

# OVERVIEW OF THE CENTER FOR ADVANCING RESEARCH IN TRANSPORTATION EMISSIONS, ENERGY, AND HEALTH - **CARTEEH**

AASHTO Committee on Environment and Sustainability Annual  
Meeting: August 7, 2019

*Joe Zietsman Ph.D., P.E.*

Texas A&M Transportation Institute, Center for Advancing Research in  
Transportation Emissions, Energy, and Health (CARTEEH)

<https://www.carteeh.org/>



# University Transportation Centers (UTC) Program

- Began in 1987
- Administered through Office of the Secretary of Transportation
- Transportation bill research priorities (FAST Act):
  - Mobility
  - Congestion
  - Safety
  - Infrastructure
  - Environment
  - Transportation Systems

# CARTEEH – Tier 1 Center



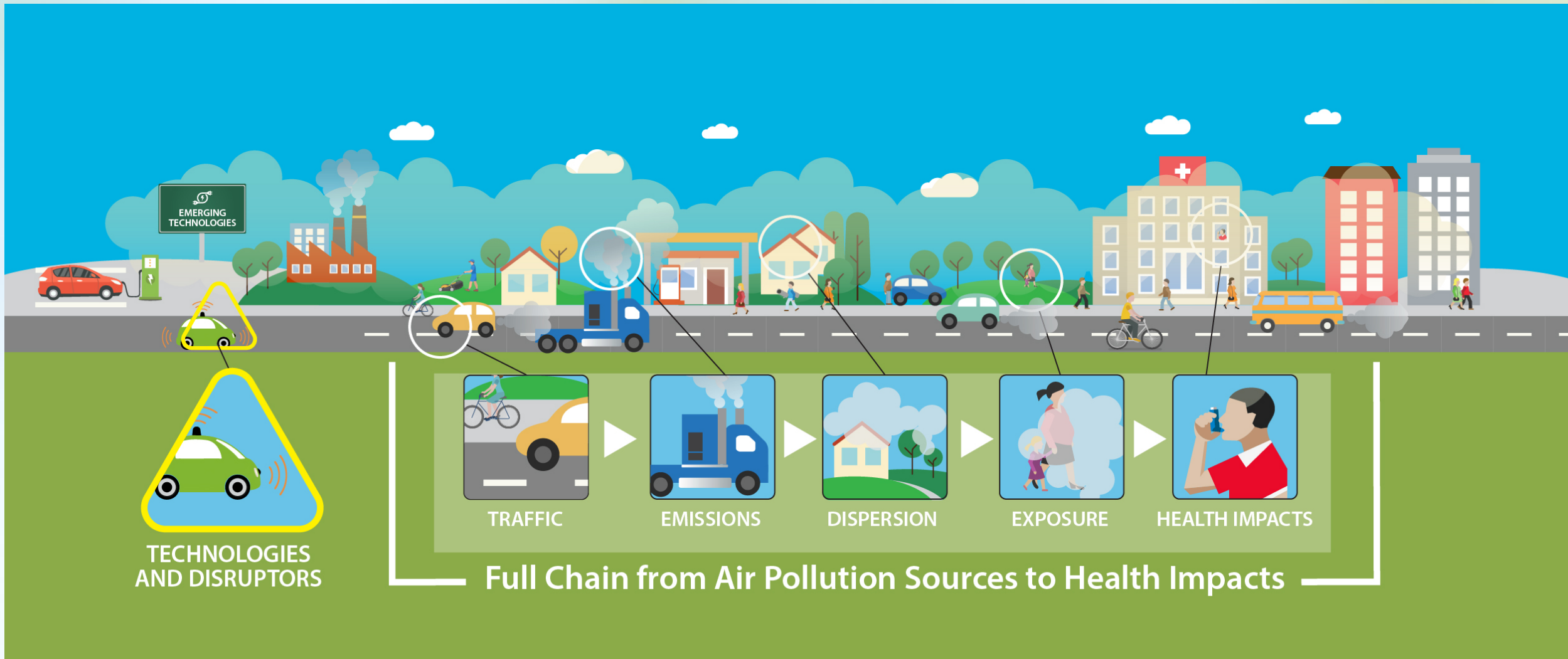


# Our Vision

*“CARTEEH is a premier University Transportation Center where transportation and public health experts work together to address the impact of transportation emissions on human health.”*



# Transportation Emissions and Health Spectrum



## Old Paradigm

Indirect Approach

Single-Disciplinary

Nonattainment Areas

Criteria Pollutants

Conventional Vehicles

Single Element Modeling

Single Element Testing

## New Paradigm

Direct Approach

Multi-Disciplinary

All Areas

All Relevant Pollutants

AV/CV, Shared Use, Electrification

Full Chain Modeling

Full Chain Testing

# TTI CARTEEH Team



**Mohammad Askariyeh**  
Graduate Research Assistant



**Raed Alotaibi, M.D.**  
Graduate Research Assistant



**Andrew Birt, Ph.D.**  
Associate Research Scientist  
Program Manager



**Reza Farzaneh, Ph.D., P.E.**  
Associate Research Engineer  
Program Manager



**Andrew Glazener**  
UTC Summer Intern



**Rohit Jaikumar, Ph.D.**  
Associate Transportation  
Researcher



**Jeremy Johnson, PMP**  
Research Specialist



**Natalie Johnson, Ph.D.**  
Assistant Professor



**Haneen Khreis, Ph.D.**  
Associate Research Scientist



**Phil Lewis, Ph.D., P.E.**  
Associate Professor



**Alex Meitiv**  
Research Scientist



**Cristopher Nunez**  
UTC Summer Intern



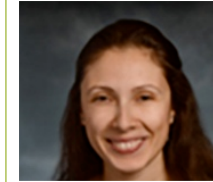
**Tara Ramani, Ph.D., P.E.**  
Assistant Research Engineer



**Kristen Sanchez**  
Research Assistant



**Dan Seedah, Ph.D.**  
Assistant Research Scientist



**Ipek Sener, Ph.D.**  
Associate Research Scientist



**Soheil Sohrabi**  
Graduate Research Assistant



**Melissa Tooley, Ph.D.**  
Sr. Research Engineer



**Inyang Uwak, M.D.**  
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**Suriya Vallamsundar, Ph.D.**  
Associate Research Scientist



**Manuel Velasco**  
UTC Summer Intern



**Marcia Walker, CRA**  
Program Coordinator



**Yanzhi (Ann) Xu**  
Research Scientist

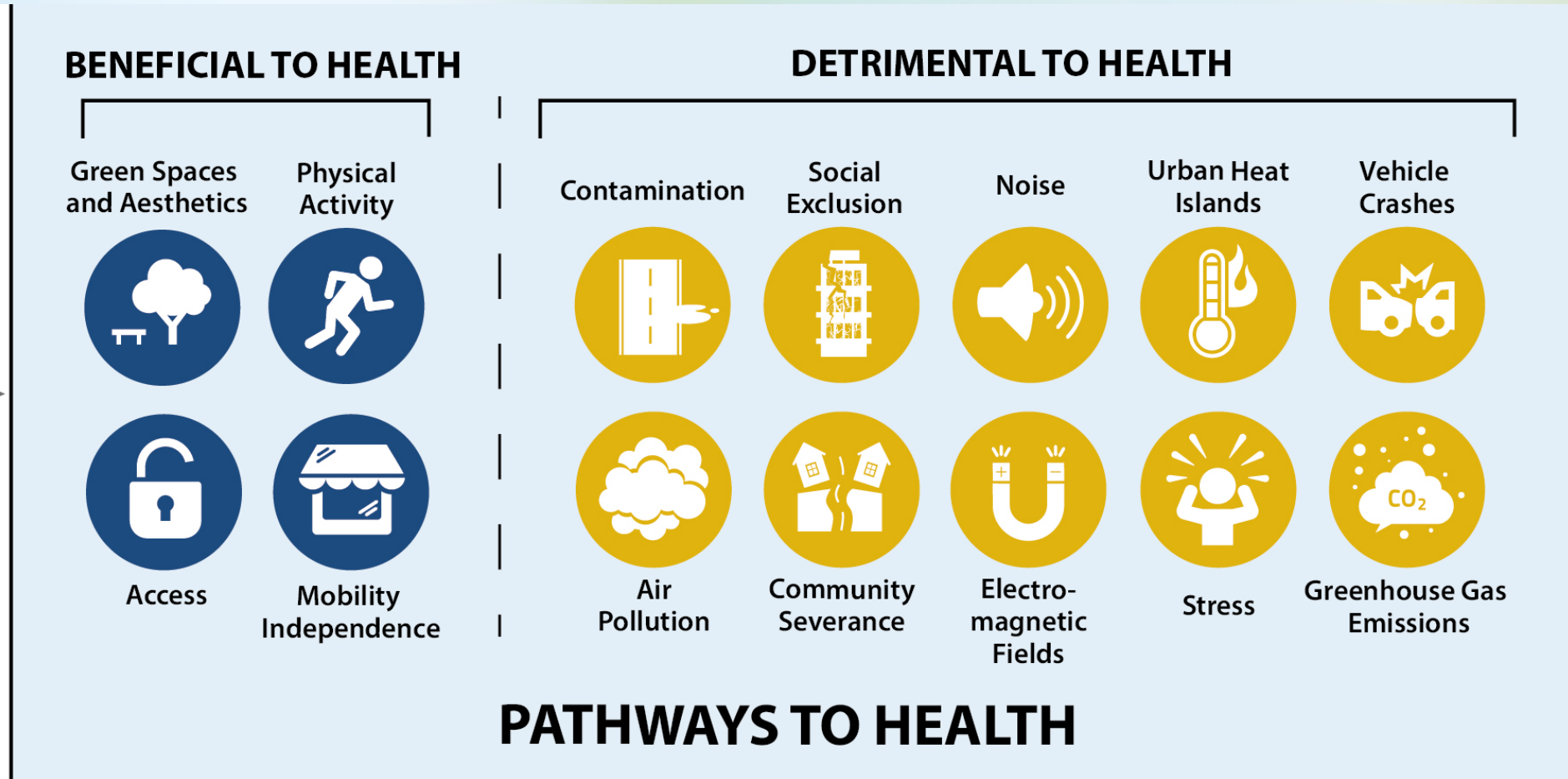


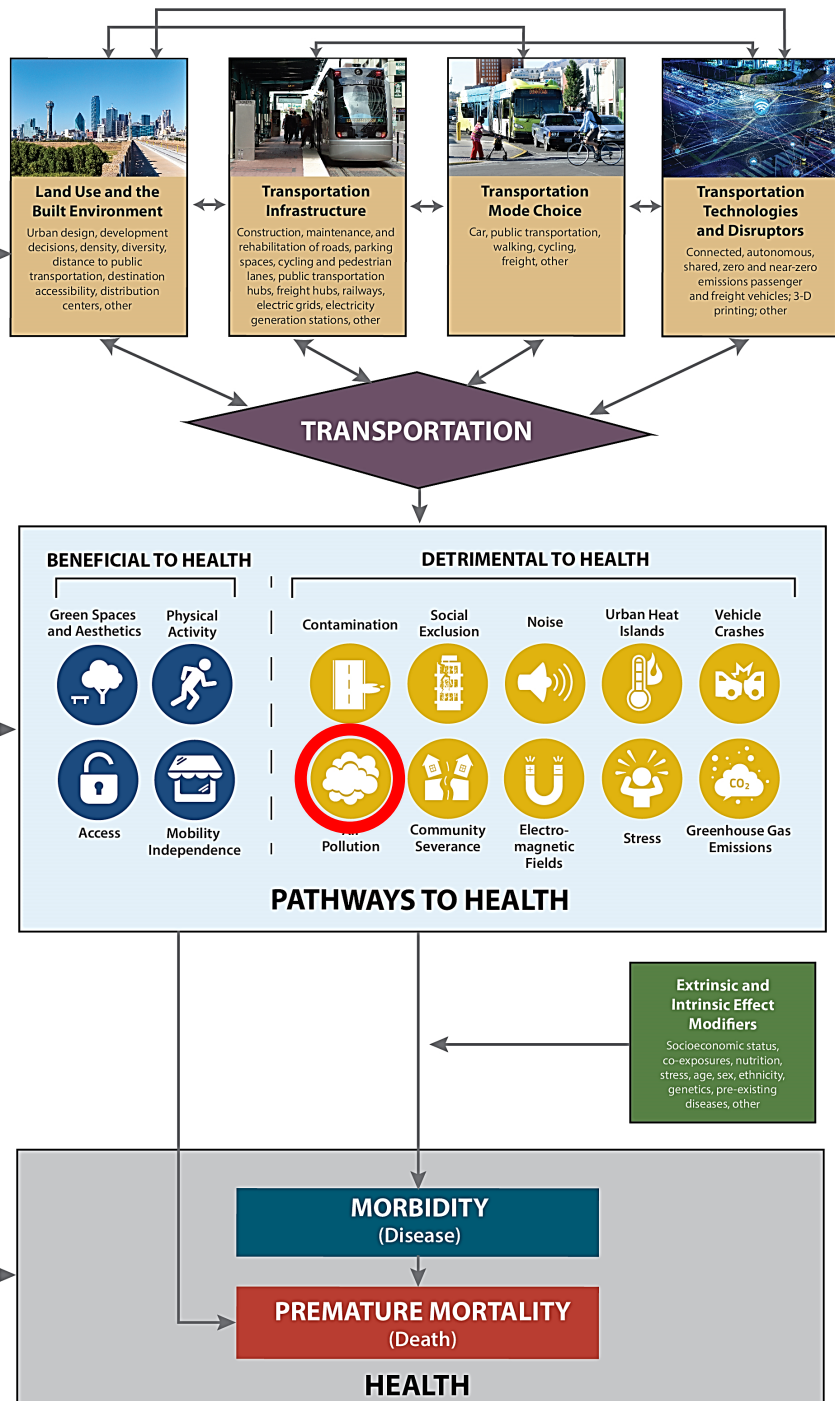
**Josias Zietsman, Ph.D., P.E.**  
Center Director  
Assistant Agency Director





# 14 Pathways Between Transportation and Health





# Most Comprehensive Model of Linkages

Khreis, Haneen; Glazener, Andrew; Ramani, Tara; Zietsman, Josias; Nieuwenhuijsen, Mark J.; Mindell, Jennifer S.; Winfree, Gregory D.; and Burke, Thomas A. (2019). Transportation and Health: A Conceptual Model and Literature Review. College Station, Texas: Center for Advancing Research in Transportation Emissions, Energy, and Health, May 2019.

<https://www.carteeh.org/14-pathways-to-health-project-brief/>

# Current CARTEEH Projects

- Developing a Transportation, Emissions, and Health Data Hub

- Border Crossing Emissions Impacts Study

- Traffic-Related Air Pollution and Childhood Asthma

- In-Cab Air Quality in Heavy Duty Diesel Construction Equipment

- Dockless Mobility User Exposure to Traffic-related Air Pollution

- Truck Driver Wellness Study

- Curriculum Development for Transportation Emissions and Health

- Future Direction for Transportation Emissions, Energy, and Health

- Urban Policy Interventions in Reducing Traffic Emissions

- Transportation and Health - Conceptualization and Quantification

- Battery Electric/Plug-in Hybrid Electric Connected Drayage Trucks

- Secondary Particulate from Current Gasoline Vehicles

- Traffic Congestion-Induced Change of Near-Road Concentrations

- Traffic-Related Air Pollution in an Underserved Community

- Dust Emissions from Highway and Desert Sources

- Truck Emissions Exposure Study in Ports

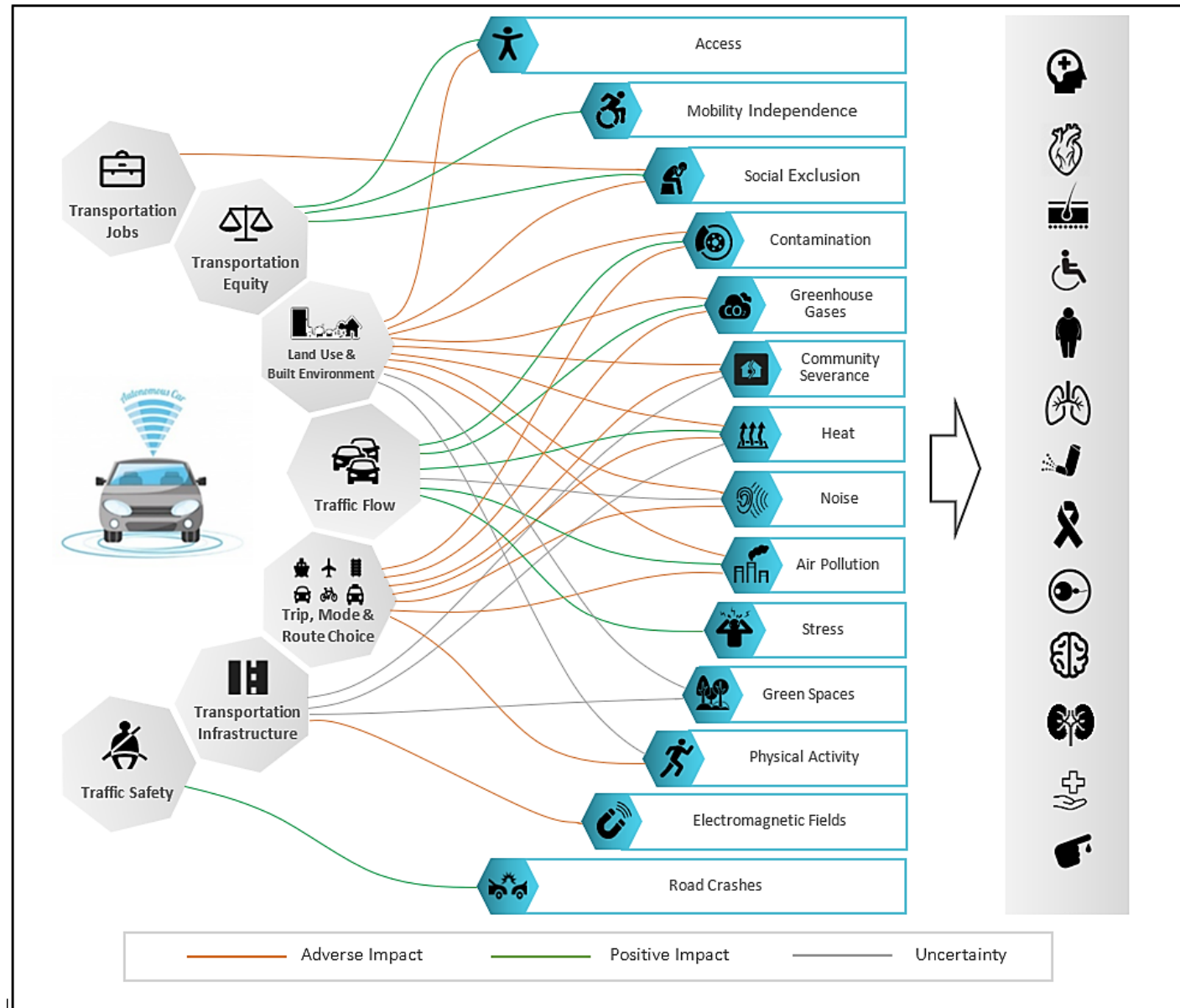
- PM Exposure for Paratransit Transport

- Exposure of Urban Cyclists to Air Pollutants

- Health Risk Characterization for Transportation Users

- Air Pollution Impacts of Crude Oil by Rail Transport





# Asthma as a Major Health Concern

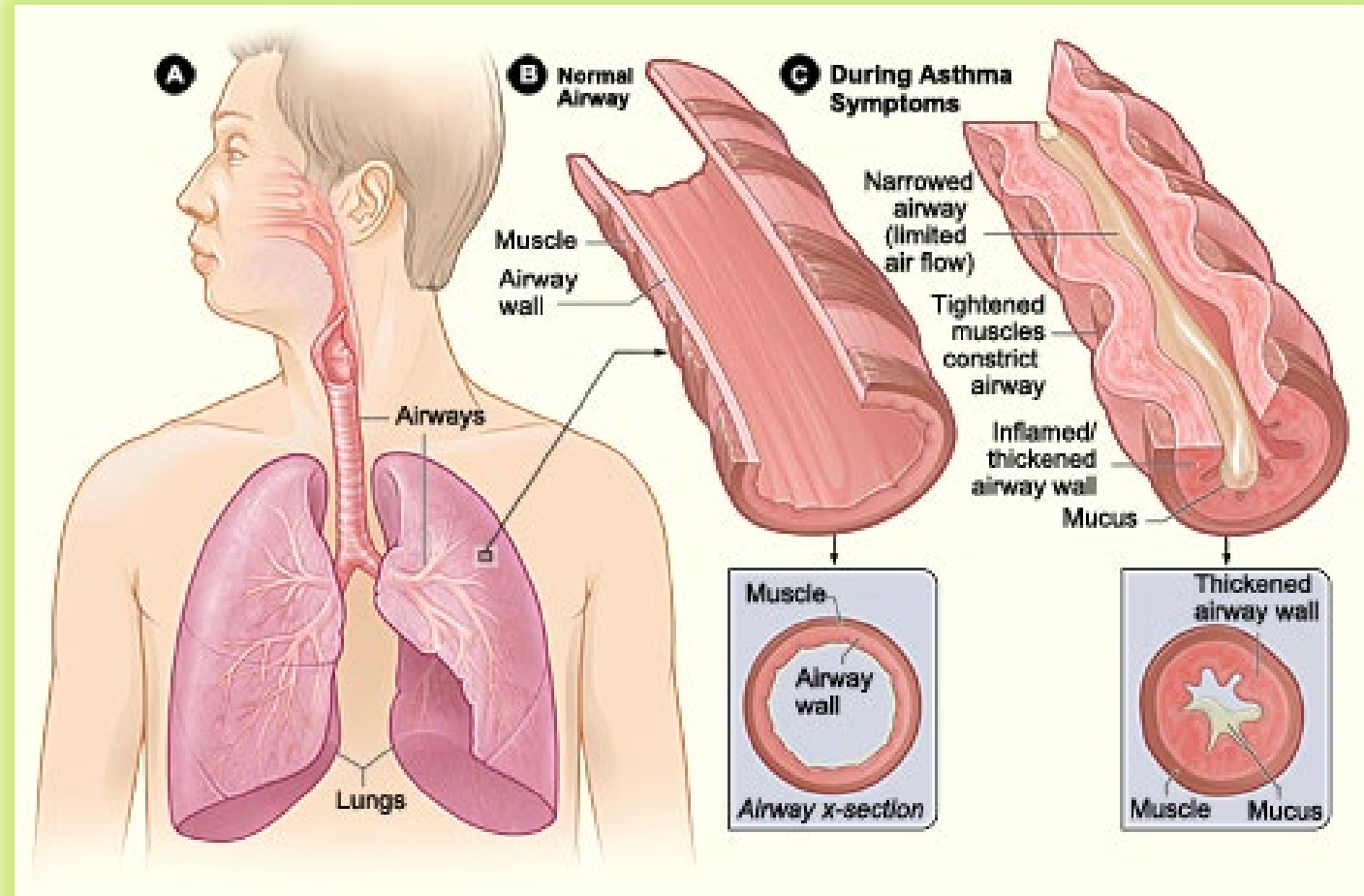
Asthma is the **reversible** or partially reversible **obstruction of airflow** presenting as episodes of wheezing, cough and shortness of breath with varying degrees of severity

## Globally

330+ million people with asthma

## United States

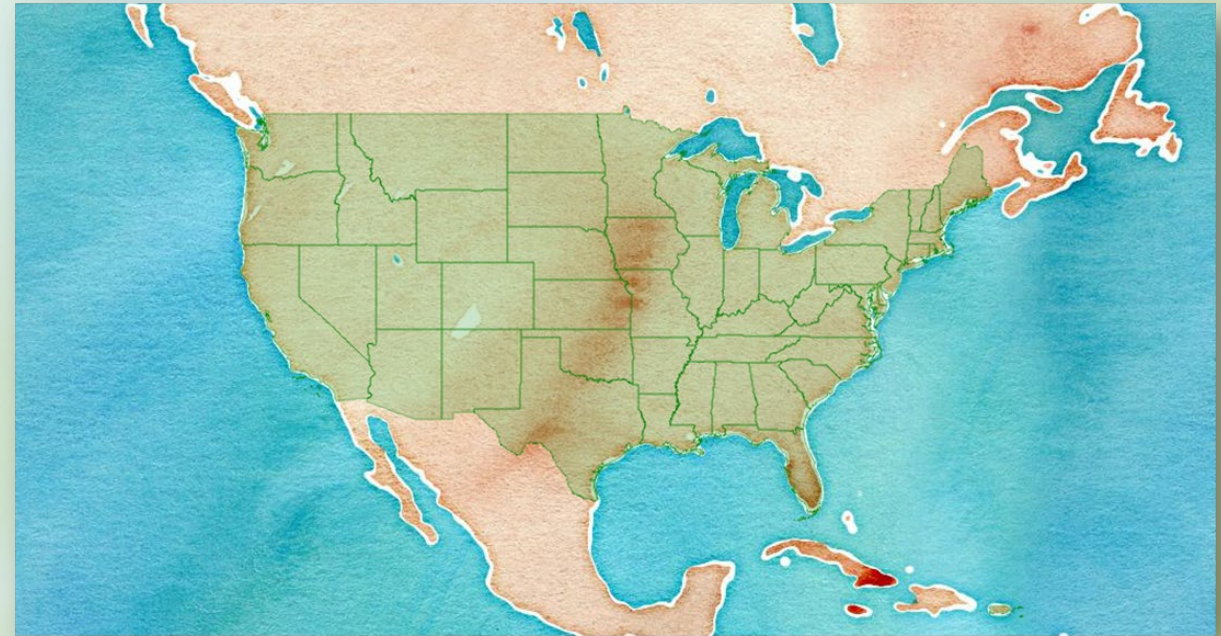
20 million adults and 6 million children



By United States-National Institute of Health: National Heart, Lung, Blood Institute - <http://www.nhlbi.nih.gov/health/health-topics/topics/asthma/>, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=24760677>

# Traffic Related Air Pollution and the Burden of Childhood Asthma

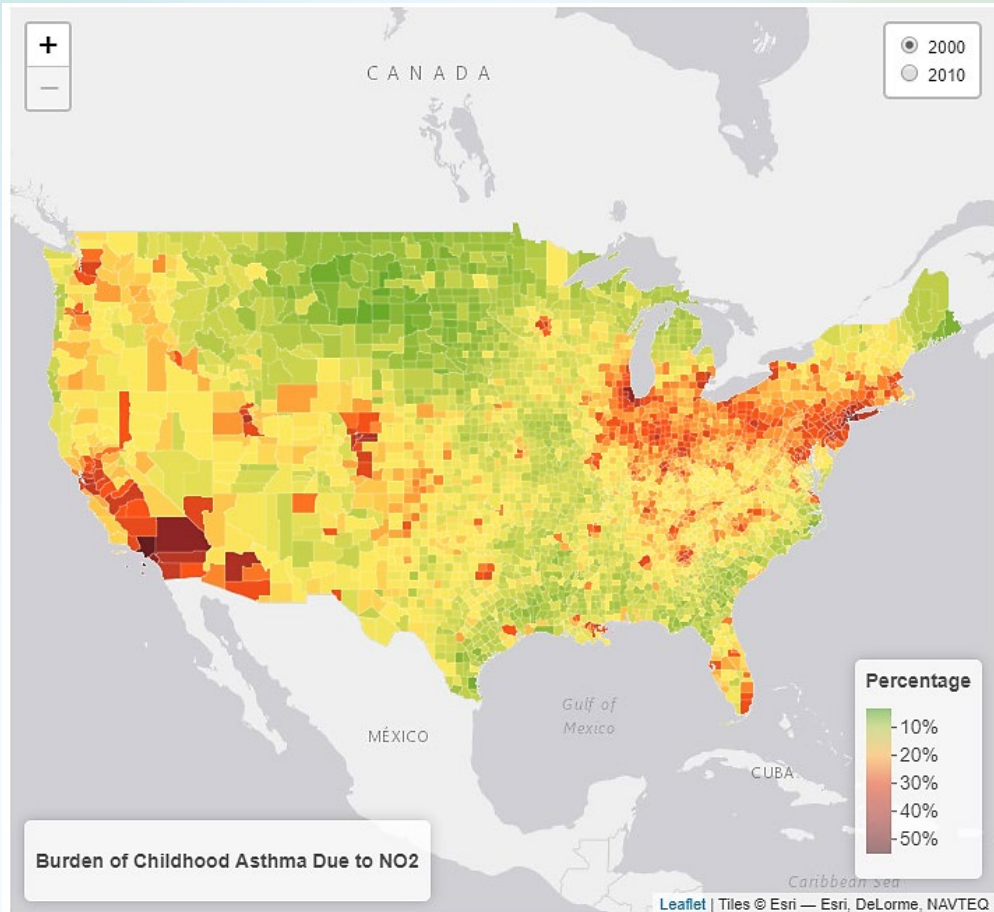
- Estimate the number and percentage of childhood asthma cases attributable to traffic-related air pollution (TRAP)
- Two years (2000 and 2010)
  - 48 states and District of Columbia
  - TRAP:  $\text{NO}_2$ ,  $\text{PM}_{2.5}$  and  $\text{PM}_{10}$
  - Census block level
  - Concentrations from land use regression (LUR) model
  - Use Concentration Response Functions





# Traffic Related Air Pollution and the Burden of Childhood Asthma

## Online Interactive Maps



## Attributable Cases and Percentage of Childhood Asthma Cases by Year

Pollutant	Attributable to TRAP		% of all cases		Change (%)
	2000	2010	2000	2010	Attributable Cases
NO <sub>2</sub>	210,000	140,000	27%	18%	-32%
PM <sub>2.5</sub>	250,000	190,000	31%	24%	-23%
PM <sub>10</sub>	330,000	290,000	42%	36%	-13%

Alotaibi, Raed; Bechle, Mathew; Marshall, Julian; Ramani, Tara; Zietsman, Joe; Nieuwenhuijsen, Mark; Khreis, Haneen, 2018, "[Air Pollution and the Burden of Childhood Asthma in the Contiguous United States in 2000 and 2010](#)"

# Data for Transportation and Health Research

- Understand data needs from both transportation and health research perspective
- Discover existing data sources
- Include new and innovative data sources
- Add value by combining datasets and performing analyses

[www.carteehdata.org](http://www.carteehdata.org)

The screenshot shows the CARTEEH Data Hub website. At the top is a navigation bar with links for Home, Search, New, Features, Login, and Register. The main header reads "DataTEEH" and "Datahub for Transportation, Emissions, Energy, & Health". Below this are six category buttons: AIR QUALITY & DISPERSION, EXPOSURE, HEALTH, EMISSIONS, TRANSPORTATION, and TECHNOLOGY. A central section features the CARTEEH data:hub logo and text identifying it as the "Center for Advancing Research in Transportation Emissions, Energy, and Health" and a "USDOT University Transportation Center". A search bar is present. A featured section titled "Transportation Emissions, Air Pollution, Exposures, and Health Literature Library" describes a resource of over 500 scientific studies and includes a link to download a spreadsheet. The footer contains a colorful illustration of a cityscape and the CARTEEH logo.

**CARTEEH Data Hub** Home Search New Features Login Register

## DataTEEH

Datahub for Transportation, Emissions, Energy, & Health

AIR QUALITY & DISPERSION EXPOSURE HEALTH

EMISSIONS TRANSPORTATION TECHNOLOGY

**CARTEEH data:hub** Center for Advancing Research in Transportation Emissions, Energy, and Health  
A USDOT University Transportation Center

Transportation Emissions, Air Pollution, Exposures, and Health Literature Library

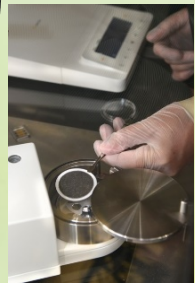
This literature library is intended as a resource for students, researchers and practitioners interested in the area of transportation and health, especially the impact of transportation emissions and air pollution on human health. It currently contains a reference list of over 500 scientific studies addressing the full-chain of events between transportation pollution sources and health impacts shown in the figure below. It tabulates several attributes for each study, including the citation details, the publication type, topic area, and type of study. This reference list will be periodically updated to include new studies as they become available.

Click [here](#) to download spreadsheet.

**CARTEEH**

# Usefulness to Practitioners

- Understanding the impact of transportation on health
- Updating and simplifying procedures
- Streamline the process
- Increased transparency
- Remain relevant and forward looking:
  - Transportation disruptors
  - Empirical data collection
  - Data science including Artificial Intelligence





# Concluding Remarks

- Health and transportation are converging
- Quantify the pathways between health and transportation
- Holistic and integrated approach
- Make it useful for practitioners
- Partnerships are very important



# 2<sup>nd</sup> CARTEEH Symposium

## 2<sup>nd</sup> Transportation, Air Quality, and Health Symposium

**SAVE THE DATE**

**MAY 18–20, 2020**

Riverside, California

