

Methods for estimating the health costs of climate change-related events

Because of the challenges of identifying reliable data sources, and a lack of consensus on methods for assigning value to non-market impacts, there is currently no single, widely-accepted method to estimate the cost of the human health impacts of climate change.¹ To estimate the health costs of six selected climate change-related events, the authors identified one event from each category that occurred between 2002 and 2009, and derived health-associated costs of event-related premature death, hospitalizations, emergency department visits, and outpatient visits that were quantified in journal literature or agency reports, using a combined Cost of Illness (COI) and Value of a Statistical Life (VSL) approach.

The authors, a team of scientists, searched peer-reviewed literature and state and federal agency reports to identify an event or episode in each of these categories that specified morbidity and mortality data within the study period. We selected one high-end event, but not the one that was most extreme. Although the links between these individual episodes and climate change cannot be proven definitively, and the pace and extent to which climate change will exacerbate these events varies between the different types, these case studies represent the kinds of health impacts projected to worsen with climate change.

The authors calculated the mortality and morbidity for each event based on data reported, or extrapolations based on values inferred using a ratio (i.e. hospitalization-to-emergency department (ED) visits, and hospitalization-to-outpatient visits) derived from the Medical Expenditure Panel Survey.² Morbidity costs reflect hospitalization, ED visits, outpatient visits, and other medical expenses. Mortality costs are based on the VSL, using a value of \$7.9 million in 2008 dollars, which is the central value from a range of the U.S. Environmental Protection Agency's economic valuation studies.³ The total health-related costs from the six events could be as high as \$40 billion, if all possible sources of variability in the estimated health effects and the methods used to value their costs are included.

Citations for Six Climate Change and Health Costs Case Studies

- 1. California Heat Wave** Knowlton K, Rotkin-Ellman M, King G, Margolis HG, Smith D, Solomon G, et al. The 2006 California heat wave: impacts on hospitalizations and emergency department visits. *Environ Health Perspect.* 2009; 117:61-67.
- 2. California Wildfires** Delfino RJ, Brummel S, Wu J, Stern H, Ostro B, Lippett M. The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003. *Occup Environ Med.* 2009; 66:189-197.
- 3. North Dakota Flooding** North Dakota Department of Health, Division of Disease Control.
- 4. Mosquito-borne Infectious Disease** Zohrabian A, Meltzer MI, Ratard R, Billah K, Molinari N, Roy K, et al. West Nile virus economic impact, Louisiana, 2002. *Emerg Infect Diseases.* 2004; 10(10):1736-1744.
- 5. Ozone Smog Pollution** Hubbell BJ, Hallberg A, McCubbin DR, Post E. Health-related benefits of attaining the 8-hr ozone standard. *Environ Health Perspect.* 2005; 113(1):73-82.
- 6. Florida Hurricane** Ragan P, Schulte J, Nelson SJ, Jones KT. Mortality surveillance 2004 to 2005 Florida hurricane-related deaths. *Am J Foren Med Path.* 2008; 29(2):148-153; Sniffen JC, Copper TW, Johnson D, Blackmore C, Patel P, Hardar-Morano L, et al. Carbon monoxide poisoning from hurricane-associated use of portable generators - Florida, 2004. *CDC MMWR* 2005; 54(28):697-700; Acierno R, et al. Psychological sequelae resulting from the 2004 Florida hurricanes: implications for postdisaster intervention. *Am J Pub Health.* 2007; 97 (S1): S103-S108.



¹ Sussman FG, ML Cropper, H Galbraith, D Godschalk, J Loomis, G Lubner, et al. Effects of Global Change on Human Welfare. In: A Report by the US Climate Change Science Program and the Subcommittee on Global Change Research [Gamble JL (ed.), Ebi KL, Sussman FG, Wilbanks TJ (authors)]. Washington, DC: US EPA; 2008. p.4-1 to 4-74.

² United States Department of Health & Human Services. Agency for Healthcare Research and Quality. Total number of events accounting for expenditures by site of service: United States, 2002-2004, 2006-2007. Medical Expenditure Panel Survey Component Data; 2010. <http://www.meps.ahrq.gov/mepsweb/>. Accessed April 26, 2010.

³ US Environmental Protection Agency. Valuing mortality risk reductions for environmental policy. Presentation to EPA's Science Advisory Board, Environmental Economics Advisory Committee. 2011.