

A Hot Pregnancy: Is Extreme Heat Exposure a Potential Determining Factor for Pre-term Births?



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ABSTRACT

Background: Preterm births are defined when an infant is born 37 weeks earlier than the gestational period, causing developmental delays or in severe cases infant mortality. With the global increase in heat temperatures, pregnant women classify as a vulnerable population to adverse health effects due to the heat. **Objective:** The objective of this literature review is to assess the relationship between increase in extreme heat temperatures and rates of preterm births in Canadian and American pregnant women. **Methods:** A structured literature review search was conducted through the University of Ottawa library databases using the keywords: preterm births and heat. Articles were refined by the inclusion and exclusion criteria providing a total of five articles eligible for the literature review. **Results:** From the five eligible articles, three were case-crossover studies and the two remaining were time-to-event study and an observational cohort study. All five publications arrived to the same conclusion, stating a positive correlation between extreme heat and preterm deliveries. **Conclusion:** An association has been proposed with the findings, however, a concrete conclusion has not been reached due to the lack of research present in the scientific community. Further investigation is needed to provide conclusive results.

INTRODUCTION

Background
Preterm births occur when an infant is born prior to 37 weeks of gestation³. Shortened pregnancy is related to numerous adverse health issues, such as growth impairment, or in severe cases infant mortality². Gestational age at the time of delivery has been reported to be a key determinant of fetal maturity². With the growing concern of increase in global temperatures, the temperature related health effects are becoming a great public health interest. National Geographic has announced an average increase of 0.8 degrees Celsius in temperature⁷. Pregnant women are among the several identified vulnerable subgroups at risk due to heat exposure⁴. Although, there is evidence in the scientific community that suggests harmful health effects of extreme high temperatures in vulnerable populations, its effect on increase in preterm birth rates remains unclear.

Research Question
The objective of this literature review is to assess the relationship between increase in extreme heat temperatures and rates of preterm births in Canadian and American pregnant women.

Rationale
Incidences of preterm births are rising across the world, however, there is little known about the reason.

METHODS

- A literature review search was conducted using the scientific databases: Scopus, PubMed and Medline (Ovid) for relevant articles.
- For the preliminary search, the search terms “preterm births” and “heat” were used, and 222 articles were presented.
- The findings were narrowed to publications from the years 2010-2017, which provided 118 articles. The findings were later refined further to the English language pertaining Canada and the United States, which expressed 43 articles.
- Articles regarding extreme heat and stillbirth rates were excluded, as well as the abstracts and full texts that were not accessible through the University of Ottawa library databases. Findings were scarce throughout all three databases as a lot of the duplicate articles were also excluded.
- A total of 5 articles were deemed relevant at the end of the search. Study designs used were observational cohort, case crossover, and time-to-event studies.

RESULTS

Table 1. Summary of data collected from each study

Study	Type of Study	Study Population	Findings
Avalos et al. (2017) ¹	case-crossover study	14,466 preterm deliveries for women a part of the Kaiser Permanente Northern California (KPNC) facility	Increase in preterm births were found to be associated with increases in temperature, especially during the warm season. During the cold season, when there were increases in temperature it did not significantly impact the overall preterm deliveries. Analysis indicated heightened preterm deliveries with a weekly average increase of 5.6 degrees Celsius during the warm season.
Ha et al. (2017) ²	observational cohort study	228,438 deliveries at more than 23 weeks gestation from 12 clinical centers across U.S.A	Exposure to extreme heat during the gestation period before 37 weeks is associated with preterm births. Stated comparison between cold and warm seasons. (RR 1.09)
Basu et al. (2017) ³	case-crossover study	14,466 women who had preterm deliveries within KPNC facility	Association between heat and race was made, Black and Hispanic women had a higher risk of preterm births during the warm season. Generally, all women had a higher chance of preterm deliveries in the warmer season.
Auger et al. (2014) ⁴	time-to event study	12,390 preterm live births from Montreal, Canada	Extreme heat episodes can trigger earlier delivery among the term births. Extreme heat episodes with 4-7 days of maximum temperature of at least 32 degrees Celsius were associated with an increased hazard of preterm deliveries.
Basu, R., Malig, B., & Ostro, B. (2010) ⁵	case-crossover study	58,681 preterm births from 16 counties in California	Positive association between extreme temperature and risk of preterm birth due to increase in weekly average temperature of 5.6 degrees Celsius. Associations with racial background was also observed.

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DISCUSSION

- Key Findings:**
- All 5 publications reviewed came to the same conclusion, clearly stating the positive correlation between extreme heat and preterm deliveries.
 - 2 publications also mentioned racial differences in labor induction
 - 2 publications mentioned extreme heat to be an increase in average temperature by 5.6 degrees Celsius, but no definitive definition of extreme heat temperature
 - All 5 studies stated in their conclusion for further investigation, as it can prove to be a global issue

- Limitations of study:**
- Didn't include other reasons that can cause preterm births (ex. mother's lifestyle)
 - Selection bias
 - Misclassification bias
 - Confirmation bias
 - Foreign language exclusion bias
 - Rhetoric bias
 - Ease of access bias

- Results Contextualized:**
- Overall, this structured literature review supported the findings from other epidemiological studies
 - Even though there are traces of variations in the literature, majority of the findings published are corresponding to the positive association between extreme heat and preterm births

- Future Implications:**
- Global warming is a rising concern, thus it is crucial to identify maternal risk factors and to propose interventions to help prevent preterm births which are induced by heat exposure
 - Future studies need to investigate this issue further on an international scale, as there are pregnant women all around the world.
 - Future Studies should clearly state the definition of extreme heat, since majority of the studies follow individual paths, thus making it inconclusive on how to effectively measure extreme heat

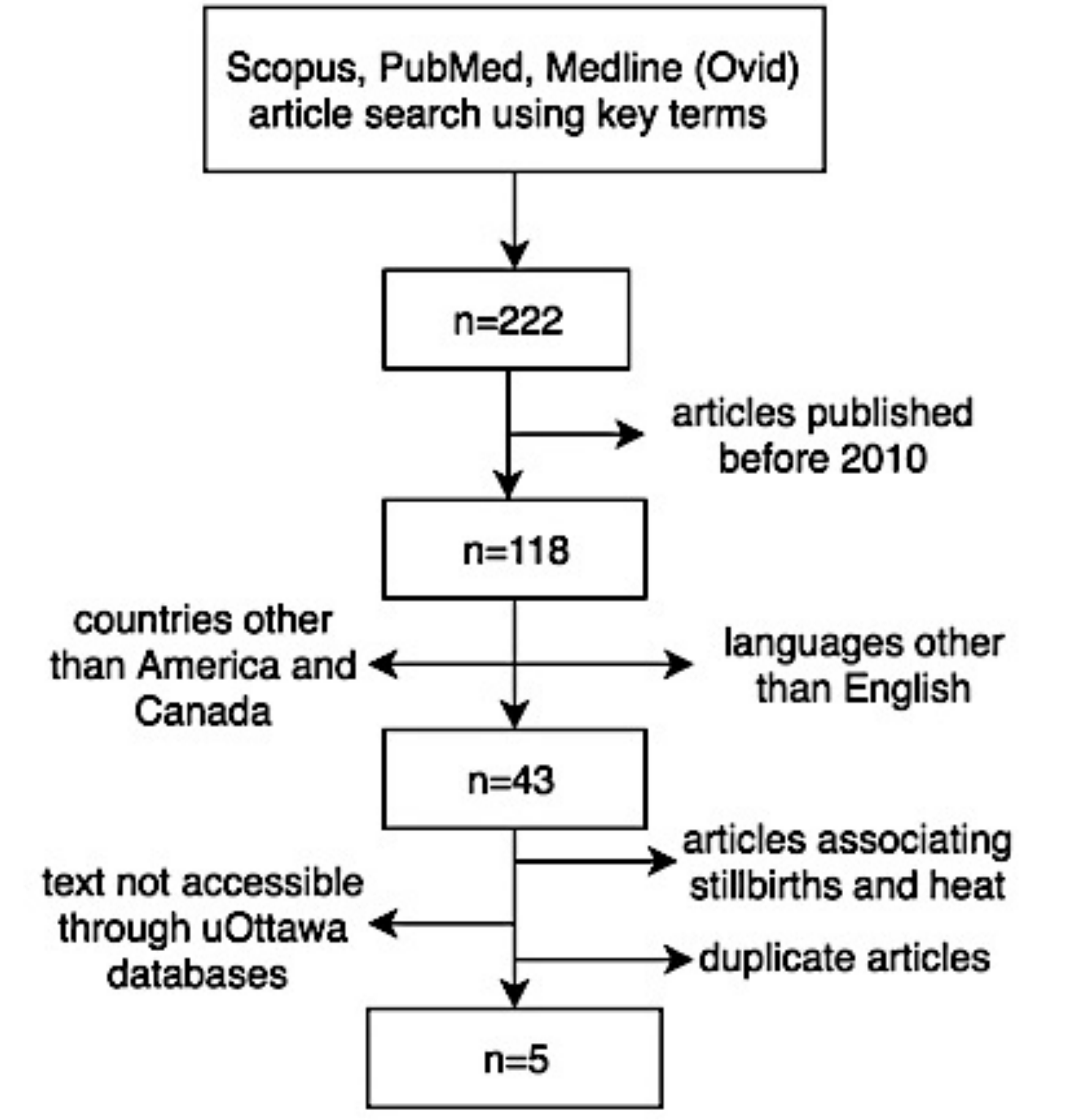


Figure 1. Flow chart illustrating the search process and selection criteria of studies used for the structured literature review.

CONCLUSION

Although majority of the publications propose an association between extreme heat exposure and preterm deliveries, a correlation between the two variables cannot be concluded due to limited findings. Further research must be conducted for conclusive results.

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