

# A Systematic Review: The Urban Heat Island Effect and Heat-Related Morbidity

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## Introduction

The Urban Heat Island (UHI) effect occurs in metropolitan areas when the area is significantly warmer than surrounding rural and suburban areas.

The Urban Heat Island (UHI) effect has become a major problem due to increased urbanization and industrialization. The UHI tends to “exacerbate human health stress” (Tan et al., 2010).

A wide range of characteristics such as income, poverty, sex, age, education level, and greenspace have an impact on risk of heat-related morbidity (Ingole et al., 2020).

## Objectives

This review focuses on the urban heat island effect and the increased risk of human mortality and morbidity, as compared to risk of heat related mortality in non urban areas

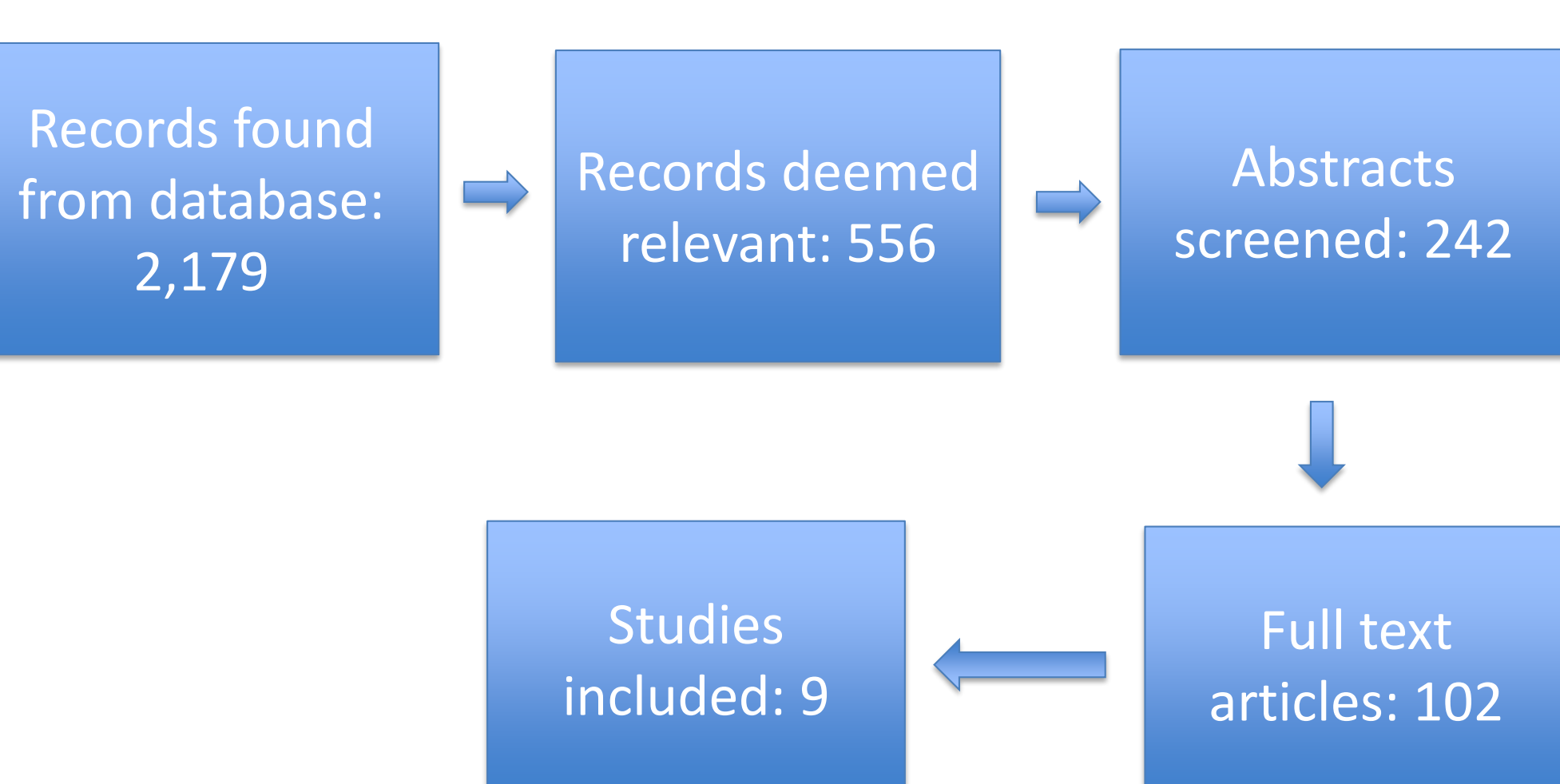


Figure 1: Summary of Literature Search

## METHODS

This review was conducted by searching for relevant literature across scholarly sources including PubMed, Himmelfarb Library, and ScienceDirect. Across all sites, 2,169 studies were found. 556 studies were deemed relevant and the abstracts of those studies were screened. After this screening, 242 studies were selected based on evidence linking the urban heat island effect to increase heat-related mortality as well as other heat related illnesses

Studies were excluded based on the following criteria: studies that were not in English, studies that were not case studies, studies that did not examine heat stress exposure in major urban areas, studies that did not focus on heat-related morbidity as a major health outcome, studies that were less than 3 years.

Strength of evidence was based on : risk of bias for individual studies, the quality of evidence across all eight studies and the strength of evidence across all studies.

## RESULTS

| Article                       | Confounding  | Exposure Assessment/Misclass. | Incomplete Outcome Data | Selective Outcome Reporting | Conflict of Interest | Other Sources of Bias | Rating   |
|-------------------------------|--------------|-------------------------------|-------------------------|-----------------------------|----------------------|-----------------------|----------|
| Tan et al.(2010)              | High         | Low                           | Medium                  | Low                         | Low                  | Medium                | Moderate |
| Ingole et al.(2020)           | Low          | Medium                        | Low                     | Low                         | Low                  | Low                   | High     |
| Janicke et al.(2019)          | Probably low | Medium                        | Probably Low            | Probably Low                | Low                  | Medium                | Moderate |
| Paravantis et al. (2017)      | Probably Low | Low                           | Low                     | Low                         | Low                  | Probably Low          | High     |
| Hondula and Barnett (2013)    | Medium       | Probably Low                  | Low                     | Low                         | Low                  | Medium                | Moderate |
| Dang et al. (2018)            | Probably low | Low                           | Low                     | Low                         | Probably Low         | Probably low          | High     |
| Hu et al. (2019)              | Low          | Low                           | Medium                  | Low                         | Low                  | Medium                | Moderate |
| Henderson et al. (2013)       | Low          | Low                           | Low                     | Low                         | Probably Low         | Probably Low          | High     |
| Pyrgou and Santamouris (2018) | Probably Low | Low                           | Low                     | Low                         | Low                  | Probably Low          | High     |

Table 1: Summary of Risk Bias Table

Overall, the studies included in this review had a low to moderate risk of bias.

All studies found an increased risk of heat-related morbidity with increased heat-stress.

Risk of bias was most prevalent in the areas of confounding, exposure assessments, and other sources of bias.

Risk of confounding was highest due to lack of consideration for variables such as socioeconomic status of the district, air pollution, housing factors, and demographic factors.

## CONCLUSIONS

Heat stress was always associated with higher heat-related morbidity, and the results support further research on heat related illness in urban populations as well as provide evidence for the need for more heat emergency protection measures.

More research may be warranted to investigate spatial variations in heat vulnerability within each urban population, as well as differences amongst rural populations. Major differences amongst low income communities should be analyzed further in addition.

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