



# **Evaluation of the Department of Health National Heatwave Plan**

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## Executive Summary

The Department of Health first produced a national heatwave plan for England in 2004. It aimed to assist organisations in preparing for a heatwave and gave advice on measures to be taken during heatwaves. Within the plan there is a “Heat-Health watch” which comprises 4 levels:

- Level 1 – awareness;
- Level 2 – alert;
- Level 3 – heatwave;
- Level 4 – emergency.

In 2006 the alert level reached level 3 for the first time since the plan was launched. Following this heatwave, the Department of Health asked the HPA to undertake an evaluation of the National Heatwave Plan.

This evaluation was completed in three parts. Part one was an epidemiological study analysing morbidity and mortality over the heatwave period. Part two was a questionnaire-based study that assessed awareness of the heatwave plan and overall impacts of a number of key organisations with roles in the heatwave plan. The third part was a multi-agency seminar to discuss the results of the two previous studies, other relevant research and to develop an expert consensus view.

Overall the evaluation showed that there is high awareness of the heatwave in the main organisations and there was a positive response to the plan. Many organisations also stated that the plan assisted them in the heatwave situation.

The evaluation also described the impacts (morbidity and mortality) of the 2006 heatwave and the sources currently available to measure impacts. The information indicated that the 2006 heatwave was less severe, both in impacts and weather, to the heatwave of 2003.

This evaluation report includes a number of recommendations to the Department of Health. Recommendations on improvements to the plan include improving communication, re-visiting definitions of and the expectations for caring for vulnerable individuals and re-visiting the measures and thresholds that the plan and the associated levels are based around. Limitations are discussed, both in respect to this evaluation and the overall issue of agreeing the correct baselines and comparisons in order to identify the impacts of heatwaves.

The evaluation report also identifies areas where further research would be beneficial. This includes further epidemiological studies on heatwaves and associated effects and research to determine the most appropriate ways to evaluate interventions.

## 1. Introduction

Following the heatwave conditions experienced during the summer of 2003 throughout Europe and the large number of excess deaths associated with it, the Department of Health developed and issued a national heatwave plan. The frequency of such extreme weather events is likely to increase due to climate change and the 2003 heatwave highlighted the need for a defined plan of action to allow appropriate preparedness for heatwave situations and to minimise the excess deaths associated with them.

The national heatwave plan for England has been revised twice and in 2006 was re-launched (Department of Health, 2004; Appendix 1). In 2006 the heatwave plan was published along with other supporting documents. There were fact sheets which gave specific advice on supporting vulnerable people before and during a heatwave for health and social care professionals and for care home managers and staff. A guide for the general public on looking after themselves and others during a heatwave was also published. The heatwave plan and supporting documents described the responsibilities of a number of organisations including Primary Care Trusts (PCTs), Local Authorities (LAs), Strategic Health Authorities (SHAs) and NHS Trusts.

The core elements of the plan are:

- 'Heat-Health watch' over the summer months which triggers levels of response (Levels 1 – 4)
- Advice and information direct to the public and health and social care professionals
- Guidelines for the identification of individuals at risk and local advice for assisting these individuals
- Extra assistance from the voluntary sector, families and others to care for those most at risk
- The use of the media to get the information disseminated both before and during a heatwave

A covering letter for the plan was addressed to SHA and LA Chief Executives and copied to other key organisations such as the HPA, PCTs, NHS Acute Trusts, the Commission for Social Care Inspection (CSCI) and General Practitioners. The onus was put on the SHAs and LAs to ensure that the service providers within their areas were aware of the plan and the responsibilities of their organisations.

The publication of this plan was shortly followed by climatic conditions across England leading to 'Heat-Health watch' warning alert level 3 being issued in five regions on 4 July 2006 (Figure 1). A second hot period occurred and on 19 July 2006 all nine regions in England reached alert level 3. This was the first time since the launch of the heatwave plan that alert level 3 had been activated. Therefore this heatwave gave organisations across England the opportunity to implement the specific measures outlined in the plan.

Following the end of the 'Heat-Health watch' period (1 June to 15 September), the Department of Health commissioned the HPA to evaluate the heatwave plan. This was to assess the impact of the plan on the various actions it proposed, and to test whether these had had an effect on heatwave related morbidity and mortality.

Region	01/07/2006	02/07/2006	03/07/2006	04/07/2006	05/07/2006	06/07/2006	07/07/2006	08/07/2006	09/07/2006	10/07/2006	11/07/2006	12/07/2006	13/07/2006	14/07/2006	15/07/2006	16/07/2006	17/07/2006	18/07/2006	19/07/2006	21/07/2006	22/07/2006	23/07/2006	24/07/2006	25/07/2006	26/07/2006	27/07/2006	28/07/2006	29/07/2006	30/07/2006	31/07/2006	
North West	Yellow	Yellow																													
Yorkshire and The Humber	Yellow	Yellow																													
West Midlands	Yellow	Yellow	Yellow	Red	Yellow	Yellow																									
East Midlands	Yellow	Yellow	Yellow	Red	Yellow	Yellow																									
East of England	Yellow	Yellow																													
South East	Yellow	Yellow																													
London	Yellow	Yellow																													
South West	Yellow	Yellow																													
North East	Yellow	Yellow																													

- Alert Level 1 - Awareness
- Alert Level 2 - Alert
- Alert Level 3 - Heatwave
- Alert Level 4 - Emergency

Figure 1: Alert levels by region for in July 2006. Source: Met Office

## 2. Aims

The evaluation aimed:

1. To provide a rapid overview of mortality and morbidity in the period when the Heatwave Plan was in operation.
2. To assess the level of implementation of the plan across health and social care organisations in England.
3. To assess the effectiveness of the Heatwave Plan.
4. To assess surveillance and information resources and possible needs.

## 3. Methodology

### Part 1: Epidemiological Study

Three aspects of meteorological information relevant to evaluating the heatwave were briefly summarised:

- general description of summer 2006 weather
- temperature by day and region (England and Wales)
- identification of the temperature thresholds where impacts were observed in relation to the response levels within the heatwave plan.

Mortality and morbidity analyses were conducted. Mortality was analysed in two ways:

- mortality associated with temperature
- predicted mortality associated with air pollution.

Primary care data was analysed in two ways:

- a summary of the impact of heat on NHS Direct calls and GP consultations (recorded by the QResearch database)
- an estimate of the excess in total NHS Direct calls during the two severe heat episodes (July 2006).

### Part 2: Evaluation Survey

Five types of organisations were sampled in this study via questionnaires: SHAs, PCTs, Acute NHS Trusts, Health Protection Units (HPUs) of the HPA and CSCI Inspectors. Purposive non-random sampling was used and this has implications for what conclusions can be drawn.

The HPA requested each of the nine HPA Regional Offices in England to survey a varying number of SHAs, PCTs and Acute Trusts in their region depending on the population of the region. They were asked to select these organisations themselves, and the questionnaires (of between 17 and 22 questions depending on the organisation) were administered by telephone interviews.

All 32 HPU Directors within the HPA were also asked to complete a self administered questionnaire of five questions.

Three CSCI inspectors from each region were requested to complete a questionnaire of seven questions. Approximately half of the CSCI Inspectors surveyed were selected as they had previously given feedback to CSCI management of their observations over the heatwave period, and the other half were selected randomly.

### Part 3: Multi- Agency Seminar

A multi-agency seminar of key experts on public health, environmental epidemiology and weather was organised to share research and ideas on heat and health and the evaluation of the heatwave plan. The seminar involved a number of presentations and was followed by group discussion. The organisations represented included the HPA, Met Office, Department of Health, Office of National Statistics (ONS), UKPHA, NICE, NHS Direct, London School of Hygiene and Tropical Medicine (LSHTM) and Help the Aged. The main points and discussions were then presented to the group and discussed, leading to a consensus view of the key issues, conclusions and recommendations.

## 4. Results

### Part 1: Epidemiological Study

A complete set of results from the epidemiological study can be found in appendix 2. There is an overall association between weekly temperature and weekly death counts, with a linear regression coefficient corresponding to 75 extra deaths for each degree temperature elevation ( $p=0.026$ ), and lag zero between the two. An estimate was produced of the mortality attributable to air pollution during the heatwave period.

Several approaches were used to estimate excess deaths. The different approaches resulted in varying estimates from small, or even negative, to several hundred excess deaths in each heatwave week. This variation was largely dependent on which baseline/comparison periods were used. The negative estimates probably occurred because of the inclusion of particularly hot weeks in the baseline. The estimates for each heatwave period in 2006 were lower than the estimated excess deaths in the August 2003 heatwave (around 2000 deaths over 10 days).

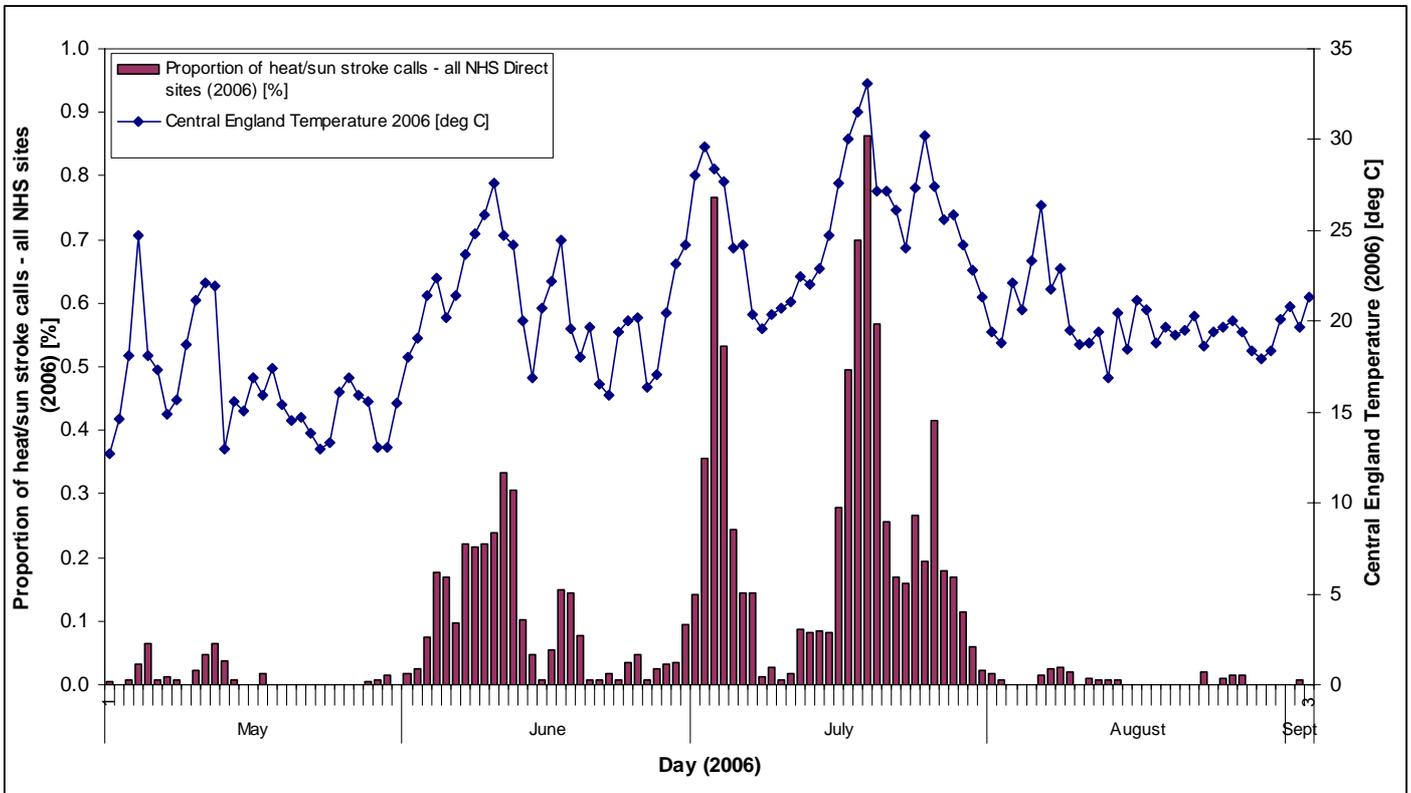


Figure 2. Daily NHS Direct 'heat/sun stroke' calls as a proportion of total calls for summer 2006; and Central England Temperature (representative of a roughly triangular area of the United Kingdom enclosed by Bristol, Lancashire and London).

There were four distinct peaks in heat/sun stroke calls to NHS Direct, as a proportion of total calls (Figure 2):

- 11 June (52 calls, 0.3%),
- 3 July (109 calls, 0.8%),
- 19 July (115 calls, 0.9%), and;
- 26 July (26 calls, 0.4%).

### **Part 2: Evaluation Survey**

Overall the study found that there was a high awareness of the heatwave plan and most organisations found the plan assisted them before and in alert level 3 periods.

Of the CSCI inspectors surveyed, 51% stated that a positive response had been implemented in all or the majority of the Care Homes they had visited. 12% stated they saw a positive response in half of the care homes visited, 15% saw a positive response in the minority of care homes visited and 4% did not see a positive response in any care homes visited.

Most SHAs felt the plan was clear and concise about their expectations and that there was a good multi-agency heatwave response. The media coverage was high and it is possible that this may have been a large contributing factor to the low level of heat related impact. It was suggested that if this was the case, perhaps the focus of the heatwave plan should have more emphasis on communications. The following issues and suggestions were also raised by SHAs.

1. The fluctuating alert levels can result in difficulties in raising and lowering a response and there may be an advantage to maintaining a higher level, once reached, if hot weather is expected to continue. Trigger points may need to be reviewed because the levels often went from level 1 to level 3 in one step, missing out level 2 where most of the preparation takes place. Either level 2 needs to be initiated earlier or the actions required need to happen earlier if this is likely this will be the pattern of alerts in the future.
2. The definition of vulnerable groups needs to be revisited. The definitions in the plan are so broad that in some areas they represent a very large proportion of the population. To check on these each day is not feasible, even using the combined strength of health and local authority social care staff. A more focused approach is needed to identify individuals and for actually approaching them. This might make more use of the non-statutory sector.
3. Out of hours processes need to be investigated and strengthened to ensure alert level activations are received and passed on.

In PCTs there were high levels of awareness and dissemination of the plan. The majority of PCTs thought the plan was clear about what their organisation had to do, but many made commented that while they were clear, there were difficulties in achieving what was requested. It was also noted that there needed to be more clarity on responsibility and accountability. The main difficulty for the PCTs was in contacting vulnerable people with results showing:

- 67% of PCTs surveyed were satisfied that lists of vulnerable people were drawn up at practice or other local level over the heatwave period,
- 17% were partially satisfied and
- 17% were not satisfied.
- Of the PCTs that were satisfied (67%) only two thirds (47% of the 67%) were also satisfied that the vulnerable individuals were contacted during levels 2 and/or 3.

In the evaluation survey some PCTs and acute trusts reported an increase in admissions. It is not clear if this is simply anecdotal evidence from a few organisations; it would be useful to have better data as this could assist in planning.

### **Part 3: Multi- Agency Seminar**

The seminar discussed all the results and interpretations of the epidemiological study and the evaluation survey. There were also presentations on mortality, meteorology and general heatwave epidemiology. Following the presentations the most important themes were debated leading to a general discussion on what conclusions could be drawn and what recommendations could be made.

London and the South East generally had higher temperatures than the rest of the country. Evidence indicated that although higher temperatures were observed these were not the only regions that showed the high impacts during the heatwave. Many regions had high impacts around built up areas for example the West Midlands showed impacts in Birmingham.

## **5. Discussion**

### **Limitations**

#### **Epidemiological Study**

The main limitation to this study was the lack of data available. Daily deaths and regional level mortality data were not available at the time to fully analyse the impacts of the heatwave.

#### **Evaluation Survey**

The main limitations of the Evaluation Survey were the low response rates, non-random sampling and lack of specific information on the implementation of frontline interventions. It is therefore difficult to draw strong conclusions and confidently generalise the results across all other organisations. However the study identified certain themes surrounding the implementation of the heatwave plan, and it is possible to make some recommendations on how to improve responses to heatwaves in future years.

#### **Multi-agency Seminar**

As with any consensus and opinion-based approach it is important to accept that views are not always evidence based. However, the seminar participants made great efforts to clarify the rationale behind the overall conclusions and recommendations.

### **2006 Heatwave**

#### **Mortality data**

A linear relationship between temperature and weekly mortality was observed in summer 2006, with 75 extra deaths per week for each degree of increase in temperature. Part of this increase may be attributable to air pollution or other factors that are related to temperature.

The current mechanism for prompt analysis of mortality data in heatwaves has many drawbacks. Opportunities to improve this should be investigated. A baseline to use as a comparison in analysis of future heatwaves should be developed in advance.

Using established coefficients from time-series studies, it can be estimated that the increase in pollution during the heatwave periods led to an increase in deaths brought forward. In the epidemiological study the full range of data was not available so it is difficult to compare this with the estimated overall excess deaths. Therefore, it was not possible to be confident about the impact of the effects of pollution in 2006.

### **Morbidity data**

The proportion of heat related NHS Direct calls increased over the periods in which the alert levels two and three were activated, and this was the only real-time data available during these periods. Daily surveillance updates were issued to key staff within the HPA, DH and other agencies involved with the heatwave plan. Overall, daily NHS Direct call data is important - more as a prompt signal that health effects are present in the population during a heat wave than as a comprehensive mechanism for quantifying such effects.

Weekly GP consultations for heatstroke, recorded by the Q-RESEARCH database, also peaked during heatwave periods. This suggests that these data are a sensitive signal and may be useful for real-time signaling of heat-health effects, even though these are not available on a real time basis at present.

### **Comparison of Heatwaves**

Several presentations and evidence from a number of different organisations and studies compared the 2003 and 2006 heatwaves. The overall consensus was that the 2006 heatwave differed from the heatwave in 2003 in a number of ways. The weather itself was less extreme in 2006 with lower temperatures and shorter periods of high temperatures. Mortality was far lower in 2006 and the less extreme weather is likely to have had a significant impact, though other factors may have contributed including the implementation of the heatwave plan. The heatwave that occurred in 2003 probably increased general awareness of what should be done in high temperatures in the community. The heatwave occurred later in the summer months in 2006 and there may have been some level of acclimatisation. It is difficult to assess the relative contribution of all these factors and this will require more evidence. However, good overall awareness of the heatwave plan was shown in a number of key organisations.

In the 2006 heatwave more effects were observed in some regions than others. The regions that were shown to have the higher impacts were not the regions that had the highest temperatures. Evidence such as this must be taken into account when developing research and plans to assist in heatwaves situation to ensure the correct parts of the population are targeted.

## **The Heatwave Plan**

### **Main findings**

Overall the response to the heatwave plan was positive. Awareness was high and many organisations commented that the plan helped their preparation for and during times of high temperatures. There may be a need for more/extra fact sheets/leaflets for specific settings and circumstances. This could include outdoor charity/sporting events and schools. Organisations without specific instructions should still take sensible precautions in times of high temperatures in line with the general Department of Health advice.

### **Measures and Thresholds**

The levels in the heatwave plan are based on temperature alone. This method is easily understood and makes the changes in thresholds relatively straightforward. If other factors such as pollution are shown to be synergistic a composite measure may be more appropriate to determine alert levels. This might include temperature, pollution and morbidity (NHS Direct calls, GP consultations). If there were to be a composite single indicator it would need to be presented in a standard way by all those involved. However, even if a composite indicator is not used a relationship has been shown between heat, temperature and pollution. It would be sensible to ensure

the right links are created between the heat-health watch system and the air pollution alert system coordinated by DEFRA. Therefore there is also a need for more effective joint working and communication to the public between the organisations involved (Department of Health, Met Office, DEFRA, HPA) in order to present a single, timely and unified message to the public.

### **'Heat-Health Watch' Levels**

A number of organisations stated that there were difficulties when alert levels changed often and particularly when they went from 1 to 3. While this is inevitable given that the thresholds are based on forecasts, in 2006 the levels went from 1 to 3 75% of the times that level 3 was activated. This could indicate that the threshold for level 2 has been set too high and if reduced would assist in the overall implementation of the plan during a heatwave. Alert level 1 covers the entire period from 1 June to 15 September so is the minimum state for this period. A change in nomenclature could assist in overall understanding of the plan. For example the current level 1 could be renamed to be "increased summer awareness" with three levels above this point: "alert", "heatwave" and "emergency". Organisations also noted that reaching alert level 3 for only one day was difficult operationally, especially when alert level 3 happened again within a few days. There may be an advantage in having a minimum time period for which level 3 lasts - and three days was suggested as an appropriate period.

### **Vulnerable people**

Some PCTs reported difficulties in contacting vulnerable people defined by the heatwave plan and this was mainly because these groups covered a large proportion of their population. It would seem sensible to refine the definitions more to focus on those most at risk. For example, women over 85 years living alone.

There are a high proportion of vulnerable people living in residential, care and nursing homes and there is a high relative risk for these individuals during a heatwave. France has identified this issue and now encourages homes to have at least one "cool room" in the establishment where residents can go when indoor temperatures are high. These organisations could be targeted more to ensure that they receive the most up to date advice and are implementing the appropriate measure during times of high heat, including advice to have a cool room and to measure temperatures regularly. There could also be more advice given on an opportunistic basis by primary and social care staff, for example during GP consultations.

### **Communication**

The evaluation survey showed that there were communication problems in getting information to front line staff, especially within acute trusts. There were also comments that suggested some staff were not well informed on the required actions during a heatwave. For example, ward staff were less aware than senior management. Some Acute Trusts were also not aware of changes in alert levels (both increases and decreases). It seems that there is scope for clarifying and simplifying the communication route at all levels to ensure a more effective and timely system. This may be assisted by having one authoritative body to distribute information for simplicity, consistency and to ensure the timeliness of the information.

There appeared to be gaps in awareness of the heatwave plan for some care homes, and some did not have the resources to receive electronic message of alert levels. Given the numbers of vulnerable people in these homes, it would seem sensible to ensure that their awareness is increased. Perhaps the ability to receive e mail warnings could be a required standard for nursing and care homes.

Finally, there was a useful suggestion that when the plan is distributed each year there should be a clear description of how it has changed from the previous year.

## **Further Research**

### **Agreement of Baselines**

One of the most important limitations to all studies examining the impacts of extreme temperatures is agreeing what baseline to use for comparing mortality and morbidity data. Caution must be taken when drawing conclusions on impacts as these can be based on different baselines and there is no single correct answer to which baseline is correct. We could consider using the gradient of the temperature and mortality as function to determine adaptation/responses to heatwave situations. A short life working group of individuals from a number of organisations should be formed to come to an overall consensus on baselines, measures and indicators that could be used to assess the impacts of heatwaves and of the responses to them.

### **Mortality data**

Death data are collected by the Office of National Statistics (ONS). Weekly data is available but has a number of associated problems. It cannot be used for real time analysis and the figures are based on death registration dates which results in artefacts around bank holidays. Death data using date of death has a lag of at least 10 months. Daily death data would be useful if it was available on a real time basis because it could be used to monitor real time impacts – and these are important in heatwaves.

### **Evidence base**

Increasing the evidence base for the heatwave plan would assist in making it more effective. Key questions that would benefit from further work include:

- who is vulnerable?
- who experiences heat stress?
- are composite threshold measures better?
- what specific interventions have the greatest effects?
- do hospital admissions increase in heatwaves?
- are daytime or night-time temperatures more important?
- what are the effects of length and rate of temperature change in relation to trigger factors?

Specific ideas for research to address these issues include detailed case studies to determine an individual's circumstances and behaviours. Identifying and following individuals who attend Accident and Emergency departments with heat related symptoms could also be a source of case studies.

One of the issues to emerge in the seminar was whether indoor environment/temperature is an important risk factor. Sustainable new housing and refurbishment of existing housing stock is currently oriented to reducing heat loss with a view to keeping people warm in winter and saving energy. However, this could give rise to high indoor temperatures, with consequent problems in summer. Housing developments are long term programmes and need to take into account global warming and the implications for heat stress. A number of CSCI inspectors also noted that addition of conservatories to care homes can also be a major issue when attempting to control temperature in extreme temperatures (both high and low).

The association of pollution with other contributory factors needs to be examined more thoroughly to determine if this correlates to any increase in morbidity and mortality. If there is a causative effect shown, how should this be included in the heatwave plan?

As an episode/heatwave occurs, could more timely data on health outcomes help to track the course of the heatwave, make immediate projections and reduce the impacts? There are concerns about the availability and timeliness of data to be able to relate health outcomes to temperature, for examples GP consultations and ONS death estimates. Could these be improved, or could we get preliminary figures that could be used in the episode? Also, is the research on the previous years' experiences timely enough for the Department of Health timetable for heatwave plan development?

Specific interventions described in the heatwave plan could be assessed. This could be done on a number of groups including the general public and vulnerable people. Randomised trials could be used to evaluate interventions. For example, on the introduction of cool rooms in care homes as this could give evidence to support making this a requirement. Research could be done on the heat load in occupational settings. The education and associated behavioural change of groups such as carers and the overall population could also be assessed.

This research process must not be sporadic or uncoordinated and must incorporate continued learning. This should also include learning from the experiences of hotter countries that have already looked at a number of these problems. Overall the research will need to involve a number of organisations but there is a need for this to be lead by one agency.

### **Future evaluations**

This evaluation has demonstrated the value of evaluation as a tool in refining the planning process. There are several ways in which this could be improved:

- If the heatwave plan were more focussed then specific evaluations could be done. For example, evaluating targeting vulnerable people by GPs
- Evaluation of people's responses to media messages
- Evaluating the impact of media messages on calls to NHS Direct
- Examining if the response of NHS Direct has any impact on health care utilisation
- Evaluating whether we have the tools to evaluate the plan properly
- Evaluating the availability of data. How quickly is the data provided? Who has access? Is the work being coordinated?

Overall standards need to be developed in order to asses the effectiveness of the heatwave plan.

## **6. Conclusions and recommendations**

The Department of Health heatwave plan was seen positively around the country. The plan was well disseminated and most organisations were aware of the overall roles and responsibilities during each alert level. There was a positive and proactive response by many organisations and the plan assisted with informing them of specific actions to undertake when the heatwave occurred.

However it is clear that there are areas where the heatwave plan could be improved and become more evidence based. Communication systems must be refined and improved to ensure awareness in frontline staff, the alert levels need to be redefined and adjusted, and the definition of vulnerable groups needs tightening. Improved research needs a multifaceted approach and should cover a number of different areas, from environmental epidemiology to behaviour change. The evaluation process must be strengthened to better establish the extent to which the key frontline interventions are being implemented and to assess their associated impacts.

## Summary of conclusions from the Evaluation

### 2006 Heatwave

#### Mortality data

- A linear relationship between temperature and weekly mortality was observed in summer 2006, with 75 extra deaths per week for each degree of increase in temperature. Part of this increase may be attributable to air pollution or other factors related to temperature.
- It is currently difficult to determine the scale of the effects of pollution in 2006.

#### Morbidity data

- NHS Direct calls and GP consultation data are sensitive enough to detect morbidity impacts in a heatwave situation.

#### Comparison of heatwaves

- The 2006 heatwave had fewer impacts than the 2003 heatwave. This may be due to less severe weather, increased general awareness because of the 2003 heatwave, the implementation of the heatwave plan or the heatwave occurring later in the year and a level of acclimatisation.

### The Heatwave Plan

#### Main findings

- There was an overall positive response to the heatwave plan and it was useful in times of a heatwave.

## Summary of recommendations from the Evaluation

### The Heatwave Plan

#### Measures and thresholds

- Further research is needed to determine the basis of thresholds for alert levels, including the need for composite thresholds.
- If a single temperature based threshold maintained there need to be links between the air pollution alert system that is coordinated by DEFRA.
- Communication between key organisations should be increased to ensure the public receive a single unified message of alert levels and information.

#### 'Heat-Health Watch' Levels

- The threshold for Level 2 should be lowered to ensure that in general levels are activated in sequential order
- The alert levels should be reclassified as:
  - Increased Summer Awareness (1 June to 15 September)
  - Alert
  - Heatwave
  - Emergency
- Level 3 should be activated for a minimum of 3 days.

#### Vulnerable people

- Advice on heat and heatwave management should be given more opportunistically by health and social care staff.
- Care and Residential homes need to be targeted to ensure they are aware of Department of Health advice and guidelines.
- The introduction of "cool rooms" and temperature monitoring could be encouraged for care and residential homes.
- The definition of vulnerable groups needs to be tightened considerably.

### **Communication**

- The system for communicating alert levels should be reviewed to ensure clarity in relation to which organisation is the definitive source of the levels, and to ensure that messages get into all levels of key organisations as quickly as possible.
- Care homes that do not have the resources to receive electronic messages need to be targeted to ensure that they receive information and alerts.
- A summary of all changes to the plan should be included when new versions are released.

### **Further Research**

#### **Agreement of Baselines**

- A short life working group of individuals from a number of organisations should be formed to come to an overall consensus on baselines or measures to be used when assessing impacts of high temperatures.

#### **Mortality data**

- Current mortality data has limitations due to timeliness of date of death data and artefacts observed in weekly death registration figures. This needs to be improved so real time mortality data to be accessed.

#### **Evidence base**

- The Department of Health should agree research priorities for heatwave planning and response as part of its overall approach to research prioritisation.
- Research on indoor temperatures and possible effects of high temperatures. This research would be beneficial to feed back into housing developments.
- Research to determine effects of pollution in times of high heat.
- Research could be done to determine the effectiveness of interventions

#### **Future Evaluations**

- The Heatwave Plan should be evaluated on an annual basis.
- Standards should be developed to assess the implementation of the plan and its effectiveness.