

World Gynecologic Oncology Day: the use of Twitter to raise awareness of gynecologic cancers



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BACKGROUND: Social media provides an opportunity for people to connect and form communities. This community architecture can help to disseminate health-related information in the form of an awareness campaign. The European Society of Gynaecological Oncology and the European Network of Gynaecological Cancer Advocacy Groups initiated a global campaign, World Gynecologic Oncology Day, on September 20, 2020. We studied and analyzed the impact and reach of this Twitter campaign.

OBJECTIVE: This study aimed to assess the impact and reach of the 2020 World Gynecologic Oncology Day Twitter campaign.

STUDY DESIGN: We analyzed gynecologic oncology—specific posts (tweets) between 12 AM on September 17, 2020, to 11:59 PM on September 25, 2020 (Coordinated Universal Time), covering the days immediately before and after World Gynecological Oncology Day (September 20, 2020), using Tweepy. The European Network of Gynecological Cancer Advocacy Groups suggested hashtags (#GoForPurple, #WorldGODay, and #GoForCheckup) should be used for this social media campaign. We used these hashtags for our data (tweet) collection.

RESULTS: A total of 382 Twitter accounts participated in this campaign and 662 tweets, including retweets, were reported. Of those, 22% of participants were healthcare professionals. A total of 164 unique hashtags were identified, and #WorldGODay was the most frequently used among the Twitter accounts. #VaginalCancer, #CervicalCancer, and #VulvarCancer were used in relation to the campaign. We identified 5 significant communities that contributed to raising awareness.

CONCLUSION: Twitter campaigns should be designed around a single, short, easy-to-spell hashtag and coordinated with previously identified influential accounts using timed tweets. #WorldGODay hashtag was relevant, easy to spell, memorable, and the most effective hashtag used in this campaign.

Key words: academic tweeting, cancer awareness, gynecologic cancer, health promotion, ovarian cancer, patient and public involvement social media, Twitter

Introduction

The advent of social media has brought about a revolution. Not only do women with cancer now have the opportunity to network, create, and share content, but healthcare professionals and scientists do as well. Experiences and new insights are shared internationally, creating novel connections among patients, families, healthcare providers, advocates, and policymakers.¹ Patients and their families use social networking platforms, such as Twitter, Facebook,

and Instagram, to obtain and disseminate information regarding their healthcare issues.² These platforms provide an arena where patients can interact with oncology professionals, form communities, and gain knowledge about their health and support for their health or loved ones.³

Cancer-specific online communities, such as on Twitter, are flourishing. Users can follow specific interests with the use of hashtags. Twitter discussions or “tweet chats” enable conversations

between nonclinicians and experts in their field of oncology care. Support, knowledge, and guidance can be gained for those affected by cancer and those who support them.⁴ Structured healthcare hashtags have been shown to facilitate access to health information for patients, physicians, and institutions.⁵

Targeted social media interventions can boost patient engagement, crowdfunding for research, crowdsourcing for trial design, and clinical trial participation. Raising awareness about cancer is

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Why was this study conducted?

This study aimed to assess the impact and reach of the 2020 World Gynecologic Oncology Day Twitter campaign.

Key findings

Diverse Twitter users actively participated in the Twitter campaign on World Gynecologic Cancer Day and promoted cancer awareness.

What does this add to what is known?

A better coordinated social media campaign could potentially reach a larger target population if simpler and shorter hashtags are used and if influential users are engaged in the campaign.

crucial for reducing the burden of this disease. Dedicated Twitter awareness campaigns are one way to reach out to target populations. World Gynecologic Oncology Day is one such endeavor, celebrated on September 20 since 2019,⁶ with September also being Gynecologic Cancer Awareness Month.⁷ Numerous online and offline activities are conducted worldwide during this month to spread awareness about gynecologic cancers.

There is limited literature examining social media content related to gynecologic cancer care and the extent to which it provides valuable information. Analyzing Twitter data provides a significant opportunity to explore how patients and their healthcare providers interact in terms of their care and experience.

This study aimed to assess the impact and reach of the 2020 World Gynecologic Oncology Day Twitter campaign.

Materials and Methods**Data collection**

Retrospective analysis of gynecologic oncology-specific posts (tweets) between 12 AM on September 17, 2020, to 11:59 PM on September 25, 2020 (Coordinated Universal Time (UTC)) covering the days immediately before and after World Gynecologic Oncology Day (September 20, 2020).

The social media platform Twitter was used for data collection. Tweepy⁸ was used to access Twitter's application programming interface to collect tweets. This was achieved using a dedicated

python script application created for this purpose. The European Network of Gynecological Cancer Advocacy Groups (ENGAGE) suggested a list of hashtags (#GoForPurple, #WorldGODay, and #GoForCheckup) that should be used for the social media campaign. We used these hashtags for our data (tweet) collection. Tweets using one or more of these hashtags were collected between September 17 and 25, 2020. Extracted data included tweets and retweets without any restriction, except for the designated data collection window stipulated previously, and the associated metadata (Twitter account, followers, number of tweets, profile description) of each Twitter account.

Data processing and analysis

Hashtags from each tweet were extracted using the dedicated python script application. In the case of retweets, hashtags from the original tweet were extracted if the retweet occurred within the boundaries of the data collection time frame. Therefore, some original tweets originated outside the data collection window but were included because their retweets fell within the desired time frame. Duplicate hashtags inputted by Twitter accounts were excluded to leave unique hashtags in tweets. The dedicated python script application classified hashtags as connected if a tweet quoted another tweet (ie, retweeting with text).

Our team members screened and assessed all extracted tweets and Twitter accounts for relevance to the research

topic. We then reviewed public profiles and categorized each Twitter user account into 1 of the following groups:

1. Healthcare professionals—individuals involved directly in health (physicians, nurses, paramedical staff, etc.)
2. Patients or relatives—individuals with gynecologic cancers or their relatives
3. Patient advocacy groups—groups working toward propagation of knowledge about prevention and treatment of cancers
4. Healthcare—professional societies, hospitals, pharmaceutical companies, or agencies
5. Others—individuals not falling in any of the above categories, including media-related accounts.
6. Our team also reviewed the tweet content and categorized them in the following list:

1. Gynecologic Oncology/World Gynecologic Oncology Day-related hashtags
2. Ovarian cancer + BRCA
3. Corpus cancer + Lynch
4. Cervical cancer
5. Vulval cancer
6. Vaginal cancer
7. Other
8. Society/charity/government department
9. Human papilloma virus

Unrelated tweets and users who only tweeted irrelevant content were excluded from further analysis, and their counts are reported in the results.

We used the social network analysis (SNA) technique using Gephi version 0.9.2 software⁹ to observe the impact of tweets and Twitter accounts. The following metrics were calculated: degree, weighted degree, modularity class, and connected component. These are presented using Yifan Hu, ForceAtlas2, radial axis, and dual circle layouts to identify communities within the search results. Table 1 explains these technical terms related to SNA and Gephi.

In this study, SNA used hashtags or Twitter accounts to form a node with

connections, termed edges or links, created to represent a relationship or interaction between individual nodes. Connected hashtags and Twitter accounts form pairs known as dyads. A repeating dyad contributes to the weight of the edge (visually seen as a thicker line). As data are added, the network grows from 1 connection between 2 points (a dyad) to a more extensive network of interrelated nodes (tweets or accounts).²⁰

We conducted 3 SNAs, namely a hashtag network, tweeter-retweeter network, and hashtag-Twitter account network. First, we looked at the hashtags within the tweets and how they interact. Second, we analyzed tweeter to retweeter-directed dyads to explore the influence of the originating Twitter accounts and their followers. The final SNA technique focused on the relationship between hashtags and Twitter accounts. Microsoft Excel²¹ was used for descriptive analysis. We obtained the American University of Sovereign Nations School of Medicine Institutional Review Board ethical approval (IRB number IRB00009932) for this study.

Results

A total of 667 tweets were fetched from Twitter that were tweeted by 384 users. After assessing each tweet for relevance, we excluded 5 tweets and 2 users from our analysis because they were unrelated to gynecologic cancer. The final data set consisted of 662 tweets by 382 users. Of the tweets, 22% (n=144) were original tweets, whereas the rest were retweets (n=518).

The largest category of user accounts was the other category (57%). Accounts belonging to healthcare professionals represented 22% of those using the selected hashtags, followed by healthcare in general at 11%. Table 2 further summarizes users' profile information and their tweets. Within the data collection time, the highest tweet count with a peak of 401 tweets was recorded on September 20, 2020 (World Gynecologic Oncology Day). In contrast, the lowest activity was seen on September 24, 2020, with only 3 tweets using the selected hashtags. Details of the daily

TABLE 1

Glossary of social network analysis and social media terms

SNA: analysis of "a set of socially relevant nodes connected by one or more relations." "Graphic illustrations are used to reveal patterns" and "mathematical and computational models" to explain these patterns.¹⁰

Node: individual, Twitter account, hashtag, or things within the network linked by edges illustrating relationships or interactions. In this study, analysis was performed using both Twitter accounts and retweeter accounts and hashtags as nodes to explore relationships between them.

Edge: connection or link between nodes that defines an association between 2 nodes.

Dyad: 2 connected nodes

Degree: "number of edges connected to a particular node" illustrated graphically by a thicker line connecting nodes.¹¹

Weight: value given to each edge to show the strength of a connection between connected nodes.

Weighted degree: sum of the number and weight of each edge for each node.

Modularity: measure of the strength of connections between nodes. Networks with high modularity will have nodes clustered together. Low modularity will see the nodes spread apart. Modularity is used to investigate the structure of the communities within networks.

Modularity class: approach to identifying substructures within a network. A number is assigned to each group of nodes identified by modularity analysis.¹²

Connected component: "a set of vertices that are connected to each other by direct or indirect paths."¹³

Betweenness centrality: a way of detecting the "influence a node has over the flow of information," measuring "how often a node appears on the shortest path between nodes in the network," thereby acting as a bridge from one part to another.¹⁴

Layouts: set the shape of a graph to highlight features of a topology (eg, divisions, complementarities, ranking). There are various types of layouts used in SNA. The following layouts have been used in this study: Yifan Hu, ForceAtlas2, radial axis, and dual circle.¹¹

Community: a group of connected nodes in which "connections between the nodes are denser than connections with the rest of the network"¹⁵

Hashtag drift: the tendency for hashtags to drift away from the official hashtag owing to mistyping, being misremembered, spelling mistakes, or individuals simply choosing to make up their own.¹⁶

Impression: number of times a tweet is seen on Twitter.¹⁷

Mention: "Tweet that contains another person's username anywhere in the body of a tweet."¹⁸

Profile visits: number of profile visits through a tweet.¹⁹

SNA, social network analysis.

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tweet counts can be found in Appendix 1. Tweets varied by language, with 10 different languages identified. Most tweets were in English (66%; n=439), followed by Spanish (17%; n=109). Twitter could not define the language used in some of the tweets categorized as undefined (6%; n=40).

Hashtag network

A total of 164 different hashtags were identified using #WorldGODay, #GoForPurple, and #GoForCheckup hashtags. The most frequently used hashtags are listed in Figure 1. #WorldGODay (n=593) and #GoForPurple (n=333) were the first and second most frequently used hashtags used for data extraction and formed the basis of the European Society of

Gynaecological Oncology (ESGO)/ENGAGE social media campaign. #GoForCheckup had 17 related tweets. Overall, we categorized 48 unique hashtags related to gynecologic oncology or World Gynecologic Oncology Day.

To investigate hashtags drift, English language hashtags related to #WorldGODay, #GoForPurple, and #GoForCheckup were identified, leading to 18 related hashtags; 7 stemmed from #WorldGODay, 7 from #GoForPurple, and 4 from #GoForCheckup. Variations included different or incorrect spellings and variations on the theme (Table 3).

Figure 1 shows the SNA results and the descriptive statistics of each hashtag and its category. Each category is color-coded with the legend shown in

TABLE 2
Profile information of users using #GoForPurple, #WorldGODay, or #GoForCheckup hashtags

User type	Twitter accounts, % (n)	Tweets, % (n)
1. Healthcare professionals	22 (82)	17 (114)
4. Healthcare	11 (43)	18 (117)
3. Patient advocacy groups	7 (27)	14 (95)
2. Patients or relatives	3 (11)	6 (41)
5. Others	57 (219)	45 (295)
Total	382	662
Cumulative twitter “followers”		
Mean (standard deviation)	2300 (11,525)	
Median	388	
Min	0	
Max	2,05,275	
Total	8,78,567	
Cumulative Twitter “followings”		
Mean (standard deviation)	1296 (2516)	
Median	511	
Min	6	
Max	26,855	
Total	4,95,029	
Users’ total number of tweets as of September 25, 2020		
Mean (standard deviation)	20,146 (75,138)	
Median	2659	
Min	2	
Max	12,05,532	
Total	76,95,708	
Users’ tweets related to the topic as of September 25, 2020		
Mean (standard deviation)	2 (3)	
Median	1	
Min	1	
Max	32	
Total	662	

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Figure 1, D. The circles representing each hashtag in Figure 1 are calculated by their degree, which means the number of hashtags related to it. Figure 1, A shows the Yifan Hu layout of the hashtag distribution.²² This visualization shows that most of the hashtags fall between the 2 leading hashtags used in the search strategy (#WorldGODay and #GoForPurple). #WorldGODay is

associated with more hashtags that are not subsequently shared. These hashtags are presented in Figure 1, A by being pulled to the side of the layout. Their position, spaced out, indicates low modularity or weaker connection to nearby nodes. Figure 1, B is a dual circle layout in which search terms are fixed in the center and surrounded by related hashtags. The circles are generated with

weighted degrees showing the contribution of edge weight (thicker lines represent increased dyad occurrence frequency). Figure 1, B shows that the layout centralizes #VaginalCancer, #CervicalCancer, #VulvarCancer, and #HPV because they are the most related hashtags used by the Twitter accounts.

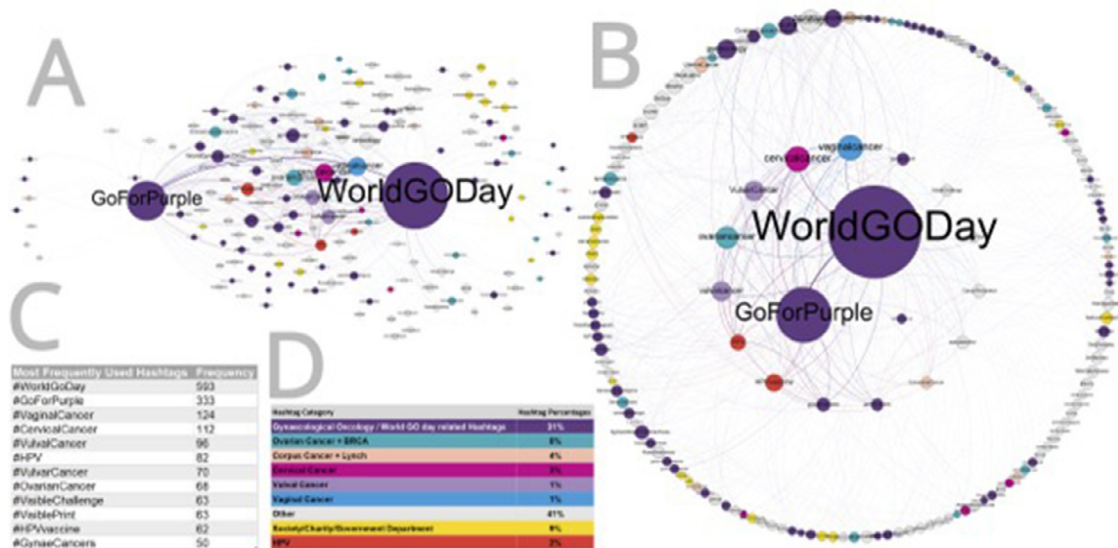
Tweeter and Retweeter Network

Figure 2 illustrates the relationship of Twitter accounts to retweeter accounts based on the tweets gathered. Figure 2, A shows the SNA using ForceAtlas2 layout in which each circle represents a Twitter account.²³ The size of each circle is calculated using their weighted out-degree to demonstrate their influence within the community. Connected component analysis showed 39 unconnected communities in Figure 2, A.¹³

These unconnected communities are placed within the layout outside the central community with no connection to the main group of Twitter accounts. An example of this is @MedtronicES, which shows connections to several Twitter accounts in the other category but is placed outside the central community. The colors represent each account’s type as per the legend (Figure 2, C). The most influential account was @VulvalCancerUK, which belongs to a patient. Connections from this account are predominantly with patient or relative or healthcare professional accounts. @GSK_ES and @GSK are Twitter accounts for GlaxoSmithKline, a pharmaceutical company with @GSK_ES being the Spanish branch. These accounts were influential within their connected communities as represented by their size in the visualization. They are surrounded by many gray circles (accounts categorized as other or general public) and the occasional healthcare professional or healthcare account.

The most connected account, based on “betweenness centrality” analysis (measuring how often a node appears on the shortest path between other nodes in the network)¹¹ is @Lynch-syndromirl followed by @ESGO_society. In Figure 2, A, these accounts can be seen to be connected to and

FIGURE 1
Hashtag Network of Tweets



A, The hashtag network analysis with Yifan Hu layout. **B**, The hashtag network analysis with dual circular layout in which #WorldGoDay, #GoForPurple, and #GoForCheckUp have fixed positions. **C**, The most frequently used hashtags and their frequencies in descending order. **D**, Hashtag categories and their overall percentages. Background colors match with the colors in A and B.

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surrounded by other influential accounts. Figure 2, B lists the accounts and the number of tweets posted related to the topic. These accounts are illustrated with their connections to healthcare professionals, patients or relatives, advocacy groups, healthcare societies or institutions, and other uncategorized accounts.

Hashtag and Twitter account network

Figure 3 shows the Twitter accounts and the hashtag relatedness in 2 layouts. Figure 3, A gives an overview of the Twitter accounts and hashtag distribution displayed in a radial axis layout with each arm representing a modularity class identified during SNA. The more extended arm reaching the left

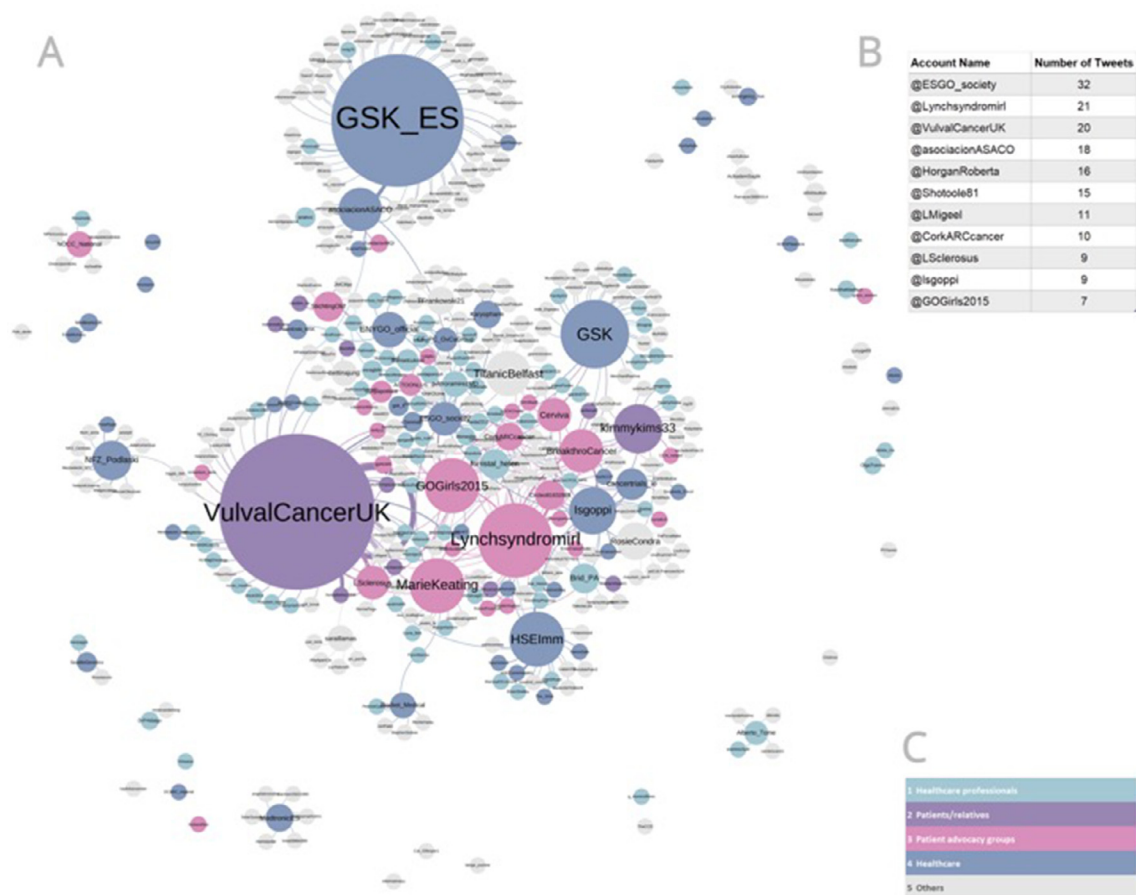
has a modularity class containing more accounts and hashtags, with hashtags indicated by the color green and Twitter accounts indicated in pink. Figure 3, B presents the same analysis using a Yifan Hu layout¹¹ to distinguish the hashtag usage patterns by Twitter account types. Each Twitter account is categorized as healthcare professional, patient or relative, patient advocacy group, healthcare society or institution, and other (not falling into the categories above), and the background color of each legend indicates this. Hashtags that are pushed out of the central distribution are used less frequently. #GoForPurple is associated with a more diverse range of account types and hashtags used in associated tweets. #WorldGoDay was more regularly used as a single hashtag in tweets, primarily by accounts categorized as other. Healthcare professional and patient advocacy groups used diverse hashtags (ie, multiple hashtags within tweets) and used both leading hashtags (#GoForPurple and #WorldGoDay).

TABLE 3
Hashtag drift associated with the studied hashtags #WorldGoDay, #GoForPurple, and #GoForCheckUp

#WorldGoDay	#GoForPurple	#GoForCheckUp
GODay	GOpurple	CheckYourself
gynecologiconcologyawarenessday	Ishallwearpurple	getitchecked
ISupportWorldGynaecologicOncologyDay	LightUpInPurple	GoFor
WorldGoDay2020	LightUpInPutple	GoForCheckUps
WorldGoFor	purple	
WorldGynaecologicalOncologyDay	purplelips	
WorldGynecologicOncologyDay	purpletoenails	

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FIGURE 2
Tweeter and Retweeter Network



A, Tweeter and retweeter social network analysis using ForceAtlas 2 layout. **B**, Twitter accounts with the associated number of tweets. **C**, Legend: Twitter account categories.

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Comment Principal findings

#WorldGODay was the most frequently used hashtag. It was also most commonly used (not with other associated hashtags) within tweets and primarily by accounts categorized as other. Many different cancer-specific hashtags were identified, with ovarian cancer-specific hashtags featuring most frequently. These hashtags are seen most often in Twitter discussions among healthcare professionals. The most influential account was @VulvalCancerUK. The account found to be the most connected was @Lynchsyndromirl, followed by @ESGO_society.

Results in the context of what is known

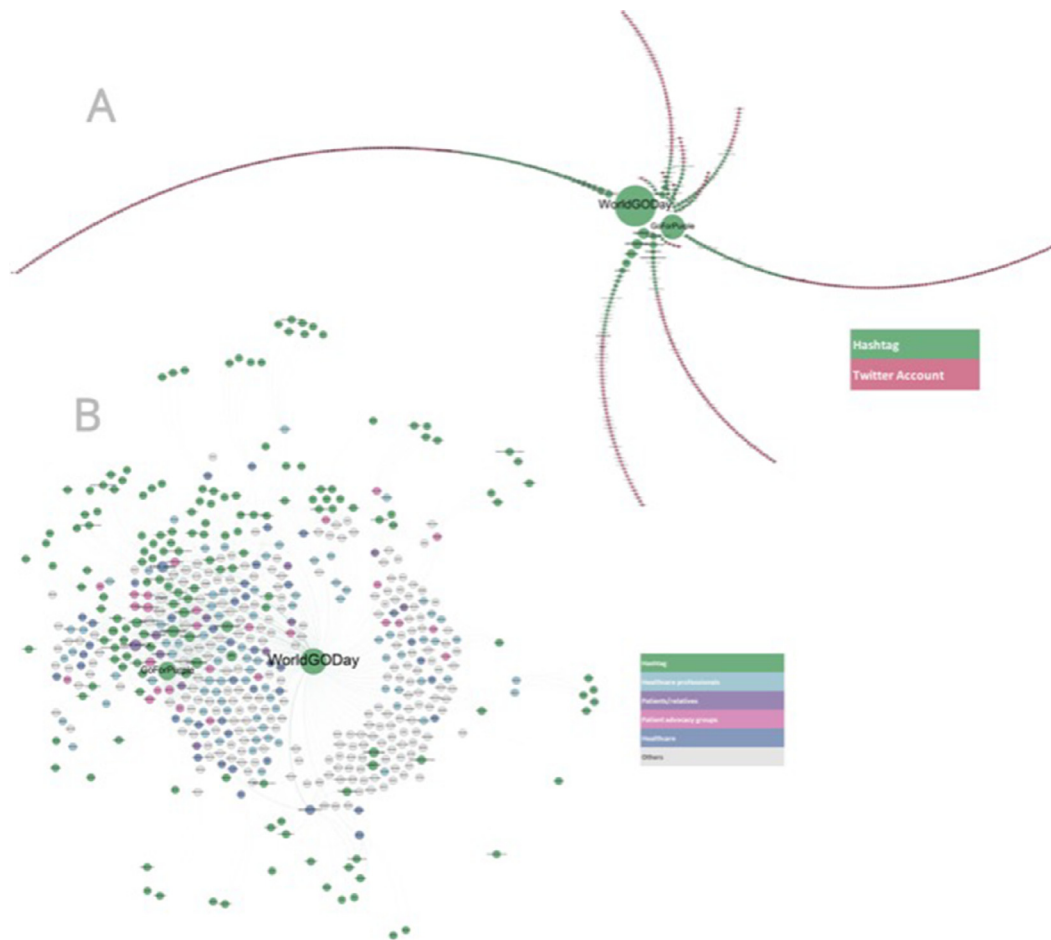
Cancer-related tweet discussions have been studied in the past. The frequency of discussion and differences by race and ethnicity of cancer-related topics among unique users via Twitter was examined in a study.²⁴ A wide range of cancer-specific hashtags and variations in race-specific Twitter discussions were found. We have also found diverse hashtags being used in tweets, apart from the ones suggested by ESGO/ENGAGE.

Another study concluded that social media could serve as a potent and vital tool in implementing and disseminating

critical prevention, screening, and treatment messages to the community in real-time. We found a similar reach of Twitter discussions both among the healthcare community and the general population.

The effects of an online intervention on awareness about cervical cancer was analyzed in another study.²⁵ There was a nonsignificant increase in awareness about human papillomavirus, the causative agent behind cervical cancer, that was observed. Another qualitative study investigated health behavior discussions related to cervical and breast cancer on Twitter.²⁶ This study found that Twitter could be a valuable tool to disseminate health awareness.

FIGURE 3
Hashtag and Twitter Account Network



A, Hashtag user network with radial axis layout grouped by modularity class. **B**, Hashtag user network with Yifan Hu layout colored by user categories. *Uwins. Gynecologic cancer awareness on Twitter. Am J Obstet Gynecol Glob Rep 2022.*

Another group of investigators studied the tweet chat using the commonest gynecologic cancer–specific hashtag #gynccsm. Social media was found as a good support tool for patients and caregivers.²⁷ Cervical cancer awareness month’s tweets were analyzed in January 2016 to quantify the positive or negative nature of top tweets about cervical cancer during that month.²⁸ Of the tweets identified, 25% were from healthcare organizations and the rest were from private organizations and personal accounts. The majority (70.3%) of tweets focused on cervical cancer prevention, and 90% generated a positive sentiment. Twitter was a helpful platform to disseminate positive messages regarding cancer prevention.²⁸ We also found similar results in that,

diverse users helped to disseminate cancer awareness messages.

Clinical implications

Healthcare professionals, patients and relatives, and advocacy groups actively participated in this social media campaign. Our study captured diverse tweeting behaviors too. Among the 3 suggested hashtags by ENGAGE, #GoForPurple was favored by patient advocacy groups and healthcare professionals. #WorldGODay was used the most by Twitter accounts categorized as other.

Research implications

Cancer awareness campaigns on social media could potentially achieve a higher reach by using the following strategy:

- Know your target audience and tailor tweets to them.
- Strategies to enhance the impact of future social media awareness campaigns include keeping 1 hashtag rather than 3, avoiding long words in hashtags that have different spellings in different countries or languages, identifying influential accounts, and coordinating the message with timed tweets.
- Following the KISS (keep it simple, Stupid) mantra when choosing hashtags.

The hashtag #WorldGODay met these criteria because it was relevant, easy to spell, and memorable. This may well explain why it was the most

successful hashtag. #Goday, shorter and more memorable, was also used by the World Gynecologic Oncology Day Twitter account. #GODay was, however, also associated with more tweets unrelated to World Gynecologic Oncology Day. This cross-contamination could potentially aid in disseminating gynecologic cancer awareness to people choosing to follow #GODay for an unrelated reason.

Strengths and limitations

A strength of this manuscript is that it serves as an educational tool for using social media in healthcare and health promotion in general. Social media terminology, unfamiliar to many health professionals, is clearly explained. We hope it will be helpful as a resource for healthcare professionals wishing to engage with social media or ignite further interest in SNA research.

The categorization was completed based on the account's name and supplied account description; this, therefore, reflects the public image that these accounts wish to portray but may not give the account owners a complete or accurate picture, which could be seen as a limitation. Lastly, we only captured Twitter as the social media platform for our study. Similar conversations were simultaneously occurring on Facebook, Instagram, and TikTok.

Conclusion

Cancer awareness campaigns on social media should be designed around a single, short, easy-to-spell hashtag and coordinated with previously identified, influential accounts using timed tweets. The #WorldGODay hashtag was relevant, easy to spell, memorable, and the most effective hashtag used in this campaign. ■

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.xagr.2022.100079](https://doi.org/10.1016/j.xagr.2022.100079).

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