



National Institute of  
Environmental Health Sciences



# PEGS Personalized Environment & Genes Study

Powerful science for integrating genomic and environmental data to understand human health

## How Does the Environment Affect Your Health?

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- Food outlets, alcohol outlets
- Built environment
- Urban land use
- Population density
- Green space



- Physical activity
- Sleep behavior
- Diet
- Smoking
- Drug / Alcohol use



# Exposomics



- Income
- Quality
- Social capital
- Cultural norms
- Psychological / mental stress



- |                          |                           |                           |                          |
|--------------------------|---------------------------|---------------------------|--------------------------|
| • Temperature / Humidity | • Point, line sources     | • Pesticides              | • Water contaminants     |
| • Electromagnetic fields | • Odor / Noise            | • POPs                    | • Soil contaminants      |
| • Ambient light          | • Air pollution           | • Plastics / Plasticizers | • Food contaminants      |
| • Pollen / Mold / Fungus | • Agricultural activities | • PBDEs                   | • Occupational exposures |

Adapted from:  
Vermeulen et al.,  
Science, 2020

# PEGS Data Collection



- From 2013-2020, three (3) surveys were used to collect health and exposure data in the cohort
- Information from approximately 9,400 participants was collected
- Types of information collected:
  - General Demographics
  - Family Medical History
  - Lifestyle Factors
  - Occupational Exposure
  - Address histories
- Whole genome sequencing (WGS) for over 4,700 participants

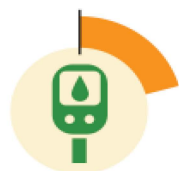
# PEGS

## Health & Exposure Survey

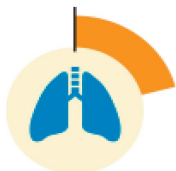
Participants: 9,414 | Questions: 496



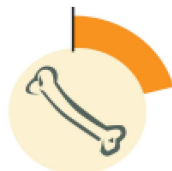
### Self-Reported Diseases or Conditions | Number: 122



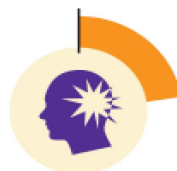
12%  
Diabetes



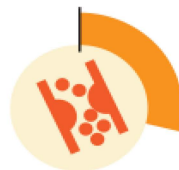
13%  
Asthma



13%  
Bone Loss



17%  
Migraine  
Headaches



33%  
High  
Cholesterol



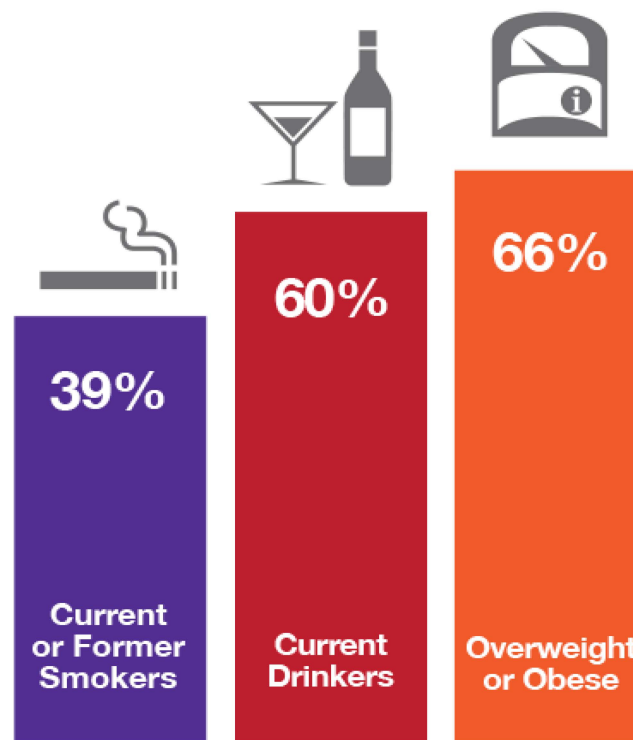
37%  
High Blood  
Pressure



40%  
Seasonal  
Allergies



75%  
Pregnancy  
(Women)



### Lifestyle Factors

# Internal and External Exposome Survey

## PEGS

### External Exposome Survey

Participants: 3,618 | Questions: 607



**15%** of respondents have been exposed to solvents and degreasers.

**42%** of respondents report that their home has been regularly treated with insecticides or pesticides.



**44%** of respondents live within one mile of a gas station.

**21%** of respondents live within one mile of high-tension power lines.



**23%** of respondents live within one mile of a farm.

**66%** of respondents have pets.



**14%** of respondents have been exposed to occupational carcinogens.

Rev 10/12/2023

## PEGS

### Internal Exposome Survey

Participants: 3,071 | Questions: 719



**25%** of respondents report getting eight or more hours of sleep per night during the week.

**41%** of respondents report doing moderate exercise three or more times per week.



**33%** of respondents report going to fast food restaurants one or more times per week.

**29%** of respondents report their blood type as O positive.



Percentage of respondents taking medications for:



High cholesterol = 18%



Anxiety = 13%



High blood pressure = 25%



Depression = 15%



Diabetes = 8%



Asthma = 7%

Rev 10/12/2023

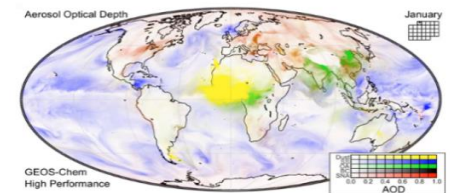


# Geospatial Information Systems (GIS)



## Environment

### Global Air Quality Models

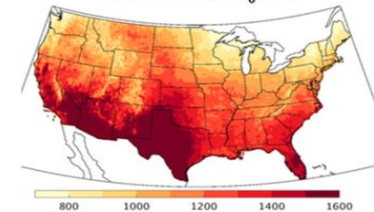


## Climate

### Daily Weather

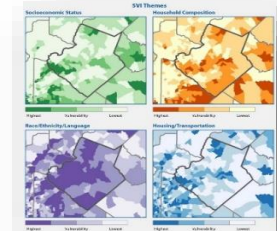
#### GRIDMET

1 Jan-9 Nov 2017 ET<sub>0</sub> (mm)



## Social

### CDC Social Vulnerability Index

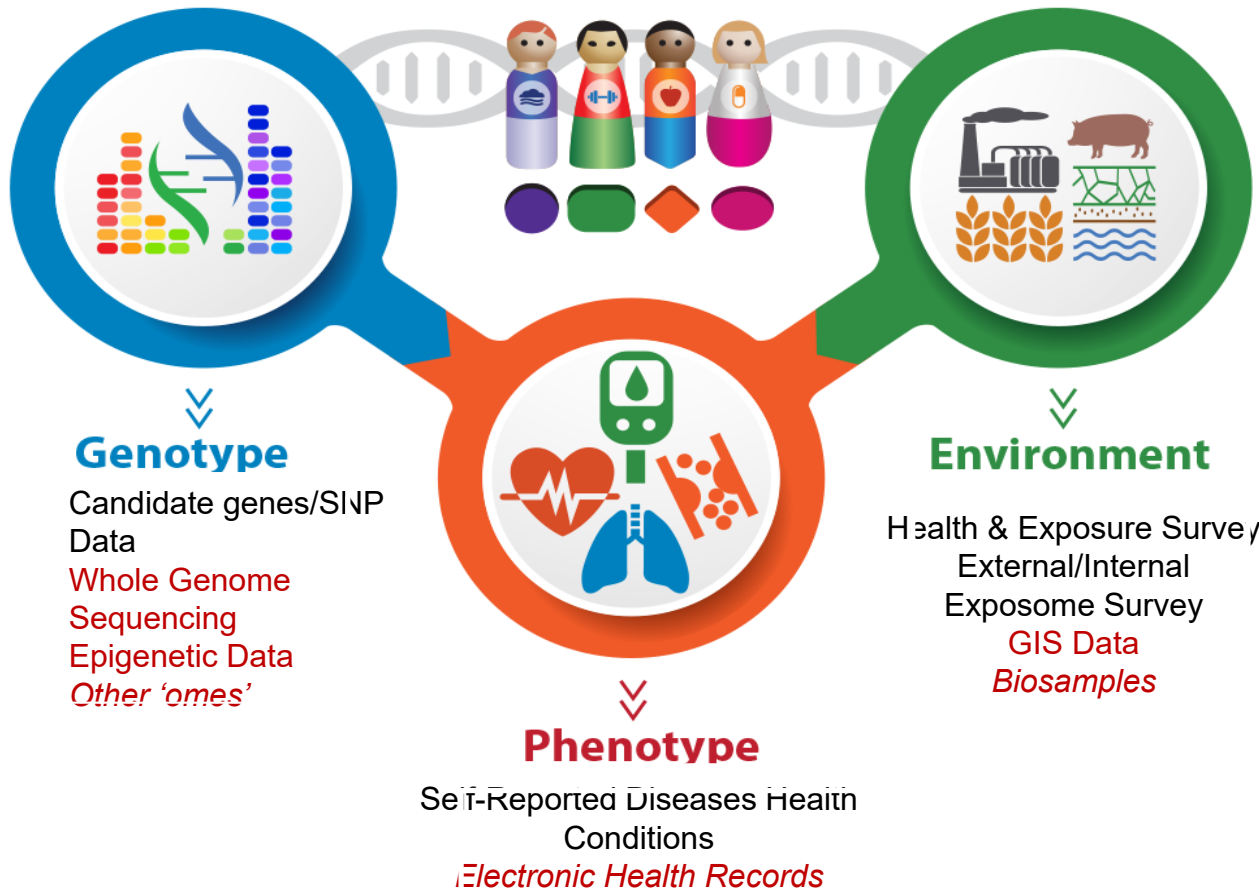


# Precision Environmental Health



- To understand individual risk by integrating multi-level factors that measure exposures (exposomics) or provide evidence of their effects (epigenetics, metabolomics, microbiome) in combination with genetics (Genetics x Environment x Disease)
- To create precision interventions to:
  - Reduce exposures or ameliorate their effects (absence of disease)
  - Screen for, block or slow progression (subclinical disease)
  - Reduce disease morbidity and mortality (known disease)

# Integrating the Environment into Precision Medicine and Health



## Genotype

Candidate genes/SNP  
Data

Whole Genome  
Sequencing  
Epigenetic Data  
Other 'omes'

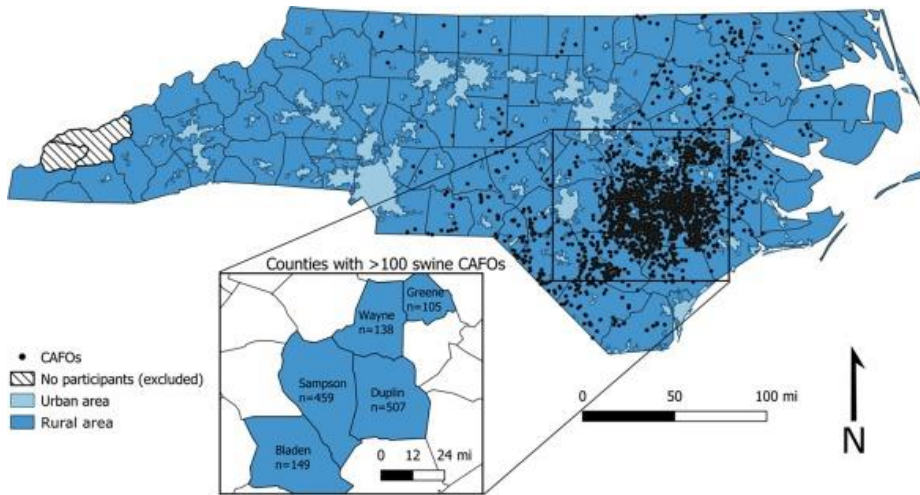
## Environment

Health & Exposure Survey  
External/Internal  
Exposome Survey  
GIS Data  
Biosamples

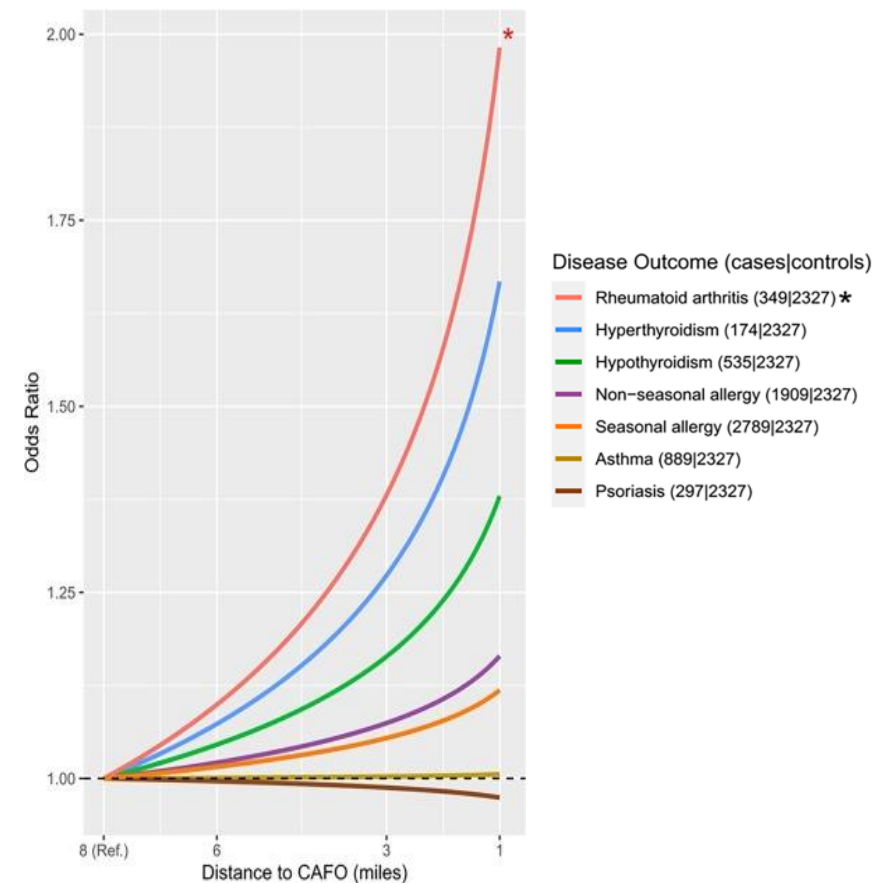
## Phenotype

Self-Reported Diseases Health  
Conditions  
Electronic Health Records





- Immune-mediated diseases are increased with proximity to commercial animal feeding operations (particulate matter, volatile organic compounds, aerosols, gasses)
- Potential role of ARH-ARHNT pathway



(Ayala-Ramirez et al., 2023)



**Diabetes** is an extremely common disease in the PEGS population as it is across the US

- there are a number of genes that increase the risk of diabetes
- in a study using our data from PEGS,
  - a composite score for exposures identified in our questionnaires was even better at predicting the risk of diabetes than a similar composite score for genetic risk  
(*Akhtari et al., 2022*)

## **Psoriasis and Eczema**

- The air that surrounds us does not contain just one pollutant but a mixture of different potential toxins
- In a study using data from PEGS that included air composition obtained from approximate address
  - mixtures of xx in air were associated with self-reported psoriasis or eczema (*Lowe et al., 2022*)

# Your Preferences





**What type of information would you like to receive from PEGS?**

- a) Information on publications and presentations made using PEGS data**
- b) Environmental health issues**
- c) Health education topics (i.e., fitness, diet, etc.)**
- d) Upcoming events**



**Of the following list, what types of communications or items would you be interested in receiving from PEGS?**

- a) Video messages with study updates**
- b) Newsletters**
- c) Social media posts**
- d) Holiday cards/birthday cards**
- e) Not interested in additional communications**

# DID YOU KNOW ???



## Pesticides

*Parkinson's  
Disease  
Birth defects  
Reproductive  
disorders*



## Non-stick Pots and Pans

*Testicular Cancer  
Thyroid Cancer  
Kidney Cancer*



## Mold

*Allergies  
Asthma  
Other respiratory  
illnesses*



## Lead Pipes

*Cardiovascular disease  
Cognitive decline  
Kidney failure*

## Plastics

*Impaired  
immunity  
Endocrine  
disruption  
Insulin  
resistance*





# Reported Exposome Survey Data



- **14% of respondents report mold in their residence in the past year**
- **16% of respondents report that they apply pest control chemicals every 2 or 3 months**
- **16% of respondents report that they do not know if they have been occupationally exposed to the plastic production compound BPA**

# Common environmental exposures and how to minimize your risk



## Lead

- Minimize your risk by running water from the tap before drinking or cooking to flush pipes
- Keep painted surfaces in good condition to minimize deterioration. (If your home was built before 1978, it may contain lead-based paint.)

## Mold

- Ventilate shower, laundry, and cooking areas to control humidity levels
- Use a dehumidifier if humidity levels remain high
- Fix leaky roofs, windows and pipes

# Pesticides/Insecticides



- Close windows and doors when spraying pesticides outdoors
- Read and follow instructions on product label, don't use more than needed
- Store out of reach of children



# Endocrine Disrupting Chemicals (EDCs)



**Natural or man-made chemicals that can interfere with your hormones**

- Per- and polyfluoroalkyl substances (PFAS), also known as **Forever Chemicals**, found in fire fighting foam, nonstick pans, paper, textile
- Phthalates (plasticizers), found in food packaging, cosmetics and are present everywhere
- Bisphenol A (BPA), used to make plastics and epoxy resins
- Polybrominated diphenyl ethers (PBDE), flame retardants in furniture and carpet
- You contact them in the air, water, and food

# Endocrine Disrupting Chemicals (EDCs)



How to minimize exposure?

- Avoid heating foods in plastic containers
- Use metal or glass water bottles
- Use water filters (activated carbon or reverse osmosis)
- Use fragrance free cosmetics and soaps
- Open your windows! Household dust can contain EDCs. Use HEPA air filters
- Instead of paper receipts, ask for digital receipts
- Avoid vinyl products such as flooring or shower curtains

# PEGS Participant Advisory Board (PAB)





# How YOU can help ... PEGS Participant Advisory Board



The PEGS Participant Advisory Board (PAB) was created to work collaboratively with the study team with specific purposes in mind:

1. To serve as a liaison between the study team and their cohort by sharing research needs expressed by the participants and to offer suggestions for future research to the study team
2. To assist with developing goals and objectives centered around PEGS that will positively impact participants through study participation and to advance science
3. To provide feedback on study materials and activities
4. To provide ideas for how best to inform participants of PEGS-related news and scientific advances

# How YOU can help ... PEGS Participant Advisory Board



## Solicitation and Criteria

- The study team is actively seeking persons to become a part of the PAB.
- Selection criteria:
  - Express an interest! Be available!
  - Be willing to share and interact with others about the study!
- Email us at [niehs-pegs-info@nih.gov](mailto:niehs-pegs-info@nih.gov) if you're interested!
- If you have already contacted us, look for information later this year about the PAB first meeting.

# Evaluation Questions



- Did this Town Hall session help you identify ways that you can limit environmental exposures in your home? **Yes/No**
- Would you recommend this presentation to others? **Yes/No**

# Questions??



## PEGS NIEHS Website

