

NEW DIRECTIONS FOR INFECTIOUS DISEASE DETECTION IN CORRECTIONS

NATIONAL CONFERENCE ON CORRECTIONAL HEALTH
LAS VEGAS NV: October 2022

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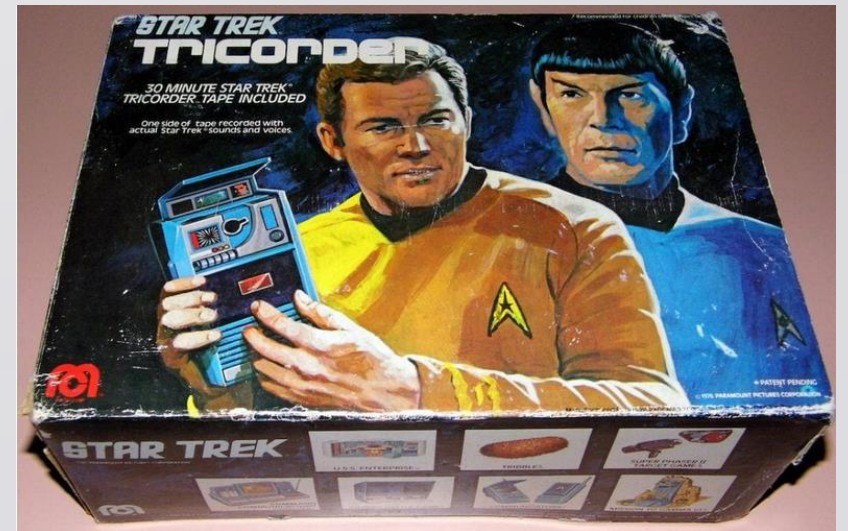
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Cook County Health



@CHIPatEmory

Disclosures /Potential Conflicts of Interest

No funding was received from any device manufacturer

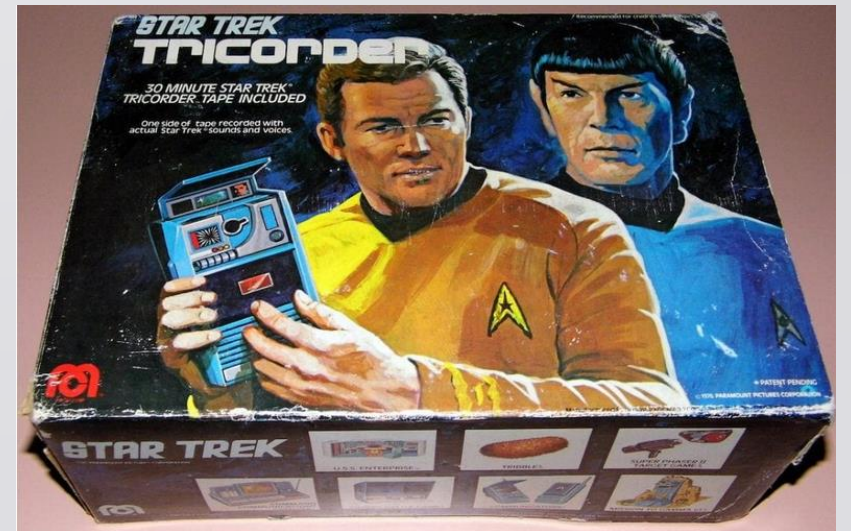


Disclosures /Potential Conflicts of Interest

No funding was received from any device manufacturer

Dr. Spaulding, through her institution, has received funding for a research grant from Gilead Sciences and test supplies from bioLytical Laboratories.

Dr. Zawitz has received honoraria for medical education from Gilead Sciences and ViiV.





Objectives—among 3 in program book, **focus on testing**

- 1. Explain why incarcerated persons have higher rates of STD, HIV, HCV, and COVID-19
- 2. Discuss **screening and testing** for STDs, HIV, HCV, and COVID-19
 - **Justify for case-finding: early, opt-out, rapid, in jails**
 - **Describe recent advances in point-of-care testing**
 - **Describe how wastewater testing has been used in COVID surveillance and describe its use in infection control:**
 - When cases are rare, when rampant
 - Implications for other diseases

////////////////////
Objectives—among 3 in program book, **focus on testing**

- **3. Treatment**

- Will not focus on treatment.
- Will not focus on managing comorbidities





Will not focus on treatment


- **DHHS guidelines for HIV**
- **ID Society of America Guidelines on COVID-19**
- **AASLD/IDSA guidelines for HCV**



Management of HCV 2022: Harnessing the Power of DAAs

USPSTF: Test all US adults for HCV at least once/lifetime;

CDC: HCV test all jail/prison entrants. Use IDSA AASLD Tx guidelines.



Management 2022

USPSTF: Test all US adults for HCV at least once/lifetime;

CDC: HCV test all jail/prison entrants. Use IDSA AASLD Tx guidelines.

IDSA AASLD: HCV antibody, with reflex RNA testing.

W/U: Noninvasive methods OK to estimate liver disease severity--

Liver-directed physical exam (normal in most patients)

ALT, AST, albumin, bilirubin, INR, CBC/platelet; Serum fibrosis formulae

Rx: pan-genotypic direct acting agent--no need for genotype

F/U: No monitoring labs on treatment? SVR: check RNA 12 wks. post tx



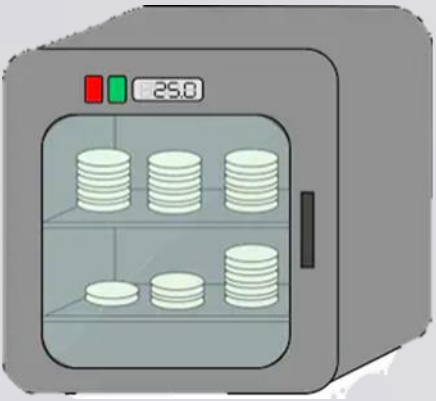
Risks for Infectious Diseases in Carceral Settings

To Characterize Role of Prisons in Infectious Disease



- **Reservoir?**

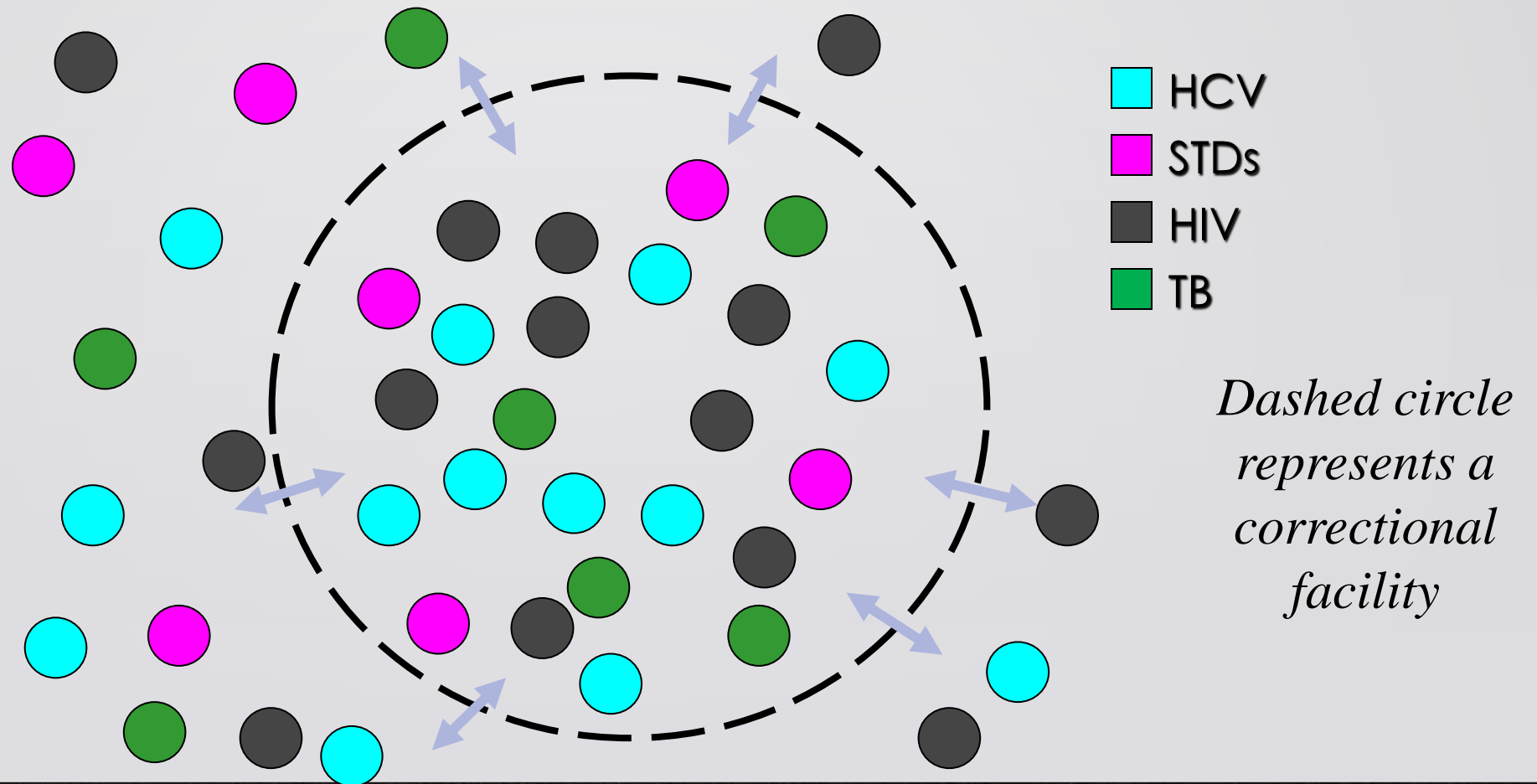
- Those jailed: high risk before admission
- Concentrates infectious disease
- Opportunity to manage consequences
- Opportunity to impact community spread



- **Incubator?**

- Amplifies infectious disease → Airborne (C19, TB)

Community-Corrections Connection: 9-10 Million Incarcerated Persons Per Year Released to the Community



KEY QUESTIONS TO CONSIDER

1. “Classical” Infectious Diseases

How should jails/prisons/juvenile facilities find individual cases?

Lessons learned that could have applied to other diseases

- HIV—test at intake—opt-out testing; point of care;
 - Applying concept to STI and (possibly) HCV

2. “New” Infectious Diseases—and Institutional Level Considerations

How to apply above lessons to COVID?

- Individual testing.
- Lessons learned with COVID: wastewater testing and future applications: Monkeypox? Polio? TB? HIV?

“Classic” Infectious Diseases

D
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f
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e

Known in the pre-COVID era,
@ time of last Las Vegas NCCHC



WILL DO
LOGISTIC
REGRESSION
FOR FOOD

Acknowledgements:

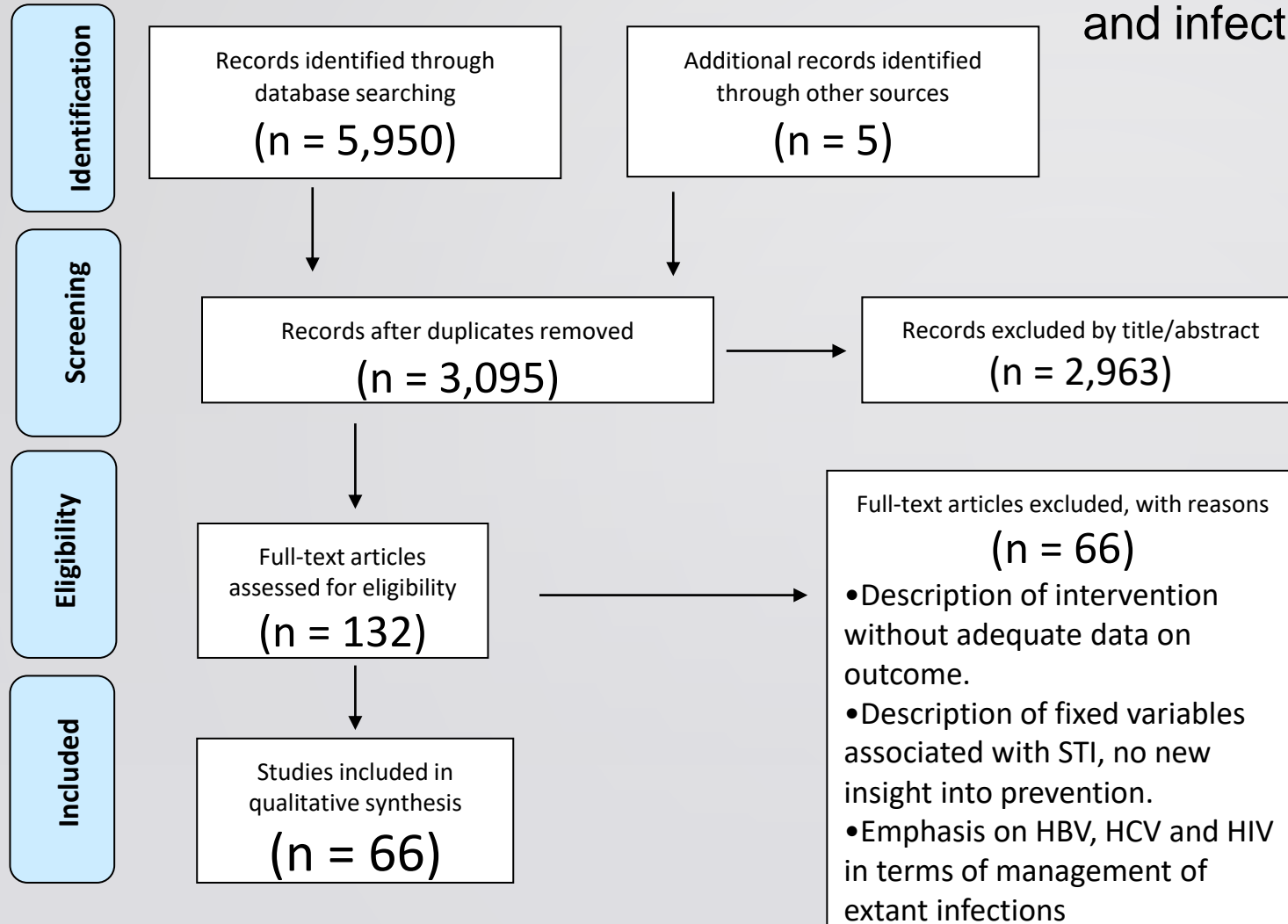
Co-authors of a recent systematic review



Spaulding AC, Rabeeah Z, Del Mar González-Montalvo M, et al. Prevalence and Management of Sexually Transmitted Infections in Correctional Settings: A Systematic Review. *Clin Infect Dis.* 2022;74(Suppl_2):S193-S217. doi:10.1093/cid/ciac122

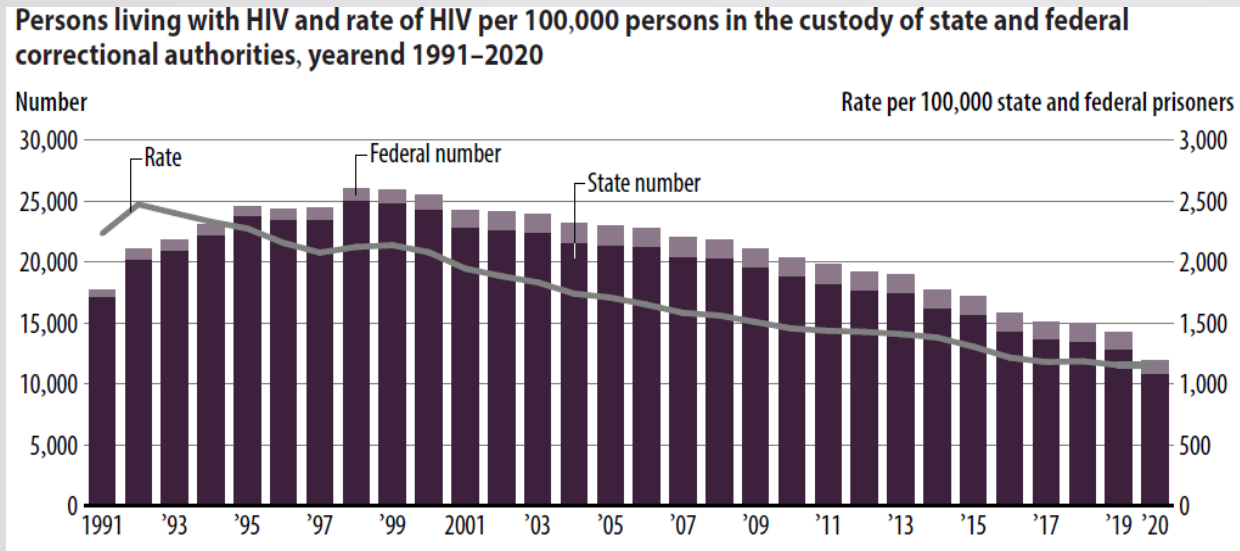
PRISMA Flow Diagram

Databases: PubMed, MEDLINE, Scopus, Cochrane Library, CINAHL; (and select abstracts from correctional and infectious disease meetings)



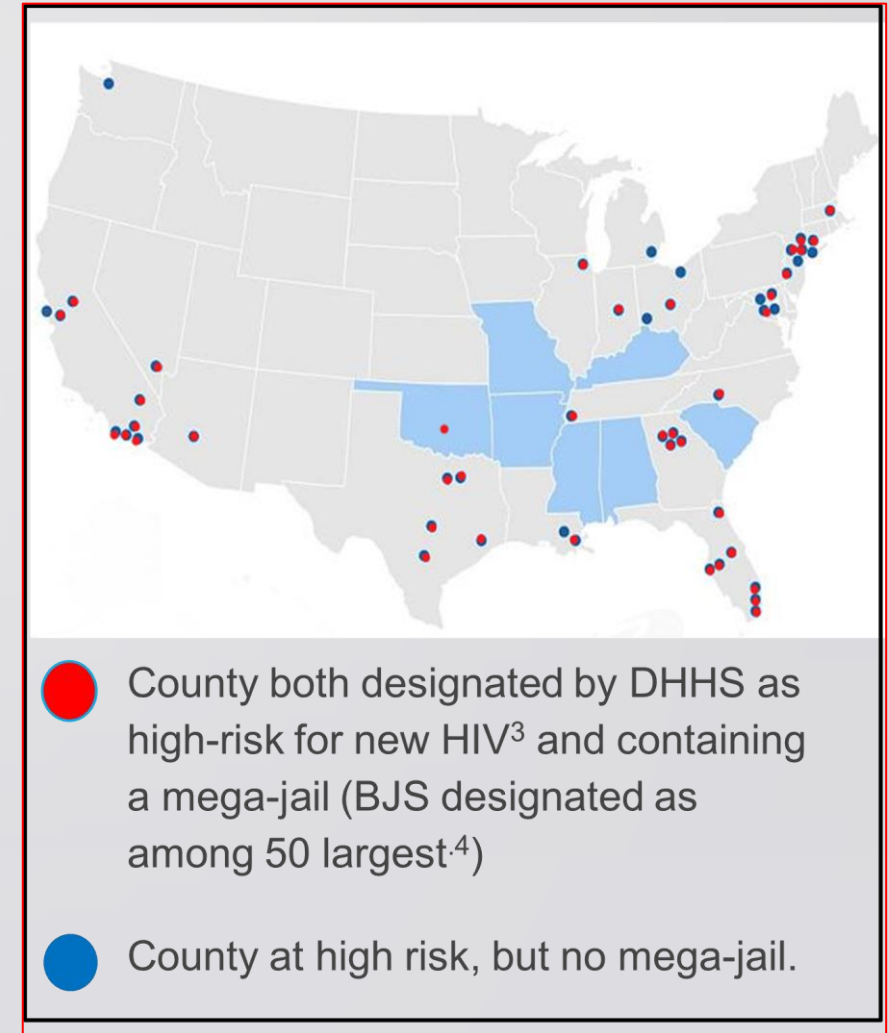
- Addressed questions
- Low emphasis: qualitative studies
- Low emphasis: non-US studies
- Most articles: HIV/HCV
- Included: pop. level mgmt.
- Excluded: linkage to long-term care

Prevalence of HIV: 1.2%



Source: Bureau of Justice Statistics HIV in Prisons 2020

Still high in many counties highlighted by Ending the HIV Epidemic initiative: 80% of the 50 largest jails are in these counties. (Spaulding 2019)



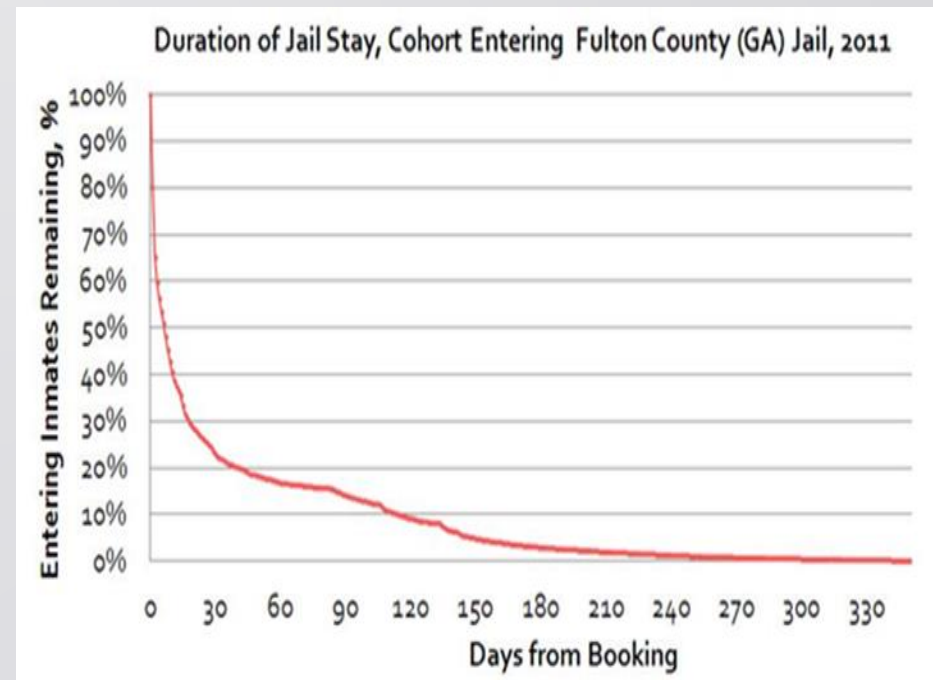
Key Differences Between Jails and Prisons

Jails churn fast: screen at arrival, and fast!!



Jail: A place for those awaiting trial-
Median Length of Stay 2-5 d
Juvenile facility: if <18 years old.

Prison: A place for criminals serving long sentences for serious crimes.





Best practices for CF to find/treat cases?

Early in jail stay: e.g., at entrance, when competent

Point-of-care test: so result before release

Opt-out (vs. opt-in)

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

Routine POC, Opt-out: 89 new HIV diagnoses/year; Opt-in Lab Based: 15

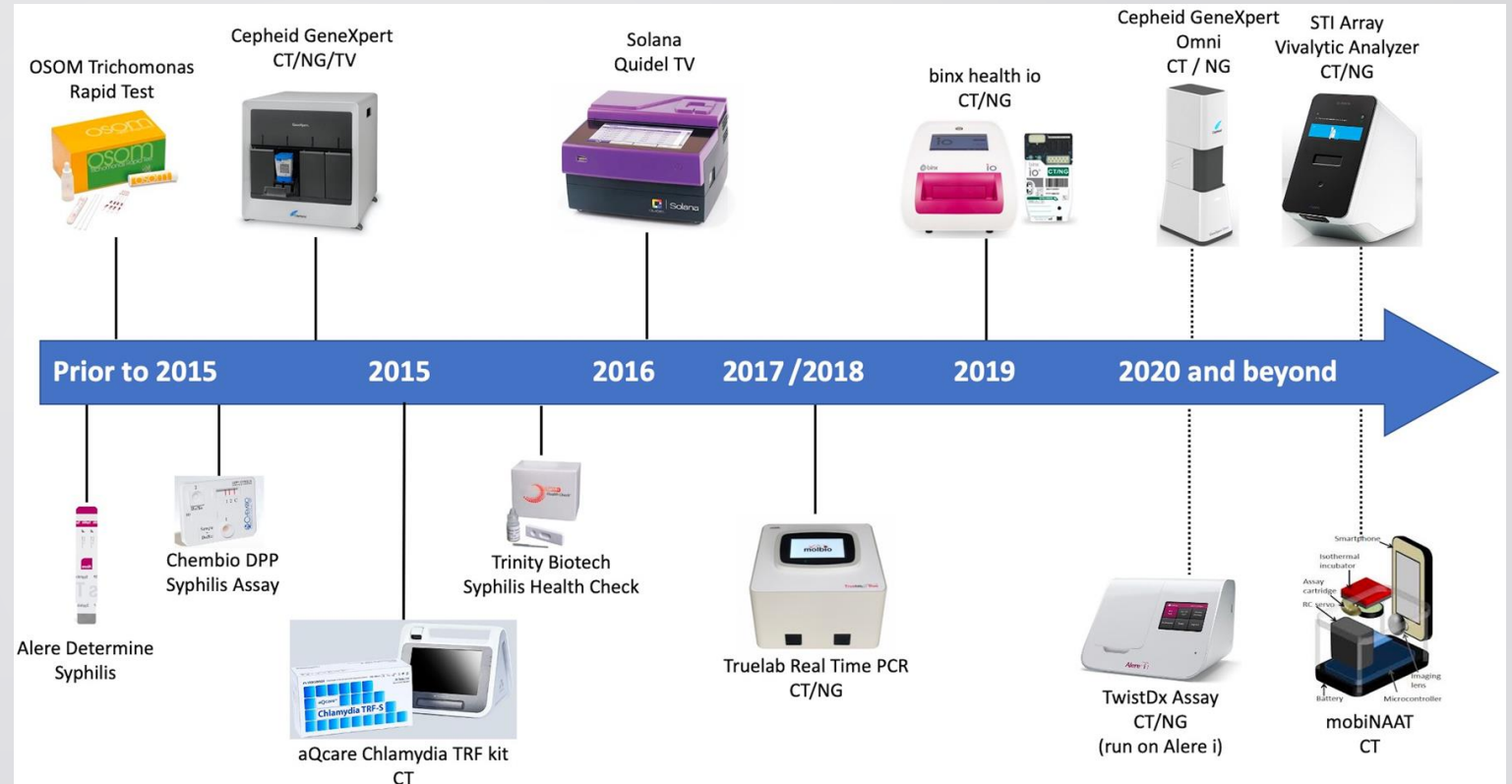
Results: Routine screening identified 74 more new HIV infections over 1 year than targeted testing, resulting in an estimated 10 HIV transmissions averted and 45 quality-adjusted life-years saved, and was cost saving. The missed opportunity to diagnose infections because routine screening was eliminated 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.

Implications: gonorrhea, chlamydia, trichomonas, syphilis

RECOMMENDATIONS

- Test early in jail stay
- Point-of-care testing:
 - Syphilis, GC, CT



- Source: Adamson PC et al. Point-of-Care Testing for Sexually Transmitted Infections: A Review of Recent Developments. Arch Pathol Lab Med. 2020 Nov 1;144(11):1344-1351

Rapid, Timely Treatment...

Syphilis

Prevalence much higher in jail populations

Likelihood rises with increasing age (Javanbakht
LA County Jail)

Benz PCN IM for syphilis (not doxycycline bid x 30 days)

Missed Opportunities for Prevention—

California, 2012 to 2014*

Substantial portion (13%) pregnant
women w/syphilis pass thru jails

Failure to treat in jail a missed opportunity

Gonorrhea

Ceftriaxone 500mg IM x one dose

Chlamydia

Azithromycin 1 gram po x one dose

Alternative: doxy bid x 1 week

(Not okay if in short term CF)



Ways Forward to Improve Capacity for Hepatitis C Elimination

Technologies

| | |
|-------------------------------|---|
| Testing | <ul style="list-style-type: none">• Point of care anti-HCV - at home and point of care options (saliva, blood); not licensed in US• HCV PCR; core antigen testing (not licensed) in US |
| New treatment options- | <ul style="list-style-type: none">• Long-acting DAA one – several monthly injections• Launch of provider preference survey (globalhep.org) |
| HCV vaccine | <ul style="list-style-type: none">• New candidates needed |

Care strategies

| | |
|----------------|--|
| Testing | <ul style="list-style-type: none">• Dried blood spot• Reflex HCV RNA of anti-HCV+ |
| Care | <ul style="list-style-type: none">• Simplification – minimal monitoring• Integration in non-specialty care follow-up• Telehealth• Community-based settings (NSP) (OST)• Incarceration |

SLIDE COURTESY OF JOHN WARD



What is the community impact of screening and treating in correctional settings?

- Disproportional Minority Confinement
- Lowers the male: female ratio in AA communities
- Contributes to poverty
- Poverty associated with STDs
- Contributes to stigma

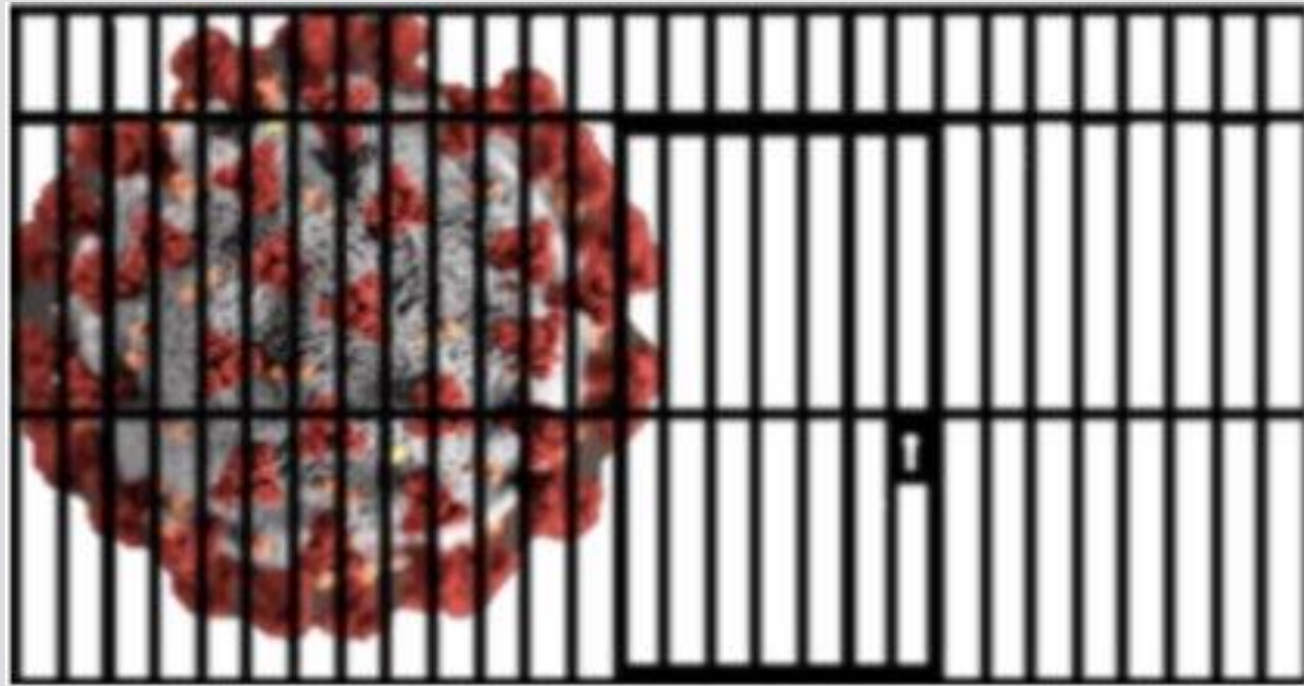
Source: Nijhawan. Infectious Diseases and the Criminal Justice System. American J of Medical Sciences 2016



Recommendation: (Harmon National STD Conference 2018)

- Without outside support, especially staff, unlikely to sustain.
- Many jails are privatized.
- Put STD screening in jurisdiction's RFPs and subsequent contracts.

COVID: Jails and Prisons





Testing Lessons Learned: Implications for COVID testing

- Opt-out testing for SARS-CoV-2
 - 591 people tested per day of testing
- Contrast: opt-in testing, required written consent before every test:
 - 20 persons per day of testing

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





Surveillance of wastewater and nasal-self collection of specimens SWANSS:

Surveillance of Wastewater And Nasal-Self-collection of Specimens
SWANSS:



PI: A. Spaulding

Co-I: Christine Moe/Pengbo Liu

Victoria Phillips PhD

Matt Akiyama MS MD

Sam Jenness PhD

Wastewater as a Surveillance Tool...because infected people shed virus in stool

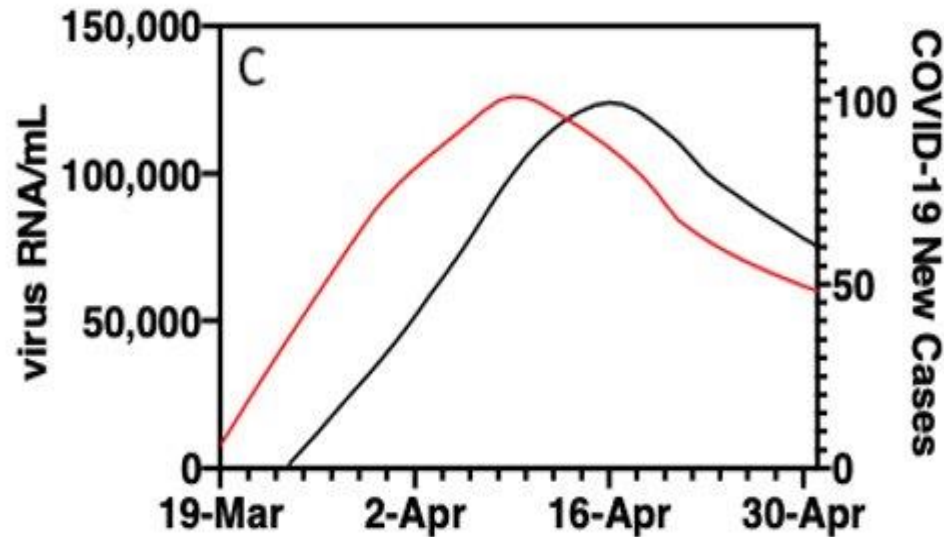


**Coronavirus is in wastewater
before infected persons are symptomatic**

**Measuring virus levels in wastewater could save
time and resources, as opposed to other
surveillance methods**

**Linking sewage collection sites to specific
buildings can provide targeted mitigation efforts**

COVID wastewater testing



2020 data from Yale University:

Collected sludge fr. New Haven wastewater plant.

SARS-CoV-2 virus RNA signal in sludge:

1. Correlated with trends in COVID-19 hospital cases
2. Started to rise **about 3-7 days ahead of community**

Suggesting this could be an early warning signal

■ SARS-CoV-2 RNA Concentration over time

■ Hospital admissions over time, same city

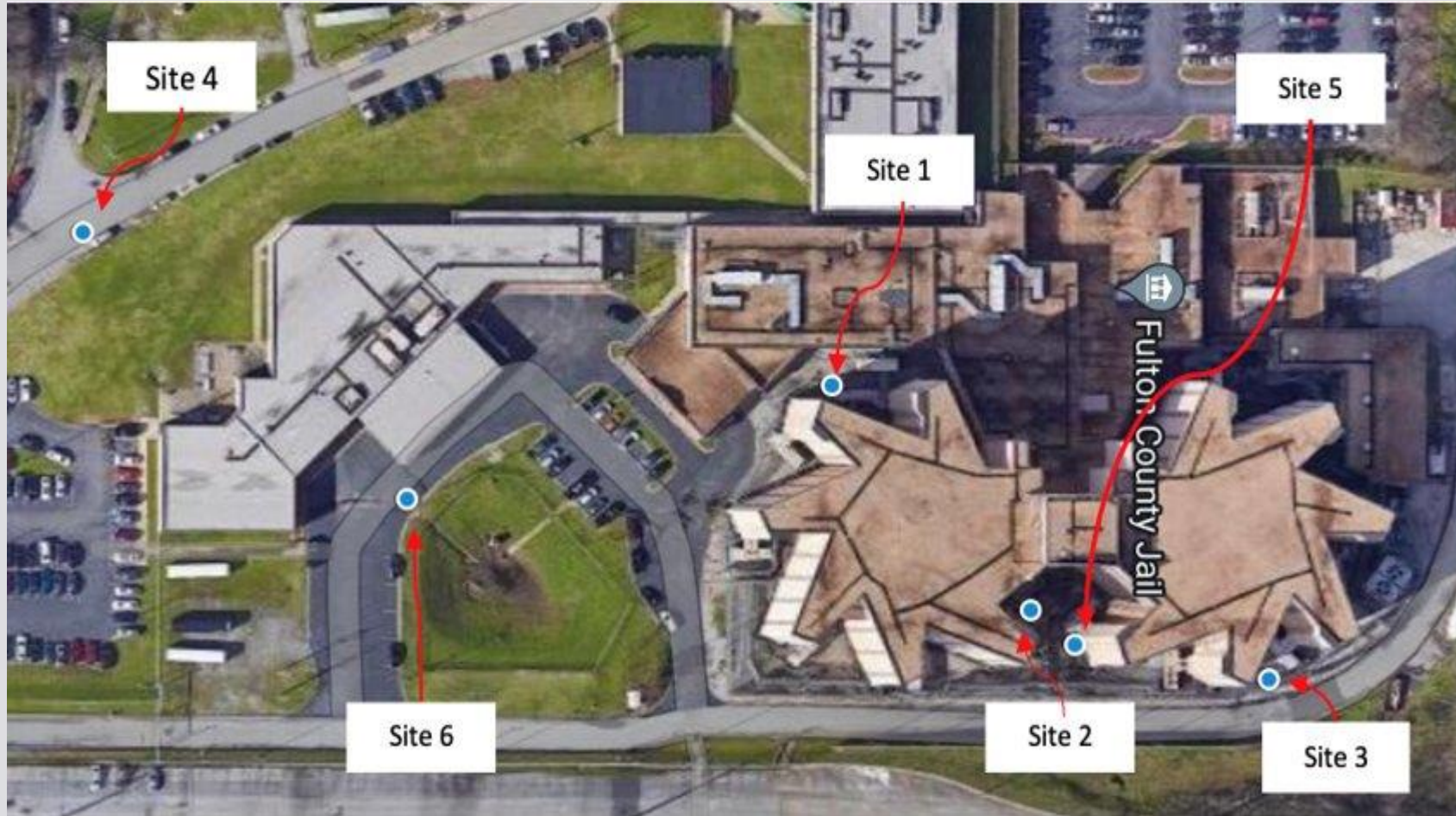
See: Peccia, J, Zulli A, Brackney DE et al. Nature 2020

SARS-CoV-2 Detection using Moore Swabs on Emory Campus, mid-August 2020 to February 2021













Moore Swabs: Sit in Sewer x 24-48 hours; Grab sample: scoop and done.
Analogy: **Hgb A1c** versus **fingerstick glucose**


Sample collection sites



Collection Points



| Result Key | | |
|---|---|---|
| |  | Negative |
| |  | Positive |
| Result Matrix | | Testing Implications |
| 600 | → 500 | |
|  |  | → Test individuals in 500 North |
|  |  | → Both negative, no testing required |
|  |  | → Both positive, test both locations, 500 confounded by 600 |
| <hr/> | | |
|  |  | → 600 flows to 500, result unlikely |

 Based on wastewater flow, Site 3 is proxy measurement for all North Tower

Wastewater testing accomplishments

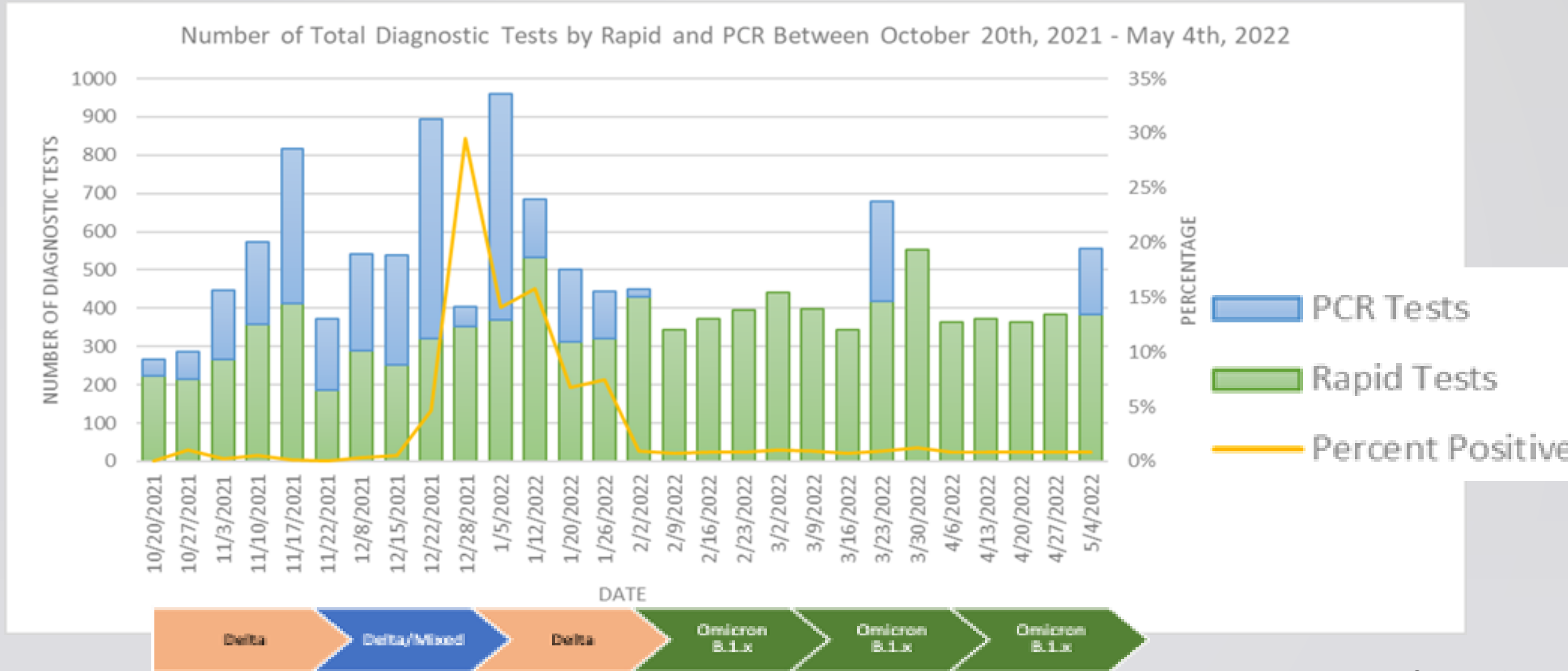


Wastewater testing accomplishments

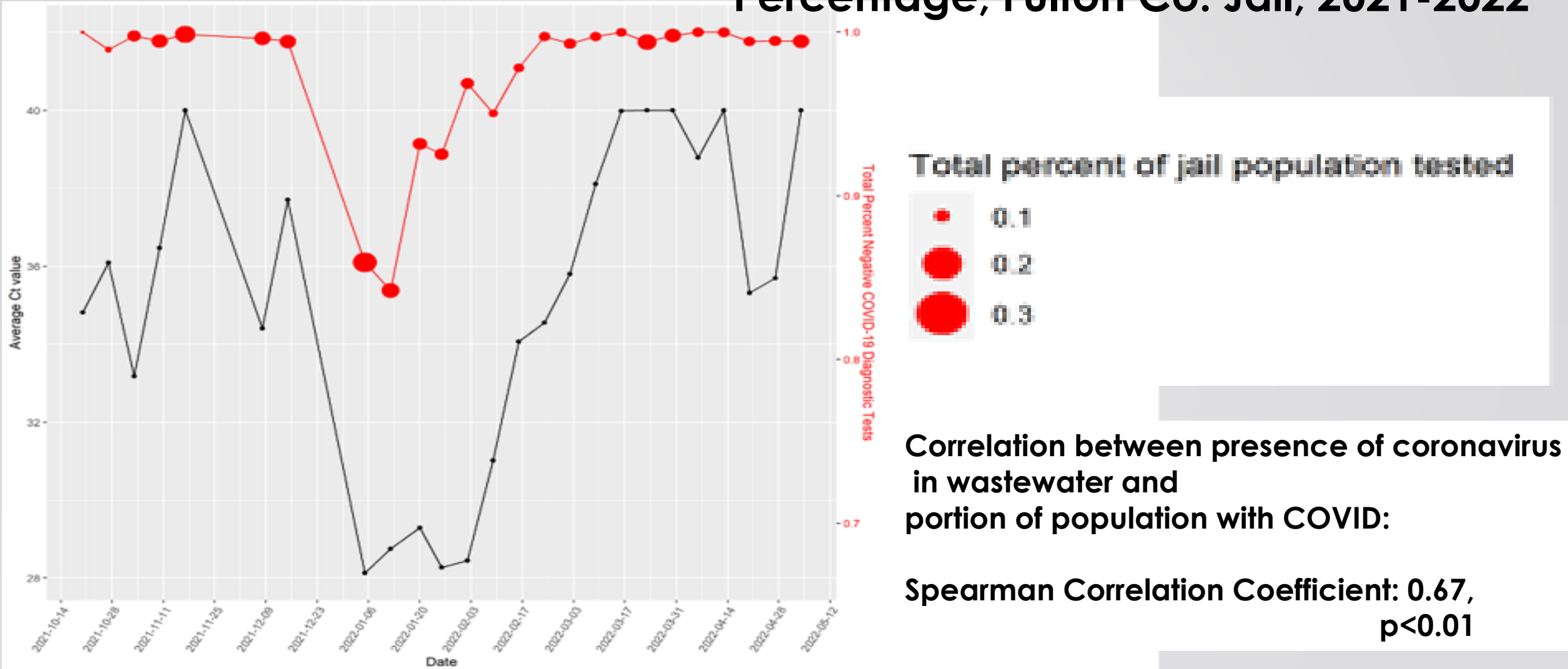
- 1) **Tracer Dye Testing** to help pinpoint/identify potential sources of infected inmates in correlation with positive wastewater signals.
- 2) **Capability** to successfully collect Moore swabs and grab samples on a weekly basis.
 - a) Establish consistent sampling protocol
 - b) Weekly coordination with the jail
 - c) Environmental sampling team
 - d) Physical labor
- 1) **Capacity** to process all samples using Laboratory processes and Real-time PCR on an ongoing basis.



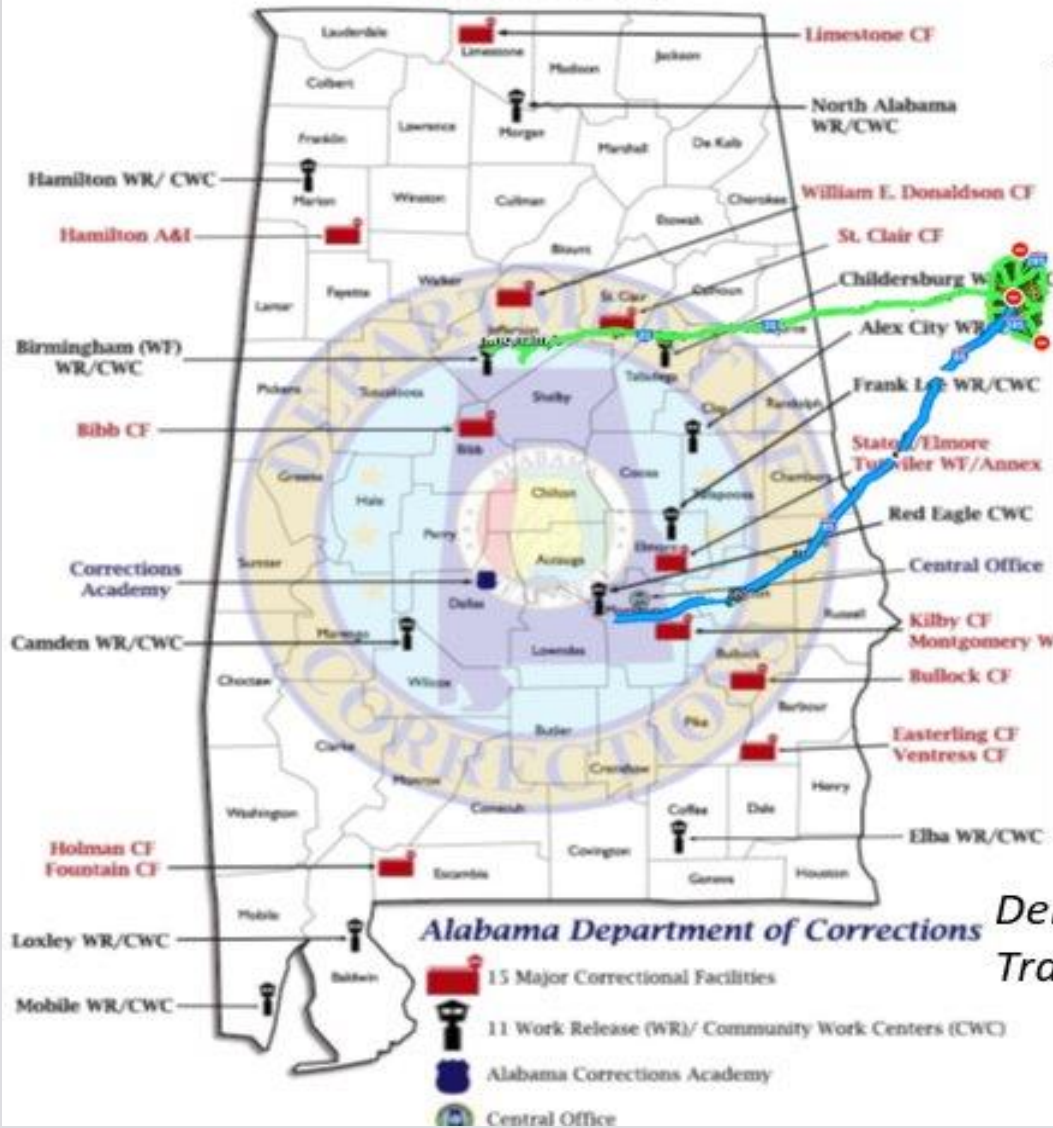
SWANSS Individual Testing with Variants in Wastewater



Comparison of Wastewater & Diagnostic Results with Population Percentage, Fulton Co. Jail, 2021-2022



Alabama Department of Corrections Facilities Map



REPLICATION IN A STATE PRISON SYSTEM 150 miles from Atlanta

Can Wastewater-Based Monitoring work in prison?

- Can wastewater be collected? Manholes accessible?
- Multiple access points for the building?
- Will wastewater be transported to lab regularly?
- Local ability to run wastewater tests? @ UAB?

Can mass testing be sustained while wastewater +?

- Rosters available, to use software?
- Will collection be as labor intensive in a prison?
- Residents, officers cooperative?
- Can testing be limited to one dorm/housing unit?

*Demonstration with collection in a Montgomery Prison March 10??
Training of Laboratory at University of Alabama, with collection by
Alabamans in Birmingham area prisons: late spring 2022?*



CRAINES - Conducting Correctional COVID Research and Implementing Novel, Ethically Sound, Sustainable Surveillance Systems

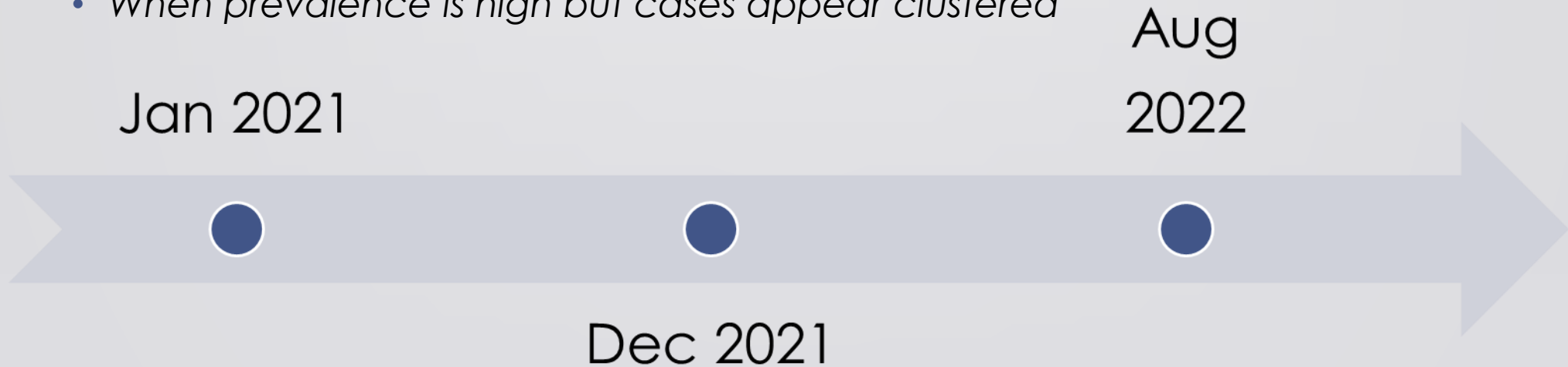
- Cook County (IL) **ADP 6000** (#1U01DA056000-01)
- Fulton Co (Atlanta) **ADP 3000**
- Washington DC **ADP 1500**
- Middlesex Co (MA) **ADP ~750**

Table 1. Implementation Team for the site.

| Stakeholders: Implementation Team | Examples of who might fill |
|--------------------------------------|---|
| 1. Lead Administrator of Jail | Sheriff, Chief Jailer |
| 2. Medical Director/Health Authority | Lead doctor of jail or medical vendor, clinically trained |
| 3. Director of Nursing | Lead nurse for jail or medical vendor, usually an RN |
| 4. Health Service Administrator | Person overseeing management of healthcare |
| 5. Director of Jail's Facilities | Person overseeing plumbing; hired by jail or vendor |
| 6. Mid-level custody manager | Captain or lieutenant, overseeing correctional officers |
| 7. Non-managerial staff members (2) | Correctional officer; nurse; maintenance or office worker |
| 8. Formerly detained individuals (2) | Persons with lived experience of residing in a jail |

Using Wastewater Results: Cook County SARS-CoV-2

- *Describe how wastewater testing has been used in COVID surveillance and describe its use in infection control:*
 - *When cases are rare*
 - *When prevalence is high but cases appear clustered*



COVID Wastewater Surveillance at CCJ

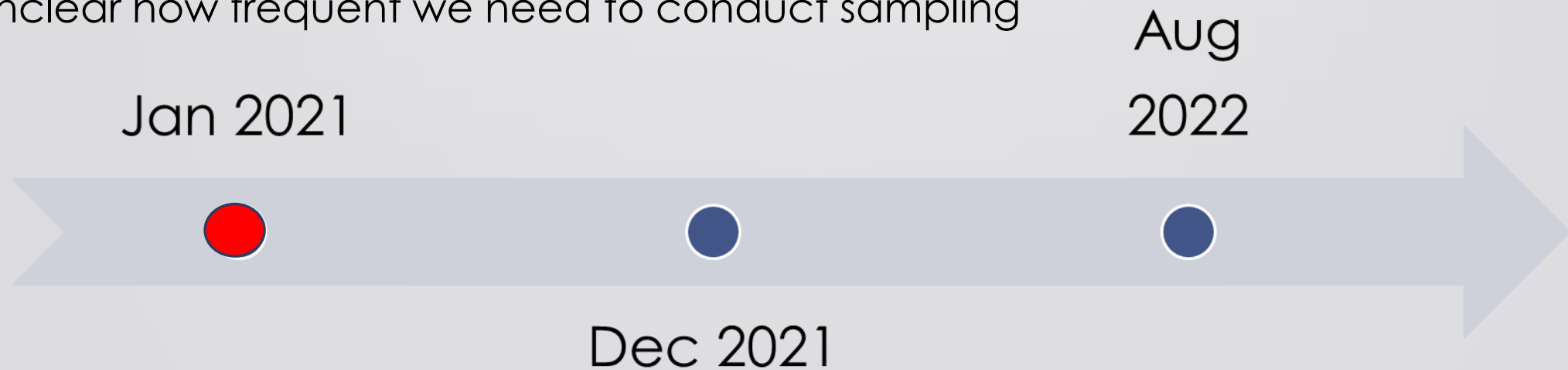
- First and largest COVID wastewater surveillance in corrections
- Bi-weekly sampling starting approximately January 2021; Locations for sampling adjusted weekly (up to 6 sites twice weekly)
- Results shared and interpreted weekly with Dr. Zawitz
- Initial analysis done without clear hypothesis of best practice to use results
- Analysis interpreted alongside existing “real-time” COVID swab results and locations

Cermak Health Services at the Cook County Jail



Initial Iteration of Wastewater Results Reporting

- Provided date, location, number of gene copies per 25ml
- Collaborative interpretation of results with real-time jail context
- Was not initially used in a practical manner
- Still unclear how frequent we need to conduct sampling



Early Evolving Wastewater Results Reporting

SAMPLE RESULTS

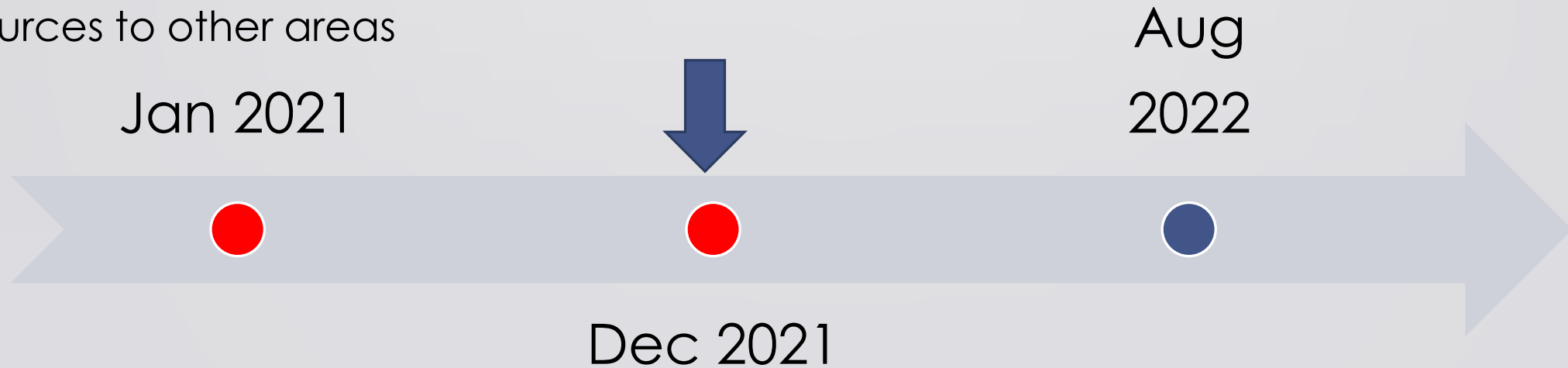
| DATE | UIC ID | SAMPLE SOURCE | SAMPLE TYPE | N1 GC/RXN | N2 GC/RXN |
|-----------|--------|--------------------|-----------------|--------------|--------------|
| 3/22/2021 | CCJ_68 | Division 8 (N) | Grab sample | ND | ND |
| | | | | | |
| 3/29/2021 | CCJ_77 | Division 4 | Grab sample | ND | ND |
| 3/29/2021 | CCJ_78 | Division 8/RTU | Grab sample | 37 | <7† |
| 3/29/2021 | CCJ_79 | Division 5 | Grab sample | ND | ND |
| 3/29/2021 | CCJ_80 | Division 8 (N) | Grab sample | ND | ND |
| | | | | | |
| 3/31/2021 | CCJ_81 | Division 4 | Grab sample | ND | ND |
| 3/31/2021 | CCJ_82 | Division 2 | Grab sample | ND | ND |
| 3/31/2021 | CCJ_83 | Division 5 | Grab sample | ND | ND |
| 3/31/2021 | CCJ_84 | Division 8 (N) | Grab sample | ND | ND |
| 3/31/2021 | CCJ_85 | Division 8 (N) | 48-hr composite | 18 | ND |
| 3/31/2021 | CCJ_86 | Division 5 | 48-hr composite | 41 | <7† |
| 3/31/2021 | CCJ_87 | Division 6 (North) | 48-hr composite | ND | ND |
| 3/31/2021 | CCJ_88 | Division 6 (South) | 48-hr composite | ND | <7† |

ND: Not detected

†: Below the limit of quantification (LOQ)

Early Evolving Wastewater Results Reporting

- Data presentation improved readability
- Beginning hypothesis of how to best use this information
- We found that areas with ND (not detected) were most useful early on
- ND implied little to no COVID was in an entire division; allowed consideration of deploying resources to other areas



Composite Trending of Wastewater Results

PROTOTYPE CORONAVIRUS ASSESSMENT NETWORK NODE (PCANN)



| Date | Div2-D2 | Div 3 | Div5 | Div 6 -S | Div8_RTU | Div8_N | Div 9 | Div10 | Div11A | Div11B | Div11C | Div11D |
|----------|---------|-------|--------|----------|----------|--------|-------|-------|--------|--------|--------|--------|
| 9/15/21 | ND | ND | ND | ND | 65 | | | ND | | | | |
| 9/20/21 | ND | ND | 274 | ND | 72 | | | ND | | | | |
| 9/22/21 | 28 | ND | ND | ND | 765 | | | ND | | | | |
| 9/27/21 | ND | ND | 35 | ND | ND | | | | | | | |
| 9/29/21 | ND | ND | <9† | | 30 | | | ND | | | | |
| 10/4/21 | ND | ND | 32,251 | | 5,388 | | | ND | | | | |
| 10/6/21 | ND | ND | 72 | | 55 | | | ND | | | | |
| 10/11/21 | | ND | ND | ND | 13 | | | ND | | | | ND |
| 10/13/21 | | 91 | 227 | ND | 994 | | | ND | | | | ND |
| 10/18/21 | | ND | ND | ND | ND | | | ND | | | | ND |
| 10/20/21 | | ND | 21 | ND | 44 | | | ND | | | | ND |
| 10/25/21 | | ND | ND | ND | ND | | | ND | | | | ND |
| 10/27/21 | | ND | 43 | ND | 65 | | | ND | | | | ND |
| 11/1/21 | | ND | ND | ND | 16 | | | ND | | | | ND |
| 11/3/21 | | ND | ND | ND | ND | | | ND | | | | ND |
| 11/8/21 | | | 28 | | 60 | | | | ND | ND | 594 | ND |
| 11/10/21 | | | 52 | | ND | | | | ND | ND | 72 | ND |
| 11/15/21 | ND | ND | 10,382 | 15 | 547 | | | ND | | | | ND |
| 11/17/21 | ND | ND | 39 | 1,472 | 3,064 | | | ND | | | | ND |
| 11/22/21 | ND | ND | ND | 514 | 538 | | | 170 | | | | ND |
| 11/24/21 | ND | ND | ND | 6,986 | 658 | | | ND | | | | ND |
| 11/29/21 | ND | ND | ND | 67 | 526 | | | ND | | | | ND |
| 12/1/21 | ND | ND | 16 | 751 | 145 | | | ND | | | | ND |
| 12/8/21 | ND | ND | 439 | | | | ND | 23 | | | 40 | ND |

Concentrations of the N1 SARS-CoV-2 gene target, by date and location. ND=non-detect.

†: Detected but below the limit of quantification (LOQ)

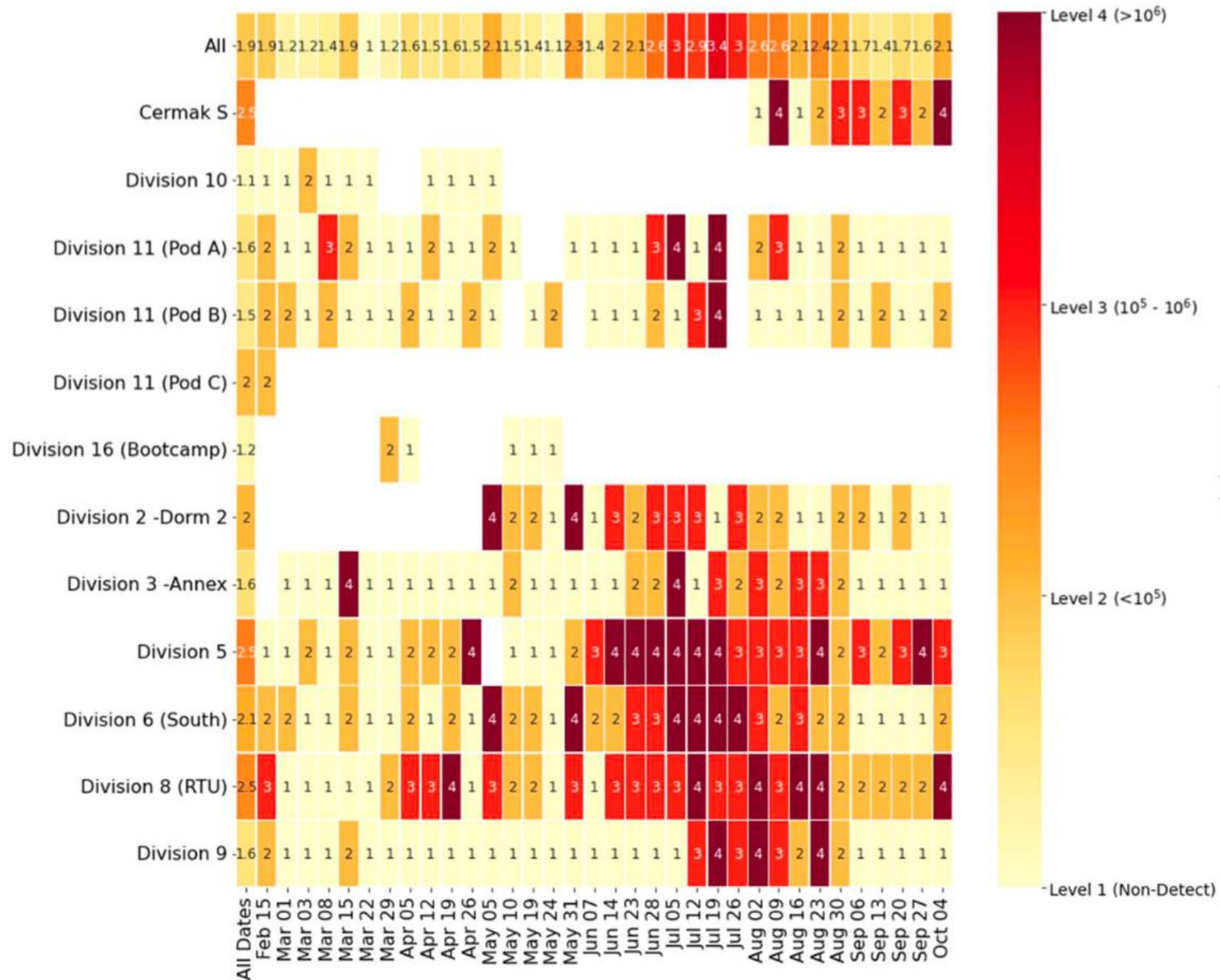
Composite Trending of Wastewater Results

- Evolving methods to depict values AND trends over time
- Beginning of “predictive” interpretation of where to anticipate the next “hot spots” (water detected areas of new/increasing activity 3-7 days before clinical cases identified)
- Permitted predictive use of limited isolation and quarantine housing; creation/preparation of new bedspace for anticipated new case detection with swab testing
- Improved collaboration with CCSO partners



COVID Wastewater Location Heat Map

Location



COVID Wastewater Heat Map

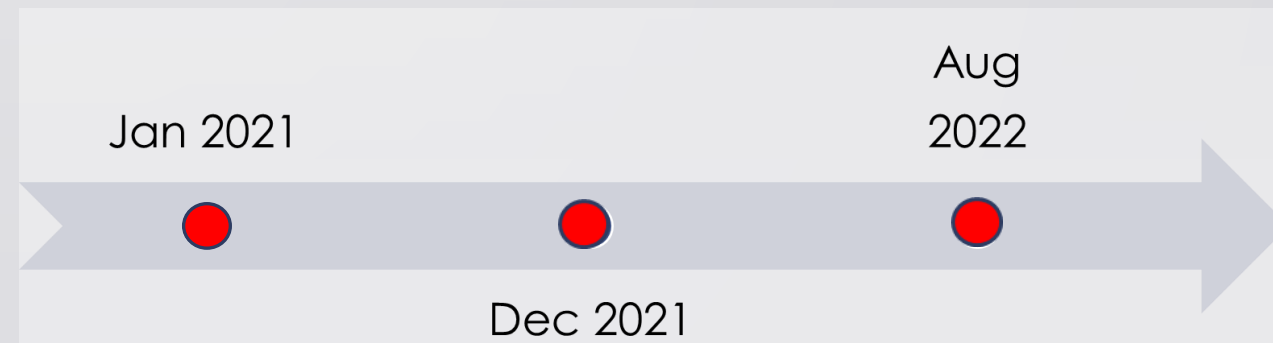
- Current iteration of data
- Sample collection, processing, and data analysis now run by CDPH
- Increased to 8 sites but only once weekly
- Improved visual depiction of location and COVID activity levels and trends
- Working on modeling to predict 'how many' individual cases within a division based on trends and gene copies
- Complex, many variables make this extremely difficult

COVID Wastewater Surveillance: Benefits

- Streamlined and **clear visual interpretation** of COVID activity
- Allows for **predictive trending** of COVID activity by location
- **Reduces use of limited resources** (e.g. swab staff, swab kits, JSH lab capacity, CCSO security, IC department time/resources) (**potential cost savings**: supplies/staff time, lab etc)
- Reduces staff exposure to potentially infected patients
- Reduces “swab fatigue” for patients by avoiding unnecessary testing
- It's COOL!

Monkeypox—testing of individual

- Late July, CCJ isolated the first confirmed case of MPX in a US correctional facility
- In collaboration with the Chicago Dept. of Public Health, COVID wastewater from the division housing the MPX patient was archived for MPX testing
- **After weeks of archived samples tested, no MPX detected**
- Unclear how to interpret this;
- MPX Wastewater based surveillance was not validated at that time



The FUTURE

- Wastewater surveillance is evolving science
- Potential for surveillance for many other things (Influenza.... Coming this fall?)
- Other infections/conditions (Food-borne outbreaks, TB, HIV, POLIO, certain cancers....)
- Monkeypox wastewater surveillance (underway....)
- Early detection of COVID variants
- Illicit substances (drugs of abuse)
- Collaboration with NIH-funded corrections group (Atlanta, Boston, DC)



Hard Questions

- What is the 'epidemiologic limit of quantification' of wastewater-based testing?
- What sampling strategies are best support public health response in the Jail?
- Do we really provide "lead time"?
- Do the end-users of the data (CCSO, Cermak Health Services, CDPH) use the data? How?
- What do the end-users of the data see as the problems and the opportunities with wastewater monitoring at CCJ?
- Can we develop a data-driven matrix of responses for data users to the wastewater test results?



Conclusions: Our Take Home Messages

1. You get what you pay for:
 - Budget for screening and treatment if epi indicates need
2. Use opt-out rather than opt-in for screening
 - As long as patient competent and offer not coercive
3. Screen: as early as possible, as fast as possible
 - unless long-term, sentenced patients
4. Point of care---match made in heaven for short-stay facilities
5. Explore **targeting the population** as focus of testing—community viral load

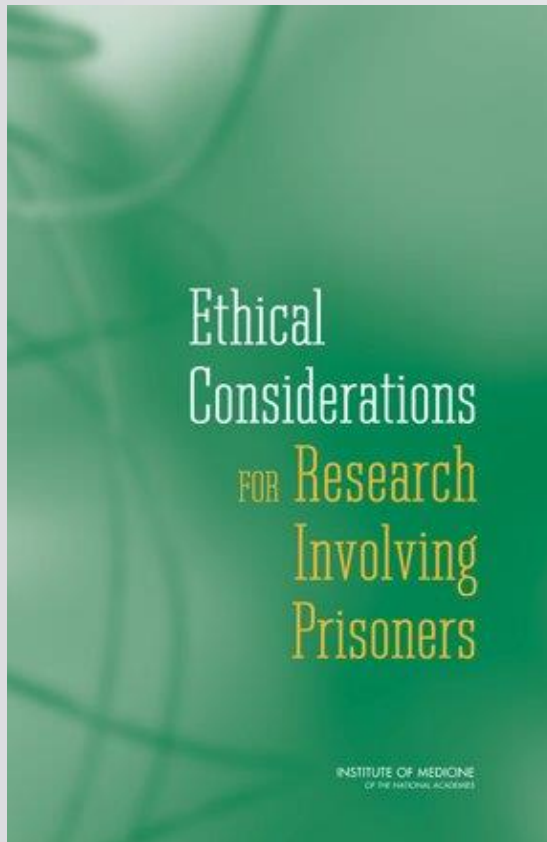


Thank you!

Any
questions?

Extra Slides

IOM Report, 2006



1. Expand the definition of "prisoner";
2. Ensure universally and consistently applied standards of protection;
3. Enhance systematic oversight of research involving prisoners;
4. Update the ethical framework to include collaborative responsibility; and
5. Shift from a category-based to a risk-benefit approach to research review

Wastewater interpretation



Resources/Citations

- <https://www.chicago.gov/city/en/sites/covid-19/home/covid-19-wastewater-surveillance.html>
- <https://www.cdc.gov/healthywater/surveillance/wastewater-surveillance/wastewater-surveillance.html>
- <https://www.nature.com/articles/s41545-018-0019-5>: **Pepper mild mottle virus as a water quality indicator.**
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7583624>: **Quantitative analysis of SARS-CoV-2 RNA from wastewater solids in communities with low COVID-19 incidence and prevalence.**
- <https://pubmed.ncbi.nlm.nih.gov/33813042>. **Outbreak of COVID-19 and interventions in a large jail - Cook County, IL, United States, 2020.**





COVID Wastewater Timeline

