

# *The Climate Crisis and Pregnancy*



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“Climate change is the defining issue of our age. Our response will define our future. To ride this storm we need all hands on deck.”

*Former UN Secretary-General, Mr. Ban Ki-moon,  
opening address to the UN Climate Summit, 2014*



# How Climate Change Impacts Health Across the U.S.

Rising temperatures, an increase in extreme weather, longer wildfire seasons and more disease-spreading insects are all symptoms of climate change — and they're also bad for your health. A new report by a group of physicians highlights the health impacts of climate change across the country.



-  **Extreme temperatures**
-  **Outdoor air quality**
-  **Extreme weather events**
-  **Food-related infection & agriculture**
-  **Water-related infection**
-  **Mosquito- and tick-borne infections**
-  **Wildfires**
-  **Mental health & well-being**





# Global Climate Change and Children's Health

COUNCIL ON ENVIRONMENTAL HEALTH

## abstract

Rising global temperatures are causing major physical, chemical, and ecological changes in the planet. There is wide consensus among scientific organizations and climatologists that these broad effects, known as "climate change," are the result of contemporary human activity. Climate change poses threats to human health, safety, and security, and children are uniquely vulnerable to these threats. The effects of climate change on child health include: physical and psychological sequelae of weather disasters; increased heat stress; decreased air quality; altered disease patterns of some climate-sensitive infections; and food, water, and nutrient insecurity in vulnerable regions. The social foundations of children's mental and physical health are threatened by the specter of far-reaching effects of unchecked climate change, including community and global instability, mass migrations, and increased conflict. Given this knowledge, failure to take prompt, substantive action would be an act of injustice to all children. A paradigm shift in production and consumption of energy is both a necessity and an opportunity for major innovation, job creation, and significant, immediate associated health benefits. Pediatricians have a uniquely valuable role to play in the societal response to this global challenge.

## INTRODUCTION

It is clear from observations across a range of indicators that many fundamental measures of climate are changing. These broad changes, known as "climate change," threaten the biological systems on which the life, health, and prosperity of all children depend. On the basis of well-established evidence from the past 20 years, there is now wide consensus among scientific organizations and approximately 97% of climatologists that human-generated greenhouse gas emissions are the cause of climate change.<sup>1-4</sup> Although the effects of climate change are already being felt across the world, the magnitude of the effects of future changes depends on our ability to substantially reduce greenhouse gas emissions and implement adaptation strategies within the ensuing decades.<sup>5</sup> Thus, it remains possible to protect children, families, and communities from the worst potential effects of climate change.

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# Global Climate Change and Children's Health

Samantha Ahdoot, MD, FAAP, Susan E. Pacheco, MD, FAAP, THE COUNCIL ON ENVIRONMENTAL HEALTH

## abstract

Rising global temperature is causing major physical, chemical, and ecological changes across the planet. There is wide consensus among scientific organizations and climatologists that these broad effects, known as climate change, are the result of contemporary human activity. Climate change poses threats to human health, safety, and security. Children are uniquely vulnerable to these threats. The effects of climate change on child health include physical and psychological sequelae of weather disasters, increased heat stress, decreased air quality, altered disease patterns of some climate-sensitive infections, and food, water, and nutrient insecurity in vulnerable regions. Prompt implementation of mitigation and adaptation strategies will protect children against worsening of the problem and its associated health effects. This technical report reviews the nature of climate change and its associated child health effects and supports the recommendations in the accompanying policy statement on climate change and children's health.

Global climate change is a leading public health threat to all current and future children. Rising global temperature, known as "global warming," is causing major physical, chemical, and ecological changes in the planet. The term "climate change" is used in this report to include these broader effects. There is now broad consensus among the world's leading scientific organizations and approximately 97% of climate scientists<sup>1-4</sup> that these changes are the result of human-generated greenhouse gas emissions.

Rising greenhouse gas concentrations and climate change are part of a larger constellation of change resulting from contemporary human activity. Exponential increases in human population, habitat transformation, energy production and consumption, and climate change<sup>5</sup> are putting unprecedented pressure on the earth, resulting in physical, chemical, and ecological changes that are fundamentally altering the planet.<sup>6</sup> These accelerating changes threaten the biological systems on which the life, health, and prosperity of all children depend.

There is wide recognition of climate change among scientific bodies,<sup>7</sup> international agencies,<sup>8-10</sup> and world religions,<sup>11</sup> and it is important for pediatricians to be aware of the effects of climate change on the health and security of individuals, families, and communities. Children are a uniquely

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"Without question, climate change has a disproportionate effect on global women's health, as it broadens existing gender-based health disparities."

*Policy Statement on Climate Change  
American College of Obstetricians and Gynecologists*



# DOCTORS



What my friends think I do



What my Mom thinks I do



What society thinks I do



What the government thinks I do

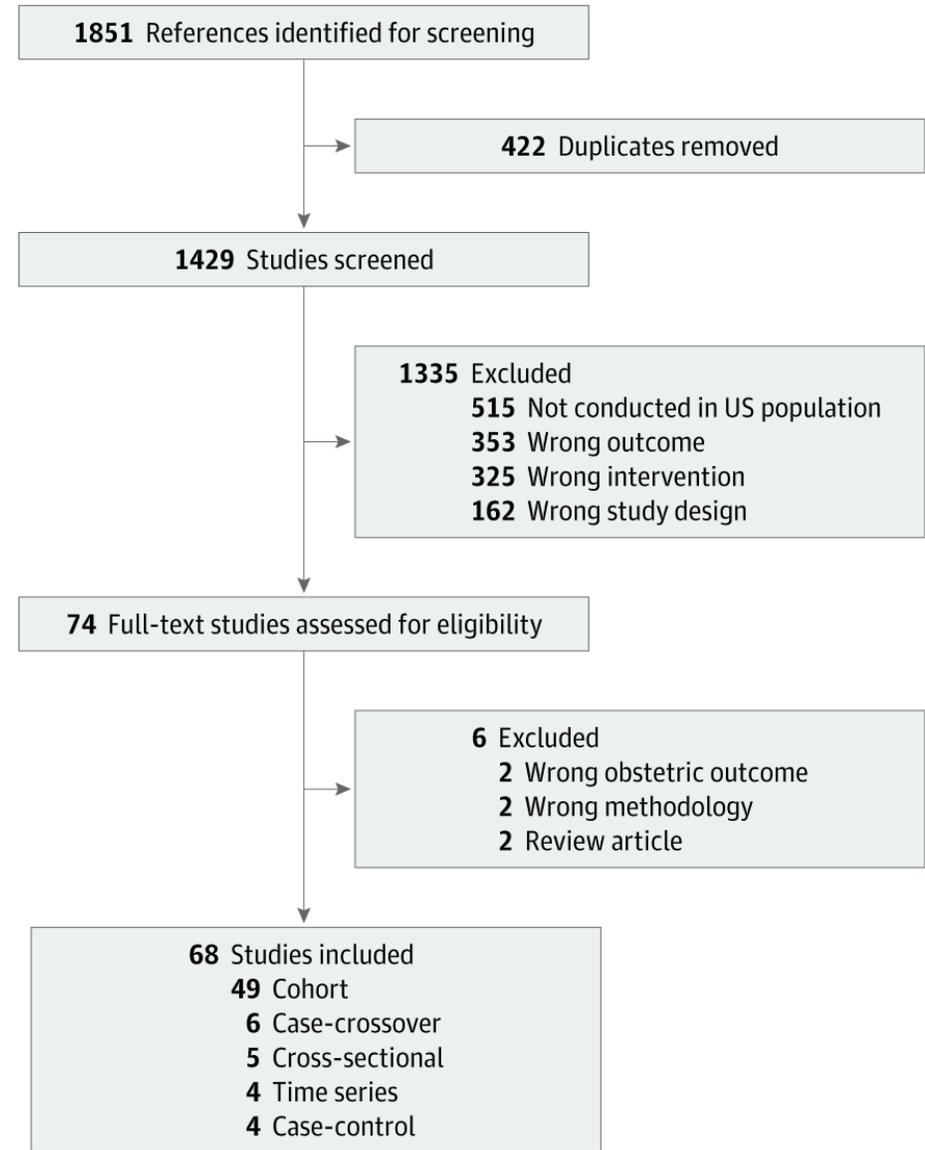


What I think I do



What I really do

# 1851





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

## Abstract

**IMPORTANCE** Knowledge of whether serious adverse pregnancy outcomes are associated with increasingly widespread effects of climate change in the US would be crucial for the obstetrical medical community and for women and families across the country.

**OBJECTIVE** To investigate prenatal exposure to fine particulate matter (PM<sub>2.5</sub>), ozone, and heat, and the association of these factors with preterm birth, low birth weight, and stillbirth.

**EVIDENCE REVIEW** This systematic review involved a comprehensive search for primary literature in Cochrane Library, Cochrane Collaboration Registry of Controlled Trials, PubMed, ClinicalTrials.gov website, and MEDLINE. Qualifying primary research studies included human participants in US populations that were published in English between January 1, 2007, and April 30, 2019. Included articles analyzed the associations between air pollutants or heat and obstetrical outcomes. Comparative observational cohort studies and cross-sectional studies with comparators were included, without minimum sample size. Additional articles found through reference review were also considered. Articles analyzing other obstetrical outcomes, non-US populations, and reviews were excluded. Two reviewers independently determined study eligibility. The Arskey and O'Malley scoping review framework was used. Data extraction was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline.

**FINDINGS** Of the 1851 articles identified, 68 met the inclusion criteria. Overall, 32 798 152 births were analyzed, with a mean (SD) of 565 485 (783 278) births per study. A total of 57 studies (48 of 58 [84%] on air pollutants; 9 of 10 [90%] on heat) showed a significant association of air pollutant and heat exposure with birth outcomes. Positive associations were found across all US geographic regions. Exposure to PM<sub>2.5</sub> or ozone was associated with increased risk of preterm birth in 19 of 24 studies (79%) and low birth weight in 25 of 29 studies (86%). The subpopulations at highest risk were persons with asthma and minority groups, especially black mothers. Accurate comparisons of risk were limited by differences in study design, exposure measurement, population demographics, and seasonality.

**CONCLUSIONS AND RELEVANCE** This review suggests that increasingly common environmental exposures exacerbated by climate change are significantly associated with serious adverse pregnancy outcomes across the US.

JAMA Network Open. 2020;3(6):e208243.  
Corrected on July 7, 2020. doi:10.1001/jamanetworkopen.2020.8243

## Key Points

**Question** Are increases in air pollutant or heat exposure related to climate change associated with adverse pregnancy outcomes, such as preterm birth, low birth weight, and stillbirth, in the US?

**Findings** In this systematic review of 57 of 68 studies including a total of 32 798 152 births, there was a statistically significant association between heat, ozone, or fine particulate matter and adverse pregnancy outcomes. Heterogeneous studies from across the US revealed positive findings in each analysis of exposure and outcome.

**Meaning** The findings suggest that exacerbation of air pollution and heat exposure related to climate change may be significantly associated with risk to pregnancy outcomes in the US.

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Author affiliations and article information are listed at the end of this article.

This review revealed a disproportionate effect on populations defined as pregnant women with certain medical conditions or specific race/ethnicities. Women with asthma may be particularly susceptible to adverse outcomes, such as preterm birth and stillbirth, in association with PM<sub>2.5</sub> exposure during gestation.<sup>24,40</sup> Among racial/ethnic groups, our findings suggest that black mothers are at greater risk for preterm birth and low birth weight. Social determinants of health, including residence in urban areas with higher exposure to air pollutants and long-term high levels of stress, are known to contribute to adverse obstetrical outcomes.<sup>82</sup> A recent study<sup>83</sup> from California suggested that PM<sub>2.5</sub> exposure alone was associated with an equivalent amount of the racial disparity (black vs white) in preterm birth rates as did other demographic and social factors. Our research suggests that these environmental exposures further exacerbate that background risk and could be included among these social determinants.

Regarding both air pollutant and heat exposure, associations with adverse birth outcomes were found across the continental US. For example, studies on air pollution and low birth weight found an association in 19 states in the Northeast (10), Southeast (5), Midwest (2), Mountain (1), and West (1) regions. California, known for both high temperatures and unhealthy particulate and ozone levels,<sup>84</sup> was included in the greatest number of studies showing a positive association (13), followed by Massachusetts (6), Georgia (5), and Florida (4). The exposures are complex; even within 1 state, the weather patterns, geography, and urbanization may create zones with widely different pollution risks, as shown by Tu et al<sup>31</sup> in Georgia.

Future research is needed to further identify at-risk populations, high-exposure geographic areas, and effects of seasonality. This ongoing research may be enhanced by improved geographic information systems that can be mapped onto existing US public health databanks such as the Nationwide Inpatient Sample and Kids' Inpatient Database.<sup>85,86</sup>

## Strengths and Limitations

Strengths of the study include the considerable sample size and the wide geographic range that includes every region of the US domestic population. Although other reviews have included global analysis, our focus on the US population makes the findings particularly relevant to pregnant women and health care clinicians in the US. Also, in research examining diffuse exposures, such as air pollution and heat, in which pooled analysis across studies is often not feasible, there is merit to tabulating the overall preponderance of observations from varying studies examining the same outcomes.

This study has limitations. First, this review covers only observational studies with heterogeneous sources of air pollution and heat exposure as well as diverse methods of measurement. For air pollutant studies, results can vary based on exposure measurement methods,<sup>10,87</sup> locations and sources analyzed,<sup>88</sup> and population demographics.<sup>35</sup> For heat exposures, results may also be affected by demographics,<sup>52</sup> acclimatization, and seasonal effects.<sup>46,50</sup> For both air pollution and heat exposure, different study designs may complicate direct comparison of the data even within a single study.<sup>50</sup> In addition, the number of studies on stillbirth is limited.

## Conclusions

This review suggests that increasingly common environmental exposures exacerbated by climate change are significantly associated with serious adverse pregnancy outcomes across the US. It appears that the medical community at large and women's health clinicians in particular should take note of the emerging data and become facile in both communicating these risks with patients and integrating them into plans for care. Moreover, physicians can adopt a more active role as patient advocates to educate elected officials entrusted with public policy and insist on effective action to stop the climate crisis.

## Article Information

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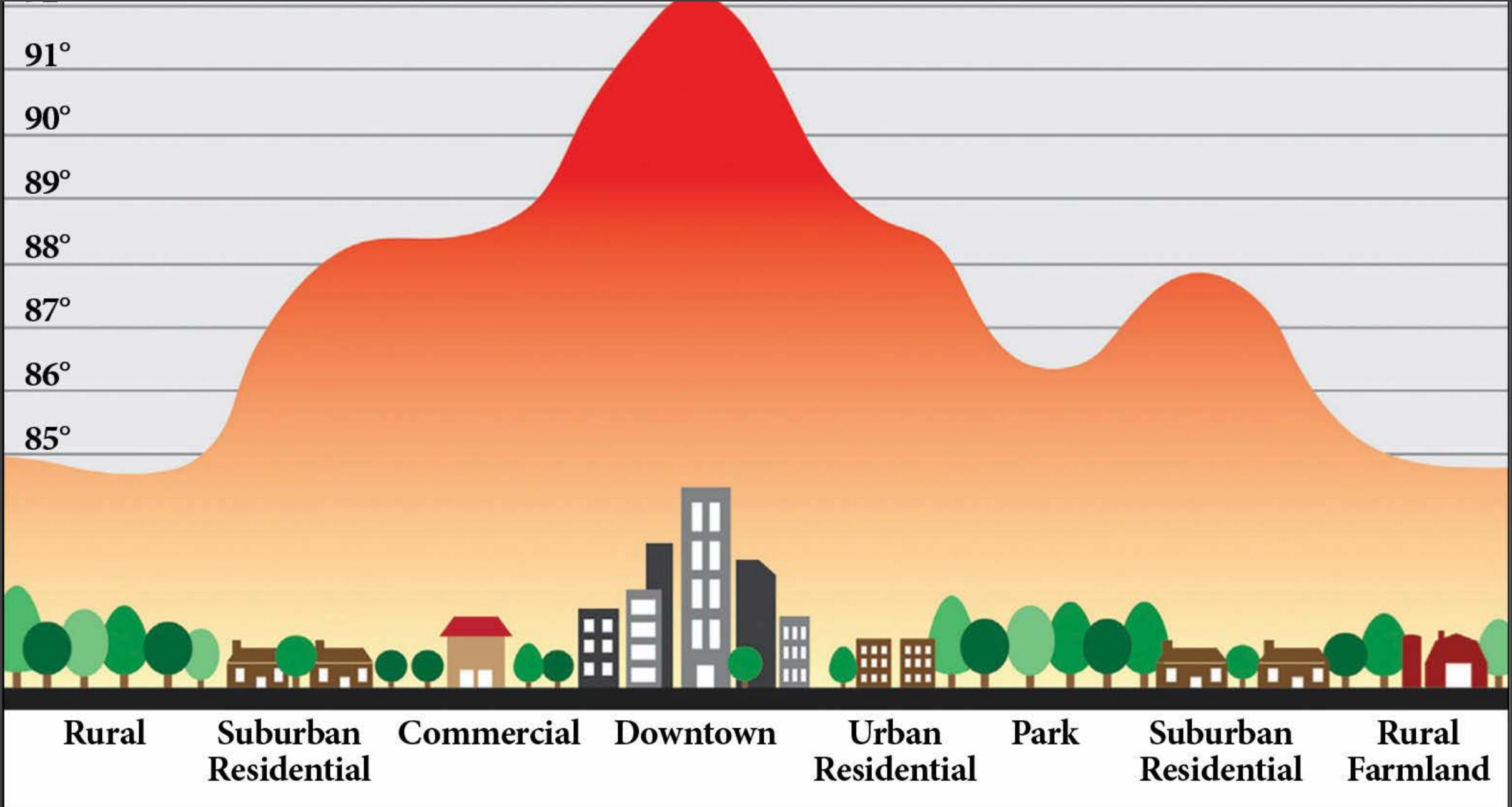
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**Correction:** This article was corrected on July 7, 2020, to fix an error in the Results section.

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# Fracking and Low Birthweight: Dose Response

RESEARCH ARTICLE | ENVIRONMENTAL STUDIES

## Hydraulic fracturing and infant health: New evidence from Pennsylvania

Janet Currie<sup>1,2,\*</sup>, Michael Greenstone<sup>2,3</sup> and Katherine Meckel<sup>4</sup>

[+ See all authors and affiliations](#)

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Vol. 3, no. 12, e1603021  
DOI: 10.1126/sciadv.1603021

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### Abstract

The development of hydraulic fracturing (“fracking”) is considered the biggest change to the global energy production system in the last half-century. However, several communities have banned fracking because of unresolved concerns about the impact of this process on human health. To evaluate the potential health impacts of fracking, we analyzed records of more than 1.1 million births in Pennsylvania from 2004 to 2013, comparing infants born to mothers living at different distances from active fracking sites and those born both before and after fracking was initiated at each site. We adjusted for fixed maternal determinants of infant health by comparing siblings who were and were not exposed to fracking sites in utero. We found evidence for negative health effects of in utero exposure to fracking sites within 3 km of a mother’s residence, with the largest health impacts seen for in utero exposure within 1 km of fracking sites. Negative health impacts include a greater incidence of low-birth weight babies as well as significant declines in average birth weight and in several other measures of infant health. There is little evidence for health effects at distances beyond 3 km, suggesting that health impacts of fracking are highly local. Informal estimates suggest that about 29,000 of the nearly 4 million annual U.S. births occur within 1 km of an active fracking site and that

They found that **infants born within 1 kilometer of a well were 25% more likely to have low birth weights** (less than 2500 grams or 5.5 pounds) than infants more than 3 kilometers away, they report today in *Science Advances*. Babies born in the first circle also showed significantly lower scores on a standard index of infant health. Infants born in the outer circles—between 1 and 3 kilometers away—were smaller and less healthy than those who lived farther away, but they weren’t as badly off as babies born closest to the wells.



# Closing of oil and coal power plants linked to drop in preterm births

Shereen Lehman

4 MIN READ



(Reuters Health) - The shuttering of eight oil- and coal-fueled electric plants in California was associated with a sizeable decrease in preterm births among women living nearby, researchers say.

Their study took advantage of a “natural experiment” when six oil-fueled electricity-generating plants and two coal-powered plants were retired. Using data collected from 2001 to 2011, they found that preterm birth rates among women exposed to the highest amounts of pollution from the plants fell from 7 percent of births to 5.1 percent after the plant closures.



## Air Pollution and Preterm Birth: Knock-Out Test: 27% Reduction in PTB

**Table. Summary of Evidence Key Questions 1 Through 6**

Exposure and outcome	Studies finding an association, No./total No.	Births/study, mean (SD)	Total births in millions	Increased risk, median (range), % <sup>a</sup>	Studies finding racial disparity, No./total No.	Notable findings <sup>b</sup>
<b>Air pollution</b>						
Preterm birth	19/24	318 960 (393 272)	7.3	11.5 (2.0-19.0) <sup>c</sup>	10/19	Preterm birth risk increased 52% for asthmatic mothers
Low birth weight	25/29	661 205 (878 074)	18.5	10.8 (2.0-36.0) <sup>c</sup>	13/25	Low birth weight risk increased 3% for each 5-km proximity to a solid waste plant
Stillbirth	4/5	1 020 975 (1 176 174)	5.1	14.5 (6.0-23.0) <sup>c</sup>	1/4	Stillbirth risk increased 42% with high third-trimester exposure
<b>Heat</b>						
Preterm birth	4/5	192 625 (207 995)	0.8	15.8 (9.0-22.0) <sup>d</sup>	2/4	Preterm birth risk increased 11.6% per 5.6 °C increase
Low birth weight	3/3	902 277 (985 803)	2.7	31.0 (13.0-49.0) <sup>d</sup>	1/3	Term birth weight decreased 16 g per IQR temperature increase
Stillbirth	2/2	115 943 (115 933)	0.2	NA <sup>e</sup>	2/2	Stillbirth risk increased 6% per 1 °C increase the week before delivery during the warm season

Abbreviations: IQR, interquartile range; NA, not applicable.

<sup>a</sup> Risk presented as range from significant studies. The median is calculated from the range; a pooled analysis was not performed. For consistency, the whole pregnancy exposure was presented where possible.

<sup>b</sup> Single study unless specified.

<sup>c</sup> For whole pregnancy PM<sub>2.5</sub> exposure.

<sup>d</sup> For whole pregnancy heat exposure.

<sup>e</sup> The only 2 studies on heat and stillbirth did not provide comparable outcomes that could be combined into a range with a median.

## ***Climate Change Tied to Pregnancy Risks, Affecting Black Mothers Most***

Women exposed to high temperatures or air pollution are more likely to have premature, underweight or stillborn babies, a look at 32 million U.S. births found.



Researchers looked at data from studies covering more than 32 million births from 2007 to 2019. Living Art Enterprises, LLC/Science Source



By Christopher Flavelle

[View in browser](#) | [nytimes.com](#)

The New York Times  
**The Morning**

June 19, 2020



By David Leonhardt

**Good morning. Facebook and Twitter take actions against Trump. Climate change is making babies sick. And the Supreme Court issues its second left-leaning decision in a week.**

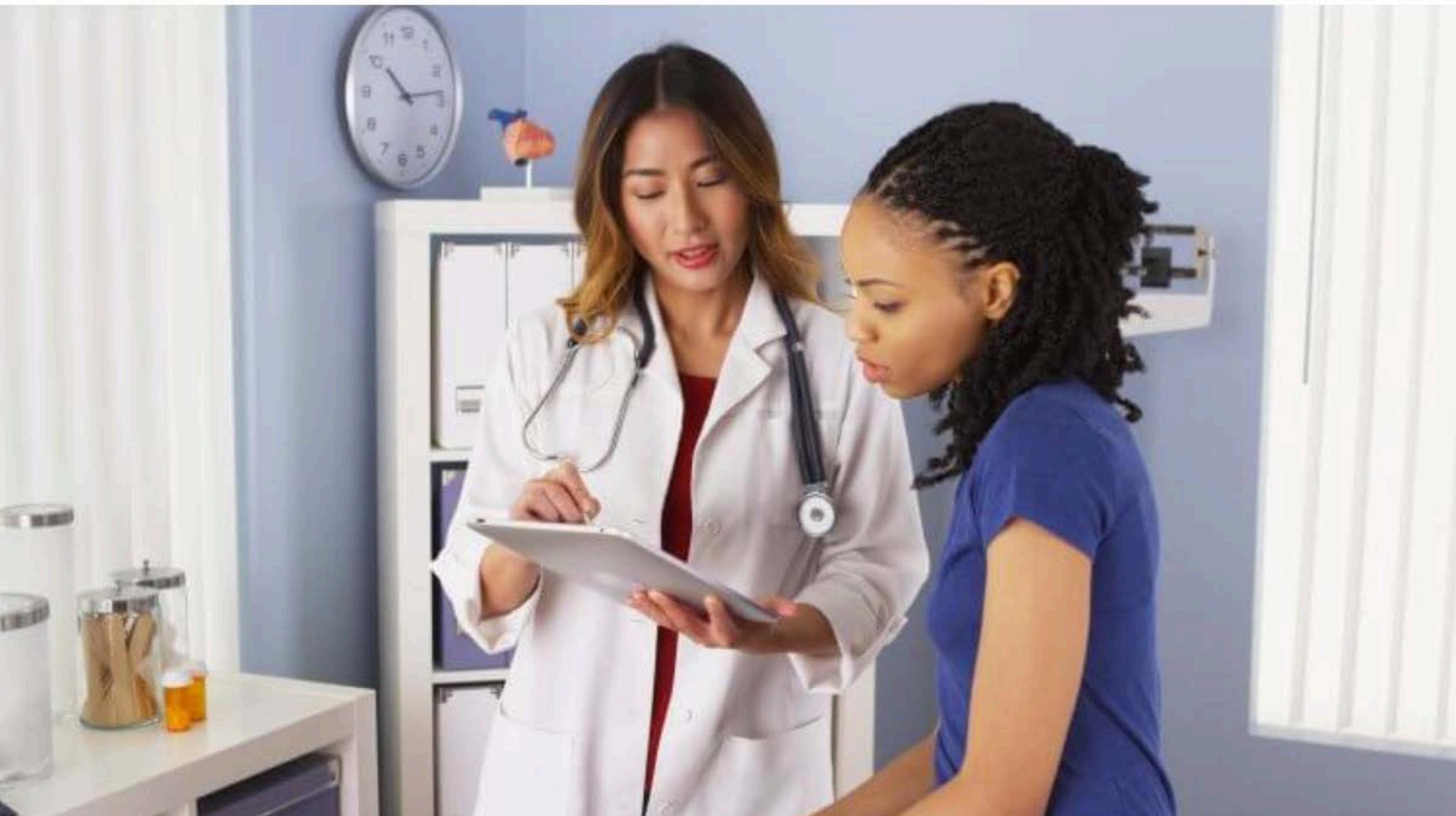
“Black moms matter,” said Bruce Bekkar, a retired gynecologist and obstetrician one of the co-authors of Thursday’s report, as well as a board member with the Climate Action Campaign, an advocacy group in San Diego. “It’s time to really be paying attention to the groups that are especially vulnerable.”

The paper also looked for research examining the effects of pregnancy from greater exposure to two types of air pollution:



**Joe Biden**  @JoeBiden · 6m 

Climate change is linked to increased pregnancy risks — and heartbreakingly, Black mothers are being hit the hardest. As President, I'll work every day to tackle the climate crisis head-on and root out injustice. Because they are intertwined.

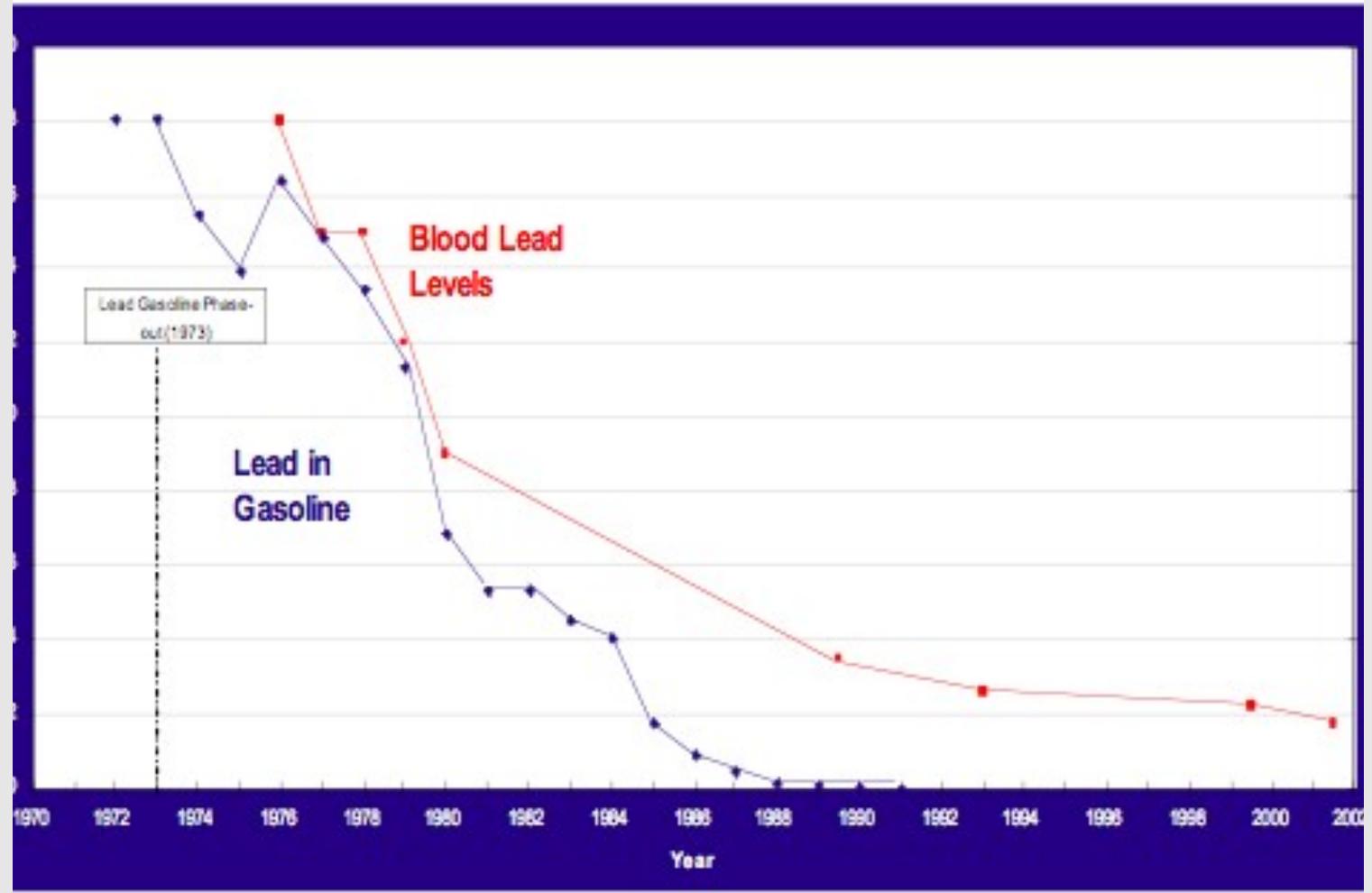


# We've done it before..

- ✓ 1970 – Comprehensive Clean Air Act
- ✓ 1970 – Earth Day
- ✓ 1970 – Environmental Protection Agency
- ✓ 1971 – Doctors Without Borders
- ✓ 1972 – DDT Banned
- ✓ 1972 – Clean Water Act
- ✓ 1973 – Unleaded Gas



Many Toxic Exposures Cannot Be Controlled by Individual Action





Coronavirus Has Cut China's Carbon Emissions by  
100 Million Metric Tons

# We must do it again

- ✓ 2013 – ACOG Committee Opinion Toxic Environmental Exposures
- ✓ 2016 – AAP Technical Report Climate Change
- ✓ 2016 – Project TENDR
- ✓ 2017 – Medical Society Consortium on Climate and Health
- ✓ 2018 – “Single-use” is Merriam-Webster Word of the Year
- ✓ 2020 – 50<sup>th</sup> Anniversary of Earth Day



# No special training required..

OPINION // OPEN FORUM

## Open Forum: Climate change is already affecting your health

By Ashley McClure and Amanda Millstein | Oct. 3, 2019



Protesters block traffic on California Street as part of the Global Climate Strike in San Francisco on Sept. 25.  
Photo: Paul Chinn / The Chronicle

Climate change is a health emergency. As physicians, we regularly see the ways in which it's already damaging the health of our patients.

CAC  
@sdclimateaction

Follow

"Climate change is a medical emergency." Dr. Bruce Bekker calls on @SDGE to stop blocking clean energy.



**STOP BURNING  
OUR  
BABIES' FUTURES**

IT'S GETTING  
**HOT**  
IN HERE



Healthy Mom,  
Healthy Baby...

Begins with a  
Healthy Environment