EPA United States Environmental Protection Agency

# Innovation through ORD's Partnerships and Collaborations

Pre-recorded material provided for the NASEM Committee on Anticipatory Research for EPA's Research and Development Enterprise to Inform Future Environmental Protection, in advance of November 17, 2021 Committee Meeting

# The Importance of ORD's Collaborations

- ORD has asked the Committee to:
  - identify advancing scientific and technological areas important to ORD's work over the next several decades and how we may take advantage of them, and
  - provide recommendations on how ORD can strategically position itself to anticipate and respond to future research needs of the Agency.
- Collaborations are one way through which ORD advances science, innovates, and takes advantage of new scientific areas.
- Collaborations allow for more diverse, inclusive, interdisciplinary, and cross-sector expertise and resources to be brought to the table.

# Examples of Innovative Collaborations

- This series of pre-recorded presentations will highlight a few examples of research areas in ORD where different types of collaborations have been leveraged to push forward into new scientific or technological fields, approaches, or innovations.
- These examples are meant to demonstrate for the Committee:
  - the different ways in which ORD collaborates, which could be mechanisms through which ORD takes advantage of the emerging scientific and technological areas identified by the Committee,
  - the characteristics that enable successful collaborations to drive innovation and advance into new scientific areas.

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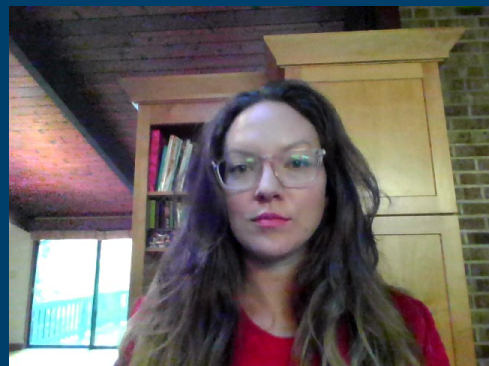
# Collaborative Electronic Health Records Research & the EPA

**Dr. Cavin Ward-Caviness**
Computational Biologist
CPHEA/PHITD
Office of Research & Development

Provided for the NASEM committee on Anticipatory Research for EPA's Research and Development Enterprise to Inform Future Environmental Protection



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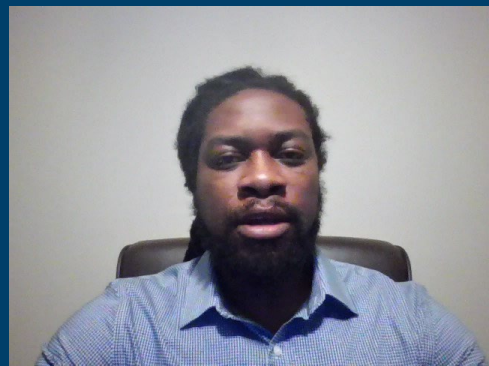
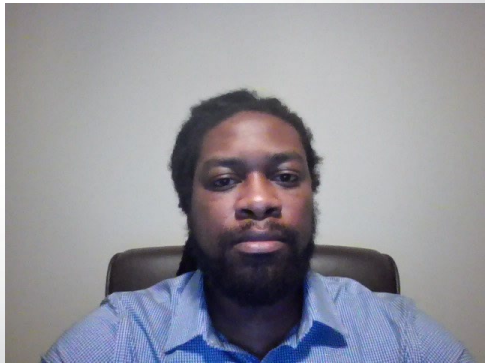


# Statement of Purpose

- Innovation at the EPA requires highly collaborative efforts with multiple partners
- One of the areas in which collaborations have greatly facilitated the EPA's ability to innovate is electronic health records (EHRs)
- EHRs have represented a significant advance over previous approaches as they allow the EPA to study vulnerable patient populations, with longitudinal records, deep clinical phenotyping, and where available 'omics measures
- In this talk we will cover three collaborations around EHRs that have significantly advanced innovation at the EPA
  1) CATHGEN– Academic Collaboration on EHRs & 'Omics
  2) EPA CARES - Hospital System Collaborations on EHRs and Environmental Health
  3) N3C – Multi-site Consortium Collaboration on EHRs and the COVID19 Pandemic



# Working with EHR Collaborators

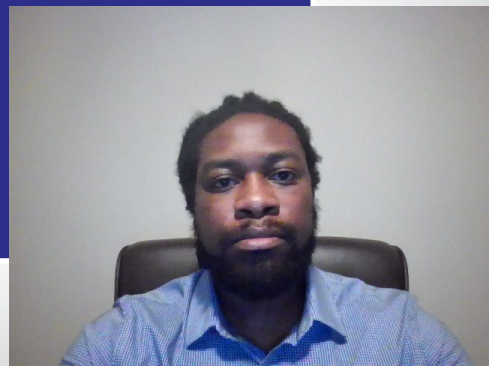
**All EPA partnerships surrounding EHRs require a similar set of legal and infrastructure steps required independent of the partnership.**

**These steps establish the legal boundaries, provide human subjects projection, and allow for secured computational infrastructure**

Data Use Agreement

IRB

Secure / Remote Access



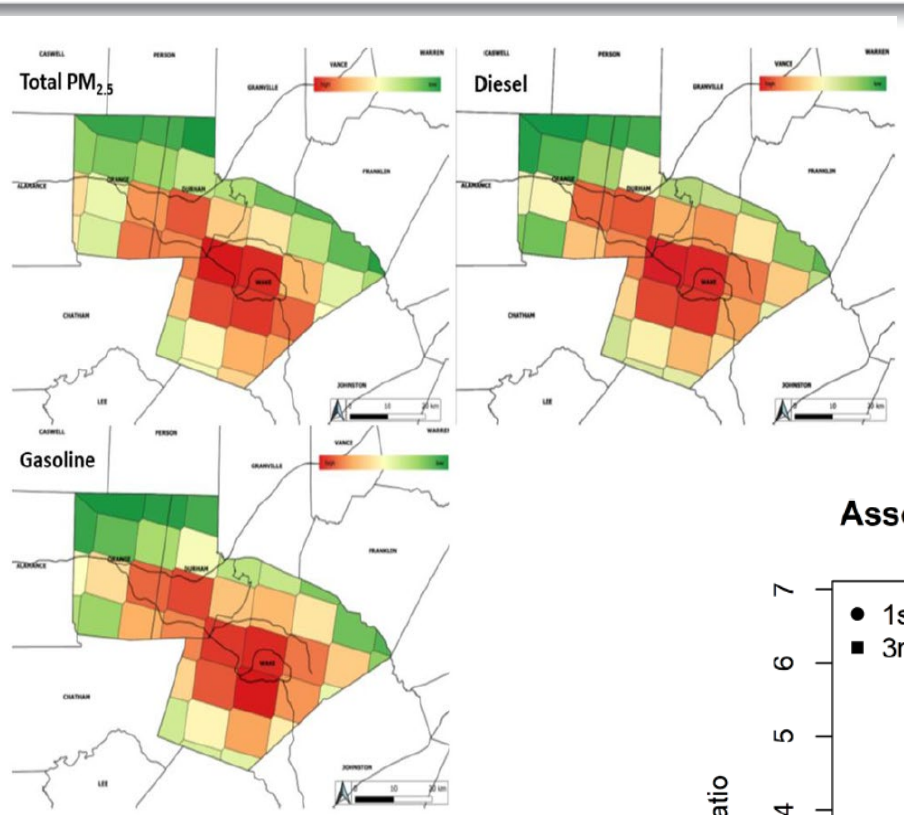
# Collaboration on EHRs, 'Omics and Environmental Health

**Problem:** The EPA needs to understand the impact of the environment on molecular biomarkers in human populations and how molecular biomarkers can be used to identify responsive individuals.

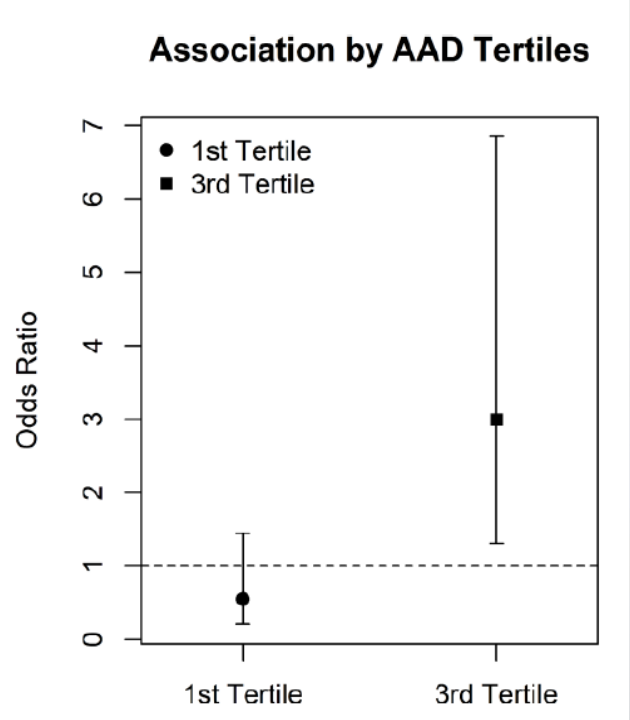
**Collaborations:** CathGEN – an NIH funded cohort study based out of Duke University

**Innovation:** Allowed EPA researchers to access high-dimensional (N > 800,000) 'omics data linked with EHRs on thousands of individuals. EPA researchers added environmental and analytical expertise needed for innovative analyses.

Established epigenetic aging as a potential molecular biomarkers of environmental sensitivity. Allowed novel studies of air quality and neighborhood stressors




**Associations with traffic air pollution differ based on epigenetic aging biomarkers**

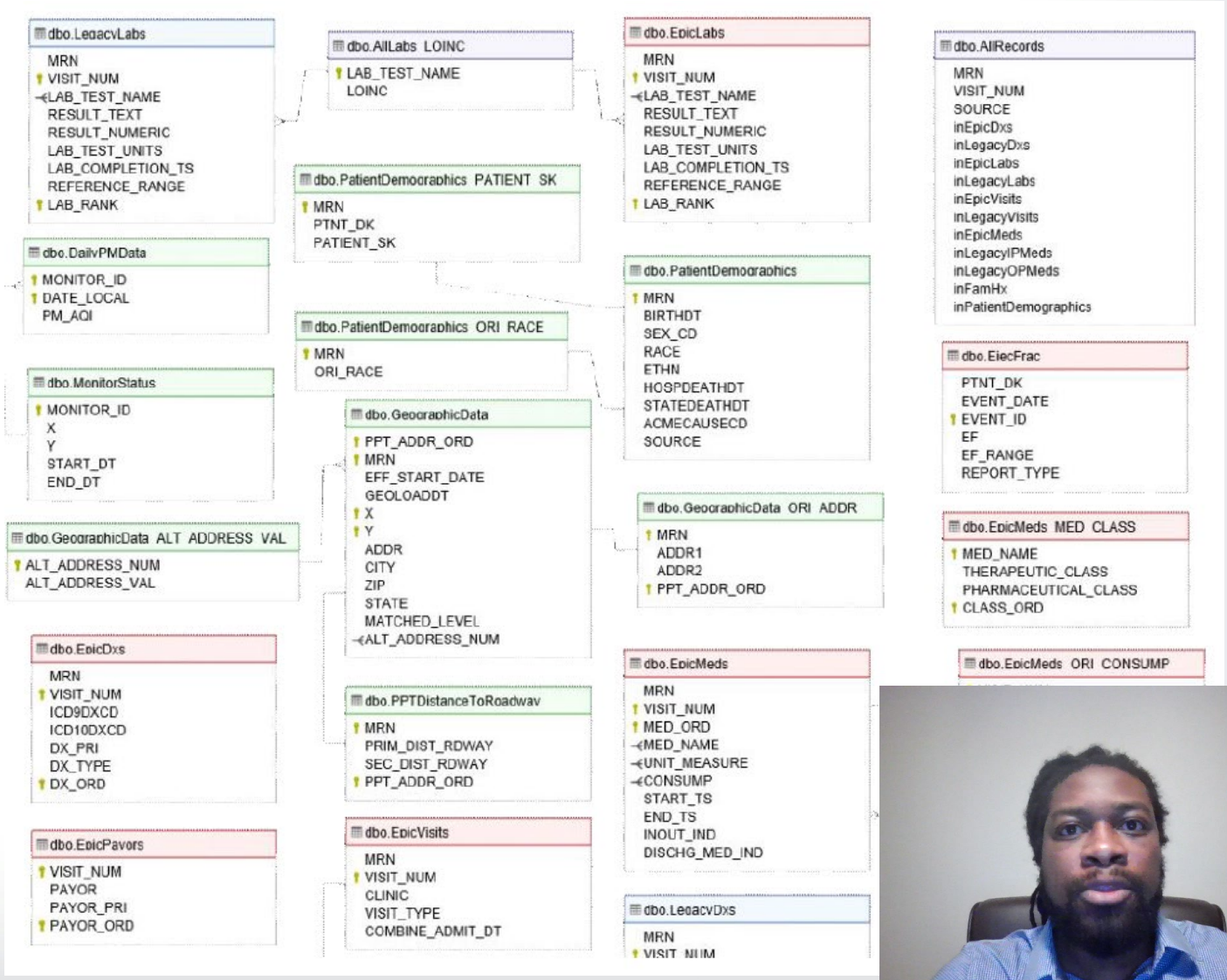


# EPA CARES

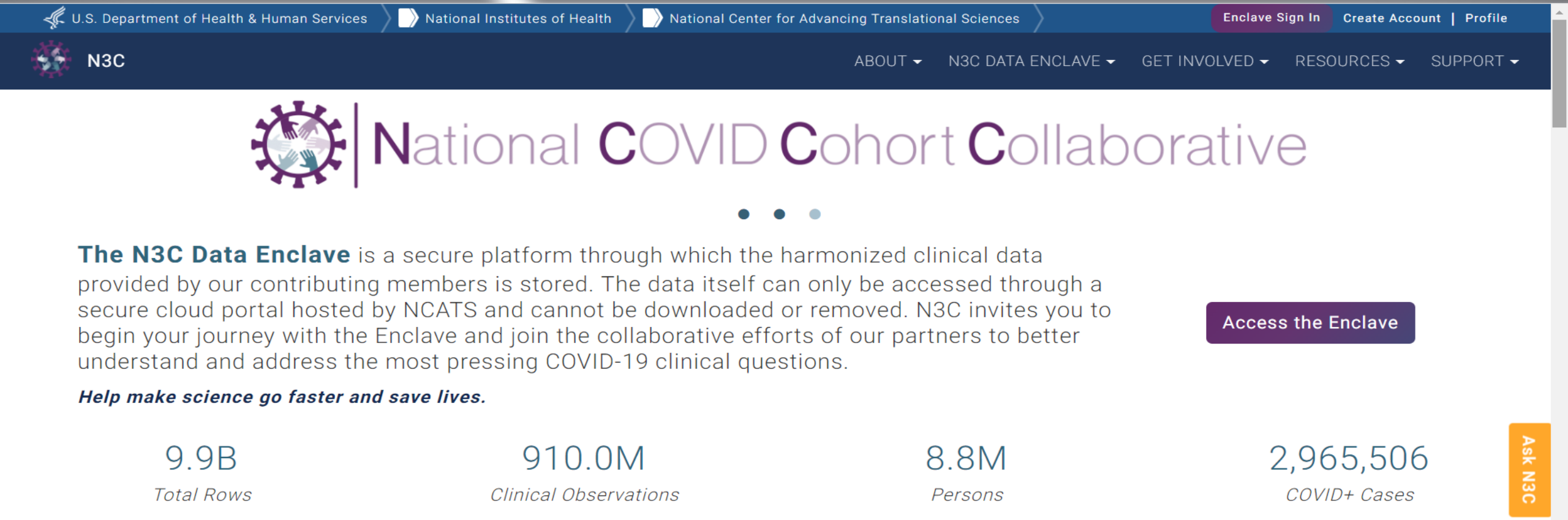
**Problem:** The EPA needs longitudinal data with deep clinical phenotyping to enable novel studies of environmental health and environmental justice

**Collaborations:** EPA CARES – a resource merging electronic health records and environmental exposure maps from the University of North Carolina and Vidant Health

**Innovation:** Has enabled novel studies of vulnerable patient populations (heart failure patients), shown that family history may be an indicator of environmental health risks, and empowered studies of medication-environment interactions that may point towards therapeutic interventions



# COVID19 Partnerships




**Problem:** The COVID19 pandemic presents unique and ongoing environmental health risks with urgent solutions needed

**Collaborations:** N3C– a multisite collaborative effort to perform COVID19 research using electronic health records

**Innovation:** Procedures for incorporating environmental exposure data into modern common data models; Unprecedented analyses of environmental health risks in an evolving pandemic; Incorporation of environmental exposures into symptom severity prediction models

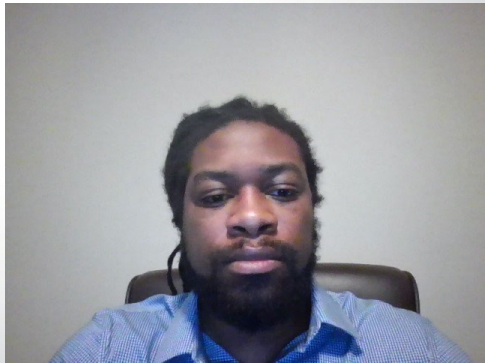
# Overall Successes

1. EHRs from more than 100K patients linked with environmental exposure data

2. Novel frameworks for incorporating environmental exposures into internationally utilized EHR systems

3. 20+ publications since 2011 on environmental justice, vulnerable populations, and environmental epigenetics

4. Establishment of EPA as a leader in national, multi-institution consortiums, e.g. N3C



# Conclusion

1) As environmental health expands from the domain of public health and into the realm of precision medicine collaborations will be at the core of achieving many agency needs
2) These collaborations span academia, hospital systems, and even governments both locally and internationally
3) Electronic health records are a key area where agency needs can only be met via collaborative efforts
4) Continuing the agency's successful history of these collaborations will require enhanced legal understandings, improved means for accessing data remotely and securely, and continued investments into shared resources