Crohn's & Colitis 360, 2021, **3**, 1–9
https://doi.org/10.1093/crocol/otab052
Advance access publication 4 August 2021
Observations and Research

Reach and Power of Physician-Initiated Tweets in a Twitter Inflammatory Bowel Disease Community

Keerthana Kesavarapu, DO,*, Asta Zelenkauskaite, PhD,† and Neilanjan Nandi, MD, FACP‡,

*Department of Gastroenterology and Hepatology, Temple University, Philadelphia, Pennsylvania, USA
†Department of Communication, Drexel University, Philadelphia, Pennsylvania, USA
‡Department of Gastroenterology and Hepatology, University of Pennsylvania, Philadelphia, Pennsylvania, USA

Address correspondence to: Neilanjan Nandi, MD, FACP, 218 Wright Saunders Building, 51 N. 39th St, Philadelphia, PA 19104, USA (Neilanjan.Nandi@pennmedicine.upenn.edu).

Background: Inflammatory bowel disease (IBD) specialist Twitter engagement and thematic content was assessed.

Methods: The nature of interaction between IBD specialists and users who responded to them was analyzed based on (1) content analysis of stakeholders who responded to them; (2) nature of interaction through a manual thematic content analysis of IBD specialist tweets and responses; (3) prominence of interaction by employing descriptive analysis and statistical inferences relative to the number of replies, likes, and retweets. Analyzed samples included of tweets (n = 320) compiled from 16 IBD specialists, and associated replies (n = 299), retweets (n = 869), and likes (n = 4068).

Results: Healthcare professionals (HCPs) more often engaged with peer-HCPs, compared to other stakeholders. When it comes to the nature of exchanges, of original tweets, the most common content was for knowledge sharing (58%) and endorsement (28%). In the knowledge sharing category, research accounted for more than half of those tweets (53%). Of replies, knowledge sharing occurred most frequently with a subtheme of IBD management (62%).

Conclusions: HCP–HCP Twitter engagement was more frequent than HCP–other Twitter stakeholder interaction. The primary purpose for this engagement was found to obtain real-time information, professionally network, and disseminate research.

Lay Summary

The nature and content of inflammatory bowel disease (IBD) physician engagement on Twitter was critically analyzed. Clinicians more often engage their peers, than patients, with the objective to share new educational updates, disseminate research findings, and provide IBD patient management commentary.

Key Words: social media, physician communication online, physician–patient interaction, inflammatory bowel disease, medical education

Introduction

Inflammatory bowel disease (IBD) encompasses the phenotypic spectrum of Crohn's disease and ulcerative colitis and is estimated to affect over 3 million individuals in America with estimated healthcare economic expenditure between $14.6 and $31.6 billion.[1] Due to the chronic nature of IBD and the significant impact on quality of life, it is paramount to better understand the relationship between patients and their gastroenterologists in educating patients on appropriate treatment strategies. Fostering more effective relationships between patients and their physicians has been shown to increase patient satisfaction and improve outcomes.[2]

Similarly, the limited allotted time for clinic visits may cause strain on the interactive and didactic quality of patient–physician engagement. Face-to-face patient–physician communication is traditionally isolated to the clinic where the allotted clinic visit time has progressively become shorter.[3,4] In fact, the National Ambulatory Medical Care Survey (NAMCS) indicates that the average face-to-face duration has progressively dwindled among general physicians from 18.7 minutes in 2003 to 13.3 minutes in 2005.[3,4] The average visit length for an IBD patient in a gastroenterologist's office is 15 minutes.[2] Emphasis of clinic visits is placed on quantification of symptoms, but time constraints may limit in-depth inquiry into the emotional impact of disease, alignment of goals, and education about disease state and biologic and small-molecule therapies.[2] Aside from the time constraints imposed by healthcare economic factors, family surveys suggest that other barriers to healthcare access exist including lack of insurance coverage, limited access to services, and unaffordable costs preventing necessary consultations.[5] Strict demands on time during traditional clinic hours, may limit the opportunity physicians have to procure new knowledge and to devote to much needed patient education.

Social Media for IBD-Specialist Engagement

Notably, social media platforms have become a novel and emerging vehicle for both knowledge dissemination and patient–physician interactive engagement.[6] Social media platforms such as Facebook, Instagram, and Twitter have become ubiquitous and accessible virtual spaces where both patients and clinicians may exchange and disseminate many types of

Received for publications: December 30, 2020. **Editorial Decision:** May 3, 2021
© The Author(s) 2021. Published by Oxford University Press on behalf of Crohn's & Colitis Foundation.
This is an Open Access article distributed under the terms of the Creative Commons Attribution-Non-Commercial License (https://creativecommons.org/licenses/by-nc/4.0/), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact journals.permissions@oup.com

information with great velocity. This is in distinct contrast to traditional web applications where patients must be actively directed to a website to obtain information without the opportunity to interact with the expert subspecialist. While web applications and social media both enable information access beyond the walls of the clinic, social media platforms uniquely provide an opportunity for direct and bidirectional engagement of the patient–healthcare professional (HCP) relationship on a timeline that is independent of the clinic clock. Furthermore, social media allows for a rapid information exchange between HCPs. Indeed, a healthcare-related Twitter hashtag analysis by Massey et al demonstrated that HCPs were particularly invested in tweeting about human papilloma vaccination guidelines with the inherent of goal of rapid information dissemination.[7]

Social media-based patient–HCP interaction promotes unprecedented access to subspecialists and interdependent acquisition of knowledge by both clinicians and patients. This study investigates the degree to which opportunities for social media interaction are utilized by various stakeholders. Understanding the dynamics of this interactive exchange is critical to maximizing the platform's ability to provide information to both patients and HCPs from reliable sources such as verified physicians. However, there is very little known about the individual stakeholders in this conversation regarding physician engagement, patient engagement, and the topics that drive conversation.

While patients may belong to Facebook social community support groups, more physicians are on Twitter in a professional capacity. A study in 2013 verified over 2000 IBD specialists on Twitter, based on their National Provider Identifier (NPI) tweeting more than once per day with at least 300 followers each.[8] Additionally, these IBD specific surveys demonstrated that patients are interested in acquiring knowledge via social media ideally from a gastroenterologist. One study highlighted that 84% of IBD patients craved an e-health space that allowed direct contact with an IBD specialist in a one-on-one basis.[9,10] Furthermore, Twitter is the most popular form of social media used for healthcare communication.[11] Because our aim was to analyze what content physicians in the IBD area tweet and who interacts with their tweets, we focused our approach on IBD specialists on Twitter.

Here within, we present our first foray to characterize the social media-based HCP engagement in the Twitter IBD space with various stakeholders. Previous studies analyzed tweets through the analysis of specific hashtags. Instead, in this study, we focus on a group of IBD specialists initiating interaction online.[12] These nascent assessments will help us identify the advantages and challenges of online spaces and the areas that may enhance IBD e-health patient education when the clinic time has concluded.

Materials and Methods

This study was based on 3 research questions (RQ):

- RQ1: To what degree and what types of stakeholders interact (likes, replies, retweets, shares) with the IBD specialist tweets?
- RQ2: What types of content do the IBD specialist share in their tweets?
- RQ3: What kind of content do various identified stakeholders reply to IBD specialist tweets?

Data Samples

Previous research has demonstrated a positive correlation between Twitter activity and 2019 U.S. News and World Report reputation scores.[13] To analyze IBD specialist interaction through Twitter, 16 IBD specialists with verified Twitter handles were drawn from a range of medical institutions across the United States listed in 2019 U.S. News and World Report.[14] The complete list of hospitals for all specialists include: University of Chicago, John Hopkins, Mayo Clinic, Cleveland Clinic, University of Michigan, Ohio State University, University of North Carolina, Houston Methodist, Loyola, New York University Langone, University of Michigan, Cedars Sinai, University of Miami, and University of Pennsylvania. This IBD specialist sample is diverse in terms of: (1) time since a given IBD specialist joined Twitter (measured in months); (2) IBD specialist number of followers; (3) geographic location; (4) IBD specialist practice setting (eg, academic vs private practice); and (5) IBD specialist gender. Since Twitter accounts can be created by anyone, our included IBD specialist sample authenticity on Twitter was further verified by our research team's IBD specialist.

The following metrics contextualize and further illustrate diversity of our sampled IBD specialist population: the average number of months for these 16 IBD specialists since joining Twitter was 50 months; the average number of tweets was 3601 (range 36–16 200), average number of followers was 2668 (range 421–5744), and the average number of likes was 5270 (range 9–33 400). Table 1 shows a breakdown by gender, location, and practice setting with a similar number of female (56%) and male (44%) physicians. The majority of the physicians were practicing in an academic setting (94%), compared to 6% in the private setting.

The subsequent tweet-level sampling included the following procedure. From each IBD specialist, 20 of the most recent tweets (in the order they appear on Twitter) were selected generating a sample of 320 tweets. Tweets were chosen from each physician's Twitter account between May 1, 2019 and

Table 1. IBD physician demographics

Characteristic	*N* (%)
Gender—*N* (%)	Females—9 (56%)
	Males—7 (44%)
Organized by geography—*N* (%)	Northeast—2 (12.5%)
	Southeast—3 (19%)
	Midwest—8 (50%)
	Southwest—2 (12.5%)
	West—1 (6%)
Academic vs private practice—*N* (%)	Private—1 (6%)
	Academic—15 (94%)
Number of months on Twitter	Median—46.5 months
Number of tweets	Mean ± stdev; range—3601 ± 4791; 36–16 200
Number of followers	Mean ± stdev; range—2668 ± 2421; 364–8923
Number of likes	Mean ± stdev; range—5270 ± 8395; 9–33 400
Months since joining Twitter	Mean ± stdev; range—50 ± 32; 13–121

Abbreviation: IBD, inflammatory bowel disease.

June 30, 2019. For each of these original tweets, up to 25 most recent replies (when available) were collected for a given original IBD specialist tweet. This resulted in a total of 299 replies. From the original IBD specialist tweets, we recorded all likes and retweets resulting in 4068 likes, and 869 retweets. Specifically, the following sampling and analytical procedures were employed to answer each of 3 RQs: RQ1, RQ2, and RQ3.

RQ1: sampling procedures for IBD specialist interaction

RQ1 assessed IBD specialist interaction patterns on Twitter. For that, we first excluded tweets that were not healthcare related: the 320 original IBD specialist tweet sample was scrutinized based on 2 criteria: (1) tweets must be healthcare related; (2) tweets were original and duplicate tweets were only included once. There was one instance of a repeated tweet posted by a single IBD specialist that was treated as non-original content and 5 tweets of non-healthcare-related nature. Based on these 2 criteria, the sample was reduced to 314 tweets, given that 6 (2%) tweets in total did not meet inclusion criteria. We operationalized healthcare-related content as dealing with health-related topics or regarding IBD specialists and conferences. An example of a healthcare-related tweet written by an IBD specialist on Twitter is presented here (example extracted from Twitter): "Crohn's disease treatment goals" or "Dr. *** leading expert on ESD [endoscopic submucosal dissection] gives cutting edge talk with important pearls of wisdom. Great job!" An example of an IBD specialist tweet that does not pertain to "medical" content includes this tweet: "Great time with DJ."

To further analyze the level and the nature of interaction, each of the 314 IBD original tweets was coded by the number of replies, likes, and retweets. The initial sample of replies (n = 299) to the original IBD specialist tweets (n = 314) was constructed by assessing the first 25 replies to this tweet. The reply tweets sample was further scrutinized with 32 replies being excluded from the subsequent analysis resulting in the reply tweet sample equal to 267. The exclusion of reply tweets was based on the following criteria: (1) replies had to comprise identifiable stakeholders (there were 7 replies by unidentifiable Twitter users which we coded as "unknown"); (2) replies had to be accessible "publicly" (there were 25 replies that the user did not set to be displayed publicly or they are hidden due to the sociotechnical constraints of Twitter (eg, they were not displayed beyond 25 messages in each thread)).

Three hundred fourteen original IBD specialist tweets generated 4068 likes which were subsequently coded for stakeholders. For the purposes of analyzing stakeholders, we coded the first 25 likes (when available) for a given original IBD specialist tweet. This procedure yielded a final sample of 3242 likes. Analogically, 314 original IBD specialist tweets generated 869 retweets. We have further analyzed stakeholders of the first 25 retweets (when available) for a given IBD specialist tweet. This procedure yielded a final sample of 836 retweets.

RQ2: sampling procedures for IBD specialist content analysis

RQ2 was approached by performing a qualitative content analysis of 314 original IBD specialist tweets. The sampling procedure was the same as described for RQ1.

RQ3: sampling procedures for non-IBD specialist reply content analysis

RQ3 was addressed by performing a content analysis of the 267 replies to the IBD specialist original tweets.

Analytical Procedures

RQ1: level of interaction

RQ1 addressed the level of interaction in this study by assessing the replies, retweets, and likes that were generated by a type of stakeholder detailed below. We subsequently coded stakeholders who posted likes, retweets, and replies (refer to the sampling methodology above).

RQ1: stakeholders involved in the interaction

For RQ1, to address IBD specialist interaction patterns and content, we categorized interaction by the type of participants who replied, liked, or retweeted original IBD specialist tweets (n = 314) (refer to the sampling methodology above). We operationalized these participants as stakeholders—namely, types of users who replied to the IBD specialists' original messages on Twitter.

A codebook was developed to classify individual stakeholder categories found in our sample performed on replies (n = 267). We used grounded theory approach: the coding started with the expected categories (eg, patients or IBD specialists) and we expanded them, as the new categories emerged from the data.[15] Stakeholders emerged from our sample included the following categories: (1) physicians (in our sample this category included IBD specialists with a DO/MD designation in the Twitter handle or biography) and non-physician HCPs (nurses, dieticians, pharmacists, non-physician medical educators, medical students); (2) advocates who were defined as such based on "advocate" identifiers found on their biography or Twitter handle; we have conceptualized advocates as "brokers" who procure and disseminate information from IBD specialists to other online patients, communities, or support groups; notably advocates could be patients or other individuals, such as parents and/or caregivers); (3) non-advocate patients (identified as patient on Twitter user name or profile biography or images, and/or following IBD support groups); (4) organizations (our sample included healthcare-related organizations such as the Crohns and Colitis Foundation, insurance groups, hospital organizations, and medical technology organizations); (5) "other" which was comprised of accounts without codifiable identifiers and also included messages written by bots (computer generated, and confirmed by us via a publicly developed tool botometer: https://botometer.iuni.iu.edu); and (6) "unknown" category of the users whose messages were hidden by the Twitter platform affordances that also could not be coded by using the codebook established in our protocol.

RQ2 and RQ3: types of content tweeted by IBD specialists and responding stakeholders

To address the nature of content being tweeted for RQ2 (n = 314), and for content being replied for RQ3 (n = 267) we designed a standardized codebook (Table 2). As in stakeholder coding, principles of grounded theory coding were applied and each content category was constructed by aggregating several codes. Categories constructed in the codebook are mutually exclusive and exhaustive. During the process of coding for content categories, we ensured the internal validity by cross validating our codes and their reflection in the data through a discussion by team members who are experts in IBD. To contextualize themes, we looked at the total and the average number of replies for each theme.

Ethical Considerations

This article is an original contribution that has not been published previously. All authors meet the authorship criteria put forth by the International Committee of Medical Journal Editors and have approved the final draft before submission. As the paper reports a retrospective analysis of Twitter conversations, ethical permissions were not required. Our team's IBD specialist was not included in the sample of IBD specialists in this study.

Table 2. Codebook of content themes and subthemes

Codes	Themes
Networking	Knowledge sharing
Insurance	Research
Non-biologic medications	• Diagnosis
Biologics	• Management
Research studies	• Preventative care
Preventative care	• Pregnancy
Non-IBD	Endorsement of practitioners
Epidemiology	Information seeking
Fistula	Insurance
Microbiome	Social support
Genetics	Awareness
Pathogenesis-related research	Other
Exercise	
Diet/nutrition	
Stricture	
Remission	
National conferences: ACG, DDW, CCC	
Surgery: ostomy	
Self-care, self-worth	
Pregnancy	
Complications of IBD	
Drug monitoring	
Diagnosis: calprotectin	
NAFLD	
Patient anecdote	
Social media	
Awareness	

Abbreviation: IBD, inflammatory bowel disease.

Results

Given the variability in our sample of IBD specialists, in terms of time since a given IBD specialist joined Twitter and the amount of interaction, we have further analyzed if time since a given IBD specialist joined Twitter correlated with the number of tweets, followers, and likes. Pearson correlation analysis revealed a statistically significant positive correlation between the time since a given IBD specialist joined Twitter and the number of followers ($r(16) = .796$, $P = .000$), while the amount of tweets and likes did not correlate with time since a given IBD specialist joined Twitter (operationalized as a number of months). However, there was a statistically significant positive correlation between the number of tweets and followers ($r(16) = .609$, $P = .012$) and between the number of tweets and likes ($r(16) = .825$, $P = .000$). Descriptive statistics of the IBD specialist sample can be found in Table 3.

RQ1: Engagement: Replies, Likes, and Retweets

RQ1 focused on the types of stakeholders that interacted with the IBD specialists on Twitter in the form of likes, replies, and shares. Figure 1 shows that 314 IBD specialist tweets garnered 267 replies out of which the largest group were IBD specialists, followed by advocates, non-advocate patients, organizations, and the unknown category.

By looking at types of engagements, unsurprisingly, "liking," was the most prominent way of engagement with IBD specialists in all groups of stakeholders, compared to replies and retweets. From 3242 analyzed likes, there were 2184 likes by physicians or other non-physician HCPs, 691 by patients or advocates, 224 by organizations, and 143 by unknown users (Figure 2). Physicians or other non-physician HCPs were more likely to like a tweet written by a physician and this difference was again statistically significant ($F(1, 15) = 3.5$, $P = .001$).

Table 3. IBD physician Twitter metrics (sorted by the number of tweets in a descending order)

$N = 16$	Months since joining Twitter	Number of tweets	Number of followers	Number of likes
1	31	16 200	4533	33 400
2	91	13 900	5744	10 000
3	90	5817	4409	771
4	121	4225	8923	4933
5	50	3320	3300	12 200
6	14	3211	1700	8118
7	82	2974	4703	2535
8	73	2770	2004	3817
9	17	1668	2191	1437
10	49	1659	1314	4602
11	49	944	885	1309
12	37	247	895	524
13	25	235	421	277
14	14	233	464	246
15	44	182	364	149
16	13	36	840	9

Abbreviation: IBD, inflammatory bowel disease.

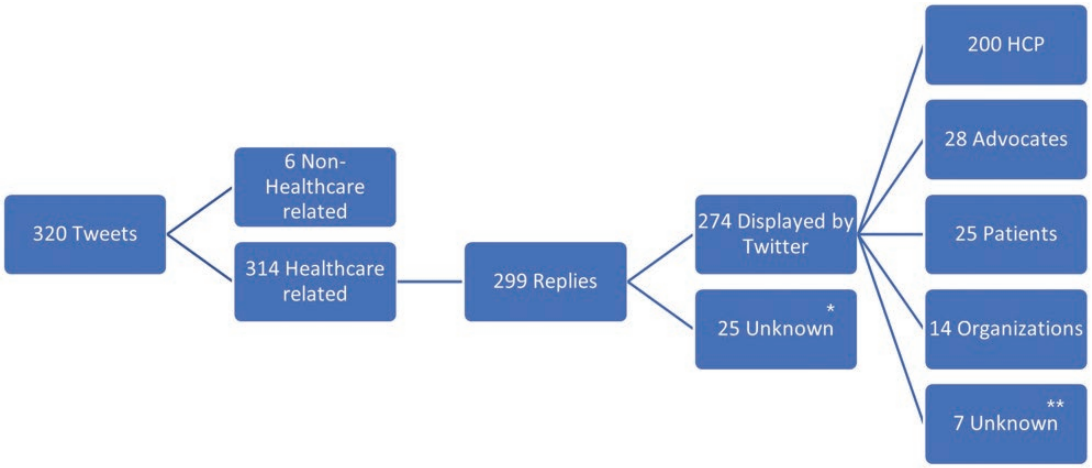

Figure 1. Sample and stakeholder description. The sample of 320 original IBD tweets was sampled, along with 299 replies. Six types of stakeholders were involved. * depicts unknown users who did not set to be displayed publicly or they are hidden due to the sociotechnical constraints of Twitter. ** depicts unknown users who could not be identified. Abbreviation: IBD, inflammatory bowel disease.

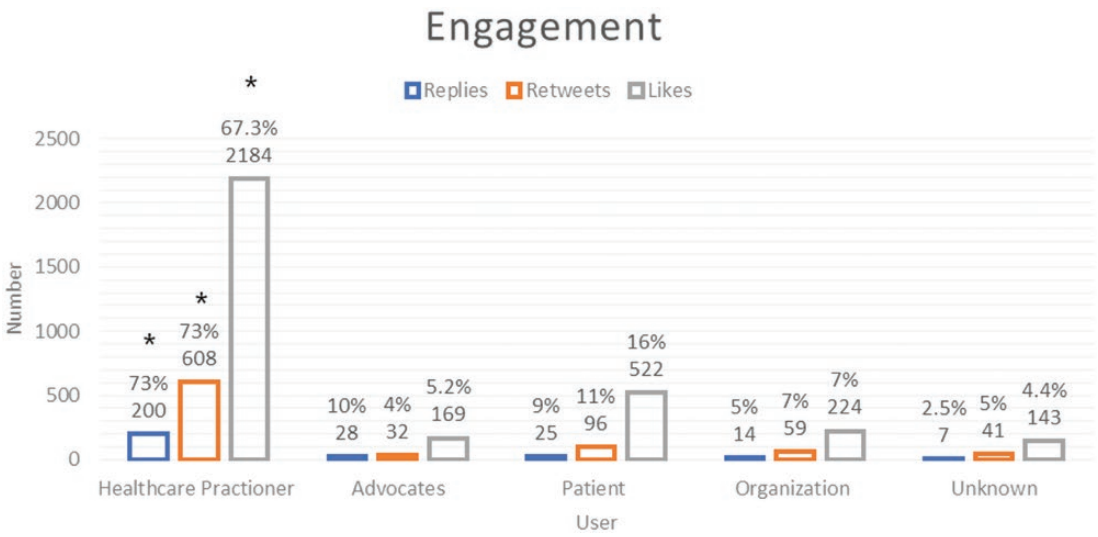

Figure 2. Twitter engagement measured by number of replies, retweets, and likes. Figure depicts that healthcare practitioners were more likely to like, retweet, and reply to a tweet written by a physician. * signifies significance.

Out of our 267 reply sample, there were 200 (75%) replies by physicians or non-physician HCPs, 28 (10%) by advocates, 25 (9%) by patients, 14 (5%) by organizations, and 7 (2.5%) by unknown. Physicians or other non-physician HCPs were more likely to reply to a tweet written by the IBD specialist, compared to stakeholders in other categories and this difference was noted to be statistically significant ($F(1, 15) = 8.7$, $P = .03$).

The organizations that replied to IBD specialist tweets included Propel a Cure (non-profit), American College of Gastroenterology (non-hospital organization), Unite for Anti-MAP Antibiotic Therapy (non-hospital organization), Aetna (insurance company), Nova Scotia Collaborative IBD (non-hospital organization), Houston Methodist (hospital), American Gastroenterological Association (non-hospital organization), and Washington University in St. Louis IBD Center of Excellence (hospital).

From the coded 836 retweets, there were 608 retweets by physicians or non-physician HCPs, 128 by patients or advocates, 59 by organizations, and 41 by unknown users (Figure 2). Physicians and other non-physician HCPs were more likely to retweet a tweet written by a physician and, this difference too, was statistically significant ($F(1, 15) = 6.1$, $P = .001$).

RQ2 and RQ3: Content Analysis

To address RQ2 regarding the content of IBD specialist messages, 7 main themes emerged from content analysis in answering our second RQ regarding the nature of the IBD specialists' tweets. Of 314 tweets discussing various aspects of IBD (Figure 3), 7 main themes emerged: (1) knowledge sharing, (2) endorsement of practitioners, (3) information seeking from peers, (4) insurance, (5) social support for patients, (6) awareness, and (7) other. "Other" category refers to the 6 tweets that did not fit in the current categories (Figure 3A). We further looked at knowledge sharing and identified 6 subthemes visualized in Figure 3: (1) research, (2) diagnosis, (3) management, (4) surgery, (5) preventative care, and (6) pregnancy (Figure 3B). Analysis of main themes revealed that Twitter was used by IBD specialists mostly

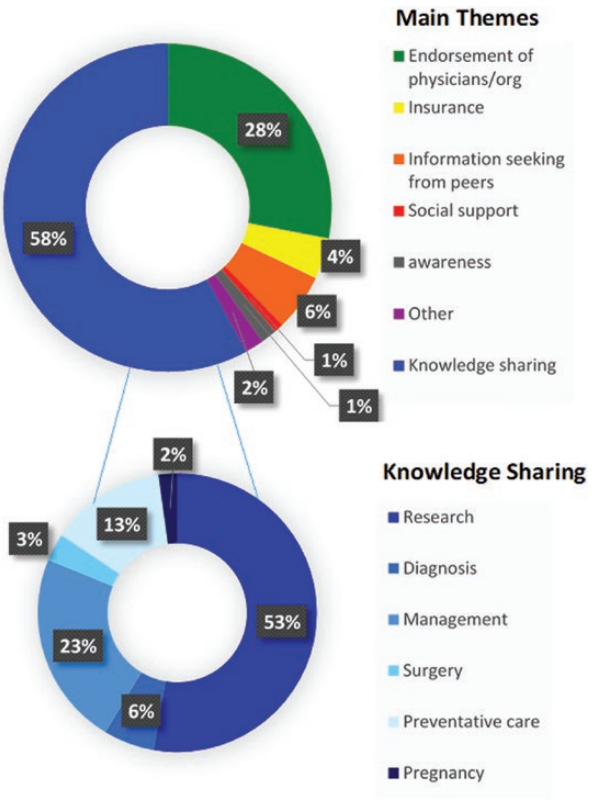

Figure 3. (A) Analysis of original IBD specialist tweets classified as main themes shared through qualitative coding on tweets. (B) Analysis of original IBD specialist tweets classified as subthemes of knowledge sharing shared through qualitative coding on tweets. Abbreviation: IBD, inflammatory bowel disease.

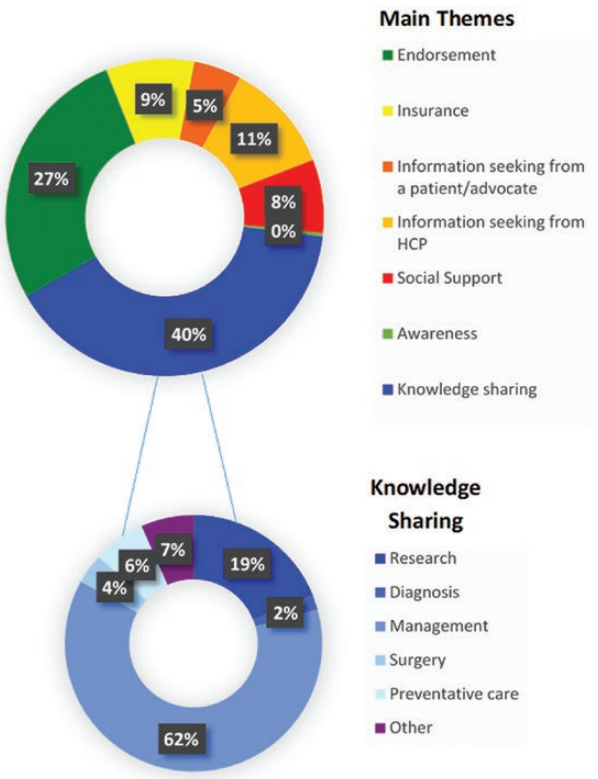

Figure 4. (A) Analysis of replies to the original IBD specialist tweets classified as main themes shared through qualitative coding on tweets. (B) Analysis of replies to originator tweets classified as subthemes of knowledge sharing shared through qualitative coding on tweets. Abbreviation: IBD, inflammatory bowel disease.

for knowledge sharing and for endorsement. When analyzing the subthemes of knowledge sharing, there was a significant emphasis on content that was research focused.

Information-seeking tweets and insurance tweets received the most replies followed by knowledge sharing, endorsement, and social support, respectively. When assessing the themes for the individual top liked tweets for each individual IBD specialist, they ranged from 16 likes to 156 likes for a given most liked tweet. Focusing on the most liked tweet with 156 likes in the entire dataset, it was found to cover issues of insurance and received 14 replies. Separately, when we assessed the top 20 of the most "replied" IBD specialist tweets (ranging from 3 to 14 replies), the most prominent topics were regarding knowledge sharing, and knowledge sharing of management, information seeking from peers, endorsement of peers, and information sharing. Notably, 8 out of these top 20 most replied-to-tweets shared a common feature by asking a question and one of them also solicited a poll.

To address the nature of the replies to the IBD specialist tweets (RQ3), 7 main themes emerged from our analysis of the 267 replies (Figure 4): (1) endorsement of physicians/organizations, (2) insurance, (3) information seeking, (4) social support, (5) awareness, (6) knowledge sharing, and (7) other. There were 7 tweets that did not fit into any category classified as "other." There are 7 subdomains of knowledge sharing: (1) research, (2) diagnosis, (3) management, (4) surgery, (5) preventative care, (6) other, and (7) unknown. There were no tweets that met more than 1 domain or subdomain.

As seen from Figure 1, of the 267 replies, 53 replies came from patients and advocates compared to the 200 replies from HCPs. These 53 replies had equally dispersed themes aside from knowledge sharing: endorsement of physicians (14, 26%), insurance (14, 26%), information seeking from providers (13, 25%), some with anecdotal response with personal stories and social support (10, 19%) and knowledge sharing (2, 4%). Twenty-five tweets fell into the "unknown" category. Of the remainder of the replies, 200 came from HCPs and 14 from organizations.

Discussion

To our knowledge, this is the first study that specifically analyzes the nature of Twitter-based content and communication structure of Twitter tweets made by IBD niche focused physicians. The online interaction in this community appears to be largely driven by HCPs (73%) with a focus on knowledge sharing and emphasis on disseminating IBD research and related management.

Perhaps not surprisingly, most IBD physicians mainly tweet medically related content (98% of originator tweets). This has been substantiated in the literature with 1 study noting 52% of tweets by all health-related Twitter users and 61% of tweets when focusing on physicians were related to medicine.[16,17] This amplifies the potential of Twitter to promote greater knowledge sharing by IBD specialists in online IBD communities beyond the bounds of a clinic room. In our study, a much larger percentage of medical tweets was ob-

served among our physicians. Admittedly, our sampling included a selection of a group of IBD specialists who were rather active on social media.[18] However, it is also possible that our fixed snapshot of time may have contributed to a smaller total tweet sample.

From the perspective of assessing communication structure, the online interaction appeared to occur among HCPs (73%) rather than between HCPs and patients/advocates (19%). For physicians whose motivation for joining Twitter may include sharing scientific information, crowdsourcing new ideas, discussing emerging research, pursuing professional development, expanding professional network, or providing moral support to colleagues, this study highlights an appropriate communication structure[19] in line with recent research focusing on emergency medicine physicians and their followers.[20] For other healthcare providers, whose motivation is disseminating information for education of patients, our study suggests that for Twitter this is not optimized. It is also worth mentioning that in order to find relevant information, patients may have to actively seek out an individual physician's Twitter account in order to follow them. Future studies should analyze the level of reach by patients toward their IBD specialists via social media platforms.

We found that knowledge sharing, specifically about research, is the most common theme for tweets and replies by HCPs. This finding is in line with the research showing that users mainly utilized Twitter to obtain real-time information, expand professional network, and communicate results of publications to their peers.[21] While the evidence is mixed, studies have demonstrated a positive correlation between tweeted article and future citations with increased potential for being cited.[22,23] Our findings suggest that physicians may perceive their "target audience" on Twitter to be other physicians, rather than patients and information dissemination as the most imminent goal.

Endorsement by one HCP of another HCP was another popular theme of tweets and replies. Endorsement offers a supportive environment and confers positive reinforcement to colleagues' contributions in IBD (eg, lectures, presentations, promotions, and publications), but also serves as networking tool.[17] In an era of increasing physician fatigue (eg, physician burnout, moral injury), this sense of endorsement and validation may be of both professional and personal significance to the individual HCP. When observing patients and advocate replies to tweets made by HCPs, we note that social support was a smaller reason for engagement. This may be explained by patients not using Twitter to turn to a medical professional to seek or offer social support. Instead, patients may be more likely to seek social support by joining a community of their peers on Twitter, Facebook, or other social media platforms.[9,10,16] In this context, Lee et al highlight in their qualitative content analysis of HCPs that healthcare advocates tweeted more about personal health issues and social support significantly more than providers.[16]

The nature of the content demonstrated that Twitter was utilized by IBD physicians and their peers to promote endorsement, which reflects the inherently social nature of social media. Likewise, the main theme of replies was specific to knowledge sharing with particular focus on the management of IBD. While HCP–HCP interaction was the most prominent, there were, however, many other stakeholders involved in the replies to the original IBD specialist tweet. Organizations were observed to closely follow discussion and may occasionally actively engage in the social media space as well. These organizations' range from patient advocacy groups to "revenue agencies" (eg, insurance companies). Importantly, the motivations of social listening by non-profit vs for-profit agencies are of great interest as well. Non-profit advocacy groups typically encourage education and dissemination of information from trusted sources such as academic HCPs. However, the appreciation of this education by for-profit insurance companies can be greatly questioned as these entities tend to contain costs by historically moderating access to costly diagnostic, monitoring, and treatment regimens.

Our patient cohort analysis further subdivided this group into patient advocates and non-advocate patients. Advocates appeared to play a unique role by serving as "brokers" or "gatekeepers" of information. Advocates demonstrated a higher level of engagement in the form of replies and retweets compared to non-advocate patients who may prefer to like or retweet without reply. Patient advocates were found to more likely to engage HCPs and had the potential to report back to patients. However, non-advocate patients may solely observe as "silent" participants. Non-advocate patients were not likely to comment but did demonstrate engagement in the form of likes and retweets. While there is limited data, this concept has been described in the Twitter stream regarding the breast cancer gene (BRCA), between 2013 and 2015, where individual advocates supplanted organizations in top broadcasting and gatekeeping roles.[24] In other words, not only did Twitter use enhance the emergence of the non-elites, it also allowed the transfer of power roles from non-elite collective actors (eg, organizations) to non-elite individual actors (eg, patient advocates).

Limitations and Future Considerations

This study was not without limitations. Our results are based on a specific timeframe that can be viewed as a snapshot of the interaction. Future studies should examine if the physician interaction through Twitter patterns found in this study hold for a longer period of time or if interactions are sustained and how norms of interaction evolve over time.

This study aimed to understand online Twitter-based interactions in the healthcare setting departing from a physician perspective. To understand the communication ecosystem as a whole, future studies should assess tweets from other stakeholder perspectives (eg, IBD advocates) or by using a network analysis which can also better characterize the engagement and content nature of the interaction between advocates, non-advocate patients, and HCPs. Our study suggested overall limited patient interaction with IBD specialists. However, this may be better enhanced by exploiting Twitter's sociotechnical affordances such as patient-centered disease state campaign hashtags in physician tweets by which patients could find more relevant and digestible content.

Our study analyzing IBD specialist interaction online supplements countless examples documented in the literature that support utilizing social media platforms for augmenting medical education to stimulate topic discussion and promote critical thinking.[25] Currently, there are multiple initiatives that utilize social media, especially Twitter, to disseminate reliable medical information that are primarily targeted at HCPs. Twitter is purported to be a novel vehicle for physician education for the purposes of continued medical education

(CME). The advent of #MondayNightIBD as a means to earn CME is a prominent example in the IBD medical education realm. Multiple Twitter journal clubs are established in many internal medicine subspecialties and other fields (Cardiology: @ACCJournalClub, IBD: @ibdclub, Infectious Disease: @IDJcluband, Nephrology: @NephJC, Dermatology: @DermatologyJC).[26] Lastly, the use of Twitter at conferences has gained significant momentum to discuss and enhance a speaker's presentation in real-time through the comments of the audience and for future reference by attendees to recall salient clinical pearls.[27] Indeed, the coronavirus pandemic has catalyzed the transition from in-person conference learning to virtual didactic formats on a number of platforms that capitalize upon social media's dissemination of educational knowledge.

Clinicians are often called upon to provide real-time updates on time-sensitive issues, especially during times of crisis such as pandemics. While much of the literature addressing dissemination of information on Twitter highlights the rapid spread of misinformation by non-medical users, there is a potential call for Twitter to create a public list of verifiable physicians who often serve as a reference point for other HCPs and the lay public.[28,29]

Finally, results of the correlation analysis performed on the IBD specialist activity in this study offer some guidelines for IBD specialists aspiring to share their expertise and foster online healthcare community. Our data illustrate that the longer an IBD specialist was on Twitter was associated with larger number of followers but not necessarily with the generation of more original tweets. However, IBD specialists who tweeted more had more followers. Therefore, proactive public engagement can be achieved with active tweeting.

Conclusions

In summary, there is a growing network of IBD physician Twitter users who utilize the platform to educate and disseminate information with their peers. Our research shows that there is a number of stakeholders who are involved in online interaction which presents an opportunity for public outreach and engagement to harness its communicative potentials ranging from peer-based information sharing to public patient education and engagement.

Funding

None declared.

Conflicts of Interest

None declared.

Data Availability

The data that we have used for this study are publicly available on Twitter. However, sharing the specific IBD specialist sample may reveal their unique identities. Therefore, with ethical considerations and in congruence with social science protocol, we have anonymized their data and will maintain the dataset so that we can share with other scientists on demand and for our own purposes of future research.

References

1. Mehta F. Report: economic implications of inflammatory bowel disease and its management. *Am J Manag Care*. 2016;22(3):s51–s60.
2. Rubin DT, Dubinsky MC, Martino S, Hewett KA, Panés J. Communication between physicians and patients with ulcerative colitis: reflections and insights from a qualitative study of in-office patient-physician visits. *Inflamm Bowel Dis*. 2017;23(4):494–501.
3. Gottschalk A, Flocke SA. Time spent in face-to-face patient care and work outside the examination room. *Ann Fam Med*. 2005;3(6):488–493.
4. Hing E, Middleton K. National Hospital Ambulatory Medical Care Survey: 2001 outpatient department summary. *Adv Data*. 2003;(338):1–26.
5. Devoe JE, Baez A, Angier H, Krois L, Edlund C, Carney PA. Insurance + access not equal to health care: typology of barriers to health care access for low-income families. *Ann Fam Med*. 2007;5(6):511–518.
6. Frohlich DO. Inflammatory bowel disease patient leaders' responsibility for disseminating health information online. *Gastroenterol Nurs*. 2019;42(1):29–40.
7. Massey PM, Budenz A, Leader A, Fisher K, Klassen AC, Yom-Tov E. What drives health professionals to tweet about #HPVvaccine? Identifying strategies for effective communication. *Prev Chronic Dis*. 2018;15(2):E26.
8. Meskó B. *Social Media in Clinical Practice*. 1st ed. Springer; 2013:155.
9. Reich J, Guo L, Groshek J, et al. Social media use and preferences in patients with inflammatory bowel disease. *Inflamm Bowel Dis*. 2019;25(3):587–591.
10. Reich J, Guo L, Hall J, et al. A survey of social media use and preferences in patients with inflammatory bowel disease. *Inflamm Bowel Dis*. 2016;22(11):2678–2687.
11. Pershad Y, Hangge PT, Albadawi H, Oklu R. Social medicine: Twitter in healthcare. *J Clin Med*. 2018;7(6):121.
12. Facanali MR Jr, Facanali CBG, Queiroz NSF, et al. # Crohns: historical cohort of Twitter activity. *Crohns Colitis 360*. 2020;3(1):1–6.
13. Ciprut S, Curnyn C, Davuluri M, Sternberg K, Loeb S. Twitter activity associated with U.S. News and World Report reputation scores for urology departments. *Urology*. 2017;108(6):11–16.
14. Archive of US News & World Report Best Hospitals 2019. Accessed February 1, 2020. https://www.webmd.com/health-insurance/news/20190730/us-news-releases-2019-2020-top-hospitals-list, WebMD.com
15. Glaser BG, Strauss AL. *Discovery of Grounded Theory: Strategies for Qualitative Research*. Routledge; 2017.
16. Lee JL, DeCamp M, Dredze M, Chisolm MS, Berger ZD. What are health-related users tweeting? A qualitative content analysis of health-related users and their messages on Twitter. *J Med Internet Res*. 2014;16(10):e237.
17. Ventola CL. Social media and health care professionals: benefits, risks, and best practices. *P T*. 2014;39(7):491–520.
18. Sheu SJ, Wei IL, Chen CH, Yu S, Tang FI. Using snowball sampling method with nurses to understand medication administration errors. *J Clin Nurs*. 2009;18(4):559–569.
19. Choo EK, Ranney ML, Chan TM, et al. Twitter as a tool for communication and knowledge exchange in academic medicine: a guide for skeptics and novices. *Med Teach*. 2015;37(5):411–416.
20. Riddell J, Brown A, Kovic I, Jauregui J. Who are the most influential emergency physicians on Twitter? *West J Emerg Med*. 2017;18(2):281–287.
21. Mohammadi E, Thelwall M, Kwasny M, Holmes KL. Academic information on Twitter: a user survey. *PLoS One*. 2018;13(5):e0197265.
22. Peoples BK, Midway SR, Sackett D, Lynch A, Cooney PB. Twitter predicts citation rates of ecological research. *PLoS One*. 2016;11(11):e0166570.
23. Haustein S, Peters I, Sugimoto C, Thelwall M, Larivière V. Tweeting biomedicine: an analysis of tweets and citations in the biomedical literature. *J Assoc Inf Sci Technol*. 2013;65(4):556–559.

24. Vicari S. Twitter and non-elites: interpreting power dynamics in the life story of the (#)BRCA Twitter Stream. *Soc Media Soc*. 2017;3(3):2056305117733224.
25. George DR, Dellasega C. Use of social media in graduate-level medical humanities education: two pilot studies from Penn State College of Medicine. *Med Teach*. 2011;33(8):e429–e434.
26. Topf JM, Sparks MA, Phelan PJ, et al. The evolution of the journal club: from Osler to Twitter. *Am J Kidney Dis*. 2017;69(6):827–836.
27. McKendrick DR, Cumming GP, Lee AJ. Increased use of Twitter at a medical conference: a report and a review of the educational opportunities. *J Med Internet Res*. 2012;14(6):e176.
28. Oyeyemi SO, Gabarron E, Wynn R. Ebola, Twitter, and misinformation: a dangerous combination? *BMJ*. 2014;349(10):g6178.
29. Broniatowski DA, Paul MJ, Dredze M. National and local influenza surveillance through Twitter: an analysis of the 2012–2013 influenza epidemic. *PLoS One*. 2013;8(12):e83672.