

Web Annex D

Report of the systematic review on the effect of indoor heat on health

**Karen Head, Mike Clarke, Meghan Bailey, Alicia Livinski,
Ramona Ludolph and Ambrish Singh**

In:

WHO Housing and health guidelines



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Abbreviations

ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
CIBSE	Chartered Institution of Building Services Engineers
GDG	Guideline Development Group
PECO	Population, exposure, comparison, outcome
WHO	World Health Organization

Introduction

This report assesses the effects of indoor temperatures above 24°C on health. We have conducted a systematic review of this topic to support the development of the World Health Organization's (WHO) Housing and health guidelines. The aim of this systematic review is to provide the best available evidence from existing research to contribute to the deliberations of the Guideline Development Group (GDG).

The structure of this report is as follows:

- Background: provides a brief contextualization of the home environment and disability, and the rationale for this systematic review.
- Eligibility criteria and population, exposure, comparator, outcomes (PECO): outlines the PECO for this systematic review, and provides detailed inclusion and exclusion criteria.
- Search strategies and checking of articles: presents the process of searching and identifying articles.
- Extraction of information, preparation of narrative summaries, evidence profiles and summary of findings tables: provides the process of data extraction, quality assessment, and outcomes and findings presentation.
- Findings: summarizes the results of this review and information from related work.
- Discussion: discusses the lack of evidence for this topic.
- Comprehensive Appendices 1–17 present detailed information in relation to this systematic review.

Background

Heat is a natural hazard and high temperatures have the potential to compromise the human body's ability to maintain thermoregulation and consequently, can adversely affect health (Kovats & Hajat, 2008). A systematic review of epidemiological studies of heat-related mortality and morbidity has focused on outdoor ambient temperature as the exposure (Basu, 2009). The review concluded that there is an independent effect of increased outdoor temperature on mortality (Basu, 2009). In most of the included studies, exposure to heat is estimated using data from the nearest meteorological monitoring station (Basu, 2009). This classification of entire communities is likely to miss heat exposure, which is more variable at the local level.

In addition, despite the most studies using outdoor temperature as the exposure, it has been found during a personal exposure study in people aged over 65 years (Basu & Samet, 2002), that most of the participants spent a majority of their time indoors (>90%) during the summer months. A review of deaths from the 2003 heatwave in France indicated that the number of deaths at home was far higher compared to previous years without extreme heat events (Fouillet et al., 2006). These studies suggest there may be a health risk of overheating in the indoor environment and that indoor temperature may be associated with health risks.

Chan et al. (2001) found in their development of a model of key risk factors for health in heat waves that a healthy person in an indoor unventilated building was 3.8 times more likely to have an adverse health effect due to heat than a healthy individual outdoors (Chan, Stacey, Smith, Ebi, & Wilson, 2001).

Building energy codes and standards help to ensure that the building thermal envelope and the installed heating, ventilation, and air-conditioning systems are able to maintain the building's interior environment within reasonable bounds (Sailor, 2014). Although some standards have been written to set minimum or acceptable thresholds for indoor environmental conditions, these have been based on evidence of conditions that are acceptable to achieve thermal comfort for occupants. The term "thermal comfort" is defined by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) as the "condition of mind which expresses human satisfaction with the thermal environment". This definition does not include health aspects although some authors have tried to begin to establish a link between thermal comfort and health (Ormandy & Ezratty, 2012). The Zero Carbon Hub in their recently published report summarizes the current indoor temperature thresholds published by different organizations, although the evidence supporting the values are not provided (Zero Carbon Hub, 2015c).

This systematic review aims to look at the evidence for a link between indoor temperatures and health with the aim of informing upper indoor temperature thresholds.

Eligibility criteria and PECO

The PECO question, including a ranking of the important outcomes, was provided by the WHO at the start of the project, and is presented in Table 1.

The finalized research question to be answered is:

Do residents living in housing where indoor temperatures are above 24°C have worse health outcomes than those living in housing with indoor temperatures below 24°C?

Table 1 Elements of the PECO question and eligibility criteria

	Eligibility criteria		
Context	<p>This PECO is suggested with the understanding that "above 24°C" indicates a temperature range, and does not imply the 24°C to be the definite threshold. Instead, it just serves to identify indoor exposure situations of "24°C and above".</p> <p>The systematic review would then identify literature documenting health effects of 24°C and above which would enable identification of the most appropriate threshold, which could be 24°C or any higher temperature. As the threshold ambient temperature at which heat-related health effects occur varies by location, an alternative measure utilizes the idea of a "hot spell" or "heat wave", variously defined as the average of two or three consecutive maximum outdoor temperatures over a defined period and one or two minimum average night temperatures in between the days measured.</p>		
Further considerations needed for the review work, if applicable	<p>For heat effects on health, the time window of heat exposure is relevant. Certain temperatures may be harmful over a period of a few days while higher temperatures may have a more acute effect. The review therefore needs to accurately report for which exposure duration a certain health effect is observed and whether it is measuring indoor temperatures, or interpolating from outdoor temperatures.</p> <p>It has been suggested that heat effects may not only depend on the daily maximum heat, but may also be driven by the level of the minimum temperature (e.g. high maximum temperatures during a heat wave may be less harmful when the temperature decreases significantly at night). The review would need to accurately report what temperature parameter is associated with the reported health effects.</p> <p>Thermal stress is compounded by high humidity, which reduces evaporation and effectiveness of perspiration for cooling and lack of effective ventilation.</p> <p>All populations need to be examined, but specific attention will need to be given to vulnerable subgroups.</p> <p>The review also needs to identify whether this intervention reduces or increases inequalities.</p>		
Rating of suggested	All-cause mortality	7.68	1-3 => Low importance 4-6 => Important but not
	Heatstroke	7.21	

Eligibility criteria			
outcomes to be used for systematic review	Hyperthermia	7.16	critical 7–9 => Critical for decision-making
	Dehydration	7.16	
	Hospital admission	7.11	
Potential indicators for exposure description to be used for systematic review	Maximum indoor temperature Maximum indoor night temperature Minimum indoor night temperature Average indoor temperature Average indoor night temperature Difference between maximum indoor and outdoor temperatures		
Potential indicators for confounders – possible intervention	Mechanical fan Mechanical air conditioning Evaporative cooling (mechanical) Openable windows for cross-ventilation Thermal insulation (building envelope with better thermo-physical properties than conventional ones) Cool roofs/green roofs Good water supply		
Vulnerable groups	Older people Infants under 12 months Children under 5 years Slum residents Persons during illness or confined to their home (by disease or disability)		
Confounders to be considered during systematic review	Age Gender SES (socioeconomic status) Single-person vs multi-person household Outside temperature Housing details (tenure, cooling system)		

Search strategies and checking of articles

The constraints of time and resources involved in the conduct of this rapid systematic review means that it is not possible to explore all potential sources of information that might be drawn upon in a more comprehensive systematic review. Such activities would require extensive searching for unpublished studies and for studies reported in the grey literature or published in journals that are not well-indexed in the major bibliographic databases. However, the intention behind the searching was to try to avoid missing any pivotal study which would transform the overall findings of the systematic review or the conclusions to be drawn from these findings.

Specially designed searches were prepared and delivered by Kath Wright, an experienced Information Specialist at the Centre for Reviews and Dissemination at the University of York, the United Kingdom.

The main search for this review was of indexed bibliographic databases: Embase, Greenfile, MEDLINE, PAIS International, Science Citation Index, and Social Science Citation Index. These searches were run in January 2015. The searches were run with no date restrictions and records were downloaded into Endnote bibliographic software and de-duplicated. The search results were subsequently restricted to those published from 2004 onwards (as agreed by WHO) to January 2015. The search strategies are provided in Appendices 1–6.

Table 2 shows the numbers of records identified from each database for both the unrestricted date results and the date restricted results. A total of 10 200 records were retrieved by the electronic searches.

Table 2 Number of records retrieved and checked from each source during the search in 2015

Database	No. with no date restriction	No. loaded into Endnote	No. published from 2004 onwards
Embase	4 339	4 291	2 488
Greenfile	4 447	4 447	3 529
MEDLINE	3 710	3 703	1 803
PAIS International	375	375	263
Science Citation Index	5 283	5 283	2 647
Social Science Citation Index	2 404	2 404	1 780
Total records		16 478 after deduplication within each database	10 200 after deduplication within each database

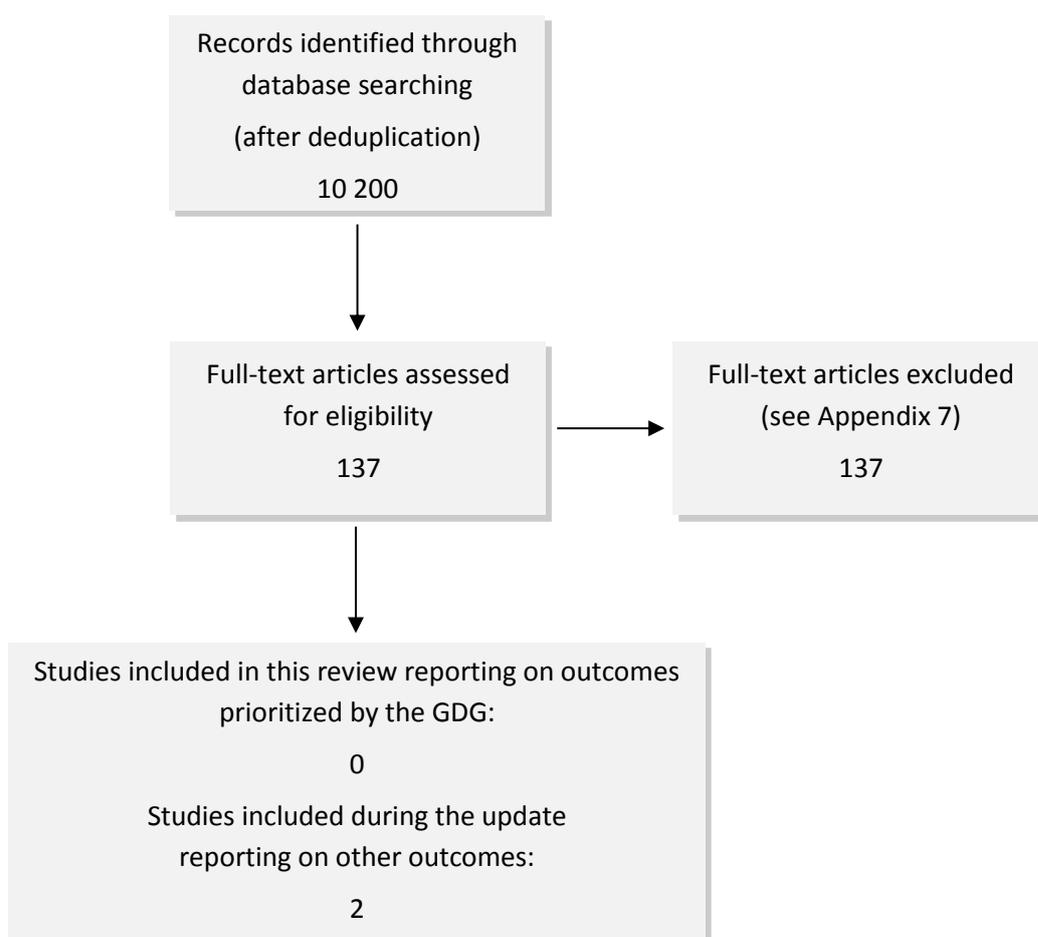
The WHO provided some references during the systematic process such as the Zero Carbon Hub reports (Zero Carbon Hub, 2015c, 2015d) (see Appendix 14). These are two of the five reports on overheating produced by the Zero Carbon Hub in March 2015. They are not included in the main body of this report because they were not systematically identified.

All records retrieved from the searches were checked by two reviewers independently, to identify potentially relevant articles. Where there was disagreement between the reviewers and where these could not be resolved by discussion, a third reviewer made the final decision. Decisions about the potential eligibility were made on the basis of the English language abstract. It was presumed that no pivotal papers that would substantially change the findings or conclusions of the reviews would have been missed because of their publication in a language other than English. This is based on the likelihood that any such research would have found its way into the English literature or been clearly relevant from the abstract. Time constraints prevented searching the foreign language literature

As expected when the searches were designed, most of the retrieved records were not relevant to this systematic review and this was obvious from scrutiny of their title or abstract. For example, a large proportion related to the thermal performance of buildings or modelling of a new heating or air-conditioning system with no health outcomes. For pragmatic reasons, reasons for the early exclusion of each of these several thousand records were not recorded.

Of the 10 200 articles found through the searches, a total of 137 full-text articles were identified as potentially relevant from the search and 135 papers were retrieved (two studies were unobtainable) and checked for relevance. In addition, the systematic reviews had their reference lists screened for additional potentially eligible studies. A list of the 137 articles that were identified as potentially eligible and then excluded, along with the reason for their exclusion is provided in Appendix 7. The flow diagram for the identification of studies is shown in Figure 1.

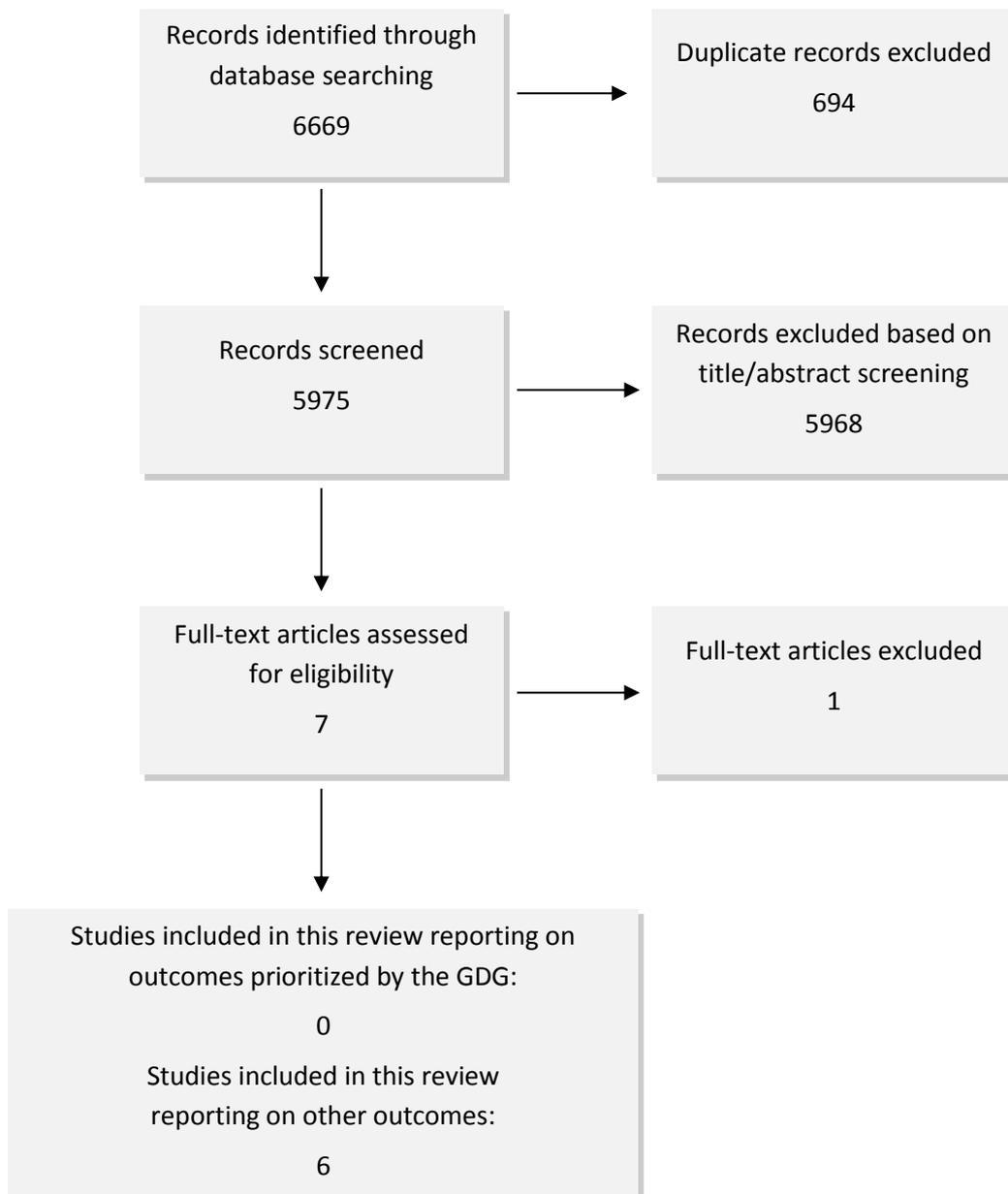
Figure 1 Flow diagram for identification of studies in 2015



In order to bring the systematic review up-to-date, new searches for eligible studies were done in April 2018 to identify articles published since 1 January 2015. We used the original search strategies for the following databases: EMBASE (including Medline), Greenfile, Medline, PAIS, Science Citation Index and Social Science Citation Index (see Appendices 8-13 for search strategies). The retrieved records were checked by two authors and the full text was sought for all studies judged to be potentially eligible. When obtained, the full text of each of these articles was checked by two authors. Figure 2 shows the flow of articles through this updating process.

In conducting the update of the review in 2018, the eligibility criteria were revised to also include studies investigating the effects of indoor heat on health outcomes other than the ones prioritized by the GDG. This change was intended to broaden the scope of the eligible studies and boost the evidence base for this part of the WHO Housing and health guidelines. The broadening of eligibility criteria led to the retroactive inclusion of two studies identified during the first search conducted in 2015 that reported on health outcomes not prioritized by the GDG.

Figure 2 Flow diagram for identification of studies in 2018



Extraction of information, preparation of narrative summaries, evidence profiles and summary of findings tables

For the papers assessed as eligible, one reviewer was responsible for data extraction and risk of bias assessment, while a second reviewer independently checked the results for consistency. The accuracy of the extracted data and the risk of bias assessments were confirmed through discussion.

The following information was extracted from eligible studies:

- Location and date of study
- Study design
- Type and number of participants
- Details of the exposure and any comparator
- Results for all relevant outcomes reported
- Confounders adjusted by any statistical analyses

The following risk of bias assessment criteria were used to judge the studies' quality:

- Clearly focused issue addressed by the study
- Cohort recruited in an acceptable way
- Exposure and outcomes accurately measured to minimize bias
- Important confounding factors were identified and accounted for in the analysis
- Follow-up of subjects complete and long enough
- Reliability of results
- Applicability of results to the local population
- Adequate description of statistical analysis and how sample size was arrived at
- Adequate description of study participants

Findings

This systematic review shows that there is no evidence published after 2003, which provides details on indoor temperature monitoring and allows for a direct link to be established between indoor temperatures and health outcomes prioritized by the GDG including all-cause mortality, heatstroke, hyperthermia, dehydration or hospital admission.

The problem of missing evidence has been noted by other authors (Anderson, Carmichael, Murray, Dengel, & Swainson, 2013) and limits the ability to create evidence-based recommendations in this area. The lack of evidence is also confirmed by the Zero Carbon Hub reports, which include a discussion on the effect of indoor temperature on health (Appendix 14).

Studies investigating the effects of indoor heat on health

Following the broadening of eligibility criteria to also include studies reporting on other health outcomes than the originally prioritized ones, eight studies investigating the effect of indoor heat on health outcomes including sleep disorders (three studies); general health, blood pressure, respiratory and cardiovascular disease (two studies each); body temperature,

mental health, and pregnancy outcomes (one study each) were identified (see Appendix 15 for a Summary of findings table and Appendix 16 for a GRADE evidence profile).

One quasi-experimental study of 57 people in the United States of America found that reductions in number of days above 27°C corresponded with improved quality of health and life, reduced emotional distress and increased hours of sleep (Ahrentzen, Erickson & Fonseca, 2016).

Three cohort studies explored the association between indoor heat and morbidity. While there were no associations between indoor temperatures and reports of respiratory viral infection or heat illness in a cohort of 40 households in the United States of America, the same study found a significant relationship in sleep problems and prior day's temperature in the summer season but not in winter (Quinn & Shaman, 2017). Similarly, among 113 elderly people in the Netherlands, an increase of 1°C of indoor temperature raised the risk of sleep disturbance by 24% (in the temperature range of 20.8 to 29.3°C) (van Loenhout, le Grand, Duijm, Greven, Vink, Hoek et al., 2016). A third cohort study from Slovenia reported worse cardiovascular symptoms with a higher heat burden and low indoor air quality (Fink, Erzen, & Medved, 2017).

One case series involving 20 low-income elderly people in the Republic of Korea and one cohort study including 132 women in India, found a non-significant positive relationship between indoor temperature and systolic blood pressure but a significant positive association with diastolic blood pressure (Kim, Kim, Cheong, Ahn, & Choi, 2012; Sinha, Kumar, Singh, & Saha, 2010).

A case-control study reported that humidity exposure and indoor heat above 26°C nonsignificantly increased the proportion of emergency calls in New York that were due to cardiovascular cases and respiratory distress calls (Uejio, Tamerius, Vredenburg, Asaeda, Isaacs, Braun, et al. 2015).

Finally, a cross-sectional study among 1136 women in Ghana found a non-significant increase in adverse pregnancy outcomes, such as stillbirth or miscarriage, with each additional 1°C increase in atmospheric heat exposure (Asamoah, Kjellstrom, & Östergren, 2018).

The risk of bias assessment showed that the studies were of mixed quality with the most common methodological flaws relating to acceptable recruitment of the study sample, lack of identification of important confounders and insufficient description of sample size calculation. For Fink et al. (2012) it was not possible to assess the study quality in a satisfactory manner as there was only abstract data available. Table 3 provides an overview of the risk of bias assessment for each study.

Table 3 Risk of bias assessment of studies investigating the effects of indoor heat on health outcomes

Study	Did the study address a clearly focused issue?	Was the cohort recruited in an acceptable way?	Was the exposure accurately measured to minimize bias?	Was the outcome accurately measured to minimize bias?	Have the authors identified all important confounding factors?	Were confounders taken into account in the analysis?	Was the follow up of subjects complete enough?	Was the follow up of subjects long enough?	Are the results reliable?	Can the results be applied to the local population?	Was there a description of how study size was arrived at?	Was there an adequate description of the statistical analysis?	Is there an adequate description of the study participants?
Ahrentzen et al. 2016	+	-	+	+	unclear	unclear	-	+	unclear	unclear	+	+	+
Asamoah et al. 2018	+	+	unclear	+	-	+	N/A	N/A	unclear	unclear	+	+	+
Fink et al. 2017	-	unclear	unclear	unclear	unclear	unclear	unclear	unclear	unclear	unclear	unclear	-	+
Kim et al. 2012	+	unclear	+	+	+	+	+	+	+	unclear	-	+	+
Quinn et al. 2017	+	-	+	unclear	-	-	+	+	unclear	unclear	+	+	+
Sinha et al. 2010	+	+	+	+	+	+	-	+	+	unclear	+	+	+
Uejio et al. 2016	+	+	+	+	unclear	+	N/A	N/A	+	unclear	-	+	+
van Loenhot et al. 2016	+	+	+	unclear	unclear	unclear	+	+	unclear	unclear	+	+	+

General overview of the literature on heat and health

In light of the scarce evidence on indoor heat and its effect on human health, the following sections provide an overview of studies that did not meet the eligibility criteria of this systematic review but give insights into the indirect relationships between heat and health.

Existing systematic reviews on temperature and health

Seven systematic reviews on the topic of temperature and health were identified in the searches (Anderson et al., 2013; Bouchama et al., 2007; Hajat, O'Connor, & Kosatsky, 2010; Kovats & Hajat, 2008; Oudin Astrom, Bertil, & Joacim, 2011; Rashid, 2015; Thomson, Thomas, Sellstrom, & Petticrew, 2013). Most of these studies did not report rigorous methods and none answered the specific PECO question. Four studies exclusively assessed outdoor temperatures (Bouchama et al., 2007; Hajat et al., 2010; Kovats & Hajat, 2008; Oudin Astrom et al., 2011) and one assessed interventions to improve housing but did not consider any interventions relevant to this review (Thomson et al., 2013). One paper exclusively assessed office and health care settings (Rashid, 2015). The final paper (Anderson et al., 2013) conducted a review of the literature with the aim of defining indoor heat thresholds for health in the United Kingdom. One of the objectives of the review was to review the current evidence on the link between heat and health. The authors highlighted the need for more longitudinal studies on the impact of indoor heat and health and concluded that given the current literature, they did not consider it to be feasible to define indoor thresholds on a widespread or national basis. Further, there are two systematic reviews on “Defining Overheating” and “Impacts of Overheating” produced by the Zero Carbon Hub (Zero Carbon Hub, 2015c, 2015d). These reports are discussed in more detail in Appendix 14.

Studies measuring indoor temperature in residences

Nine papers reporting on eight separate studies were conducted, which monitored indoor temperatures in residences (Lomas & Kane, 2013; Mavrogianni, Davies, Wilkinson, & Pathan, 2010; Quinn et al., 2014; Sakka, Santamouris, Livada, Nicol, & Wilson, 2012; Soebarto & Bennetts, 2014; Tamerius et al., 2013; Walsh, Loane, Doyle, Kealy, & Acfarlane, 2013; White-Newsome et al., 2012, 2011).

Nine papers (eight studies) investigated indoor temperatures and looked at exposure of residents to high internal temperatures, although they did not record any health outcomes (Lomas & Kane, 2013; Mavrogianni et al., 2010; Quinn et al., 2014; Sakka et al., 2012; Soebarto & Bennetts, 2014; Tamerius et al., 2013; Walsh et al., 2013; White-Newsome et al., 2011, 2012). One study did report on the residents' thermal comfort (Soebarto & Bennetts, 2014).

Relationship between indoor and outdoor temperatures

Four studies (five papers) investigated the differences between internal and external temperatures over the summer months (Quinn et al., 2014; Sakka et al., 2012; Tamerius et al., 2013; White-Newsome et al., 2011, 2012). These studies have concluded that significant differences in thermal stress and hence occupant heat exposure may exist for different sub-populations and households, even when houses are in the same area. Households have recorded high internal temperatures, sometimes exceeding dangerous heat threshold levels (Quinn et al., 2014) and sometimes higher than external temperatures (Tamerius et al., 2013).

These studies have highlighted the difficulty in developing an index to link indoor temperature and outdoor temperature. One study comments that factors that might influence the internal temperature include stable attributes (e.g. building type, window placement and socioeconomic status) as well as behavioural factors (e.g. cooking, bathing, and use of air conditioning) (Quinn et al., 2014).

Cross-sectional studies recording indoor temperature

One cross-sectional study (two papers) measured indoor temperature at one point in time but did not record health outcomes as required by WHO (Gustafson et al., 2014; Quandt, Wiggins, Chen, Bischoff, & Arcury, 2013). These papers reported on different aspects of a cross sectional study which reviewed the accommodation of Latino migrant farmers in North Carolina, the USA. Quandt et al. (2013) reported on the number of sleeping areas which had a dangerous heat index, whereas Gustafson et al. (2014) looked at the heat index along with other accommodation features in relation to the outcomes of skin conditions such as rash, scaling, blisters, pruritus, and ingrown nails.

Indoor temperature measurement in non-residential environments

Eleven papers provided results for studies conducted in climate controlled chambers or other controlled non-residential environments. These studies usually used a small number of young, healthy volunteers and many measured thermal comfort as their outcome. The studies found are summarized in Appendix 17, although it should be noted that the search strategy was not set-up to retrieve these studies, and therefore it cannot be guaranteed that all such studies were identified.

Although the PECO question required direct correlation between high indoor temperature and specified health outcomes it might be worth noting the evidence between health outcomes and thermal comfort. A review by Ormandy (Ormandy & Ezratty, 2012) reviews the history of WHO guidance regarding the thresholds for indoor temperatures. Their report indicates that the perception of thermal comfort has been linked to self-reported health outcomes in the WHO Large Analysis and Review of European housing and health Status (LARES) study. However, it was noted that using the perception of thermal comfort proves difficult in some of the vulnerable populations such as the elderly where there is evidence that they do not 'discriminate' temperatures well, or the very young or severely disabled where communication of thermal comfort may be an issue.

Building standards

Indoor thermal thresholds have been identified by a number of different groups. The recent 'defining overheating' report from the Zero Carbon Hub (Zero Carbon Hub, 2015c) contains an in-depth look at the different thermal comfort building standards.

One of the most common standards discussed in the studies identified in this review was the ANSI/ASHRAE Standard 55 (Thermal Environmental Conditions for Human Occupancy), which is a standard that provides minimum requirements for acceptable thermal indoor environments. It establishes the ranges of indoor environmental conditions that are acceptable to achieve thermal comfort for occupants.

The Chartered Institute of Building Services Engineers (CIBSE) published a technical memorandum of Health Issues in Building Services in 2006 (Chartered Institute of Building Services Engineers, 2006). This document contained a review of the current legislation and a review of current guidelines and their relevance to building services engineers. No information about the methods used to develop the review was provided. The document focuses on work environments and provides an illustrative relationship between room temperature and performance at temperatures between 15 and 35°C based on nine studies; all published before 2004. This document was based on absolute temperature thresholds and has recently been superseded by TM52, based on adaptive thermal comfort approaches (Chartered Institute of Building Services Engineers, 2013).

Anderson et al. (Anderson et al., 2013) note that both, the current ASHRAE and CIBSE standards, are based on a working environment and are therefore limited to a healthy workforce.

Vulnerable populations

Elderly people: No evidence was found, which related indoor temperature to health outcomes in older people. There is a body of evidence that identifies people over 65 years, particularly those living in nursing and care homes, as particularly vulnerable during a heat wave (Dhainaut, Claessens, Ginsburg, & Riou, 2004; Hajat, Kovats, & Lachowycz, 2007; Klenk, Becker, & Rapp, 2010). Although these studies have been based on outdoor temperatures, it seems likely that many of the participants will have spent a lot of their time indoors and will therefore have been exposed to high indoor temperatures. One case-control study was identified with cases being people who had died at home from heat-related causes during the 2003 heat wave in France and had been at home at least 24 hours before their death (Vandentorren et al., 2006). Due to the study design it was not possible to measure indoor temperature during the time leading up to death. However, researchers visited the homes as part of the study and were able to identify factors, which may have increased the risk of death. The risk of death was higher for those who had a lack of mobility, were confined to bed or had pre-existing medical conditions (Vandentorren et al., 2006). Some studies have reported that the elderly may not be good at discriminating temperature and may feel comfortable at temperatures that are outside of the 'safe' thresholds as defined by building standards (Ormandy & Ezratty, 2012; van Hoof, Kort, Hensen, Duijnste, & Rutten, 2010).

Infants and children: We did not find any relevant information about the health risk of increased heat in infants and children.

Slum residents: There were three papers investigating the effects of heat of people living in slums in India (Sinha et al., 2010; Sinha, Taneja, Dhuria, & Saha, 2008; Tran et al., 2013). One cross-sectional study (Tran et al., 2013) explored associations between heat illness and household vulnerability factors. Although indoor temperature was not recorded, the study noted that the indoor temperature was often perceived by residents to be higher than the outdoor temperature. About 20% of participants reported symptoms of heat illness and approximately 1% reported severe heat illness. Two longitudinal studies of people living in slums in India by the same author were identified by the systematic review (Sinha et al., 2010, 2008). The 2008 study (Sinha et al., 2008) compared the prevalence of the symptoms of dizziness, giddiness, fainting and weakness during the winter and summer months but did

not measure indoor temperatures in either season. The 2010 study (Sinha et al., 2010) measured the indoor temperature and blood pressure for 132 normotensive women living in slums in India in each of the four seasons.

Persons during illness or confined to their home: One study (Holstein, Canoui-Poitaine, Neumann, Lepage, & Spira, 2005) assessed the functional status of patients in a nursing home during the 2003 European heatwave. Results show that the mortality rate of less dependent residents of nursing homes increased to the same rate as of highly dependent residents during the heat wave. The authors suggest that this may have been due to more care being focused on highly dependent patients during this period. This result, however, was not repeated in other studies (Klenk et al., 2010; Lorente, Serazin, Daube, Tillaut, & Salines, 2004).

Health inequalities

One study looking at the relationship between indoor and outdoor temperatures (Tamerius et al., 2013) commented that it was a possibility that observed geographic and demographic differences in climate-health relationships across latitude, socioeconomic status and age may be partly because of differences in the management of indoor climate.

In their study of indoor and outdoor temperatures, Quinn et al. (2014) comment that like other health risks, heat stress is more likely to have adverse effects, including fatalities, among residents at the lower end of the socioeconomic spectrum. This may be related to the ability to afford the cost of cooling residential properties. In addition, the emissions created by the use of the cooling units have the potential to create a positive feedback loop. Besides, the use of natural ventilation by opening windows may be limited in some areas due to pollution, crime, noise or keeping a home airtight (Anderson et al., 2013).

Discussion

The findings of this systematic review, and supported by other recent reviews in this area (Anderson et al., 2013; Zero Carbon Hub, 2015a, 2015c), show that there is a lack of epidemiologic studies investigating the effect of indoor dwelling temperature on health outcomes. The difficulty of completing such studies has been discussed previously (Ormandy & Ezratty, 2012) and lies, amongst others, in the number of participants required to have enough power to detect significant differences in outcomes and the difficulty of installing temperature sensors in homes.

The terminology used in studies of overheating has been discussed in previous reviews (Anderson et al., 2013; Zero Carbon Hub, 2015c). These studies note that when indoor temperatures are investigated, the outcomes are usually expressed in terms of 'thermal comfort'. Whereas when outdoor temperatures are discussed, 'mortality and morbidity' terms are used. It has been suggested (Zero Carbon Hub, 2015c) that this may be because of the background from where the research originates. Indoor research has traditionally been instigated from the building services sector whereas outdoor temperature research has often originated from a public health standpoint.

Contributors

Lead: Karen Head (Freelance systematic reviewer, St. Genis-Pouilly, France), Mike Clarke (Queen's University of Belfast, Northern Ireland and Evidence Aid, United Kingdom).

Team: Meghan Bailey (Environmental Change Institute, University of Oxford, United Kingdom), Alicia Livinski (National Institutes of Health Library, Washington. USA), Ramona Ludolph (Department of Public Health, Environmental and Social Determinants of Health, World Health Organization, Switzerland), Ambrish Singh (Independent Researcher, New Delhi, India).

Claire Allen (Evidence Aid, the United Kingdom) provided project coordination and copy editing. Kath Wright (Centre for Reviews and Dissemination, University of York, the United Kingdom) designed and refined the search strategies.

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Appendices

Appendix 1 Search strategy for EMBASE (including MEDLINE) – original search conducted in January 2015

Searched via OVIDSP

Search date: 13 January 2015

Search strategy:

Identified 4339 records all years

Deduplicated within Embase to 4291 records

- 1 housing/ or home for the aged/ or nursing home/ (63379)
- 2 air conditioning/ or humidity/ or heating/ (58378)
- 3 temperature/ or low temperature/ or high temperature/ or room temperature/ (228309)
- 4 2 or 3 (274302)
- 5 1 and 4 (948)
- 6 (indoor adj2 temperature\$.ti,ab. (295)
- 7 heat exposure\$.ti,ab. (1764)
- 8 (heat wave\$ or heatwave\$).ti,ab. (1025)
- 9 hot spell\$.ti,ab. (11)
- 10 thermal stress.ti,ab. (2597)
- 11 (indoor adj2 heat\$).ti,ab. (92)
- 12 domestic temperature\$.ti,ab. (2)
- 13 air condition\$.ti,ab. (3267)
- 14 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (8831)
- 15 1 and 14 (159)
- 16 (cooling adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (29)
- 17 (ventilat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (1497)
- 18 (insulat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (175)

- 19 (heat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (456)
- 20 (thermal adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (61)
- 21 (humidity adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (40)
- 22 (temperature\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (417)
- 23 (air condition\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (154)
- 24 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 (2747)
- 25 ((increas\$ or raise\$ or elevat\$ or suscept\$ or ambient) adj2 (temperature\$ or heat)).ti,ab. (57282)
- 26 25 and 1 (72)
- 27 5 or 15 or 24 or 26 (3705)
- 28 (animal/ or nonhuman/) not exp human/ (4701216)
- 29 27 not 28 (3340)
- 30 (animal or animals or mouse or mice or rat or rats or rabbit\$ or cat or cats or feline or dog or dogs or canine or pig or pigs or porcine or swine or horse or horses or cattle or cow or cows or calf or calves or bovine or goat or goats or sheep or ovine or poultry).ti. (2061441)
- 31 29 not 30 (3280)
- 32 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$).ti,ab. (424851)
- 33 32 and 3 (4450)
- 34 limit 33 to humans (1254)
- 35 34 not 30 (1232)
- 36 31 or 35 (4339)

Appendix 2 Search strategy for Greenfile – original search conducted in January 2015

Searched via EBSCO

Search date: 15 January 2014

4447 records retrieved all years

Search history

#	Query	Results
S31	S1 OR S4 OR S14 OR S23 OR S25 OR S30	4 447
S30	S2 AND S29	606
S29	S26 OR S27 OR S28	8 516
S28	((DE "VENTILATION") OR (DE "AIR conditioning")) OR (DE "HUMIDITY")	3 283
S27	DE "SEASONAL temperature variations"	76
S26	DE "TEMPERATURE" OR DE "TEMPERATURE control" OR DE "TEMPERATURE effect"	5 520
S25	S2 AND S24	12
S24	(increas* or raise* or elevat* or suscept* or ambient) N2 (temperature* or heat)	408
S23	S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22	3 778
S22	air condition* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	938
S21	temperature* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	190
S20	humidity N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	19
S19	thermal N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	414
S18	heat* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	1 036

#	Query	Results
S17	insulat* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	324
S16	ventilat* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	1 473
S15	cooling N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	288
S14	S2 AND S13	893
S13	S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12	10 445
S12	air condition*	9 382
S11	domestic temperature*	32
S10	indoor N2 heat*	68
S9	thermal stress	324
S8	hot spell*	7
S7	Heat wave* or heatwave*	456
S6	heat exposure*	111
S5	indoor N2 temperature*	284
S4	S2 AND S3	136
S3	DE "HEALTH"	5 152
S2	T1 house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*	11 720
S1	DE "HOUSING & health"	89

Appendix 3 Search strategy for MEDLINE – original search conducted in January 2015

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

Searched via OVIDSP

Search date: 13 January 2015

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

Identified 3710 records all years

Deduplicated within database to 3703 records all years

Search strategy:

-
- 1 housing/ or housing for the elderly/ or public housing/ or homes for the aged/ or nursing homes/ (48221)
 - 2 ventilation/ or air conditioning/ or humidity/ or heating/ (22579)
 - 3 temperature/ or cold temperature/ or hot temperature/ (318168)
 - 4 2 or 3 (332712)
 - 5 1 and 4 (1133)
 - 6 (indoor adj2 temperature\$.ti,ab. (221)
 - 7 heat exposure\$.ti,ab. (1589)
 - 8 (heat wave\$ or heatwave\$).ti,ab. (871)
 - 9 hot spell\$.ti,ab. (10)
 - 10 thermal stress.ti,ab. (2420)
 - 11 (indoor adj2 heat\$).ti,ab. (71)
 - 12 domestic temperature\$.ti,ab. (1)
 - 13 air condition\$.ti,ab. (2311)
 - 14 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (7311)
 - 15 1 and 14 (168)
 - 16 (cooling adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (21)

- 17 (ventilat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (1066)
- 18 (insulat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (112)
- 19 (heat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (329)
- 20 (thermal adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (51)
- 21 (humidity adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (23)
- 22 (temperature\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (303)
- 23 (air condition\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (98)
- 24 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 (1940)
- 25 ((increas\$ or raise\$ or elevat\$ or suscept\$ or ambient) adj2 (temperature\$ or heat)).ti,ab. (52250)
- 26 25 and 1 (48)
- 27 5 or 15 or 24 or 26 (3045)
- 28 exp animals/ not humans/ (3967499)
- 29 27 not 28 (2804)
- 30 (animal or animals or mouse or mice or rat or rats or rabbit\$ or cat or cats or feline or dog or dogs or canine or pig or pigs or porcine or swine or horse or horses or cattle or cow or cows or calf or calves or bovine or goat or goats or sheep or ovine or poultry).ti. (1842540)
- 31 29 not 30 (2773)
- 32 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$).ti,ab. (333959)
- 33 32 and 3 (3667)
- 34 limit 33 to humans (1197)
- 35 34 not 30 (1184)
- 36 31 or 35 (3710)

Appendix 4 Search Strategy for PAIS International – original search conducted in January 2015

Searched via ProQuest

Search date: 14 January 2014

Identified 375 records all years

Select all	Set	Search	Databases	Results	Actions
Select item 22	S22	<p>((ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND (ab(ventilation OR air condition* OR humidity OR heating OR temperature) OR ti(ventilation OR air condition* OR humidity OR heating OR temperature))) OR ((ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND ((ab(indoor NEAR/2 temperature*) OR ti(indoor NEAR/2 temperature*) OR ab(heat exposure*) OR ti(heat exposure*) OR ab(heat wave* OR heatwave*) OR ti(heat wave* OR heatwave*) OR ab(hot spell*) OR ti(hot spell*) OR ab(thermal stress) OR ab(thermal stress)) OR (ab(indoor NEAR/2 heat*) OR ti(indoor NEAR/2 heat*) OR ab(domestic temperature*) OR ti(domestic temperature*) OR ab(air condition*) OR ti(air condition*)))) OR ((ab(cooling NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(cooling NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))) OR (ab(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))) OR (ab(insulat** NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))) OR (ab(heat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(heat* NEAR/2 (house OR</p>	PAIS International	375°	Actions

Select all	Set	Search	Databases	Results	Actions
		<p>houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ((ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND (ab((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat)) OR ti((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat))))</p>			
Select item 21	S21	<p>(ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND (ab((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat)) OR ti((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat)))</p>	PAIS International	23°	Actions
Select item 20	S20	<p>ab((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat)) OR ti((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat))</p>	PAIS International	141°	Actions
Select item 18	S18	<p>(ab(cooling NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(cooling NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR</p>	PAIS International	165°	Actions

Select all	Set	Search	Databases	Results	Actions
		<p>slum*)) OR ti(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(insulat** NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(heat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(heat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))</p>			
Select item 17	S17	<p>ab(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))</p>	PAIS International	9°	Actions

Select all	Set	Search	Databases	Results	Actions
Select item 16	S16	ab(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS International	5°	Actions
Select item 15	S15	ab(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS International	0°	Actions
Select item 14	S14	ab(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS International	10°	Actions
Select item 13	S13	ab(heat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(heat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS International	110°	Actions
Select item 12	S12	ab(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS International	22°	Actions
Select item 11	S11	ab(insulat** NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS International	22°	Actions
Select item 10	S10	ab(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS International	5°	Actions
Select item 9	S9	ab(cooling NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) OR ti(cooling NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))	PAIS International	12°	Actions
Select item 8	S8	(ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR	PAIS International	76°	Actions

Select all	Set	Search	Databases	Results	Actions
		shelter* OR slum*) AND ((ab(indoor NEAR/2 temperature*) OR ti(indoor NEAR/2 temperature*) OR ab(heat exposure*) OR ti(heat exposure*) OR ab(heat wave* OR heatwave*) OR ti(heat wave* OR heatwave*) OR ab(hot spell*) OR ti(hot spell*) OR ab(thermal stress) OR ab(thermal stress)) OR (ab(indoor NEAR/2 heat*) OR ti(indoor NEAR/2 heat*) OR ab(domestic temperature*) OR ti(domestic temperature*) OR ab(air condition*) OR ti(air condition*)))			
Select item 7	S7	(ab(indoor NEAR/2 temperature*) OR ti(indoor NEAR/2 temperature*) OR ab(heat exposure*) OR ti(heat exposure*) OR ab(heat wave* OR heatwave*) OR ti(heat wave* OR heatwave*) OR ab(hot spell*) OR ti(hot spell*) OR ab(thermal stress) OR ab(thermal stress)) OR (ab(indoor NEAR/2 heat*) OR ti(indoor NEAR/2 heat*) OR ab(domestic temperature*) OR ti(domestic temperature*) OR ab(air condition*) OR ti(air condition*))	PAIS International	413°	Actions
Select item 6	S6	ab(indoor NEAR/2 heat*) OR ti(indoor NEAR/2 heat*) OR ab(domestic temperature*) OR ti(domestic temperature*) OR ab(air condition*) OR ti(air condition*)	PAIS International	309°	Actions
Select item 5	S5	ab(indoor NEAR/2 temperature*) OR ti(indoor NEAR/2 temperature*) OR ab(heat exposure*) OR ti(heat exposure*) OR ab(heat wave* or heatwave*) OR ti(heat wave* or heatwave*) OR ab(hot spell*) OR ti(hot spell*) OR ab(thermal stress) OR ab(thermal stress)	PAIS International	117°	Actions
Select item 4	S4	(ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND (ab(ventilation OR air condition* OR humidity OR heating OR temperature) OR ti(ventilation OR air condition* OR humidity OR heating OR temperature))	PAIS International	334°	Actions
Select item 3	S3	ab(ventilation or air condition* or humidity or heating or temperature) OR ti(ventilation or air condition* or humidity or heating or temperature)	PAIS International	1362°	Actions
Select item 2	S2	ab(house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*) OR ti(house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	PAIS International	41026*	Actions

* Duplicates are removed from your search, but included in your result count. _

Appendix 5 Search Strategy for Science Citation Index – original search conducted in January 2015

Searched via Web of Science

Search date: 14 January 2015

Records retrieved 5283

# 30	5 283	#29 OR #22 OR #13 OR #11 Indexes=SCI-EXPANDED Timespan=1900–2015
# 29	45	#28 AND #10 Indexes=SCI-EXPANDED Timespan=1900–2015
# 28	20 053	#27 OR #26 OR #25 OR #24 OR #23 Indexes=SCI-EXPANDED Timespan=1900–2015
# 27	5 399	TI=(ambient* NEAR/2 (temperature* or heat)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 26	1 031	TI=(suscept* NEAR/2 (temperature* or heat)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 25	11 141	TI=(elevat* NEAR/2 (temperature* or heat)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 24	146	TI=(raise* NEAR/2 (temperature* or heat)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 23	2 623	TI=(increas* NEAR/2 (temperature* or heat)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 22	3 115	#21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 Indexes=SCI-EXPANDED Timespan=1900–2015
# 21	178	TI=("air condition*" NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 20	233	TI=(temperature* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 19	26	TI=(humidity NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 18	652	TI=(thermal* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 17	673	TI=(heat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 16	262	TI=(insulat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 15	911	TI=(ventilat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 14	312	TI=(cooling NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SCI-EXPANDED Timespan=1900–2015
# 13	3 799	#12 AND #10 Indexes=SCI-EXPANDED Timespan=1900–2015

# 12	771 198	TI=(ventilation or humidity or heating or temperature) Indexes=SCI-EXPANDED Timespan=1900–2015
# 11	362	#10 AND #9 Indexes=SCI-EXPANDED Timespan=1900–2015
# 10	148 072	TI=(house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*) Indexes=SCI-EXPANDED Timespan=1900–2015
# 9	7 421	#8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 Indexes=SCI-EXPANDED Timespan=1900–2015
# 8	3 111	TI=("air condition*") Indexes=SCI-EXPANDED Timespan=1900–2015
# 7	2	TI=("domestic temperature*") Indexes=SCI-EXPANDED Timespan=1900–2015
# 6	60	TI=(indoor NEAR/2 heat*) Indexes=SCI-EXPANDED Timespan=1900–2015
# 5	2 712	TI=("thermal stress") Indexes=SCI-EXPANDED Timespan=1900–2015
# 4	14	TI=("hot spell*") Indexes=SCI-EXPANDED Timespan=1900–2015
# 3	937	TI=("Heat wave*" OR heatwave*) Indexes=SCI-EXPANDED Timespan=1900–2015
# 2	475	TI=("heat exposure*") Indexes=SCI-EXPANDED Timespan=1900–2015
# 1	127	TI=(indoor NEAR/2 temperature*) Indexes=SCI-EXPANDED Timespan=1900–2015

Appendix 6 Search Strategy for Social Science Citation Index – original search conducted in January 2015

Searched via Web of Science

Search date: 14 January 2015

Records retrieved 2404

# 30	2 404	#29 OR #22 OR #13 OR #11 Indexes=SSCI Timespan=1900–2015
# 29	144	#28 AND #10 Indexes=SSCI Timespan=1900–2015
# 28	1 390	#27 OR #26 OR #25 OR #24 OR #23 Indexes=SSCI Timespan=1900–2015
# 27	728	TOPIC: (ambient* NEAR/2 (temperature* or heat)) Indexes=SSCI Timespan=1900–2015
# 26	22	TOPIC: (suscept* NEAR/2 (temperature* or heat)) Indexes=SSCI Timespan=1900–2015
# 25	206	TOPIC: (elevat* NEAR/2 (temperature* or heat)) Indexes=SSCI Timespan=1900–2015
# 24	55	TOPIC: (raise* NEAR/2 (temperature* or heat)) Indexes=SSCI Timespan=1900–2015
# 23	1 161	TOPIC: (increas* NEAR/2 (temperature* or heat)) Indexes=SSCI Timespan=1900–2015
# 22	648	#21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 Indexes=SSCI Timespan=1900–2015
# 21	38	TOPIC: ("air condition*" NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SSCI Timespan=1900–2015
# 20	65	TOPIC: (temperature* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SSCI Timespan=1900–2015
# 19	10	TOPIC: (humidity NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SSCI Timespan=1900–2015
# 18	98	TOPIC: (thermal* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SSCI Timespan=1900–2015
# 17	259	TOPIC: (heat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SSCI Timespan=1900–2015
# 16	61	TOPIC: (insulat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SSCI Timespan=1900–2015
# 15	136	TOPIC: (ventilat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SSCI Timespan=1900–2015
# 14	59	TOPIC: (cooling NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) Indexes=SSCI Timespan=1900–2015
# 13	2 210	#12 AND #10 Indexes=SSCI Timespan=1900–2015

# 12	20 167	TOPIC: (ventilation or humidity or heating or temperature) Indexes=SSCI Timespan=1900–2015
# 11	289	#10 AND #9 Indexes=SSCI Timespan=1900–2015
# 10	225 813	TOPIC: (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*) Indexes=SSCI Timespan=1900–2015
# 9	1 171	#8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 Indexes=SSCI Timespan=1900–2015
# 8	448	TOPIC: ("air condition*") Indexes=SSCI Timespan=1900–2015
# 7	0	TOPIC: ("domestic temperature*") Indexes=SSCI Timespan=1900–2015
# 6	21	TOPIC: (indoor NEAR/2 heat*) Indexes=SSCI Timespan=1900–2015
# 5	126	TOPIC: ("thermal stress") Indexes=SSCI Timespan=1900–2015
# 4	7	TOPIC: ("hot spell*") Indexes=SSCI Timespan=1900–2015
# 3	450	TOPIC: ("Heat wave*" OR heatwave*) Indexes=SSCI Timespan=1900–2015
# 2	133	TOPIC: ("heat exposure*") Indexes=SSCI Timespan=1900–2015
# 1	60	TOPIC: (indoor NEAR/2 temperature*) Indexes=SSCI Timespan=1900–2015

Appendix 7 Excluded articles following check of the full text in 2015

Ref ID	Reference	Final decision
Aliu2013	Aliu, I.R., & Adebayo, A. (2013). Establishing a nexus between residential quality and health risk: An exploratory analytical approach. <i>Indoor and Built Environment</i> , 22(6), 852–863.	Exclude [not relevant exposure]
Anderson2013	Anderson, M., Carmichael, C., Murray, V., Dengel, A., & Swainson, M. (2013). Defining indoor heat thresholds for health in the UK. <i>Perspectives in Public Health</i> , 133(3), 158–164.	Exclude [multiple reasons]
Aronow2004	Aronow, W.S., & Ahn, C. (2004). Elderly nursing home patients with congestive heart failure after myocardial infarction living in new york city have a higher prevalence of mortality in cold weather and warm weather months. <i>Journals of Gerontology Series A-Biological Sciences and Medical Sciences</i> , 59(2), 146–147.	Exclude [not relevant exposure]
Bouchama2007	Bouchama, A., Dehbi, M., Mohamed, G., Matthies, F., Shoukri, M., & Menne, B. (2007). Prognostic factors in heat wave related deaths: a meta-analysis. <i>Archives of Internal Medicine</i> , 167(20), 2170–2176.	Exclude [not relevant exposure]
Brown2008	Brown, S., & Walker, G. (2008). Understanding heat wave vulnerability in nursing and residential homes. <i>Building Research and Information</i> , 36(4), 363–372.	Exclude [not relevant exposure]
Brunetti2013	Brunetti, N.D., Amoroso, D., De Gennaro, L., Dellegrottaglie, G., Di Giuseppe, G., Antonelli, G., & Di Biase, M. (2013). Hot Spot: Impact of July 2011 heat-wave in southern Italy (Apulia) on cardiovascular disease assessed by Emergency Medical Service and tele-medicine support. <i>European Heart Journal</i> , 34, 469.	Exclude [not relevant exposure]
Chen2011a	Chen, C.-P., Hwang, R.-L., Chang, S.-Y., & Lu, Y.-T. (2011). Effects of temperature steps on human skin physiology and thermal sensation response. <i>Building and Environment</i> , 46(11), 2387–2397.	Exclude [not relevant outcome]
Ciancio2007	Ciancio, B.C., Di Renzi, M., Binkin, N., Perra, A., Prato, R., Bella, A., ... Fusco, A. (2007). [Risk factors for mortality during a heat-wave in Bari (Italy), summer 2005.]. <i>Igiene E Sanita Pubblica</i> , 63(2), 113–125.	Exclude [foreign language]
Dhainaut2004	Dhainaut, J.F., Claessens, Y.E., Ginsburg, C., & Riou, B. (2004). Unprecedented heat-related deaths during the 2003 heat wave in Paris: consequences on emergency departments. <i>Critical Care (London, England)</i> , 8(1), 1–2.	Exclude [multiple reasons]
Efstratopoulos2008	Efstratopoulos, A., Voyaki, S., Mourgos, L., & Meikopoulos, M. (2008). Effect of ambient temperature on office, home and 24-h ambulatory blood pressure in patients with essential hypertension. <i>Journal of Hypertension</i> , 26, S87–S88.	Exclude [not relevant exposure]
Fang2004	Fang, L., Wyon, D.P., Clausen, G., & Fanger, P.O. (2004). Impact of indoor air temperature and humidity in an office on perceived air quality, SBS symptoms and performance. <i>Indoor Air</i> , 14 Suppl 7, 74–81.	Exclude [not relevant outcome]
Firlag2005	Firlag, M., Gussmann, V., Mandt, M., Ploss, P., Schilder, M., Sulflow, H., & Unterarbeitsgruppe "Pflege" der Hessischen Arbeitsgruppe zur Gesundheits-Pravention Bei, H. (2005). [Hot summer in the nursing home: some do not like it hot]. <i>Pflege Zeitschrift</i> , 58(7), 440–444.	Exclude [foreign language]

Ref ID	Reference	Final decision
Foroni2007	Foroni, M., Salvioli, G., Rielli, R., Goldoni, C.A., Orlandi, G., Zauli Sajani, S., ... Mussi, C. (2007). A retrospective study on heat-related mortality in an elderly population during the 2003 heat wave in Modena, Italy: the Argento Project. <i>Journals of Gerontology Series A-Biological Sciences and Medical Sciences</i> , 62(6), 647–651.	Exclude [not relevant exposure]
Fouillet2006	Fouillet, A., Rey, G., Laurent, F., Pavillon, G., Bellec, S., Guihenneuc-Jouyaux, C., ... Hemon, D. (2006). Excess mortality related to the August 2003 heat wave in France. <i>International Archives of Occupational and Environmental Health</i> , 80(1), 16–24.	Exclude [not relevant exposure]
Friebel2005	Friebel, P. (2005). Thermal pressure of the population in large cities during periods of heat. Conclusion from diseases and fatalities in the Karlsruhe Nursing Home in August 2003. <i>Gesundheitswesen</i> , 67(3), 245.	Exclude [foreign language]
Garszen2005	Garszen, J., Harmsen, C., & de Beer, J. (2005). The effect of the summer 2003 heat wave on mortality in the Netherlands. <i>Euro Surveillance: Bulletin Europeen Sur Les Maladies Transmissibles = European Communicable Disease Bulletin</i> , 10(7), 165–168.	Exclude [not relevant exposure]
Goggins2012	Goggins, W.B., Chan, E.Y., Ng, E., Ren, C., & Chen, L. (2012). Effect modification of the association between short-term meteorological factors and mortality by urban heat islands in Hong Kong. <i>PLoS ONE [Electronic Resource]</i> , 7(6), e38551.	Exclude [multiple reasons]
Goggins2013	Goggins, W.B., Chan, E.Y., Yang, C., & Chong, M. (2013). Associations between mortality and meteorological and pollutant variables during the cool season in two Asian cities with sub-tropical climates: Hong Kong and Taipei. <i>Environmental Health: A Global Access Science Source</i> , 12, 59.	Exclude [multiple reasons]
Graudenz2005	Graudenz, G.S., Oliveira, C.H., Tribess, A., Mendes Jr., C., Latorre, M.R., & Kalil, J. (2005). Association of air-conditioning with respiratory symptoms in office workers in tropical climate. <i>Indoor Air</i> , 15(1), 62–66.	Exclude [multiple reasons]
Grewe2010	Grewe, H.A., Heckenhahn, M., Blattner, B., & Muller, K. (2010). Community-Based Prevention of Climate-Associated Health Risks. <i>Gesundheitswesen</i> , 72(8-9), 466–471.	Exclude [foreign language]
Grewe2014	Grewe, H.A., Heckenhahn, S., & Blattner, B. (2014). Health protection during heat waves. European recommendations and experience in Hesse. <i>Zeitschrift Fur Gerontologie Und Geriatrie</i> , 47(6), 483–489.	Exclude [foreign language]
Grossmann2012	Grossmann, K., Franck, U., Kruger, M., Schlink, U., Schwarz, N., & Stark, K. (2012). Social dimensions of heat-stress in cities. <i>Disp</i> , 48(4), 56–68.	Exclude [foreign language]
Gustafson2014	Gustafson, C.J., Feldman, S.R., Quandt, S.A., Isom, S., Chen, H., Spears, C.R., & Arcury, T.A. (2014). The association of skin conditions with housing conditions among north carolina latino migrant farm workers. <i>International Journal of Dermatology</i> , 53(9), 1091–1097.	Exclude [not relevant outcome]
Haines2013	Haines, A., Bruce, N., Cairncross, S., Davies, M., Greenland, K., Hiscox, A., ... Wilkinson, P. (2013). Promoting health and advancing development through improved housing in low-income settings. <i>Journal of Urban Health</i> , 90(5), 810–831.	Exclude [multiple reasons]

Ref ID	Reference	Final decision
Hajat2007	Hajat, S., Kovats, R.S., & Lachowycz, K. (2007). Heat-related and cold-related deaths in England and Wales: who is at risk? <i>Occupational and Environmental Medicine</i> , 64(2), 93–100.	Exclude [not relevant exposure]
Hajat2010	Hajat, S., O'Connor, M., & Kosatsky, T. (2010). Health effects of hot weather: from awareness of risk factors to effective health protection. <i>Lancet</i> , 375(9717), 856–863.	Exclude [multiple reasons]
Hasegawa2014	Hasegawa, K., & Yoshino, H. (2014). National Survey on Ventilation Systems and the Health of Occupants in Japanese Homes. <i>International Journal of Ventilation</i> , 13(2), 141–151.	Exclude [multiple reasons]
Heudorf2005	Heudorf, U., & Meyer, C. (2005). Heat waves and health—Analysis of the mortality in Frankfurt, Germany, during the heat wave in august 2003. <i>Gesundheitswesen</i> , 67(5), 369–374.	Exclude [foreign language]
Holstein2005	Holstein, J., Canoui-Poitrine, F., Neumann, A., Lepage, E., & Spira, A. (2005). Were less disabled patients the most affected by 2003 heat wave in nursing homes in Paris, France? <i>Journal of Public Health</i> , 27(4), 359–365.	Exclude [not relevant exposure]
Huang2013	Huang, C., Barnett, A.G., Xu, Z., Chu, C., Wang, X., Turner, L.R., & Tong, S. (2013). Managing the health effects of temperature in response to climate change: challenges ahead. <i>Environmental Health Perspectives</i> , 121(4), 415–419.	Exclude [multiple reasons]
Ikaga2012	Ikaga, T., Hori, S., Miyake, Y., Suzuki, M., & Murakami, Y. (2012). [Indoor environment and heatstroke risk]. <i>Nippon Rinsho—Japanese Journal of Clinical Medicine</i> , 70(6), 1005–1012.	Exclude [foreign language]
Iwabu2010	Iwabu, A., Konishi, K., Tokutake, H., Yamane, S., Ohnishi, H., Tominaga, Y., & Kusachi, S. (2010). Inverse correlation between seasonal changes in home blood pressure and atmospheric temperature in treated-hypertensive patients. <i>Clinical and Experimental Hypertension (New York)</i> , 32(4), 221–226.	Exclude [not relevant exposure]
Jackson2011	Jackson, G., Thornley, S., Woolston, J., Papa, D., Bernacchi, A., & Moore, T. (2011). Reduced acute hospitalization with the healthy housing programme. <i>Journal of Epidemiology and Community Health</i> , 65(7), 588–593.	Exclude [multiple reasons]
Jin2011	Jin, Q., Duanmu, L., Zhang, H., Li, X., & Xu, H. (2011). Thermal sensations of the whole body and head under local cooling and heating conditions during step-changes between workstation and ambient environment. <i>Building and Environment</i> , 46(11), 2342–2350.	Exclude [multiple reasons]
Joubert2011	Joubert, D., Thomsen, J., & Harrison, O. (2011). Safety in the Heat: A Comprehensive Program for Prevention of Heat Illness Among Workers in Abu Dhabi, United Arab Emirates. <i>American Journal of Public Health</i> , 101(3), 395–398.	Exclude [multiple reasons]
Kayaba2015	Kayaba, M., Kondo, M., & Honda, Y. (2015). Characteristics of elderly people living in non-air-conditioned homes. <i>Environmental Health and Preventive Medicine</i> , 20(1), 68–71.	Exclude [multiple reasons]
Keatinge2004	Keatinge, W. R., & Donaldson, G. C. (2004). The impact of global warming on health and mortality. <i>Southern Medical Journal</i> , 97(11), 1093–1099.	Exclude [not relevant study design]

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Kent2012	Kent, S. T., McClure, L. A., Howard, V. J., Crosson, W. L., Al-Hamdan, M. Z., Wadley, V. G., ... Kabagambe, E. K. (2012). Relationship between sunlight and temperature exposure to stroke incidence in the reasons for geographic and racial differences in stroke (regards) study. <i>Stroke</i> , 43 (2 Meet).	Exclude [not relevant exposure]
Kim2012	Kim, Y. M., Kim, S., Cheong, H. K., Choi, K., & Ahn, B. (2012). Effects of high temperature on body temperature and blood pressure in elderly people living in poor housing conditions. <i>Epidemiology</i> , 1), S817.	Exclude [abstract with no extractable outcomes] Note: was included retroactively
Klenk2010	Klenk, J., Becker, C., & Rapp, K. (2010). Heat-related mortality in residents of nursing homes. <i>Age and Ageing</i> , 39(2), 245–252.	Exclude [not relevant exposure]
Kondo2013	Kondo, M., Ono, M., Nakazawa, K., Kayaba, M., Minakuchi, E., Sugimoto, K., & Honda, Y. (2013). Population at high-risk of indoor heatstroke: the usage of cooling appliances among urban elderlies in Japan. <i>Environmental Health and Preventive Medicine</i> , 18(3), 251–257.	Exclude [multiple reasons]
Kosatsky2012	Kosatsky, T., Henderson, S. B., & Pollock, S. L. (2012). Shifts in mortality during a hot weather event in Vancouver, British Columbia: rapid assessment with case-only analysis. <i>American Journal of Public Health</i> , 102(12), 2367–2371.	Exclude [not relevant exposure]
Kovats2006	Kovats, R. S., & Ebi, K. L. (2006). Heatwaves and public health in Europe. <i>European Journal of Public Health</i> , 16(6), 592–599.	Exclude [foreign language]
Kovats2008	Kovats, R. S., & Hajat, S. (2008). Heat stress and public health: a critical review. <i>Annual Review of Public Health</i> , 29, 41–55.	Exclude [multiple reasons]
Laaidi2011	Laaidi, K., Zeghnoun, A., Dousset, B., Bretin, P., Vandentorren, S., Giraudet, E., ... Pascal, M. (2011). Health impact of heat waves in urban heat Islands: How to estimate the exposure of the population? <i>Epidemiology</i> , 22, S22.	Exclude [multiple reasons]
Lecomte2004	Lecomte, D., & de Penanster, D. (2004). [People living in Paris, dead during the August 2003 heatwave, and examined in Medicolegal Institute]. <i>Bulletin de L Academie Nationale de Medecine</i> , 188(3), 459–470.	Exclude [foreign language]
Liu2008b	Liu, W., Lian, Z., & Liu, Y. (2008). Heart rate variability at different thermal comfort levels. <i>European Journal of Applied Physiology</i> , 103(3), 361–366.	Exclude [not relevant outcome]
Lomas2013	Lomas, K. J., & Kane, T. (2013). Summertime temperatures and thermal comfort in UK homes. <i>Building Research and Information</i> , 41(3), 259–280.	Exclude [Multiple reasons]
Lorente2004	Lorente, C., Serazin, C., Daube, D., Tillaut, H., & Salines, G. (2004). Risk factors of mortality during the heat wave of August 2003 in France's nursing homes. <i>Epidemiology</i> , 15(4), S217–S217.	Exclude [multiple reasons]
Mabote2012	Mabote, T., Torabi, A., Antony, R., Zhang, Z., Pellicori, P., Clark, A. L., & Cleland, J. G. F. (2012). Effect of environmental temperature on haemodynamics in patients with heart failure. <i>HeartCycle (FP 216695) European union 7th framework programme. European Journal of Heart Failure, Supplement</i> , 11, S35.	Exclude [abstract with no extractable outcomes]

Ref ID	Reference	Final decision
Mabote2013	Mabote, T., Torabi, A., Dierckx, R., Parsons, S., Weston, J., & Cleland, J. G. F. (2013). Effects of environmental temperature on non-invasive haemodynamics in patients with heart failure. <i>Heart</i> , 99, A16–A17.	Exclude [abstract with no extractable outcomes]
Maiti2014	Maiti, R. (2013). Physiological and subjective thermal response from Indians. <i>Building and Environment</i> , 70, 306–317.	Duplicate
Maiti2013	Maiti, R. (2014). PMV model is insufficient to capture subjective thermal response from Indians. <i>International Journal of Industrial Ergonomics</i> , 44(3), 349–361.	Exclude [not relevant outcome]
Maller2011	Maller, C. J., & Strengers, Y. (2011). Housing, heat stress and health in a changing climate: promoting the adaptive capacity of vulnerable households, a suggested way forward. <i>Health Promotion International</i> , 26(4), 492–498.	Exclude [not relevant study design]
Mannan2011	Mannan, I., Choi, Y., Coutinho, A. J., Chowdhury, A. I., Rahman, S. M., Seraji, H. R., ... Baqui, A. H. (2011). Vulnerability of newborns to environmental factors: Findings from community based surveillance data in Bangladesh. <i>International Journal of Environmental Research and Public Health</i> , 8(8), 3437–3452.	Exclude [not relevant exposure]
Marinacci2009	Marinacci, C., Marino, M., Ferracin, E., Fubini, L., Gilardi, L., Demaria, M., ... Costa, G. (2009). Testing of interventions for prevention of heat wave related deaths: results among frail elderly and methodological problems. <i>Epidemiologia & Prevenzione</i> , 33(3), 96–103.	Exclude [foreign language]
Mavrogianni2010	Mavrogianni, A., Davies, M., Wilkinson, P., & Pathan, A. (2010). LONDON HOUSING AND CLIMATE CHANGE: Impact on Comfort and Health – Preliminary Results of a Summer Overheating Study. <i>Open House International</i> , 35(2), 49–59.	Exclude [not relevant outcome]
Monacelli2010	Monacelli, F., Aramini, I., & Odetti, P. (2010). For debate: The August sun and the December snow. <i>Journal of the American Medical Directors Association</i> , 11(6), 449–452.	Exclude [not relevant study design]
Narsai2013	Narsai, P., Taylor, M., Jinabhai, C., & Stevens, F. (2013). Variations in housing satisfaction and health status in four lower socio-economic housing typologies in the eThekweni Municipality in KwaZulu-Natal. <i>Development Southern Africa</i> , 30(3), 367–385.	Exclude [multiple reasons]
Ormandy2012	Ormandy, D., & Ezratty, V. (2012). Health and thermal comfort: From WHO guidance to housing strategies. <i>Energy Policy</i> , 49, 116–121.	Exclude [not relevant exposure]
Osyaeva2014	Osyaeva, M., Rodnenkov, O., Fedorovich, A., Zairova, A., Shitov, V., Saidova, M., ... Kuznetsova, T. (2014). Prolonged heat stress as a factor of endothelial damage. <i>European Heart Journal</i> , 35, 1127.	Exclude [not relevant outcome]
OudinAstrom2011	Oudin Astrom, D., Bertil, F., & Joacim, R. (2011). Heat wave impact on morbidity and mortality in the elderly population: A review of recent studies. <i>Maturitas</i> , 69(2), 99–105.	Exclude [multiple reasons]
Parsons2009	Parsons, K. (2009). Maintaining health, comfort and productivity in heat waves. <i>Global Health Action</i> , 2, 39–45.	Exclude [multiple reasons]
Pathak2005	Pathak, A., Lapeyre-Mestre, M., Montastruc, J. L., & Senard, J. M. (2005). Heat-related morbidity in patients with orthostatic hypotension and primary autonomic failure. <i>Movement Disorders</i> , 20(9), 1213–1219.	Exclude [not relevant exposure]
Pevalin2008	Pevalin, D. J., Taylor, M. P., & Todd, J. (2008). The dynamics of unhealthy housing in the UK: A panel data analysis. <i>Housing Studies</i> , 23(5), 679–695.	Exclude [multiple reasons]

Ref ID	Reference	Final decision
Phair2004	Phair, L. (2004). Healthy heating. <i>Nursing Older People</i> , 16(9), 10–12.	Exclude [not relevant study design]
Pierse2012	Pierse, N., Richard, A., Michael, K., Philippa, H. C., Julian, C., & Malcolm, C. (2012). Indoor temperature and lung function. <i>European Journal of Epidemiology</i> , 1), S99.	Exclude [multiple reasons]
Pillai2014a	Pillai, S. K., Noe, R. S., Murphy, M. W., Vaidyanathan, A., Young, R., Kieszak, S., ... Wolkin, A. F. (2014). Heat illness: predictors of hospital admissions among emergency department visits-Georgia, 2002-2008. <i>Journal of Community Health</i> , 39(1), 90–98.	Exclude [not relevant exposure]
Poumadere2005	Poumadere, M., Mays, C., Le Mer, S., & Blong, R. (2005). The 2003 heat wave in France: Dangerous climate change here and now. <i>Risk Analysis</i> , 25(6), 1483–1494.	Exclude [not relevant study design]
Price2013	Price, K., Perron, S., & King, N. (2013). Implementation of the Montreal heat response plan during the 2010 heat wave. <i>Canadian Journal of Public Health. Revue Canadienne de Sante Publique</i> , 104(2), e96–100.	Exclude [multiple reasons]
Prince2004	Prince, P. B., Rapoport, A. M., Sheftell, F. D., Tepper, S. J., & Bigal, M. E. (2004). The effect of weather on headache. <i>Headache</i> , 44(6), 596–602.	Exclude [multiple reasons]
Proietti2005	Proietti, L., Longo, B., Gulino, S., La Rocca, G., Bonanno, G., & Vasta, N. (2005). Sick building syndrome in office workers. <i>Gazzetta Medica Italiana Archivio per Le Scienze Mediche</i> , 164(1), 23–27.	Exclude [foreign language]
Qiang2011a	Qiang, P., Linglin, X., Dezhi, H., Weitong, H., & Hai, S. (2011). The effect of different observed period on blood pressure-temperature relationship evaluation. <i>Heart</i> , 97, A114.	Exclude [multiple reasons]
Quandt2013a	Quandt, S. A., Wiggins, M. F., Chen, H., Bischoff, W. E., & Arcury, T. A. (2013). Heat index in migrant farmworker housing: implications for rest and recovery from work-related heat stress. <i>American Journal of Public Health</i> , 103(8), e24–6.	Exclude [multiple reasons]
Quinn2014	Quinn, A., Tamerius, J. D., Perzanowski, M., Jacobson, J. S., Goldstein, I., Acosta, L., & Shaman, J. (2014). Predicting indoor heat exposure risk during extreme heat events. <i>Science of the Total Environment</i> , 490, 686–693.	Exclude [multiple reasons]
Rabczenko2009	Rabczenko, D., Wojtyniak, B., Kuchcik, M., & Seroka, W. (2009). [Risk of deaths from cardiovascular diseases in Polish urban population associated with changes in maximal daily temperature]. <i>Przegląd Epidemiologiczny</i> , 63(4), 565–570.	Exclude [foreign language]
Rashid2008	Rashid, M. (2015). A review of the empirical literature on the relationships between indoor environment and stress in health care and office settings—Problems and prospects of sharing evidence. <i>Environment and Behavior</i> (Vol. 40, p. 21).	Exclude [multiple reasons]
Richard2011	Richard, L., Kosatsky, T., & Renouf, A. (2011). Correlates of hot day air-conditioning use among middle-aged and older adults with chronic heart and lung diseases: the role of health beliefs and cues to action. <i>Health Education Research</i> , 26(1), 77–88.	Exclude [multiple reasons]
Rosenthal2014	Rosenthal, J. K., Kinney, P. L., & Metzger, K. B. (2014). Intra-urban vulnerability to heat-related mortality in New York City, 1997-2006. <i>Health & Place</i> , 30, 45–60.	Exclude [multiple reasons]

Ref ID	Reference	Final decision
Rozzini2004	Rozzini, R., Zanetti, E., & Trabucchi, M. (2004). Elevated temperature and nursing home mortality during 2003 European heat wave. <i>Journal of the American Medical Directors Association</i> , 5(2), 138–139.	Exclude [not relevant exposure]
Saeki2014	Saeki, K., Obayashi, K., Iwamoto, J., Tone, N., Okamoto, N., Tomioka, K., & Kurumatani, N. (2014). Stronger association of indoor temperature than outdoor temperature with blood pressure in colder months. <i>Journal of Hypertension</i> , 32(8), 1582–1589.	Unobtainable
Sailor2014	Sailor, D. J. (2014). Risks of summertime extreme thermal conditions in buildings as a result of climate change and exacerbation of urban heat islands. <i>Building and Environment</i> , 78, 81–88.	Exclude [multiple reasons]
Saito2013	Saito, S., & Fuj, T. (2013). A possibility of relation between weather to joint bleedings in haemophic patients. <i>Journal of Thrombosis and Haemostasis</i> , 11, 1061–1062.	Exclude [abstract with no extractable outcomes]
Sakka2012	Sakka, A., Santamouris, M., Livada, I., Nicol, F., & Wilson, M. (2012). On the thermal performance of low income housing during heat waves. <i>Energy and Buildings</i> , 49, 69–77.	Exclude [multiple reasons]
Sampson2013	Sampson, N. R., Gronlund, C. J., Buxton, M. A., Catalano, L., White-Newsome, J. L., Conlon, K. C., ... Parker, E. A. (2013). Staying cool in a changing climate: Reaching vulnerable populations during heat events. <i>Global Environmental Change Part A: Human and Policy Dimensions</i> , 23(2), 475–484.	Exclude [multiple reasons]
Sandberg2014	Sandberg, J. C., Talton, J. W., Quandt, S. A., Chen, H. Y., Weir, M., Doumani, W. R., ... Arcury, T. A. (2014). Association Between Housing Quality and Individual Health Characteristics on Sleep Quality Among Latino Farmworkers. <i>Journal of Immigrant and Minority Health</i> , 16(2), 265–272.	Exclude [multiple reasons]
Sankoh2011	Sankoh, O. (2011). Climate-related mortality and climate-induced migration at indepth's health and demographic surveillance systems in Africa and Asia. <i>Tropical Medicine and International Health</i> , 16, 43–44.	Exclude [not relevant exposure]
Schellen2010	Schellen, L., van Marken Lichtenbelt, W. D., Loomans, M. G., Toftum, J., & de Wit, M. H. (2010). Differences between young adults and elderly in thermal comfort, productivity, and thermal physiology in response to a moderate temperature drift and a steady-state condition. <i>Indoor Air</i> , 20(4), 273–283. 0668.2010.00657.x	Exclude [multiple reasons]
Schols2009	Schols, J. M., De Groot, C. P., van der Cammen, T. J., & Olde Rikkert, M. G. (2009). Preventing and treating dehydration in the elderly during periods of illness and warm weather. <i>Journal of Nutrition, Health and Aging</i> , 13(2), 150–157.	Exclude [not relevant study design]
Scovronick2012a	Scovronick, N., & Armstrong, B. (2012). Corrigendum to "The impact of housing type on temperature-related mortality in South Africa, 1996–2015" [<i>Environ. Res.</i> 113 (2012) 46–51]. <i>Environmental Research</i> , 116, 140.	Duplicate
Scovronick2012b	Scovronick, N., & Armstrong, B. (2012). The impact of housing type on temperature-related mortality in South Africa, 1996-2015 (vol 113, pg 46, 2012). <i>Environmental Research</i> , 116, 140.	Exclude [multiple reasons]
Sekhar2013	Sekhar, C., Wai, C. K., & Toftum, J. (2013). Healthy Buildings 2012-Ventilation and Thermal Comfort. <i>Hvac&R Research</i> , 19(8), 923–925.	Exclude [not relevant study design]

Ref ID	Reference	Final decision
Sheridan2009	Sheridan, S. C., Kalkstein, A. J., & Kalkstein, L. S. (2009). Trends in heat-related mortality in the United States, 1975-2004. <i>Natural Hazards</i> , 50(1), 145–160.	Exclude [not relevant exposure]
Shi2013	Shi, X., Zhu, N., & Zheng, G. (2013). The combined effect of temperature, relative humidity and work intensity on human strain in hot and humid environments. <i>Building and Environment</i> , 69, 72–80.	Exclude [not relevant outcome]
Shie2007	Shie, H. G., & Li, C. Y. (2007). Population-based case-control study of risk factors for unintentional mortality from carbon monoxide poisoning in Taiwan. <i>Inhalation Toxicology</i> , 19(10), 905–912.	Exclude [multiple reasons]
Sinha2010	Sinha, P., Kumar, T. D., Singh, N. P., & Saha, R. (2010). Seasonal Variation of Blood Pressure in Normotensive Females Aged 18 to 40 Years in an Urban Slum of Delhi, India. <i>Asia-Pacific Journal of Public Health</i> , 22(1), 134–145.	Exclude [not relevant outcome] Note: was included retroactively
Sinha2008	Sinha, P., Taneja, D. K., Dhuria, M., & Saha, R. (2008). Incidence of summer associated symptoms, host susceptibility and their effect on quality of life among women 18 to 40 years of age in an urban slum of Delhi. <i>Indian Journal of Public Health</i> , 52(2), 72–75.	Exclude [not relevant exposure]
Soebarto2014	Soebarto, V., & Bennetts, H. (2014). Thermal comfort and occupant responses during summer in a low to middle income housing development in South Australia. <i>Building and Environment</i> , 75, 19–29.	Exclude [not relevant outcome]
Sookchaiya2010	Sookchaiya, T., Monyakul, V., & Thepa, S. (2010). Assessment of the thermal environment effects on human comfort and health for the development of novel air conditioning system in tropical regions. <i>Energy and Buildings</i> , 42(10), 1692–1702.	Exclude [multiple reasons]
Stanojevic2014	Stanojevic, G. B., Spalevic, A. B., Kokotovic, V. M., & Stojilkovic, J. N. (2014). Does Belgrade (Serbia) need heat health warning system? <i>Disaster Prevention and Management</i> , 23(5), 494–507.	Exclude [not relevant exposure]
Strengers2011b	Strengers, Y., & Maller, C. (2011). Integrating health, housing and energy policies: social practices of cooling. <i>Building Research and Information</i> , 39(2), 154–168.	Exclude [multiple reasons]
Sun2014a	Sun, X., Sun, Q., Zhou, X., Li, X., Yang, M., Yu, A., & Geng, F. (2014). Heat wave impact on mortality in Pudong New Area, China in 2013. <i>Science of the Total Environment</i> , 493, 789–794.	Exclude [not relevant exposure]
Swynghedauw2012	Swynghedauw, B. (2012). [Health consequences of environmental temperature and climate variations]. <i>Bulletin de L Academie Nationale de Medecine</i> , 196(1), 201–215.	Exclude [foreign language]
Tamerius2013	Tamerius, J. D., Perzanowski, M. S., Acosta, L. M., Jacobson, J. S., Goldstein, I. F., Quinn, J. W., ... Shaman, J. (2013). Socioeconomic and Outdoor Meteorological Determinants of Indoor Temperature and Humidity in New York City Dwellings. <i>Weather Climate and Society</i> , 5(2), 168–179.	Exclude [not relevant outcome]
Tawatsupa2013	Tawatsupa, B., Yiengprugsawan, V., Kjellstrom, T., Berecki-Gisolf, J., Seubsman, S. A., & Sleigh, A. (2013). Association between Heat Stress and Occupational Injury among Thai Workers: Findings of the Thai Cohort Study. <i>Industrial Health</i> , 51(1), 34–46.	Exclude [multiple reasons]
Tham2004	Tham, K. W. (2004). Effects of temperature and outdoor air supply rate on the performance of call center operators in the tropics. <i>Indoor Air</i> , 14 Suppl 7, 119–125.	Exclude [not relevant outcome]

Ref ID	Reference	Final decision
Theocharis2013	Theocharis, G., Tansarli, G. S., Mavros, M. N., Spiropoulos, T., Barbas, S. G., & Falagas, M. E. (2013). Association between use of air-conditioning or fan and survival of elderly febrile patients: a prospective study. <i>European Journal of Clinical Microbiology and Infectious Diseases</i> , 32(9), 1143–1147.	Exclude [not relevant exposure]
Theocharis2012	Theocharis, G., Tansarli, G. S., Mavros, M. N., Spiropoulos, T., & Falagas, M. E. (2012). Association between use of air-conditioning or fan and survival of elderly febrile patients: A prospective study. <i>Academic Emergency Medicine</i> , 19 (6), 717–718.	Exclude [abstract with no extractable outcomes]
Thomson2007a	Thomson, H., & Petticrew, M. (2007). Housing and health—Heating improvements may hold most promise for developing healthy housing policy. <i>British Medical Journal</i> , 334(7591), 434–435.	Exclude [not relevant study design]
Thomson2013	Thomson, H., Thomas, S., Sellstrom, E., & Petticrew, M. (2013). Housing improvements for health and associated socio-economic outcomes. <i>Cochrane Database of Systematic Reviews</i> , 2, CD008657.	Exclude [multiple reasons]
Tillaut2004	Tillaut, H., Salines, G., Lorente, C., Serazin, C., & Daube, D. (2004). Risk factors of mortality during the heat wave of August 2003 in France's nursing homes. <i>Epidemiology</i> , 15(4), S123–S123.	Exclude [abstract with no extractable outcomes]
Tillett2006	Tillett, T. (2006). Inadequate Housing May Put Immigrant Farmworkers at Risk. <i>Environmental Health Perspectives</i> , 114(8), A467–A467.	Exclude [multiple reasons]
Toulemon2008	Toulemon, L., & Barbieri, M. (2008). The mortality impact of the August 2003 heat wave in France: investigating the “harvesting” effect and other long-term consequences. <i>Population Studies</i> , 62(1), 39–53.	Exclude [not relevant exposure]
Tran2013	Tran, K.V, Azhar, G.S., Nair, R., Knowlton, K., Jaiswal, A., Sheffield, P., ... Hess, J. (2013). A cross-sectional, randomized cluster sample survey of household vulnerability to extreme heat among slum dwellers in ahmedabad, india. <i>International Journal of Environmental Research & Public Health [Electronic Resource]</i> , 10(6), 2515–2543.	Exclude [not relevant study design]
Trigo2009	Trigo, R.M., Ramos, A.M., Nogueira, P.J., Santos, F.D., Garcia-Herrera, R., Gouveia, C., & Santo, F.E. (2009). Evaluating the impact of extreme temperature based indices in the 2003 heatwave excessive mortality in Portugal. <i>Environmental Science and Policy</i> , 12(7), 844–854.	Exclude [not relevant exposure]
Uejio2011	Uejio, C.K., Wilhelmi, O.V, Golden, J.S., Mills, D.M., Gulino, S.P., & Samenow, J.P. (2011). Intra-urban societal vulnerability to extreme heat: the role of heat exposure and the built environment, socioeconomics, and neighborhood stability. <i>Health & Place</i> , 17(2), 498–507.	Exclude [not relevant exposure]
VanHoof2010	Van Hoof, J., Kort, H.S.M., Hensen, J.L.M., Duijnste, M.S.H., & Rutten, P.G.S. (2010). Thermal comfort and the integrated design of homes for older people with dementia. <i>Building and Environment</i> , 45(2), 358–370. doi:10.1016/j.buildenv.2009.06.013	Exclude [multiple reasons]
VanZutphen2012	Van Zutphen, A.R., Lin, S., Fletcher, B.A., & Hwang, S.A. (2012). A population-based case-control study of extreme summer temperature and birth defects. <i>Environmental Health Perspectives</i> , 120(10), 1443–1449.	Exclude [multiple reasons]

Ref ID	Reference	Final decision
Vandentorren2006	Vandentorren, S., Bretin, P., Zeghnoun, A., Mandereau-Bruno, L., Croisier, A., Cochet, C., ... Ledrans, M. (2006). August 2003 heat wave in France: risk factors for death of elderly people living at home. <i>European Journal of Public Health</i> , 16(6), 583–591.	Exclude [not relevant exposure]
Velho2013	Velho, S., Monteiro, A., Almeida, M., & Carvalho, V. (2013). COPD as an indicator of urban metabolism and an upshot of people and place. <i>European Journal of Epidemiology</i> , 1), S76.	Exclude [abstract with no extractable outcomes]
Vescovi2005	Vescovi, L., Rebetez, M., & Rong, F. (2005). Assessing public health risk due to extremely high temperature events: climate and social parameters. <i>Climate Research</i> , 30(1), 71–78.	Exclude [multiple reasons]
Vigotti2006	Vigotti, M.A., Muggeo, V.M.R., & Cusimano, R. (2006). The effect of birthplace on heat tolerance and mortality in Milan, Italy, 1980-1989. <i>International Journal of Biometeorology</i> , 50(6), 335–341.	Exclude [not relevant exposure]
VonKlot2009	Von Klot, S., Paciorek, C., Melly, S., Coull, B., Dutton, J., & Schwartz, J. (2009). Association of Temperature at Residence Vs Central Site Temperature with Mortality in Eastern Massachusetts-A Case Crossover Analysis. <i>Epidemiology</i> , 20(6), S75–S75.	Exclude [not relevant exposure]
VonSeidlein2013	Von Seidlein, L. (2013). How can we make low-cost housing in tropical climates not only healthy but also comfortable? <i>Tropical Medicine and International Health</i> , 18, 35.	Exclude [multiple reasons]
VonWichert2008	Von Wichert, P. (2008). [The importance of atmospheric heat waves for health service in already altered people]. <i>Medizinische Klinik</i> , 103(2), 75–79.	Exclude [foreign language]
Walker2011a	Walker, R., Hassall, J., Chaplin, S., Congues, J., Bajayo, R., & Mason, W. (2011). Health promotion interventions to address climate change using a primary health care approach: a literature review. <i>Health Promotion Journal of Australia</i> , 22, S6–S12.	Exclude [multiple reasons]
Walsh2013	Walsh, L., Loane, J., Doyle, J., Kealy, A., & Acfarlane, M. (2013). Great northern haven: From raw smart home data to health metrics. <i>Irish Journal of Medical Science</i> , 182, S211–S212.	Exclude [not relevant outcome]
White-Newsome2012	White-Newsome, J.L., Sanchez, B.N., Jolliet, O., Zhang, Z., Parker, E.A., Dvonch, J.T., & O'Neill, M.S. (2012). Climate change and health: indoor heat exposure in vulnerable populations. <i>Environmental Research</i> , 112, 20–27.	Exclude [not relevant outcome]
White-Newsome2011	White-Newsome, J.L., Sanchez, B.N., Parker, E.A., Dvonch, J.T., Zhang, Z., & O'Neill, M.S. (2011). Assessing heat-adaptive behaviors among older, urban-dwelling adults. <i>Maturitas</i> , 70(1), 85–91.	Exclude [not relevant outcome]
Williams2013	Williams, S., Bi, P., Newbury, J., Robinson, G., Pisaniello, D., Saniotis, A., & Hansen, A. (2013). Extreme heat and health: Perspectives from health service providers in rural and remote communities in South Australia. <i>International Journal of Environmental Research and Public Health</i> , 10(11), 5565–5583.	Exclude [multiple reasons]
Wilson2014	Wilson, J., Dixon, S.L., Jacobs, D.E., Breysse, J., Akoto, J., Tohn, E., ... Hernandez, Y. (2014). Watts-to-Wellbeing: does residential energy conservation improve health? <i>Energy Efficiency</i> , 7(1), 151–160.	Exclude [multiple reasons]

Ref ID	Reference	Final decision
Yudhastuti2008	Yudhastuti, R. (2008). Housing sanitation and acute respiratory tract infection among undergraduate students in Indonesia. <i>Asia-Pacific Journal of Public Health</i> , 20 Suppl, 262–265.	Unobtainable
Zanobetti2014a	Zanobetti, A., Luttmann-Gibson, H., Horton, E.S., Cohen, A., Coull, B.A., Hoffmann, B., ... Gold, D.R. (2014). Brachial artery responses to ambient pollution, temperature, and humidity in people with type 2 diabetes: a repeated-measures study. <i>Environmental Health Perspectives</i> , 122(3), 242–248.	Exclude [not relevant exposure]
Zanobetti2013	Zanobetti, A., O'Neill, M.S., Gronlund, C.J., & Schwartz, J.D. (2013). Susceptibility to Mortality in Weather Extremes Effect Modification by Personal and Small-Area Characteristics. <i>Epidemiology</i> , 24(6), 809–819.	Exclude [not relevant exposure]
Zuluaga2011	Zuluaga, M.C., Guallar-Castillon, P., Conthe, P., Rodriguez-Pascual, C., Graciani, A., Leon-Munoz, L.M., ... Rodriguez-Artalejo, F. (2011). Housing conditions and mortality in older patients hospitalized for heart failure. <i>American Heart Journal</i> , 161(5), 950–955.	Exclude [not relevant exposure]
ONTHEONEHAND	ON THE ONE HAND. (2013). <i>Sierra</i> , 98(4), 22.	Exclude [abstract with no extractable outcomes]
Homeiswherethe	Home is Where the Health is. (2010). <i>Environmental Design & Construction</i> , 13(4), 34.	Exclude [abstract with no extractable outcomes]

Appendix 8 Search strategy for EMBASE (including MEDLINE) – update search conducted in April 2018

Searched via OVIDSP

Search date: 05 April 2018

Search strategy:

Identified 5205 records all years, 1168 for 2015-2018

- 1 housing/ or home for the aged/ or nursing home/ (59457)
- 2 air conditioning/ or humidity/ or heating/ (69144)
- 3 temperature/ or low temperature/ or high temperature/ or room temperature/ (249545)
- 4 2 or 3 (304021)
- 5 1 and 4 (875)
- 6 (indoor adj2 temperature\$.ti,ab. (401)
- 7 heat exposure\$.ti,ab. (1785)
- 8 (heat wave\$ or heatwave\$).ti,ab. (1463)
- 9 hot spell\$.ti,ab. (13)
- 10 thermal stress.ti,ab. (3152)
- 11 (indoor adj2 heat\$).ti,ab. (111)
- 12 domestic temperature\$.ti,ab. (2)
- 13 air condition\$.ti,ab. (3106)
- 14 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (9741)
- 15 1 and 14 (178)
- 16 (cooling adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (39)
- 17 (ventilat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (1889)
- 18 (insulat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (136)
- 19 (heat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (489)
- 20 (thermal adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (80)

- 21 (humidity adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (49)
- 22 (temperature\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (534)
- 23 (air condition\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (153)
- 24 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 (3272)
- 25 ((increas\$ or raise\$ or elevat\$ or suscept\$ or ambient) adj2 (temperature\$ or heat)).ti,ab. (62545)
- 26 25 and 1 (96)
- 27 5 or 15 or 24 or 26 (4144)
- 28 (animal/ or nonhuman/) not exp human/ (4357531)
- 29 27 not 28 (3759)
- 30 (animal or animals or mouse or mice or rat or rats or rabbit\$ or cat or cats or feline or dog or dogs or canine or pig or pigs or porcine or swine or horse or horses or cattle or cow or cows or calf or calves or bovine or goat or goats or sheep or ovine or poultry).ti. (1584245)
- 31 29 not 30 (3681)
- 32 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$).ti,ab. (509382)
- 33 32 and 3 (5852)
- 34 limit 33 to humans (1773)
- 35 34 not 30 (1735)
- 36 31 or 35 (5202)
- 37 limit 36 to yr="2015 –Current" (1168)

Appendix 9 Search strategy for Greenfile – update search conducted in April 2018

Searched via EBSCO

Search date: 5 April 2018

1441 records identified

Search history

#	Query	Results
S32	YR=2015-2018	1 441
S31	S1 OR S4 OR S14 OR S23 OR S25 OR S30	9 515
S30	S2 AND S29	3 262
S29	S26 OR S27 OR S28	9 935
S28	((DE "VENTILATION") OR (DE "AIR conditioning")) OR (DE "HUMIDITY")	3 777
S27	DE "SEASONAL temperature variations"	206
S26	DE "TEMPERATURE" OR DE "TEMPERATURE control" OR DE "TEMPERATURE effect"	6 347
S25	S2 AND S24	131
S24	(increas* or raise* or elevat* or suscept* or ambient) N2 (temperature* or heat)	638
S23	S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22	4 843
S22	air condition* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	1 166
S21	temperature* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	257
S20	humidity N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	31
S19	thermal N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	590
S18	heat* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	1 335
S17	insulat* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	398
S16	ventilat* N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	398
S15	cooling N2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	1 920
S14	S2 AND S13	5 573
S13	S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12	12 248
S12	air condition*	10 782
S11	domestic temperature*	1

#	Query	Results
S10	indoor N2 heat*	101
S9	thermal stress	485
S8	hot spell*	7
S7	Heat wave* or heatwave*	648
S6	heat exposure*	66
S5	indoor N2 temperature*	451
S4	S2 AND S3	482
S3	DE "HEALTH"	4 096
S2	TI house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*	93 600
S1	DE "HOUSING & health"	94

Appendix 10 Search strategy for MEDLINE – update search conducted in April 2018

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

Searched via OVIDSP

Search date: 05 April 2018

Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

Identified 744 records

Search strategy:

- 1 housing/ or housing for the elderly/ or public housing/ or homes for the aged/ or nursing homes/ (54821)
- 2 ventilation/ or air conditioning/ or humidity/ or heating/ (26248)
- 3 temperature/ or cold temperature/ or hot temperature/ (364654)
- 4 2 or 3 (381269)
- 5 1 and 4 (1322)
- 6 (indoor adj2 temperature\$.ti,ab. (329)
- 7 heat exposure\$.ti,ab. (1941)
- 8 (heat wave\$ or heatwave\$).ti,ab. (1374)
- 9 hot spell\$.ti,ab. (17)
- 10 thermal stress.ti,ab. (3283)
- 11 (indoor adj2 heat\$).ti,ab. (100)
- 12 domestic temperature\$.ti,ab. (1)
- 13 air condition\$.ti,ab. (2807)
- 14 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (9566)
- 15 1 and 14 (226)
- 16 (cooling adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (34)
- 17 (ventilat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (1290)

- 18 (insulat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (132)
- 19 (heat\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (405)
- 20 (thermal adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (74)
- 21 (humidity adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (35)
- 22 (temperature\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (413)
- 23 (air condition\$ adj2 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$)).ti,ab. (120)
- 24 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 (3427)
- 25 ((increas\$ or raise\$ or elevat\$ or suscept\$ or ambient) adj2 (temperature\$ or heat)).ti,ab. (65806)
- 26 25 and 1 (73)
- 27 5 or 15 or 24 or 26 (3715)
- 28 exp animals/ not humans/ (4438182)
- 29 27 not 28 (3419)
- 30 (animal or animals or mouse or mice or rat or rats or rabbit\$ or cat or cats or feline or dog or dogs or canine or pig or pigs or porcine or swine or horse or horses or cattle or cow or cows or calf or calves or bovine or goat or goats or sheep or ovine or poultry).ti. (420288)
- 31 29 not 30 (4596)
- 32 (house or houses or housing or home or homes or residence\$ or building\$ or accommodation or shelter\$ or slum\$).ti,ab. (420288)
- 33 32 and 3 (4596)
- 34 limit 33 to humans (1500)
- 35 34 not 30 (1479)
- 36 31 or 35 (4537)
- 37 limit 36 to yr="2015 -Current" (744)

Appendix 11 Search strategy for PAIS – update search conducted in April 2018

Comment: Original search was for PAIS International only. This search was done for PAIS Index, which includes both PAIS International and PAIS Archive. However, PAIS Archive includes only publications between 1915 and 1976.

Comment #2: Although the search strategy states 132 results, the actual number of hits displayed within the search motor was 88.

Searched via ProQuest

Search date: 5 April 2018

Identified 88 records

Set	Search	Databases	Results
S21	(ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND (ab(ventilation OR air condition* OR humidity OR heating OR temperature) OR ti(ventilation OR air condition* OR humidity OR heating OR temperature)) Limits applied: Publication year = 2015–2018	PAIS Index	132°
S20	(ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND (ab(ventilation OR air condition* OR humidity OR heating OR temperature) OR ti(ventilation OR air condition* OR humidity OR heating OR temperature))	PAIS Index	965°
S19	(ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND (ab((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat)) OR ti((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat)))	PAIS Index	50°
S18	ab((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat)) OR ti((increas* OR raise* OR elevat* OR suscept* OR ambient) NEAR/2 (temperature* OR heat))	PAIS Index	311°
S17	(ab(cooling NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(cooling NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))) OR (ab(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))) OR (ab(insulat** NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))) OR (ab(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))) OR (ab(heat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(heat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))) OR (ab(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR	PAIS Index	492°

Set	Search	Databases	Results
	ti(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR (ab(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)))		
S16	ab(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(air condition* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS Index	39°
S15	ab(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(temperature* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS Index	13°
S14	ab(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(humidity* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS Index	2°
S13	ab(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(thermal* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS Index	36°
S12	ab(heat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(heat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS Index	310°
S11	ab(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS Index	66°
S10	ab(insulat** NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(insulat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS Index	66°
S9	ab(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) OR ti(ventilat* NEAR/2 (house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*))	PAIS Index	37°
S8	ab(cooling NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) OR ti(cooling NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))	PAIS Index	31°
S7	(ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND ((ab(indoor NEAR/2 temperature*) OR ti(indoor NEAR/2 temperature*) OR ab(heat exposure*) OR ti(heat exposure*) OR ab(heat wave* OR heatwave*) OR ti(heat wave* OR heatwave*) OR ab(hot spell*) OR ti(hot spell*) OR ab(thermal stress) OR ab(thermal stress)) OR (ab(indoor NEAR/2 heat*) OR ti(indoor NEAR/2 heat*) OR ab(domestic temperature*) OR ti(domestic temperature*) OR ab(air condition*) OR ti(air condition*)))	PAIS Index	219°

Set	Search	Databases	Results
S6	(ab(indoor NEAR/2 temperature*) OR ti(indoor NEAR/2 temperature*) OR ab(heat exposure*) OR ti(heat exposure*) OR ab(heat wave* OR heatwave*) OR ti(heat wave* OR heatwave*) OR ab(hot spell*) OR ti(hot spell*) OR ab(thermal stress) OR ab(thermal stress)) OR (ab(indoor NEAR/2 heat*) OR ti(indoor NEAR/2 heat*) OR ab(domestic temperature*) OR ti(domestic temperature*) OR ab(air condition*) OR ti(air condition*))	PAIS Index	1 162°
S5	ab(indoor NEAR/2 heat*) OR ti(indoor NEAR/2 heat*) OR ab(domestic temperature*) OR ti(domestic temperature*) OR ab(air condition*) OR ti(air condition*)	PAIS Index	953°
S4	ab(indoor NEAR/2 temperature*) OR ti(indoor NEAR/2 temperature*) OR ab(heat exposure*) OR ti(heat exposure*) OR ab(heat wave* or heatwave*) OR ti(heat wave* or heatwave*) OR ab(hot spell*) OR ti(hot spell*) OR ab(thermal stress) OR ab(thermal stress)	PAIS Index	231°
S3	(ab(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*) OR ti(house OR houses OR housing OR home OR homes OR residence* OR building* OR accommodation OR shelter* OR slum*)) AND (ab(ventilation OR air condition* OR humidity OR heating OR temperature) OR ti(ventilation OR air condition* OR humidity OR heating OR temperature))	PAIS Index	965°
S2	ab(ventilation or air condition* or humidity or heating or temperature) OR ti(ventilation or air condition* or humidity or heating or temperature)	PAIS Index	4 184°
S1	ab(house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*) OR ti(house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)	PAIS Index	112 494*

* Duplicates are removed from your search, but included in your result count.

° Duplicates are removed from your search and from your result count.

Appendix 12 Search strategy for Science Citation Index – update search conducted in April 2018

Searched via Web of Science

Search date: 5 April 2018

Records retrieved: 1653

# 31	1 653	#29 OR #22 OR #13 OR #11 <i>Indexes=SCI-EXPANDED Timespan=2015-2018</i>
# 30	6 938	#29 OR #22 OR #13 OR #11 <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 29	59	#28 AND #10 <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 28	23 439	#27 OR #26 OR #25 OR #24 OR #23 <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 27	6 472	TI=(ambient* NEAR/2 (temperature* or heat)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 26	1 074	TI=(suscept* NEAR/2 (temperature* or heat)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 25	12 988	TI=(elevat* NEAR/2 (temperature* or heat)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 24	116	TI=(raise* NEAR/2 (temperature* or heat)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 23	3 126	TI=(increas* NEAR/2 (temperature* or heat)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 22	4 029	#21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 21	217	TI=("air condition*" NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 20	310	TI=(temperature* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 19	27	TI=(humidity NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 18	873	TI=(thermal* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 17	834	TI=(heat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 16	354	TI=(insulat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 15	1 177	TI=(ventilat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 14	416	TI=(cooling NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) <i>Indexes=SCI-EXPANDED Timespan=all years</i>

# 13	4 982	#12 AND #10 <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 12	872 597	TI=(ventilation or humidity or heating or temperature) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 11	481	#10 AND #9 <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 10	179 548	TI=(house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 9	9 294	#8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 8	3 810	TI=("air condition*") <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 7	2	TI=("domestic temperature*") <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 6	82	TI=(indoor NEAR/2 heat*) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 5	3 256	TI=("thermal stress") <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 4	19	TI=("hot spell*") <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 3	1 394	TI=("Heat wave*" OR heatwave*) <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 2	573	TI=("heat exposure*") <i>Indexes=SCI-EXPANDED Timespan=all years</i>
# 1	190	TI=(indoor NEAR/2 temperature*) <i>Indexes=SCI-EXPANDED Timespan=all years</i>

Appendix 13 Search strategy for Social Science Citation Index – update search conducted in April 2018

Searched via Web of Science

Search date: 5 April 2018

Records retrieved: 1569

# 31	1 569	#29 OR #22 OR #13 OR #11 <i>Indexes=SSCI Timespan=2015-2018</i>
# 30	3 997	#29 OR #22 OR #13 OR #11 <i>Indexes=SSCI Timespan=all years</i>
# 29	347	#28 AND #10 <i>Indexes=SSCI Timespan=all years</i>
# 28	3 032	#27 OR #26 OR #25 OR #24 OR #23 <i>Indexes=SSCI Timespan=all years</i>
# 27	1 072	TOPIC: ((ambient* NEAR/2 (temperature* or heat))) <i>Indexes=SSCI Timespan=all years</i>
# 26	25	TOPIC: ((suscept* NEAR/2 (temperature* or heat))) <i>Indexes=SSCI Timespan=all years</i>
# 25	291	TOPIC: ((elevat* NEAR/2 (temperature* or heat))) <i>Indexes=SSCI Timespan=all years</i>
# 24	61	TOPIC: ((raise* NEAR/2 (temperature* or heat))) <i>Indexes=SSCI Timespan=all years</i>
# 23	1 892	TOPIC: ((increas* NEAR/2 (temperature* or heat))) <i>Indexes=SSCI Timespan=all years</i>
# 22	960	#21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 <i>Indexes=SSCI Timespan=all years</i>
# 21	53	TOPIC: (("air condition*" NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))) <i>Indexes=SSCI Timespan=all years</i>
# 20	98	TOPIC: ((temperature* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))) <i>Indexes=SSCI Timespan=all years</i>
# 19	8	TOPIC: ((humidity NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))) <i>Indexes=SSCI Timespan=all years</i>
# 18	148	TOPIC: ((thermal* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))) <i>Indexes=SSCI Timespan=all years</i>
# 17	381	TOPIC: ((heat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))) <i>Indexes=SSCI Timespan=all years</i>
# 16	113	TOPIC: ((insulat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))) <i>Indexes=SSCI Timespan=all years</i>
# 15	191	TOPIC: ((ventilat* NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))) <i>Indexes=SSCI Timespan=all years</i>
# 14	95	TOPIC: ((cooling NEAR/2 (house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*))) <i>Indexes=SSCI Timespan=all years</i>

# 13	3 721	#12 AND #10 <i>Indexes=SSCI Timespan=all years</i>
# 12	28 712	TOPIC: ((ventilation or humidity or heating or temperature)) <i>Indexes=SSCI Timespan=all years</i>
# 11	532	#10 AND #9 <i>Indexes=SSCI Timespan=all years</i>
# 10	294 591	TOPIC: ((house or houses or housing or home or homes or residence* or building* or accommodation or shelter* or slum*)) <i>Indexes=SSCI Timespan=all years</i>
# 9	1 877	#8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 <i>Indexes=SSCI Timespan=all years</i>
# 8	691	TOPIC: (("air condition*")) <i>Indexes=SSCI Timespan=all years</i>
# 7	0	TOPIC: (("domestic temperature*")) <i>Indexes=SSCI Timespan=all years</i>
# 6	34	TOPIC: ((indoor NEAR/2 heat*)) <i>Indexes=SSCI Timespan=all years</i>
# 5	185	TOPIC: (("thermal stress")) <i>Indexes=SSCI Timespan=all years</i>
# 4	9	TOPIC: (("hot spell*")) <i>Indexes=SSCI Timespan=all years</i>
# 3	755	TOPIC: (("Heat wave*" OR heatwave*)) <i>Indexes=SSCI Timespan=all years</i>
# 2	218	TOPIC: (("heat exposure*")) <i>Indexes=SSCI Timespan=all years</i>
# 1	135	TOPIC: ((indoor NEAR/2 temperature*)) <i>Indexes=SSCI Timespan=all years</i>

Appendix 14 Zero Carbon Hub reports

Two recently produced systematic reviews produced by the Zero Carbon Hub were identified by the WHO during the systematic review process as possible useful references (Zero Carbon Hub, 2015c, 2015d). These reports were not found during the systematic review based as they were published in March 2015, which was after the original search date (Zero Carbon Hub, 2015c, 2015d). On investigation, there were two other reports and a leaflet which were published in March 2015 by the Zero Carbon Hub (Zero Carbon Hub, 2015a, 2015b, 2015e). Although the reports appear to be very comprehensive in their evidence review, no information about methodology is provided in the documents.

Defining overheating (Zero Carbon Hub, 2015c)

The purpose of this evidence review is to set out the different ways the term “over- heating” is understood. The report:

- Summarizes existing technical overheating thresholds for thermal comfort, health and wellbeing, productivity and infrastructure resilience;
- Assesses the level of evidence on which each threshold is based; and
- Comments on their practical implementation to date.

Impacts of overheating (Zero Carbon Hub, 2015d)

This review summarizes recent research and evidence on some of the more common impacts and consequences of overheating in residential buildings, primarily focusing on:

- The health and wellbeing of people; and
- The downstream impacts on businesses, the health service and the economy.

Assessing overheating risk (Zero Carbon Hub, 2015a)

This review summarizes:

- The existing methodologies for predicting overheating risk in domestic and non-domestic buildings;
- The tools available to carry out these assessments;
- The data required for assessments particularly focusing on internal gains and occupancy profiles;
- Weather files including future climate data; and
- Key observations regarding current practice in overheating risk assessment.

Overheating risk mapping (Zero Carbon Hub, 2015e)

This review details the current research and risk mapping methods, including the outcomes presented for a regional level such as Greater London and at a national level for England and Wales.

Overheating in homes – drivers of change (Zero Carbon Hub, 2015b)

This is a leaflet which provides an update on the Zero Carbon Hub's 'Tackling Overheating in Homes' project and summarizes national-level statistics and trends that could affect the extent and severity of overheating in the future.

Appendix 15 Summary of findings

Indoor heat		1.	Study: Ahrentzen 2016	Citation: Ahrentzen S, Erickson J, Fonseca E. Thermal and health outcomes of energy efficiency retrofits of homes of older adults. <i>Indoor Air</i> 2016; 26: 582-93		
Study design	Setting	Population	Data collection time period	Purpose of the study		
Quasi-experimental (before–after)	Phoenix, the USA	Low-income adults	July 2009 to October 2012	To investigate whether energy retrofits in affordable housing for older adults can also improve indoor climatic conditions and health and comfort of residents.		
Size of the sample	Exposure/intervention	Outcome measures	Results	Other comments		
57 residents from 53 apartment units	Energy retrofit, recording mean temperature before and after the retrofit (26°C (SD 1.31) versus 25.4°C SD 1.27), and how often unit temperatures exceeded 27.2°C (varied before and after)	General health	Changes in an apartment's number of days of excessive temperatures (>27°C) corresponded with improved quality health/life (t: 3.179, p<0.01), reduced emotional distress (t: 2.085, p<0.05), and increased hours sleeping (t: 2.150, p<0.05).			
Indoor heat		2.	Study: Asamoah 2018	Citation: Asamoah B, Kjellstrom T, Östergren PO. Is ambient heat exposure levels associated with miscarriage or stillbirths in hot regions? A cross-sectional study using survey data from the Ghana Maternal Health Survey 2007. <i>Int J Biometeorol</i> 2018; 62: 319-30		
Study design	Setting	Population	Data collection time period	Purpose of the study		
Cohort	Ghana	Pregnant women, in the Ghana Maternal Health Survey 2007	2004 to 2007	To investigate if maternal heat exposure during pregnancy in hot regions is associated with increased spontaneous abortions or stillbirths		
Size of the sample	Exposure/intervention	Outcome measures	Results	Other comments		
1136 (of whom 141 had a miscarriage or stillbirth)	Heat measured indoors or outdoors in the shade	Miscarriage or stillbirth	OR: 1.15 (95% CI 0.92-1.42) with each additional degree increase			

Indoor heat		3.	Study: Fink 2017	Citation: Fink R, Eržen I, Medved S. Symptomatic Response of the Elderly with Cardiovascular Disease during the Heat Wave in Slovenia. <i>Central Europ J Pub Health</i> 2017; 25(4): 293	
Study design	Setting	Population	Data collection time period	Purpose of the study	
Cohort	Slovenia	Adults (>65 years) diagnosed with cardiovascular disease versus group that did not have the disease	Not reported	Not reported	
Size of the sample	Exposure/intervention	Outcome measures	Results	Other comments	
Not reported	Heat (not specific)	Health	Expression and aggravation of symptoms are related to an increase of heat burden and low indoor air quality	Abstract only available	
Indoor heat		4.	Study: Kim 2012	Citation: Kim Y-M, Kim S, Cheong H-K, Ahn B, Choi K. Effects of heat wave on body temperature and blood pressure in the poor and elderly. <i>Environmental Health & Toxicology</i> . 2012;27:e2012013.	
Study design	Setting	Population	Data collection time period	Purpose of the study	
Case series	Seoul, Republic of Korea	Elderly adults (63-95 years, mean: 74.3 ±8.1) living in accommodation called “zzockbang” in Korean, which means a very small room divided into several compartments	27 July 2010 to 6 August 2010	To investigate the acute effects of heat stress on body temperature and blood pressure of elderly people living in poor housing conditions.	
Size of the sample	Exposure/intervention	Outcome measures	Results	Other comments	
20	Indoor temperature: Calibrated thermometers and hygrometers for every household, installed to avoid particular heat source locations, were used to measure the temperature and relative humidity in the morning (8:00-9:00) and afternoon (14:00-15:00) during the study period. Temperature and humidity values were recorded hourly over nine days in two households that participated in the study.	Systolic blood pressure (SBP) and diastolic blood pressure (DBP)	DBP decreased by 2.05 mmHg (95% CI 0.05 to 4.05 mmHg, p<0.05) as indoor temperature increased by 1°C. SBP decreased by 1.75 mmHg (95% CI, -1.11 to 4.61 mmHg, p>0.05) indoor temperature increased by 1°C.		

Indoor heat		5.	Study: Quinn 2017	Citation: Quinn A, Shaman J. Health symptoms in relation to temperature, humidity, and self-reported perceptions of climate in New York City residential environments. <i>Int J Biometeorol</i> 2017; 61: 1209-20	
Study design	Setting	Population	Data collection time period	Purpose of the study	
Cohort	Manhattan, Brooklyn, and Bronx, the USA	Households with primary household contact >18 years	2013 to 2015	To investigate associations between temperature and humidity, perceptions of indoor environmental conditions, and health symptoms.	
Size of the sample	Exposure/intervention	Outcome measures	Results	Other comments	
21 households in summer 1, 33 in winter, and 29 in summer 2	Mean daily temperatures in the apartment	Sleep quality and heat-related illnesses	Self-reported sleep problems were positively associated with the prior day's in summer (OR: 2.28, p<0.05) but not in winter (OR: 0.98). In logistic regression, heat illness was positively associated with higher indoor temperature (temp today OR: 1.19; temp last 3 weeks: 0.98). No association between viral infection and temperature or humidity.		
Indoor heat		6.	Study: Sinha 2010	Citation: Sinha P, Kumar TD, Singh NP, Saha R. Seasonal variation of blood pressure in normotensive females aged 18 to 40 years in an urban slum of Delhi, India. <i>Asia-Pacific Journal of Public Health</i> . 2010;22(1):134-45.	
Study design	Setting	Population	Data collection time period	Purpose of the study	
Cohort	4 service blocks of Urban Health Centre Gokulpuri, an urban slum in Delhi, India	Normotensive women aged 18 to 40 years	March 2004 to March 2005	To quantify the magnitude of seasonal changes in blood pressure among normotensive women aged 18 to 40 years and to find out the association of blood pressure variation between winter and summer with body mass index, temperature, humidity, day length, and salt intake.	
Size of the sample	Exposure/intervention	Outcome measures	Results	Other comments	
159 agreed to participate but 132 provided full follow-up	Indoor temperature of the living room was recorded in all the 4 seasons using standard mercury Celsius thermometers. Mean indoor temperature was spring: 27.80 ±2.22°C, summer: 33.18 ±1.41°C; autumn: 25.49 ±0.88°C; winter: 17.83 ±1.85°C.	Systolic blood pressure (SBP) and diastolic blood pressure (DBP)	Mean increase in SBP and DBP in winter was 11.07 and 6.79 mm Hg compared to summer (p < 0.001). No significant relationship in blood pressure variation with change in environmental variables was observed.		

Indoor heat		7.	Study: Uejio 2016	Citation: Uejio CK, Tamerius JD, Vredenburg J, et al. Summer indoor heat exposure and respiratory and cardiovascular distress calls in New York City, NY, U.S. <i>Indoor Air</i> 2016; 26(4): 594–604	
Study design	Setting	Population	Data collection time period	Purpose of the study	
Case-control	New York City, the USA	Adults receiving emergency medical care	July to August 2013	To investigate indoor environments of people receiving emergency medical care, to determine the relative influence of outdoor conditions as well as patient characteristics and neighbourhood sociodemographics on indoor temperature and specific humidity (N = 764) and to determine whether cardiovascular or respiratory cases experience hotter and more humid indoor conditions as compared to controls	
Size of the sample	Exposure/intervention	Outcome measures	Results	Other comments	
338 respiratory cases, 291 cardiovascular cases, and 471 controls.	Heat: temperature in the building, threshold 26°C	Respiratory and cardiovascular health	≥26°C increased proportion of respiratory distress calls (OR: 1.43, 95% CI: 0.97-2.10, p=0.071), but not cardiovascular (OR: 0.85, 95% CI: 0.55-1.31, p=0.472).		
Indoor heat		8.	Study: van Loenhout 2016	Citation: van Loenhout JAF, le Grand A, Duijm F, et al. The effect of high indoor temperatures on self-perceived health of elderly persons. <i>Environ Res</i> 2016; 146: 27-34	
Study design	Setting	Population	Data collection time period	Purpose of the study	
Cohort	Arnhem and Groningen, Netherlands	Adults (≥65 years)	April to August 2012	To investigate relationship between indoor temperature and heat-related health problems.	
Size of the sample	Exposure/intervention	Outcome measures	Results	Other comments	
113	Heat: temperature measured continuously in the living rooms and bedrooms	Sleep disturbance and other health symptoms	Of the symptoms, only sleep disturbance had a significantly positive association with temperature.		

Appendix 16 GRADE evidence profile for indoor heat

Quality assessment							No. of participants	Effect	Quality	Importance
Number of studies	Designs	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations				
Blood pressure										
2 (Kim 2012, Sinha 2010)	Case series: 2 (Kim 2012, Sinha 2010)	High	Consistent	Direct	Imprecise	Studies were in 20 adults (>62 years) in the Republic of Korea (Kim 2012) and 132 women (18–40 years) in India (Sinha 2010).	Case series: 152	Case series: Both studies found a non-significant relationship between indoor temperature and systolic blood pressure, and a significant relationship with diastolic blood pressure (Kim 2012, Sinha 2010).	⊕⊖⊖⊖ Very low	Very low (because the studies are small, with narrow populations)
Body temperature										
1 (Kim 2012)	Case series: 1 (Kim 2012)	High	Not applicable (one study)	Indirect	Imprecise	Study was in 20 adults (>62 years) in the Republic of Korea (Kim 2012).	Case series: 20	Case series: Body temperature increased by 0.21°C (95% CI: 0.16 to 0.26°C) for each 1°C increase in indoor temperature, after adjusting for age and sex (Kim 2012).	⊕⊖⊖⊖ Very low	Very low (because the study is small with a narrow population)
General health										
2 (Ahrentzen 2016, Quinn 2017)	Quasi-experimental: 1 (Ahrentzen 2016) Cohort: 1 (Quinn 2017)	Moderate	Inconsistent	Direct	Imprecise	Studies were in 57 people in the USA (Ahrentzen 2016) and 40 households in the USA (Quinn 2017).	Quasi-experimental study: 57 Cohort study: 40 households	Quasi-experimental study: reductions in number of days above 27°C corresponded with improved quality of health and life, reduced emotional distress, and increased number of hours sleep (Ahrentzen 2016). Cohort study: heat illness reports were nonsignificantly higher with higher temperatures today (OR: 1.19) but not with higher temperatures in last 3 weeks (OR: 0.98) (Quinn 2017).	⊕⊕⊖⊖ Low	Low
Mental health										
1 (Ahrentzen 2016)	Quasi-experimental: 1 (Ahrentzen 2016)	Moderate	Not applicable (one study)	Direct	Imprecise	Study was in 57 people in the USA (Ahrentzen 2016).	Quasi-experimental study: 57	Quasi-experimental study: reductions in number of days above 27°C corresponded with reduced emotional distress (Ahrentzen 2016).	⊕⊖⊖⊖ Very low	Very low

Quality assessment							No. of participants	Effect	Quality	Importance
Number of studies	Designs	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations				
Sleep										
3 (Ahrentzen 2016, Quinn 2017, van Loenhout 2016)	Quasi-experimental: 1 (Ahrentzen 2016) Cohort: 2 (Quinn 2017, van Loenhout 2016)	Moderate	Consistent	Direct	Imprecise	Studies were in 57 people in the USA (Ahrentzen 2016), 40 households in the USA (Quinn 2017), and 113 people in the Netherlands (van Loenhout 2016).	Quasi-experimental study: 57 Cohort studies: 133 people and 40 households	Quasi-experimental study: reductions in number of days above 27°C corresponded with increased number of hours sleep (Ahrentzen 2016). Cohort studies: both studies found increased sleep problems with higher temperature. One study found a significant relationship with prior day's temperature in the summer season (OR: 2.28, p<0.05) but not in winter (OR: 0.98) (Quinn 2017). The other study found a significantly positive association with temperature (van Loenhout 2016).	⊕⊕⊖⊖ Low	Low
Pregnancy outcomes										
1 (Asamoah 2018)	Cross-sectional: 1 (Asamoah 2018)	Moderate	Not applicable (one study)	Direct	Imprecise	Study was in 1136 women in Ghana (Asamoah 2018).	Cross-sectional study: 1136	Cross-sectional study: non-significant increase in adverse pregnancy outcomes (stillbirth or miscarriage) with each additional degree increase in atmospheric heat exposure (OR 1.15: 95% CI: 0.92–1.42).	⊕⊖⊖⊖ Very low	Very low
Respiratory disease										
2 (Quinn 2017, Ueijo 2016)	Cohort: 1 (Quinn 2017) Case-control: 1 (Ueijo 2016)	Moderate	Inconsistent	Direct	Imprecise	Studies were in 40 households in the USA (Quinn 2017) and 764 people receiving emergency care in the USA (Ueijo 2016).	Cohort study: 40 households Case-control study: 764	Cohort study: no association was found between respiratory viral infection and indoor temperature (Quinn 2017). Case-control study: buildings with indoor heat indices ≥26 °C non-significantly increased respiratory distress calls (OR: 1.43, 95% CI: 0.97-2.10, p=0.071). (Ueijo 2016)	⊕⊖⊖⊖ Very low	Low

Quality assessment							No. of participants	Effect	Quality	Importance
Number of studies	Designs	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations				
Cardiovascular disease										
2 (Fink 2017, Ueijo 2016)	Cohort: 1 (Fink 2017) Case-control: 1 (Ueijo 2016)	Moderate	Inconsistent	Direct	Imprecise	Studies were in an unreported number of people in Slovenia (Fink 2017) and 764 people receiving emergency care in the USA (Ueijo 2016).	Cohort study: not reported Case-control study: 764	Cohort study: expression and aggravation of cardiovascular symptoms were related to higher heat burden and low indoor air quality (Fink 2017). Case-control study: Cardiovascular cases were not more likely than controls to surpass a higher indoor heat index threshold ($\geq 26^{\circ}\text{C}$) (OR: 0.85, 95% CI: 0.55–1.31, $p=0.472$). (Ueijo 2016).	⊕⊕⊕⊕ Very low	Low

Ahrentzen S, Erickson J, Fonseca E. Thermal and health outcomes of energy efficiency retrofits of homes of older adults. *Indoor Air* 2016; 26: 582–93.

Asamoah B, Kjellstrom T, Östergren PO. Is ambient heat exposure levels associated with miscarriage or stillbirths in hot regions? A cross-sectional study using survey data from the Ghana Maternal Health Survey 2007. *Int J Biometeorol* 2018; 62: 319–30.

Fink R, Eržen I, Medved S. Symptomatic Response of the Elderly with Cardiovascular Disease during the Heat Wave in Slovenia. *Central Eur J Public Health* 2017; 25(4): 293.

Kim YM, Kim S, Cheong HK, et al. Effects of Heat Wave on Body Temperature and Blood Pressure in the Poor and Elderly. *Environ Health Toxicol* 2012; 27.

Quinn A, Shaman J. Health symptoms in relation to temperature, humidity, and self-reported perceptions of climate in New York City residential environments. *Int J Biometeorol* 2017; 61: 1209–20

Sinha P, Kumar TD, Singh NP, Saha R. Seasonal Variation of Blood Pressure in Normotensive Females Aged 18 to 40 Years in an Urban Slum of Delhi, India. *Asia-Pacific J Pub Health* 2010; 22(1): 134–45.

Ueijo CK, Tamerius JD, Vredenburg J, et al. Summer indoor heat exposure and respiratory and cardiovascular distress calls in New York City, NY, U.S. *Indoor Air* 2016; 26(4): 594–604.

van Loenhout JAF, le Grand A, Duijm F, et al. The effect of high indoor temperatures on self-perceived health of elderly persons. *Environ Res* 2016; 146: 27–34

Note: Studies highlighted in red were added during the update of the systematic review.

Appendix 17 Studies in a climatic chamber/controlled environments

Study	Population	Exposure	Outcome
Chen 2011 (Chen, Hwang, Chang, & Lu, 2011)	16 healthy volunteers aged 18–22.	Climatic chamber. 2 temperature step down: 32°C to 24°C/ 28°C to 24°C One step up: 20° to 24°C	Thermal sensation and skin physiological properties (skin capillary blood flow, skin moisture, transepidermal water loss, and skin temperature).
Fang 2004 (Fang, Wyon, Clausen, & Fanger, 2004)	30 female subjects with average age of 23 years.	Real office with a carefully controlled environment. 4 different operating settings: 3.5L/s ventilation rate 20°C/40% relative humidity 10.5L/s ventilation rate 20°C/40% relative humidity 23°C/50% relative humidity 26°C/60% relative humidity	Productivity of office work (typing, proofreading, addition and creative thinking). Thermal comfort and symptoms of sick building syndrome were assessed.
Jin 2011 (Jin, Duanmu, Zhang, Li, & Xu, 2011)	23 healthy volunteers. Mean age 24 +/- 2.5 years.	29 different test simulating summer and winter conditions. Different air velocities and nozzle positions around head. Temperatures for summer conditions were 24°C, 28°C and 30°C.	Overall thermal sensation and thermal sensation at the head of participants.
Liu 2008 (Liu, Lian, & Liu, 2008)	33 healthy volunteers. Mean age 23.9 +/- 0.4 years.	Three groups. Each group was exposed to 40 minutes of 4 different temperatures: Group 1: 21°C, 24°C, 26°C, 29°C Group 2: 29°C, 26°C, 24°C and 21°C Group 3: 21°C, 28°C, 30°C, 24°C	Heart rate variability measured by electrocardiogram and thermal comfort.
Mabote 2012 (Mabote et al., 2012)*	12 men with mean age 72 years with chronic heart failure.	Randomized to spend 3 hours either at 19°C or at 28°C.	Heart rate, systolic blood pressure, echocardiography.
Mabote 2013 (Mabote et al., 2013)*	12 men with stable heart failure aged between 46 and 90 years. Control group of 6 (5 men and 1 woman) with hypertension aged between 51 and 75 years.	Unclear whether this is in a climate chamber. It says measurements were made on two separate days at cool (19°C) and warm (28°C) temperatures.	Haemodynamics measured using continuous beat-to-beat pulse contour analysis using finger-tip, volume-clamps.
Maiti 2013/ Maiti 2014 (R Maiti, 2014; Rina Maiti, 2013)	40 male healthy volunteers with a mean age of 25.18 +/- 2.4 years of Indian origin.	Experiment split into 2 parts with a gap of at least half a day: 1. Conference room with temperature reducing from 27°C to 21°C. 2. Laboratory room with temperature rising from 28°C to 33°C	Skin temperature, core temperature and body temperature. Thermal sensation.
Osyaeva 2014 (Osyaeva et al., 2014)*	6 healthy male volunteers mean age 34.3 +/- 9.6 years.	Isolation in sealed housing unit for 30 days. Temperature was maintained at a mean of 33.9 +/- 2.3°C and relative humidity 68.5 +/- 7.1%.	Endothelial damage measured by skin microcirculation of the upper limbs by laser Doppler flowmetry and capillaroscopy ultrasound echocardiography, finger photoplethysmography and blood sampling for endothelial apoptosis CD31+CD41- microparticles was also performed.

Study	Population	Exposure	Outcome
Schellen 2010 (Schellen, van Marken Lichtenbelt, Loomans, Toftum, & de Wit, 2010)	16 male, healthy volunteers: 8 young adults (aged 22–25 years). 8 older adults (aged 67–73 years).	Climate chamber exposed under two conditions for 8 hours each time: 1. Steady state – 21.5°C. 2. Transient state 17–25°C temperature drifting upward then downwards. All subjects performed office tasks during the experiment.	Skin temperature and core temperature. Thermal sensation also measured during study.
Shi 2013 (Shi, Zhu, & Zheng, 2013)	5 healthy male volunteers mean age 23.8 +/- 0.4 years.	Climatic chamber set at 3 different temperatures (32°C, 36°C and 40°C) and three different values of relative humidity. Therefore there were 9 conditions. Participants were asked to complete light, moderate and heavy work in each of the different conditions.	Rectal temperature, heart rate and sweat rate. These measures were combined to calculate a physiological strain index.
Tham 2004 (Tham, 2004)	56 female customer service operators (age range 25–36 years) working in a call centre.	2 different temperatures (22.5 and 24.5°C) and two different air velocities were trialled in a factorial design.	Thermal comfort measures, workers talk time performance and workers perception of sick building syndrome symptoms.

* Study only reported as an abstract.