



Impact of Tweet Content on the Number of Retweets

— “Tweet the Meeting 2022” —

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Background: Previous research has investigated the effectiveness of the “Tweet the Meeting” campaign, but the relationship between tweet content and the number of retweets has not been fully evaluated.

Methods and Results: We analyzed the number of tweets and retweets during the Japanese Circulation Society’s 2022 annual meeting. The ambassador group had significantly more session- and symposium-related tweets than the non-ambassador group ($P < 0.001$), associated with the number of retweets. Symposium-related tweets with figures generated more retweets than those without figures (mean $[\pm SD]$ 3.47 ± 3.31 vs. 2.48 ± 1.94 retweets per tweet, respectively; $P = 0.001$).

Conclusions: The study revealed that official meeting-designated Twitter ambassadors disseminate more educational content than non-ambassadors, and generated more retweets.

Key Words: Annual congress; Cardiology; Twitter

Twitter, a form of social media, is an interactive appropriation of user-driven content and a powerful tool for clinicians and research physicians to disseminate knowledge.¹ Annual scientific and medical congresses can enhance the transmission and influence of important information thanks to real-time communications via social networks.^{2,3} From the 83rd annual congress of the Japanese Society of Cardiology (JCS) held in 2019, the JCS supported “tweeting the meeting”, which meant disseminating presentation materials and related links, including published articles. To facilitate this, the Society’s Information and Communication Committee has appointed several medical professionals as JCS Twitter Ambassadors to tweet agreed slide presentations effectively.⁴ Prior

research has shown that the Ambassadors’ tweets are highly quoted and facilitate networking with other users.⁵ Similarly, the importance of the ambassador model on Twitter has been recognized, as an increase in Twitter ambassador engagement contributes to the rise in the number of tweets. Because of this early success, the JCS continued to use Twitter Ambassadors for the most recent meeting in 2022.⁶

However, the complete effects of the Twitter Ambassador program are not clear. Specifically, although the program has improved the quantity of tweets and retweets, the relationship between the content of scientific meetings and the tweeting activity of ambassadors and non-ambassadors remains unstudied. Therefore, the aim of this study was to

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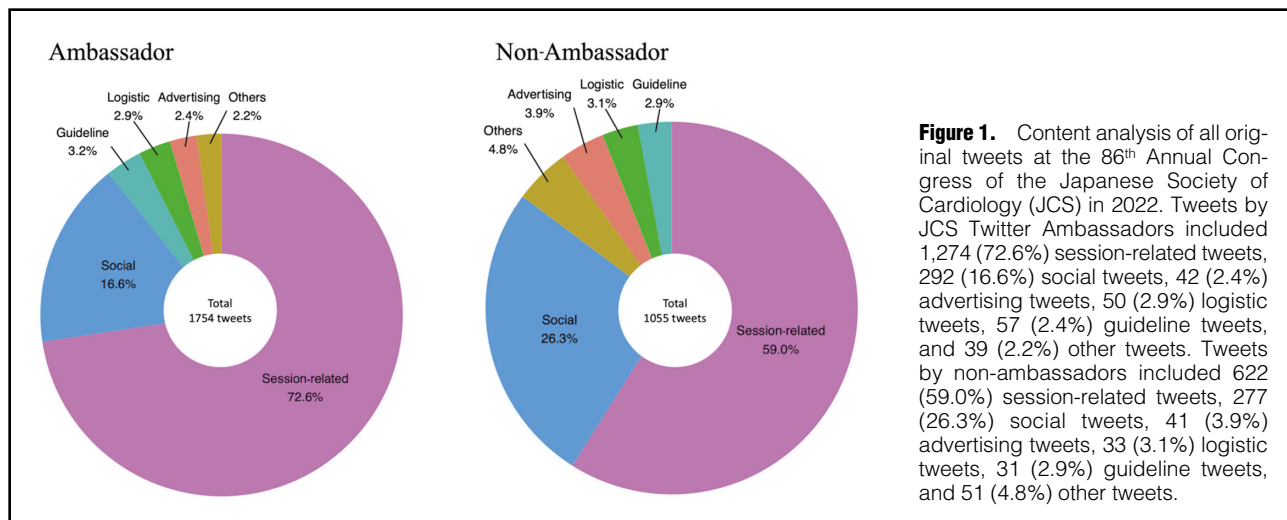
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analyze all original tweets at the 86th Annual Congress of the JCS in 2022 and identify differences in the classification of tweet content between ambassadors and non-ambassadors. We also identified the extent to which tweets covered the content of the clinical sessions. We discuss the usefulness of Twitter in disseminating valuable scientific information, including tweets based on clinical knowledge and tweets regarding the latest guidelines presented at the congress.

Methods

Study Setting

We extracted tweets using the Twitter Archiving Google Sheet (TAGS), which accesses the Twitter application programming interface (API) and records information regarding tweets and retweets for up to the previous 7–10 days, to a maximum of 18,000 tweets and retweets, as described in the previous study.⁷ Relevant tweets were extracted using the conference-specific hashtag #22JCS. The 2022 Annual Meeting of the JCS was held virtually due to the increasing number of COVID-19-infected patients. Only tweets within the period March 11–13, 2022, Japan Standard Time, were used in the analysis. Twitter IDs were classified into 2 categories: JCS Twitter Ambassador and Non-Ambassador. In all, 60 ambassadors were assigned to this congress. We defined Influencers as non-JCS Twitter Ambassadors with more than 10,000 followers. This study only included original tweets, not retweets or replies. Quoted tweets were not classified as retweets for this study, as in the previous study.⁵ We also calculated and compared the number of retweets to the original tweet by each tweet category and by ambassador status. We used the number of retweets to indicate a tweet's reach and influence.

Classification of Tweets

Tweet transcripts were reviewed independently by 2 investigators (T. Suzuki, A.M.), and any disagreements were resolved by consultation. Tweets were classified into 6 categories (i.e., session-related, social, advertising, logistic, guidelines, and others) based on modified methods developed by Neill et al⁸ and Schwenk et al.⁹ Given that the JCS introduces new guidelines at each annual meeting and holds a session associated with the new guidelines, we included a

guideline category, because our previous findings suggested that guideline-related tweets generate higher engagement and more retweets than those in other categories.⁵

The 6 tweet categories were defined as follows:

1. Session-related: comments, messages, or information directly related to a specific track, session content, or session of JCS 2022
2. Social: tweets not explicitly related to education or research, communication among participants not associated with session content or resource sharing, tweets about the overall conference atmosphere, or Twitter
3. Advertising: comments promoting commercial products or services through the use of Twitter, including companies exhibiting at the conference
4. Logistic: informing participants of JCS 2022 sessions and lectures, including personal research and poster presentation promotional messages
5. Guideline: comments and messages related to newly presented JCS 2022 guidelines
6. Others: messages not classified into any of the above categories.

Symposium Allocation to Official Twitter Ambassadors

Before the start of the annual congress, the JCS procured official agreements for disseminating slide presentations on Twitter via JCS-designated ambassadors. The JCS provided the ambassadors with a list of symposia and requested that they were opt-in to tweeting about each one, thereby ensuring coverage for all designated symposia. Because the number of JCS official Twitter ambassadors was not sufficient to cover all the agreed presentations, we examined the percentage of agreed symposia tweeted about. Furthermore, we compared the number of retweets between symposium-related tweets that included accompanying figures of slide presentations and those that did not.

Statistical Analysis

Categorical variables are reported as frequencies and percentages, whereas continuous variables are expressed as the mean \pm SD. The significance of differences in categorical variables between groups was assessed using Chi-square tests. Comparisons of the number of retweets to the original tweet between each category were statistically analyzed

Table 1. Number of Retweets of Original Tweets According to Ambassador and Non-Ambassador Status			
	Ambassador	Non-Ambassador	P value
No. original tweets	1,754	1,055	
No. total retweets	5,051	2,567	
Mean no. retweets per original tweet	2.88±3.00	2.43±2.88	<0.001
Tweet classification			
Session-related	3.00±2.63	2.58±2.45	<0.001
Social	1.83±1.66	2.08±2.26	0.21
Advertising	3.19±2.60	2.22±1.60	0.046
Logistic	3.06±3.65	2.12±1.88	0.11
Guideline	5.19±8.27	4.23±6.90	0.06
Others	3.00±4.33	1.88±1.73	0.12
Symposium-related	3.07±2.87	2.61±2.85	0.005

Unless indicated otherwise, data are given as the mean±SD.

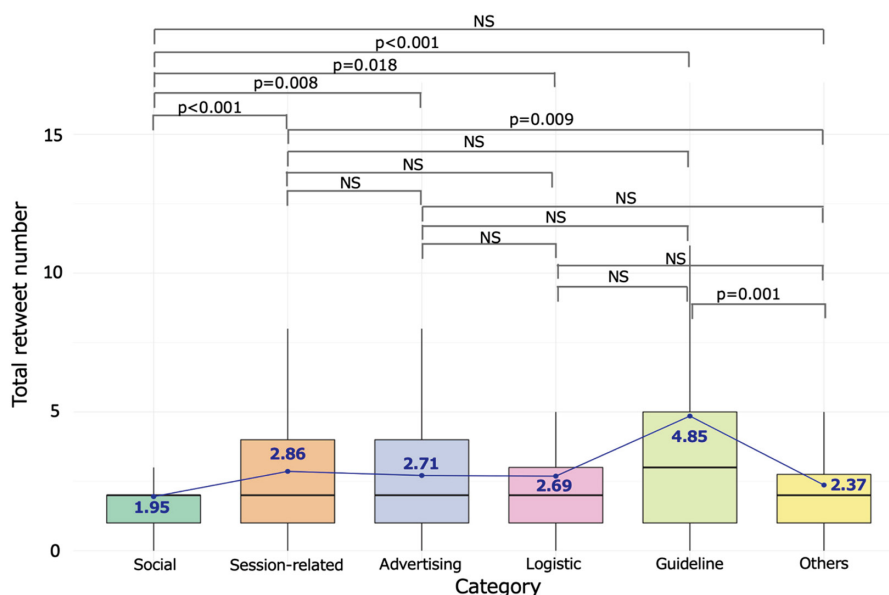


Figure 2. Boxplots of the number of retweets for each tweet category. The blue circles, numbers, and lines indicate the mean number of tweets. P values were calculated using the Steel-Dwass multiple comparison test. According to the Steel-Dwass multiple comparison test, the number of retweets of “session-related”, “advertising”, “logistic” and “guideline” tweets was significantly higher than those for “social” tweets. “Guideline” and “session-related” tweets were significantly more retweeted than “other tweets”.

using the Mann-Whitney U test, Kruskal-Wallis test, and the Steel-Dwass multiple comparison tests. Considering the skewness of the retweets count, data were logarithmically transformed before analysis, with counts presented as medians values. In the multiple linear regression model, the tweet data were adjusted by the following variables: tweets by JCS Twitter Ambassadors; tweets by Influencers; classification of tweet content; tweets with figures; and day of the tweet during the congress. All analyses were performed using R version 4.2.3 (R Foundation for Statistical Computing, Vienna, Austria).

Results

Throughout the 3 days (March 11–13, 2022), 10,703 tweets

were generated. Of these, 2,809 (26.2%) constituted original tweets, with 7,894 (73.8%) being retweets or replies. Of the 2,809 original tweets, the JCS official Twitter account @JCIRC_IPR accounted for 49 tweets (1.7%), and the top 5 tweeters accounted for 726 tweets (25.8%). The number of tweets by Ambassadors was 1,754 (62.4%), compared with 1,055 (37.6%) tweets by Non-Ambassadors. During the congress, there were 641 symposium presentations, of which 218 (34.0%) were authorized to be tweeted beforehand. Of these 218 presentations, Ambassadors tweeted about 102 (46.8%) with accompanying academic figures.

The number of original tweets in each of the 6 categories was as follows: session-related, 1,896 (67.5%); social, 569 (20.3%); advertising, 83 (3.0%); logistics, 83 (3.0%); guidelines, 88 (3.1%); and others, 90 (3.2%). **Figure 1** shows

Table 2. Linear Regression Model for the Total Number of Retweets

	Coefficient (95% CI)		P value
	Log10 (Total no. retweets)	Total no. retweets	
Original tweet by JCS Twitter Ambassadors	0.02 (−0.02, 0.07)	1.02 (0.98, 1.07)	0.30
Original tweet by Influencers	0.19 (0.12, 0.26)	1.21 (1.13, 1.30)	<0.001
Tweet classification			
Session-related vs. social	0.18 (0.12, 0.23)	1.20 (1.13, 1.26)	<0.001
Advertising vs. social	0.17 (0.05, 0.30)	1.19 (1.05, 1.35)	0.007
Logistic vs. social	0.16 (0.04, 0.29)	1.17 (0.98, 1.34)	0.012
Guideline vs. social	0.34 (0.21, 0.46)	1.40 (1.23, 1.58)	<0.001
Others vs. social	0.06 (−0.07, 0.18)	1.06 (0.93, 1.20)	0.37
With figures vs. without figures	0.21 (0.16, 0.27)	1.23 (1.17, 1.31)	<0.001
Day 2 vs. Day 1	−0.14 (−0.19, −0.09)	0.87 (0.83, 0.91)	<0.001
Day 3 vs. Day 1	−0.18 (−0.24, −0.13)	0.84 (0.79, 0.88)	<0.001

Influencers were defined as non-JCS Twitter Ambassadors with more than 10,000 followers. JCS, Japanese Society of Cardiology.

tweets in each of the categories for Ambassadors and Non-Ambassadors separately. Tweets by Ambassadors included 1,274 (72.6%) session-related tweets, 292 (16.6%) social tweets, 42 (2.4%) advertising tweets, 50 (2.9%) logistic tweets, 57 (2.4%) guideline tweets, and 39 (2.2%) other tweets. The Ambassador group had significantly more session-related tweets than the Non-Ambassador group (72.6% vs. 59.0%, respectively; $P<0.001$). Conversely, the Ambassador group had significantly fewer social (16.6% vs. 26.3%; $P<0.001$) and other (2.2% vs. 4.8%; $P<0.001$) tweets than the Non-Ambassador group. There were significantly more tweets connected to the symposium in the Ambassador than Non-Ambassador group (27.1% vs. 15.0%; $P<0.001$).

Table 1 summarizes the distribution of the total retweet number by tweet content for Ambassadors and Non-Ambassadors. The mean number of retweets per original tweet was significantly greater for Ambassadors than Non-Ambassadors (2.88 ± 3.00 vs. 2.43 ± 2.88 , respectively; $P<0.001$). Similarly, session-related tweets retweets were significantly greater for Ambassador than Non-Ambassadors posts (3.00 ± 2.63 vs. 2.58 ± 2.45 , respectively; $P<0.001$). The number of retweets of symposium-related tweets was significantly higher among Ambassadors than Non-Ambassadors (3.07 ± 2.87 vs. 2.61 ± 2.85 ; $P=0.005$). **Figure 2** shows box-plots of the number of retweets in each of the 6 categories of tweet classification. The results of the Steel-Dwass multiple comparison tests revealed that the number of retweets of “session-related” ($P<0.001$), “advertising” ($P=0.008$), “logistic” ($P=0.018$) and “guideline” ($P<0.001$) tweets was significantly higher than the number of retweets of “social” tweets. Of the 633 symposium-related tweets, 375 (59.2%) had figure(s). The number of retweets per symposium-related tweet with figures was significantly higher than that of retweets per symposium-related tweet without figures (3.47 ± 3.31 vs. 2.48 ± 1.94 , respectively; $P=0.001$).

A linear regression model revealed that the total number of retweets increased for tweets with figures (coefficient 0.21; $P<0.001$; 95% confidence interval [CI] 0.16–0.27) and original tweets by Influencers (coefficient 0.19; $P<0.001$; 95% CI 0.12–0.26). Regarding tweet classifications, the total number of retweets was exponentially associated with session-related (coefficient 0.18; $P<0.001$, 95% CI 0.12–0.23) and guideline tweets (coefficient 0.34; $P<0.001$, 95% CI 0.21–0.46) than social tweets (**Table 2**).

Discussion

This study aimed to investigate tweet contents during a “tweeting the meeting” campaign in cardiology and evaluate the association between JCS Ambassador/Non-Ambassador status and tweet content. The results of the analysis yielded 3 main findings. First, JCS Twitter Ambassadors disseminated session- and symposium-related content at a greater rate than Non-Ambassadors. Second, academic tweets, especially those related to guidelines, were most frequently retweeted. Third, symposium-related tweets containing academic figures generated more retweets than those without figures.

Thoughtful placement of ambassadors, coordination of communication content, and integration of social media strategies are critical to successful participant engagement and dissemination of conference highlights. Previous research has highlighted the central role of ambassadors in conference communication through network analysis, increased participant engagement, and sharing of conference content with broader audiences.¹⁰ In this context, the analysis of tweet content is vital for the future academic development of Twitter activities and marketing strategies. This study demonstrated that JCS Twitter Ambassadors increased the frequency of educational content tweets, such as session- and symposium-related tweets, and that the ambassadors’ tweets were retweeted more than those of non-ambassadors, consistent with our prior report for the 2019–2021 triennium.⁵ These findings suggest that Twitter ambassadors are useful disseminators of information and educational content, including guidelines, which effectively expands the potential readership of scholarly articles and improves their impact.^{11,12}

Our classification of tweets showed that almost 70% were session-related, 3% were guideline-related tweets, and 13.3% were tweets with figures, which received more retweet responses, consistent with previous research.¹³ Our previous study on the 2019–2021 annual meeting found that the number of retweets increased by 35% when the tweet content was related to guidelines.⁵ In the present study, the number of retweets of guideline-related tweets was also high for both Ambassadors and Non-Ambassadors, suggesting that Twitter dissemination of guidelines may lead to an increased awareness of guidelines. Moreover, we found that symposium-related tweets with figures received

more retweets, highlighting the potential of visual information in promoting the spread of medical information on social media. These findings align with previous studies that demonstrated the effectiveness of attaching multimedia, including images, and inserting hashtags in increasing the number of retweets.^{14–16} However, the impact of adding auditory information to visuals in tweets remains an area that requires further research. Therefore, future studies are expected to provide more evidence on the effectiveness of including videos, images, and infographics in conference-related tweets to improve their impact and dissemination.

Academic tweets with figures generated more retweets and could be more educationally significant. Nonetheless, the content covered on Twitter constituted approximately 15% of the congress. The reliability of these ambassadors' dissemination in accurately reporting the sessions intended by the conference organizers and program creators remains debatable. Consequently, it is important to be aware of the potential for content to be arbitrarily tweeted, which constitutes selection bias. It is important to recognize the need to have enough ambassadors and public relations personnel to ensure fair and comprehensive coverage of congress content through Twitter. By allocating adequate resources to this endeavor, organizers can better facilitate the dissemination of scientific knowledge to broader audiences. As a future perspective, we suggest conducting further research to identify the optimal number of ambassadors and public relations personnel needed for fair and comprehensive congress coverage.

This study has several limitations. First, only original tweets with the #22JCS hashtag were included in the analysis, so tweets without hashtags or inaccurate hashtags were not analyzed, which may have underestimated actual conference-related tweeting activity. Second, the classification of tweet content was not completely objective, which could result in misclassification. Third, Twitter content represented only 15% of the congress, so we must be aware of potential selection bias due to arbitrary content selection and tweeting. Finally, a tweet's impact was analyzed by the number of retweets within the 3-day during the congress. Further studies are needed to reveal how long we should include the data after the congress's final day.

In conclusion, this study revealed that Twitter ambassadors disseminate more educational content at cardiology conferences. The future challenge lies in enhancing the tweeting activity and the quality of the educational content. Further research is expected for a more detailed data analysis of the disseminated educational content.

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Disclosures

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Author Contributions

T. Suzuki wrote a draft of the manuscript. A.M. supervised the study and edited the manuscript. All authors revised the report, commented on drafts, and approved the final manuscript.

IRB Information

This study was approved by the Research Ethics Committee of St. Luke's International University (Reference no. 20-R118).

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