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## **What Drives U.S. Congressional Members' Policy Attention on Twitter?**

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### **Abstract**

Social media platforms like Twitter enable policymakers to communicate their policy preferences directly and provide a birds-eye view of their diverse policy agendas. We leverage politicians' social media data to study political attention using a supervised machine learning classifier that detects policy areas in individual tweets. We examine how individual diversity and institutional factors affect differential attention to public policy among members of the U.S. Congress (MCs). Our novel approach to measuring policy attention builds on work by the Comparative Agendas Project, in order to study MCs' political attention in near real-time and to uncover both intra- and inter-group differences. Using this classifier, we labeled more than one million tweets and found statistically significant differences in both the level and distribution of attention between parties, chambers, and genders. However, these differences were small enough to suggest that other MC characteristics are also at play. We explored institutional factors (e.g., committee assignment, caucus), partisan issue preferences (e.g., issue-ownership), and the political environment (e.g., partisan issues, confirmations) that may help explain the patterns of political attention that appear in Congress's tweets.

### **Introduction**

Lawmakers' public statements often garner as much attention as their policy proposals in Congress, if not more. Members of Congress (MCs) use press releases, television, and now social media to communicate their policy priorities and preferences. Scholars have traditionally understood an actor's policy agenda by their institutional actions (e.g., roll-call votes) but now increasingly engage with non-legislative tools to understand complex policy attention questions (Carson, Engstrom, & Roberts, 2007; Rocca & Gordon, 2010; Shepsle, 1979; Shepsle & Weingast, 1987). Public statements can signal a lawmaker's policy intentions even before legislative action takes place, and increasingly, Twitter is a popular site for these statements to appear (Russell, 2018;

Straus, Glassman, Shogan, & Smelcer, 2013). Public statements on Twitter provide timely data to determine how individual characteristics (i.e., gender, party, and chamber) and institutional factors (i.e., committee and caucus membership) affect policy attention. For example, in 140- or 280-characters<sup>1</sup>, a member can support a policy, take credit for its success, and signal its advantages to his or her constituents. Here we introduce a computational method to identify the topics discussed in more than one million Congressional tweet messages, investigate what drives the attention that policy topics receive, and explain patterns of policy attention among various groups of lawmakers. Politicians have indicated that they use social media, even when they don't expect it to impact voters (U. Bernhard, Dohle, & Vowe, 2015), and our study explains how individual and institutional characteristics, rather than strategic considerations, influence social media content.

Studying Twitter presents researchers with a methodological challenge of sorting through large volumes of tweets and deciphering policy attention amid partisan disagreements, birthday messages, and other types of non-policy-related tweets. We address this challenge by introducing a computational model to identify expressions of individual MCs' policy agendas in their tweets. We trained a supervised machine learning classifier to categorize lawmaker tweets according to the Comparative Agenda Project's Policy Codebook (Baumgartner, 2019). Our approach allows us to study MCs' policy attention in near real-time and to uncover both intra- and inter-group differences that not only highlight how MCs use social media but also reveal MCs' public agenda-setting behavior. The model enables us to evaluate how individual and institutional characteristics affect how legislators explain their work to public audiences.

Our results confirm a pattern of skewed policy attention, similar to what other researchers found in studies of budgets, hearings, and bill introductions (e.g., Rocca & Gordon, 2010; Sheingate, 2006; Woon, 2008). Having established tweets as a reliable measure for policy attention based on their reflection of similar patterns in other Congressional materials, we conducted a multinomial logistic regression to identify factors that influence the attention patterns we detected. Our results suggest that party, gender, and chamber affect the policy areas that MCs tweet about. We also compared the diversity of political attention among lawmakers and found that Democrats, Representatives, and women are generally more likely to post policy-related tweets; Democrats and Senators exhibited significantly more diversity than Republicans and Representatives. The specific policies that lawmakers address and the timing of their

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<sup>1</sup> Twitter announced the move from 140 to 280 characters in the Fall of 2017 (<https://twitter.com/jack/status/912784057863245824>), and therefore some of the tweets in our sample were limited to 140 characters and others to 280.

attention likely depend on legislative debates and MCs' committee and caucus memberships.

## **Tweeting Political Agendas**

Traditional agenda-setting studies typically assess the policy agendas of legislative bodies or institutions. However, individual lawmakers also practice agenda setting. Elite actors have personal policy agendas, each with a unique distribution of preference intensities (Rocca, Sanchez, & Morin, 2011). Policy agenda-setting is contingent on many factors — e.g., political climate, political feasibility, personal and constituent priorities (Dearing & Rogers, 1996). The bills that a senator introduces may shed light on their policy priorities, but given these multiple multiple policy motivations, we need a non-legislative tool to understand the complexity behind individual decision-making.

Media communications offer a valuable non-legislative lens through which to understand how lawmakers set policy agendas. Different media allow for different modes of information production and consumption (Jungherr, 2014). The constraints of the technology underlying broadcast news are different than that of social media, for example. The fact that social media can bypass traditional media institutions altogether requires that we differentiate how we study social and traditional media sources (Jungherr, 2014; Shapiro & Hemphill, 2017). A new digital logic requires research that takes advantage of social media's platforms—particularly Twitter—to aggregate attention and participate in dialogue unmediated by mass media.

Twitter enables direct communication with both elite and mass publics with minimal opportunity costs. Actors have increased control over their own communications strategies with minimal time and resources expensed and thus have the ability to better target communications to their base of followers. This low-cost effort has had the outsized potential to increase the interactions between elite and mass publics by publicly broadcasting their agenda and creating an accessible record of government action (Bruns & Highfield, 2012). Twitter is a broadcasting device for politicians (Gainous & Wagner, 2014; Golbeck et al., 2018; Hemphill, Otterbacher, & Shapiro, 2013a), so being able to take advantage of its outreach capabilities is especially important to politicians and their staffers (Chi & Yang, 2011; Straus et al., 2013). This public communication domain offers policymakers a relatively unfiltered credit claiming opportunity (Mayhew 1974) to highlight accomplishments and advertise a political brand. Politicians seem oriented toward their peers in their social media use (U. Bernhard et al., 2015), indicating that they use social media to raise their individual profiles, especially among other political elites (Scherpereel, Wohlgemuth, & Lievens, 2017). In newspapers or television broadcasts, politicians' priorities become integrated with the news organizations' priorities. Further, traditional media messages may be an

index of elite opinions or deferential to politicians (Bennett, 1990). Traditional media offer a periodic, indirect measure of priorities, and Twitter offers a more frequent, direct measure where only the political actors and their staffs contextualize content.

## **Modeling the Variation in Policy Agendas on Twitter**

Studying political attention is essential to understanding how lawmakers distribute attention and frame issues for voters and the public at large. Existing methods for studying the policy agendas of lawmakers often employ manual topic labeling, which depends on human effort and can be restrictive in terms of scope and scale (Quinn, Monroe, Colaresi, Crespin, & Radev, 2010). As members of Congress have expanded their use of social media for daily communications about policy problems, so too must the research methods that we use to understand how lawmakers engage various constituencies. To understand what influences those patterns of attention and how they differ among lawmakers, we seek alternative methods of policy agenda analysis.

To address the need for a comprehensive and consistent mechanism for measuring policy agendas on Twitter and at scale, we developed a computational model for estimating political attention. We leveraged a sample of human-labeled congressional tweets to train a supervised machine learning classifier to label the policy topics in lawmakers' tweets. We tested that classifier to evaluate the performance of our models against experts' labels, and found that the trained classifier serves as a viable alternative to manual coding techniques.

With a high-performing classifier, we can analyze what drives lawmakers' patterns of attention among a consistent set of policy topics on a much larger scale than possible by current content coding techniques. Senators' Twitter agendas are an ideal platform to address theoretically important questions about legislators' agenda-setting behavior and representation (Russell, 2018). Our machine learning classifier enables analysis across the set of topics from the Comparative Agendas Project that have been used over time to study policy attention. By using all the tweets of lawmakers in Congress, the data allows us to use this coding scheme to test hypotheses common to inquiries of legislative activity and lawmaker homestyle. Because individuals develop unique styles of communication and legislative style (W. Bernhard & Sulkin, 2018; Grimmer, 2013), we expect their Twitter agendas and the issues they choose to prioritize for public messaging to reflect those patterns of communication. Policy attention is often dependent on the political climate, issue emergence, and policy frames, but at the individual level, we look at how lawmaker-specific characteristics and institutional factors influence attention allocation to policy issues on Twitter.

## **Individual Characteristics Affecting Policy Attention**

### Gender

Work by Evans and Clark (2016) suggests gender will directly affect political candidates' social media messages. They found that women running for Congress discuss policy issues on Twitter at a higher rate, and those issues are often "women's issues" (e.g., health care, education, poverty). Stereotypes of female lawmakers as compassionate relationship-builders rather than policy experts may incentivize some women to be more active in policy communication on Twitter (Evans & Clark, 2016; Huddy & Terkildsen, 1993). Once in office, they may also adopt styles of communication that highlight policy preferences more often. Women may also combat stereotypes by adopting more diverse agendas that allow them to develop reputations as experts in many policy areas and deter possible challengers (Atkinson & Windett, 2018). Having an alternative agenda space on Twitter may enable female MCs to counter these stereotypes and compensate for perceptions that female lawmakers are less policy-capable. Based on this earlier work, we expect that women will discuss policy more often than their male counterparts and that they will exhibit greater attention diversity.

H<sub>1</sub>: Women will discuss policy more often than men.

H<sub>2</sub>: Women will exhibit more diverse policy agendas than men.

### Party

Political parties are a mechanism to serve and facilitate electoral goals (Mayhew, 1974) and to maintain majority status (Aldrich, 1995). Prior work on Congressional tweets established that Republican and Democratic parties use Twitter for different communication activities (Golbeck et al., 2018; Hemphill et al., 2013a; Russell, 2018), and we expect to see similar differentiation here. Another study of Twitter use in U.K. Parliament found that Labour Party members generated fragmented communication networks rather than a cohesive party (Adi, Erickson, & Lilleker, 2014). The precise impact of party on a politicians' expressed agenda and communication preferences remains unknown.

One expectation is that Republicans will more frequently turn to Twitter to frame their policy priorities given a higher sense of distrust of traditional media outlets. Lawmakers have increased discretion on Twitter and that discretion is essential for those who believe alternative media platforms, like newspapers or television coverage, are biased. Research suggests an overall decline in public trust of the media (Gronke & Cook, 2007), but that cynicism is most prevalent among conservatives and Republicans (T.-T. Lee, 2005). Conservative politicians signal the public and co-partisans to believe that the media is biased and favors Democrats (Domke, Watts, Shah, & Fan, 1999; Watts, Domke, Shah, & Fan, 1999). Republicans may view Twitter as a more viable outlet for

their messaging strategies if they believe other options are untrustworthy and therefore use it more.

A party's collective effort constrains a lawmaker's strategic action. Individual members's goals may conflict with the party's or collective's (Damore & Hansford, 1999), and party pressure may lead elected officials to prioritize policy in line with party preferences. Party leaders have increased influence over the institutional agenda (Aldrich, 1995; Cox & McCubbins, 1993; Rohde, 1991), but the extent to which leaders and the party influence the issues that individual lawmakers choose to address in their public agendas on Twitter has implications for both representation and the policy process.

Research on issue ownership—the idea that the public associates particular issues with one party or the other (Arbour, 2014; Egan, 2013)—suggests that Republicans and Democrats will discuss different policy issues. For instance, Republicans are often associated with security and military issues, while Democrats own issues around education and health care (Egan, 2013). The theory argues that voters will consider one party or the other more qualified to handle issues in an area (Petrocik, 1996), and that parties reinforce and leverage these expectations by addressing mainly those issues they own.

Together, the research about parties and the media suggest that we'll observe two patterns:

H<sub>3</sub>: Republicans will discuss policy more often than Democrats.

H<sub>4</sub>: Republicans and Democrats will attend to different policy issues; specifically, they will attend to issues their party owns.

### **Institutional Characteristics Affecting Policy Attention**

#### Chamber

Research that examines chamber differences in Twitter behavior, explicitly, found that senators were, on average, less frequent tweeters than representatives (Hemphill, Otterbacher, & Shapiro, 2013b). Senators and representatives represent different constituencies—states and districts within states—and those constituencies likely require different political strategies. Prior research shows that the differing constituencies produce distinct patterns in federal spending policy and credit-claiming between the two chambers (F. E. Lee, 2004). This prior literature on chamber differences suggests that senators employ more resources and must address more diverse constituencies (Druckman, Hennessy, Kifer, & Parkin, 2009; Gulati & Williams, 2007). The smaller size of the Senate also means that individual senators enjoy more opportunity for influence than do individual House members (Sheingate, 2006).

Therefore, we predict that the Senate will use Twitter more often to discuss policy and that they will exhibit more diversity in their attention.

H<sub>5</sub>: Senators will discuss policy more often than Representatives do.

H<sub>6</sub>: Senators will exhibit more diverse policy agendas than Representatives.

Whether and how lawmakers use Twitter to communicate their policy agendas and how that communication differs among parties, chambers, and genders are open questions that we address here. We first describe the construction of our classifier and then report and discuss the patterns of political attention we found after labeling the 115th U.S. Congress's tweets.

## Methods

### Data

#### 115th Congress Data

Using the Twitter Search API, we collected all tweets posted by official accounts linked to voting members of Congress during the 115th Congress, which ran January 3, 2017 to January 3, 2019. We identified MCs' Twitter user names by combining lists of MC social media accounts from the UnitedStates project<sup>2</sup>, George Washington Libraries<sup>3</sup>, and the Sunlight Foundation<sup>4</sup>. Throughout 2017 and 2018, we periodically used the Twitter API to search for the user names in this composite list and retrieved the accounts' most recent tweets. We conducted our final search on January 3, 2019, shortly after the 115th Congress ended. In all, we collected 1,485,834 original tweets from 524 accounts. We included data from while they were in office for MCs who resigned (e.g., Ryan Zinke) and those who joined after special elections (e.g., Rep. Conor Lamb).

#### Metadata

We used UnitedStates project and Sunlight Foundation datasets to retrieve MC metadata information, including details about which state they represent, chamber, party, and gender. For each of six MCs (gianforte, lindseygrahamsc, repblumenauer, repryanzinke, amashoffice, and senbillcassidy) that did not have state metadata available via UnitedStates project or Sunlight Foundation, we used data from their official websites to manually collect metadata.

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<sup>2</sup> <https://github.com/unitedstates/congress-legislators>

<sup>3</sup> <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/UIVHQR>

<sup>4</sup> <https://sunlightlabs.github.io/congress/index.html#legislator-spreadsheet>

## Manually-Labeled Training Data

The original set of labeled tweet data from Russell (2017, 2018) comprised 68,398 tweets. Of these tweets, the model labeled 45,402 tweets as “policy” and 22,996 as “not-policy” tweets. We removed retweets from this set to limit our classification to original tweets, resulting in a final dataset of 59,826 labeled tweets (39,704 *policy* tweets and 20,122 *not policy* tweets). By restricting our analysis to original tweets, we provide conservative estimates of attention.

## Model Specification

We used the manually-labeled data to train a logistic regression classifier and achieved an F1 score of 0.79. We experimented with alternative preprocessing steps, different classification algorithms, and feature selection approaches such as word2vec (Mikolov, Chen, Corrado, & Dean, 2013), and found that simple bag-of-words vectorization and logistic regression achieved the best performance<sup>5</sup>.

## Statistical Analyses

Our goal is to understand and explain how a member’s party, chamber, and gender affect their political attention. A tweet’s policy area class indicates attention to that topic. Since the Comparative Agendas Project (CAP) codebook includes 20 policy areas, we used multinomial logistic regression to approach this question. We chose policy area number 5, *labor*, as our reference category and used the *nnet* package in R (Venables & Ripley, 2002) to conduct these analyses. We selected *labor* as the base category, given its moderate level of salience and inter-party appeal that spans from issues around workforce development to questions about fair pay and benefits.

## Results

We summarize the variables used in our models in Table 1. To address whether there are differences among genders, parties, and chambers related to tweeting about policy generally, we first used logistic regression (LR) to predict the frequency of policy tweets on any topic. We fit models of the predictors independently, in combination, and with interaction terms. Using AIC comparisons and ANOVA, we found that the exhaustive model that included all three independent variables and interactions among them was the model of best fit when predicting the frequency of policy-related tweets (see Table 2). We plotted residuals using the binned plot function of the *arm* package (Gelman & Su, 2018) and found no significant outliers.

**Table 1.** Variables included in regression analyses

<sup>5</sup> Additional details about (a) the development of the model and our experiments and (b) frequencies and associated terms for each category are available in the supplementary materials.



Variable	Definition
<b>Dependent Variables</b>	
policy_tweet	0 = tweet is not about policy 1 = tweet is related to policy
policy_area	0 = tweet is not about policy 1-21 = major code from the Comparative Agendas Project Codebook that is most likely associated with the tweet
<b>Independent Variables</b>	
republican	0 = Democrat or Independent 1 = Republican
senate	0 = Representative 1 = Senator
man	0 = woman 1 = man

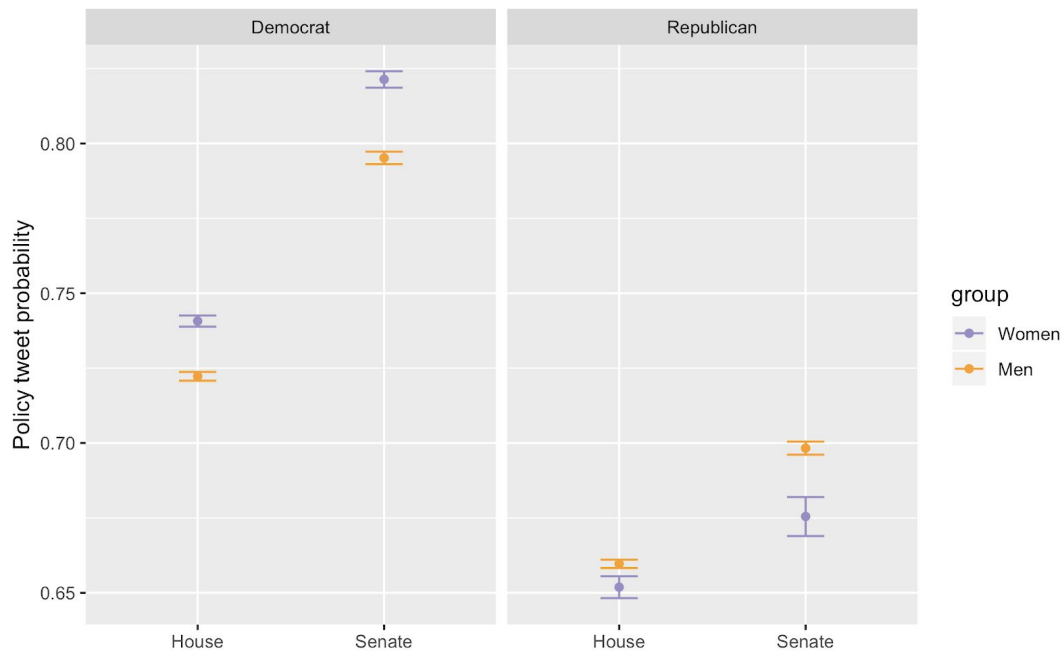
Overall we found more policy discussion in 2018 than in 2017. We also found that policy discussion on Twitter peaked in April and May of 2018, increasing after the 2018 primaries, and decreasing after Congressional elections in November 2018. Democrats, Senators, and women tended to post policy tweets more frequently than Republicans, Representatives, and men (see Table 3).

Our results indicate that among Democrats, women discuss policy more often, and among Republicans, men do (see Figure 1). Democrats, generally, are more likely to discuss policy, and so are Senators. Senate Democrats were the most frequent policy tweeters, and House Republicans were the least. These results indicate mixed results for  $H_1$  (the effect of gender on policy tweet frequency depends on party and chamber) and do not support  $H_5$  (Senators more frequently discussed policy than did Representatives).

**Table 2.** Results of Logistic Regression predicting policy tweets

Term	Odds Ratio	SE
republican	0.656***	0.006
senate	1.610***	0.017
man	0.910***	0.006
republican:senate	0.691***	0.014
republican:man	1.137***	0.012
senate:man	0.927***	0.012

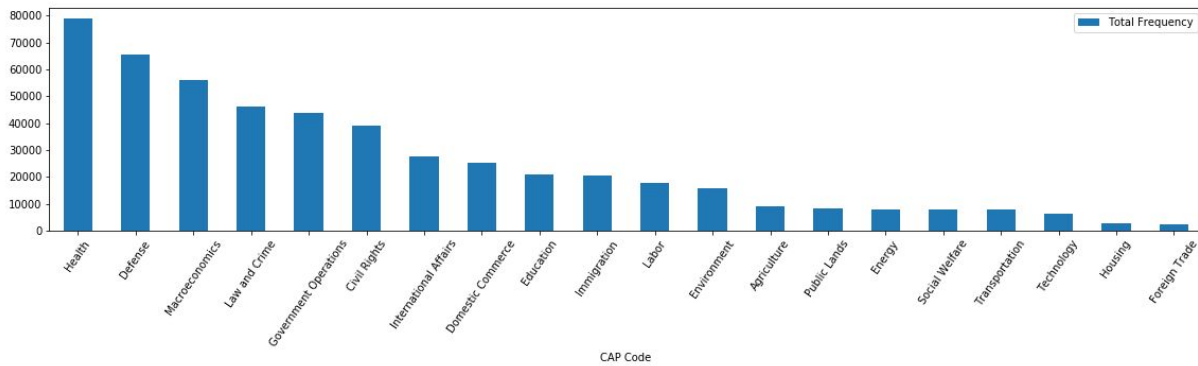
republican:senate:man	1.158***	0.026
(Intercept)	2.857***	0.014



**Figure 1.** Marginal effects plot comparing policy tweet frequencies by party, chamber, and gender

Then, to identify patterns in the specific policies discussed, we fit six different multinomial logistic regression (MLR) models to determine the relationships between party, chamber, gender, and policy area. We fit each of the independent variables alone, then all three together, interacting party and chamber, and interacting all three terms. Using AIC comparisons and ANOVA, we found that the model of best fit included all three independent variables and no interaction terms. Table 3 shows the results of the best MLR<sup>6</sup>; it contains odds ratios and standard errors for each topic. The significance of these odds ratios indicates that the genders, parties, and chambers exhibit different patterns of political attention, but the magnitude of the odds ratios suggest those associations are weak.

<sup>6</sup> Complete results for all models are available in supplementary documents.



**Figure 2.** Overall distribution of attention (frequency of tweets) across policy areas for the 115th Congress. Topic 3 (*health*) receives the most attention overall.

### What patterns of political attention appear on Twitter?

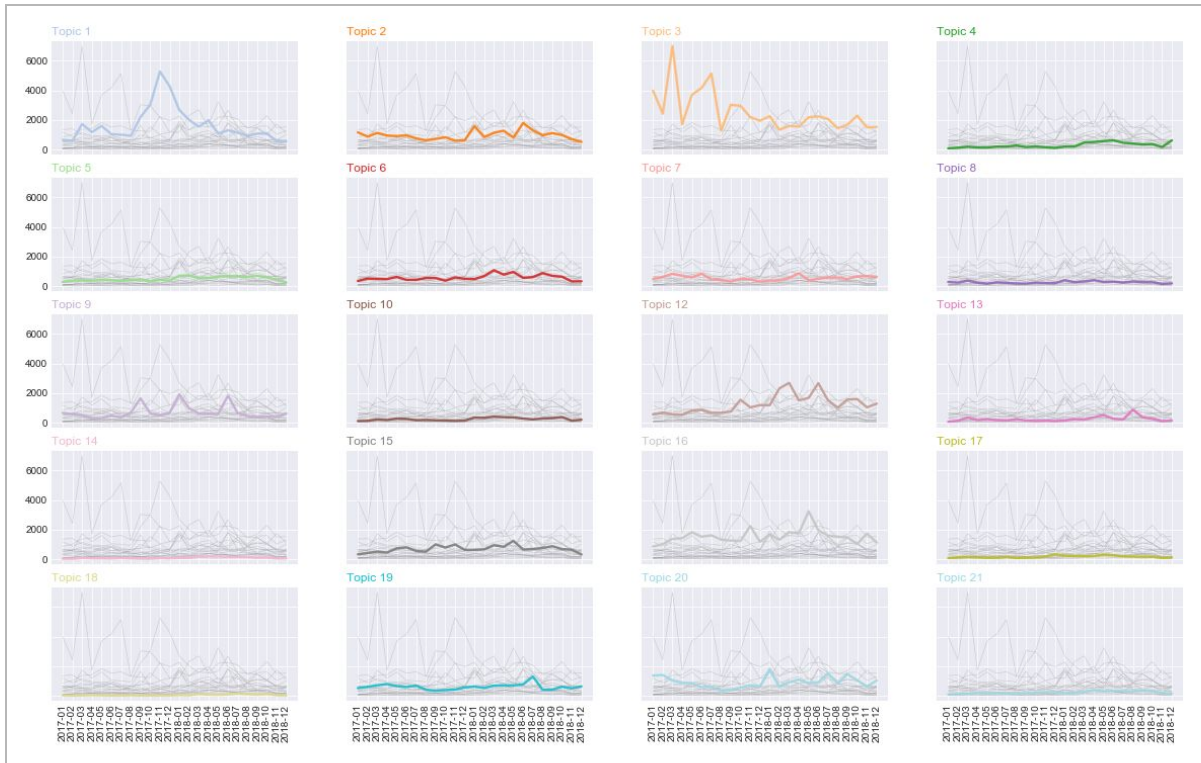
We see that most policy topic areas receive little attention, and those low levels of attention vary little over time (see Figure 3). *Health*, *macroeconomics*, *law and crime*, *defense*, and *immigration* receive more attention sporadically. *Health* received a peak in attention during the first half of 2017 and then leveled off over the remainder of the 115th Congress. *Macroeconomics* peaked in the fall of 2017. *Law and crime* received increased attention during the first half of 2018, which then decreased for the rest of the year while remaining higher overall than 2017 rates of attention. *Defense* featured a generally higher baseline than most topics, demonstrating some periodicity towards the end of 2017 and early 2018. For *immigration*, we observed three noticeable peaks—the 4th quarter of 2017 and the first and second quarters of 2018.

**Table 3.** Results of Multinomial Logistic Regressions. Odds ratios and standard errors are provided. “Labor” (CAP #5) is the reference category. The CAP codebook has no #11.

CAP #	CAP Major Code	Issue Owner	GOP	SE	Sen.	SE	Man	SE	Const.	SE
1	Macro-economics	Dem	1.46***	0.012	0.87***	0.013	1.28***	0.014	2.03***	0.012
2	Civil Rights	Dem	0.63***	0.013	0.82***	0.014	0.86***	0.014	2.73***	0.012
3	Health	Dem	1.02	0.012	1.03**	0.012	0.99	0.013	3.75***	0.011
4	Agriculture	Dem	1.83***	0.019	1.34***	0.019	0.86***	0.021	0.34***	0.019
6	Education	Dem	0.88***	0.015	0.94***	0.015	0.89***	0.016	1.23***	0.014
7	Environment	Dem	0.49***	0.017	1.28***	0.016	1.51***	0.018	0.66***	0.016

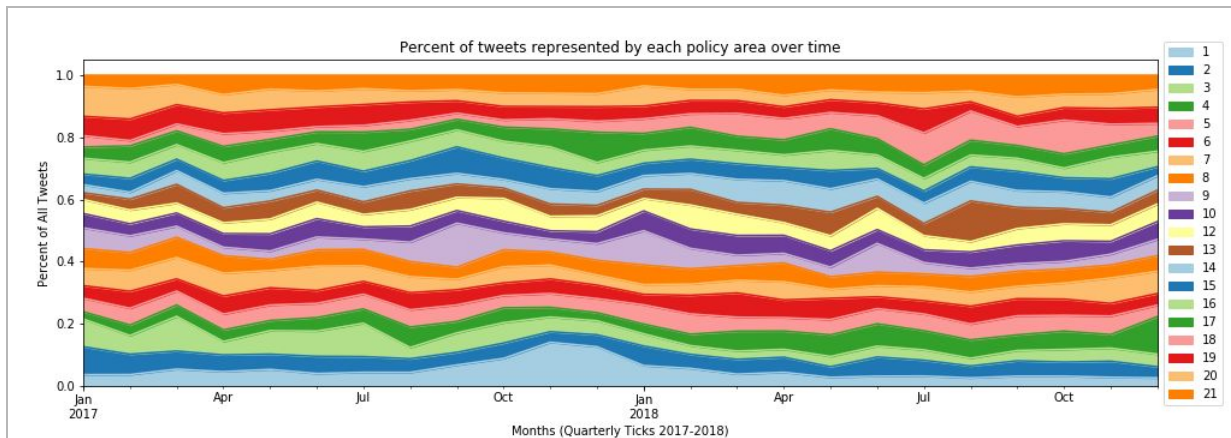
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8	Energy	Dem	1.97***	0.018	1.45***	0.018	1.26***	0.021	0.29***	0.019
9	Immigration	GOP	0.70***	0.016	0.71***	0.017	1.23***	0.017	0.93***	0.015
10	Transportation		0.98	0.019	1.12***	0.019	1.15***	0.021	0.38***	0.019
12	Law and Crime	GOP	0.75***	0.013	0.996	0.013	0.95***	0.014	2.48***	0.012
13	Social Welfare	Dem	0.54***	0.021	0.59***	0.023	0.83***	0.02	0.62***	0.017
14	Housing	Dem	0.64***	0.032	1.16***	0.031	1.03	0.032	0.15***	0.028
15	Domestic Commerce	GOP	1.27***	0.014	0.96***	0.015	1.11***	0.016	1.08***	0.014
16	Defense	GOP	1.70***	0.012	0.96***	0.012	1.18***	0.013	2.51***	0.012
17	Technology		1.15***	0.022	1.36***	0.022	1.05*	0.025	0.24***	0.022
18	Foreign Trade	GOP	1.34***	0.035	1.51***	0.034	1.15***	0.041	0.07***	0.037
19	International Affairs	GOP	1.39***	0.014	1.10***	0.014	1.36***	0.016	0.94***	0.014
20	Government Operations		1.22***	0.012	1.17***	0.013	1.25***	0.014	1.67***	0.012
21	Public Lands	Dem	1.15***	0.019	1.44***	0.019	1.00	0.021	0.36***	0.019



**Figure 3.** Frequency over time for each topic in CAP codebook. Results are presented with monthly frequencies.

Figure 3 shows the percent of tweets represented by each policy area over time during the 115th Congress. While Figures 3 and 4 display the same data, the stacking in Figure 4 reveals different trends and anomalies. We see that during the first three quarters of 2018, *housing* (topic 14) and *foreign trade* (topic 18) increased slightly in their proportion of tweet attention relative to other topics. During the third quarter of 2018, we see *social welfare* (topic 13) exhibit a jump in tweet attention. Finally, during the final quarter of 2018, we see *agriculture* (topic 4) also exhibit a jump in Tweet attention.



**Figure 4.** Percent of tweets in each policy area over time.

### **Do the parties, chambers, and genders discuss different policies?**

The results of the MLR (see Table 3) show that there are significant differences between parties, chambers, and genders for nearly all topics in the CAP codebook. We can look to the odds ratios for these variables' effects to understand the nature of these differences. These odds ratios, all less than 2, indicate weak to moderate associations between party, chamber, gender, and policy attention.

Concerning the effects of gender, we found that *environment* exhibited the highest odds ratio for men compared to women and that *social welfare* receives the lowest odds ratio. These odds ratios suggest that men are more likely to focus attention on *environment* than women, and women are more likely to focus attention on *social welfare* than men.

When examining party effects, we found that the highest odds ratio exists for Republicans compared to Democrats with *energy*. The lowest odds ratio exists for Republicans compared to Democrats for *environment*. These odds ratios suggest that the Republican MCs are more likely to focus attention on *energy* than are Democrats, and Democrat MCs are more likely to focus attention on *environment* issues than are Republicans.

Finally, concerning the effects of chamber, we found the highest odds ratio exists for Senators compared to House Representatives with *foreign trade* and the lowest odds ratio for *social welfare*. These odds ratios suggest that Senators are more likely to focus attention on *foreign trade* than are House Representatives, and House Representatives are more likely to focus attention on *social welfare* than are Senators.

<b>Table 4.</b> Predicting Agenda Diversity (Shannon's H) by Party, Chamber, and Gender	
	Shannon's H
partyRepublican	-0.184***
	(0.017)
chamberSenate	0.104***
	(0.021)
genderM	0.003
	(0.021)
Constant	2.419***
	(0.019)
<i>Note:</i> *p<0.1; **p<0.05; ***p<0.01	

We also calculated attention diversity for each MC using Shannon's H as recommended by Boydston, Bevan, and Thomas (2014) and ran linear regression to predict H using party, chamber, and gender<sup>7</sup>. Table 4 shows the results of that regression and indicates that Democrats and Senators exhibited significantly more diversity than Republicans and Representatives. The difference between genders was not significant.

<b>Table 5.</b> Summary of hypotheses and their support.	
<b>Hypothesis</b>	<b>Result</b>
H <sub>1</sub> : Women will discuss policy more often than men.	Among Democrats: Supported  Among Republicans: Not supported
H <sub>2</sub> : Women will exhibit more diverse policy agendas than men.	Not supported
H <sub>3</sub> : Republicans will discuss policy more often than Democrats do.	Not supported

<sup>7</sup> We also ran models including interaction terms, and the full list of models and their results are available in supplementary materials. We again report only the model of best fit here.

H <sub>4</sub> : Republicans and Democrats will attend to different policy issues.	Supported
H <sub>5</sub> : Senators will discuss policy more often than Representatives do.	Supported
H <sub>6</sub> : Senators will exhibit more diverse policy agendas than Representatives.	Supported

## Discussion

We presented a supervised machine learning model that detects political topics in tweets and assigns them to categories in a widely-used codebook for measuring political attention. This model enabled us to (1) observe patterns in Congress's political attention through the 115th Congress and (2) identify differences in political attention among lawmakers' parties, chambers, and genders. We found that the proportion of lawmakers' tweets that address policy issues stayed relatively stable throughout the congress, ranging from 41%-57% of tweets, but that the parties, genders, and chambers produced different patterns of attention to issues within those policy tweets. These differences were quite small in effect, and below we explore institutional factors that may help explain the patterns of attention we observed.

We also demonstrated Twitter's utility for studying attention—the factors that drive attention elsewhere drive attention on Twitter. Twitter's readily available data lets us study attention without having to wait for legislative sessions to complete or to aggregate other resources such as press releases.

### Party, Gender, and Chamber Effects

Our results show that Democrats, Representatives, and women are generally more likely to post policy-related tweets. However, the significance of the interaction terms in our LR indicate that these general patterns do not always hold. Rather, the effects of party, chamber, and gender depend on one another.

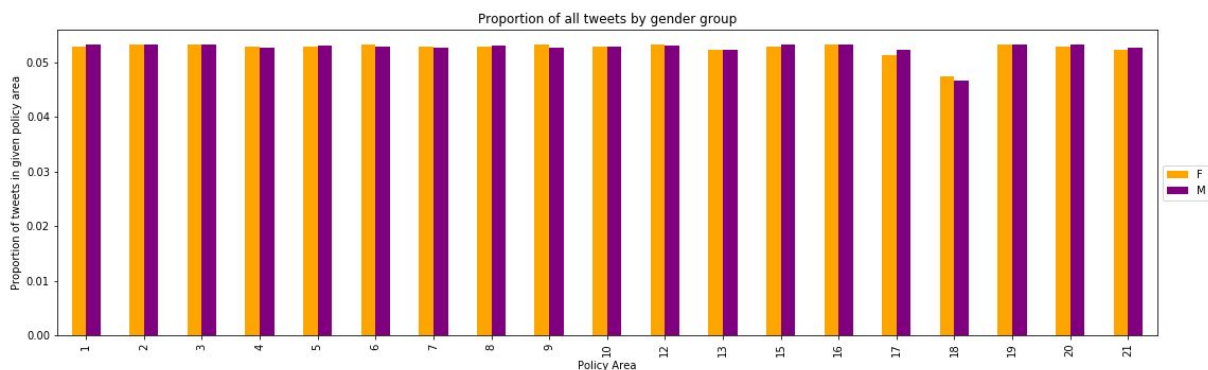
Specifically, party moderates the effect of gender. Democratic women attend to policy more often than Democratic men, and Republic women attend to policy less than Republican men. Evans and Clark (2016) also found that women were more likely to attend to policy issues. They do not indicate whether women in both parties exhibit the same pattern, but we found that Republican women were less likely than their male counterparts to post policy tweets. In a related vein, Pearson et al. (2011) found that "Republican congresswomen have particularly strong incentives to highlight their partisan credentials to both party leaders and attentive constituents," which may explain why Republican women were less policy-attentive in their tweets than Democratic women. Republican women spend more of their time tweeting about constituent relations (i.e., district affairs, emergency response, district awards, holidays, etc.) or partisan debate.



In regards to the diversity of issues, we find no difference between men and women in terms of the range of issues that are discussed on Twitter. Women are not sticking to a narrow set of “women’s issues” nor are they trying to address more issues than their male colleagues. This finding runs counter to work by Atkinson and Windett (2018) that shows women offer a more diverse number of policy proposals than their male colleagues in their legislative activity. On Twitter, these differences by gender do not appear and suggest further inquiry into the different audiences and different motivations of agenda-setting on Twitter versus in Congress.

Democrats in both chambers attend to policy more often than Republicans, and senators of both parties do so more than representatives. The higher frequency of policy tweets among senators contradicted earlier findings where Republicans and Representatives tweeted more often (Hemphill et al., 2013a).

We then examined policy tweets alone and found main effects for party, chamber, and gender on the relative attention topics receive. However, in evaluating each of these demographic groups’ different tweet frequencies, we found that the low odds ratios that indicate weak associations meant these differences among demographic groups were not meaningful in practice. For instance, Figure 5 shows the proportion of tweets in each category by gender. Though the regression showed a significant difference between the genders for nearly all topics, the figure shows how small those differences are. As Hayes and Lawless (2016), the “file drawer” problem may mean that published research about gender differences may overrepresent those differences. The small effects of the differences we identified are likely more interesting than the effects themselves.



**Figure 5.** Male and female policy area attention distributions. Orange bars indicate the proportion of attention females paid to a given policy area relative to others, and purple bars indicate male attention.

## **Other Institutional Effects**

Given the small differences observed when we examine the categories and independent variables globally, we examined *health*, the most frequent policy topic, in more detail to explore what else may be driving attention on Twitter. *Health* topics also fall under multiple jurisdictions (Sheingate, 2006) and so provide an opportunity to examine the potential influences of institutional factors on Twitter policy attention. To explore what motivates *health* policy area tweet patterns, we examined which MCs contributed to these posts and what they are posting about. We sampled users from two groups: prolific and attentive users. *Prolific* users are those who posted most often (raw count) about *health* and included Sen. Patty Murray (D-WA, F), Sen. Rob Portman (R-OH, M), Sen. Richard J. Durbin (D-IL, M), and Rep. Frank Pallone, Jr. (D-NJ, M). Among *attentive* users, health was the topic they talked about most (proportionally) and included Rep. Brett Guthrie (R-KY, M), Rep. Michael C. Burgess (R-TX, M), Rep. Grace F. Napolitano (D-TX, F), and Rep. Diane Black (R-TN, F). Interestingly, these two lists of MCs do not overlap—those who tweet the most about *health* are not the people who spend most of their attention on *health*. We used tweets from these users to explore the potential influences of institutional factors on Twitter policy attention, including committee membership, caucus membership, and legislative debates.

Beginning with content analysis of peaks and troughs in *health* attention, we observed patterns in content that reflected prescient legislative debates. However, not all content in these periods reflected these debates. Responding to existing scholarship on committee and caucus membership, we examined each of these phenomena's potential influences on *health* attention in order to understand possible tweet motivations beyond legislative debate. We examined committee membership's effects based on Mann and Ornstein's (1981) findings that lawmakers develop legislative expertise in committees, which they can then talk about publicly to gain national exposure and draw attention from voters. We also examined caucus membership's effects based on Hammond's (2001) findings that caucus membership can support both greater coordination across some policy agendas and greater fragmentation across others. Building on these findings, we sought to evaluate whether caucus membership would demonstrate any notable topical relationship with policy attention patterns, reflective of either those coordinative or fragmenting effects which Hammond observed in policy agenda setting.

### Legislative Debates

Through generating time series visualizations, we identified peaks and troughs in health attention, and studied prevalent content patterns during these periods. Health received the most attention during the first half of 2017 and then leveled off. This peak in attention was likely related to debates in Congress about repealing and replacing the Affordable Care Act (ACA) that peaked during the same period. 155,638 tweets were

labeled as health. Of these, 32,997 or approximately 21% address the ACA and its debates explicitly (i.e., including hashtags or phrases such as #ACA, #repealANDreplace, Obamacare, aca). Figure 6 shows the total number of tweets about health and the subset that contain ACA-related phrases. We can see that the ACA-related tweets reflect spikes in activity that mirror noticeable spikes in health-related conversation. Though these moments in the tweet stream and legislative debates may not explain the entirety of the health spike during the first half of 2017, they suggest a correlation between legislative debates in Congress and the type of content that MCs tweet about that is worthy of further investigation.

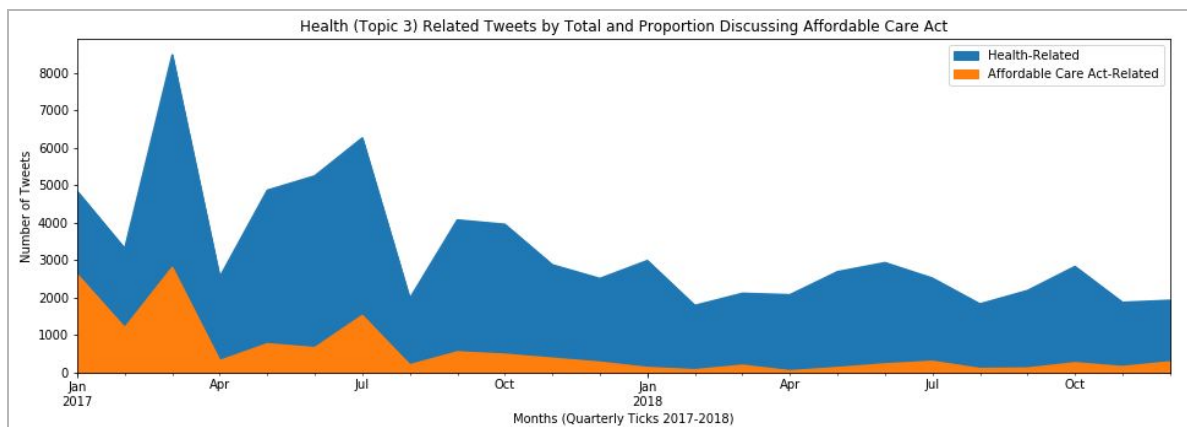


Figure 6. Frequency of tweets labeled *health* during the 115th Congress. The orange area marks tweets that explicitly mentioned the Affordable Care Act and/or related repeal efforts.

Not all MCs reflect legislative debates on their Twitter timelines in the same way, however. We plot each of these MCs' health-focused tweet attention patterns over time in Figure 7 and discuss the topics in each groups' tweets. Overall, among the prolific and attentive groups, we see deviations from the overall pattern of health tweets. Individuals in these groups exhibit different peaks, valleys, and overall distributions from one another and Congress overall. Cook (2016) found that social media activity, at least in the Senate, did not reflect legislative activity. Rather, mass media and social media influenced the networks Senators generated through Twitter. Our close reading suggests a relationship between legislative activity and the content of tweets, and determining the nature of the relationship between content and network relationships is an avenue for future research.

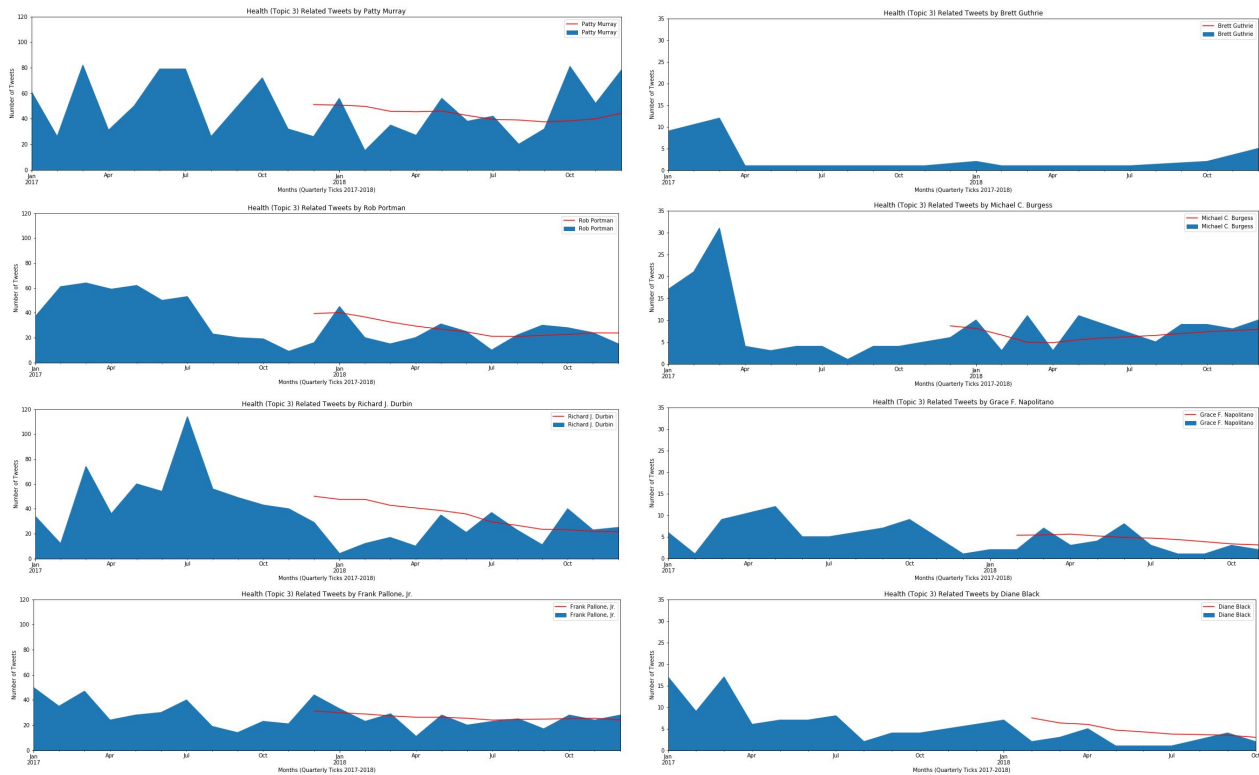


Figure 7. Each of the most prolific tweeters' attention to health over time according to the number of tweets (on left), and the MCs that paid most attention to health relative to other topics they tweeted about over time according to the number of tweets (on right).

*Prolific* tweeters focused mainly on specific legislative actions, whether the ACA repeal and replacement attempts, opioid-related bills, or CHIP. *Attentive* tweeters discussed a wider variety of general health issues, some concerning specific bills and others concerning raising awareness of health-related events and issues. We observe that in some months, individual attention patterns among *prolific* tweeters appear reflected in overall attention patterns. Given this observation, we argue that, when they tweet prolifically, individual MCs do affect overall tweet attention patterns. That *attentive* tweets appear less closely aligned with overall tweet attention patterns suggests that in addition to legislative events, MCs may be motivated to tweet to raise public awareness around particular issues or attend to their own interests.

#### Committee and Caucus Membership

We also examined the relationships between committee and caucus memberships and *health* attention among these eight MCs. Analysis of each of these eight MCs suggests that committee or caucus memberships do motivate tweet narratives around particular topics or issues. For instance, Sen. Murray's committee memberships and the issues she discussed are closely aligned. Sen. Murray belongs to the Senate Committees on Appropriations; Budget; and Health, Education, Labor, and Pensions (HELP). HELP

was responsible for reviewing the GOP's counter-proposal to the ACA (the American Health Care Act of 2017) and Tom Price's nomination to U.S. Secretary of Health and Human Services. Appropriations also deals with government funding issues like government shutdowns. The salience of repeal and replace, Price's nomination, and the government shutdown on Sen. Murray's tweetstream suggest that these committee memberships' may affect tweet behavior. Similarly, Black belonged to the House Budget Committee and Ways and Means Committee. The House Budget Committee's Subcommittee on Health was responsible for review of the GOP's counter-proposal to the ACA, which holds thematic resemblance to Black's sustained tweet narrative surrounding this proposal.

In the ACA debates, it is difficult to separate institutional effects because the ACA was a popular topic throughout Congress, not just in relevant committees. This means we cannot yet identify committee membership's specific impacts on Sen. Murray's and Rep. Black's attention. In Sen. Portman's case, none of his narrative appears to be explicitly related to his committee or caucus memberships, but we observe that much of his tweet attention relates to bills he sponsors.

#### Impacts of Institutional Effects

We provide this preliminary discussion to demonstrate our model's analytic utility and to understand what else might be driving attention. Results from these samples of prolific and attentive tweeters indicate that MC's Twitter content may be driven by:

1. partisan position taking in legislative debates (i.e., ACA debate),
2. advocacy for sponsored legislation (i.e., Sen. Portman's push for his sponsored STOP Act and reauthorization and expansion of the CARA Act),
3. position-taking in nomination confirmation debates (i.e., Tom Price to U.S. Secretary of Health and Human Services), and
4. committee and caucus membership (i.e., Napolitano's mental health narrative, or Murray and Black's focus on the ACA debates).

#### **Future work**

Our main contributions are a model for labeling tweets according to their political topics and explanation of the motivations for specific patterns of MC policy attention online. We suggest future work should make advances in three areas: a) modeling, b) relationships between agendas expressed online and elsewhere, and c) strategic motivations for communication activities.

To improve the modeling, research may consider including topic vectors or hashtag co-occurrence features may improve these models. We experimented with different approaches to improve the performance of the model but recommend that future work

explore additional designs. For instance, more experiments with different word embedding models may identify a better approach such as topic2vec (Niu, Dai, Zhang, & Chen, 2015) that can learn both words and topics. It may also be useful to include individual characteristics in the models themselves. Party, chamber, and gender have small influence on the topics discussed and so may be more analytically useful as model features—they may help the model assign topics when two categories have similar probabilities such as immigration and agriculture or energy and environment in the U.S. context. Researchers should also experiment with unsupervised approaches to detecting political topics. Our approach leverages manually labeled data to effectively classify documents, but an unsupervised approach, where the model identifies latent relationships, may generate results that are useful for different approaches to understanding political topics. Denny and Spirling (2018) and Hemphill and Schöpke-Gonzalez (2019) provide interesting comparisons of the two approaches and how they may be useful for different political research agendas.

In addition to model improvements, we suggest that future work should test correlations between political attention on Twitter and elsewhere. For instance, Cormack (2016) found that in email, MCs communicate an ideology that matches their voters' preferences better than it matches their actual voting history. One interesting question for future work is whether this holds in Twitter as well as email. This type of work can contribute important revelations about how legislators' communication motivations and goals differ across media platforms.

Future work should evaluate explicit relationships between communication and legislative action in U.S. Congress. Purpura and Hillard's (2006) legislation classification models, which also use CAP codebook codes, make it possible to compare topic distributions across tweets and legislation. By combining behavioral data from votes and topic data from both votes and tweets, future work could explain the relationships between legislative actions and communicative activities. Russell and Wen (2019) examine the relationship between bill introductions and tweets, and their work falls in this vein finding an association between policy rhetoric and policy activity in Congress. Each of these analyses can leverage time series analyses to understand how attention patterns and their influences change over time and across media platforms.

Researchers could also explain why politicians adopt *prolific* or *attentive* strategies in their communications and whether those strategies impact electoral or career outcomes. Existing research suggested that an individual's leadership aspirations had greater influence over their behavior than their legislative institution (Scherpereel et al., 2017) or their party (U. Bernhard et al., 2015). Adopting a prolific strategy online may help an individual garner a reputation for general leadership, for instance, while attentive strategies may signal expertise in particular issues. Our findings around

gender and party differences, and earlier work on gender and campaigning (Evans & Clark, 2016; Hayes & Lawless, 2016; Hayes, Lawless, & Baitinger, 2014) indicate that men and women will have different success with these strategies.

## **Conclusion**

Understanding how Members of Congress (MCs) distribute their political attention is key to many areas of political science research including agenda-setting, framing, and issue evolution. We demonstrated that it is possible to exploit MCs' Twitter behavior to study their political attention and found statistically significant differences in attention between parties, chambers, and genders. However, these differences were small enough to suggest that other MC characteristics are also at play. Our multi-methodological approach (computational modeling and close-read content analysis) enabled us to examine institutional factors (e.g., committee assignment, caucus), partisan issue preferences (e.g., issue-ownership), and the political environment (e.g., partisan issues, confirmations, etc.). Our findings indicate these factors likely explain the patterns of political attention we observed. Our study examines just one aspect of the dataset and method we developed—what differences in attention appear—and facilitates future efforts to understand political attention, social media, and legislative action.

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