The Climate Crisis and Birth Outcomes in the US: Now What?

Collaborative on Health and The Environment webinar
July 27th, 2021

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- Lead author, Association of air pollution and heat exposure and preterm birth, low birth weight and stillbirth in the US*, JAMA Network Open*, June 18, 2020

POLICY STATEMENT Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

American Academy of Pediatrics

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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.

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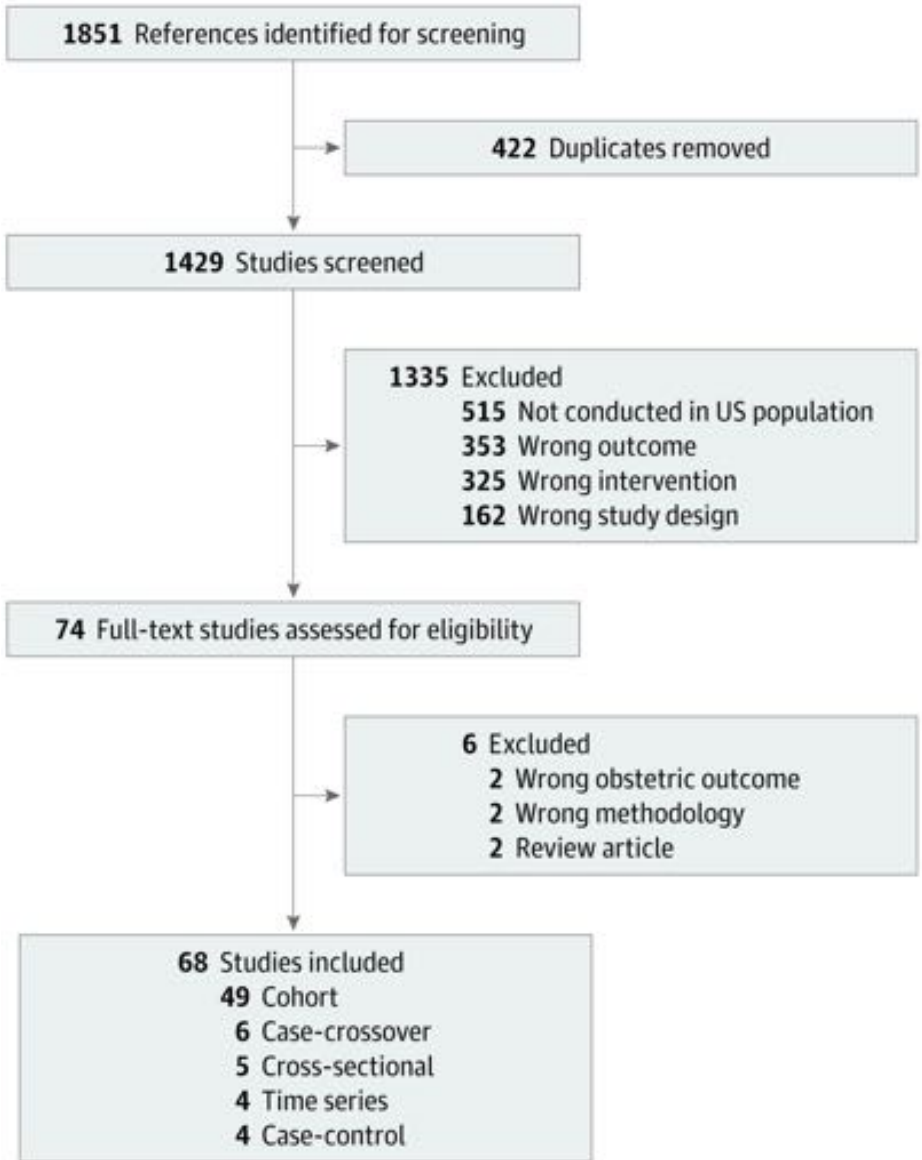
DOI: 10.1542/peds.2013-3332

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

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.[1–4] 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.[5] Thus, it remains possible to protect children, families, and communities from the worst potential effects of climate change.



JAMA Network Open

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 ($PM_{2.5}$), 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 $PM_{2.5}$ 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.

+ Invited Commentary
+ Supplemental content

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

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), %[a]
Air pollution				
Preterm birth	19/24	318 960 (393 272)	7.3	11.5 (2.0-19.0)[b]
Low birth weight	25/29	661 205 (878 074)	18.5	10.8 (2.0-36.0)[b]
Stillbirth	4/5	1 020 975 (1 176 174)	5.1	14.5 (6.0-23.0)[b]
Heat				
Preterm birth	4/5	192 625 (207 995)	0.8	15.8 (9.0-22.0)[d]
Low birth weight	3/3	902 277 (985 803)	2.7	31.0 (13.0-49.0)[d]
Stillbirth	2/2	115 943 (115 933)	0.2	NA[e]

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

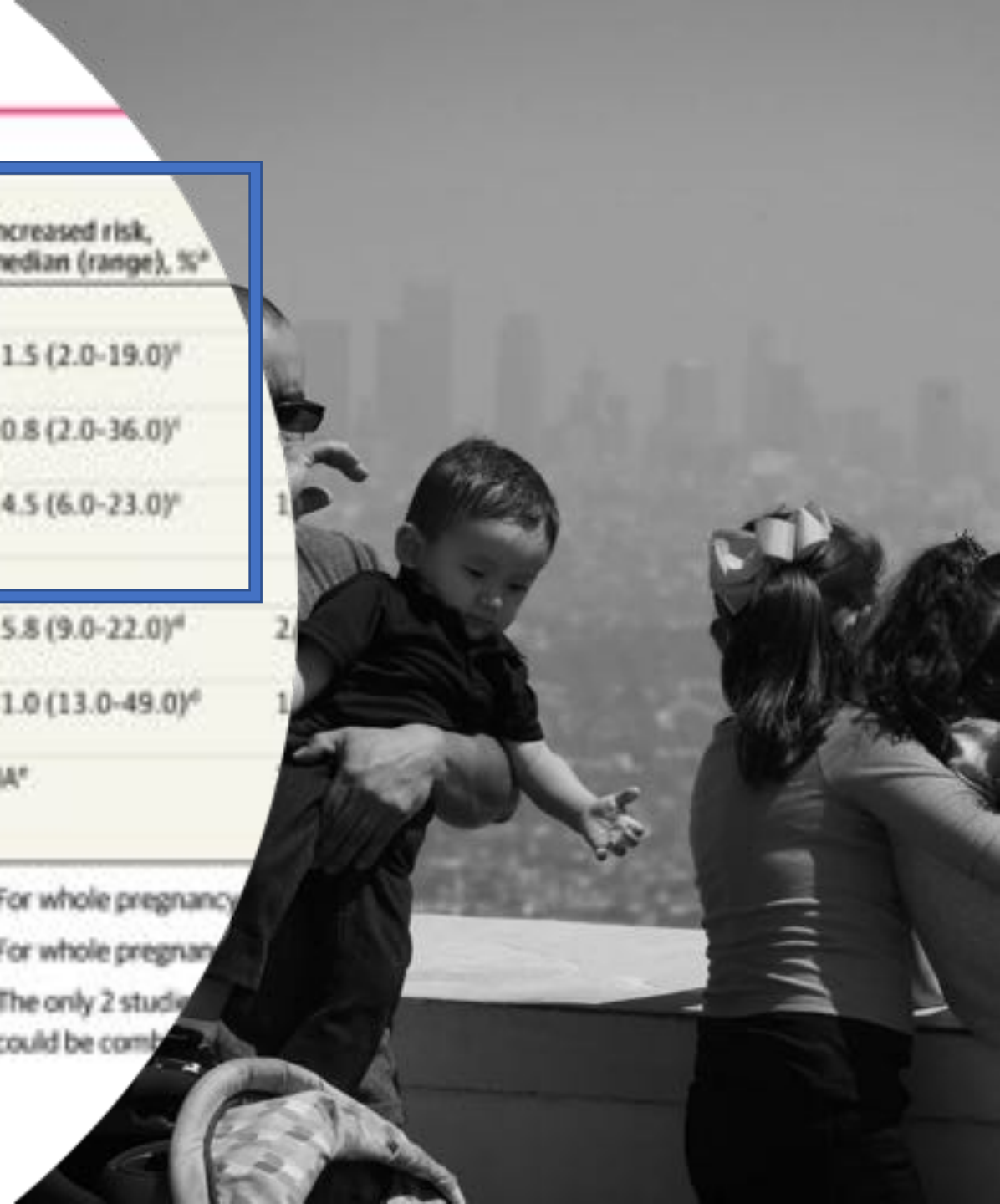
[a] Risk presented as range from significant studies. The median is calculated from the range; a pooled analysis was not performed. For consistency, the whole pregnancy exposure was presented where possible.

[b] Single study unless specified.

[c] For whole pregnancy

[d] For whole pregnan

[e] The only 2 studi
could be comb



Mechanisms: Air Pollution and Preterm Birth

- Maternal hematologic transport of inhaled toxic chemicals
- Increased levels of systemic inflammation
- Changes in function of the autonomic nervous system

1. Kannan. Exposures to airborne particulate matter and adverse perinatal outcomes: a biologically plausible mechanistic framework. *Environ Health Perspect*. 2006;114(11):1636-1642
2. Brook. Insights into the mechanisms and mediators of the effects of air pollution exposure on blood pressure and vascular function in healthy humans. *Hypertension*. 2009;54(3):659-667
3. US Environmental Protection Agency. Integrated Science Assessment (ISA) of ozone and related photochemical oxidants (final report, Feb 2013). US Environmental Protection Agency; 2013.

Bekkar B, Pacheco S, Basu R, DeNicola N. Association of Air Pollution and Heat Exposure With Preterm Birth, Low Birth Weight, and Stillbirth in the US: A Systematic Review. *JAMA Network Open.* 2020;3(6):e208243

HEALTH NEWS JUNE 8, 2018 / 1:52 PM / 3 MONTHS AGO

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.

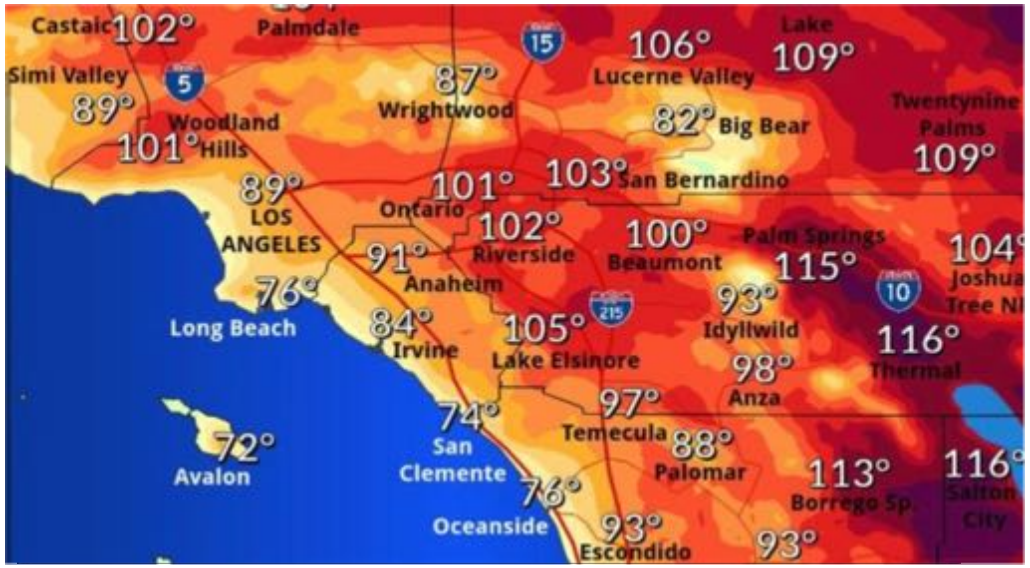


Table. Summary of Evidence Key Questions 1 Through 6

Exposure and outcome	Studies finding an association, No./total No.	Births/study, mean (SD)	Total births in millions	Increased risk, median (range), %[a]	Studies finding racial disparity, No./total No.	Notable findings[b]
Air pollution						
Preterm birth	19/24	318 960 (393 272)	7.3	11.5 (2.0-19.0)[c]	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)[c]	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)[c]	1/4	Stillbirth risk increased 42% with high third-trimester exposure
Heat						
Preterm birth	4/5	192 625 (207 995)	0.8	15.8 (9.0-22.0)[d]	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)[d]	1/3	Term birth weight decreased 16 g per IQR temperature increase
Stillbirth	2/2	115 943 (115 933)	0.2	NA[e]	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.

[a] 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.

[b] Single study unless specified.

[c] For whole pregnancy $PM_{2.5}$ exposure.

[d] For whole pregnancy heat exposure.

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

Prenatal exposure to particulate air pollution and gestational age at delivery in Massachusetts neonates 2001–2015

A perspective of causal modeling and health disparities

Qiu, Xinye[a]; Fong, Kelvin C.[b]; Shi, Liuhua[a,c]; Papatheodorou, Stefania[d]; Di, Qian[e]; Just, Allan[f]; Kosheleva, Anna[a]; Messerlian, Carmen[a,d]; Schwartz, Joel D.[a,d] Author Information

Environmental Epidemiology: October 2020 - Volume 4 - Issue 5 - p e113

Results:

A 5 µg/m3 increase in average third trimester PM2.5 exposure is linked to point estimates of 1.7 to 10 GA reduction across the GA percentiles for subpopulation with high average ambient temperature (≥21°C) in the third trimester and also linked to 0 to 6.8 days reduction for subpopulation with low average ambient temperature (≤−0.59°C) in the third trimester

Discussion:

The neonatal GA at delivery seemed to be affected to a larger extent when exposed to increased levels of PM2.5 in extreme high and low tempered third trimester window

1. Wang Q, Li B, Benmarhnia T, Hajat S, Ren M, Liu T, et al.2020. Independent and combined effects of heatwaves and $PM_{2.5}$ on preterm birth in Guangzhou, China: a survival analysis. **Environ Health Perspect**128(1):017006

2. Kwag Y, Kim MH, Ye S, et al. The Combined Effects of Fine Particulate Matter and Temperature on Preterm Birth in Seoul, 2010-2016. **Int J Environ Res Public Health**. 2021;18(4):1463. Published 2021 Feb 4. doi:10.3390/ijerph18041463

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[d] For whole pregnancy heat exposure.

[e] 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

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.

Reducing Prenatal Exposure to Toxic Environmental Agents

Committee Opinion | Number 832 | July 2021

Number 832 (Replaces Committee Opinion Number 575, October 2013)

Committee on Obstetric Practice

The American College of Nurse-Midwives endorses this document. This Committee Opinion was developed by the Committee on Obstetric Practice in collaboration with liaison member Nathaniel DeNicola, MD, MSc and committee member Ann E. Borders, MD, MSc, MPH, and with the assistance of Veena Singla, PhD and Tracey J. Woodruff, PhD, MPH.

ABSTRACT: There is emerging evidence that links exposure to toxic environmental agents and adverse reproductive and developmental health outcomes. Toxic exposures related to reproductive and developmental health opposite have been

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Figures & Tables

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"We can help prepare our patients for the health challenges they will face.."

Dr. Cheryl Holder, Florida International University

Black and Brown Maternal Health and Environmental Justice Roundtable

117th CONGRESS
1st Session

H. R. 957

To direct the Secretary of Health and Human Services to establish a grant program to protect vulnerable mothers and babies from climate change risks, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

February 8, 2021

Ms. Underwood (for herself, Ms. Adams, Mr. Khanna, Ms. Velázquez, Mrs. McBath, Mr. Smith of Washington, Ms. Scanlon, Mr. Lawson of Florida, Mrs. Hayes, Mr. Butterfield, Ms. Moore of Wisconsin, Ms. Strickland, Mr. Ryan, Mr. Schiff, Mr. Johnson of Georgia, Mr. Horsford, Ms. Wasserman Schultz, Ms. Barragán, Mr. Deutch, Mr. Payne, Mr. Blumenauer, Mr. Moulton, Mr. Soto, Mr. Nadler, Mr. Trone, Ms. Clarke of New York, Ms. Schakowsky, Ms. Bass, Ms. Pressley, Mr. Evans, Ms. Blunt Rochester, Ms. Castor of Florida, Ms. Sewell, and Ms. Williams of Georgia) introduced the following bill; which was referred to the Committee on Energy and Commerce

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A BILL

To direct the Secretary of Health and Human Services to establish a grant program to protect vulnerable mothers and babies from climate change risks, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) Short Title.—This Act may be cited as the "Protecting Moms and Babies Against Climate Change Act".

(b) Table Of Contents.—The table of contents for this Act is as follows:

Advocacy experience:

- Climate Reality Project
- ecoAmerica/ Climate for Health Ambassadors Program
- Medical Society Consortium for Climate and Health
- Local non-profits

Justice will not be served until those who are unaffected are as outraged as those who are.

~ Benjamin Franklin

AZ QUOTES


STOP BURNING
OUR
BABIES' FUTURES
IT'S GETTING
HOT