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Title: International Gynaecological Cancer Society (IGCS) 2020 Annual Global meeting Twitter activity analysis: A beginning

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Collaborator: IGCS

Declarations

Ethics approval and consent to participate

This study is an analysis of Twitter conversations, available in public domain, and not performed under any specific institute/organization, thus no formal ethical approval was sought. Permission from top ten users (Twitter accounts mentioned in manuscript) was obtained, for using their Twitter handles

Consent for publication

Not applicable

Availability of data and materials

Data will be provided, if requested

Competing interests

GB, HH, NN, SJ, FN, WA declare no competing interests
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Abstract

Introduction

Scientific conference organizers encourage attendees to disseminate information and communicate through social media. Twitter is the most frequently used social media platform by healthcare practitioners, at medical conferences. Official hashtags are announced before scientific conferences take place, and participants are asked to use these hashtags in their tweets. If users begin to use a hashtag, it makes it visible to their followers, and therefore it helps to increase visibility for the conference. Analysis of Twitter conversations during a gynecology oncology conference has not yet been attempted. This study aimed to analyze Twitter conversations during the virtual International Gynecological Cancer Society 2020 conference, to understand the interactions between Twitter users related to the conference.

Methods

Tweets using the hashtag "#IGCS2020" were searched using the Twitter Search Application Programming Interface (API) during the period 10th to 13th Sept 2020. We used NodeXL Pro to retrieve data. The Clauset-Newman-Moore cluster algorithm was used to cluster users into different groups or 'clusters' based on how users interacted.

Results

The total number of users within the network was 168, and there were 880 edges connecting users. Five types of edges were identified, these were as follows: ‘replies

to' (n=18), 'mentions' (n=221), 'mentions in retweets' (n=375), retweets (n=198), and tweets (n=68). The most influential account was that of the IGCS account itself (@IGCSociety). The overall network shape resembled a community where distinct groups formed within the network.

Conclusion

Twitter users during IGCS 2020 were clustered within several groups, and the overall network represented a community.

Keywords

Social media, Conference, Education, Information Dissemination, Twitter, Gynecological cancer

Highlights

1. Twitter engagement during scientific conferences can potentially be enhanced by regular analysis.
2. Twitter users during IGCS 2020 were clustered within several groups, and the overall network represented a community.
3. This study could provide a framework for increased social media engagement during future IGCS meetings.

Introduction

With the advent of social media, medical communication during conferences has evolved. Twitter, a social media platform, has now become a major form of interaction. Wikipedia defines Twitter as an “American microblogging and social networking service on which users post and interact with messages known as ‘tweets.” Twitter, Inc. is based in San Francisco, California, United States, and was established in 2006. [1] In January 2021,https://www.statista.com/ ranked Twitter as the sixteenth most used social network with 353 million monthly visitors. [2] A 2016 research poll found that Twitter is used by 22% of all online American adults. [3] The countries with most Twitter users are in the United States, Japan and India, with 69.3 million, 50.9 million, and 17.5 million users respectively reported in January 2021, [4] Since its inception, Twitter has grown and is increasingly adopted as a communication and learning tool in educational and research activities in the oncology field. [5] Hashtag (#), a form of metadata, can share content, organize health information, and create virtual communities. Metadata in the Twitter context serves to help users identify a topic/conversation. By adding the hashtag (#) symbol to words or strings of characters, social media users can create information channels to bring focused information, narrowcasting around a specific issue, or create new communities with a common interest. [6, 7] Several other standard Twitter terms are described in Table 1.

The International Gynecological Cancer Society (IGCS) was established in 1987 with its mission to enhance the care of women with gynecologic cancer worldwide

through education and training and public awareness. [8] Members include gynecologic oncologists, radiation oncologists, medical oncologists, and pathologists. In 2020 the society had 2930 members, representing 113 countries. [8] In 2020, the 19th annual IGCS meeting was completely virtual due to the COVID-19 pandemic, limiting international travel and in-person gatherings. While some studies have looked at Twitter engagement during scientific conferences [9-12], gynecologic oncology conference tweeting is yet to be analyzed. With a completely virtual conference, we anticipated increased levels of social media use. In this study, we aimed to describe the content shared on Twitter and analyse Twitter conversations during the first virtual IGCS 2020 annual meeting, held in September 2020.

Methods

We specifically evaluated: Who was the most influential Twitter user during the virtual IGCS 2020 conference? What were the most frequently occurring ‘co-words’ and topics that were being discussed? And what was the shape of the network?

Data Retrieval

Tweets using the hashtag "#IGCS2020" were searched and collected prospectively by WA, using Twitter Search Application Programming Interface (API) [13] during the period 10th to 13th Sept 2020 (virtual IGCS meet period). No tweets were excluded since the data collection period was focussed to four days of the conference only. The Search API is a means to connect to Twitter to retrieve data. Different APIs provide different access levels, and academic researchers most commonly use the Search API. We used NodeXL Pro [14] to retrieve data. #IGCS2020 was promoted prior to and during the conference by conference organisers themselves (@IGCSociety and @MaryCEiken).

Data Analysis

Social network analysis (performed in NodeXL) was used to analyze the data drawing on algorithms and layout options built-in NodeXL. The Clauset-Newman-Moore cluster algorithm was used to cluster users into different groups or 'clusters' based on how users were interacting within the group. The graph was laid out using the Harel-Koren Fast Multiscale layout algorithm. Each small dot on the network chart represents a connection to another user. The six types of the Twitter network were used to interpret the network graph. *Polarized Crowd:* Polarized discussions feature two large and dense groups that have little connection between them. *Tight Crowd*: These discussions are characterized by highly interconnected people with few isolated participants. *Brand Clusters* These are formed by accounts that discuss a well-known service, product, or person. Brand-mentioning participants focus on a topic but tend not to connect. *Community Clusters*: Some popular topics may develop multiple smaller groups, which often form around a few hubs, each with its audience, influencers, and sources of information. *Broadcast Network*: Twitter commentary around breaking news stories and the output of well-known media outlets and pundits has a distinctive hub and spoke structure. Many people repeat what prominent news and media organizations tweet. *Support Network*: Customer complaints about a significant business are often handled by a Twitter service account that attempts to resolve and manage customer issues around their products and services. This produced a hub and spoke structure that is different from the Broadcast Network pattern. In the Support Network structure, the hub account replies to many otherwise disconnected users, creating outward spokes. [15]

'Influence' in Twitter term may be described in several forms. "Indegree" "retweets" or "mentions". Indegree is the number of people who follow a user;

retweets mean the number of times others “forward” a user’s tweet; and mentions mean the number of times others mention a user’s name. [16] Influential users were detected by using the 'betweenness centrality' algorithm. This algorithm is one of the advanced network metrics to find those Twitter users who are on the most paths between others in the network. 'Co-words,' also known as 'word-pairs,' are essentially two words used together in tweets most frequently. The co-word analysis was conducted in NodeXL which analysed the Twitter data to identify words that occur most frequently together. They provide insight into the conversations that are taking place. The shape of the network is determined by how users in the network conversed with each other. Research has noted that Twitter topics can fall into 6-types of shapes, as mentioned earlier. [15].

Results

There were a total of 2009 registrants for the virtual IGCS 2020 conference. Eighty users referred to the meeting website from Twitter, during conference duration i.e. from 10th to 13th Sept 2020. The total number of users within the network was 168, and there were 880 edges connecting users. There were five types of edges. These were as followed: 18 replies to, 221 mentions, 375 mentions in retweets, 198 retweets, and 68 tweets. The overall network shape (Fig 1) resembled a community where distinct groups formed within the network. We define the phenotype of this network as a community network shape with elements of broadcast. The figure is created by taking all users tweeting during the conference and analyzing the relationships between different users. The groups are formed based on retweets, replies, and quotes. The groups are ordered by size, and the largest group is on the top left and side (labeled G1) and the second-largest group underneath it (labeled G2). The circles represent individual users. Lines between users indicate

relationships, and the graph is directed with arrows indicating the direction of the relationship. The brighter lines represent stronger connections between users, and the lighter lines represent weaker ties among users. The algorithm groups users based on their connections i.e., mentions and replies are used to form the grouping. This is so that users who interact more frequently are clustered together. The boxed groupings are simply showing those users accounts that engaged with each frequently enough to be clustered together in a group.

The network graph also highlights that users across the network were connecting. The graph highlights that attendees can form groups on Twitter just as they may do so in real life; for instance, different conference attendees may develop over a lunch break. In the case of IGCS 2020's network, it can be seen that two groups of Twitter users had connected the most, followed by a slightly smaller cluster and some other smaller groups.

Overview of Influential Users

Table 2 demonstrates the ten most influential Twitter accounts within the network. The most influential account was that of IGCS itself. There were five influential individual users, one gynecologic oncology journal, one hospital, one journal’s fellow's group account, and another gynecologic oncologic society's account. This study made use of betweenness centrality as it identifies users that are most influential in terms of information propagation. However, there are also other ways of measuring centrality such as InDegree and OutDegree. Moreover, some social media studies may examine influence by looking specific at the most mentioned users and/or the most followed users in a network.

Overview of word-pairs and topics

Table 3 depicts the most frequently occurring co-words within the network, i.e., two words that were most used with each other. The most common co-words were "ovarian cancer." It is possible that "ovarian cancer" emerged as the top 'co-word' as both medical as well surgical management of ovarian cancer continues to be intensely researched. Words that contain a preceding '#' relate to hashtags. This is because our analysis also detected the occurrence of hashtags.

Discussion

Summary of main results

In this analysis of the IGCS 2020 annual meeting, we found that Twitter users were clustered within several groups. Because these groups highlight different users conversing amongst each other, we can conclude that the overall network represented a community. Our results highlight that the most influential account belonged to the society itself. Our overview of the most popular keywords such as 'ovarian' and 'cancer' provided insight into the types of discussions that were taking place. However, cervical cancer incidence is highest among the world in terms of gynecological cancer, rating 18.8 per 100,000 in transitioning countries. [17] This is several times higher than that of ovarian cancer

Our focus and research aim were to specifically examine content around the IGCS2020 hashtag, which was officially promoted. We also wanted the ability to complete follow up studies, for instance, in 2021 and 2022. By focusing on the main hashtag, comparisons in the future can be more easily made. Moreover, although other hashtags such as '#gyncsm' may have been used by some of the meeting participants, this is a broader hashtag that could include content from non-meeting members.

Our study made use of simple word-pair analysis as the focus of the paper was to conduct a social network analysis. Typically, word associates past four may not be possible such that could link words that would appear later in the sentence.

Results in the Context of Published Literature

Twitter and similar social media platform users are encouraged, usually by conference organizers, to actively tweet before, during, and after the conference. Each conference has an official conference hashtag, such as #IGCS2020 for this study. It has been found that conference tweeting can extend beyond official hashtags. In this study, we found that #ovariancancer featured as another leading hashtag in #IGCS2020 conversations. A similar study was conducted recently during the American Society of Clinical Oncology 2020 virtual conference, where they studied twitter engagement after introducing a new hashtag. This study had suggested that gynecological oncology tweeting needs coordination and agreement on a common hashtag to organize content at virtual events and between meetings. [18] European Society for Medical Oncology 2018 Congress Twitter analysis had found a difference between ‘commercial’ and ‘non-commercial’ tweeters. [9] Such an analysis was out of scope of our study. Another study by Mackenzie et al. found that conference tweeting during European Society of Surgical Oncology 39th clinical conference extended beyond the conference hashtag. [10] We have planned to conduct a similar analysis during the IGCS meeting in 2021.

Strengths and Weaknesses

This is the first study of its kind performing Twitter engagement analysis related to an international gynecological oncology conference. We employed a methodological design previously used in other studies for the analysis of interaction

in social networks, specifically Twitter, which is a platform with wide dissemination in healthcare practitioners.

Our study is limited by the fact that the only social media platform analyzed was Twitter. Other social media platforms like Facebook, Instagram, etc., also contribute to conference conversations and represent a different population of social media users. Potential Conflicts of Interests of the participants in the network were not checked, since it was not the objective of the study and is beyond its scope. But this aspect could have influenced the most used words, for example, if there were more researchers working on ovarian cancer in the network. The search for tweets was restricted to the days of the conference, so we may have missed possible interactions beyond the event, which also reflects the dissemination of the conference. There is no way to log data from participants who only read the content but do not tweet or re-tweet. Chaudhry et al. (19), reported that the “real value of tweets at conferences often consists in reading the information, not in disseminating it”. Some twitter users may forget to add # to their tweets, and such tweets will be missed, similarly others may not use correct official hashtag and would be left out of the captured data. Users may create new hashtags, and there could be parallel conversations/discussions generated, apart from conference-related conversations. Efforts should be made to include more social media platforms in future related work. It is essential to consider that IGCS 2020 was a virtual meeting due to the COVID 19 pandemic; therefore, it is possible that more Twitter users engaged in conversations this year. In the absence of comparative data from the last meeting, this remains speculative.

Implications for Practice and Future Research

Our study provides baseline data for analysis of future International Gynecological Cancer Society annual meetings. The results of our research would allow future conference organizers to benchmark to other conferences and iterations of the same meeting. We have planned to analyze the upcoming IGCS 2021 conference [20], which will again be predominantly a virtual event. This would provide insight into trends in Twitter engagement during the meeting if any. Our research aim was to examine the meeting dates itself to see the amount of activity generated, content and discussions as a result of the meeting. Our reasoning was that conferences, academic events etc might not contain relevant information prior to or after the events. These tweets tend to be very general in nature 'Looking forward to attend event X' and 'It was great to attend event X'. Although, future research could seek to examine dates prior to and after the event.

Following strategies could be adopted to improve dissemination via Twitter in future meetings. Using multimedia, URL or hashtags, and mentioning other Twitter account (s), have been found to be independently associated with retweet success. [21, 22] The location of the participants within the network is unknown. The scope of the event is worldwide and not all countries have extensive use of Twitter. This information would be very useful to generate regional strategies for the dissemination of social networks in an upcoming event. This analysis was made at a 100% virtual oncology gynecology conference, which could have some positive effects on the use of Twitter. These results may potentially differ when compared to another congress that includes presential activity, an aspect that should be taken into account in the next measurement.

Conclusions

This study demonstrates Twitter engagement in the IGCS 2020 virtual conference. The results of this study could be used during future IGCS meetings to benchmark. Our current analyses demonstrated that less than 10% of the total members interacted on Twitter. Future research could seek to compare this to future meetings and conferences.

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430

431 Figure 1: Social Network Analysis Results

432 Table 1: Description of ‘Twitter’ terms

Term	Definition
Tweet	A tweet is a message that is posted on an individual user's account.
Hashtag	A hashtag, i.e., '#"#IGCS2020', can be added to tweets such that anyone following that hashtag can see tweets containing it. Hashtags are often used in conferences so all attendees can see each other's tweets.
Retweet	Users can also 'retweet' other users, which is sharing other user's tweets to an individual's own Twitter feed.
Reply	On Twitter, as well as sending individual tweets, users can also reply to other users. A reply will start with '@' followed by the username.
Quote	Tweets can also be quoted, which allows other users to add their views and opinions to them.
Network	The network is the collection of all users and their interactions with one another.
Edges	Edges are the connections between different users

Network shape	The structure of the network after social network analysis is applied. The six types of the network are documented in Smith, Rainie, Shneiderman, and Himelboim (2014). NodeXL will cluster users into different groups to identify patterns.
Influential user	Twitter users may become influential due to their location within the network. There are several methods of calculating influence.
Betweenness Centrality	Betweenness centrality is one way to calculate the influence of Twitter users. These users are often the bridge within the network.
Co-words	These are words that occur together most frequently. It provides insight into the discussion.

433

434 Table 2. Overview of most influential users ranked by 'Betweenness Centrality'

Rank	User (Twitter handle)	Betweenness Centrality
1	IGCS (@Igcsociety)	14364
2	Shannon Westin (@ShannonWestin)	5554
3	Mary Eiken (@MaryCEiken)	2066
4	Rebecca Previs (@BeccaPrevisMD)	2055
5	Kavitha Madhuri (@KavithaMadhuri)	1590
6	IJGC (@IJGConline)	1270
7	MD Anderson Cancer Center (@MDAndersonNews)	1256
8	IJGC Fellows (@IJGCfellows)	1165
9	The GOG Foundation Inc. (@GOG)	1076
10	Natacha Phoolcharoen (@NPhoolcharoen)	976

435

436 Table 3. Overview of the 20 most frequently occurring co-words

Word 1	Word 2	Count
ovarian	cancer	39
global	meeting	32
annual	global	28
xdigital	annual	23
#ovariancancer	#igcs2020	21
utc	#igcs2020	20
cancer	surgery	19
#igcs2020	#gyncsm	19
gynecologic	cancer	18
2020	xdigital	17
#gocc	#powerfultogether	17
#ovariancancer	patients	17
igcsociety	#igcs2020	16
xdigital	meeting	15
global	ovarian	15

cancer	charter	15
meeting	portal	14
igcsociety	2020	14
#igcs2020	igcsociety	14
ijgconline	ijgcfellows	13