Many researches have highlighted the influence of climate on mortality, showing a high increase in mortality in summer time during “heatwaves”, periods with very high temperature and humidity levels. This relation seems to be stronger than those between mortality and other environmental factors, such as atmospheric pollution. According to estimates made in the United States and Greece, unusual heatwaves could cause a 100% increase in daily mortality with respect to the period mean value, and it might also be speculated that most of such deaths would not have occurred. The greatest effects have been detected in cities with high but episodic peaks of intensely hot weather, such as Chicago, New York, Athens, and Rome. The relevance of such studies is becoming more and more marked as climate change effects are widely investigated.

METHODS

We studied the effect of bioclimatic discomfort on resident mortality rate (for all causes of death) in a fairly wide area (about 200 km × 70 km) in the north east of Italy. The regional population is about 4 million inhabitants. We considered three bioclimatic indices associated with physiological discomfort: daily maximum temperature and Thom index constructed using both average and maximum daily temperature (mean and maximum Thom index). We found a very high correlation between all such indices (Pearson correlation index ranging from 0.91 and 0.99) implying that the precise choice of the index is not critical. The spatial variation of the bioclimatic indices is fairly low. Pearson correlation indices and regression coefficients among maximum Thom indices in eight meteorological stations distributed with sufficient uniformity in the regional territory range from 0.64 to 0.93 and from 0.92 to 1.13 respectively. All these statistics are highly significant. The average of eight station values in the plain area was considered representative for the entire flat area. Mountain areas were excluded from the analysis.

RESULTS AND DISCUSSION

Summer mortality over four years (1995–1998) showed remarkable variations. The year 1997 had the lowest mortality rate, 10% higher than 1998. The annual tendency of overall summer mortality as a function of the number of bioclimatically critical days confirms the existence of an association between these two variables and supports the hypothesis that heatwaves could generate additional deaths (table 1).

Figure 1 shows the relation between daily mortality and maximum Thom index, which is at first substantially flat and then increases almost linearly. The behaviour is similar for all three bioclimatic indices. In the case of maximum Thom index, the change of behaviour value (threshold value) is about 26; in the case of mean Thom index, the threshold value is about 24; for maximum temperature it is about 31°C. The average daily mortality before the thresholds is 97; seven are, on average, the additional deaths for each unit increment of maximum Thom index. At present, however, it is quite difficult to identify reliable
thresholds because of data dispersion; for the same reasons, it is
difficult to establish a linear relation beyond those thresholds.
Stronger effects are actually to be expected at very high values
of the indices, but episodes of particularly offensive meteorolo-
gical situations are unusual and longer historical series must
be analysed to properly evaluate the effects of such heatwaves.
On the other hand, the occurrence of situations with maximum
Thom index beyond the threshold is not an altogether rare
event: 80 of 368 days considered by the study showed
unfavourable bioclimatic conditions. Additionally, the effects of
meteorology on mortality assume considerable importance
regarding prevention (population alert in connection with fore-
casting of potentially dangerous episodes) and interpretation of
epidemiological surveys on atmospheric pollutants.

Authors’ affiliations
S Zauli Sajani, A Ranzi, P Lauriola, Environmental Epidemiology Unit,
ARPA Emilia Romagna, Italy
G Garaffoni, C A Goldoni, Assessorato alla Sanità, Regione Emilia
Romagna, Italy
S Tibaldi, Regional Meteorological Service, ARPA Emilia Romagna, Italy

Funding: none.

Conflicts of interest: none.

Correspondence to: Dr P Lauriola, ARPA Emilia Romagna, Direzione
Tecnica-Area Epidemiologia Ambientale, Strada Attraglio 23, 41100
Modena, Italy; plauriola@mo.arpa.emr.it

Accepted for publication 14 September 2001

REFERENCES
3 Smith J, Tirpak DA, eds. The potential effects of global climate
change on the United States: report to Congress. Washington, DC:

Call for peer reviewers

Clinical Evidence is a regularly updated evidence based journal available world wide
both as a paper version and on the internet. Clinical Evidence urgently needs to recruit
a number of new contributors. Contributors are health care professionals or epidemiologists
with experience in evidence based medicine and the ability to write in a concise and
structured way.

Clinical Evidence needs to recruit a number of new peer reviewers. Peer reviewers are
health care professionals or epidemiologists with experience in evidence based medicine.
As a peer reviewer you would be asked for your views on the clinical relevance, validity
and accessibility of specific topics within the journal, and their usefulness to the intended
audience (international generalists and health care professionals, possibly with limited
statistical knowledge). Topics are usually 2000–3000 words in length and we would ask
you to review between 2–5 topics per year. The peer review process takes place through-
out the year, and our turnaround time for each review is ideally 10–14 days.
If you are interested in becoming a peer reviewer for Clinical Evidence, please complete
the peer review questionnaire at www.clinicaledvidence.com or contact Polly Brown
(pbrown@bmjgroup.com).