Assessing the health impact of the Urban Heat Island of Birmingham, UK

Paul Fisher, Research Fellow, Fellow of the Faculty of Public Health

24th July 2015
Examining the association between temperature and health in Birmingham and Baltimore: implications for public health and health inequalities.
Overview

- History
- Mortality
- Ambulance
- Syndromic Surveillance
- Future steps
# The Significant Seven

## Climate change health impact

1. **Increased heat related illness and death** – increased mortality from respiratory and cardiovascular diseases.  
2. **Flood related illness and displacement** – as well as injury and infection, the effect of flooding on mental health is well documented, and a considerable part of the overall health burden.  
3. **Increase in food, water and vector borne diseases** – an increase in incidences of infections may be seen due to higher temperatures, drought, flooding, changes in habitat and rainfall patterns.  
4. **Health impacts relating to air quality and aeroallergens** – high temperatures are linked to poor air quality with high levels of ozone which are formed more rapidly in strong sunlight; fine particles (PM$_{10}$, PM$_{2.5}$) that damage health may also become more prevalent in the future. Climate change may result in earlier seasonal appearance of respiratory symptoms and longer duration of exposure to aeroallergens (e.g. pollen).  
5. **Skin cancer and sunburn** – excessive exposure to UV may have consequences ranging from premature aging of the skin to skin cancer. Malignant melanoma incidence rates in the UK have more than quadrupled over the last thirty years.  
6. **Pressure on health care providers to keep services running in the face of extreme weather** – extreme events such as droughts, wildfires and storms may impact on service delivery as they become more common in the future. This includes ability to deliver services in the community.  
7. **Increase in health inequalities** – between different population groups. For example increase fuel and food prices, reduced access to heating, cooling, health services, education and food security.
The Significant Seven

1. Increased heat related illness and death – increased mortality from respiratory and cardiovascular diseases.

2. Flood related illness and displacement – as well as injury and infection, the effect of flooding on mental health is well documented, and a considerable part of the overall health burden.

3. Increase in food, water and vector borne diseases – an increase in incidences of infections may be seen due to higher temperatures, drought, flooding, changes in habitat and rainfall patterns.

4. Health impacts relating to air quality and aeroallergens – high temperatures are linked to poor air quality with high levels of ozone which are formed more rapidly in strong sunlight; fine particles (PM$_{10}$, PM$_{2.5}$) that damage health may also become more prevalent in the future. Climate change may result in earlier seasonal appearance of respiratory symptoms and longer duration of exposure to aeroallergens (e.g. pollen).

5. Skin cancer and sunburn – excessive exposure to UV may have consequences ranging from premature aging of the skin to skin cancer. Malignant melanoma incidence rates in the UK have more than quadrupled over the last thirty years.

6. Pressure on health care providers to keep services running in the face of extreme weather – extreme events such as droughts, wildfires and storms may impact on service delivery as they become more common in the future. This includes ability to deliver services in the community.

7. Increase in health inequalities – between different population groups. For example increase fuel and food prices, reduced access to heating, cooling, health services, education and food security.
Research gaps, De Sario et al, (2013)*

- Effect on specific diseases/morbidity outcomes
- Effect on children and young age groups
- Effect on low socio economic subgroups
- To identify vulnerability factors
- Interaction of temperature on specific pollutants
- Toxicological and pathogenetic mechanisms

*De Sario M, Katsouyanni K, Michelozzi P. Climate change, extreme weather events, air pollution and respiratory health in Europe. Eur Respir J. 2013 Sep;42(3):826-43
<table>
<thead>
<tr>
<th>Location</th>
<th>Minimum Mortality Temperature ($T_{MM}$)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>15.5</td>
<td>Huynen et al, 2001</td>
</tr>
<tr>
<td>UK</td>
<td>15.6 – 18.6</td>
<td>Donaldson et al, 2001</td>
</tr>
<tr>
<td>North Finland</td>
<td>18.0</td>
<td>Eurowinter, 2007</td>
</tr>
<tr>
<td>London, UK</td>
<td>18.0</td>
<td>Pattenden et al, 2003</td>
</tr>
<tr>
<td>Sofia, Bulgaria</td>
<td>18.0</td>
<td>Pattenden et al, 2003</td>
</tr>
<tr>
<td>Budapest, Hungary</td>
<td>19.6</td>
<td>Hajat et al, 2006</td>
</tr>
<tr>
<td>Paris, France</td>
<td>20.6 – 23.6</td>
<td>Laaidi et al, 2006</td>
</tr>
<tr>
<td>Barcelona, Spain</td>
<td>21.0</td>
<td>Saez et al, 2000</td>
</tr>
<tr>
<td>Boston, America</td>
<td>22.0</td>
<td>Gosling et al, 2007</td>
</tr>
<tr>
<td>Valencia, Spain</td>
<td>22.0 – 22.5</td>
<td>Ballester et al, 1997</td>
</tr>
<tr>
<td>North Carolina, America</td>
<td>22.3 – 25.3</td>
<td>Donaldson et al, 2003</td>
</tr>
<tr>
<td>Athens, Greece</td>
<td>22.7 – 25.7</td>
<td>Keatinge et al, 2000</td>
</tr>
<tr>
<td>Milan, Italy</td>
<td>23.4</td>
<td>Hajat et al, 2006</td>
</tr>
<tr>
<td>Sydney, Australia</td>
<td>26.0</td>
<td>Gosling et al, 2007</td>
</tr>
<tr>
<td>Taiwan</td>
<td>26.0 – 29.0</td>
<td>Pan et al, 1995</td>
</tr>
</tbody>
</table>
Cardiovascular Disease
A class of diseases involving the heart and/or blood vessels

Epidemiology:
Detected most in adults >65 years
Can be exacerbated by high and low temperatures

Current trend:
• Increased mortality during winter and hot summer weather
• Minimum mortality between 15-18°C

Source: WMPHO and BADC (British Atmospheric Data Centre)
Figure 1  Total daily 999 ambulance calls 1 April 2007–30 November 2011.
Percentage of daily Category A responses within 8 min versus mean daily temperature.
Temperature drop delaying responses

Every one-degree fall in outside air temperature during the winter corresponds to a drop in ambulance response time of more than 1 per cent, reveals research published online in the Emergency Medicine Journal.

Increased demand and treacherous road conditions during the winter months combine to stretch ambulance services in England, which have a target of reaching 75 per cent of immediately life-threatening (category A) calls within eight minutes, said the authors.

Studies on the impact of extreme weather conditions on health have tended to focus on associated illness and death, but there has been relatively little research on the impact of weather on NHS infrastructure in the UK, they said.

Extreme Weather Hampers EMT Response

Falling temperatures appear to have a significantly adverse effect on the response time of emergency medical services — in some instances almost doubling response time.

Why you shouldn't get sick in a cold snap - it can take ambulances twice as long to respond

• Study looked at how long it took ambulances to arrive at emergencies in Birmingham between 2007 and 2011
this is the most ridiculous study ever. Anyone who has ever driven an emergency service vehicle (which i did for 30 years) have always used the mantra "drive to arrive" and that means adapting your driving to suit the road conditions to make sure you actually arrive safely even though it is done at the maximum speed possible in those conditions even if that arrival is delayed slightly. Just how many emergency vehicles were involved in accidents during the cold weather?

Thanks for the tip, DM, I'll bear that in mind when I am planning my next bout of illness.

Falling temperatures appear to have a significantly adverse effect on the response time of emergency medical services — in some instances almost doubling response time.
Category A Performance, Annual 2009-2014

↓ 1.24%
Allergies/Rash/Stings
Autumn 2009-2014

↑ 8.1%

↑ 2.4%
Breathing Problems
Winter 2009-2014

9.2% ↑ 2.1%
Sick Person
Spring 2009-2014

↑ 2.4%

4.5%
Issues

- Exposure assessment
- Routinely available data
- Aggregate data
- Limited confounders
24 monitoring stations across Birmingham linked to their nearest Lower Super Output Area (LSOA) of which there are 639
Amber — Heatwave action

Triggered when the Met Office confirms threshold temperatures for one of more regions have been reached for one day and the following night, and the forecast for the next day has a greater than 90% confidence level that the day threshold temperature will be met. This stage requires social and healthcare services to target specific actions at high-risk groups.

**Advice:** Stay out of the sun. Keep your home as cool as possible – shading windows and shutting them during the day may help. Open them when it is cooler at night. Keep drinking fluids. If there's anybody you know, for example an older person living on their own, who might be at special risk, make sure they know what to do.

Advice on how to reduce the risk either for yourself or somebody you know can be obtained from NHS Choices at [www.nhs.uk/summerhealth](http://www.nhs.uk/summerhealth), NHS 111 or from your local chemist.

### Threshold temperatures

<table>
<thead>
<tr>
<th>Region</th>
<th>Day max (°C)</th>
<th>Night min (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North East England</td>
<td>28</td>
<td>15</td>
</tr>
<tr>
<td>North West England</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Yorkshire and the Humber</td>
<td>29</td>
<td>15</td>
</tr>
<tr>
<td>West Midlands</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>East Midlands</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>East of England</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Southeast England</td>
<td>31</td>
<td>16</td>
</tr>
<tr>
<td>London</td>
<td>32</td>
<td>18</td>
</tr>
<tr>
<td>Southwest England</td>
<td>30</td>
<td>15</td>
</tr>
</tbody>
</table>

These temperatures could have significant effect on health if reached on at least two consecutive days and the intervening night.
PHE Syndromic Surveillance data

10: Heat stroke

Daily heat stroke calls as a percentage of total calls. Baselines are constructed from historical data since 2010, including data from NHS 111 and NHS Direct.

11: Heatstroke and sunstroke.

Shown as a percentage of the total contacts with a Read code and as a 7 day average.

GP OOHs

NHS 111 UNIVERSITY OF BIRMINGHAM
23: Heat/sunstroke

Daily incidence rate (and 7-day moving average*) per 100,000 population (all England, all ages).

22: Heat / Sunstroke

Daily percentage of all attendances recorded as Heat / sunstroke attendances across the EDSSS network.
Includes 20/35 EDs.
There might be an additional 179,000 cases of food poisoning in the UK by the year 2050 as a result of climate change.
Thanks to:

- Prof. John Thornes
- WMAS
- Birmingham City Council
- Public Health England
- Dr. Lee Chapman (PhD supervisor)
- Dr. Neil Tomas (PhD supervisor)

Reference:

Merci pour votre attention

p.a.fisher@bham.ac.uk