



HHS Public Access

Author manuscript

Am Heart J Plus. Author manuscript; available in PMC 2021 October 01.

Published in final edited form as:

Am Heart J Plus. 2021 August ; 8: . doi:10.1016/j.ahjo.2021.100041.

Social media for cardiovascular journals: State of the art review

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Abstract

In cardiovascular (CV) medicine, the use of social media (SoMe) has increased the dissemination of scientific knowledge, including the sharing of scientific journal articles. With the rapid growth of online methods for communicating scientific research, the critical question is whether online attention correlates with citations in academic journal articles. Traditionally, the performance of a scientific journal article has been determined by the number of times it has been cited. The impact factor and the number of citations in peer-reviewed journals are widely accepted measures of scientific impact. Social media platforms such as Twitter ([Twitter.com](https://twitter.com)) enable the development of novel article- or journal-level metrics for assessing effect and influence. Indeed, “alternative metrics” for journal article impact have been proposed, with the most frequently used being the Altmetric Attention Score (AAS; [Altmetric.com](https://www.altmetric.com)). The relationship between these new metrics and established indicators such as citations has not been thoroughly investigated. We summarize numerous studies investigating associations between social media posts about journal articles and journal article citations. We then describe our own journal’s social media strategy in light of these findings.

Keywords

Social media; Cardiovascular medicine; Citation; Impact factor; Altmetrics

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

1. Introduction

The use of social media (SoMe) in cardiovascular (CV) medicine has increased the dissemination of scientific knowledge, including sharing of scientific journal articles. The fast rise of online methods for communicating scientific research poses the critical question of whether online attention correlates with academic journal article citations. A scientific journal's manuscript performance is traditionally judged by the number of times it is cited. The impact factor and citations in peer-reviewed journals are widely acknowledged indices of scientific impact. Social media platforms like the microblogging website Twitter ([Twitter.com](https://twitter.com)) allow for the creation of novel article-level or journal-level metrics to measure effect and influence. Indeed, "alternative metrics" for journal article impact have been proposed, with the Altmetric Attention Score (AAS; [Altmetric.com](https://altmetric.com)) being the most used. The AAS is a newer metric that is a real-time, automatically determined, weighted count of the online attention given to research output. The AAS estimates the amount of attention a scientific manuscript receives across many internet venues, such as news, blogs, and social media. As a result, AAS delivers data on a journal article's impact and performance on social media platforms, news or media sites, blogs, and podcasts. The AAS has been promoted as a quick technique to determine the effect of a piece of research, both in terms of future scholarly citations and wider internet participation. The relationship between scientific article dissemination on Twitter and online visibility (including the Altmetric score) has been suggested [1]. The link between these new measurements and classic indicators like citations has not been extensively investigated. Various recent journal groups have attempted to study associations between journal article social media posts and journal article citations [1–6] (Table 1). Prior to these studies, the influence of social media posts on citation rates had never been examined. Here, we review the studies and describe our own journal social media strategy based on the findings of this review. While some of these studies were not in cardiovascular research journals, their findings are informative for cardiovascular journal SoMe.

2. Social media posts and journal article citations

The journals of the European Society of Cardiology (ESC), as well as the Journal of Medical Internet Research (JMIR), Journal of the American College of Cardiology (JACC), Mayo Clinic Proceedings, Royal Society Open Science journal, International Journal of Public Health, and Circulation have all hosted articles reporting results of studies assessing associations between journal article citations (or journal article access/downloads) and Twitter social media posts or AAS. Some journals have pursued studies reporting on indirect measures of journal article impact or dissemination, such as page views or article downloads, without measuring citation. All but the latter two journals listed have shown significant association in observational or randomized controlled trials, described as follows.

2.1. European Society of Cardiology journals

ESC published results of a study assessing access and downloads of articles published in ESC journals before and after initiation of the ESC journals' Twitter account (@ESC_Journals). Results indicated that prior to ESC activating and operationalizing the

journals Twitter account, there was a low number of journal article access or downloads [1]. However, subsequent to activation and use of ESC journals' own Twitter account, the study showed that for more than a half of the ESC journals, there were much greater numbers of website clicks and downloads for journal articles associated with their Twitter account. Following this observation, ESC Journals conducted another randomized control trial [2]. In the trial, 696 manuscripts published in the ESC journal family between March 2018 and May 2019 were randomly assigned to receive Twitter promotion or to a control arm with no active tweeting from ESC channels, with the goal of determining whether Twitter promotion increased citation rate (primary endpoint) and Altmetric score [2]. A preliminary study of 536 publications (77% of the journals' total publications) that were published between January and December 2018 (i. e., manuscripts published at least six months prior to their gathering citation and Altmetrics data was conducted). In the primary endpoint study, Twitter promotion of publications resulted in a 1.43 (95% confidence interval [CI] 1.29–1.58) increase in the rate of journal article citations, irrespective of article type. The Altmetric score and the number of tweeting users positively associated with the number of citations, with the Twitter arm demonstrating a greater association. Although causation could not be proven, the results of this randomized controlled trial results were highly suggestive that tweeting led to a higher rate of citations.

2.2. Journal of Medical Internet Research

JMIR reported a study on the use of social media to measure the impact of scholarly articles, assess for associations with the nature of social media post content, analyze timing in relation to journal article publication, and determine whether these metrics may be specific enough to predict highly cited articles [3]. The study author mined all tweets containing links to manuscripts in the journal between July 2008 and November 2011. They then calculated social media effect measures for a subset of >1500 tweets regarding 55 articles published between March 2009 and February 2010, with subsequent comparison to citation data from Scopus and Google Scholar ~15–30 months later. Tweet data were then used to validate a heuristic for predicting the most-cited articles in each issue. Study results indicated a total of ~4200 tweets citing >280 JMIR articles. The distribution of tweets in the first 30 days after article publication followed a power law (Zipf, Bradford, or Pareto distribution). The majority of tweets were sent on the day of publication (1458/3318 tweets, 44% percent of all tweets in 60 days) or the next day (528/3318 tweets, 16%), followed by a rapid decline. For a subset of 55 articles, log-transformed citation count was compared to log-transformed tweet count using Pearson's correlations. These analyses demonstrated significant correlations between journal article tweets and citations on Google Scholar ($r = 0.39$; $p = 0.004$) or Scopus ($r = 0.31$; $p = 0.02$). Time and tweets were identified as significant factors ($p < 0.001$), possibly explaining 27% of the variation in citations in a linear multivariate model.

Highly tweeted articles were 11 times more likely than less-tweeted articles to be highly cited (9/12 or 75% of highly tweeted articles were highly cited, compared to just 3/43 or 7% of less-tweeted articles; rate ratio 0.75/0.07 = 10.75, 95% CI 3.4–33.6). Additionally, top-cited articles were predicted with 93% specificity and 75% sensitivity using top-tweeted articles. Thus, the study results suggested that within the first three days of an article's

publication, tweets could predict highly referenced articles. Of note, the author emphasized that social media activity may increase citations or may instead reflect underlying attributes of journal articles that could also or alternatively predict citations.

Social impact indicators based on tweets may therefore augment traditional citation metrics through a proposed “twimpact factor”. The proposed standard twimpact factor (tw7) is the cumulative number of journal article Twitter citations (number of times the weblink for an article is included in an original posted tweet or retweet) within seven days after publication. Tw7 is a potentially valuable and timely indicator for determining research uptake and filtering research findings that resonate with the global scientific community in real time.

2.3. Journal of the American College of Cardiology

JACC conducted a study assessing the link between AAS (and its components) and journal article citations and downloads [4]. The study covered all publications published in JACC between January 2016 and December 2017. Study authors recorded the AAS and number of citations for each article as of December 2018. Each manuscript was scrutinized for article type and topic. The Pearson’s correlation between each component of AAS and the total journal article downloads and citations was determined. The AAS (and its components), months since publication, and article type were assessed as covariates in a linear regression model, with total paper download count (from JACC.org) or citation count as the outcome. The analysis included >770 journal manuscripts, with >470 (61%) original research publications. The median number of citations was 19 (interquartile range [IQR]: 10 to 34), and the median AAS was 42 (IQR: 20 to 78). The median number of downloads was 1381 (IQR: 775 to 2454), and the median number of twitter mentions was 42 (IQR: 20 to 88). The overall AAS and downloads had a Pearson’s correlation of 0.138 ($p < 0.001$), while the overall AAS and citations had a 0.159 ($p < 0.001$) correlation. Twitter mentions and policy manuscripts showed the highest Pearson’s correlation with article downloads of 0.257 ($p < 0.001$) and 0.458 ($p < 0.001$), respectively, across all AAS components. This research was the first to examine the association between AAS and its components and paper downloads and citations in a cardiovascular journal. The analysis demonstrated a link between AAS and article downloads, with Twitter social media posts being one of the most significant individual factors influencing journal article downloads.

2.4. Mayo Clinic Proceedings journal

Mayo Clinic Proceedings conducted a randomized controlled trial to establish the effect of a planned social media promotion strategy on online article access in a reputable academic medical journal [5]. A cohort of 68 papers from the same journal issue was used. These articles were split evenly into two groups. The manuscripts comprising group one were tweeted from Mayo Clinic’s Twitter account (@MayoClinic), while the manuscripts in group two were not. The goal of these tweets was to propagate the information about the paper by the authors from their particular institution and also to have these papers cited. However, citation counts were not explicitly assessed in this study.

For 30 days, articles published in October to December 2015 ($n = 68$) were randomly assigned to receive social media promotion (SoMe) through Twitter, Facebook, and

LinkedIn or to receive no social media marketing (NoSoMe) (beginning with the date of online article publication). Journal website visits and full-text article downloads were assessed between SoMe and NoSoMe for the 0–30 and 31–60 days following online publication. Between 0 and 30 days, the SoMe group (n = 34) had considerably more website access than the NoSoMe group (n = 34): 1070 median downloads versus 265, $p < 0.001$. Similarly, the median number of full-text article downloads from 0 to 30 days was greater in the SoMe group: 1042 versus 142, $p < 0.001$. Articles assigned to SoMe had significantly more website visitors through Twitter (90 vs. 1), Facebook (526 vs. 2.5), and LinkedIn (31.5 vs. 0)—all $p < 0.001$.

The results showed that tweeted manuscripts associated with ~5 times more journal article website visits than the manuscripts that were not tweeted from the account. Additionally, the articles from group one were also ~5 times more frequently downloaded than the articles that were not tweeted. These results suggest that tweeting about academic manuscripts increases website visits and article downloads.

2.5. Royal Society Open Science

One study conducted by the Royal Society Open Science journal examined variance in the AAS of 2677 research articles published between 2012 and 2016 in ten ornithological journals [6]. The study found that AAS grew sevenfold on average during the last five years, primarily due to increased activity on Twitter, which accounted for 75% of the overall score. Increases in AAS from 1 to 20 resulted in a predicted 112% increase in citations, up from 2.6 to 5.5 citations per article for a selection of 878 publications published in 2014, including an extra 323 ornithology publications from non-specialist publications. This interacted with journal impact factor, with AAS having a smaller effect in journals with a greater impact factor. Their findings implied that, in addition to supplementing established measures of scholarly influence in ornithology such as citations, Altmetrics (or the online activity they monitor) may also predict or even drive them.

2.6. International Journal of Public Health

Authors of a study in the International Journal of Public Health found that the random assignment of scientific publications to a social media exposure intervention did not affect article downloads or citations [7], similar to their previous observation [8]. In this work, the authors looked at whether adding more time to the observation period after being exposed to a social media intervention would change the previously reported results [7]. The authors updated article download and citation statistics for articles published in the International Journal of Public Health between December 2012 and December 2014 for a minimum of 24-month follow-up. They then re-examined the impact of social media exposure on article downloads and citations. For all manuscripts when stratified by open access status, there was no difference between the intervention and control groups in terms of downloads ($p = 0.72$) or citations ($p = 0.30$). Additionally, the proportional disparities in the number of downloads and citations between manuscripts in the social media control group and those in the intervention group did not rise with longer observation time.

2.7. Circulation

Circulation published the results of a trial in which articles from the journal were randomly assigned to receive targeted social media exposure, which included posts to the journal's Facebook and Twitter pages (@CircAHA) [9]. The primary metric was the number of 30-day article page views. An intention-to-treat analysis was conducted, comparing article page views using the Wilcoxon rank-sum test between articles assigned to SoMe and those in the control group that did not receive targeted SoMe exposure. Subgroups were defined based on the type of article (population/clinical/basic), the corresponding author's nationality (US vs. non-US), and whether the article received an editorial. In total, 243 articles were randomly assigned to one of two groups: 121 to the SoMe arm and 122 to the NoSoMe arm. The median 30-day page views were not significantly different (409 [social media] versus 392 [control], $P = 0.80$). There were no significant differences in terms of article type (clinical, population, or basic science; $P = 0.19$), editorial content ($P = 0.87$), or corresponding author origin ($P = 0.73$). Therefore, the cardiovascular journal's social media strategy did not result in an increase in the number of times an article was viewed. Citation counts were not directly measured or reported, and the efficacy of page views as a surrogate measure of citation counts may be limited [10].

2.8. A conglomerate of top cardiology journals

An additional study determined associations between AAS and the number of citations for full-length original cardiovascular research articles published in 2014 in eight journals with the highest Web of Science Impact Factor (according to Journal Citation Reports 2017: category "General Internal Medicine" and "Cardiology") [10]. The reported AAS and Web of Science citation counts for each article over the subsequent three years (i.e., 2015 to 2017) were extracted. In January 2018, data were collected retrospectively. Pearson's correlation coefficient and Spearman's rank correlation coefficient were used to compute pairwise correlations for parametric and nonparametric variables, respectively. The relationship between $\log(\text{Altmetric score} + 1)$ and $\log(\text{total 3-year citations} + 1)$ was determined using a linear regression model.

A total of 939 articles were retrieved, with clinical trials accounting for 18%, observational studies accounting for 76%, and meta-analyses accounting for 6%, respectively. The median AAS value was 8 (IQR: 2 to 37). At three years, the median total number of citations was 35. (IQR: 20 to 67). The correlation coefficient between AAS and three-year total citations was 0.42 ($p < 0.001$). A sensitivity analysis in which the journal with an online-only format was excluded (i.e., BMJ) did not affect the findings. The correlation coefficients for clinical trials, observational studies, and meta-analyses were 0.60, 0.31, and 0.50, respectively (all $p < 0.001$). $\log(\text{Altmetric score} + 1)$ was a significant predictor of $\log(\text{total three-year citations} + 1)$ in linear regression ($p < 0.001$). This study demonstrated that, among a sizeable number of full-length original cardiovascular research articles published in the most prestigious medical and cardiovascular journals, online attention as measured by AAS appeared to have a moderate correlation with three-year citation counts. When only clinical trials or meta-analyses were considered, the correlation was strong. The findings of this study indicated that the amount of online attention paid to a cardiovascular research article may be related to the number of citations.

3. Our journal's social media strategy

The majority of studies reviewed indicated that Twitter social media posts of journal articles, and in particular from the journals' Twitter account, associated with higher rates of journal article citations. Consequently, we devised a strategy for our new journal American Heart Journal Plus with a focus on social media posts for each article from our journal's own Twitter account. We also developed a multidisciplinary social media team to help establish the presence of our new journal on social media, with the ultimate goal of achieving high journal article citations.

3.1. Multidisciplinary social media influencers

Our SoMe team of influencers is reflective of the composition of our journal's Editorial Board. We engage multiple individuals who are physicians, trainees, advanced practice providers, and scientists in cardiovascular diseases with an interdisciplinary approach. All of these individuals together help advance the journal's SoMe efforts. Primarily, we tag these individuals in our journal tweets to facilitate collaborative commenting and retweeting. Our Editorial Board includes an Associate Editor for Social Media (or Social Media Editor), working with our Editor-in-Chief and Social Media Manager. Our Social Media Manager also functions as our team's "citizen scientist." We recognize that our journal's SoMe posts are permanently available for review by the worldwide community of health care professionals and patients. Our patients, advocates, and citizen scientists can contribute at all stages of medical education and research development, including dissemination of research articles on SoMe.

3.2. Science direct social media facilitation

Articles for a myriad of journals can benefit from the social media functionality enabled by the Science Direct website platform. With a simple click to share the Science Direct journal article, the article link and title are instantly provided in a draft social media post for Twitter, Facebook, or LinkedIn. Our journal utilizes this convenient feature in our efficient social media strategy. We also encourage all our readers and especially our published manuscript authors to use this functionality to help disseminate journal articles.

3.3. Social media posts

Twitter is the most commonly used SoMe platform for the dissemination of cardiovascular journal articles. Twitter, therefore, hosts most of our journal social media efforts. In our Twitter posts from the newly created Journal Twitter handle @AHJPlus, we use the novel hashtag #AHJPlus to encourage its use by our followers, readers, and authors (Fig. 1). We also include the popular Twitter Cardiology hashtag #CardioTwitter. Additionally, we tag @ScienceDirect, several of our Editorial Board members who are active on Twitter, and various SoMe influencers. We disseminate tweets that introduce the title and link of each of our new journal articles, usually with a figure from the article and mention of relevant hashtags and Twitter handles. We invite all of our manuscript authors to provide draft tweets and their author(s) and institution Twitter handles. We schedule tweets for optimal times daily when a new issue is published.

4. Discussion

Cardiovascular journals have begun to establish a collective presence on SoMe, in particular on Twitter. A SoMe approach focused on Twitter marketing appears to associate with greater online exposure and citations for cardiovascular medicine studies, based on results from ESC Journals, JMIR, JACC, Mayo Clinic Proceedings, and Royal Society Open Science. Social media posts on Twitter disseminating information about new journal articles may lead to increased access and download of articles, resulting in higher rates of journal article citations, which may in turn influence journal impact factor (Fig. 2). Like other cardiovascular journals, our new cardiology journal is well positioned to influence medical education and research direction via SoMe. Our open access model may allow for even greater access and downloads of articles without the limitation of needing an individual or institutional subscription. As virtual learning becomes more commonplace in the digital era, facilitated by SoMe, it will become standard practice for journal impact factors to be influenced by the propagation of journal article data on SoMe. Several studies were reviewed here, indicating the utility of sharing journal article information on SoMe, associated with higher article views, downloads, or citation rates [1–6].

It is important to note that not every study of the relationship between tweets of journal articles and citation of journal articles confirms a beneficial trend. If no effect on citations is noted after tweeting journal articles [7,8] (or indirect measures such as page views [9]), several considerations may account for the ineffectiveness. These considerations include journal impact factor, various aspects of tweet content and presentation, the timing used for social media posts, and the SoMe account baseline activity and engagement. Additionally, as is typical with any study, small sample size may be a limitation. Journals with higher impact factors may have baseline higher rates of journal article access, download, and citation, thereby limiting the potential for significant increases in citation rates for articles that are tweeted [6,10]. Typically, a high-impact tweet will include novel compelling information, a short link to the source of the information, a video or photo illustrating the data, and mention of hashtags and Twitter handles that are influential in propagating the new information (Fig. 3). If a link is not provided, individuals may not go searching for the article. If a link is too long, this limits the number of characters remaining to describe the novel compelling information. If a video or photo is not included, this decreases the visual appeal of the tweet and the nature of the compelling evidence. If commonly used hashtags are not included, then the tweet will not show up in an organized fashion when Twitter users are searching for new data on the topic. If individuals who are SoMe influencers are not tagged in the tweet, they will not have the opportunity to help share the information with their thousands of engaged followers. The times at which tweets are posted can also be impactful. Twitter users typically have high volume engagement at specific times of the day and week, such as early morning while commuting or just before clinic or rounding at the hospital, mid-day during a short break, or in the evening during commute or while decompressing after the workday. Experimenting with days and times of the week that may best fit the anticipated audience for the SoMe posts can be useful. It should be noted that an original or retweeted SoMe post does not guarantee that the Twitter user has downloaded or plans to cite the tweeted article. A SoMe post or retweet may sometimes indicate extrinsic factors such as professional

relationships or connections with the author of either the article or the original tweet, which may especially be the case when tweeting or retweeting outside of one's primary specialty. Finally, the nature of the engaged followership of journal SoMe accounts can also make a difference in the impact of the SoMe post.

Knowledge gaps that can be addressed to advance our understanding of the nature of the relationships among journal article SoMe posts, downloads, and citations include the following:

- Improve our opportunity to determine causality between online attention scores and subsequent citations in academic journal articles.
- Develop comprehensive journal impact factors that incorporate both traditional and alternate modern SoMe metrics.
- Optimize studies to directly assess citations in addition to journal article access/downloads.
- Assess the extent to which the time between intervention and gathering of article view/download, citation, and Altmetrics data can make a difference; calculate the optimal time frame that should be adopted for future studies.
- Investigate whether there is a greater impact on citation rate if journal article is tweeted from Journal Twitter account versus the Twitter accounts of others on SoMe such as influencers unrelated to the specific journal.
- Evaluate how frequently SoMe posts are subsequently shared by general users or influencers after each journal tweets them.
- Research whether partnership with influencers increases the reach of SoMe posts and subsequent citation rates.
- Determine whether SoMe activity increases citations or instead reflects underlying attributes of journal articles that could also or alternatively predict citations.
- Study whether tweeting of journal articles influence medical education and research direction.
- Further illuminate reasons for some studies finding no effect of SoMe dissemination of journal articles on article views, downloads, or citations.

Addressing these knowledge gaps will help us better understand the nature of the relationships among journal article SoMe posts, downloads, and citations.

The field of medicine has been profoundly impacted by improvements in digital trends and technology over the last decade, with faster delivery of and access to information [11]. CV medicine, in particular, has undergone substantial technological advancements; and practitioners of CV medicine have become adept at using digital platforms and SoMe. SoMe and other digital platforms will continue to serve as critical instruments for communication, education, and information delivery in these unusual times of the COVID-19 pandemic and beyond. Thus, the use of SoMe will continue to transform and elucidate the role of

CV journals in enhancing virtual learning and influencing medical education and research. Nevertheless, additional research is required to continue to decipher and quantify the mechanisms by which SoMe can enhance the impact of published cardiovascular research.

Funding

No funding was applicable to this work.

References

- [1]. Ladeiras-Lopes R, Baciú L, Grapsa J, Sohaib A, Vidal-Perez R, Böhm A, et al. , Social media in cardiovascular medicine: a contemporary review, *Eur. Heart J. Digit. Health.* 1 (1) (2020) 10–19.
- [2]. Ladeiras-Lopes R, Clarke S, Vidal-Perez R, Alexander M, Lüscher TF, Twitter promotion predicts citation rates of cardiovascular articles: a preliminary analysis from the ESC journals randomized study, *Eur. Heart J.* 41 (34) (2020) 3222–3225. [PubMed: 32306033]
- [3]. Eysenbach G, Can tweets predict citations? Metrics of social impact based on twitter and correlation with traditional metrics of scientific impact, *J. Med. Internet Res.* 13 (4) (2011), e123. [PubMed: 22173204]
- [4]. Parwani P, Martin GP, Mohamed MO, Hajeer A, Nwaokoro M, Narang A, et al. , Relationship of altmetric attention score to overall citations and downloads for papers published in JACC, *J. Am. Coll. Cardiol.* 76 (6) (2020) 757–759. [PubMed: 32762911]
- [5]. Widmer RJ, Mandrekar J, Ward A, Aase LA, Lanier WL, Timimi FK, et al. , Effect of promotion via social media on access of articles in an academic medical journal: a randomized controlled trial, *Acad. Med.* 94 (10) (2019) 1546–1553. [PubMed: 31149923]
- [6]. Finch T, O’Hanlon N, Dudley SP, Tweeting birds: online mentions predict future citations in ornithology, *R. Soc. Open Sci.* 4 (11) (2017), 171371. [PubMed: 29291121]
- [7]. Tonia T, Van Oyen H, Berger A, Schindler C, Kunzli N, If I tweet will you cite later? Follow-up on the effect of social media exposure on article downloads and citations, *Int. J. Public Health*65 (2020) 1797–1802. [PubMed: 33159529]
- [8]. Tonia T, Van Oven H, Berger A, Schindler C, Kunzli N, If I tweet will you cite? The effect of social media exposure of articles on downloads and citations, *Int. J. Public Health*61 (2016) 513–520. [PubMed: 27193574]
- [9]. Fox CS, Bonaca MA, Ryan JJ, Massaro JM, Barry K, Loscalzo J, A randomized trial of social media from circulation, *Circulation*131 (1) (2015) 28–33. [PubMed: 25406308]
- [10]. Barakat AF, Nimri N, Shokr M, Mahtta D, Mansoor H, Mojadidi MK, et al. , Correlation of altmetric attention score with article citations in cardiovascular research, *J. Am. Coll. Cardiol.* 72 (8) (2018) 952–953. [PubMed: 30115234]
- [11]. Senapati A, Khan N, Chebroly LB, Impact of social media and virtual learning on cardiology during the COVID-19 pandemic era and beyond, *Methodist Debakey Cardiovasc. J.* 16 (3) (2020) e1–e7.



Fig. 1.
New Journal Twitter handle and hashtag.



Fig. 2.
High-impact tweet may facilitate high journal impact factor via high citation rate.

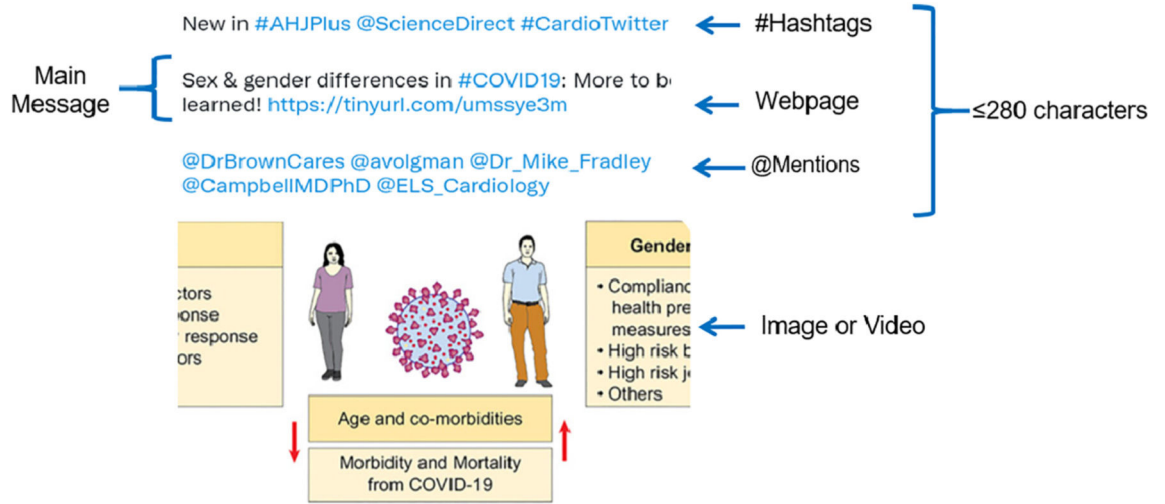


Fig. 3.
The Anatomy of a social media post on Twitter.

Table 1

Association of journal article social media activity with journal article views, downloads, or citations.

Journal(s)	Reference	Type of study	Number of articles	Article publication timeframe	Intervention	Lead time ^a	Article access/views	Article download	Article Citations	Association with citation rate
ESC Journals	[1]	Observational	Not reported	November 2017–February 2018	Initiation of @ESC_Journals Twitter Account	4 months	Increased	Increased	Not reported	Not reported
ESC Journals	[2]	Randomized control trial	536	January 2018–December 2018	Journal article Twitter Social Media Posts	6 months	Not reported	Not reported	Increased by 1.43 times	Altmetric score; number of journal tweeters
JMIR	[3]	Observational	55	March 2009–February 2010	Journal article Twitter Social Media Posts	15–30 months	Not reported	Not reported	Increased by 11 times	Tweeting article; time
JACC	[4]	Cohort	>770	January 2016–December 2017	Journal article Twitter Social Media Posts	1 year	Increased	Increased	Increased by 0.208 (log-transformed)	Altmetric score; Tweeting article
MCP	[5]	Randomized control trial	68	October 2015–December 2015	Journal article Twitter, LinkedIn, Facebook Posts	60 days	Increased by 5 times	Increased by 5 times	Not reported	Not reported
RSOS	[6]	Observational	878	January 2014–December 2014	Journal article Twitter Social Media Posts	2 years	Not reported	Not reported	Increased by 1.12 times	Tweeting article; Altmetric score
IJPH	[7]	Observational	130	December 2012–December 2014	Journal article Social Media Posts	4 years	Not reported	No effect	No effect	None
Circulation	[9]	Randomized control trial	243	September 2013–August 2014	Journal article Twitter and Facebook Posts	30 days	No effect	No effect	Not reported	Not reported
8 Top CV Journals ^b	[10]	Observational	939	January 2014–December 2014	Journal article Social Media Posts	3 years	Not reported	Not reported	Increased by 0.024 (log-transformed)	Altmetric score

^aTime between intervention and gathering of article view/download, citation, and Altmetrics data.

^bSeveral top cardiology journals in aggregate. CV = cardiovascular; ESC = European Society of Cardiology; IJPH = International Journal of Public Health; JACC = Journal of the American College of Cardiology; JMIR = Journal of Medical Internet Research; MCP = Mayo Clinic Proceedings; RSOS = Royal Society Open Science.