Who Leads in the Shadows? ERGM and Centrality Analysis of Congressional Democrats on Bluesky

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Abstract. Following the 2024 U.S. presidential election, Democratic lawmakers and their supporters increasingly migrated from mainstream social media platforms like X (formerly Twitter) to decentralized alternatives such as Bluesky. This study investigates how Congressional Democrats use Bluesky to form networks of influence and disseminate political messaging in a platform environment that lacks algorithmic amplification. We employ a mixed-methods approach that combines social network analysis, exponential random graph modeling (ERGM), and transformer-based topic modeling (BERTopic) to analyze follows, mentions, reposts, and discourse patterns among 182 verified Democratic members of Congress. Our findings show that while party leaders such as Hakeem Jeffries and Elizabeth Warren dominate visibility metrics, overlooked figures like Marcy Kaptur, Donald Beyer, and Dwight Evans occupy structurally central positions, suggesting latent influence within the digital party ecosystem. ERGM results reveal significant homophily along ideological, state, and leadership lines, with Senate leadership exhibiting lower connectivity. Topic analysis identifies both shared themes (e.g., reproductive rights, foreign conflicts) and subgroup-specific issues, with The Squad showing the most distinct discourse profile. These results demonstrate the potential of decentralized platforms to reshape intra-party communication dynamics and highlight the need for continued computational research on elite political behavior in emerging digital environments.

Keywords: Congressional Democrats, Social Network Analysis, Exponential Random Graph Models (ERGM), Bluesky, Political Communication, Topic Modeling, Decentralized Social Media, Political Influence.

1 Introduction

In the wake of growing political polarization in the U.S., user migration across social media platforms has become a key focus for public discourse and computational social science. After the 2024 presidential election, notable shifts in platform allegiance, especially among Democratic supporters, sparked renewed interest in decentralized and algorithmically transparent alternatives to mainstream platforms like X (formerly Twitter) (Ambrose, 2024; NPR, 2024). One platform, Bluesky, built on open-source AT Protocol, has rapid adoption, surpassing 35 million users by April 2025 (Bluesky, n.d.).

Bluesky differentiates itself through decentralization, user autonomy, and customizable content curation, enabled by its open API and lack of algorithmic amplification (Kleppmann et al., 2024). These features make it an ideal testbed for studying organic network formation, elite communication strategies, and the self-organization of political communities. Yet, despite its growing relevance, little academic research has systematically analyzed the platform's network dynamics—especially among verified or high-profile users such as U.S. Congressional Democrats.

This study uses exponential random graph modeling (ERGM) to examine the structural determinants of connectivity among Democratic members of Congress active on Bluesky. We investigate how network ties (follows, mentions, reposts) are shaped by mutual connections, ideological similarity, and leadership roles. Additionally, we explore how topical interests vary across Democratic factions—moderates, progressives, and party leadership—and whether these differences influence communication patterns. Finally, we assess whether structural centrality (e.g., degree, betweenness, eigenvector centrality) correlates with public perceptions of influence, as reflected in national polling, media coverage, and internal party standing.

By addressing these dimensions, this paper contributes to the study of political communication networks on emergent platforms. It highlights early adoption patterns and discursive trends among influential actors while offering a replicable framework for analyzing evolving digital ecosystems.

2 Background

The 2024 U.S. Presidential election triggered a major shift in political discourse online, particularly among Democrats, who began migrating from traditional platforms like X (formerly Twitter) to decentralized alternatives such as Bluesky. Despite its rapid growth, academic research on Bluesky remains sparse, with most studies focusing on its technical design rather than its network dynamics. For example, Buzelin et al. (2025) examined political discourse on Discord during the 2024 election but did not apply social network analysis (SNA), leaving a gap in understanding the structure of political interactions on emerging platforms.

While prior studies on Twitter have demonstrated the utility of SNA and Exponential Random Graph Models (ERGMs) for analyzing political networks—such as party cohesion and ideological alignment (Chamberlain et al., 2021; Sadayappan et al., 2018)—these methods have not yet been applied to Bluesky. SNA offers powerful tools for mapping influence through centrality measures (degree, betweenness, eigenvector) and for uncovering ideological divisions using community detection (McCulloh et al., 2013; Ozer et al., 2016).

This study addresses the research gap by analyzing the Bluesky network of Democratic Congressional members. Using ERGMs and SNA, we examine connectivity drivers, identify influential actors, and uncover ideological clusters and discourse patterns. Our goal is to provide a deeper understanding of the emerging digital ecosystem shaping Democratic political communication post-2024.

3 Methods

We scraped verified Bluesky accounts and collected posts, mentions, follows, and reposts using open-source libraries. Data were stored in structured formats and preprocessed for network and topic analysis. A master list of House and Senate members was compiled from official directories (U.S. House of Representatives, 2024; U.S. Senate, 2024), and verified Bluesky accounts were identified through caucus posts and manual validation using name, image, and domain affiliation. Of the 211 House and 47 Senate Democrats (including Independents who caucus with the party), 182 had identifiable accounts. Missing nodes were treated as a potential source of bias, and sensitivity analyses were performed by simulating 5–10% random node removal to evaluate effects on network metrics.

We constructed three directed graphs—follows, mentions, and reposts—using Democratic members of Congress as nodes and interaction frequencies as weighted edges. To evaluate influence and positioning, we computed centrality measures including degree, closeness, betweenness (Freeman, 1979), and eigenvector centrality (Bonacich, 1987). These metrics help identify individuals with strategic positions who may be structurally important but publicly overlooked (McCulloh, Armstrong, & Johnson, 2013; Himelboim et al., 2013).

To examine tie formation, we estimated ERGMs for each interaction type using the statnet suite in R. ERGMs account for endogenous structures such as reciprocity and transitivity, as well as exogenous attributes including chamber, leadership role, gender, and ideological affiliation. Model selection was guided by AIC and convergence diagnostics, following approaches shown effective in prior studies of legislative networks (Sadayappan, McCulloh, & Piorkowski, 2018).

To analyze discourse trends, we applied BERTopic, a transformer-based topic modeling technique that generates coherent topics using class-based TF-IDF embeddings (Grootendorst, 2022). Posts were preprocessed through standard NLP steps including lowercasing, stop-word removal, lemmatization, and emoji stripping. Topics were modeled across the full corpus, then compared using cosine similarity to assess thematic alignment or divergence. Topic coherence was evaluated using the UMass metric, and incoherent or redundant topics were filtered.

4 Findings

4.1 Comparative Network Overview

We constructed three directed graphs as shown in Figure 1 representing follower (15,015 edges; density = 0.3145; diameter = 5), mention (1,434 edges; density = 0.0300; diameter = 10), and repost (468 edges; density = 0.0098; diameter = 13) networks among 219 verified Congressional Democrats on Bluesky. The follower network was the densest and most cohesive, while reposting activity was infrequent and diffuse.

Marcy Kaptur's unusually high centrality in the follows network—despite lacking formal leadership or caucus ties—demonstrates how overlooked figures may occupy pivotal positions in online political networks (McCulloh et al., 2013). Similarly, Evans and Beyer's visibility in the repost network reflects their resonance across ideological boundaries, echoing Himelboim et al.'s (2013) finding that intermediaries, not elites, often drive amplification. Comparisons are shown in Table 1.

Table 1. Comparative Network Overview and Summary

Type	Top Central Figures	Key Metrics	Notable Patterns
Follows	Kaptur (OH), Clark (MA), Moore (WI)	Close:0.95 (Kaptur), Between:0.08 (Kaptur)	Clusters by chamber; Kaptur central without leadership
Mentions	Booker (NJ), Jeffries (NY), Warren (MA), Ramirez (IL), Cleaver (MO)	High centrality across roles	Less chamber clustering; mentions follow issue-based lines
Reposts	Warren (MA), Jeffries (NY), Evans (PA), Beyer (VA)	Low overall activity	Reposts favor peer-to-peer amplification; not driven by elites

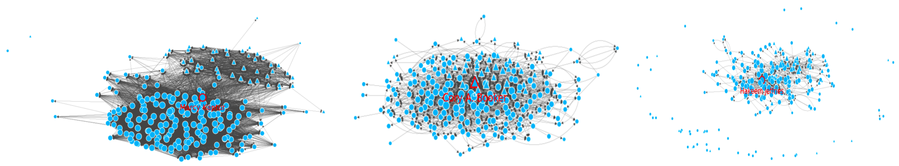

Fig. 1. Congressional Democrats Bluesky Follows, Mentions, Repost Networks, Respectively.

4.2 ERGM Results

ERGM modeling across all three networks (follows, mentions, reposts) revealed that reciprocity, shared chamber, and state affiliation consistently increased the likelihood of ties as shown in Tables 2-4. Progressive group members displayed strong clustering, particularly in the follows network, aligning with findings by Chamberlain et al. (2021) on ideological cohesion in online spaces. In contrast, Democratic Senate leadership membership negatively predicted tie formation across networks, suggesting a more hierarchical, less interactive communication style.

Table 2. Congressional Democrats Follower Network ERGM Results.

	Estimate	Std. Error	MCMC %	z value	$Pr(>\|z\|)$
edges	-3.87525	0.11860	0	-32.675	$< 1e-04$
mutual	0.35303	0.03156	0	11.185	$< 1e-04$
nodematch.member_type	2.71894	0.04420	0	61.508	$< 1e-04$
nodematch.state	0.70633	0.04885	0	14.460	$< 1e-04$
nodematch.is_verified	0.08255	0.02111	0	3.911	$< 1e-04$
nodematch.blue_dog_coalition	0.11454	0.05441	0	2.105	0.035274
nodematch.problem_solvers_caucus	0.21310	0.02888	0	7.379	$< 1e-04$
nodematch.new_democrat_coalition	0.07295	0.02101	0	3.472	0.000517
nodematch.democratic_senate_leadership	-0.13164	0.05643	0	-2.333	0.019668
nodematch.democratic_house_leadership	0.10309	0.04815	0	2.141	0.032287
nodematch.the_squad	0.38593	0.06421	0	6.010	$< 1e-04$
nodematch.congressional_progressive_caucus	0.03977	0.02140	0	1.858	0.063124

Table 3. Congressional Democrats Mentions Network ERGM Results.

	Estimate	Std. Error	MCMC %	z value	$Pr(>\|z\|)$
sum	-3.25077	0.38417	0	-8.462	$< 1e-04$
nonzero	-3.35241	0.09581	0	-34.989	$< 1e-04$
mutual.min	1.44118	0.11105	0	12.978	$< 1e-04$
nodematch.sum.member_type	0.47024	0.06216	0	7.564	$< 1e-04$
nodematch.sum.state	1.11855	0.05941	0	18.828	$< 1e-04$
nodematch.sum.is_verified	0.22416	0.04744	0	4.725	$< 1e-04$
nodematch.sum.blue_dog_coalition	1.19767	0.32032	0	3.739	0.000185
nodematch.sum.problem_solvers_caucus	0.31459	0.08439	0	3.728	0.000193
nodematch.sum.new_democrat_coalition	0.16556	0.04994	0	3.315	0.000915
nodematch.sum.democratic_senate_leadership	-0.71027	0.06838	0	-10.387	$< 1e-04$
nodematch.sum.democratic_house_leadership	-0.10635	0.09178	0	-1.159	0.246571
nodematch.sum.the_squad	-0.10315	0.12820	0	-0.805	0.421070
nodematch.sum.congressional_progressive_caucus	0.19127	0.04937	0	3.874	0.000107

Table 4. Congressional Democrats Repost Network ERGM Results.

	Estimate	Std. Error	MCMC %	z value	$Pr(>\|z\|)$
sum	-4.50874	0.77296	0	-5.833	$< 1e-04$
nonzero	-3.97581	0.16203	0	-24.538	$< 1e-04$
mutual.min	1.50311	0.22931	0	6.555	$< 1e-04$
nodematch.sum.member_type	1.36963	0.15733	0	8.706	$< 1e-04$
nodematch.sum.state	0.87873	0.10279	0	8.548	$< 1e-04$
nodematch.sum.is_verified	0.12677	0.07992	0	1.586	0.112676
nodematch.sum.blue_dog_coalition	1.62879	0.67626	0	2.409	0.016017
nodematch.sum.problem_solvers_caucus	0.69984	0.18134	0	3.859	0.000114
nodematch.sum.new_democrat_coalition	0.21394	0.08900	0	2.404	0.016228
nodematch.sum.democratic_senate_leadership	-0.83193	0.12481	0	-6.666	$< 1e-04$
nodematch.sum.democratic_house_leadership	-0.69802	0.11314	0	-6.170	$< 1e-04$
nodematch.sum.the_squad	0.03781	0.24550	0	0.154	0.877596
nodematch.sum.congressional_progressive_caucus	0.20618	0.08388	0	2.458	0.013975

Mentions and reposts highlighted different dynamics. Leadership figures were less central in these graphs, while policy-focused members gained visibility through peer amplification. This sparse network reinforces findings from Himelboim et al. (2013) that information diffusion in political networks is not solely driven by central elites, and that influential amplifiers often occupy intermediate or bridging roles. This shift indicates that decentralized platforms like Bluesky reward issue-based engagement over formal rank, supporting prior work that structural position may reveal overlooked, influential actors (McCulloh et al., 2013; Himelboim et al., 2013).

4.3 Topic Analysis

Topic modeling with BERTopic identified shared themes across the corpus, Medicaid, Israel-Gaza, reproductive rights, and the Ukraine war; indicating alignment on major issues. However, group-specific divergences were also evident. Leadership and progressives both discussed Defense Secretary Hegseth, while The Squad uniquely centered civil liberties topics like the detention of Mahmoud Khalil and Rümeysa Öztürk.

Cosine similarity scores revealed that the New Democrat Coalition had the highest alignment with overall Democratic discourse (0.5485), and also shared notable overlap with progressives (0.4694), reflecting centrist positioning. The Squad was least aligned, underscoring its distinct rhetorical identity.

These findings suggest that while structural centrality can highlight interaction patterns, semantic content reveals deeper ideological boundaries, offering insight into factional differentiation within the party's post-2024 digital landscape.

5 Conclusion

This study provides one of the first comprehensive examinations of U.S. Congressional Democrats' activity on the decentralized social media platform Bluesky. By integrating social network analysis, exponential random graph models (ERGM), and transformer-based topic modeling, we uncover both structural and semantic patterns in elite political communication following the 2024 U.S. presidential election.

Our network analysis reveals that while prominent party leaders such as Hakeem Jeffries and Elizabeth Warren dominate follower and mention networks, several overlooked figures—such as Marcy Kaptur, Donald Beyer, and Dwight Evans—occupy structurally central positions, suggesting untapped or underrecognized influence within the party's online ecosystem. These findings underscore the value of centrality measures in identifying influential actors who may not be highly visible in media coverage or formal leadership roles.

The ERGM results provide empirical support for homophily across multiple attributes, including chamber membership, state, group affiliation, and verification status. Notably, formal leadership in the Senate appears negatively associated with tie formation and content sharing behaviors, suggesting a more hierarchical or broadcast-oriented communication style among elite figures.

Topic modeling further reveals thematic cohesion on issues such as Medicaid cuts, reproductive rights, and foreign conflicts, alongside meaningful divergence among ideological subgroups. The Squad, for example, exhibited the least topical alignment with other factions, reflecting its distinct rhetorical and advocacy priorities.

Several limitations warrant consideration. First, Bluesky remains an emerging platform with incomplete adoption among political elites; our sample omits members who have not joined or who use anonymous or unverified accounts (16.4% of congressional democrats). Second, the platform's decentralization introduces complexity in verifying authenticity and assessing cross-instance visibility. Third, while our centrality measures highlight structural influence, we do not correlate these with external popularity metrics (e.g., polling data or mainstream media citations), leaving the third research question partially open. Finally, topic modeling is inherently sensitive to preprocessing and model parameters; while BERTopic offers state-of-the-art coherence, future work could triangulate findings with alternative techniques.

Building on these findings, future research could expand in several directions. First, a comparative analysis of Democratic and Republican network structures may reveal partisan asymmetries in adoption and discourse. Note that it was difficult to verify republican accounts on the Bluesky platform. There are no House or Senate accounts on the platform with starter packs. Adding to the confusion, manual searches often yield parody accounts. Prominent republicans that we manually searched for that appear to have a valid Bluesky account like Steve Scalise and Elise Stefanik had very little activity and Stefanik appears to have deactivated her account. Perhaps comparing Republican activity on X with Democrat activity on Bluesky might be more appropriate, however, differences in access to platform data may bias findings.

Second, longitudinal data collection could track the evolution of network ties and issue salience over time, particularly as the 2026 mid-terms approach. Third, linking Bluesky behavior with off-platform outcomes (e.g., voting records, donor activity, or media attention) could provide richer insight into how digital centrality translates into real-world political influence.

Ultimately, this study contributes to our understanding of how elite political networks operate in emergent, decentralized environments. As platforms like Bluesky continue to evolve, so too must the computational tools used to analyze them—offering new avenues for research at the intersection of technology, politics, and network science.

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