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Commentary

Temperature effects on health - current findings and future implications

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Heat waves and cold spells have both shown adverse effects on mortality. Moreover, a recent study by Gasparrini and colleagues estimated that 7.7% of the mortality was attributable to non-optimum temperature using data from 384 locations (Gasparrini et al. 2015). Cold was responsible for a higher proportion of deaths than was heat, while moderate high and low temperatures represented most of the total health burden. Although forecasting studies suggest the passage of (summertime) cold fronts will diminish in frequency in a warmer climate, this will not per se mean that cold effects will only have a very small effect on population health. Studies have already shown that health effects associated with temperature decreases in winter and summer can be similar in magnitude but are more pronounced in years with higher average temperatures. Therefore, the influence of unexpected temperature changes may be more relevant than the absolute temperature level itself (Shi et al. 2015; Wolf et al. 2009).

Populations worldwide are rapidly ageing. The age group 60 years and older is expected to comprise 21.1% of the population by 2050 (http://www.un.org/en/development/desa/population/publications/ageing/WorldPopulationAgeingReport2013.shtml). This increase in the elderly is expected to increase future temperature-related mortality and morbidity.

Recent reviews have contributed to the evidence on the association between air temperature and mortality and morbidity (Aström et al. 2011; Franchini and Mannucci, 2015; Phung et al. 2016; Ryti et al. 2016; Turner et al. 2012; Yu et al. 2012). However, these reviews were limited by either a focus on only heat or cold, a specific outcome, or did not include a meta-analysis. Only two of them presented age-specific results.

The purpose of the systematic review and meta-analyses by Bunker et al. was to present quantitative evidence on the effects of non-optimum high and low ambient temperatures on a range of cause-specific mortality and morbidity outcomes in the elderly (Bunker et al. 2016). Heat waves and cold spells were excluded because they are unique events with differing characteristics. Epidemiological time-series and case-crossover studies reporting quantitative associations between temperature and cause-specific, elderly mortality or morbidity (i.e. hospitalization, emergency room admissions, general practice visits, home visits) were considered.

The authors identified substantially elevated risks in the elderly for temperature-induced cerebrovascular, cardiovascular, and respiratory outcomes in particular. In their meta-analysis for morbidity, the authors showed that the effect estimates for respiratory causes were much larger than for cardiovascular causes with both, high and low temperatures – although for mortality, the effect estimates for cardiovascular causes were similar or slightly larger than for respiratory causes in case of high temperatures. This phenomenon has been already shown in previous studies (e.g. Michelozzi et al. 2009). However, the underlying mechanisms through which high temperatures may increase the risk of morbidity from respiratory causes are yet unclear. In addition, Bunker et al. found an increased risk for heat-induced diabetes, renal, and infectious disease morbidity all of which are likely to increase further with climate change and global aging.

The authors had to pool across different lags and threshold temperatures of the various studies. Therefore, the important fact that the effects of heat are most often immediate while the ones of cold become predominant with longer time lags is not obvious in their pooled effects tables. This limitation was overcome by sensitivity analyses (e.g. for certain lags) where possible.

The systematic review and meta-analysis by Bunker et al. is timely and helpful for pointing out further research needs and possible public health interventions especially for the elderly.

Climate change does not just affect air temperatures, but also a lot of other meteorological variables which might be as important to human health as temperature changes, such as humidity, barometric pressure and precipitation as well as UV-radiation. In addition, it is still unclear why outdoor temperature changes show consistent health effects across all geographical regions despite the fact that especially the elderly spend most of their time indoors. Moreover, the interplay with air pollution is quite complex and new multicenter studies as well as statistical approaches are needed. With an aging population, mental health and cognitive function in particular is an emerging field of concern (Lacruz et al. 2010) in which environmental stressors certainly play a role.

According to the European Environment Agency (http://www.eea.europa.eu/soer/synthesis/synthesis), about 75% of the European population lives in urban areas and is projected to increase to 80% by 2020. Urbanization has resulted in improved access to education, employment and health care. However, it also changed living conditions and influences lifestyles, behaviors and environmental conditions. Urban heat islands were identified as contributing significantly to the

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health impact of the 2003 heat wave in Paris (Laaidi et al. 2012). Further, it has been projected that a reduction of the green cover by 10% would increase urban temperatures by 8.2°C over the next 70 years (Gill et al. 2007) - highlighting the potential for improving health and well-being by measures improving the built environment.

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