The relation between heat wave mortality and living arrangements of the elderly in the Netherlands

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Background and research questions

Excess mortality during heat waves has received increasing attention in recent years. The heat wave of 2003, that reportedly led to about 15 thousand excess deaths in France, triggered various preventive activities in France as well as in other European countries. In the Netherlands, a coordinated programme to prevent excess mortality among the elderly has recently become operational. Since 2006, the Dutch Red Cross cooperates with a volunteer organisation to support the elderly during heat waves.
Earlier reseach has indicated that excess mortality may also be substantial in countries where warm spells are generally less extreme than in the French summer of 2003. For the Netherlands, calculations (by means of regression analysis) showed an absolute number of heat-related deaths of 33.5 (95% CI: 26.0 – 40.9) per week per degree Celsius above an optimum temperature (16.5^{o}C) (Garssen et al., 2005). The total excess mortality in the period June-September 2003 was estimated at between 1400 and 2200 deaths, implying an increase of approximately 3 to 5 percent above the number normally recorded during this period. The research furthermore showed an excess mortality of the elderly that was stronger among the institutional than among the non-institutional population (see figure). The fact that the 2003 mortality figures for the Netherlands were less dramatic than those for France was attributed to the smaller proportion of the Dutch population exposed to extreme temperatures, rather than to superior care for people at high risk.
The main question that we aim to answer in our paper concerns the relation between heat wave mortality and living arrangements. Are only (or mostly) the elderly in nursing homes, in a supposedly frailer state of health, at an increased risk, or also elderly persons who live alone in a private household? Is there a clear difference in mortality risk between one and two person private households? As it is assumed that lower educated and poorly housed persons are at a relatively high risk, we will also attempt to assess the relationship between socio-economic status and heat-related mortality, using real estate value as a proxy for socio-economic status.

Materials and method

The Dutch Central Bureau of Statistics (Statistics Netherlands) receives electronic messages on all deaths of registered inhabitants occurring in the Netherlands. The messages include demographic information on the deceased person, such as age, sex, marital status and address. The latter information is used to compile household statistics. The statistics on cause of death

are based on another (paper) source of information, the cause of death declaration that must be submitted by a family physician or coroner to the municipal authorities. These autorities provide the sealed envelope containing this confidential information with a unique code and forward it to Statistics Netherlands. The same code is also included in the electronic message on the death, allowing Statistics Netherlands to link demographic information to the cause of death.
Various other registers on the Dutch population are kept by Statistics Netherlands. This information will be linked to the information on the population at risk and on the deceased person in order to assess, for example, the socio-economic status. As the information on educational background, professional occupation, income and source of income is either incomplete or less meaningful in the case of elderly persons, we propose to use real estate values as a proxy for socio-economic status. Data on real estate values of all (rented or privately owned) properties are available.
To estimate excess mortality, we will use the average maximum daily temperature per month in the period June-September as recorded in the period 1970-2000. The temperatures are those recorded by the Royal Dutch Meteorological Institute at De Bilt, located in the centre of the Netherlands. We will then calculate the weekly averages of the daily maximum temperatures in the period 2000-2006 and carry out a linear regression analysis between the weekly temperature curve (independent variable) and the weekly mortality curve (dependent variable). For the purpose of this analysis, weekly values are selected as the optimal trade-off between daily values (with high random fluctuations) and monthly values (in which variations in temperature tend to obscure the effect of hot spells). As temperature does not usually have an immediate effect on mortality, we will estimate the average time lag between both variables by determining the best fit between the mortality and temperature curves. Allowing for the resulting time lag, we obtain an estimate of the regression coefficient by sex, age group, household position, marital status and socio-economic status.

Envisaged results

Results of this research are not yet available. We expect to demonstrate an increased risk of mortality for elderly persons and persons with a lower socio-economic status who are living alone. This increased risk should be mainly attributable to cardiovascular mortality, the cause of death that most strongly correlates with heat-related mortality.
The construction of a data base containing the linked data will be completed by 1 November 2007. Analysis and reporting will be finished by 1 May 2008. First results will be presented at the European Population Conference in Barcelona, July 2008.

Literature

Garssen, J., C. Harmsen and J. de Beer, 2005, The effect of the summer 2003 heat wave on mortality in the Netherlands. Eurosurveillance 10(7-9): 165-167.

Observed daily number of deaths in persons aged 80 years or above, summer 2003, the Netherlands (7-day moving averages)