Air pollution affects children before they are born
Particulate mater and the placenta

Black carbon particles in the human placenta, both maternal and fetal side.

Original Investigation | Environmental Health

Association of Air Pollution and Heat Exposure With Preterm Birth, Low Birth Weight, and Stillbirth in the US
A Systematic Review

Bruce Bekkar, MD; Susan Pacheco, MD; Rupa Basu, PhD; Nathaniel DeNicola, MD, MSHP
"Exposure to outdoor air pollution during trimesters of pregnancy and childhood asthma, allergic rhinitis, and eczema"

Traffic-related air pollution (NO₂)

<table>
<thead>
<tr>
<th></th>
<th>First trimester</th>
<th>Second trimester</th>
<th>Third trimester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eczema</td>
<td>1.54 (1.14-2.09)**</td>
<td>1.72 (1.02-2.97)*</td>
<td>1.77 (1.09-2.89)*</td>
</tr>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
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<tr>
<td>Allergic rhinitis</td>
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<td></td>
</tr>
</tbody>
</table>

OR (95% CI) of childhood allergic diseases

*Deng et al., 2016*
Increased risk of childhood leukemia: Benzene, NO2 (pre and post natal)

TRAP, benzene exposure: AML in children

Autism spectrum disorder and air pollution: A systematic review and meta-analysis

Frédéric Dutheil a, Aurélie Comptour b, Roxane Morlon c, Martial Mermillod d, Bruno Pereira e, Julien S. Baker f, Morteza Charkhabi g, Maëlys Clinchamps h, Nicolas Bourdel i
Air pollution Damages Children’s Brain (Mexico city)

- Neuroinflammation
- Neurodegeneration
- Structural and volumetric changes
- Cognitive deficits
- Brain tissue changes seen in patients with Parkinson and Alzheimer’s disease
Patients with DM appear to be particularly vulnerable to heat waves due to impaired thermoregulatory mechanisms together with impaired autonomous nervous system responses at high temperatures.

Traffic-related air pollution is associated with glucose dysregulation, blood pressure, and oxidative stress in children

Effects of Ambient Air Pollution on Blood Pressure Among Children and Adolescents: A Systematic Review and Meta-Analysis

Miao Huang, MD*; Jingyuan Chen, MD*; Yiping Yang, BM; Hong Yuan, MD, PhD; Zhijun Huang, MD id; Yao Lu, MD, PhD id
Particulate Matter Air Pollution and the Risk of Incident CKD and Progression to ESRD

METHODS
Observational cohort of 2,482,737 US Veterans followed for 8.52 years
Fine particulate matter <2.5 μm in aerodynamic diameter (PM$_{2.5}$) exposure data:
- EPA ground-based air monitoring stations
- NASA satellites spaceborne sensors

OUTCOMES
Increase in Risk of Kidney Outcomes for Every 10 Increase in PM$_{2.5}$ (μg/m$^3$)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>21%</th>
<th>27%</th>
<th>28%</th>
<th>26%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident eGFR &lt;60</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incident CKD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eGFR decline 25%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESRD</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

National Burden of Incident CKD Attributable to PM$_{2.5}$ Exposure Above the EPA recommended level of 12 μg/m$^3$

CONCLUSION Our findings demonstrate a significant association between exposure to ambient PM$_{2.5}$ and risk of incident CKD, eGFR decline, and ESRD.

doi.org/10.1681/ASN.2017030253
Long term exposure to air pollution (PM2.5) increases Alzheimer’s disease and other types of dementia
Cardiovascular Emergency Hospital Visits and Hourly Changes in Air Pollution

Takashi Yorifuji, MD, Etsuji Suzuki, MD, and Saori Kashima, PhD
Association between long-term exposure to air pollution and immune-mediated diseases: a population-based cohort study

Giovanni Adami, Marco Pontalti, Giorgio Cattani, Maurizio Rossini, Ombretta Viapiana, Giovanni Orsolini, Camilla Benini, Eugenia Bertoldo, Elena Fracassi, Davide Gatti, Angelo Fassio

Increase in negative birth outcomes (prematurity, LBW, stillbirth)

Bekkar et al., 2020
Maternal ambient heat exposure during early pregnancy in summer and spring and congenital heart defects – A large US population-based, case-control study

Maternal Heat Exposure increases the Incidence of Congenital Heart Disease
Climate change may force the "kidney stone risk belt" north

Source: PNAS

Perspective
A New Era of Climate Medicine — Addressing Heat-Triggered Renal Disease

Cecilia Sorensen, M.D., and Ramon Garcia-Trabanino, M.D.
Outdoor farmworkers (US)

About 3 million total

400,000 – 500,000 children (12 – 17 y) estimated to be working in U.S. agriculture

https://www.ers.usda.gov/topics/farm-economy/farm-labor/#size
https://afop.org/about/
High ambient temperatures and heat waves negatively affect mental health

Increased risk of:

Suicide

ER visits and mental health-related hospital admissions

(risks increased for any mental health condition)
Anxiety

Post-traumatic stress

Depression

Interpersonal and societal conflict

Family stress

Persistent grief

Child behavioral problems

Academic decline
Environmental justice

“Low-income communities, people of color, indigenous people, people with disabilities, older or very young people, women – all can be more susceptible to risks posed by climate impacts”
a terrible unequal threat
Disparities in Distribution of Particulate Matter Emission Sources by Race and Poverty Status

PM 2.5
People living in poverty had 1.35 times higher burden than did the overall population,

Non-Whites had 1.28 times higher burden.

Blacks had 1.54 times higher burden than did the overall population.

“Proximity of US schools to major roadways: a nationwide assessment” (2005- 2006)

6.4 million US children attended schools within 250 m of a major roadway

Schools serving minority and underprivileged children were more likely to be located within 250 m of a major roadway

Killer heat is already affecting communities unequally:

Days with temperatures above 100F(38C) 1971 and 2000 in US counties:

Over 25% Black residents: ~ 18 days/year

Over 25% Hispanic/Latinx residents: 13 days/year

Less than 25% African Americans: 7 days/year

Long-Term Air Pollution Exposure and COVID-19 Mortality: A Patient-Level Analysis from New York City

Anne Bozack¹,²,³, Stanley Pierre⁴, Nicholas DeFelice², Elena Colicino², Darby Jack⁵, Steven N. Chillrud⁶, Andrew Rundle⁷, Alfred Astua⁸, James W. Quinn⁷, Laura McGuinn², Qiang Yang⁶, Keely Johnson⁹, Joseph Masci¹⁰, Laureen Lukban¹¹, Duncan Maru¹¹,¹², and Alison G. Lee¹

Am J Respir Crit Care Med. 2022 Mar 15;205(6):651-662
U.S. COVID-19 Deaths, by Race

• Through August 4, 2020

The death rate for Black Americans from COVID-19 is more than twice that of white Americans.
Climate Change and Health Research

Figure 2  Number of articles on climate change and health published by year

Climate Change and Health Research

Figure 4: Distribution of all articles by health field

- Multiple health impacts of climate change - 614
- Infectious diseases - 374
- Temperature-related health hazards - 612
- Air pollution - 201
- Health care systems - 82
- Diet and nutrition - 86
- Maternal and child health - 34
- Extreme weather events - 66
- NCDs - 32
- WASH - 24
- Mental health - 47
- Other topics - 24

World Health Organization; 2021.
What can you do?

Reduce your CO2 footprint (home and work)
Change to renewable energy today

Get involved in advocacy

Educate your patients about adaptation
Heat exposure
Air pollution
Disaster preparedness

Invest in resilience and mental health

Promote and protect science!

Get organized. We need your help!!!
COP27 leaves world on dangerous warming path despite historic climate fund