

## REVIEW ARTICLE

# Social Media Use in Cardiovascular Imaging

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**Abstract:** Social Media is a rising influence in the global world of cardiovascular medicine, allowing for a dynamic approach to physician education, research dissemination and collaborative discussion. The visual nature of social media platforms, particularly Twitter, lends itself particularly well to the tremendous advances and stunning visuals of cardiac imaging. The hashtag “#cardiotwitter” provides around the clock, asynchronous, ubiquitous, free education. It allows connection among cardiac imagers across the world to share ideas and discuss contemporary issues pertaining to multimodality imaging. This review highlights the role of social media in advancing the practice of cardiac imaging and provides guidance on gaining visibility in the social media imaging community.

**Keywords:** Twitter, social media, cardiotwitter, facebook, cardiac imaging, #whyCMR, #echofirst, #YesCCT.

## 1. INTRODUCTION

In recent years, the use of social media has become ubiquitous amongst cardiovascular (CV) professionals [1]. This is mostly due to the advent of smartphones that has made social media (SoMe) available widely across the world. The visual nature of social media platforms lends themselves particularly well to the visually stunning advances in cardiac imaging. The CV imaging landscape on Twitter ranges from multimodality imaging case based discussions, debates of the clinical application of latest ground breaking CV imaging research, and reflections on current issues pertaining to multimodality imaging.

The purpose of this paper is to: 1. Introduce the basics of social media(#SoMe) and its intersection with the field of cardiac imaging. 2. Define the role of social media in advancing the practice of cardiac imaging. 3. Describe ways to engage on social media and provide perspectives on social media best practices for cardiac imagers.

## 2. BASICS OF SOCIAL MEDIA

The different social media (SoMe) websites offer a variety of tools for communication among their users. For example, Facebook (FB) supports comprehensive personal blogging and networking tools with audio or video as needed. Twitter is a microblogging tool in which users have a 280

character limit for publishing messages, although images and videos are supported. Instagram is a pictorial blog which has been used to share fascinating cardiovascular images [2]. In recent years, Twitter has become the most popular platform within the cardiovascular (CV) community. This is due to the concise nature of microblogging and the ability to share specific content among Twitter account holders around the world using a “hashtag”. The network of CV professionals on Twitter is known as #cardiotwitter. A message on twitter can be combined with a photo, a video or a poll. Each account has a name beginning with the “@” symbol which is also known as a ‘handle’ (Fig. 1). A Twitter account can communicate with other accounts by tagging their handle into a tweet. Tweets from any public account can be amplified by a sharing mechanism called a retweet (RT). “Engagement” is the term used to describe the number of interactions users have with the posted content, mainly with likes and RT. “Reach” is the term describing the total number of users who can see the content while “digital impression” reflects the total number of times the content is displayed. A Social Media “Influencer” is a SoMe user who has established credibility in their area of expertise. Influencers typically have acquired a large number of followers and thus have a large audience to share and spread ideas with.

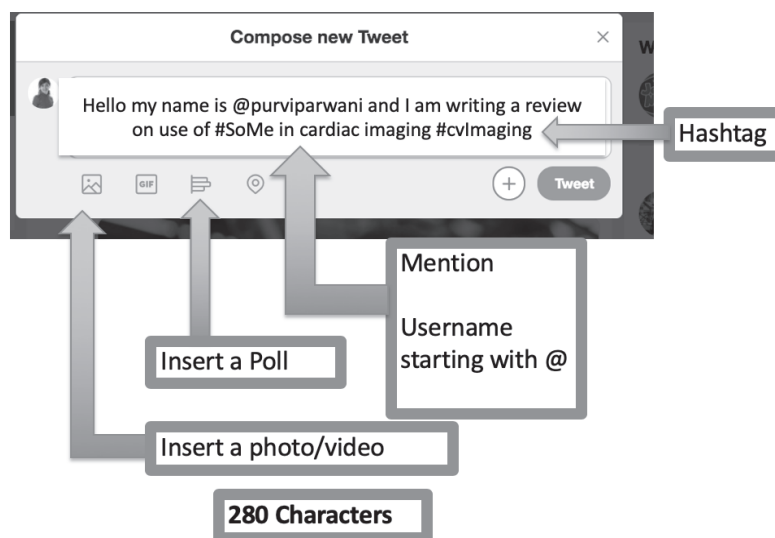
## 3. IMAGING HASHTAGS

The hashtag is a metadata tag used on twitter that allows the user to find tweets associated with specific content. A hashtag in Twitter is designated by the use of the number/pound sign in front of a word, or phrase without spaces.

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# Anatomy of a Tweet



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**Fig. (1).** Anatomy of a tweet: figure explaining the essential part of a tweet. (A higher resolution / colour version of this figure is available in the electronic copy of the article).

The CV community on Twitter has introduced and popularized many subspecialty hashtags in order to make content related to a particular subspecialty searchable. In general, the community hashtag for CV science and CV professionals is #cardiotwitter. Widely used cardiac imaging hashtags for imaging subspecialties are #echofirst, #YesCCT, #whyCMR, and #CVnuc. The hashtag #echofirst was the first widely used imaging subspecialty hashtag and was introduced by echo enthusiasts on twitter by a universal poll system in November 2017 [3]. The hashtag signifies the important early role that echocardiography plays in the CV diagnostic ladder. Similarly, the hashtag for cardiac magnetic resonance (CMR) imaging is #whyCMR (registered on 8/11/2018), which describes the utility of CMR in various CV pathologies. The hashtag for coronary computed tomography (CT) angiography #YesCCT (registered on 7/20/2018) reflects the growing role of ECG gated CT technology to diagnose CV pathology. The newest imaging hashtags are #nucards and #CVnuc. #CVImaging has been also used widely to tag any content related to cardiovascular imaging. #ACCIImaging is the hashtag created by American College of Cardiology that is also broadly used for any content pertaining to CV imaging on Twitter.

Fig. (2) shows the global reach of #cardiotwitter in addition to the content and impressions generated by each hashtag since their registration and the top 10 CV imaging hashtag influencers on #cardiotwitter.

## 4. THE UTILITY OF SOCIAL MEDIA IN CARDIAC IMAGING (FIG. 3)

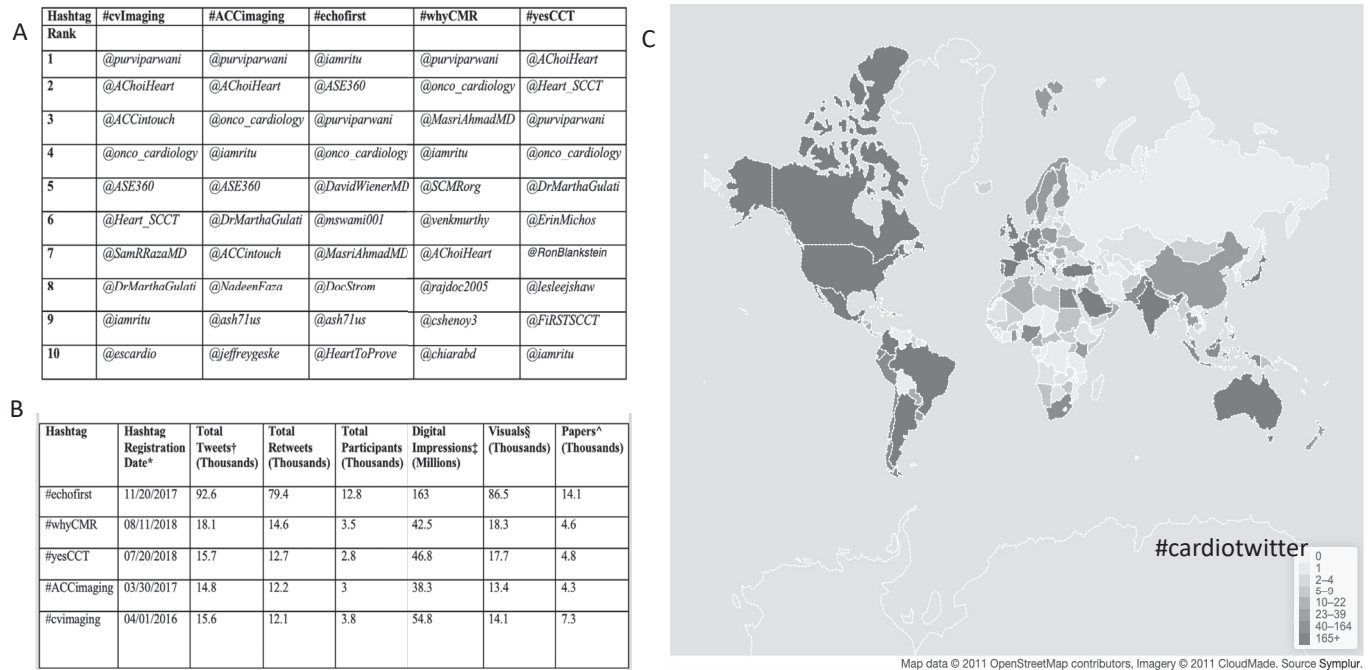
### 4.1. Advancing Clinical Cardiac Imaging Practice

Traditionally, the advancement of cardiac imaging practice has been predicated upon the ongoing incorporation of imaging cases with clinical follow-up within one's practice,

a perusal of the literature and occasional contact with colleagues at other institutions. While there is sparse data on the efficacy of social media in building knowledge compared to the traditional methods, the growing influence of social media on medical education is undeniably growing [4]. Free CV imaging content is now widely available on #cardiotwitter and searchable by imaging hashtags. Digital media sharing on social media facilitates *ad hoc* case-based discussions. Interestingly, unusual and challenging multimodality cases can be readily tweeted (and retweeted) worldwide, resulting in what is probably the largest online collection of cardiovascular images. Engaging a vast community of cardiovascular imaging specialists with niche interests, from #echofirst, to #whyCMR creates an opportunity to crowdsource approaches to difficult scenarios in which evidence to guide clinical decision-making may be unclear. Attentive SoMe educators practicing CV imaging discuss the indication, appropriate use criteria and imaging techniques while also providing educational resources in the form of latest literature, research articles, and guidelines documents. Such asynchronous free communications without any boundaries facilitate advancement of imaging practices globally. The discussions between the imagers are often filled with modality-specific technical pearls on how to obtain the most optimal image quality. Diversity of the practice landscape of the #CVImaging community allows for valuable information exchange regarding imaging practices among the CV imagers on an international scale. Such perspective permits evidence-based medicine, quality improvement and brings together a community of like-minded individuals to solve commonly faced issues in the imaging arena.

### 4.2. Multimodality Cardiac Imaging

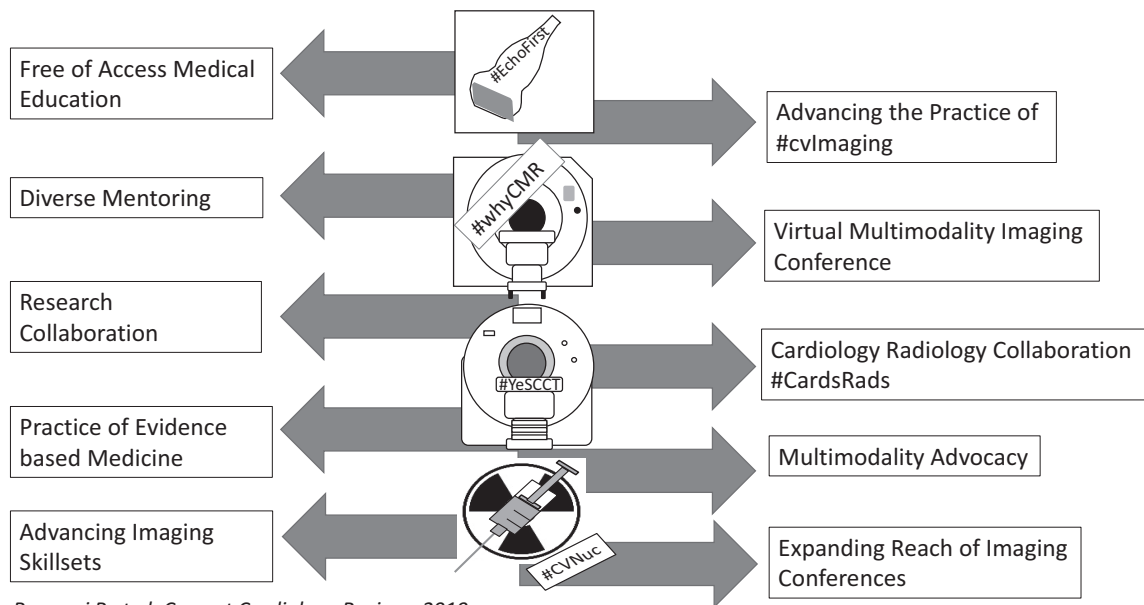
As imaging silos transition to a multimodality cardiac imaging (MMCI) paradigm, broad-based imaging training is



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**Fig. (2).** **A**) Top ten influencers of commonly used cardiac imaging hashtags. **B**) Tweet Activity Trends of commonly used cardiac imaging hashtags. **C**) Global Reach of Social Media by country of users of the hashtag #Cardiotwitter and Tweet Activity Trends of commonly used cardiac imaging hashtags. An analysis of tweets, participants, and digital impressions of the most widely-used cardiology hashtags. \*Registration date reflects the date the hashtag was registered with symplur.com. Individual hashtag data is from the registration date to access on August 8th 2019. †The total number of unique tweets since the hashtag was registered on symplur.com. ‡Impressions are computed by taking the number of times an account has tweeted multiplied by the account’s number of followers repeated for all accounts, then finally summed up. §The total number of times each photo, GIF, or video was shared. ^The total number of papers or links/URLs shared. Data from Symplur signals. (A higher resolution / colour version of this figure is available in the electronic copy of the article).

### Use of Social Media (#SoMe) in Cardiac Imaging



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\*Imaging symbol graphic credit: Dr.Juan Lopez Mattei.

**Fig. (3).** Use of social media in cardiac imaging. (A higher resolution / colour version of this figure is available in the electronic copy of the article).

increasingly prevalent. This is due to rapidly evolving and exciting imaging technologies and an increase in prognostic data supporting the role of various imaging modalities. This has led to the rise in the number of jobs requesting expertise in more than one imaging modality [5, 6]. The era of multi-modality cardiac imaging has truly arrived, and this is reflected on social media through the ubiquitous use of #echofirst, #YesCCT, #whyCMR, and #CVNuc, which have collectively generated millions of digital impressions (Fig. 2). The virtual discussions on #SoMe, serve as virtual multimodality imaging conferences and rapidly disseminate the educational workflows for given clinical or disease presentations and allow for collective interpretation by a variety of imaging experts. The digital environment provides access to social networks for sharing experiences and promoting healthcare advocacy [7, 8]. CV imagers have discussed topics such as multi-society collaborations, limitations of RVU system for MMCI, changing training paradigms, board exam overload, and more. Twitter has provided a forum for open discussion for challenging topics such as the coexistence of cardiac imagers with radiologists. These topics can be discussed with candor and the conversation archived using social media hashtags such as #cardsrads [9]. It is feasible that social media movements will allow for the momentum and critical mass needed to affect change for what have traditionally been small and isolated communities.

#### 4.3. Research

The use of SoMe overcomes the current limitations in the dissemination of CV research and provides new opportunities via networking with other CV imagers across the globe. For a busy clinician, it is often difficult to read several cardiac imaging related journals to stay abreast of the most current literature. Those from outside the United States or Europe may have limited access to major medical journals. In a survey of cardiovascular physicians, 64% cited learning about new studies as a reason for utilizing Twitter [10]. The constant news feed enables the busy clinician to stay up-to-date with the latest studies and practice guidelines. Layers of information, from headlines to links to primary data and in-depth commentary are instantly accessible. Poignant insights have greater reach than ever and can spread rapidly. This is illustrated by the worldwide heated debates that occurred in the wake of clinical trials such as ORBITA and SCOT-HEART [11-13].

Social media also helps the #CVImager promote their science. A recent, randomized controlled trial studying the effects of research article promotion from the *Mayo Clinic Proceedings* via social media showed that articles promoted on Twitter, Facebook, and LinkedIn demonstrated significantly higher website access (1,070 vs. 265 median downloads,  $p < 0.001$ ) and full-text article downloads (1,042 vs. 142,  $p < 0.001$ ) compared to those which were not promoted [14]. The impact of social media on the ascertainment of publication value is a novel concept. Traditional journal metrics, such as citation score, do not assess the readership and immediate online impact of the article. The Altmetric attention score, on the other hand, measures the online attention an article receives in the form of social media mentions, news stories and blog appearances [15]. The Altmetric atten-

tion score has also been associated weakly with the citation count [16].

One of the challenges of CV research is the inability to apply the results to the clinical patient population. Social media has been shown to bridge this disconnect [17]. A major advantage of research article dissemination *via* social media as compared to traditional platforms is the ability to draw upon global expertise and instantly further the discussions on the trial design, clinical relevance, and related previous literature. Such interactions between the researchers and clinicians indeed provide an opportunity to vet and generate more impactful hypotheses.

#### 4.4. Career Advancement

While some cardiologists have chosen careers in academic or well-known private hospitals that allow for exposure and growth, others are often performing equally important or cutting edge work in smaller or less recognized centers. For the latter group, it is often a struggle to remain involved in imaging societies and research. With the exposure provided by social media, individuals can present themselves in accordance with their career goals. This includes a demonstration of high-quality images, clinical conundrums, research, and commentary on other presented work. #SoMe led twitter research collaborations are well known in 2019 (for example the author group for this article itself). Although still being evaluated, the new concept of Social Media Scholarship has emerged as a potential avenue for academic promotions. The model of a #SoMe portfolio includes participation in scholarly activity, display of impactful social media promotion as well as a high altmetric score on #SoMe [18, 19]. Such a portfolio in the future may be considered as a part of the submission for consideration of academic promotion.

For fellows in training, a strong social media presence can lead to participation and leadership opportunities within societies, national committees and increased employment opportunities.

#### 4.5. Mentoring

Mentorship is especially critical for the career growth of both fellows in training and early career cardiologists. Meaningful mentorship in one's chosen area of interest is not always possible to find this at one's institution of training or employment. Unfortunately, it is not uncommon for a career path to be driven by what is available rather than by true interest. Social media helps in bringing people together, and the global community available on twitter easily allows access to mentors in any field of interest, including multiple, simultaneous mentors for various clinical or research interests within CV imaging.

#### 4.6. Increasing Engagement on CV Imaging Posts

Social media has several specific uses that are valuable in the realm of cardiac imaging. Delivering an educational message on SoMe is a work of art. A well-curated image or video can rapidly convey learning pearls. As they say, a picture is worth a thousand words.

#### 4.7. Images

Social media provides a forum for teaching. Well-curated case images are good for demonstrating a clinical concept as a single image or as a multi-panel image series. Static images are also good for providing single slides on difficult concepts.

#### 5. VIDEOS / CASES

Given that much of cardiac imaging involves dynamic images, improvements in video technology and compression have made short video clips excellent teaching tools. Historically the process of creating a video to upload and share was a laborious process. After the creation of a video, issues of interoperability abounded with different computers using differing file formats. Additionally, the large file size of the videos made them prohibitively difficult to widely share. Due to rapid technological advancements, social media platforms now allow for a streamlined uploading and simplified viewing experience for those without a technical background. This ease of use is what has driven much of the rich media now easily available in the social media medical sphere. An interesting pathology seen on an echocardiogram or in the cath lab can easily be captured on a smartphone video to be shared. In addition to case images, the improvements in digital video sharing also facilitate novel educational techniques in the form of live interviews, short didactic videos, and “live-streams,” of major meeting keynote presentations. This allows a level of engagement and participation in major medical conferences that is unprecedented.

#### 6. TWEETORIALS

Social media limitations have also driven innovative teaching methods. On Twitter, due to the character limits imposed upon each post, learning points must be distilled into more efficient high yield pearls. Twitter offers a way to string together multiple Tweets to allow for a more in-depth discussion with additional media to educate. However, given the format, the creation of an effective and concise “Twee-torial” still requires careful crafting by the author. Tweetorials can be posted in their entirety upon completion. They can also be Tweeted out more slowly with intermittent surveys to gauge the engagement and understanding of the audience, in essence creating an interactive mini-lecture.

#### 7. JOURNAL ARTICLE / JOURNAL CLUB

Social media has changed how we interact with traditional scientific journals. Often times print journal fall by the wayside, with little more time spent than to scan the titles for an interesting article that one wishes to digest at a more leisurely pace, during non-existent free time. Social media helps individuals to quickly understand the main learning points of an article. For authors, social media provides exposure of the article to a larger audience who may be more enticed to read the entire article. Most CV journals have an online presence and have used the medium of SoMe to promote the published research. Major cardiovascular societies are now also using social media for a unique spin on an older scientific tradition, the Journal Club. This allows interesting literature to be interactively discussed by a global audience.

In this setting, even trainees and junior faculty may have an opportunity to ask questions from the authors of the article and discuss the clinical implications with other leaders in the field.

### 8. BEST PRACTICES

#### 8.1. Privacy

One of the greatest quagmires of posting on social media in the world of social media is learning and respecting the bounds of privacy of the patients who may be involved in the imaging that is posted. The posting of cases is of tremendous learning value in that it leverages the network effect of the knowledge and experience of world experts, however, it is critical to remember that one is dealing with patient data which is governed by a complex set of legal as well as philosophical issues of patient privacy.

The Health Information Portability and Accountability Act of 1996 or HIPAA for short, implemented a broad set of rules and changes to our health care system [1]. One far-reaching provision of this law was the institution of a stringent set of standards for the protection of patient privacy by the imposition of steep penalties for the disclosure of individually identifiable health information. Since that time, social media has become ingrained in our society, with an exponential increase in the spread of information. In this setting, and given the durability of internet posts, the implications of HIPAA are more important than ever.

Beyond HIPAA, however, institutions have many varying policies on the handling of social media. Compliance with HIPAA is the minimum bar, but individual institutions may be much more strict, as what appears compliant in the judgment of an individual may inadvertently disclose the identity of a patient with a rare condition, a unique set of circumstances, or simply with a temporal relationship to the posting. These accidental disclosures can lead to patient trauma and individual job termination [20, 21].

Additional philosophical and ethical implications arise around the positing of patient information. Historically such information was published in print journals with a limited audience and long publication lead times, which improved the confidentiality of patient information. Indeed, prior to the modern age of clinical trials, case reports were the mainstay of medical literature. Today, with improved imaging and more rapid dissemination of information and an era of increasing patient sophistication of privacy issues, more traditional journals are beginning to require patient waivers prior to publication of case reports. With social media, the spread of information is even more rapid and the risk of inadvertent disclosure of patient information is magnified.

Keeping these principles in mind, it is of the utmost importance to remember that each post of any imaging data can lead to personal and professional disaster. Any post should comply not only with HIPAA law, but also individual institutional policy as well as personal ethical standards. It is therefore advisable, to avoid posting images that provide too much “shock factor,” as that may lead to increased scrutiny. Furthermore, one can pause before posting on any case to ensure that there is no potential for an image to have poten-

tial or inadvertent disclosure of patient information. This may be aided by avoiding contemporaneous posting, and adding a variable “lead time,” as that will aid in patient anonymity. Finally, it is important to ensure that each post is viewed from the perspective of the patient. Imaging data can be exquisitely private and personal, and keep in mind how you would personally feel if your information was posted publically. When in doubt, seek patient permission.

## 8.2. Trolls

### 8.2.1. Critical Appraisal vs. Trolling

While posting in an online forum, the rules of civility matter more than ever. While it may be fashionable for some individuals to play the contrarian, it is important to remember that all posts on social media will live in perpetuity. Thus, not only a previous controversial post later be used against you, the reputation you build online can spread widely and may impact future collaborative and employment opportunities. This is not to say that the controversy of ideas and differences of opinion should not be expressed. One of the wonderful opportunities of social media is in the exchange and deliberation of differing ideas. However, there is a difference between the respectful critical appraisal and what has become colloquially known as “Trolling.” While the exact definition of being an Internet Troll is a little ethereal, the principle generally revolves around posting negative opinions solely for the purpose of eliciting a negative reaction, posting provocative postings to create disruption and controversy, and certainly, those that participate in *ad hominem* attacks are particularly egregious offenders.

## 8.3. Plagiarism

As with any publication format, plagiarism whether intentional or otherwise should be avoided. This is particularly true for cardiac imaging where interesting images and videos shared by the physician on social media can be stored by anyone on social media. In some respects, the existence of the “retweet” option is helpful as it allows for the sharing of an idea while giving credit to the original poster.

## 8.4. Blind Retweet

While retweeting is an effective way of spreading ideas, one should be cautious of performing a blind retweet. This act could be construed as support of the topic at hand, and one should consider the content and purpose of why a post is being shared with your followers.

## 8.5. Shotgun Tweets

A technique that is used by some of the social media users is to perform a “shotgun tweet.” This is a technique used where the poster tags a high number of individuals with a large base of followers. This is often done in hopes of driving up the popularity of a post either through the mention itself or the hope of a retweet of the topic by a prolific social media personality. In general, while this can be appropriate on a rare occasion, the overuse of this technique is frowned upon. Most tags of individuals on a social media posting are best utilized when the subject matter is specifically relevant or of interest to the individual being tagged.

## 8.6. Consolidated Tweets

At conferences there tends to be a frenzy of social media postings. This is a great service provided by conference attendees so that individuals not present may follow along with the interesting content being presented. However, the rapid posting of individual slides is generally less effective than the consolidation of the highest yield slides into 1-2 higher quality posts with summarized learning points.

## CONCLUSION

In summary, social media and #Cardiotwitter have transformed the field of #CVimaging. Cardiovascular imagers can utilize social media to their advantage, by advancing the practice of imaging modalities through keeping up to date on the latest research and evidence base in the field of cardiac imaging, learning from rare but fascinating multimodality imaging cases on social media, collaborating with researchers and CVimagers around the world and being visible in the #SoMe imaging space. It is important to realize that social media acts as a mirror for the virtual identity of a physician, hence one needs to act wisely and responsibly to have their best face forward in the virtual professional world.

## LIST OF ABBREVIATIONS

CV	=	Cardiovascular
FB	=	Facebook
SoMe	=	Social Media

## DISCLOSURES

The views expressed in this publication are those of the author(s) and not necessarily those of the NHS, the National Institute for Health Research or the Department of Health and Social Care.

## CONSENT FOR PUBLICATION

Not applicable.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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