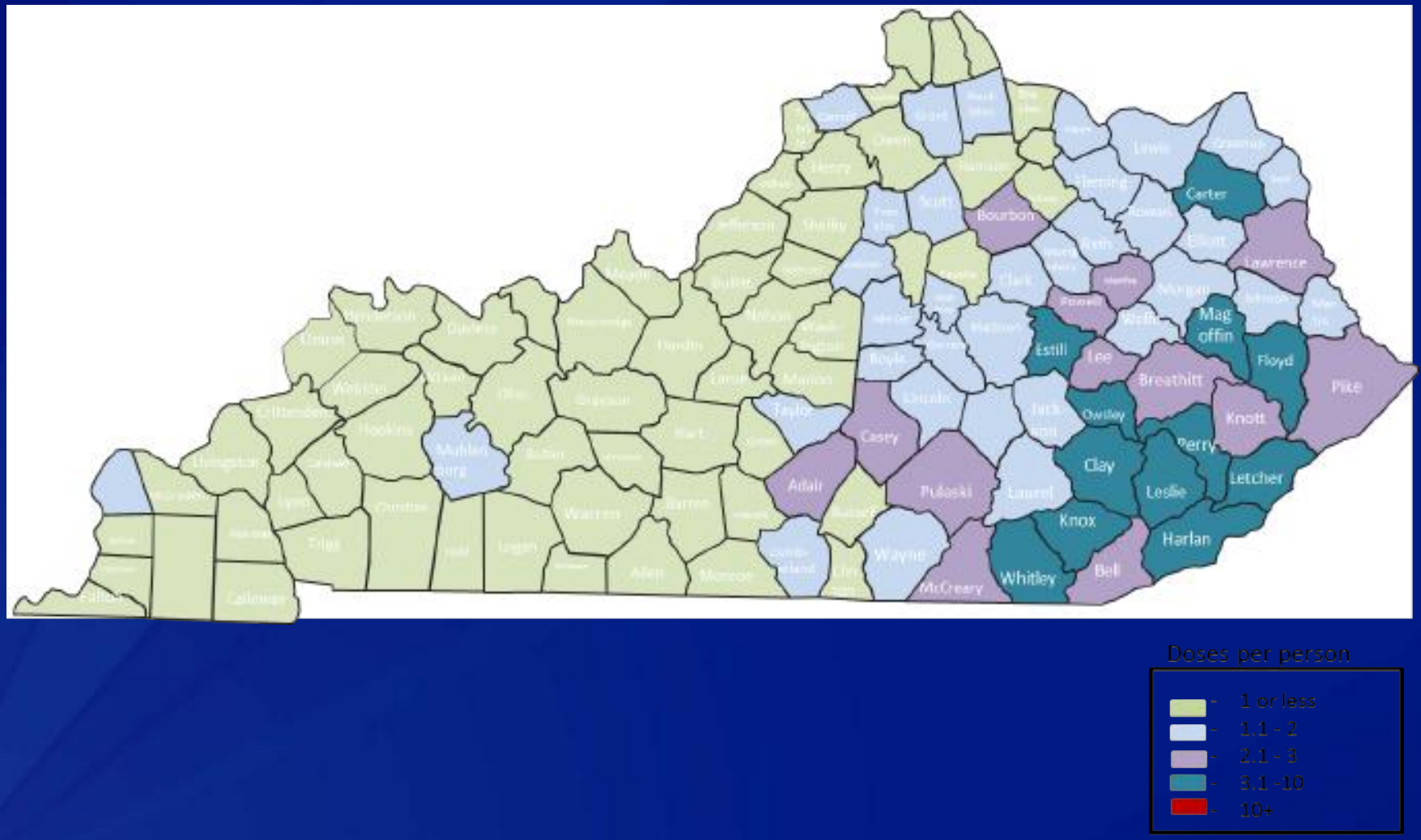
Buprenorphine Physician and Treatment Program Locator

SAMHSA
Substance Abuse & Mental Health Services Administration
U.S. Department of Health and Human Services

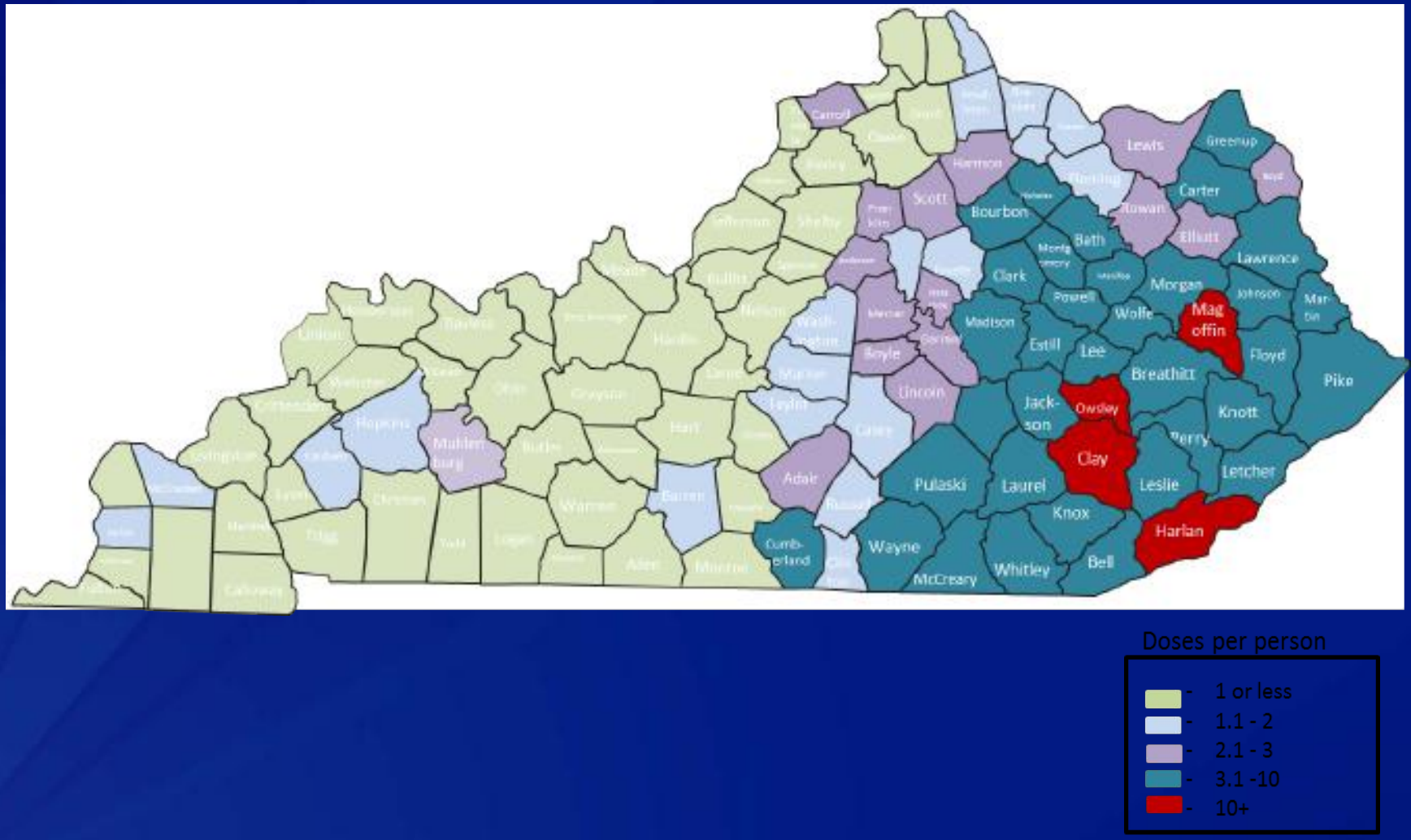
- All patients prescribed buprenorphine can be tested for HCV
- How often is testing performed?
- Promote HCV testing by adding
  - As a requirement for a SAMHSA waiver to treat addiction
  - To prescription information in SAMHSA Clinical Practice Guidelines

Division of Viral Hepatitis

2010 Kentucky Buprenorphine Data by County



2013 Kentucky Buprenorphine Data by County



Multi-Component Interventions (MCI)

An approach to risk reduction where SEPs/pharmacy access and opioid agonist therapy (OAT) programs are combined as "packages" and offered concurrently in the form of a "one-stop shop."

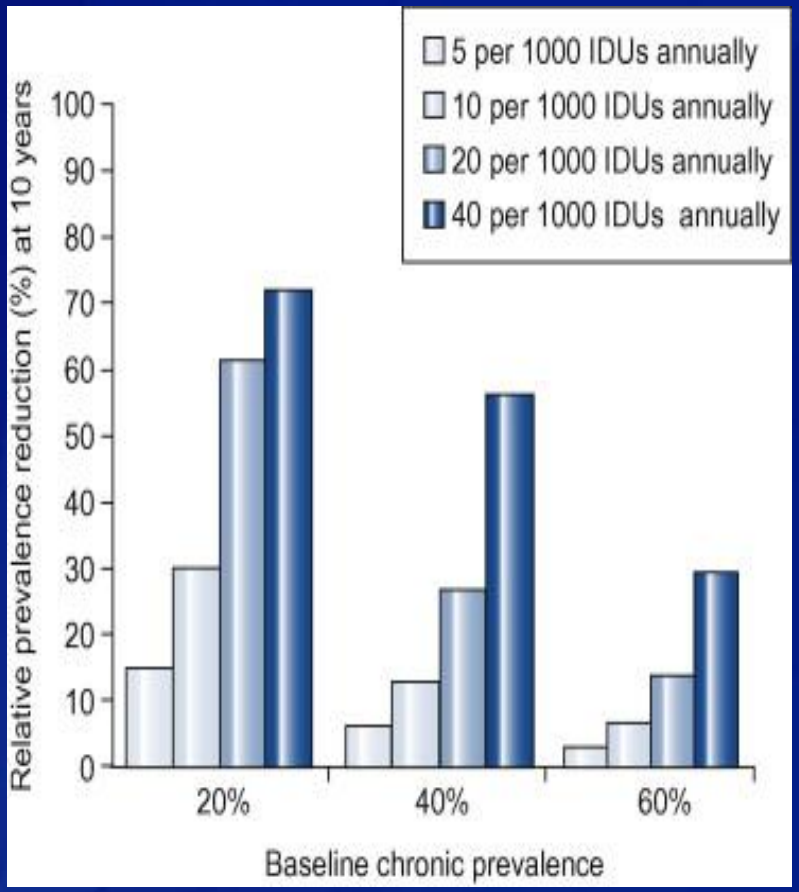
Rather than utilizing one program at a time, MCI incorporates several, low threshold services simultaneously and increases the likelihood that PWID will traverse both services depending on the status of their addiction.

Multi-Component Intervention

A combination of *readily-available* and *low threshold* OAT (with methadone and/or buprenorphine) and SEPs have been shown to:

- Reduce syringe sharing (Palmateer et al. 2010)
- Lower injecting risk (Mathers et al. 2010)
- Reduce incidence of HIV and HCV (Kwon et al. 2009)
- In the U.K., a programmatic mixture of SEPs and OAT had the effect of reducing HCV incidence by up to 80% (Turner et al. 2011).
- Other noteworthy reductions were reported in New York City (Birkhead et al. 2007) and Amsterdam (Van Den Berg 2007)
- Pouget et al.'s (2011) meta-analysis found substantial and statistically significant reductions in HCV incidence —of approximately 75%— when combination prevention strategies were implemented.

Antiviral Therapy Might Be Used to Reduce HCV Prevalence among Injecting Drug Users



- Annually treating 10 HCV infections per 1000 IDU and achieve SVR of 62.5%
- Projected to result in a relative decrease in HCV prevalence over 10 years of 31%, 13%, or 7% for prevalences of 20%, 40%, or 60%, respectively

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Martin et al. Journal of Hepatology 2011 vol. 54 ¡ 1137–1144

HCV Care via Telemedicine

- Telemedicine offers opportunity to remotely link patients with physicians who are geographically separated.

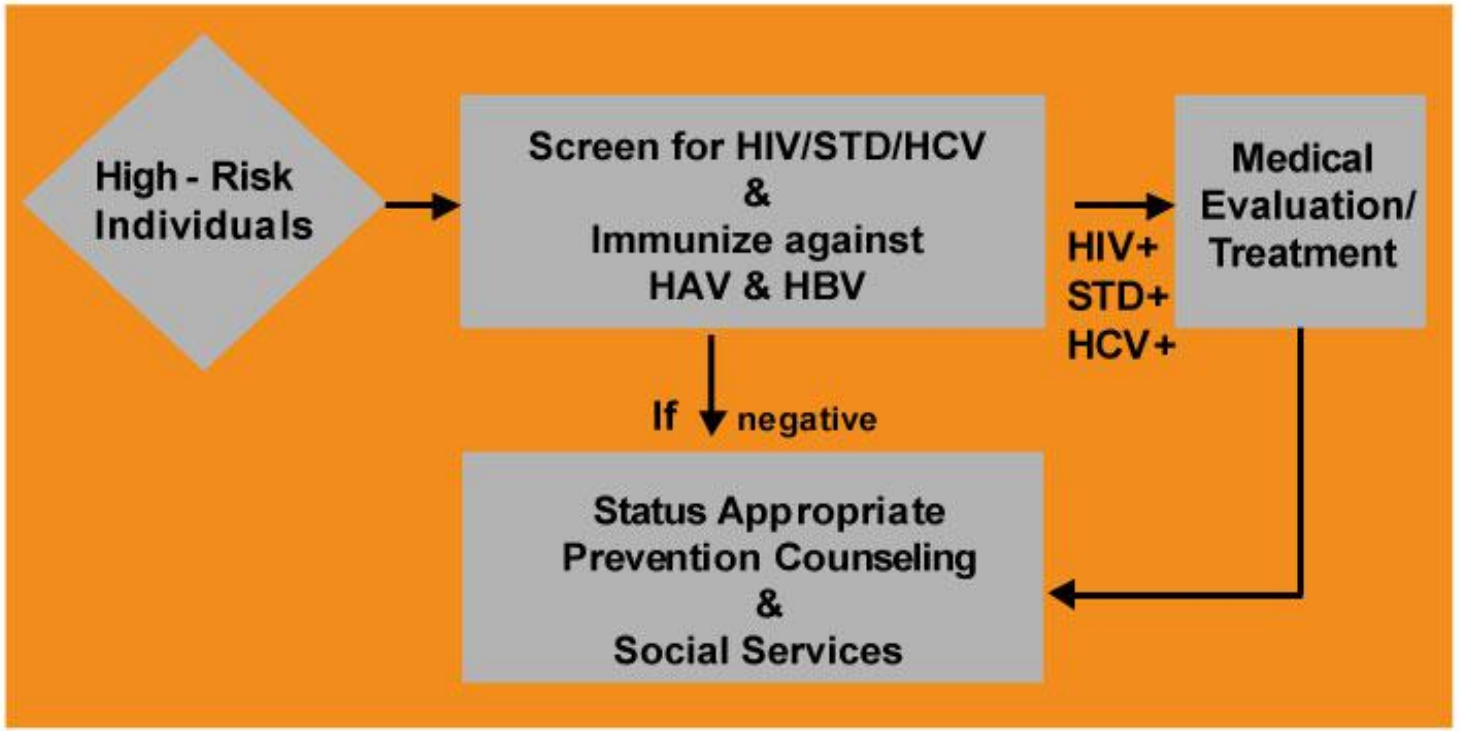
- HCV care via telemedicine
  - Prior attempts in prisons[1,2] and at rural clinics[2]
  - Web-based interventions have been used for addicted persons[3]
  - Physician interactions via telemedicine has never been attempted in opioid treatment program.

[1] Sterling et al, Amer J Gastro, 2004;99:866; [2] Arora, Hepatology 2010; 52:1124; [3] Tait, Med J Aust 2010;192(11 supp):S15

Economic Development In Appalachia Kentucky

- Jobs
- Cultivate existing industry
  - Manufacturing;; textiles; auto industry; tobacco; and health care
- Develop new industry that can thrive in Appalachia
  - Green Technologies; high tech; vocational training;
- **More choices to divert attention from drug use**
- Hope for the future. The American Dream

Comprehensive Approach to Fighting Everything!



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