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From GRID to gridlock: the relationship between scientific biomedical breakthroughs and HIV/AIDS policy in the US Congress

Matthew B Platt*§,1 and Manu O Platt*§,2,3

§Corresponding authors: Matthew B Platt, Department of Government, Harvard University, 1737 Cambridge St., Cambridge, MA 02138, USA. Tel: +1 617 495 9849. (mplatt@gov.harvard.edu) and Manu O Platt, Coulter Department of Biomedical Engineering, Georgia Institute of Technology and Emory University, 315 Ferst Dr., Suite 1308, Atlanta, GA 30332, USA. Tel: +1 404 385 8531. (manu.platt@bme.gatech.edu)

*These authors contributed equally to the work.

Introduction: From the travel ban on people living with HIV (PLHIV) to resistance to needle exchange programmes, there are many examples where policy responses to HIV/AIDS in the United States seem divorced from behavioural, public health and sociological evidence. At its root, however, the unknowns about HIV/AIDS lie at biomedical science, and scientific researchers have made tremendous progress over the past 30 years of the epidemic by using antiretroviral therapy to increase the life expectancy of PLHIV almost to the same level as non-infected individuals; but a relationship between biomedical science discoveries and congressional responses to HIV/AIDS has not been studied. Using quantitative approaches, we directly examine the hypothesis that progress in HIV/AIDS biomedical science discoveries would have a correlative relationship with congressional response to HIV/AIDS from 1981 to 2010.

Methods: This study used original data on every bill introduced, hearing held and law passed by the US Congress relating to HIV/AIDS over 30 years (1981–2010). We combined congressional data with the most cited and impactful biomedical research scientific publications over the same time period as a metric of biomedical science breakthroughs. Correlations between congressional policy and biomedical research were then analyzed at the aggregate and individual levels.

Results: Biomedical research advancements helped shape both the level and content of bill sponsorship on HIV/AIDS, but they had no effect on other stages of the legislative process. Examination of the content of bills and biomedical research indicated that science helped transform HIV/AIDS bill sponsorship from a niche concern of liberal Democrats to a bipartisan coalition when Republicans became the majority party. The trade-off for that expansion has been an emphasis on the global epidemic to the detriment of domestic policies and programmes.

Conclusions: Breakthroughs in biomedical science did associate with the number and types of HIV/AIDS bills introduced in Congress, but that relationship did not extend to the passage of laws or to hearings. When science matters, it cannot be separated from political considerations. An important implication of our work has been the depoliticizing role that science can play. Scientific breakthroughs helped to transform HIV/AIDS policy from a niche of liberal Democrats into bipartisan support for the global fight against the disease.

Keywords: agenda setting; PEPFAR; bill sponsorship; bipartisan policy.

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Introduction

On 30 October 2009, President Barack Obama announced that his administration was ending the travel ban against people living with HIV (PLHIV). Obama described the travel ban as “a decision rooted in fear rather than fact” [1]. In the early days of HIV, when it was called GRID (gay-related immunodeficiency), there was perhaps some basis for the fears that Obama references: pre- and postnatal infant infections [2,3], blood transfusions [4], infected healthcare workers [5] and female heterosexual acquisition [6]. When Congress statutorily enforced the travel ban in 1993 [7], there had been significant advances in understanding transmission [3,8–11], virus detection even in asymptomatic individuals [12] and extending lives with antiretrovirals [13,14]. Despite these important advances, the spectres of Ryan White, Arthur Ashe, Magic Johnson and dentists infecting their patients [10,11] were enough to sustain public fears.

The travel ban was an example of the US Congress responding to public fear and giving it priority over scientific knowledge. This incident is not isolated from other congressional decisions regarding HIV/AIDS. Behavioural, public health and sociological studies have been disregarded: examples include laws disallowing federal funds for needle exchange programs despite their well-documented efficacy for reducing HIV transmission [9,15,16], laws disallowing condom distribution in prisons [17] and the lack of antiretroviral drug availability for the working poor and middle class domestically. Congress has seemed out of step with recommendations from social scientists and
public health experts. HIV/AIDS is a biomedical problem with scientific discovery developing new ways to combat it. In this article, we ask: what role has biomedical scientific discovery played in the congressional response to HIV/AIDS?

At its core, this is a study of how and whether science interacts with politics. The science for policy literature suggests that climate change, like HIV/AIDS, is a case where science has been politicized [8]. Jasanoﬀ states that the credibility, trust and validity of science are necessary for scientiﬁc progress and public support [9]. Building trust between scientists and the public falls on the scientist, scientiﬁc knowledge and the committee advisors who translate these ﬁndings for policy purposes [9,20]. In a stylized world, scientiﬁc ﬁndings are divorced from ideology and partisanship. Debates on climate change took place in a real world where the public lost trust in scientists and detached from their policy positions [9]. As a result, Montpetit argues that climate knowledge is viewed among existing political divisions instead of as objective truth [21].

There are important diﬀerences between climate change and HIV/AIDS policy. Firstly, detached HIV/AIDS activists are not possible because the need for treatment ties them to the biomedical community [22]. Secondly, climate change is a long-term, collective disaster, whereas HIV/AIDS (if left untreated) is short term and personal. Biomedical advancements that have extended life to within 10 years of the non-infected life expectancy should reinforce trust in scientists. Along with properly controlled experiments, the rigors of peer review and the clinical evidence of treatments working, presumably without political agenda [23], should create trust between biomedical scientists and the government.

Despite these apparent differences between climate change and HIV/AIDS, their policy fates may be inevitably similar. Guston and colleagues posit that scientiﬁc knowledge is not separable from ideology, but has inherent partisanship [24]. A comprehensive study by Hoppe ﬁnds a strong consensus that scientiﬁc experts and advisors are not partisan and that scientists help to depoliticize hot topics [25]. However, scientiﬁc advisors overwhelmingly agreed that scientiﬁc expertise plays only a moderate role in policy, and that politics and values are the major inﬂuence. Science was used for “uncertainty reduction.” We contribute to this literature by quantitatively testing the hypothesis that biomedical science discoveries in the 30-year fight against HIV/AIDS have a correlative relationship with the congressional response to HIV/AIDS.

Methods

Study design

This is a statistical analysis of how congressional policy making – bills introduced, hearings held and laws passed – correlates with the annual number of scientiﬁc, biomedical breakthroughs published from 1981 to 2010.

Data collection

HIV/AIDS biomedical scientiﬁc literature collection

HIV/AIDS scientiﬁc breakthroughs were deﬁned using the most-cited biomedical articles and journals with the highest impact factors (Table 1). Using the Web of Science database (Thomson Reuters) and appropriate search terms, the 500 most-cited articles on HIV/AIDS were identiﬁed, and the annual number of articles published from 1981 to 2010 was counted. Articles were ranked by citations per year to avoid bias towards older articles. This measure of scientiﬁc knowledge is in line with standard conventions [18]. The cut-oﬀ at 500 was arbitrary but suﬃcient to focus on the most important advances and publications. To conﬁrm reliability, neither the sign nor the signiﬁcance of results changed when articles were cut oﬀ at 1000.

As a supplement, a list of important articles was compiled based on our own literature review. This supplemental list allowed the inclusion of inﬂuential articles that were published before the HIV/AIDS nomenclature was used or that were not among the top cited but are referenced at international conferences. This included the earliest studies by Montagnier and Gallo from 1981 to 1987, which were nicely summarized [8] during the settlement between these research groups and their governments over initial HIV patents [8,26]. Articles were coded by general subject: transmission, cure, medicine, identiﬁcation, pathogenesis, women and children, healthcare, homosexual, comorbidities and global epidemic.

Congressional policy making

The Congressional Hearing Digital Archive maintained by LexisNexis was searched using “acquired immune deﬁciency syndrome” and top-cited publications for HIV/AIDS research

Table 1. Biomedical journals with the highest impact factors and top-cited publications for HIV/AIDS research

<table>
<thead>
<tr>
<th>Impact rank</th>
<th>Journal title</th>
<th>Impact factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>New England Journal of Medicine</td>
<td>53.5</td>
</tr>
<tr>
<td>8</td>
<td>Nature Genetics</td>
<td>36.4</td>
</tr>
<tr>
<td>9</td>
<td>Nature</td>
<td>36.1</td>
</tr>
<tr>
<td>11</td>
<td>Lancet</td>
<td>33.6</td>
</tr>
<tr>
<td>14</td>
<td>Cell</td>
<td>32.4</td>
</tr>
<tr>
<td>15</td>
<td>Science</td>
<td>31.4</td>
</tr>
<tr>
<td>18</td>
<td>Journal of the American Medical Association</td>
<td>30.0</td>
</tr>
<tr>
<td>31</td>
<td>Nature Immunology</td>
<td>25.7</td>
</tr>
<tr>
<td>32</td>
<td>Nature Medicine</td>
<td>25.4</td>
</tr>
<tr>
<td>45</td>
<td>Nature Cell Biology</td>
<td>19.4</td>
</tr>
<tr>
<td>58</td>
<td>Annals of Internal Medicine</td>
<td>16.7</td>
</tr>
<tr>
<td>63</td>
<td>PLOS Medicine</td>
<td>15.6</td>
</tr>
<tr>
<td>69</td>
<td>Journal of Experimental Medicine</td>
<td>14.8</td>
</tr>
<tr>
<td>76</td>
<td>Journal of Clinical Investigation</td>
<td>14.2</td>
</tr>
<tr>
<td>91</td>
<td>Genes and Development</td>
<td>12.9</td>
</tr>
<tr>
<td>96</td>
<td>PLOS Biology</td>
<td>12.5</td>
</tr>
<tr>
<td>124</td>
<td>Blood</td>
<td>10.6</td>
</tr>
<tr>
<td>151</td>
<td>Proceedings of the National Academies of Science</td>
<td>9.8</td>
</tr>
<tr>
<td>214</td>
<td>Cancer Research</td>
<td>8.2</td>
</tr>
<tr>
<td>312</td>
<td>AIDS</td>
<td>6.3</td>
</tr>
<tr>
<td>384</td>
<td>Journal of Immunology</td>
<td>5.7</td>
</tr>
<tr>
<td>427</td>
<td>Journal of Biological Chemistry</td>
<td>5.3</td>
</tr>
<tr>
<td>456</td>
<td>Journal of Virology</td>
<td>5.2</td>
</tr>
</tbody>
</table>
**Results**

Annual attention to HIV/AIDS by congressional actions, scientific publications and popular press articles from 1981 to 2010

A data compilation of bills introduced, hearings held, laws passed, major scientific papers published and *New York Times* articles is shown as the number of each by year, from 1981 to 2010 (Figure 1). The number of bills introduced by Congress does not correlate with the number of major scientific papers published each year, but the number of hearings held does look similar to the number of *New York Times* articles published each year.

**Top-cited HIV/AIDS biomedical papers**

Looking at the most-cited article from each year between 1986 and 2011, the topics are about identification and testing, viral pathogenesis, treatments and large-scale clinical trials showing efficacy of treatments (Table 2).

**Scientific breakthroughs correlate with bill sponsorship but not with congressional hearings or laws being passed**

Table 3 shows the estimated effects that major HIV/AIDS scientific papers had on sponsoring bills, holding hearings and passing laws. There was a statistically significant relationship only between scientific breakthroughs and bill sponsorship. Years with larger numbers of major papers on HIV/AIDS did not correlate with more hearings or laws passed the following year, which fits findings from the literature for congressional attention [29,30]. Additionally, the number of bills sponsored and laws passed concerning HIV/AIDS increased in response to surges in media attention; the number of hearings held only responded to major events. Trends for hearings and media, illustrated by Figure 1B and 1E, fall in line with major events that occurred between 1985 and 1987 before trailing off after the early 1990s. It seems that congressional hearings and the media move in sync to pay attention to major events relating to HIV/AIDS.

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syndrome” to identify hearings related to HIV/AIDS from 1981 to 2010. Our dependent variable for hearings was the yearly count of HIV/AIDS hearings in Congress. Data on bill sponsorship and laws passed were also collected. Using the THOMAS database maintained by the US Library of Congress, searches for “AIDS (Disease),” “human immunodeficiency virus” and “HIV/AIDS” were completed. Bills identified from these searches were then cross-referenced with the Congressional Bills Project database. The bills variable was the yearly count of HIV/AIDS bills introduced in Congress, and the laws variable was the yearly count of HIV/AIDS bills enacted into law. Bills on HIV/AIDS were also coded by subject for consistent comparison to scientific breakthroughs.

**Control variables**

Media coverage [27], partisanship and major HIV/AIDS events in the United States were controlled in the following ways. “Acquired immune deficiency syndrome” was used to search the *New York Times* in LexisNexis, and the news variable was the yearly count of those identified articles. We operationalized partisanship to take the value of 1 when Democrats held a majority in both houses of Congress, 0 when control was split and −1 when Republicans were the majority [18]. Major events was a dummy variable that took the value of 1 for years involving major non-scientific HIV/AIDS events and zero for all others. Major-event years were 1983, when the US Centers for Disease Control and Prevention officially acknowledged AIDS; 1985–1987, when Ryan White was in the press, President Ronald Reagan spoke about AIDS for the first time and azidothymidine was introduced; 1991–1992, when Magic Johnson announced his status of living with HIV; and 1994, when AIDS became the leading killer of men aged 25–44 in the United States.

**Analysis**

Statistical software R was used for statistical analysis. Augmented Dickey–Fuller tests showed that none of the five time trends – bills, hearings, laws, scientific breakthroughs or newspaper articles – followed stationary processes. Vector auto-regression (VAR) allowed estimation of the relationship between scientific breakthroughs and congressional response to HIV/AIDS while controlling for reciprocal feedback between media coverage and congressional policy making. The “vars” package was used to run separate models for bills, hearings and laws. The congressional measures and media attention were treated as endogenous variables in a VAR(1) process, and breakthroughs, partisanship and major events were treated as exogenous variables. The breakthrough variable was lagged by one year to allow time for scientific breakthroughs to work through the political system. For example, the following equation was used for bill sponsorship:

\[
\text{bills}_t = \beta_1 \text{bills}_{t-1} + \beta_2 \text{news}_{t-1} + \beta_3 \text{major papers}_{t-1} + \beta_4 \text{democrat control}_t + \beta_5 \text{major events}_t + \epsilon_{1t}
\]

\[
\text{news}_t = \beta_6 \text{bills}_{t-1} + \beta_7 \text{news}_{t-1} + \beta_8 \text{major papers}_{t-1} + \beta_9 \text{democrat control}_t + \beta_{10} \text{major events}_t + \epsilon_{2t}
\]

Analyzing individual-level bill sponsorship

An analysis of bill sponsorship at the individual level supplemented the aggregate. The dependent variable was whether or not a given member of Congress introduced any HIV/AIDS bills in a given year. Standard political science variables of partisanship, ideology, race, gender and institutional position were included with aggregate measures of scientific breakthroughs, media attention and major events. Partisanship was binary: a value of 1 for Democrats and 0 for Republicans. Ideology was measured as the common space score from NOMINATE [28]. These scores range from −1 as most liberal to 1 as most conservative. Institutional position was a binary that took a value of 1 if the member was in the majority party and 0 otherwise. Race and gender were binaries that took values of 1 if member was Black or a woman. Lastly, the total number of bills that a member introduced in a year was included to control for differences in overall legislative activity. The individual-level analysis was conducted using a multilevel logistic regression where effects of ideology, race and partisanship were allowed to vary by year.

**Top-cited HIV/AIDS biomedical papers**

Looking at the most-cited article from each year between 1986 and 2011, the topics are about identification and testing, viral pathogenesis, treatments and large-scale clinical trials showing efficacy of treatments (Table 2).
Merging political science and biomedical science to explain HIV/AIDS bill sponsorship

In the aggregate, biomedical science has played a role in getting HIV/AIDS bills sponsored but not passed into law. This also held at the individual level (Table 4).

Figure 2A illustrates how the probability of bill sponsorship increased when the number of major scientific papers published each year increased. Given the relatively low probability that a member of Congress would introduce HIV/AIDS bills, the threefold change from 3 to 9% (over a range from 0 to 35 papers) could be considered substantial.

Ideology also had dramatic effects on introducing HIV/AIDS legislation (Figure 2B). Conservative members of Congress were far less likely to introduce bills on HIV/AIDS issues. Women were 1% more likely to sponsor legislation. Being in the majority party has consistently been related to increases in bill sponsorship [31,32] and conveys a two-percentage-point increase for introducing HIV/AIDS bills. Republicans being two percentage points more likely to introduce HIV/AIDS bills initially seems counterintuitive. The correct interpretation is that liberal and moderate Republicans are more active than conservative Democrats. For example, there are eleven members of Congress (MCs) who fall within the ideologically moderate range of 0.1 and 0.1 (conservative Democrats and liberal Republicans) and who have introduced HIV/AIDS bills. Of those 11 MCs, only two are Democrats. We need to look closer at the content of the breakthroughs and the bills to build on the correlations revealed by the aggregate- and individual-level analysis.

Congressional attention to HIV/AIDS segregated by topics

A brief summary of the most-cited papers in high-impact journals reveals a coherent story about how scientific breakthroughs compared with congressional attention. In the 1980s, HIV/AIDS scientific breakthroughs centred on Montagnier, Barre-Sinoussi and Gallo isolating and culturing HIV, developing antibodies and research reagents for molecular and cellular studies and understanding the mechanisms of infection and transmission [33–38]. Identification dominated major papers in the 1980s (Figure 3A).

Scientific advances in the 1990s shifted towards medicine and treatment (Figure 3B), as well as pathogenesis and transmission studies (including comorbidities and the side effects of antiretrovirals) (Figure 3C and 3D). Key biomedical findings during this period include sensitive, quantitative detection of viral RNA [12,39,40] and crystallization of HIV-1 reverse transcriptase [41]. This accelerated the development of pharmaceutical inhibitors targeting this key enzyme. Today, these drugs have saved 3 million years of life [42,43] and are in 100% of HIV medication cocktails.

The earliest scientific discussions on curing the disease (Figure 3E), in a real sense, began in 1996 after researchers discovered people who had a CCR5 mutated co-receptor that inhibited infection and slowed disease progression to AIDS without the use of antiretrovirals [44–47]. Removing long-term, undetectable-viral-load patients from antiretrovirals saw rebounded viral loads, plummeting CD4 cells and the realization that patients were not cured but that viral reservoirs were established in latent infected cells [48,49].
Scientists then developed fusion and integrase inhibitors to block the entry and establishment of viral reservoirs in cells [50]. HIV vaccine development suffered a setback when a major trial failed in 2003 [51,52]. Lastly, there was a surge in papers on transmission and on medication and treatment from 2000 to 2010, once biomedical scientists determined that successful viral suppression with highly active antiretroviral therapy (HAART) also lowered the risk of transmission to non-infected individuals [53,54].

All bills introduced and major papers on HIV/AIDS were coded according to predetermined subjects. Figure 4 shows how the legislative agenda for HIV/AIDS changed over time. During the 1980s, bills were introduced to fund research, adopt guidelines and programmes for testing, establish social programmes for PLWHA and help with prevention. By the 1990s, many bills were about maintaining, appropriating and, in some instances, slashing funding for these established programmes. The largest correlative peak between the science of and the congressional response to HIV/AIDS occurred in 1997 (Figures 3 and 4) with the discovery and implementation of HAART, the three-drug cocktail, to effectively suppress viral levels [55–58], leading to the first-ever

<table>
<thead>
<tr>
<th>Year</th>
<th>First author</th>
<th>Title</th>
<th>Journal</th>
<th>Times cited</th>
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<tr>
<td>1986</td>
<td>Walker, CM</td>
<td>Lymphocytes-CD8+ can control HIV-infection in vitro by suppressing virus-replication</td>
<td>Science</td>
<td>922</td>
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<td>1987</td>
<td>Folks, TM</td>
<td>Cytokine-induced expression of HIV-1 in a chronically infected promonocyte cell-line</td>
<td>Science</td>
<td>761</td>
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<td>1988</td>
<td>Pauwels, R</td>
<td>Rapid and automated tetrazolium-based colorimetric assay for the detection of anti-HIV compounds</td>
<td>J Virol Meth</td>
<td>1197</td>
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<td>1989</td>
<td>Larder, BA</td>
<td>HIV with reduced sensitivity to zidovudine (AZT) isolated during prolonged therapy</td>
<td>Science</td>
<td>1492</td>
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<td>1990</td>
<td>Zack, JA</td>
<td>HIV-1 entry into quiescent primary lymphocytes – molecular analysis reveals a labile, latent viral structure</td>
<td>Cell</td>
<td>1176</td>
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<td>1991</td>
<td>Schreck, R</td>
<td>Reactive oxygen intermediates as apparently widely used messengers in the activation of the NFκB and HIV-1</td>
<td>EMBO J</td>
<td>2855</td>
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<td>1992</td>
<td>Kohlstaedt, LA</td>
<td>Crystal-structure at 3.5 angstrom resolution of HIV-1 reverse-transcriptase complexed with an inhibitor</td>
<td>Science</td>
<td>1464</td>
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<td>1993</td>
<td>Pantaleo, G</td>
<td>HIV-infection is active and progressive in lymphoid-tissue during the clinically latent stage of disease</td>
<td>Nature</td>
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<td>1994</td>
<td>Connor, EM</td>
<td>Reduction of maternal-infant transmission of human-immunodeficiency-virus type-1 with zidovudine treatment</td>
<td>NEJM</td>
<td>2112</td>
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<td>1995</td>
<td>Ho, DD</td>
<td>Rapid turnover of plasma virions and CD4 lymphocytes in HIV-1 infection</td>
<td>Nature</td>
<td>3073</td>
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<td>1996</td>
<td>Heid, CA</td>
<td>Real time quantitative PCR</td>
<td>Genome Res</td>
<td>3376</td>
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<td>1998</td>
<td>Palella, FJ</td>
<td>Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection</td>
<td>NEJM</td>
<td>4942</td>
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<td>1999</td>
<td>Schmitz, JE</td>
<td>Control of viremia in simian immunodeficiency virus infection by CD8 (+) lymphocytes</td>
<td>Science</td>
<td>1372</td>
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<td>2000</td>
<td>Paterson, DL</td>
<td>Adherence to protease inhibitor therapy and outcomes in patients with HIV infection</td>
<td>Ann Intern Med</td>
<td>1421</td>
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<td>2001</td>
<td>Garrus, JE</td>
<td>Tsg101 and the vacuolar protein sorting pathway are essential for HIV-1 budding</td>
<td>Cell</td>
<td>721</td>
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<td>2002</td>
<td>Sheehy, AM</td>
<td>Isolation of a human gene that inhibits HIV-1 infection and is suppressed by the viral Vif protein</td>
<td>Nature</td>
<td>929</td>
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<td>2003</td>
<td>Wei, XP</td>
<td>Antibody neutralization and escape by HIV-1</td>
<td>Nature</td>
<td>922</td>
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<td>2004</td>
<td>Stremlau, M</td>
<td>The cytoplasmic body component TRIM5 alpha restricts HIV-1 infection in Old World monkeys</td>
<td>Nature</td>
<td>692</td>
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<td>2005</td>
<td>Mattapallil, JJ</td>
<td>Massive infection and loss of memory CD4(+ ) T cells in multiple tissues during acute SIV infection</td>
<td>Nature</td>
<td>590</td>
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<td>2006</td>
<td>Lopez, AD</td>
<td>Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data</td>
<td>Lancet</td>
<td>1161</td>
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<td>2008</td>
<td>Jones, KE</td>
<td>Global trends in emerging infectious diseases</td>
<td>Nature</td>
<td>481</td>
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<td>2009</td>
<td>Kerks-Ngarm, S</td>
<td>Vaccination with ALVAC and AIDSVAX to prevent HIV-1 infection in Thailand</td>
<td>NEJM</td>
<td>457</td>
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<td>2010</td>
<td>Karim, QA</td>
<td>Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the prevention of HIV infection in women</td>
<td>Science</td>
<td>271</td>
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<td>2011</td>
<td>Cohen, MS</td>
<td>Prevention of HIV-1 infection with early antiretroviral therapy</td>
<td>NEJM</td>
<td>147</td>
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</table>
passage of the President's Emergency Plan for AIDS Relief

...compassionate conservatism... of President George W.

of the 1990s, and in the early 2000s, powered by the

Republicans moved away from punitive "culture war" policies

introduced HIV/AIDS bills, and it became a bipartisan issue.

midterm elections, there was a stark partisan shift in who

when Republicans were swept into power in the 1994

introduction of bills in response to the HIV/AIDS crisis, but

of all HIV/AIDS bills introduced in this time frame (Figure 4).

The last piece of the story looks more closely at who sponsors

HIV/AIDS policy

...breakthroughs in medical treatments provided for new policy

solutions such as subsidized access to treatment.

The passage of the President’s Emergency Plan for AIDS Relief

(PEPFAR), resulting in a decade of bipartisan HIV/AIDS bill

sponsorship (Figure 5).

Table 5 provides more insight into the politics of congres-

sional attention to HIV/AIDS. Half of the top 10 sponsors of

HIV/AIDS bills represented California. This was the epicentre of

the disease in its early years, so it makes sense that these

MCs would feel a greater need to respond to the crisis. Ted

Kennedy’s senate career was defined by a longstanding

commitment to healthcare issues, so his inclusion at the top of

this list is not surprising. Conservative Republican William

Dannemeyer’s bills are all about required HIV testing and

subsequent prohibitions of PLWHA from various public health

occupations. All of Henry Hyde’s and James Walsh’s bills are

related to their positions as committee and/or subcommittee

chairmen.

A closer look at who sponsors HIV/AIDS bills shows that

institutional position, potential constituency pressures, partisanship and ideology – in other words, politics – are part of

how biomedical breakthroughs are translated into the

congressional response to HIV/AIDS.

Discussion

In the aggregate and at the individual level, science had a

real – although limited – role to play in congressional policy

making concerning HIV/AIDS. For HIV/AIDS, major scientific

papers correlated with bill sponsorship by members of

Congress. Scientific breakthroughs did not impact legislative

hearings or the passage of bills into law. Sponsoring bills

requires lower thresholds of attention, and given this, it

makes sense that biomedical scientific advances matter for

bill sponsorship rather than hearings or laws.

We interpret these results through the lens of the agenda-

setting literature in political science. Accordingly, policy

entrepreneurs define or redefine issues for appeal to broader

audiences, and then those audiences help to break estab-

lished policy monopolies that are keeping new issues off the

agenda [61,27,29,62–65]. Bill sponsorship fits into that

entrepreneurial role [66]. Table 5 illustrates that MCs took

on an entrepreneurial role for policy, electoral and institu-

tional reasons [31,67]. Increasing numbers of scientific break-

throughs provide more opportunities for entrepreneurs,

leading to more HIV/AIDS bills being introduced. As seen in

Figures 3 and 4, early breakthroughs were essential to

defining HIV/AIDS as a new national health crisis. Due to

the limits of biomedical science at the time, policy solutions

were education, prevention and research funding. Later

breakthroughs in medical treatments provided for new policy

solutions such as subsidized access to treatment.

Kingdon [62] argues that a well-defined problem and

plausible policy solution are not enough to move items onto

Congress’s formal agenda. It is important to note that our

study concerns only the biomedical science portion of the

HIV/AIDS landscape. Activism around the disease, public

health (as opposed to strictly biomedical) research and other

forms of advocacy are essential for providing a full picture of

how and why Congress paid attention to HIV/AIDS. It is

entirely possible that these other aspects fill in the gaps

that biomedical research leaves regarding hearings and

passing laws.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Bill sponsorship</th>
<th>Hearings</th>
<th>Laws</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major papers</td>
<td>0.806</td>
<td>0.056</td>
<td>0.039</td>
</tr>
<tr>
<td>Lagged bills</td>
<td>−0.017</td>
<td>0.221</td>
<td>0.938</td>
</tr>
<tr>
<td>Lagged hearings</td>
<td>0.443</td>
<td>0.293</td>
<td>0.144</td>
</tr>
<tr>
<td>Lagged laws</td>
<td>−0.192</td>
<td>0.196</td>
<td>0.338</td>
</tr>
<tr>
<td>Lagged news</td>
<td>0.038</td>
<td>0.007</td>
<td>0.007</td>
</tr>
<tr>
<td>Democrat control</td>
<td>−9.981</td>
<td>5.449</td>
<td>0.079</td>
</tr>
<tr>
<td>Major events</td>
<td>9.563</td>
<td>6.844</td>
<td>0.277</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>−308.992</td>
<td>−268.715</td>
<td>−253.516</td>
</tr>
</tbody>
</table>

Effects that major scientific papers about HIV/AIDS had on spon-
noring bills, holding hearings and passing laws were estimated as a

VAR(1) process. The coefficients from that estimation are presented

in Table 3 in boldface, along with the standard errors in roman type

and the p-values in italics. When there are more major scientific

papers published on HIV/AIDS and/or there are more news articles

about HIV/AIDS, then there should be more HIV/AIDS bills introduced

in Congress the following year.

drop in AIDS deaths [59,60]. Concurrently, the global epidemic

began to dominate the legislative agenda, accounting for 50%

of all HIV/AIDS bills introduced in this time frame (Figure 4).

This may have been due to major findings from large clinical

trials conducted at foreign research sites, which helped

illuminate the global epidemic to the United States.

Biomedical research breakthroughs foster bipartisan

HIV/AIDS policy

The last piece of the story looks more closely at who sponsors

HIV/AIDS bills. From 1983 to 1994, Democrats dominated the

introduction of bills in response to the HIV/AIDS crisis, but

when Republicans were swept into power in the 1994

midterm elections, there was a stark partisan shift in who

introduced HIV/AIDS bills, and it became a bipartisan issue.

Republicans moved away from punitive "culture war" policies

of the 1990s, and in the early 2000s, powered by the

"compassionate conservatism" of President George W.

Bush, joined efforts to fight HIV/AIDS globally, including the

passage of the President's Emergency Plan for AIDS Relief

Figures 3, 4 and 5 provide a picture of how ideology, partisanship and science shaped congressional responses. For its first 15 years, HIV and AIDS were viewed, together, primarily as the disease of drug addicts and gay White men, hence the earlier name of GRID. With that, it was relegated to being a niche liberal issue. The Democrats who controlled Congress responded with bills for social programmes for prevention, testing and research, but GRID met the gridlock of Congress and only as many as eight bills passed per year out of the 50–100 that were introduced (Figure 1). During this time, scientists worked to isolate and identify this virus [33–38]. In the mid-1990s, Republicans won control of Congress and scientific breakthroughs shifted towards more effective medical treatments. Domestically, the newly infected shifted from gay White men more to those who were Black, Latino, poor, deviant and, in the minds of some, undeserving of help [68–70]. By 2000, Blacks and Latinos had surpassed Whites in AIDS-related deaths [71]. Globally, there was an opportunity for Republicans to seize policy initiatives on HIV/AIDS and build their brand of compassionate conservatism by using scientific advances in treatments for HIV/AIDS to provide medicines for poor countries through PEPFAR.

It is interesting to postulate what role the latest biomedical breakthroughs will play in congressional attention and domestic policy going forward, with the success of the CAPRISA (Centre for the AIDS Programme of Research in South Africa) trial, in which a vaginal microbicide was shown to reduce transmission to women through heterosexual contact [72], and the iPREX (Pre-Exposure Prophylaxis Initiative) trial that showed the efficacy of pre-exposure prophylaxis (PrEP) with antiretrovirals in preventing new HIV infections among men who have sex with men (MSM) [73]. CAPRISA provides a means for women to protect themselves, but iPREX

Table 4. Independent variables’ effect on the probability of an individual US Congress member introducing HIV/AIDS legislation

<table>
<thead>
<tr>
<th>Variables</th>
<th>Change in probability</th>
<th>95% confidence interval</th>
<th>House results</th>
<th>Senate results</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Major papers</td>
<td>0.7%</td>
<td>[0.5%, 0.9%]</td>
<td>0.6% [0.4, 0.9]*</td>
<td>1.0% [0.5, 1.6]*</td>
</tr>
<tr>
<td>*Ideology</td>
<td>−2%</td>
<td>[−2.8%, −1.2%]</td>
<td>−2.2% [−3.4, −1.3]*</td>
<td>−1.9% [−4.1, −0.4]*</td>
</tr>
<tr>
<td>*Democrat</td>
<td>−2.5%</td>
<td>[−3.7%, −1.6%]</td>
<td>−2.8% [−4.3, −1.7]*</td>
<td>−2.2% [−5.2, −0.03]*</td>
</tr>
<tr>
<td>*Female</td>
<td>1.1%</td>
<td>[0.1%, 2.3%]</td>
<td>2.3% [0.9, 4.3]*</td>
<td>−0.7% [−2.6, 1.4]</td>
</tr>
<tr>
<td>Black</td>
<td>0.1%</td>
<td>[−1.1%, 1.6%]</td>
<td>0.5% [−0.8, 2.0]</td>
<td>7.9% [−4.7, 64]</td>
</tr>
<tr>
<td>*Majority</td>
<td>2.1%</td>
<td>[1.2%, 3.2%]</td>
<td>3.2% [1.9, 4.8]*</td>
<td>1.0% [−0.5, 2.9]</td>
</tr>
<tr>
<td>*Total bills</td>
<td>2.3%</td>
<td>[1.6%, 3.0%]</td>
<td>1.8% [1.2, 2.6]*</td>
<td>2.5% [1.4, 4.1]*</td>
</tr>
<tr>
<td>*News</td>
<td>2%</td>
<td>[1.4%, 2.9%]</td>
<td>1.4% [0.8, 2.2]*</td>
<td>3.4% [1.6, 5.6]*</td>
</tr>
<tr>
<td>Major events</td>
<td>1.1%</td>
<td>[−0.02%, 2.3%]</td>
<td>1.0% [−0.4, 2.5]</td>
<td>1.4% [−1.1, 4.4]</td>
</tr>
</tbody>
</table>

Predicted change in the probability of the variable (given in each row) to effect change in an individual Congress member to introduce an HIV/AIDS bill was derived from multilevel logistic regression. 95% confidence intervals are shown as well. If the confidence interval does not contain zero, then the predicted change is statistically significant. *Denotes statistical significance. The first two columns are for the full data set that combines the House and Senate. The last two columns show separate results for House members and Senate members, respectively.

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demonstrated efficacy for the high-risk (yet still culturally stigmatized) group of MSM, a group that also does not find favour with religious and political conservatives. Whether one will find more favour compared to the other in the eyes of Congress, to receive federal funds for treatment or public health distribution, remains to be seen. Perhaps Guston was right and the science cannot be separated from the politics, or at least not in the way that biomedical scientists believe it should be. Nor can it be separated from advocates and public health issues to maximize congressional response. Non-scientific methods must be involved as well, and while science is helpful, it must be supplemented “with the analysis of those aspects of the human condition that science cannot easily illuminate” [74].

Figure 3. Major scientific breakthrough publications categorized by topic for each year compared to the total number of HIV/AIDS articles published. The top 500 most-cited papers were categorized according to (A) identification, (B) pathogenesis, (C) transmission, (D) medication and treatment and (E) cure. Total numbers of papers published per year were calculated and plotted.

Figure 4. Changes in the composition of the HIV/AIDS congressional agenda over 30 years of the epidemic. All HIV/AIDS bills introduced in Congress from 1981 to 2010 were coded according to subjects and tabulated.
Conclusions

We have shown that breakthroughs in biomedical research did associate with the number and types of HIV/AIDS bills introduced in Congress, but that relationship did not extend to passage of laws or to congressional hearings. We began by asking whether science could shape policy without itself being shaped by politics. This study makes three contributions to the literature around that question. Firstly, our findings are slightly counterintuitive because we show that science can matter for policy making. The agenda-setting literature suggests that complex information, like biomedical research, would not impact bill sponsorship. Secondly, we provide a more direct quantitative test of the hypothesized relationship between science and policy. Thirdly, we provide additional nuance to the science-for-policy debate. We have argued that biomedical breakthroughs created opportunities for policy entrepreneurs — that, in effect, science opened a way for politics. However, the ultimate consequence has been a depoliticization of HIV/AIDS policy at the congressional level. Scientific breakthroughs helped to transform HIV/AIDS policy from a niche of liberal Democrats to bipartisan support to fight the disease globally. In that regard, these findings bring us closer to Guston’s position. Science matters when it suits the politics.

Authors’ affiliations

1Department of Government, Harvard University Cambridge, MA, USA; 2Wallace H. Coulter Department of Biomedical Engineering, Georgia Institute of Technology and Emory University, Atlanta, GA, USA; 3Petit Institute of Bioengineering and Biosciences, Georgia Institute of Technology, Atlanta, GA, USA

Competing interests

The authors have no competing interests to declare.

Authors’ contributions

MBP and MOP both contributed to the conception, design, acquisition of data, analysis and interpretation of data and have been involved in drafting the manuscript. Both authors have read and approved the final manuscript.

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