

PREVALENT INFECTIOUS DISEASES IN CORRECTIONS: HIV, HCV, COVID



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Disclosures

Potentially competing interests in the past year and nature of the financial relationship:

1. **bioLytical Laboratories Inc.** provided HIV testing kits to DC jail for my research studies.
2. **Gilead Sciences** provided research funds to Emory for research at DC jail.
3. **Mercy Care Atlanta** (FQHC) pays me to provide HIV care.

Learning Objectives

- Explain why correctional populations have high rates of HIV, HCV, and COVID-19.
- Discuss screening, testing, and treatment for HIV, HCV, and COVID-19.
- Identify co-morbidities between HIV, HCV, and COVID-19 in incarcerated patients.

Outline

THINK ROUTE OF TRANSMISSION

Background

BLOOD AND BODY FLUIDS

HIV

BLOOD AND BODY FLUIDS

HCV

BLOOD AND BODY FLUIDS

HCV + HIV Comorbidities

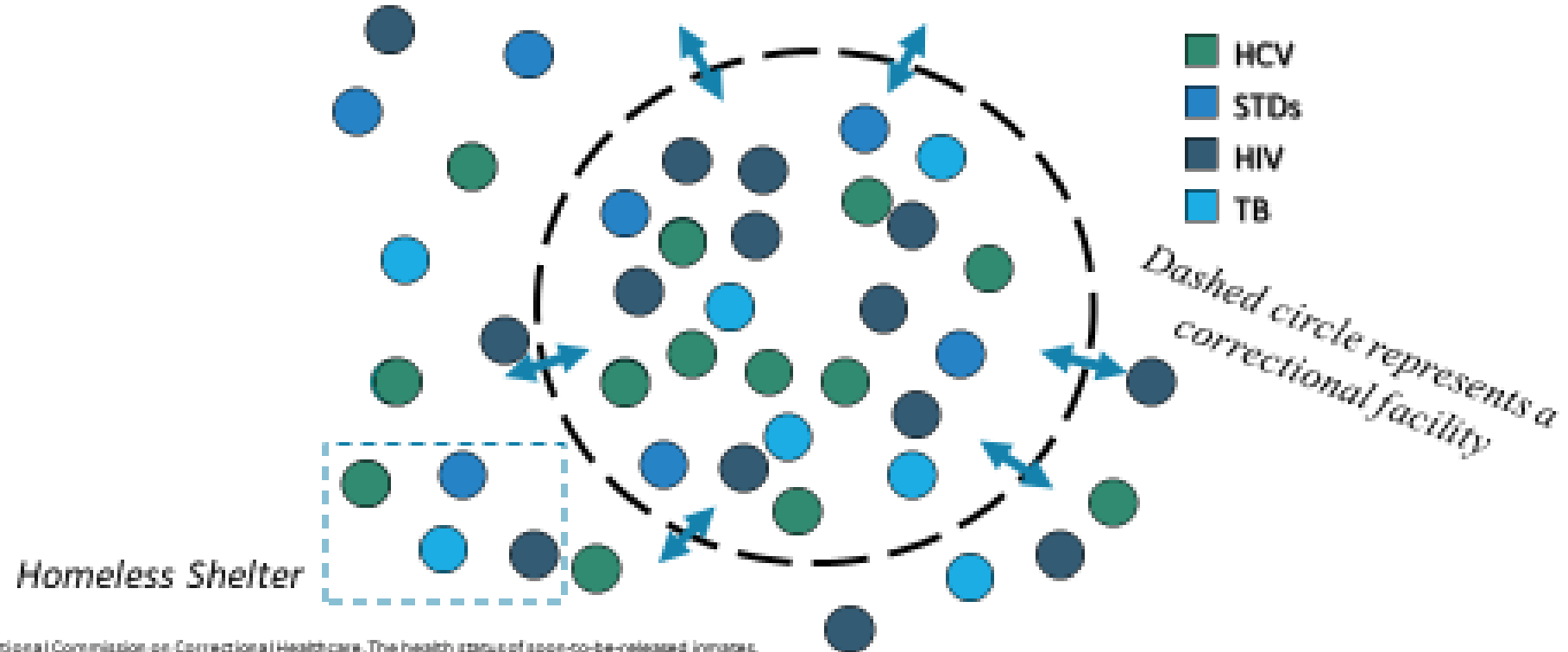
AIRBORNE

TB, COVID-19

THINK ROUTE OF TRANSMISSION

Background

HIV, HCV, TB— DYNAMICS BETWEEN CORRECTIONS/COMMUNITY



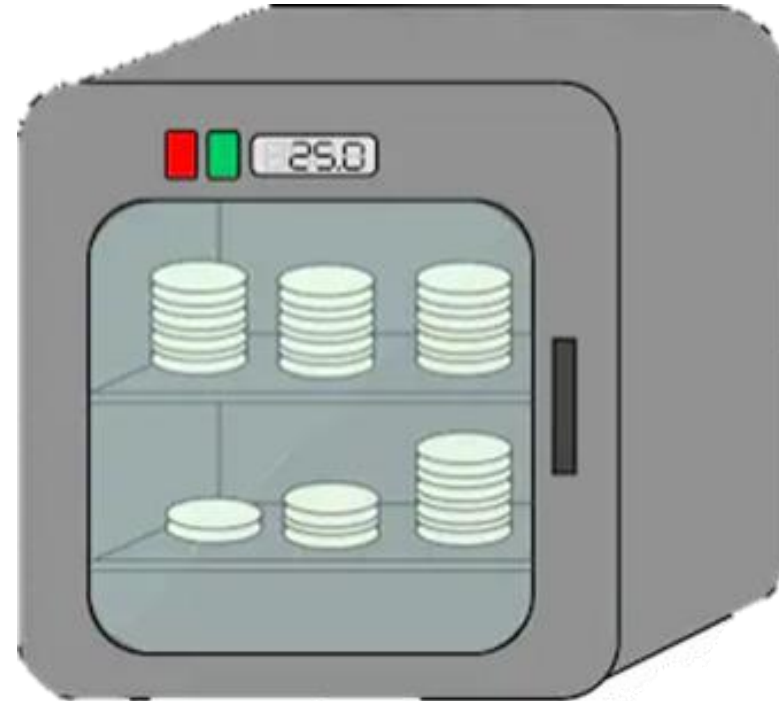
National Commission on Correctional Healthcare. The health status of soon-to-be-released inmates.
A report to Congress. March 2002; Vol 1. http://www.nccdhc.org/pubs/pubo_gtblr_voll.html. Accessed Jan 9, 2006.

To Characterize Role of Jails/Prisons in Infectious Disease Epidemiology:

- **Reservoir?**
 - Those jailed: high risk before admission
 - Concentrates infectious disease
 - Opportunity to manage consequences
 - Opportunity to impact community spread
- **Incubator?**
 - Amplifies infectious disease

Correctional Facilities (CFs)

RESERVOIR vs. INCUBATOR?



Why are infections overly represented in CF?

1. HIV: Imported infection

- Community risk behavior of entrants—sex work, IDU, behavioral disinhibition with drugs
- Demographics of entrants—men > women, disproportionate minority confinement
- Rare spread inside
- “Reservoir”



Why are infections overly represented in jails?

1. HIV

- Community risk behavior of entrants—sex work, IDU, behavioral disinhibition with drugs
- Demographics of entrants—men > women, disproportionate minority confinement
- Rare spread inside
- “Reservoir”



2. TB

- **Demographics of entrants—compared to community, HIV prevalence 3-10-fold higher, higher % foreign born**
- **Facility outbreaks common globally**
- **Prison more of an Incubator than a Reservoir**

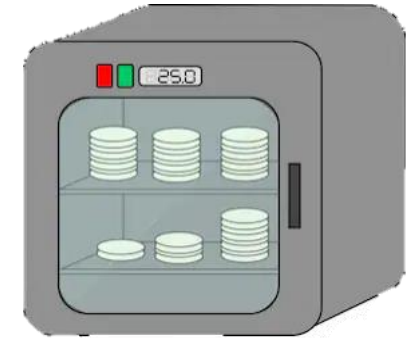
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1. HIV

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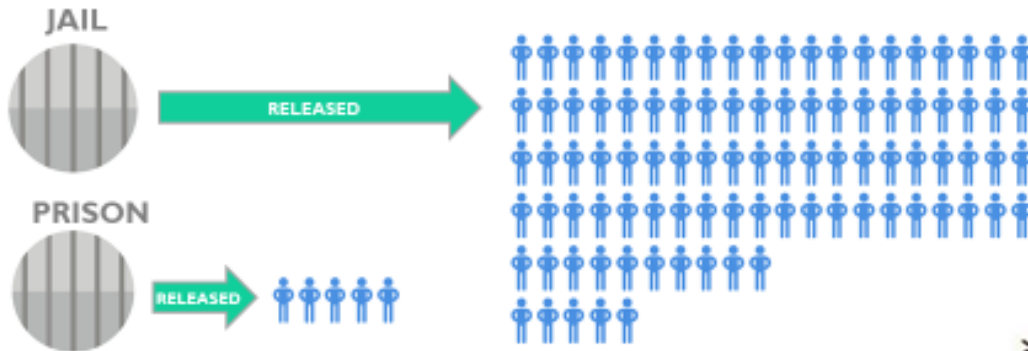
3. What does COVID-19 represent?

a. Reservoir b. Incubator c. Maybe both

KEY DIFFERENCES BETWEEN JAILS AND PRISONS

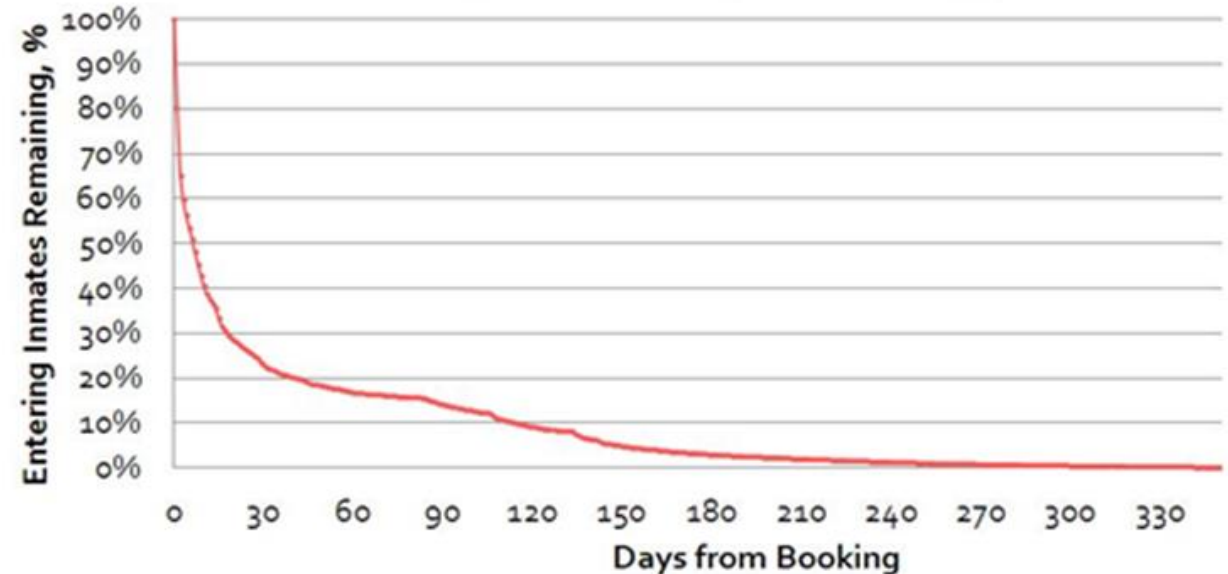
However if you look at releases over a one year period:

Approximately 95% of the 10 million people discharged from the criminal justice system each year are released from jails



DYNAMICS of Jail vs. Prison Populations

Duration of Jail Stay, Cohort Entering Fulton County (GA) Jail, 2011



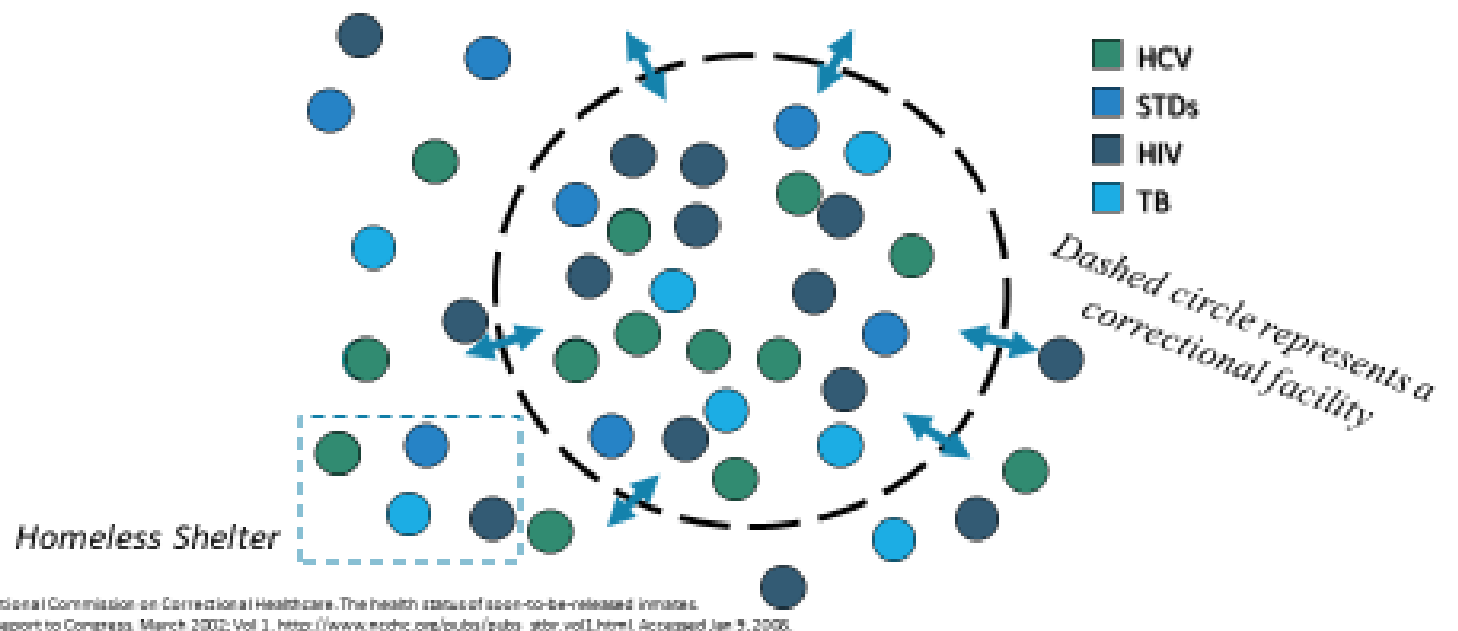
BLOOD AND BODY FLUIDS

HIV

HIV, HCV, TB— DYNAMICS BETWEEN CORRECTIONS/COMMUNITY

1:6 Persons living with HIV spends part of year in jail/prison (Spaulding PLoS One 2009)

1:3 Persons living with HCV in the US spends part of their year in a jail or prison. (Varan PHR 2014)



Traumatic Injuries Among Individuals in Custody of Law Enforcement: Assessing injuries of patients in police custody at an urban level 1 trauma center

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Introduction

- Individuals in police custody represent a vulnerable subset of trauma patients that have the potential to be at risk for disparate care.
- Though the literature on mortality of persons in police custody continues to grow, less research currently exists on morbidity.

Background

- Nearly 27 million non-fatal injuries were sustained in the United States in 2019, costing \$4.2 trillion.¹
- The United States has the highest incarceration rate in the world.²
- Individuals in police custody tend to have poorer health outcomes than the general population.³

Question: What types of traumatic injuries are sustained by individuals who either present to or are discharged from a trauma center in police custody?

Objective: Describe demographics, injuries, and health characteristics of patients in custody and compare to those not in custody.

Methods

- Data:** Trauma registry from Marcus Trauma Center at Grady Memorial Hospital, Atlanta GA
- Model:** Logistic regression w/ multivariate adjustment
- Inclusion criteria:** Hospitalized adults (18 years or older) who arrived in the emergency department and/or were discharged alive from the hospital in police custody between 1/1/2016 and 12/31/2020.
- Matching:** 3 to 1 ratio by cause of injury
- Independent variable:** Custody status

Results

- Most patients in police custody were hospitalized as the result of **blunt force trauma**, with the leading causes of injury being **firearm**, **assault**, and **motor vehicle collision**.

Table 1: Injury Overview

Variable	n (%)
Injury Type	
Blunt force trauma	452 (61.25)
Penetrating trauma	286 (38.75)
Chief Complaint	
Assault	184 (24.93)
Bicycle	1 (0.14)
Biting	6 (0.81)
Fall	87 (11.79)
Firearm	192 (26.02)
Glass	6 (0.81)
Knife	38 (5.15)
Motorcycle	29 (3.93)
Motor vehicle collision (MVC)	155 (21.00)
Penetrating mechanism	19 (2.57)
Pedestrian	16 (2.17)
Other	1 (0.14)

After adjusting for age, race, and gender, patients in custody were **significantly** ($p < 0.05$) **more likely** to be:

- Male
- Black or African American
- Current smokers
- Drug tested
- Positive for illegal drugs
- Admitted for a self-inflicted injury
- Diagnosed with a major psychiatric illness

Racial disparity **persisted** after adjusting for presence of drugs, self-inflicted injury, and major psychiatric illness.

Table 2: Patient Characteristics

Variable	In Custody (n=738)	No Custody (n=2214)	Adjusted Odds Ratio (95% CI)
Male	666 (90.24)	1658 (74.89)	2.98 (2.29–3.88)
Black/African American	588 (79.67)	1525 (68.88)	1.64 (1.33–2.03)
Current Smokers	400 (54.20)	932 (41.10)	1.43 (1.20–1.70)
Drug Tested	266 (36.04)	554 (25.02)	1.62 (1.35–1.95)
Positive Drug Test	180 (24.39)	302 (13.64)	1.88 (1.52–2.32)

Discussion

- Interactions with law enforcement, either prior to arrival in the ED/hospital or with subsequent discharge to custody, represent an important subset of trauma victims.
- Results indicate potential for involvement in illegal activities (e.g., assault as cause of injury, positive drug screenings).
- Limitations include:
 - Inclusive only of patients to the trauma center.
 - Provider bias/variability.
 - No context or details regarding custody status.
 - Possible omission of preexisting health conditions
- Potential areas for future studies:
 - Disparities in chronic and mental health conditions.
 - Financial costs attributed to care.
 - Geographical factors (e.g., zip code of injury or patient residence, injuries at correctional facility).
 - Circumstances surrounding custody status.
 - Eventual outcomes of injury.

Conclusion

- Notable inequity and overrepresentation by race is evident.
- Further studies will be required to explore community factors, understand health disparities, and identify potential targets for intervention in this population.

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QUESTIONS

HIV screening in jails

1. Is offering screening for HIV a human right? Mandela Rules: Standard Minimum Rules for the Treatment of Prisoners (were revised by the UN in 2015.)
2. Coercion—would it be an issue? How can you protect against it
3. How do you measure the impact of testing on the greater community?
 - How can you measure the relatedness of jail cases to cases in the community?

QUESTIONS

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RESEARCH ARTICLE

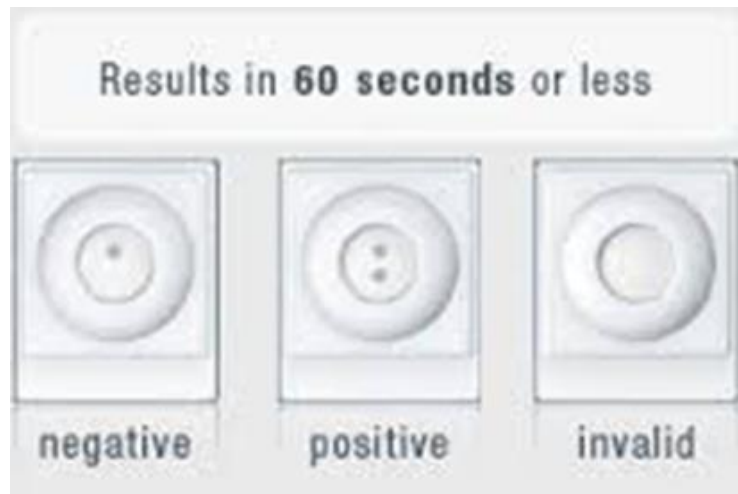
Open Access

Understanding how, why, for whom, and under what circumstances opt-out blood-borne virus testing programmes work to increase test engagement and uptake within prison: a rapid-realist review



Seth Francis-Graham^{1,6,7*} , Nnenna Adaniya Ekeke², Corey Andrew Nelson³, Tin Yan Lee³, Sulaima El Haj², Tim Rhodes⁴, Cecilia Vindrola⁵, Tim Colbourn⁶ and William Rosenberg^{1,2,7}

What test you use MATTERS!



Opt-out:
--Nudge Theory
--Default Effect



- *Conventional testing is appropriate in prisons*

QUESTIONS

HIV screening in jails

1. Is offering screening for HIV a human right? Mandela Rules: [Standard Minimum Rules for the Treatment of Prisoners](#) which were revised by the UN in 2015
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3. How do you measure the impact of testing on the greater community?
--How can you measure the relatedness of jail cases to cases in the community?

Measuring Impact— of Eliminating ROUTINE HIV SCREENING, Replacing with Clinician-Initiated Testing



**Establish HIV Screening Program Led
by Staff at Santa Clara County Jail**

Anne C. Spivey, MD, MPH; Min Ju Kim, MD, MPH; Kiemesha T. Corpening, MPH; Jennifer Carpenter, LPN;
Portia Watson, LPN; Chava J. Bowden, MD, MPH

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Context: Human immunodeficiency virus (HIV) testing in jails provides an opportunity to reach individuals outside the scope of traditional screening programs. Rapid turnover of jail populations has, in the past, been a significant barrier to offering routine access to testing. **Objectives:** To implement a rapid HIV testing program led by nurses, to measure the impact of the program, and to identify factors that facilitate testing, incarceration, jail, linkage

Costs and Consequences of Eliminating a Routine, Point-Of-Care HIV Screening Program in a High-Prevalence Jail



Angela B. Hutchinson, PhD, MPH,¹ Robin J. MacGowan, MPH,¹ Andrew D. Margolis, MPH,¹
Madeline G. Adey, MPH,² Wendy Wen, MPH,³ Chava J. Bowden, BS,² Anne C. Spaulding, MD, MPH²

Introduction: This study aims to assess the public health impact of eliminating a longstanding routine HIV screening program and replacing it with targeted testing. In addition, costs, outcomes, and cost effectiveness of routine screening are compared with those of targeted testing in the Fulton County Jail, Atlanta, Georgia.

Methods: A published mathematical model was used to assess the cost effectiveness and public health impact of routine screening (March 2013–February 2014) compared with those of targeted testing (January 2018–December 2018) from a health system perspective. Costs, outcomes, and other model inputs were derived from the testing programs and the published literature, and the

and was cost saving. The missed opportunity to diagnose infections because routine screening was eliminated resulted in an estimated 8.4 additional HIV transmissions and \$3.7 million in additional costs to the healthcare system.

Conclusions: Routine HIV screening in high-prevalence jails is cost effective and has a larger impact on public health than targeted testing. Prioritizing sustained funding for routine, jail-based HIV screening programs in high-prevalence areas may be important to realizing the national HIV prevention goals. *Am J Prev Med* 2021;61(5S1):S32–S38. Published by Elsevier Inc. on behalf of American Journal of Preventive Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Further QUESTIONS

HIV screening in jails

- Is offering screening for HIV a human right?
- Coercion—would it be an issue? How can you protect against it
- How do you measure the impact of testing on the greater community?
 - Fulton County Jail (FCJ) is a high-volume jail. Atlanta ranks 4th in annual # of new HIV diagnoses, where 83% are among men, 69% are in MSM, and 74% are in blacks.
- How can you measure the relatedness of jail cases to cases in the community?



HHS Public Access

Author manuscript

J Acquir Immune Defic Syndr. Author manuscript; available in PMC 2019 December 15

Published in final edited form as:

J Acquir Immune Defic Syndr. 2018 December 15; 79(5): 543–550. doi:10.1097/QAI.0000000000001856.

Identifying clusters of recent and rapid HIV transmission through analysis of molecular surveillance data

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¹Division of HIV/AIDS Prevention, Centers for Disease Control and Prevention, Atlanta, United States

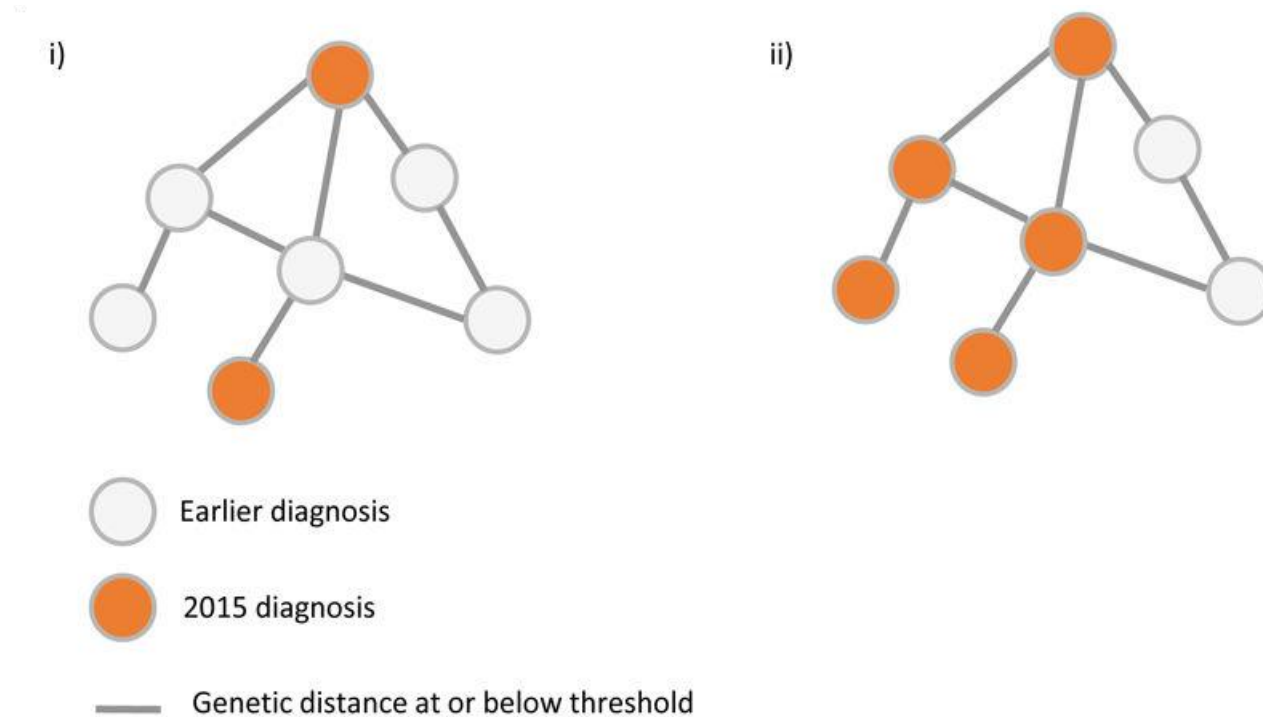
²Epidemic Intelligence Service, Centers for Disease Control and Prevention, Atlanta, United States

³Department of Medicine, University of California, San Diego, United States

[#] These authors contributed equally to this work.

HIV sequencing

- Clusters of new infection: i) Would not be considered linked. ii) Linked



- From: Oster. JAIDS 2015

Limited Adoption. And none linking Jails at First

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Oster et al.

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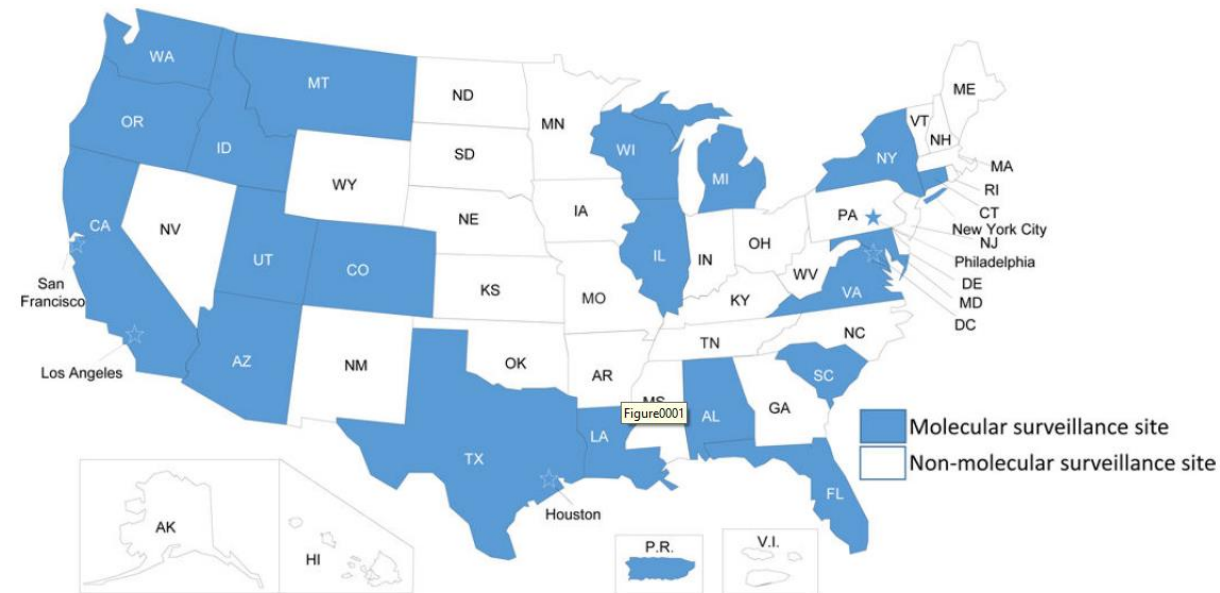


Figure 1.

Map of jurisdictions participating in molecular HIV surveillance, 2013–2017. These jurisdictions reported 70% of HIV diagnoses occurring in 2015. Stars indicate cities/counties that are separately funded for HIV surveillance activities.

2022 Follow UP

Fulton
County Jail
Health
Service now
reinstating
Point-of-care
testing.



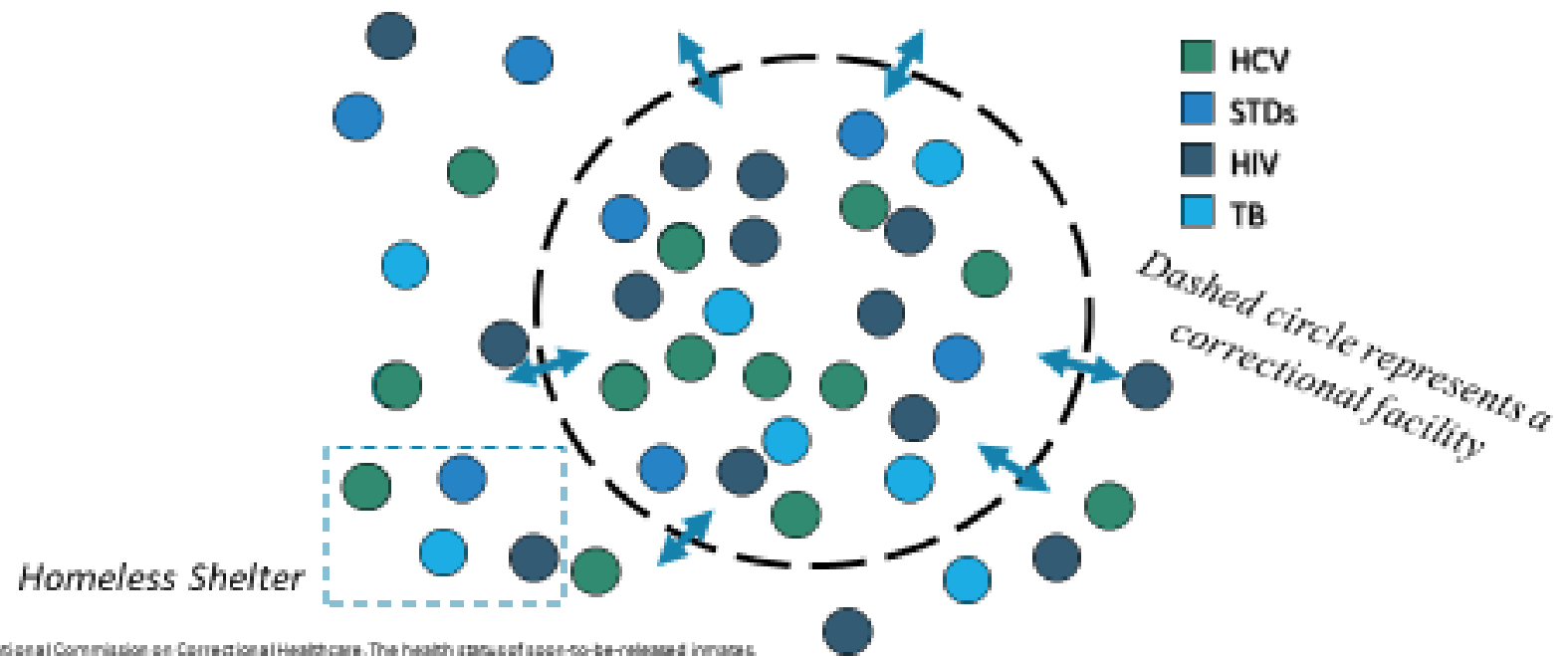
BLOOD AND BODY FLUIDS

HCV

HIV, HCV, TB— DYNAMICS BETWEEN CORRECTIONS/COMMUNITY

1:6 Persons living with HIV
spends part of year in
jail/prison
(Spaulding PLoS One 2009)

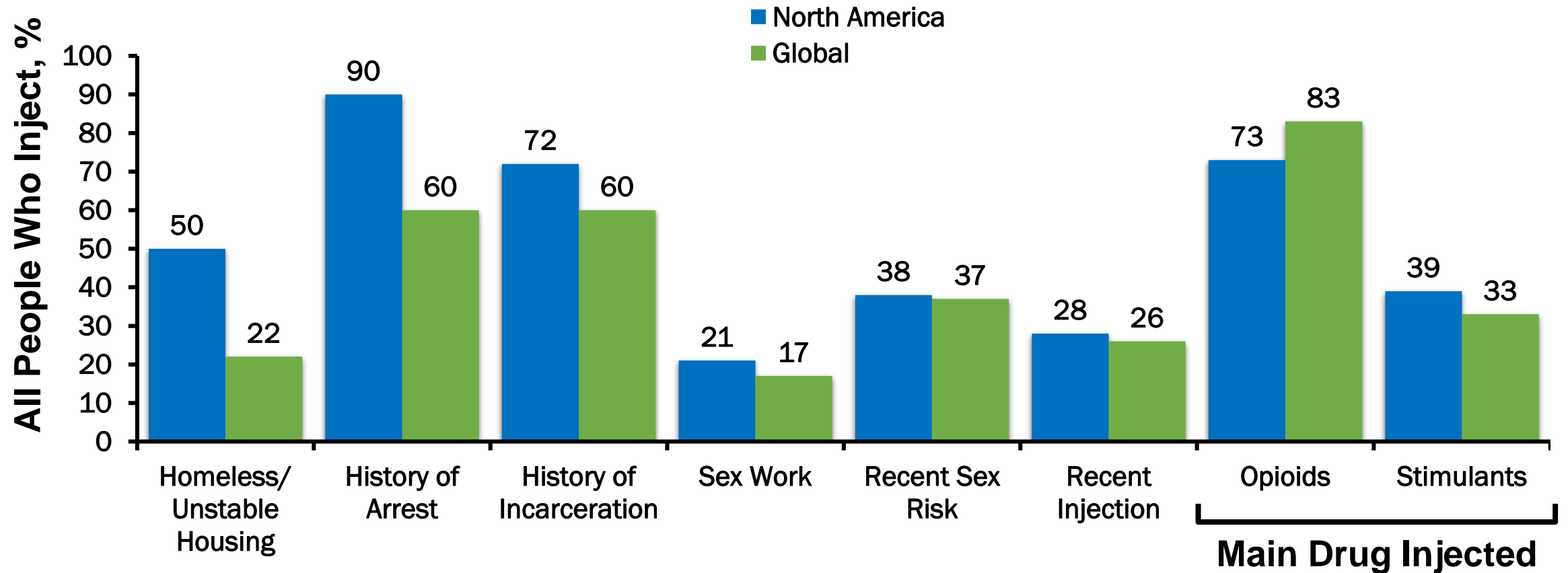
**1:3 Persons
living with HCV in
the US spends
part of their year
in a jail or prison.
(Varan PHR 2014)**



National Commission on Correctional Healthcare. The health status of soon-to-be-released inmates.
A report to Congress. March 2002; Vol 1. http://www.ncchc.org/pubs/paba_pabr_voll.html. Accessed Jan 9, 2008.

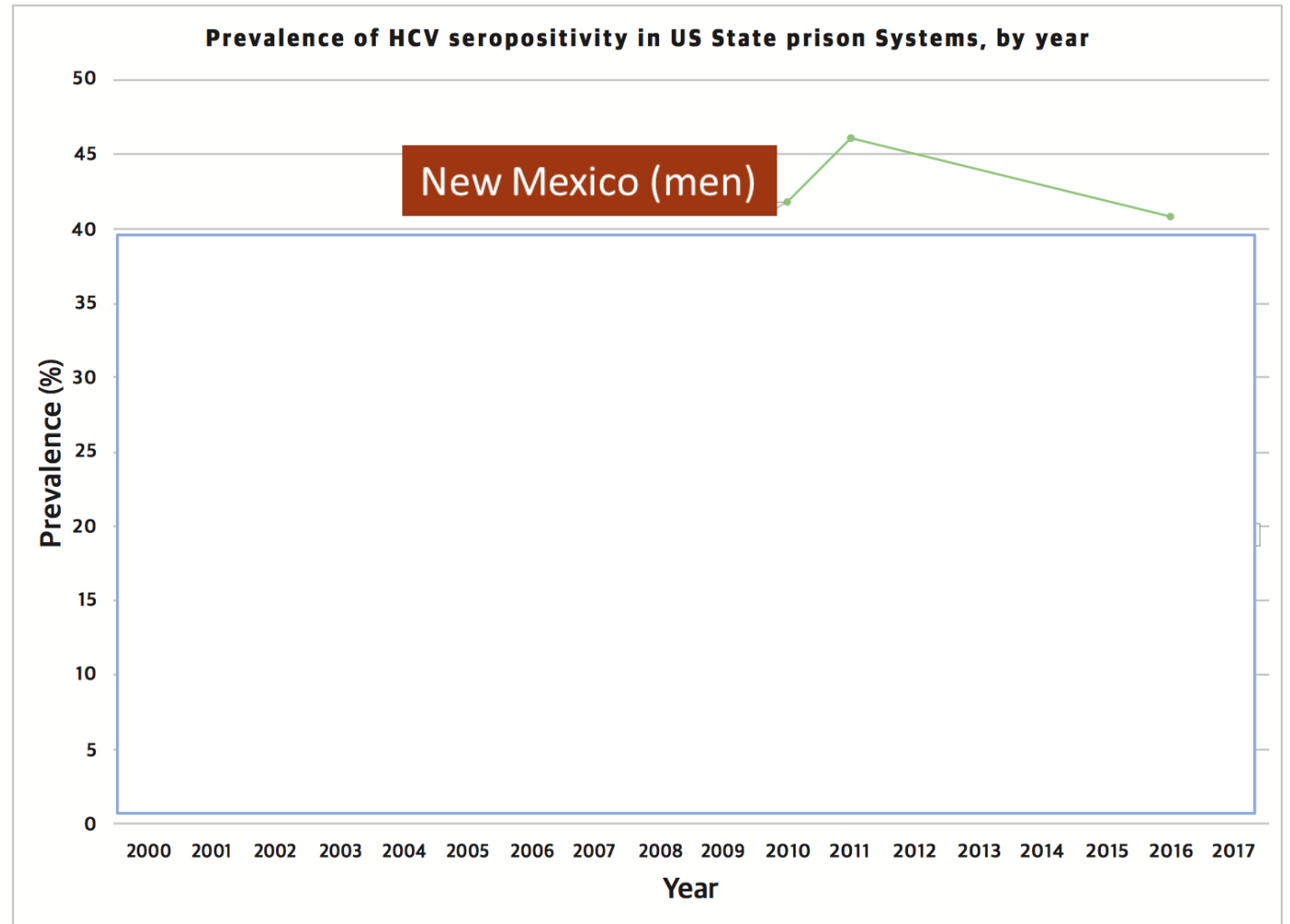
Real-World Problems: People Who Inject Drugs

LIFETIME PREVALENCE OF INCARCERATION



From: Block HIV/HCV Conference Atlanta, 9/28/18. Used with permission.
Degenhardt L, et al. *Lancet Glob Health*. 2017;5(12):e1192-e1207;.

Surveys of
State
Departments of
Corrections:
Hepatitis C
Antibody
Prevalence

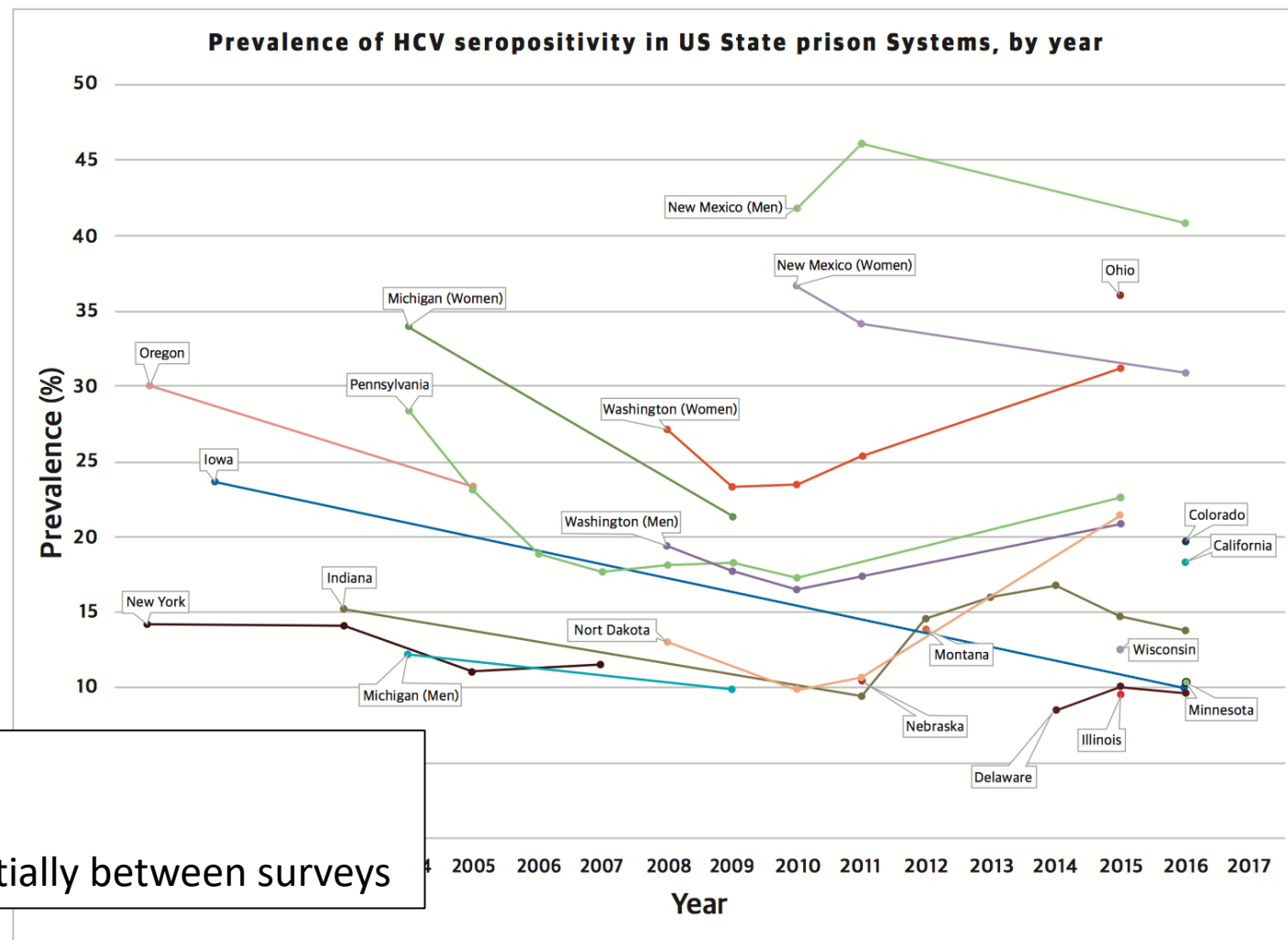


Source: Spaulding et al., AIDS Reviews 2017.

Surveys of State Departments of Corrections: Hepatitis C Antibody Prevalence

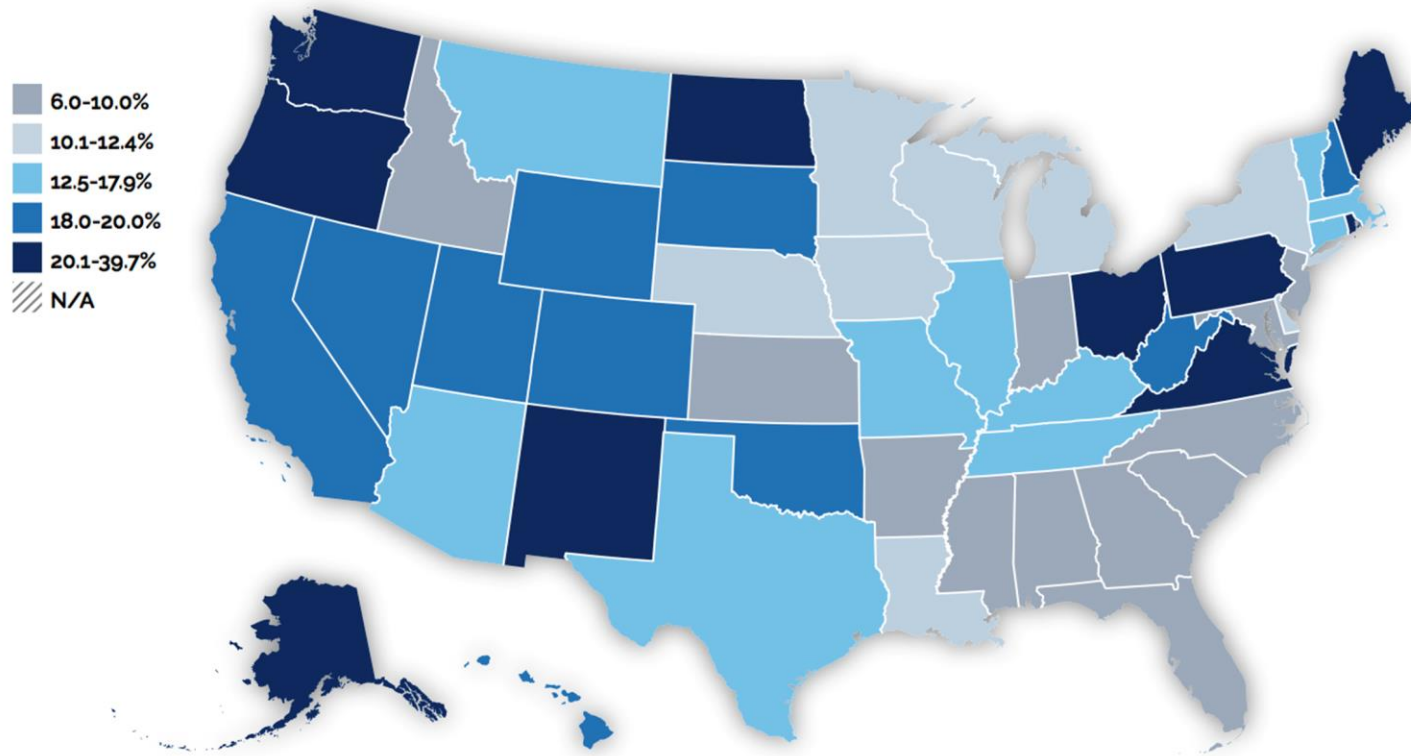
All surveys:

1. Marked heterogeneity
2. Ranking of states does not change substantially between surveys



Source: Spaulding et al., AIDS Reviews 2017.

Hepatitis C Ab Prevalence ...varies by state



Antibody:

- Range 5% - 48%
- Weighted mean: 18% (Varan 2014)

Viremia: when Ab+

- Range: 55% (California) - 78% (NM)
- Viremia prevalence: 4% - 40%?

- Antibody testing
- Prisons historically resistant with following up antibody testing with HCV RNA testing
- Treatment started at \$100,000 per patient in 2015
 - Price has dropped to ~\$10,000

Viral Hepatitis

Outbreaks

Hepatitis A Outbreaks +

Outbreaks Related to Healthcare -

Hepatitis B and C Outbreaks Reported to CDC

Healthcare Investigation Checklist

Healthcare Investigation Guide

Healthcare Investigation Letter

Healthcare Notification and Testing Toolkit

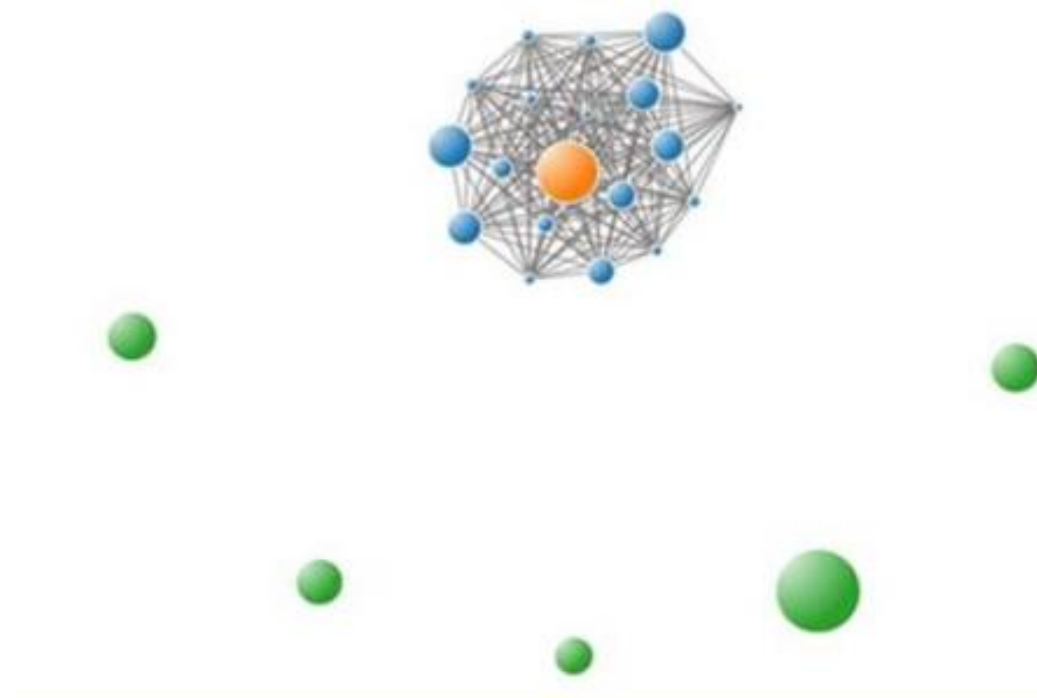
HCV Molecular Epidemiology

Hepatitis C Outbreaks in People who Inject Drugs

[Viral Hepatitis](#) > [Outbreaks](#) > [Outbreaks Related to Healthcare](#)

An example GHOST report may be found here: [Accurate genetic detection of hepatitis C virus transmissions in outbreak settings](#) 

Each patient is represented by a circle of smaller or larger size in proportion with the diversity of virus in that patient's sample. Pairs or clusters of transmission-linked patient samples are linked by bars.



BLOOD AND BODY FLUIDS

HCV + HIV Comorbidities

AIRBORNE

TB, COVID-19

Issues of screening for ID in corrections: general considerations

- Mission of corrections: security/public safety, not public health
- Every visit to medical has a “cost”—one stop is best
- Issues with TB testing
 - Skin testing—2 visits, 72 hours apart
 - IGRA—expense, must get specimen to lab ~24 hours (check)



Association between Substance use and Depression among TB positive persons incarcerated in Haitian prisons

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Introduction

- Tuberculosis (TB) is an airborne respiratory infection affecting congregate settings worldwide
- TB is associated with poverty on both the individual and national level
- TB prevalence is up to 20 times higher in lower/middle income countries versus high income countries (1)
- Prisons represent a dangerous location due to both congregate facilities and persons who tend to be poor. This is especially true in lower income countries (2)
- This is a secondary analysis of data from the TB Reach study in Haitian Prisons, a study comparing adherence to TB treatment in prisons that used video observed therapy versus those with direct observed therapy. (3)
- Original study approved by the Emory IRB and the Haitian Committee on Bioethics.



Background

- Intervention prison are prisons using Video Observed Therapy (VOT)
- Control prisons are prisons only using Direct-Observed Therapy (DOT)
- The Zanni-Lasante Depression Symptom Inventory (ZLDSI) was used to assess depression (4)
- Any type of Cannabis use is illegal in Haiti

Hypothesis: Depression is higher among people who smoke cigarettes, smoke marijuana, or drink alcohol

Objective: Determine if substance use is associated with depression, taking into account other variables such as education, age, and household income

Methods

Model: Logistic Binomial Regression

- Inclusion Criteria: all persons incarcerated who tested positive for TB at beginning of study and sought care while incarcerated in one of the intervention (Mirebalais, Petit Goave, Jacmel, Carrefour, and Gonaives) or control sites (Croix de Bouquet)
- A questionnaire (written in Creole) was conducted at intervention sites, sites utilizing Health Through Wall's video-directed observed therapy, and control sites, sites that only used directly observed therapy. The survey consisted of 13 questions relating to depression using the ZLDSI. The value for Cronbach's Alpha for the survey was $\alpha = 0.74$ among intervention sites and $\alpha = 0.85$ among control sites.
- Effect Modifiers: Education, Age, Household Income
- Independent Variable for this analysis: Marijuana Use, Cigarette Use, and Alcohol
- Dependent Variable: Depression

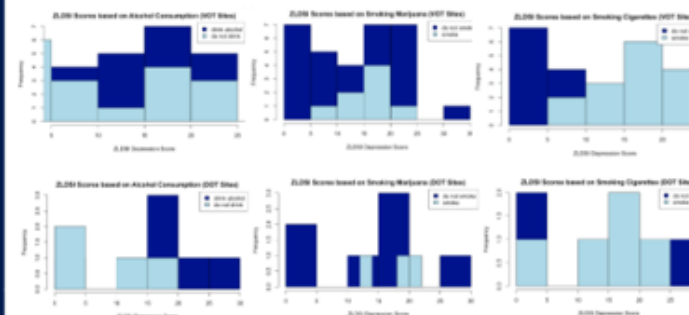
Results

Table 1: Study Characteristics

Variable	Total Number of Participants (n=50)	
	Intervention sites (VOT) (n=39)	Control sites (DOT) (n=11)
Gender, Male (n[%])	39 (100)	11 (100)
Age, years (mean [SD])	31.03 (8.95)	30.2 (6.44)
Attended School (n[%])	3 (58.97)	9 (81.82)
Average Years of Schooling (mean [SD])	3.9 (3.73)	6.7 (4.35)
Missing	9	1
First Time Incarcerated (n[%])	31 (79.5)	8 (72.73)
Missing	1	1
Household Income (n[%])		
<499 Gourdes Haitian	6 (15.38)	0 (0)
500 – 2499 Gourdes Haitian	14 (35.90)	1 (9.1)
2500 – 4999 Gourdes Haitian	7 (17.95)	1 (9.1)
>5000 Gourdes Haitian	9 (23.08)	6 (54.55)
Missing	3	3
Average Number Dependents (mean[SD])	3.58 (2.91)	4.0 (3.71)
Smoking		
Number who Smoke Cigarettes (n[%])	16 (41.03)	5 (45.45)
Number who Smoke Marijuana (n[%])	8 (20.51)	3 (27.27)
Missing	0	1
Alcohol Use		
Number who Use Alcohol (n[%])	21 (53.85)	7 (63.64)
Number who Drink Alcohol Daily (n[%])	10 (47.62)	4 (57.14)
Missing	0	1
ZLDSI Depression Scale		
Average Score, (mean [SD])	13.85 (8.1)	14.27 (8.74)
% Considered Depressed * (n[%])	25 (64.10)	8 (72.73)

*Persons considered depressed scored higher than 12 on the Zanni-Lasante Scale (4).

We found **no significant relationship** between a person's probability of a higher depression score and their substance use.



Discussion and Conclusions

- Using a logistic binomial regression, no significant relationships were found between the probability of depression and persons who have smoked marijuana, smoked cigarettes, or drank alcohol prior to incarceration.
- It was found that people who had higher household incomes were more likely to smoke marijuana (possibly due to accessibility and affordability)
- Despite null findings, other studies indicate that substance use plays an instrumental role in depression
- Studies also show that depression especially in prison settings could be due to the environment and mental state of the person while incarcerated.
- More studies need to be done looking at association of mental health and the prison settings while also taking into account substance use.

Limitations:

- We found that oversight was not as robust as expected. Due to the study being conducted overseas, it is harder to achieve effective oversight
- Many prisons are remote, so it was hard to reach these certain areas (hence reason for implementing VOT intervention)
- With such a small sample size and a large amount of missing data, there was reduced power for this research, which also may have led to insignificant results
- Exposure variables not appropriate indicators of depression for this setting



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Disclosure

The presenting author has no conflicts of interest to disclose.

Crowded Living Conditions

Prison conditions results in new transmission of TB



Malnutrition



Longer duration
of incarceration
associated with
weight loss –
cause of TB?
Reactivation of
LTBI?

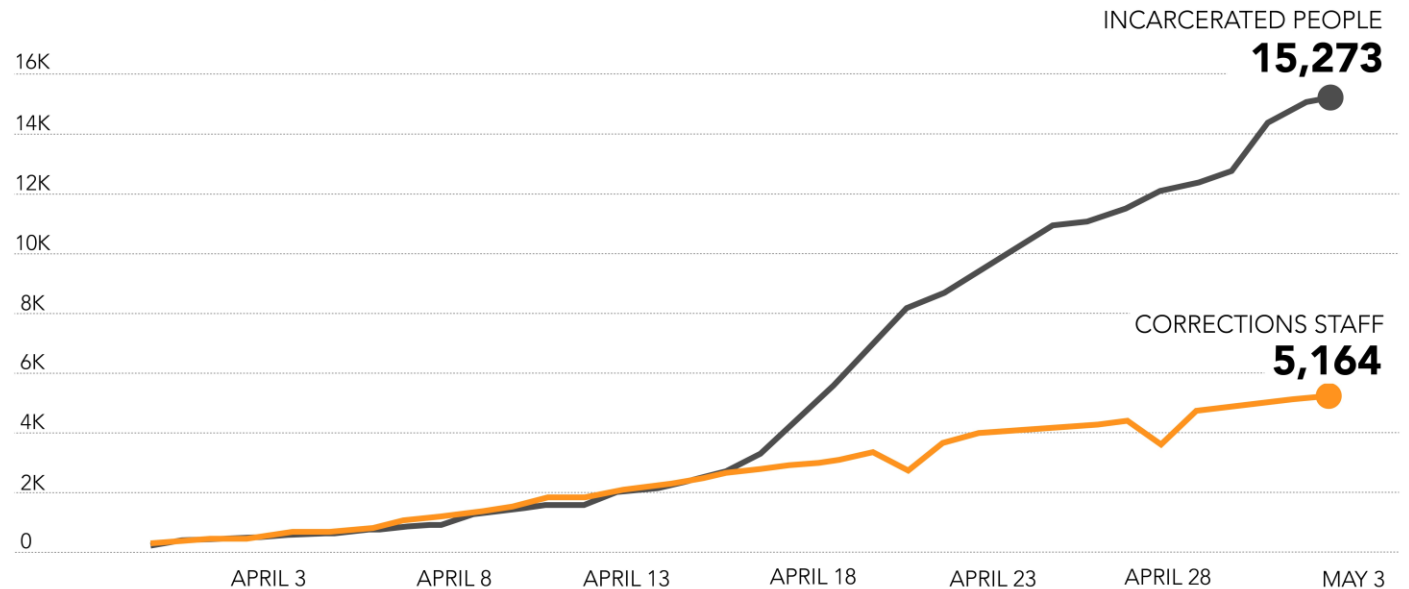


How COVID-19 outbreaks start

- Correctional officers and staff are usually the individuals introducing disease into a jail populations
- Additionally, disease can be introduced by new admissions
- Can then spread...

COVID-19 Cases Reported by State Prisons

March 31, 2020–May 3, 2020



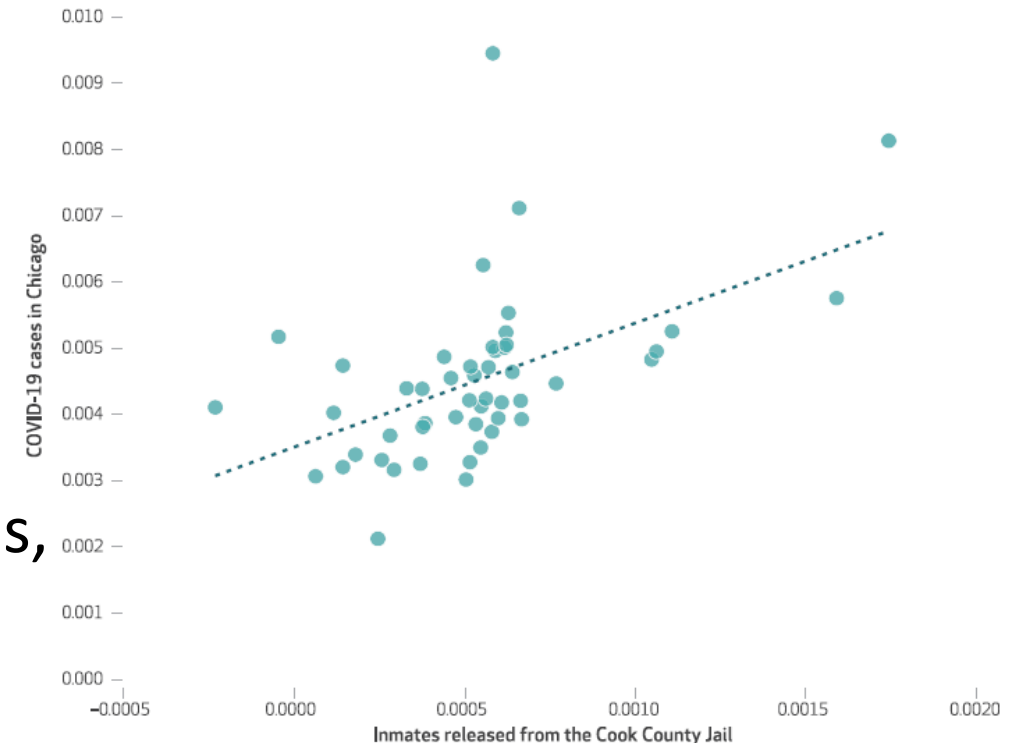
DATA SOURCES: UCLA Covid-19 Behind Bars Data Project, updated May 5, 2020, Bureau of Justice Statistics Prisoners in 2018, Bureau of Justice Statistics Justice Expenditures and Employment Extracts, and The Johns Hopkins Coronavirus Resource Center
csgjusticecenter.org

By Eric Reinhart and Daniel L. Chen

Incarceration And Its Disseminations: COVID-19 Pandemic Lessons From Chicago's Cook County Jail

- Modeling churn in/out of jail that a zip code experienced vs. C19 incidence March 2020
- Better explainer of COVID-19 incidence, than race, poverty, population density
- Churn thru CC Jail assoc. w/15.9% of Chicago cases, 15.7% of Illinois cases, April 2020

Scatter plot analysis of COVID-19 cases in Chicago, Illinois, March 2020



STRATEGIES



MEDICAL ISOLATION

Who: Symptomatic people

What: MASK & separate from others

When: Immediately once symptoms appear

Where: Ideally, an individual cell

Why: Prevent exposing others
Evaluate, test if needed
Give care

How long: It's complicated



QUARANTINE

Who: Close contacts of a known or suspected case (staff or incarcerated)

What: Separate from others
Monitor for symptoms

When: Once identified as a close contact

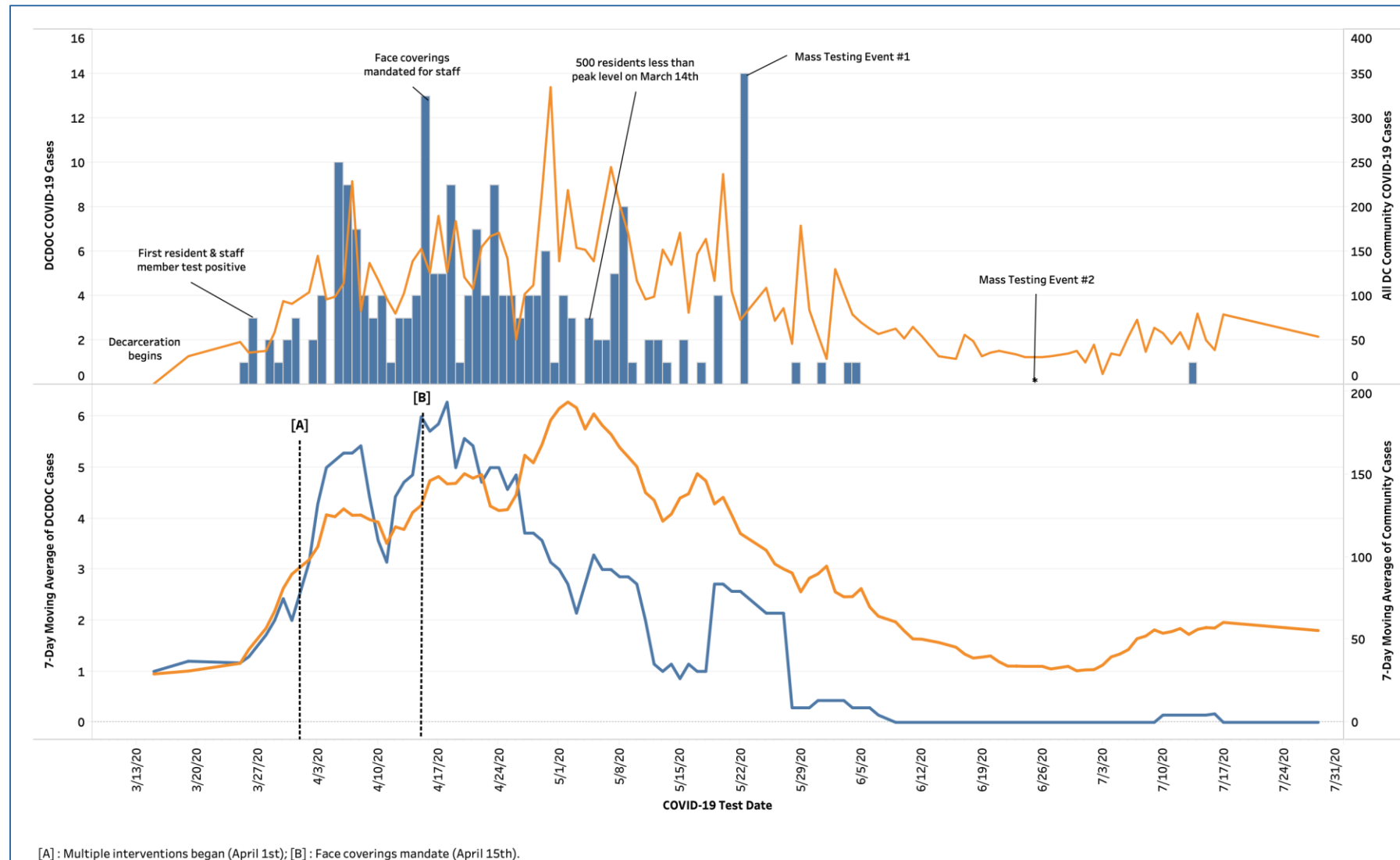
Where: Ideally, an individual cell
(if incarcerated)
At home (if staff)

Why: Prevent exposing others if infected

How long: 14 days

- Test symptomatic—Isolate the infected, quarantine the exposed
- Test contacts
- Test entrants, if feasible

Diagnosed Cases of COVID-19 at District of Columbia (DC) (orange) and DC Department of Corrections (DCDOC) (blue) in March through July, 2020



Epting et al.
2021 OFID

Introduction to Atlanta Jails—the Numbers

Source: GA Dep't of Community Affairs,
Monthly County Jail Report

County Jail Report
Primary Jail Capacity Data
August 2021

(Does not include Inmates housed in other detention facilities such as Work Release C

Jurisdiction		Number of Inmates In Jail	Jail Capacity
058	FORSYTH	332	608
059	FRANKLIN	88	72
060	FULTON	3008	2688
061	GILMER	109	142

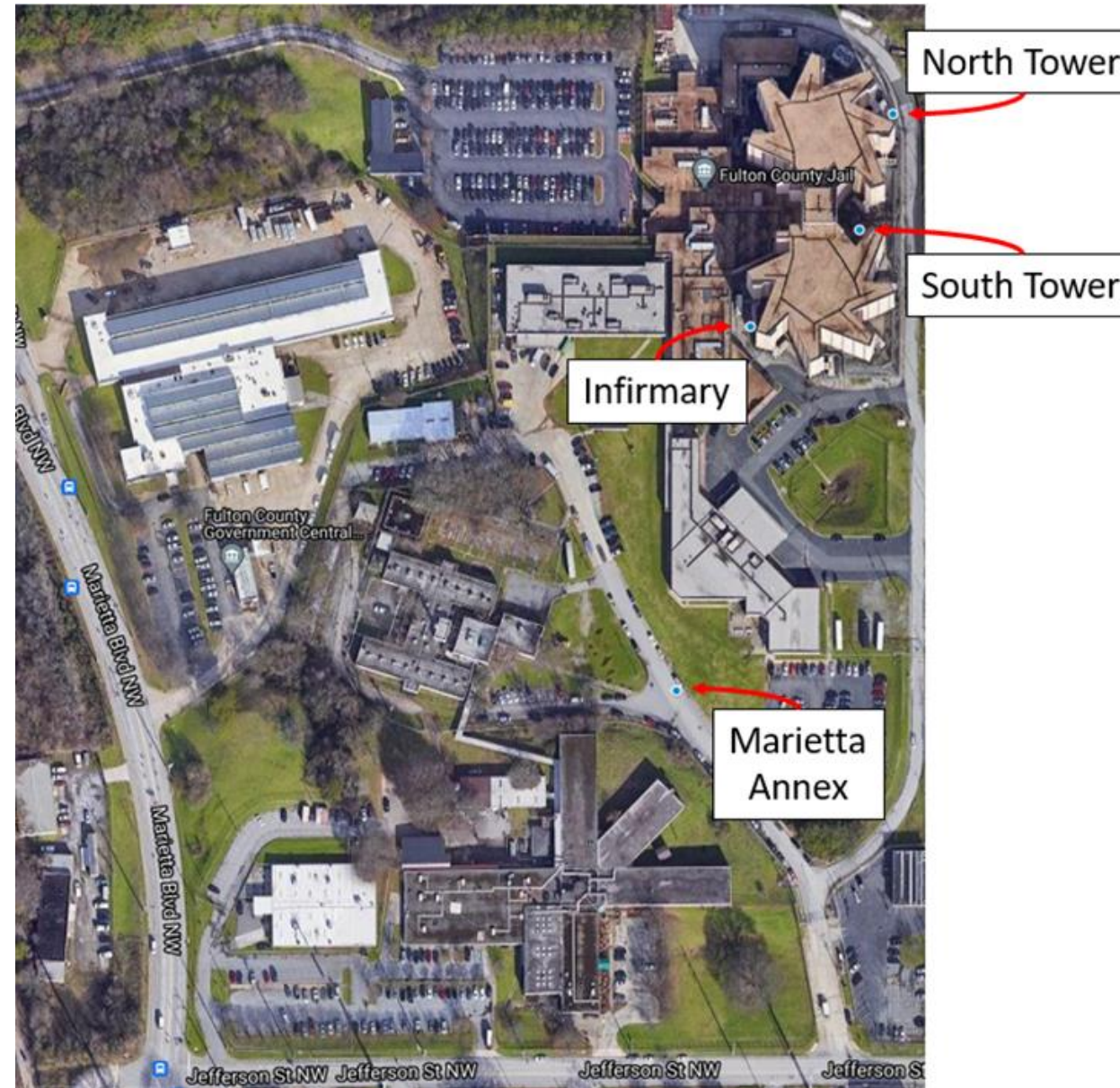




Sample collection sites



Sample collection sites for SARS-CoV-2 wastewater testing



Wastewater testing accomplishments



Surveillance by Wastewater And Nasal Self-collection of Specimens (SWANSS—Mass Testing)

XpressCollect™
Advancing Sample Collection | Transforming Laboratory Workflows



Unique collection vial with integrated swab for anterior nares sample



Supervised or unsupervised collection



Designed for automated processing



Anterior nares enabled for decapping & recapping



Collection time workflow



Significantly less sample throughput



Reduced cost





Surveillance for COVID-19 Using Wastewater and Advancing Nasal Self-Collection of Specimens (SWANSS) in an Atlanta Jail

Lindsay Saber cMPH¹, Christine Moe PhD¹, Matthew Akiyama MD, MSc², Victoria Phillips, PhD¹, Anne Spaulding MD, MPH¹

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Introduction

- Incarcerated persons have relatively high rates of pre-existing conditions and a high risk for acquisition and transmission of SARS-CoV-2.¹
- Traditional diagnostic surveillance methods are not effective in rapidly identifying outbreaks of asymptomatic infections in crowded environments.²
- Persons with COVID-19 shed SARS-CoV-2 in stool.³
- Wastewater-Based Surveillance (WBS) is a highly sensitive, noninvasive, low-cost method for population level COVID-19 surveillance.³

Objectives

- Explain the need for adequate surveillance, testing, and infection control for SARS-CoV-2 in jails.
- Describe challenges for jails to implement nasal self-collection of specimens, WBS and result-driven plans.
- Review evidence that WBS will be an effective way to monitor new COVID-19 outbreaks.

Hypothesis: WBS is an effective way for early warning of COVID-19 outbreaks in correctional settings.

Methods

Figure 1. Map of WBS sampling sites



Wastewater testing

- Samples were collected weekly via Moore Swabs, processed at Emory University Center for Global Safe WASH, at 3-4 sites around the jail property.
- Results presented as Negative, Weak or Strong Positive for SARS-CoV-2, Saber Score used to standardize WBS results across all collection points.

Methods cont.

Diagnostic testing

- Jail (capacity~2500, ADP~2,900) administered daily rapid antigen (BinaxNOW, Clearview) tests at intake and among residents with symptoms.
- Emory conducted 16 mass PCR-testing (Northwell Laboratory) events

Results

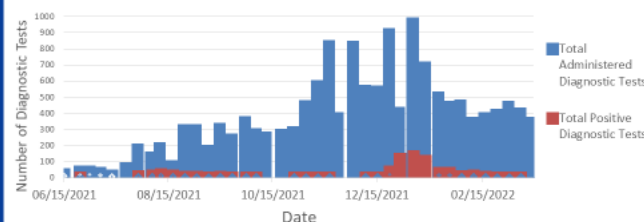


Figure 2. (Left) Diagnostic tests (PCR + rapid) administered in an Atlanta jail between 6/15/21, and 3/16/22 with positive tests indicated.

Figure 3. (Below) Saber Score (right y-axis, red bars) and total positive percentage of diagnostic tests (combination of antigen and PCR Tests) (left y-axis, black points), from 6/15/21 to 3/16/22.

The Saber Score was calculated by converting categorical data into a signal strength rating for each individual sample (Figure 2) (Negative= 0, Weak Positive= 1, Strong Positive= 2). All values were then summed together and divided by the number of collection sites, resulting in the Saber Score. The maximum score is a 2.

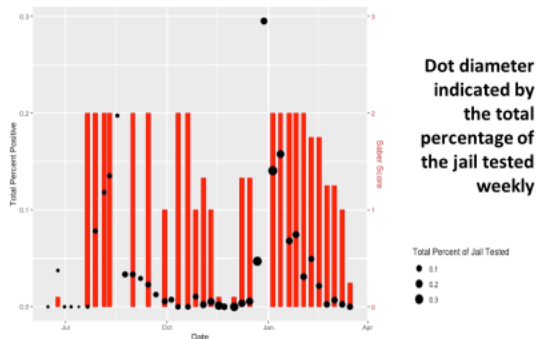


Table 1. (Right) Pearson r correlation of variables describing WBS and diagnostic testing in Atlanta Jail between 6/15/21 and 3/16/22. Values closer to 1 have a stronger association.

Pearson's r Correlation Coefficient			
Wastewater	Signal Strength	Saber Score	
Signal Strength	1.00	0.80	
Saber Score		1.00	
Diagnostics	Total % Positive	Total % Tested	# Administered Tests
Total % Positive	1.00	0.43	0.44
Total % Tested		1.00	0.99
# Administered Tests			1.00
Combined	Total % Positive	Total % Tested	# Administered Tests
Signal Strength	0.48	-0.22	-0.23
Saber Score	0.61	-0.26	-0.28

Summary

- The number of PCR tests administered each sampling period increased over time. Total number of administered test moderately correlated to the positivity rate ($r= 0.44$).
- We documented two surges in COVID-19 prevalence: weeks of 8/17/2021 (19.7%) and 12/28/2021 (29.5%), aligning with the Delta and Omicron variants, respectively.
- The Saber Score is strongly correlated with the positivity rate ($r= 0.61$); Strong Positive WBS samples closely related with increased diagnostic test positivity rates.
- We assumed a linear relationship between the Saber Score and the positivity rate, but other groups have found a saturation point when there is a large case count.
- Limitations include:
 - Diagnostic testing not always randomly distributed
 - Diagnostic tests were counted by the week
 - Precise origin of the wastewater in the jail is unclear. A dye study to map out source is currently exploring this– if origin determined, can pinpoint subsections of jail experiencing outbreak

Conclusions

- WBS could be used as an effective surveillance or monitoring tool for correctional settings.
- Correctional facilities should consider WBS over traditional mass diagnostic testing as an inexpensive and rapid alternative for surveillance of fecally-shed infectious diseases, such as COVID-19.

References

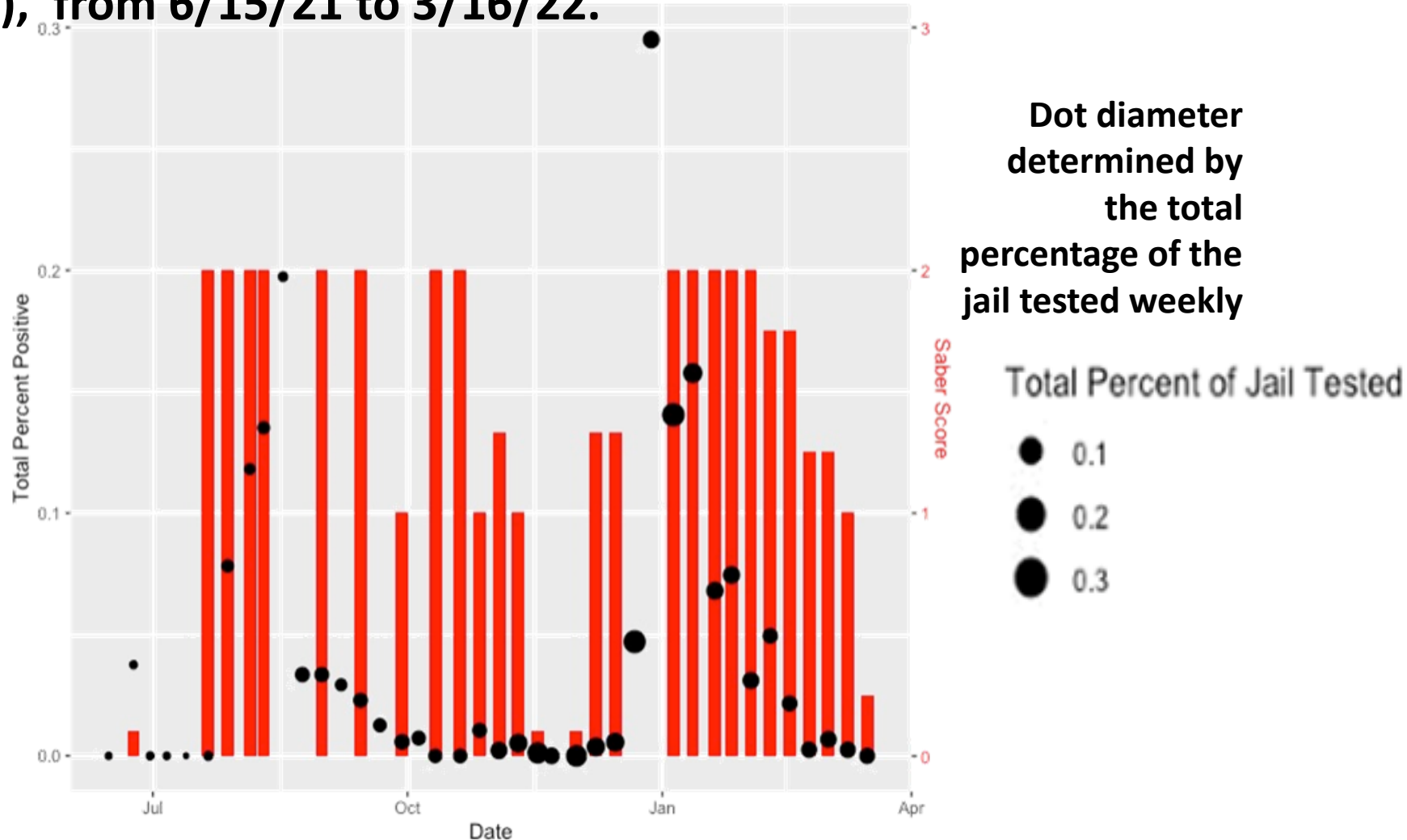
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Linking wastewater and individual testing

Saber Score (right y-axis, red bars) and total positive percentage of diagnostic tests (combination of antigen and PCR Tests) (left y-axis, black points), from 6/15/21 to 3/16/22.



CONCLUSIONS

- Thinking of route of infection, we can explain high prevalence of infectious diseases:
 - Reservoirs: based on risk factors, social determinants of health--HIV, HCV, STIs
 - Incubator: based on in-house transmission—TB predicted COVID-19
- Discuss screening, testing, and treatment for HIV, HCV, and COVID-19

ANY QUESTIONS?

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