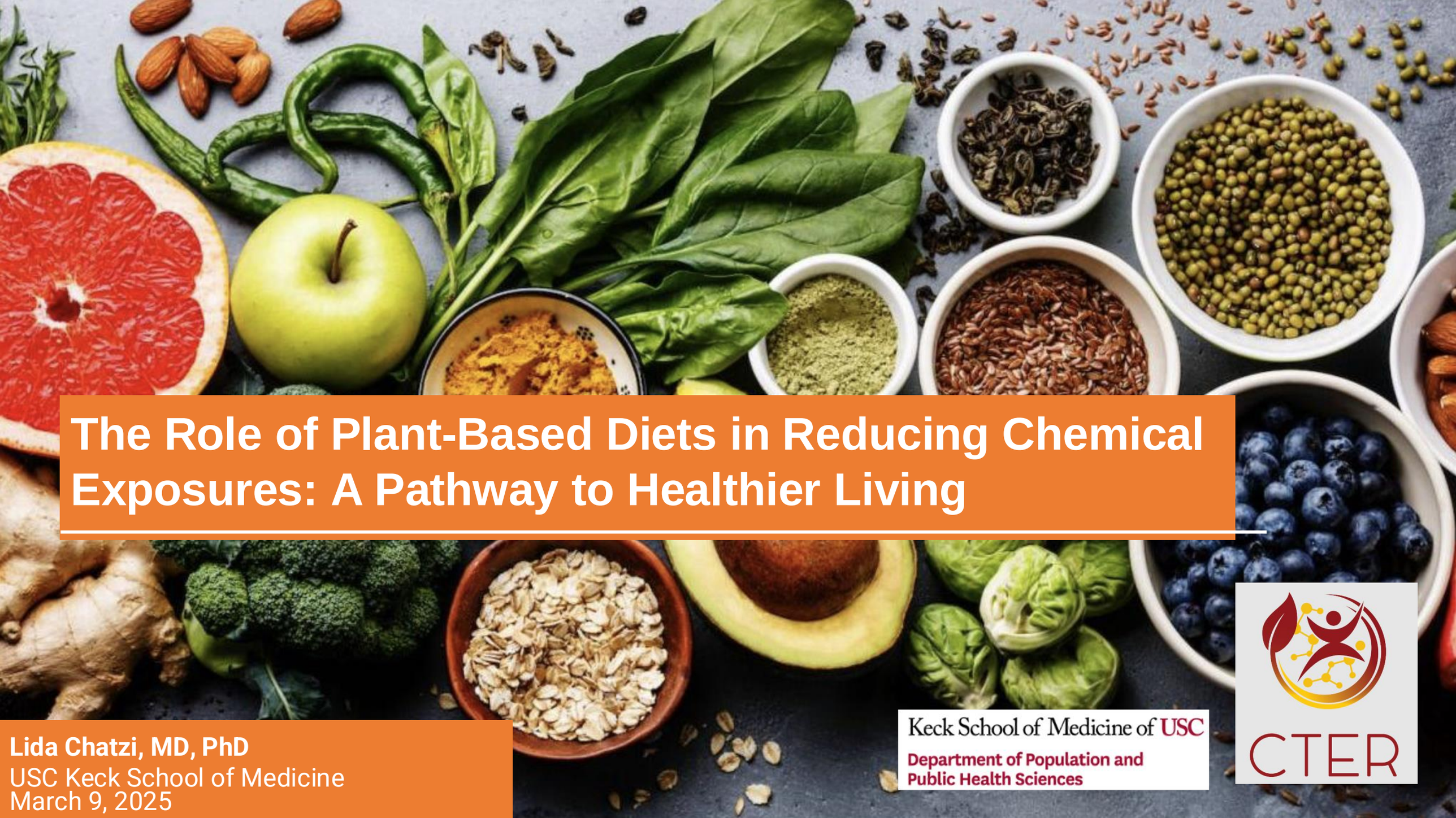

The Role of Plant-Based Diets in Reducing Chemical Exposures: A Pathway to Healthier Living

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March 9, 2025

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Department of Population and Public Health Sciences

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OUTLINE

- Diet and its association with exposure to chemicals
- Plant-based diet
  - Benefits to your health
  - Benefits to the environment
- PFAS and Diet
  - Case Study
- Discussion

DIET AND EXPOSURE TO CHEMICALS

Chemical Exposures based on Diet	
Animal-based diet	**Plant-based diet**
✔ Per- and polyfluoroalkyl substances (PFAS)	✔ Pesticides in non-organic foods
✔ Dioxins and Polychlorinated biphenyls (PCBs)	
✔ Pesticides	
✔ Bisphenols (BPA)	
✔ Organochlorine Pesticides (DDE & DDT)	
✔ Polybrominated diphenyl ethers (PBDEs)	
✔ Phthalates	

- Animal-based diets contain many chemical contaminants compared to plant-based diets.

Guo et al., 2019, International Journal of Environmental Research and Public Health; Serrano et al., 2014, Environmental Health; Baudry et al. 2021, Food and Chemical Toxicology

PLANETARY HEALTH DIET

Higher consumption of adequacy components **(whole grains, whole fruits, non-starchy vegetables, nuts and seeds, legumes, and unsaturated oils)**

- Developed by the EAT-Lancet Commission, a group of 37 scientists from 16 countries to promote health and protect the planet
- Optimal diet emphasizing plant-based foods with limited animal products for healthy diet and sustainable food production
- Limited animal products supports sustainable food production by lowering greenhouse gas emissions and reduce land and water use

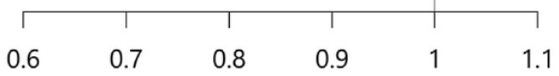
Willett et al., 2019, The Lancet

HIGH ADHERENCE TO PLANETARY DIET ASSOCIATED WITH REDUCED MORTALITY

- Higher planetary health diet scores are associated with a 16% lower risk of all-cause mortality.
- The planetary health diet is associated with lower risk of death from cardiovascular diseases, cancer, respiratory diseases, and neurodegenerative diseases.

Pooled HRs of the Planetary Health Diet Index for 20-point increase in total and cause-specific mortality in three prospective cohorts.

Cause of death	Cases	HR per 20 points	p-value
All causes	54536	0.84 (0.82, 0.85)	<.0001
Non-trauma causes	48462	0.84 (0.82, 0.86)	<.0001
Cardiovascular disease	13769	0.92 (0.89, 0.95)	<.0001
Cancer	14616	0.92 (0.88, 0.95)	<.0001
Respiratory disease*	4091	0.66 (0.62, 0.70)	<.0001
Neurodegenerative disease*	7423	0.81 (0.78, 0.85)	<.0001
Infectious disease*	969	0.87 (0.76, 1.00)	0.0422



Bui et al., 2023, The American Journal of Clinical Nutrition

IMPACT OF PLANETARY HEALTH DIET ON HUMAN HEALTH FOR THE FUTURE

The EAT-Lancet Commission predicts this diet is likely to result in major health benefits

Approach 1: Comparative Risk

- Compares current global dietary patterns with the planetary health diet
- Predicted to prevent 11.1 million deaths per year

Approach 2: Global burden of disease

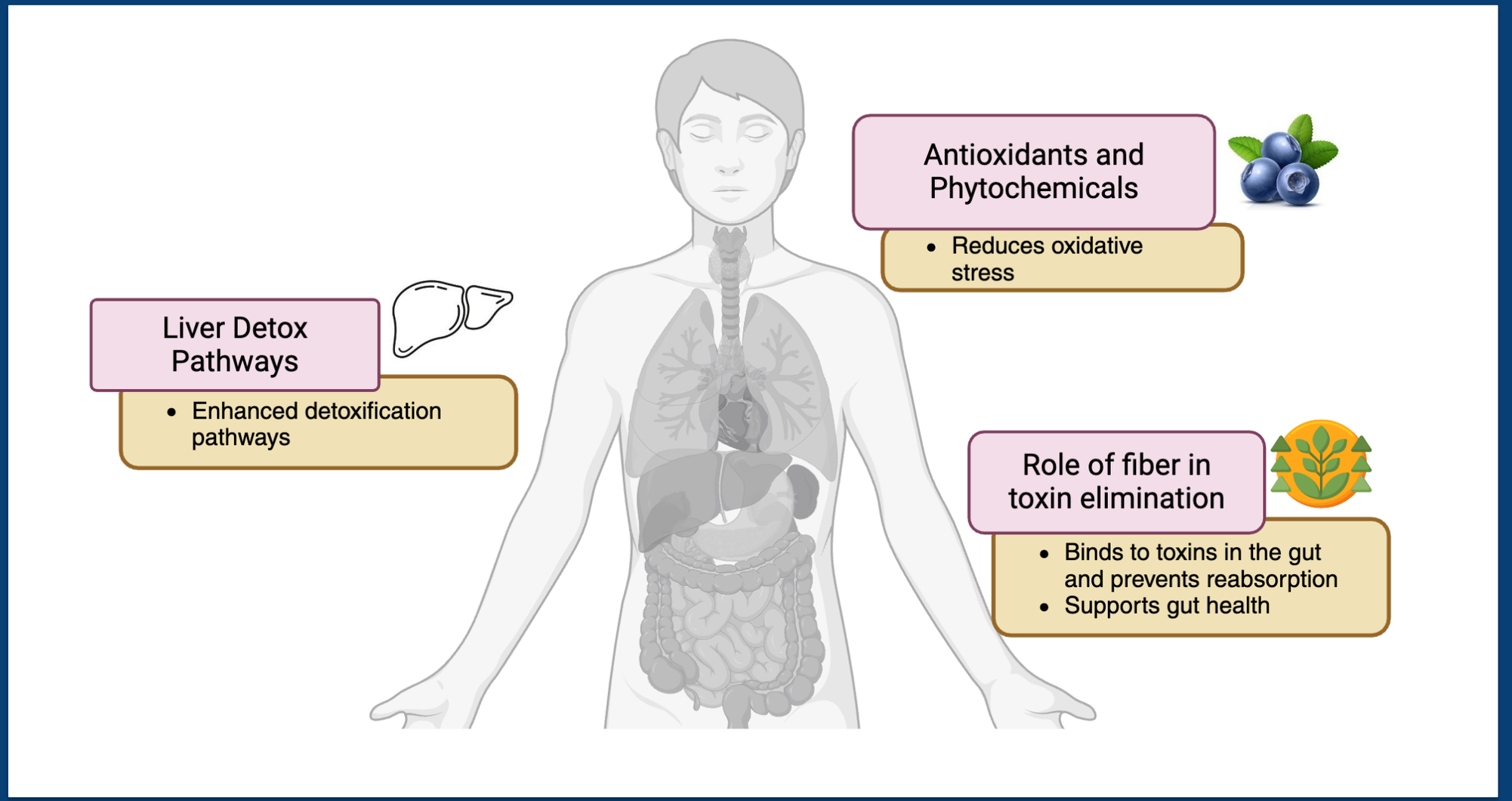
- Estimates how much diet contributes to disease burden and mortality globally
- Predicted to prevent 10.8 million deaths per year

Approach 3: Empirical disease risk

- Estimates how diet directly affects health outcomes in large populations
- Predicted to prevent 11.6 million deaths per year

Willett et al., 2019, The Lancet

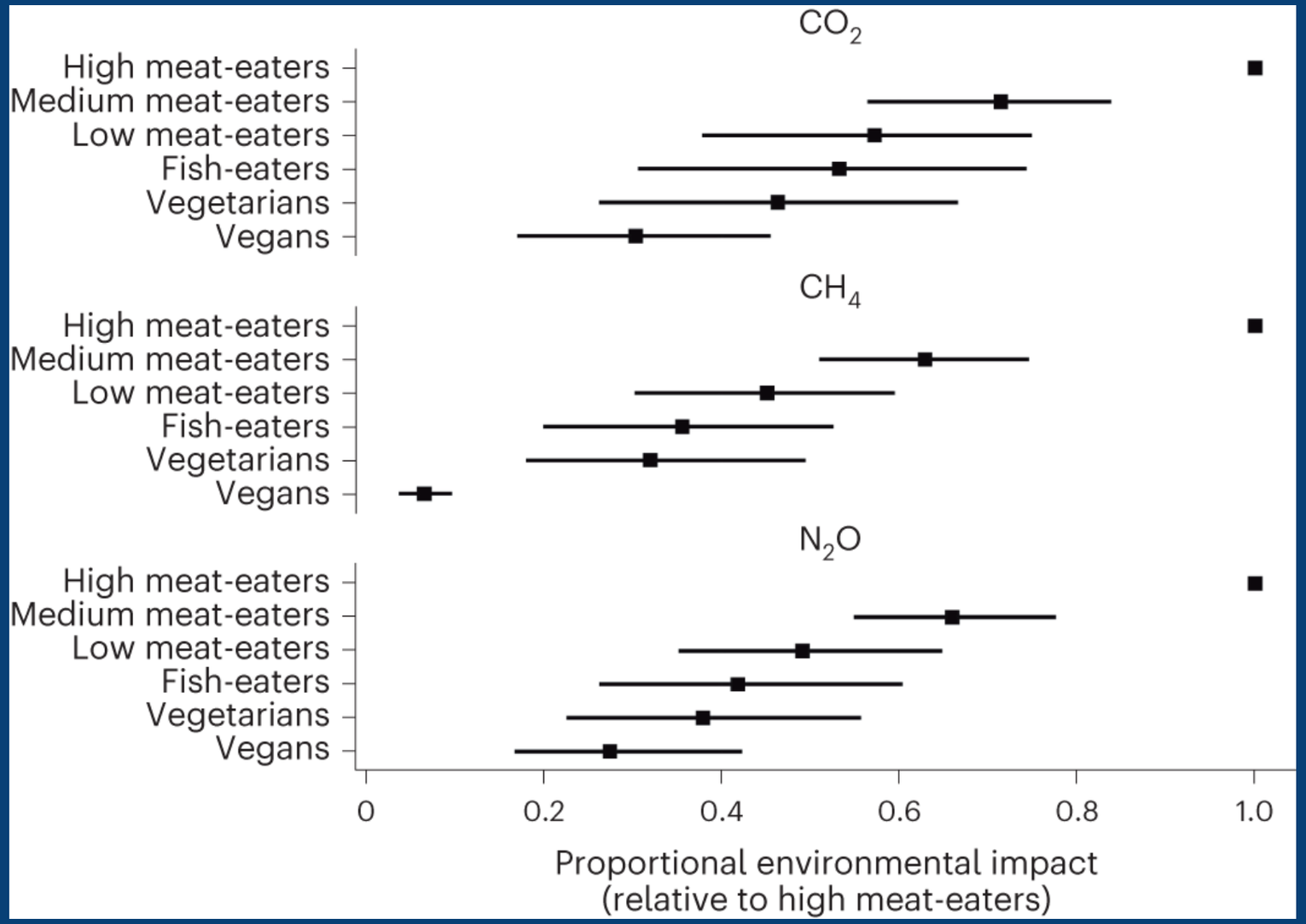
MECHANISMS OF DETOXIFICATION THROUGH DIET



Medawar et al., 2019, Translational Psychiatry; Kieffer et al., Advances in Nutrition, Tan et al., Frontiers in Pharmacology

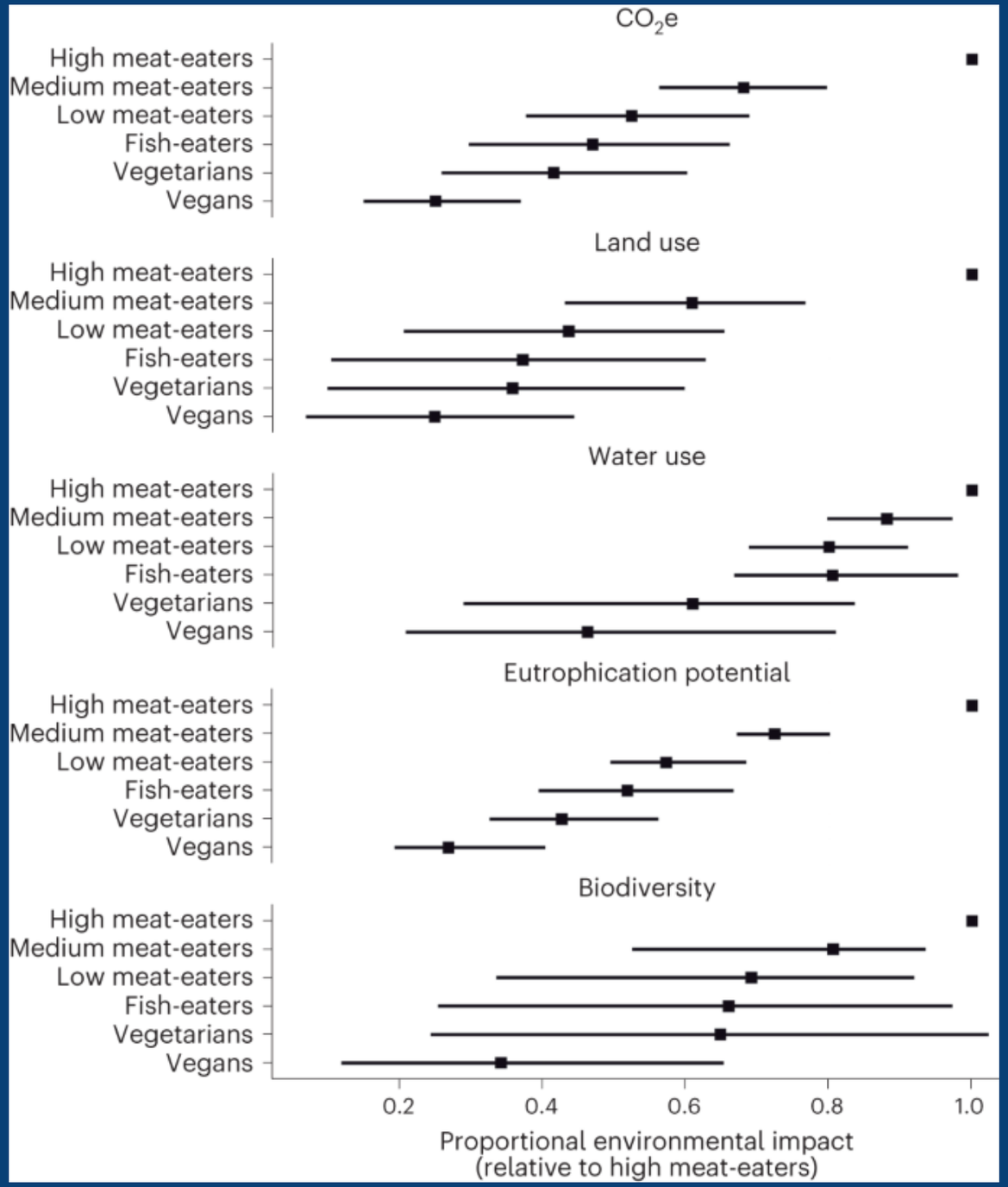
Benefits of the Planetary Health Diet on environment

RELATIVE ENVIRONMENTAL FOOTPRINT FROM GHG EMISSIONS OF DIET GROUPS IN COMPARISON TO HIGH MEAT-EATER (>100 g d^{-1})



- CO_2, CH_4, and N_2O are measures of greenhouse gas emissions.
- High-meat eaters produce the most emissions.
- Medium and low-meat eaters have lower emissions.
- Vegetarians and vegans have the smallest carbon footprint, with the lowest emissions.

Scarborough et al. 2023, Nature Food



Relative environmental footprint from GWP100, land use, water use, eutrophication potential and biodiversity impact of diet groups in comparison to high meat-eaters (>100 g d−1)

- High meat-eaters have the largest environmental impact with the most use of land and water leading to biodiversity loss.
- Vegetarians and vegans have the lowest environmental impact with lower land and water use.

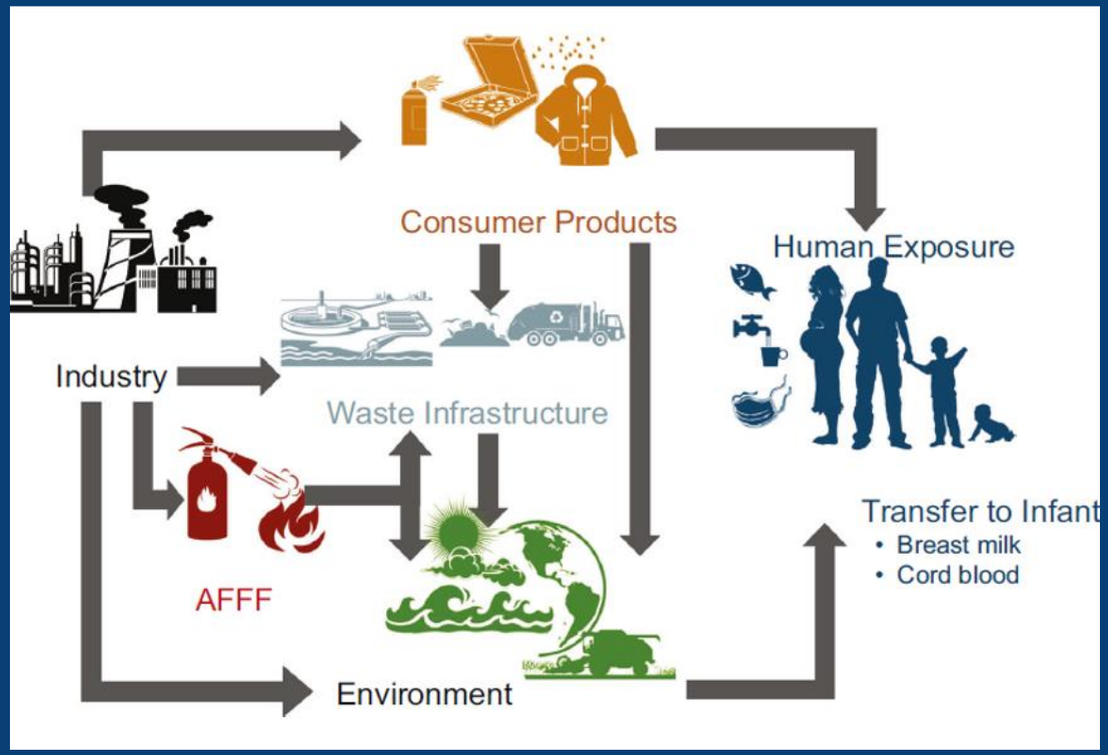
Scarborough et al. 2023, Nature Food

A Case Study of PFAS: Research Findings

A case study on PHD diet and exposure to PFAS chemicals

WHAT ARE PFAS?

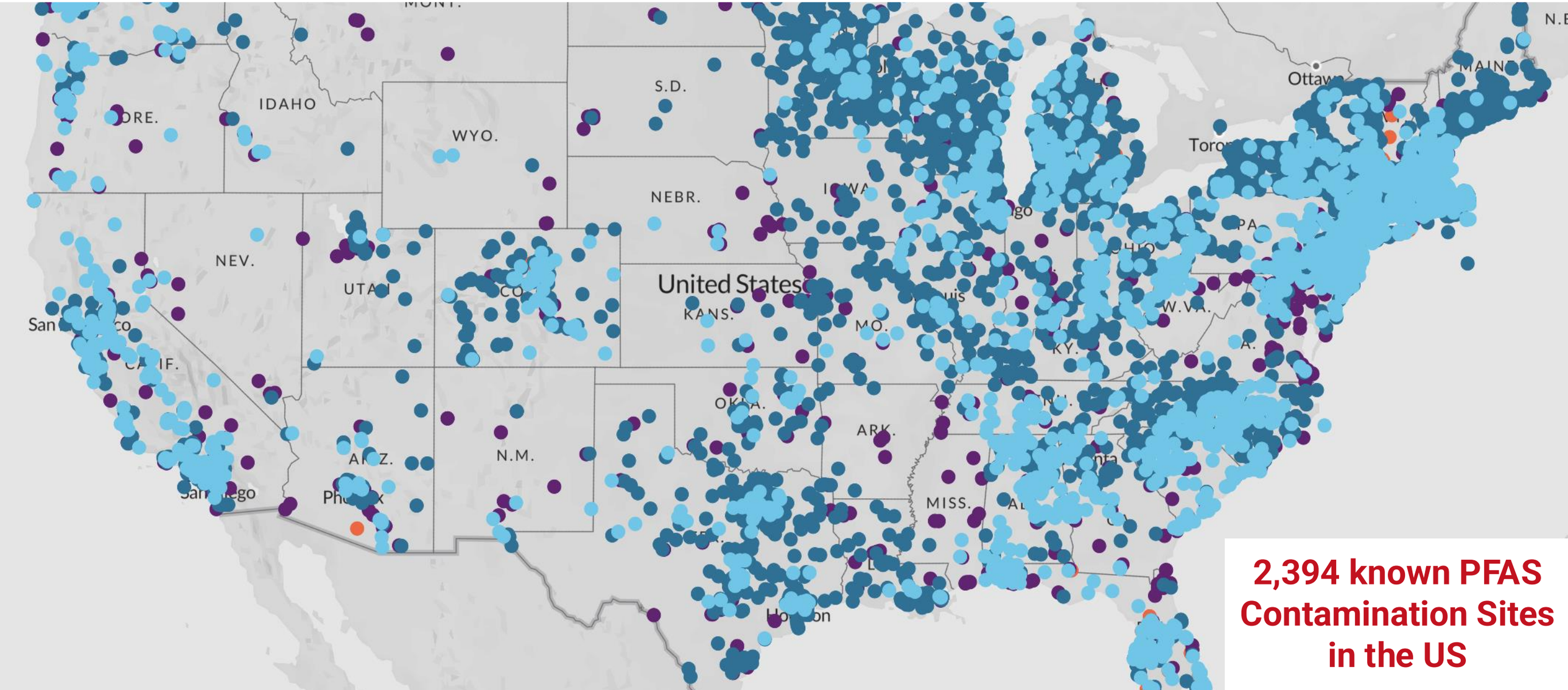
- > 7,000 chemicals
- PFAS have been widely used in industrial applications
- Resistant to degradation
- Detected in the blood of almost everyone in the U.S



Sunderland et al., J Expos Sci & Epidemiol, 2019

PFAS Water Contamination in the United States, November 20, 2024 (EWG)

Drinking water ~200 million Americans may be contaminated with PFAS (Andrews & Naidenko, 2020)



2,394 known PFAS Contamination Sites in the US

WHAT WE KNOW ABOUT DIET AND PFAS

environment INTERNATIONAL

Associations of dietary intake and longitudinal measures of per- and polyfluoroalkyl substances (PFAS) in predominantly Hispanic young Adults: A multicohort study

Hailey E. Hampson [a], Elizabeth Costello [a], Douglas I. Walker [b], Hongxu Wang [a], Brittney O. Baumert [a], Damaskini Valvi [b], Sarah Rock [a], Dean P. Jones [c], Michael I. Goran [d], Frank D. Gilliland [a], David V. Conti [a], Tanya L. Alderete [e], Zhanghua Chen [a], Leda Chatzi [a], Jesse A. Goodrich [a,*]

High Intake of Tea, Pork, Hot Dogs and Processed Meats associated with higher PFAS levels

Existing Evidence

- Diet is a source of PFAS exposure through the intake of contaminated foods
- Key sources of dietary PFAS:
  - Seafood
  - Meat
  - Dairy
- PFAS exposure can also indirectly occur from contaminated food packaging and cookware

Hampson et al., 2024, Environment International
Roth et al., 2020. Frontiers in Toxicology

PLANETARY HEALTH DIET AND PFAS Ongoing Study

Evaluate the association between adherence to Planetary Health Diet and PFAS Levels.

Aim

- Assess the relationship between adherence to PHD and PFAS in a large, population-based cohort.

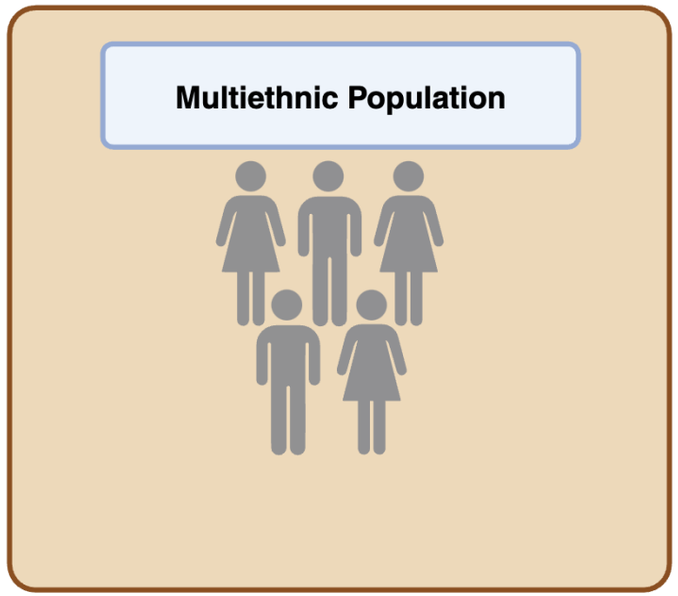
MULTIETHNIC COHORT STUDY

UNIVERSITY OF HAWAI'I CANCER CENTER

USC University of Southern California

The Multiethnic Cohort Study

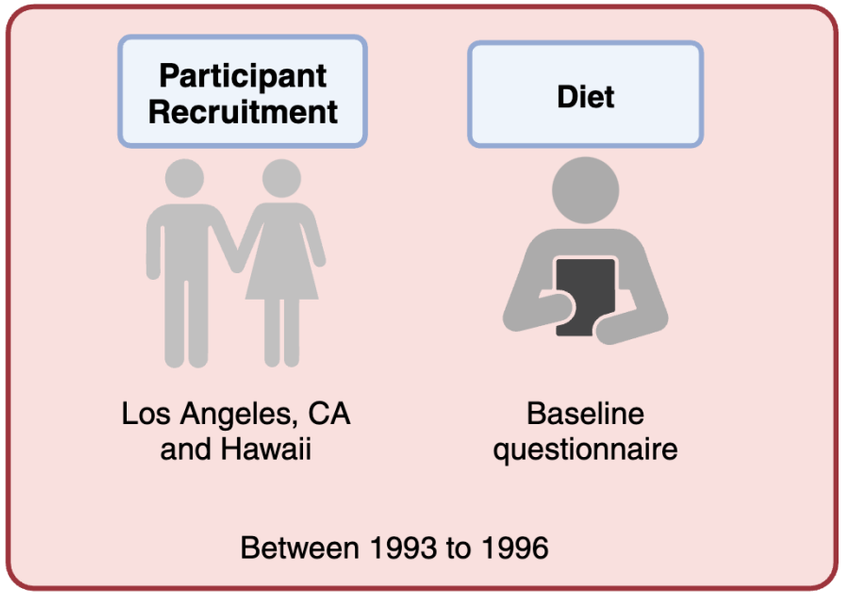
Understanding ethnic differences in cancer to prevent it in all populations

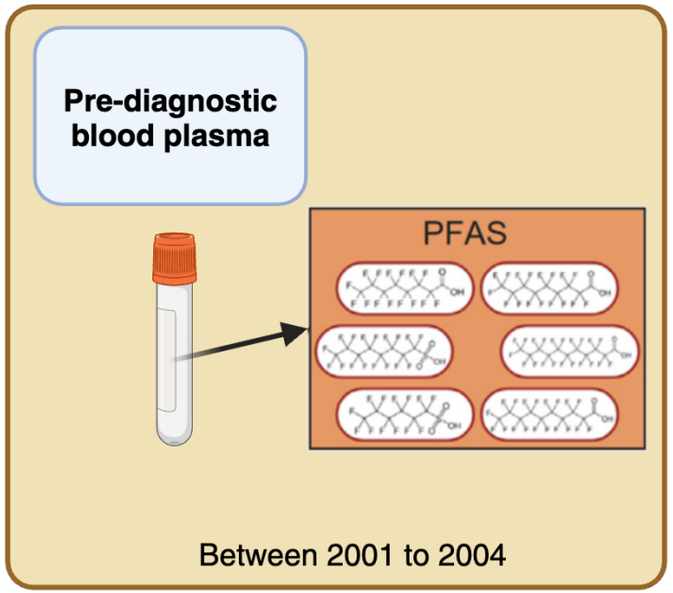


- **Prospective cohort study**
- **>200,000 participants from Los Angeles and Hawaii**
- **>20 years follow up time**

Kolonel et al., 2000, American Journal of Epidemiology
Stram et al., 2000, American Journal of Epidemiology

METHODS



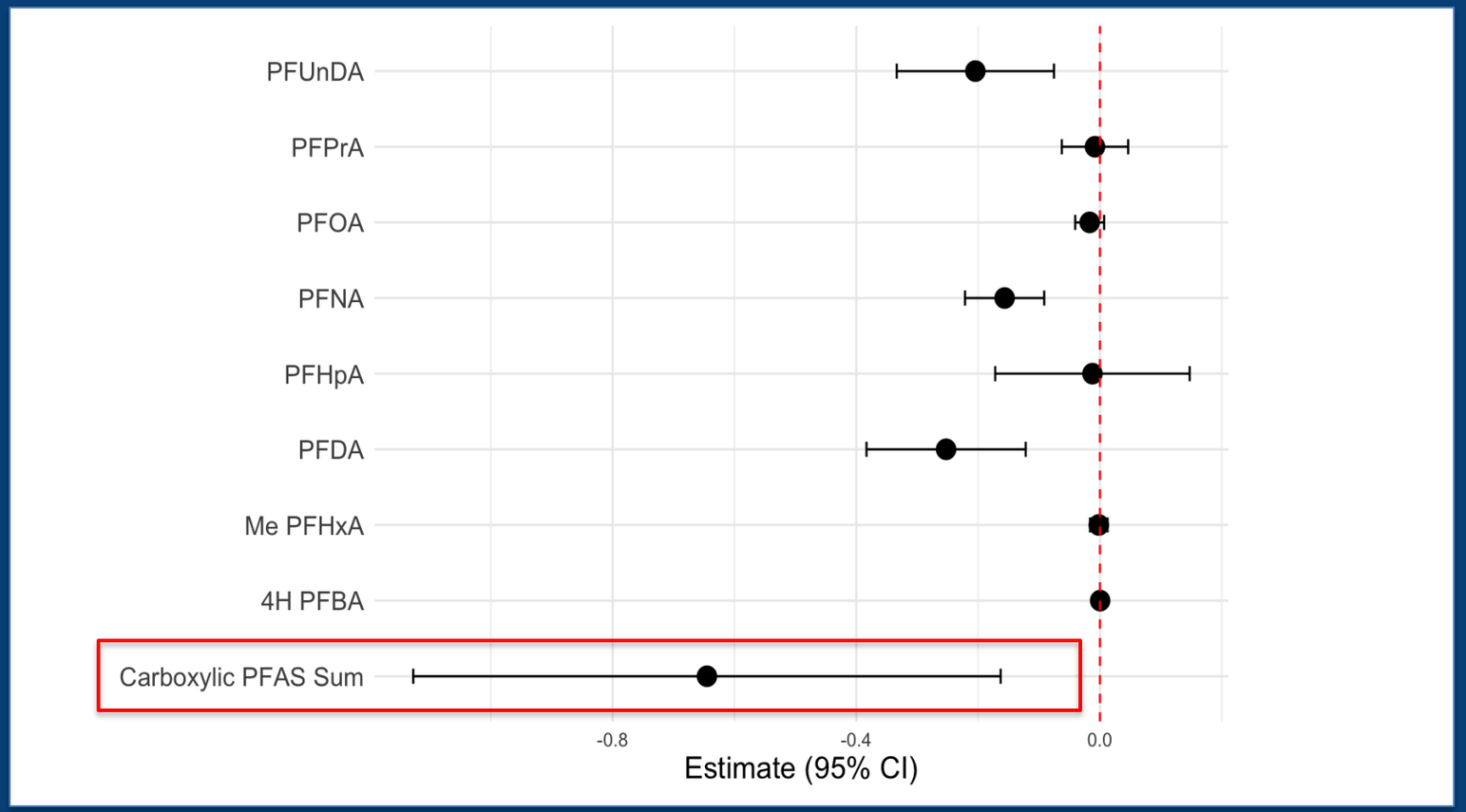


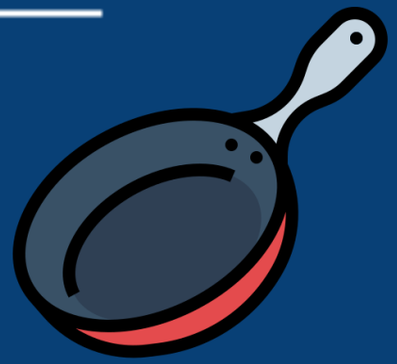
Nested case-control study design with 2,800 participants

Questionnaire collected information on food intake and dietary patterns.

PFAS were measured from blood samples collected from participants.

HIGHER ADHERENCE TO PHD IS ASSOCIATED WITH LOW EXPOSURE TO PFCAs.



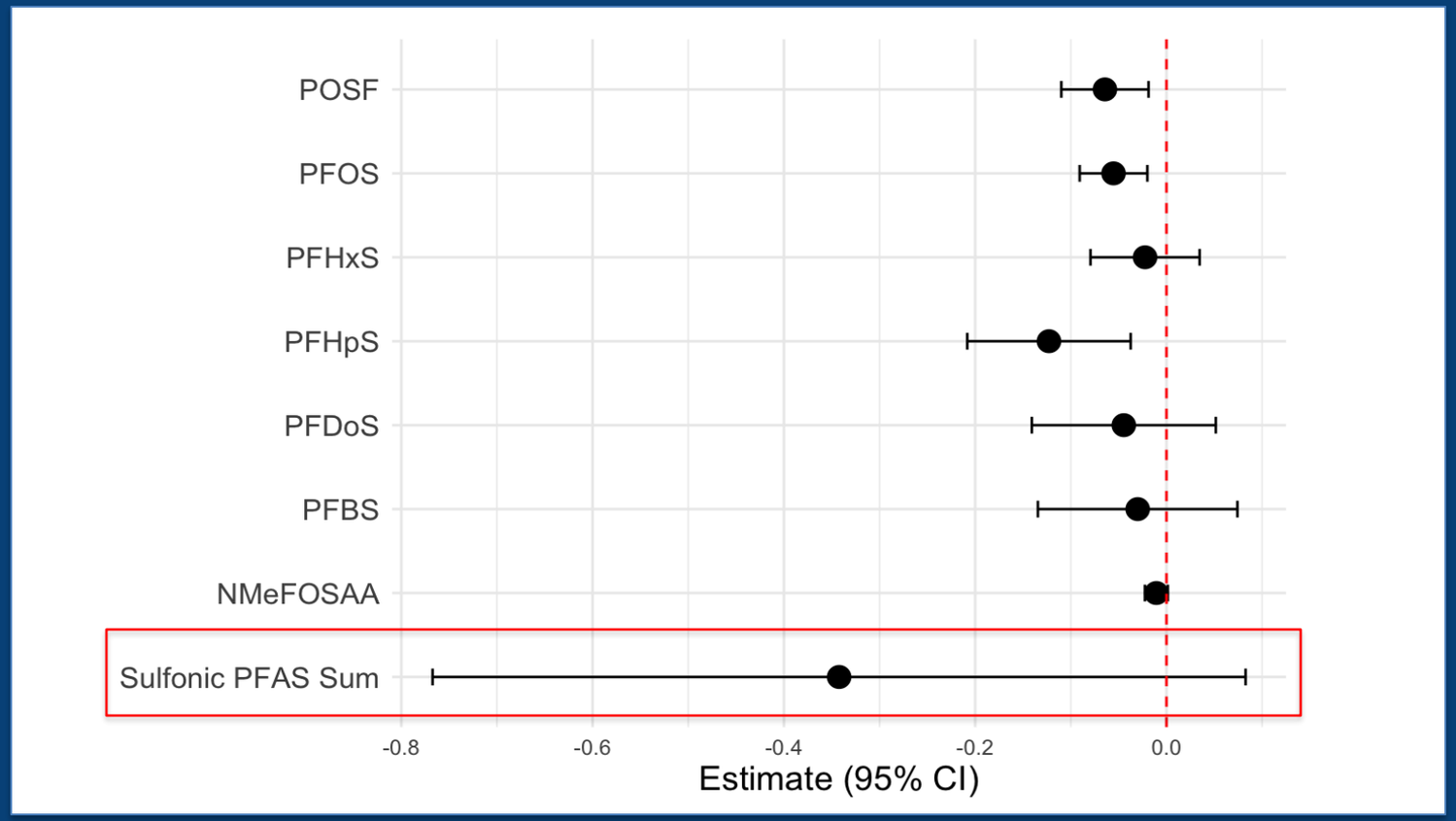


Carboxylic PFAS

- Subgroup of PFAS with a carboxyl functional group
- Found in non-stick coatings and water-resistant products

Higher PHDI score (1 unit increase in quintile) is associated with lower PFCAs.

HIGHER ADHERENCE TO PHD IS ASSOCIATED WITH LOW EXPOSURE TO PFSAs



Higher PHDI score (1 unit increase in quintile) is associated with lower PFSAs.

Sulfonic PFAS

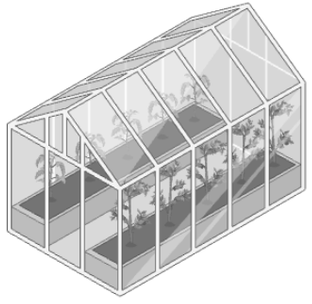
- Subgroup of PFAS with a sulfonic acid functional group
- Found in firefighting foams, water-repellent coatings, and industrial applications

DISCUSSION

PLANETARY HEALTH DIET

Reduces risk for all-cause mortality and death from cardiovascular diseases, cancer, and respiratory diseases

Reduces chemical exposures (e.g. PFAS)



Supports sustainability by reducing greenhouse gas emissions, land and crop use

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