Abstract

Name of the thesis: Spatial patterns of links between temperature extremes and cardiovascular mortality in the Czech Republic

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Previous studies have examined relationships of high and low air temperatures to mortality due to cardiovascular diseases (CVDs) in the Czech Republic as a whole. Much less has been understood about possible regional differences in the heat and cold effects on mortality. Within four papers published in international peer-reviewed journals, the author of this thesis investigated links between extreme temperatures and CVD mortality in the Czech Republic while considering in particular differences between (i) urban and rural areas, (ii) regions with different socioeconomic status, and (iii) regions with different physical–environmental conditions. Various biometeorological approaches were compared in order to identify meteorological characteristics affecting heat- and cold-related mortality. Excess mortality was determined as differences between observed and expected daily values, the latter being adjusted for long-term changes, annual and weekly cycles, and epidemics of influenza/acute respiratory infections. Air temperature, biometeorological indices (including the Universal Thermal Climate Index, Apparent Temperature, and Physiologically Equivalent Temperature), and Spatial Synoptic Classification were applied in order to identify days/spells with heat and cold stress and their climatological characteristics.

Generally higher relative excess CVD mortality on hot days than on cold days was found in both urban and rural regions. After taking into account lagged effects of temperature on excess mortality, however, the effect of hot spells was significant in highly urbanized regions while most excess deaths in rural districts may be attributed to harvesting effects. Highest population count and density, highest average temperature due to low altitude, and generally worst thermal conditions due to high proportion of artificial surface were the factors associated with largest excess CVD mortality due to hot spells in urban districts. The peak in excess CVD mortality was observed on the day after the hot spell’s onset, which was associated with a transition between oppressive weather types. While heat effects on CVD mortality for air temperature and the examined thermal indices were similar, air temperature provided a weak cold effect in comparison with the thermal indices including the wind chill effect. Only within the most deprived regions did socioeconomic status play a significantly relevant role.

Results of the thesis are potentially useful for better targeting biometeorological forecasts and warnings to population groups and regions especially vulnerable to extreme weather, as well as for estimating possible climate change effects on heat- and cold-related mortality in the Czech Republic. The study also highlights the importance of critically evaluating applicability and benefits of various biometeorological approaches using epidemiological data when defining criteria and algorithms for integrated warning systems.

Key words: heat stress; cold stress; mortality; spatial differences; cardiovascular disease