The effect of air-conditioning (AC) on intrahospital mortality during the 2003 heat wave in Mainland Portugal

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BACKGROUND
The August 2003 heat wave accounted for an excess of more than 1900 deaths in Portugal. At the European level it is acknowledged that this heat wave was responsible for an excess of about 70000 deaths. In both situations a considerable number of deaths seem to have occurred in hospitals.

OBJECTIVE
The aim of this study was to evaluate the association of the existence of AC inwards and the intrahospital mortality rate during the 2003 heat wave in Portugal mainland.

MATERIAL AND METHODS
Study Design
A historic cohort design was used, including all patients aged 45 or more, hospitalized during the last 7 days before the beginning of 2003's heat wave, and, therefore exposed to excess heat only in hospital. The study endpoint was the survival of patients in the 18 days of the heat wave plus two days. This endpoint was compared between patients in wards with air-conditioning (AC+) against patients in wards without air-conditioning (AC-).

The cohort Study Group (SG) included all patients admitted between 22.07.2003 to 28.07.2003 (before the beginning of the heat wave) and were not discharged before 30.07.2003. The Comparator Group (CG) included patients belonging to 4 sub-cohorts admitted to hospital during the winter and spring of 2003, defined in order to be as independent as possible in time from each other.

Data
Data was obtained from the National Hospital Discharge Database (ACSS, Health Ministry). Information on the air-conditioning existence was obtained by a survey of hospital administrations during 2007.

Statistical analysis
The association between the survival of patients and being hospitalized in AC+ wards was assessed with a Cox regression model after adjustment for the covariates sex, age, hospital region, type of wards, and main diagnosis. 

RESULTS
The study encompassed 41 (48%) hospitals of Portugal mainland belonging to National Health Service (NHS) and 2093 persons in SG. The study found evidence that, during the heat wave of 2003, the patients admitted in participating wards with AC+ were protected from the heat excess effect with a 40% (95%CI: 3%-63%) risk reduction of death, result obtained after adjusting by the covariates.

According to these results, for SG, figure 2, shows that survival for patients in AC+ wards was higher than for patients in AC- wards: in figure 3, it can be observed the overlapping of the survival curves for patients in AC+ and AC- wards in the CG.

The hazard ratio (HR) of death for patients in AC+ wards versus patients in AC- wards was 0.60 (table 2). The study indicates that patients hospitalized in a ward AC+ were protected from the heat excess effect with a 40% (95%CI: 3%-63%) risk reduction of death, result obtained after adjusting by the covariates.

In the Cox regression model, the following characteristics were found to be significant associations for death at discharge between survival and the following characteristics: 75-84 age group (HR=3.52; 95%CI:1.58-7.84), 85 age group (HR=2.68; 95%CI:1.09-6.61) using 45-54 age group as reference; internal medicine ward (HR=4.61; 95%CI:1.16-18.32) using orthopedic ward as reference.

CONCLUSIONS
The study found evidence that, during the heat wave of 2003, the patients admitted in participating wards with air-conditioning were associated to a survival increase. That association was probably casual. The risk reduction of death was estimated at 40%.

These results support the recommendations of hospital acclimatization issued by the Portuguese Heat Wave Contingency Plan.

Table 1: Percentual distribution for patients in AC+ wards versus patients in AC- wards, by gender, age groups, region, main diagnosis and type of wards

Table 2: Hazard ratios of death for patients in AC+ wards versus patients in AC- wards, obtained by a Cox regression model after adjustment for the following covariates: sex, age, hospital region, type of wards, and main diagnosis at discharge. 

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