EDITORIAL

THE 2003 EUROPEAN HEAT WAVES

Tom Kosatsky
Direction de Santé publique, Montréal
and Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Canada

The current issue of Eurosurveillance updates and provides additional context to the report in early 2004 of an estimated 22 080 excess deaths in England and Wales, France, Italy and Portugal during and immediately after the heat waves of the summer of 2003 [1]. While estimates for England and Wales [2], France [3], and Portugal [4], are largely unchanged from those reported earlier, to these should be added 6595-8648 excess deaths in Spain [5], of which approximately 54% or 3574-4687 occurred in August, and 1400-2200 in the Netherlands [6], of which an estimated 500 occurred during the heat wave of 31 July-13 August. Data for Italy, provided here for the cities of Bologna, Milan, Rome, and Turin, are compatible with the earlier estimate that 3134 excess deaths occurred in the 21 Italian regional capitals during the period 1 June-15 August [1,7]; the Italian National Institute of Statistics however, reported an excess of 19 780 deaths country-wide during June-September 2003 as compared to 2002 [8]. Reports elsewhere indicate that approximately 1250 heat-related deaths occurred in Belgium during the summer of 2003 [9], that there were 975 excess deaths during June-August in Switzerland [10] and 1410 during the period August 1-24 in Baden-Württemberg, Germany [11]. At this point, it seems reasonable to speculate that with evidence of heat wave-associated deaths beyond England and Wales, France, Italy, and Portugal, the previously published estimate of 22 080 early August excess deaths should be revised upward by at least 50% for all of western Europe, and by 100% or more if heat events that occurred during June and July 2003 are also taken into account.

The task ahead is to build coordinated, sustained national and local programmes to reduce the vulnerability of the population to extreme heat

Contributors employed a variety of methods to estimate the number of excess deaths during and just after the 2003 heat episodes and to relate daily death counts to weather, to concentrations of air pollutants, and to demographic and social characteristics. Indeed, the varying emphases and methods demonstrated by the six national contributors provide complementary evidence of what happened in 2003, and to whom. While the absence of uniform methods does limit between-country comparisons of the health impact of the 2003 heat waves, these reports taken together suggest that weather alone does not explain the varying tolls of excess death within and between countries.

All six reports demonstrate that the mortality impact of the 2003 heat wave was greatest on the very old: for example, excess mortality in France was estimated at 20% for those aged 45-74 years, at 70% for the 75-94 year age group, and at 120% for people over 94 years [3]. There was no evidence of excess mortality in infants and children in any of the six reports. Among the elderly in France, Portugal and Italy, the three countries which stratified deaths by sex, rates were higher in females [3,4,7]. The strength of the age effect and the direction of the sex effect differ from those described for the 1995 heat wave in Chicago, United States [12], and indeed from those of the 1981 heat wave in Portugal [13]. Also rather unexpected is the observation from Spain that mortality impacts were more pronounced in rural villages than in the provincial capitals [5]; heat wave deaths are generally assumed to be an urban phenomenon, related in part to endogenous production of heat by city-based buildings, traffic, and factories, and to heat retention by inner city asphalt and concrete [14].

Investigators in Rome and Turin calculated rates of excess death as a function of socioeconomic level. They report that the greatest excess was in people living in areas of the lowest socioeconomic level, and suggest that finding may be upwardly biased, due in part to the phenomenon that those who have the means to do so leave Italian cities in summer, leading to an overestimate of the denominator for economically advantaged elderly people resident in the city in summer [7].

It has been observed that few deaths during heat waves are declared to be due to hyperthermia, heatstroke and other classic heat illnesses [15]. Reports from both France and Portugal observe that in 2003, deaths certified as caused by ambient heat constituted an important proportion of the death excess [3,4]; in France, 2852 of 11 891 (24%) excess deaths among people over 74 years were medically certified as directly heat-related.

Assessment of deaths per day offers speculative evidence for the effect of heat wave severity and duration on excess mortality. In the Netherlands [6], deaths per week vary with average weekly maximum temperature over the entire temperature range. In Milan [7] and in Spain [5], heat events of shorter duration earlier in the summer show a moderate death excess, compared with the deep and prolonged mortality spikes associated with the 10 day August heat event. In Paris, the daily death record shows that excess deaths are apparent within 1-2 days of rising August temperatures, crescendo during the unrelenting heat of 2-12 August, drop as temperatures fall, and reach baseline levels by 19 August [3]. Taken together, these graphs of deaths per day suggest that the lag time from extreme heat to excess death is around 1-2 days, and that cumulative mortality effects occur when hot weather is prolonged.

Between-city comparisons offer insight into the influence on deaths during heat waves of air pollution, population adaptation, and community preparedness. In Portugal, August forest fires led to a reported 18 accidental casualties [4]: presumably the attendant air pollution may also have had an impact on short-term mortality. Coincident to the high temperatures, elevated concentrations of ground-level ozone and PM10 were recorded in London and the south east of England, those areas of England and Wales where excess mortality was most in evidence [2]. In France, varying concentrations of ground-level ozone in cities subject to differing meteorological circumstances has allowed investigators to assess the joint effects of ozone and heat: these appear to be additive; while the apportionment of deaths to heat versus ozone differed markedly between cities, it appears that for France overall, during

the period 3-17 August 2003, heat had the preponderant impact on mortality [16]. French contributors suggest that Marseille's experience of a heat wave in 1983 and the existence there of a risk management plan for hospitals and a public communication strategy may have led to a death excess in that city of only 26%, compared with 53% for Nice (although the proportion of the very old in Nice is somewhat larger than in Marseille) [3].

Are those who die during heat waves already near death, with extreme heat advancing the date of their demise by only a few days to weeks, and thus creating a compensatory deficit in expected deaths during the days following the heat event? US investigators have suggested so [17], and the very high rates of excess death in Europe during 2003 among the very old tends to support that concept. However, while deaths for all agesin England and Wales declined by 4% between 24-29 August when compared with expected numbers, there was no evidence of mortality displacement in France or Spain, neither during late August, nor during September, October, and November [2,3,5].

Related to this notion of mortality displacement by heat waves is the hypothesis advanced by contributors from Spain that excess 2003 summer mortality may relate in part to the lower than expected level of mortality there during the winter of 2002-2003, leading to a larger than expected pool of people in fragile health by summer 2003 [5]. Italian contributors suggest that the lower levels of excess mortality in Rome during the August heat wave, compared with two earlier episodes in June and July, may be attributable to a reduction by late summer of the pool of susceptible persons [7].

Taken together, the six articles presented here offer a quantitative overview of the short-term effects on mortality of prolonged extreme heat in Europe, a meteorological phenomenon likely to become more frequent towards the mid twenty-first century [18]. The experience of 2003 shows that those most likely to die of the heat are the old, the chronically ill, and the isolated. Both northern and southern Europe are at risk.

Still, there may be good news amidst these descriptions of catastrophe. The Netherlands has seen a decline in the influence of heat on mortality when the 1950s are compared with the 1970s or 1990s [6]. Recent community and/or institutional experience with extreme heat may lead, as in Marseille, to a dampening of the impact of subsequent heat waves [3]. And, in contrast to the situation in Portugal in 1981 and 1991, the official alerts and interventions deployed there in 2003 may in part explain a relative reduction in the impact of extreme heat on mortality [4]. Perhaps most important, national plans for hot weather preparedness and response have been implemented or refined in five of the six contributing countries since 2003.

The task ahead is to build coordinated, sustained national and local programmes to reduce the vulnerability of the population to extreme heat. This involves pre-event planning and effective during-event intervention. While research is needed to guide these programmes, surveillance, such as that described in this issue, can monitor the effectiveness of our efforts and pinpoint the evolution of vulnerabilities.

Acknowledgements

Thank you to France Labrèche, Institut national de Santé publique du Québec and Bettina Menne and Tanja Wolf, WHO Regional Office for Europe, European Centre for Environment and Health, Rome, who provided pertinent reports and publications.

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