Letters

RESEARCH LETTER

Funding and Publication of Research on Gun Violence and Other Leading Causes of Death

The United States has the highest rate of gun-related deaths among industrialized countries, with more than 30 000 fatalities annually.[1] To date, research on gun violence has been limited. A 1996 congressional appropriations bill stipulated that "none of the funds made available for injury prevention and control at the Centers for Disease Control and Prevention [CDC] may be used to advocate or promote gun control."[2] Similar restrictions were subsequently extended to other agencies (including the National Institutes of Health), and although the legislation does not ban gun-related research outright, it has been described as casting a pall over the research community.[2,3] This study sought to determine whether funding and publication of gun violence research are disproportionately low relative to the mortality rate from this cause.

Methods | CDC mortality statistics were accessed from 2004 to 2014 (the most recent year available).[1] Thirteen nonspecific causes of death (ie, "all other diseases") were excluded and the top 30 causes of death were retained for further analysis (details, excluded causes of death, and annotated code available at https://github.com/davidestark/gun-violence-research/).

CDC-derived causes of death were manually mapped to their corresponding Medical Subject Heading (MeSH) term(s). For each cause of death, MEDLINE was queried for the total number of publications between 2004 and 2015 indexed with the corresponding MeSH term(s), including descendant terms (terms subsumed under a parent term within the MeSH hierarchy).

Research funding data from 2004 to 2015 (all years available) were accessed from Federal RePORTER, a database of projects funded by US federal agencies.[4] Projects are indexed using the computerized Research, Condition, and Disease Categorization system derived in part from MeSH. For each cause of death, Federal RePORTER was queried for the total funding awarded to projects containing corresponding MeSH terms, including descendant terms.

To determine how research funding and publication volume correlated with mortality, 2 linear regression analyses were performed using mortality rate as a predictor and funding or publication count as outcomes. The predictor and outcomes were log-transformed and studentized residuals (residual divided by estimated standard error) were calculated to determine the extent to which a given cause of death was an outlier in terms of research funding or publication volume. All analyses were performed in R (R Foundation for Statistical Computing), version 3.2.2.

Results | Compared with other leading causes of death, gun violence was associated with less funding and fewer publications than predicted based on mortality rate (**Figure 1**). Gun violence had 1.6% of the funding predicted ($1.4 billion predicted, $22 million observed) and had 4.5% of the volume of publications predicted (38 897 predicted, 1738 observed) from the regression analyses. Gun violence killed about as many individuals as sepsis. However, funding for gun violence research was about 0.7% of that for sepsis and publication volume about 4%. In relation to mortality rates, gun violence research was the least-researched cause of death and the second-least funded cause of death after falls (**Figure 2**).

Discussion | Between 2004 and 2015, gun violence research was substantially underfunded and understudied relative to other leading causes of death, based on mortality rates for each cause. Ladapo and colleagues[5] previously found a smaller-than-expected increase in gun violence publications between 1991 and 2010. The present study incorporates mortality and funding data, and demonstrates the magnitude of the research funding disparity.

The study was limited by its cross-sectional design and imperfect mappings between data sources. CDC-derived causes of death were manually mapped to MeSH terms for retrieving publications. MeSH terms were used to retrieve funded projects although projects were categorized using terms only partly derived from MeSH.

Injury research has been generally undersupported[6]—a finding replicated in the present study. Gun violence had less funding and fewer publications than comparable injury-related causes of death including motor vehicle accidents and poisonings. Given that gun violence disproportionately affects the young and inflicts many more nonfatal injuries than deaths, it is likely that the true magnitude of research funding disparity, when considering years of potential life lost or lived with disability, is even greater.

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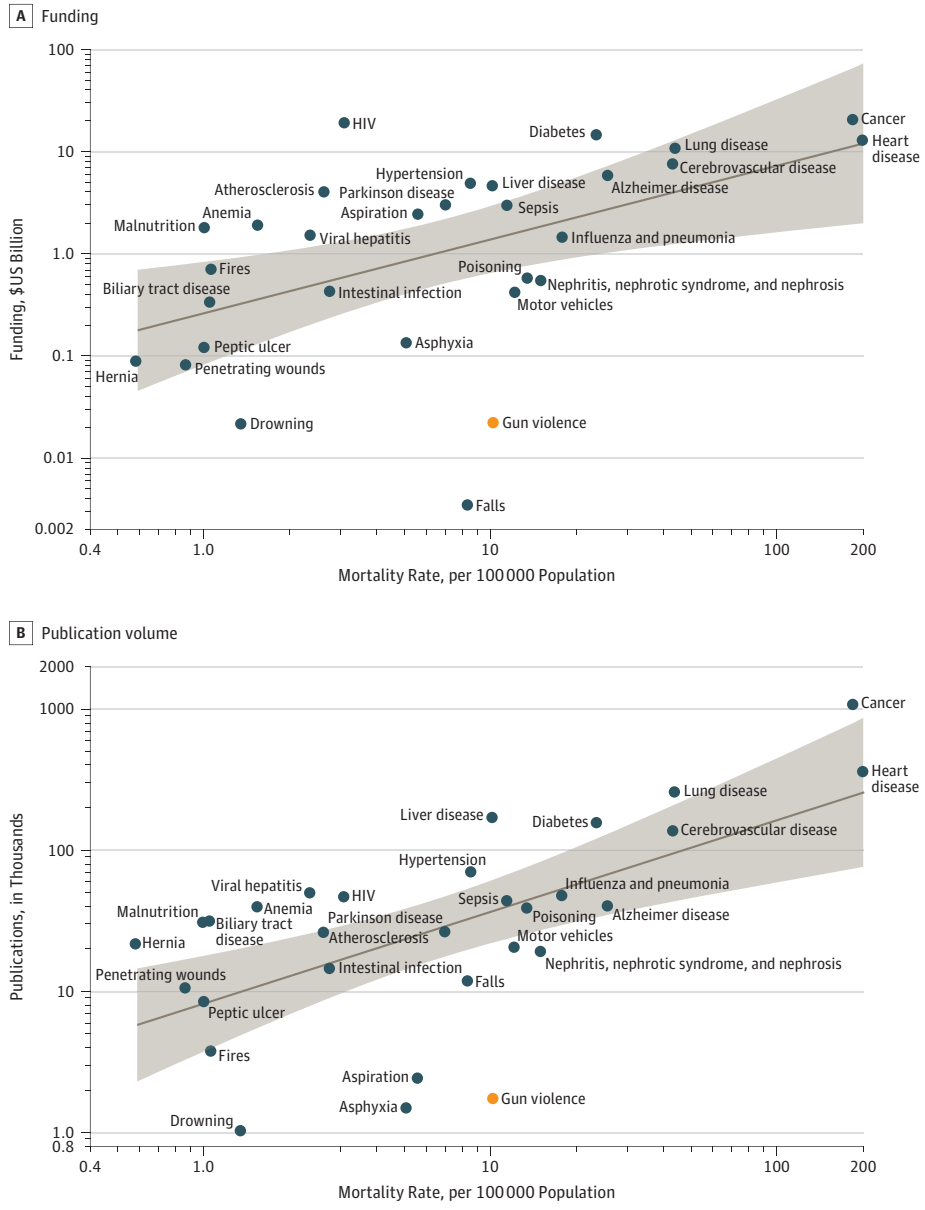
Concept and design: Stark.
Acquisition, analysis, or interpretation of data: Both authors.

Figure 1. Mortality Rate vs Funding and Publication Volume for 30 Leading Causes of Death in the United States



HIV indicates human immunodeficiency virus. Shaded areas indicate 95% CIs. Plotting is on a log-log scale. Funding represents the total funding awarded over the years 2004 to 2015. Dollar amounts have not been corrected for the year in which they were reported.

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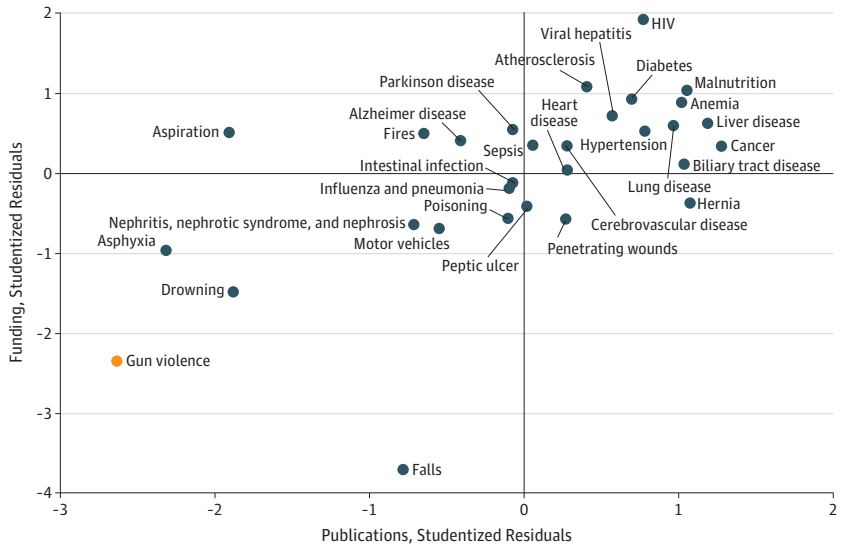
Figure 2. Studentized Residual Predicted vs Observed Funding and Publication Volumes for 30 Leading Causes of Death in the United States



HIV indicates human immunodeficiency virus. Mortality rate was used to predict funding and research volume. Studentized residuals (residual divided by estimated standard error) were calculated to give a standardized estimate of predicted vs observed funding and publication volume. The 4 quadrants represent observed funding greater than predicted, observed publication volume less than predicted (upper-left); observed funding and publication volume greater than predicted (upper-right); observed funding less than predicted, observed publication volume greater than predicted (lower-right); observed funding and publication volume less than predicted (lower-left).

COMMENT & RESPONSE

Allergenic Food Introduction and Childhood Risk of Allergic or Autoimmune Disease

To the Editor Dr Ierodiakonou and colleagues presented a comprehensive synthesis of the evidence on timing of complementary feeding and childhood atopic and autoimmune diseases.[1] We have a number of concerns.

First, we wonder what hypothesis relates allergenic foods to autoimmune conditions.

Second, we wonder what the basis was for the selection of the allergenic foods considered in the review. Selecting certain foods assumes an established immunological basis for them as opposed to other foods. However, other foods (eg, roots, fruits, and meat) also have been found to be important.[2] Evidence also indicates that food diversity is important, not just the timing of specific foods.[3] Knowledge of the mechanisms of actions is far from certain, but we find the authors' statement that there are no data showing feeding one allergenic food influences allergy to a different allergenic food to be incorrect.[2]

Third, some of our previous studies were included in this systematic review (references 24, 26, 31, and 32 in the article) based on the Finnish Type 1 Diabetes Prediction and Prevention (DIPP) study and the Study of Eczema and Asthma to Observe the Influence of Nutrition (SEATON) cohort in Aberdeen. Unexpectedly, the findings in relation to asthma were neither described in the article nor included in any meta-analysis. This was also true for the Western Australian cohort[4] and the Dutch Influence of Lifestyle-Related Factors on the Immune System and the Development of Allergies in Childhood (LISA) cohort.[5]

Fourth, even though the authors indicated "asthma/wheeze" as an outcome, there was no indication that asthma was investigated, even when the studies included asthma as an outcome. Only wheeze was an outcome reported throughout the review. The asthma findings in our studies were some of the strongest results compared with other atopic outcomes. We believe that a meta-analysis of timing of infant feeding and asthma was possible. Asthma is a critical outcome, especially when diagnosis has been confirmed by a physician, as in these studies. Physician-diagnosed asthma should be differentiated from wheeze given its clinical implications in the spectrum of atopic disease and should therefore have been included in the review as a separate outcome.

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Conflict of Interest Disclosures: The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.

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