In Response to "Temperature and Violent Crime in Dallas, Texas: Relationships and Implications of Climate Change"

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Gamble JL, Hess JJ: Temperature and Violent Crime in Dallas, Texas: Relationships and Implications of Climate Change. *West J Emerg Med*. 2012;13(3):239–246.

To the editor:

We were interested to read Gamble and Hess's study finding that the daily incidence of violent crime in Dallas increased with temperatures up to 90°F (32.2°C), but decreased above this threshold. On this basis, their abstract surprisingly concludes that "higher ambient temperatures expected with climate change…. are not likely to be accompanied by markedly higher rates of violent crime" (p .239). This conclusion contrasts with the findings of previous studies.[1-3]

Unfortunately, the authors did not attempt to actually estimate the magnitude of future warming that would be sufficient to bring about a decrease in aggregate annual violent crime, which will differ from the inflection point of the relationship between daily temperature and violent crime. We therefore used the piecewise regression model reported by the authors in order to investigate how annual aggravated assault incidence in Dallas is likely to be affected by changes in mean temperature. We focus on aggravated assault given that this was the crime for which a marked effect of temperature was reported. Temperature data for Dallas International Airport in 1999 was collected from the NCDC[4]. 1999 was used as a reference point being the last year in the series investigated by Gamble and Hess.

The simulation was conducted as follows. For each of a range of hypothetical annual temperature anomalies from -5 to +20°F, the annual anomaly was added to the actual mean temperature in each day of 1999 to obtain an annual series of daily temperatures. The piecewise regression model was then used to obtain the predicted number of assaults for each day of the series. These were then summed over the course of the year.

Our simulation suggests that the mean temperature in Dallas would have to increase by around 13°F (7.2°C) before subsequent temperature increases would begin to reduce annual aggravated assaults. At this point, the model predicts an extra 146 annual aggravated assaults per 100,000 population in comparison to a world with zero warming. Before this point, temperature increases would continue to increase assaults. Notably, a temperature increase of 13°F would be substantially greater than the warming likely by the end of the 21st century on the basis of regional climate projections for central North America.[5] As such, the inflection point in the temperature-violence relation appears to occur at too high a temperature to be of much comfort for those concerned with the implications of climate change for human violence in the medium term.

However, it is important to note that this analysis provides only *conditional* predictions about how many extra assaults are likely to arise in Dallas given a particular magnitude of warming, in comparison to an identical Dallas *without* this warming. The world of the future will be different from today's in many ways other than simply being warmer. An unconditional forecast of future violent crime rates would need to take into account multiple predictors of crime, as well as temporal trends unrelated to global warming—such as the decreasing trend in violent crime in Dallas over the last two decades.[6]

*Matt N. Williams, MA**
Stephen R Hill, PhD†
John Spicer, PhD†

** Massey University, School of Psychology, Auckland, New Zealand*
† Massey University, School of Psychology, Palmerston North, New Zealand

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Address for Correspondence: Matt N. Williams, MA. School of Psychology, Massey University, Private Bag 102904, North Shore, Auckland 0745, New Zealand. Email: M.N.Williams@massey.ac.nz.

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In reply:

We note a number of concerns regarding the accompanying letter to the editor. First, while our conclusions do contrast with the findings of some previous studies, our findings are consistent with the curvilinear affect found in a number of others, notably those conducted by Rotton and Cohn and earlier hypothesized by Baron and Bell.[1-5] As we note, it may be reasonable to conclude that the true relationship is curvilinear, but that daily temperatures in northern locales rarely reach and surpass the threshold at which the incidence of aggravated crimes might decline.

In addition, we need a more robust approach to assess the likely behavior of the response curve to warming temperatures (see Figure 2). As we noted in our paper, it is not clear whether the curve relating temperature to violent crime will remain stable in a warming climate or if it will shift. The sensitivity analysis presented in the letter to the editor seems to assume that the curve will remain stable, the crime incidence function will remain unchanged, and that total crime will increase as temperatures warm by a change of 13°F. We hypothesize that the curve may move to the right with increased temperature and the passage of time. Such a shift would be consistent with anticipated acclimatization or the institution of effective adaptation measures, such as the introduction of air conditioning in buildings not currently equipped or more widespread public health watch/warning systems, and would not necessarily result in a change in the area under the curve despite consistently higher temperatures. This hypothesis deserves further study across time and across locations in order to tease out the effects of human behavior or psychology on vulnerability as well as the effects of different climate regimes that may vary by latitude.

Finally, the sensitivity analysis described in the letter is, on the one hand, an interesting extension of the findings we present. There are, however, issues associated with doing an analysis that uses an aggregate assault count rather than actual daily counts to estimate daily effects. Using an aggregate annual count for 1999 will not account for a number of factors that may vary from day to day or season to season and that may exert an independent effect on daily assaults. Using the annual aggregate count may over- or under-estimate the effect of temperature on aggravated assaults and may do so unevenly.

Janet L. Gamble, PhD
US Environmental Protection Agency

Jeremy J. Hess, MD, MPH
Emory Schools of Medicine and Public Health

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Address for Correspondence: Janet L. Gamble, PhD. U.S. Environmental Protection Agency, 1200 Pennsylvania Ave., Mailcode 8601P, Washington, DC, 20460. Email: gamble.janet@epa.gov.

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