

Sharing is caring: an analysis of #FOAMed Twitter posts during the COVID-19 pandemic

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ABSTRACT

Purpose Free Open Access Medical Education (FOAMed) is a worldwide social media movement designed to accelerate and democratise the sharing of medical knowledge. This study sought to investigate the content shared through FOAMed during the emerging COVID-19 pandemic.

Study design Tweets containing the #FOAMed hashtag posted during a 24-hour period in April 2020 were studied. Included tweets were analysed using the Wiig knowledge management cycle framework (building knowledge, holding knowledge, pooling knowledge and using knowledge).

Results 1379 tweets contained the #FOAMed hashtag, of which 265 met the inclusion criteria and were included in the analysis. Included tweets were posted from 208 distinct users, originated from each world continent and were in five different languages. Three overarching themes were identified: (1) signposting and appraising evidence and guidelines; (2) sharing specialist and technical advice; and (3) personal and social engagement. Among 12 subthemes within these groupings, 11 aligned to one of the four dimensions of the Wiig knowledge management cycle framework, and the other focused on building and managing social networks. Almost 40% of tweets related directly to COVID-19.

Conclusion #FOAMed tweets during the COVID-19 pandemic included a broad range of resources, advice and support. Despite the geographical, language and disciplinary variation of contributing users and the lack of organisational structure uniting them, this social media medical community has been able to construct, share and use emerging technical knowledge through a time of extraordinary challenge and uncertainty for the global medical community.

BACKGROUND

Doctors' use of social media has garnered much attention, with a focus both on potential negative outcomes, such as breaches of professionalism¹ and patient confidentiality,² as well as a recognition of the possible benefits it can have on professional development³ and developing relationships.⁴ In particular, there has been interest in knowledge sharing on social media to improve medical education and training, although the quality of studies in this field to date has been variable.⁵

Although scholarship and learning through social media as a method for medical education is relatively novel, there is an extensive body of empirical and theoretical research that has conceptualised how learning communities generate and share

knowledge in the field of medicine. Social learning theories have emphasised the importance of communities and relationships in constructing and sharing medical knowledge, including 'knowledge-building communities',⁶ and operating as 'communities of practice'.^{7,8}

Among social media platforms that have been widely adopted for professional education, Twitter has been particularly popular within the field of medical education.⁹ The Free Open Access Medical Education (FOAMed), sometimes abbreviated to FOAM, was developed as a social media movement in 2012 and was initially focused on the areas of emergency medicine and critical care, especially across Australia, Western Europe and North America.¹⁰ As the name suggests, the ethos of FOAMed is about sharing medical knowledge in an accessible and egalitarian way, and it centres on materials and resources that are free to use. As with other hashtag movements, participants tag their posts and activity with #FOAMed, allowing for sharing and interacting through posting tweets. Users that share resources are often also the creators, while others are signposting to knowledge and materials.¹¹

Given that the FOAMed movement has a primary focus on improving knowledge use by medical professionals, it can be conceptualised as a knowledge management system, in that it facilitates the creation, sharing and storage of knowledge.¹² Technology has been crucial in removing the boundaries to communication and knowledge flows and an important enabler of knowledge management.¹³ Although much of the scholarship on knowledge management comes from the management literature and therefore focuses on organisations, social theorists have posited that people share knowledge by contributing to others commensurate with the contributions that they perceive are being made by others to them.¹⁴ The complexity of #FOAMed movement as a knowledge management system arises from the fact that individual contributors from around the world share a common professional identity rather than a clear organisational structure. It has been suggested though that, rather than organisational motivations, those engaged in such knowledge sharing believe that the action will be reciprocated at some future time, although the exact time and nature of the reciprocal act are unknown and unimportant.¹⁵

Social media research has identified the benefits of using knowledge management models to understand how information is shared and curated.^{16–18} Karl Wiig is widely considered a pioneer in this field, and his knowledge management cycle framework¹⁹



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conceptualises how knowledge is built and used with four distinct stages—(1) *build knowledge*; (2) *hold knowledge*; (3) *pool knowledge*; and (4) *use knowledge*—and has been widely used to understand how to share and transfer good practice, the intended aim of the FOAMed movement. To date, research on FOAMed has tended to focus on communities with no existing studies using a knowledge management lens. We hypothesised that given that 8 years have passed since FOAMed was first established to share medical knowledge, it may now be operating as an advanced knowledge management system.

The COVID-19 pandemic has caused unparalleled ill health and disruption to human life around the world, and it has been claimed that FOAMed has the potential to ‘equip health care workers worldwide with the knowledge to combat the pandemic’.²⁰ Given the significant global impact of the COVID-19 pandemic, it represents a unique opportunity to investigate, in a detailed way, the nature and content of information shared in this movement through Twitter. In particular, by exploring the extent to which its content aligns with the knowledge management theory, it offers an opportunity to examine whether or not it operates as an established knowledge management system. This study sought to answer the following question: *What types of information and advice were shared on Twitter using #FOAMed during the COVID-19 pandemic, and what does this reveal about knowledge management among medical professionals on social media during times of global crisis in healthcare?*

METHODS

We used the Symplur healthcare analytics tool²¹ to generate a graph of tweet activity using the #FOAMed hashtag for a 30-day period during the peak of the COVID-19 pandemic (in April–May 2020). The number of daily tweets during that time ranged between 1024 and 1707. A single 24-hour episode through this period (28/29 April) with a mid-ranging number of tweets (1379) was selected in order to provide a cross section of tweet content, and an indepth search was performed to gather all tweets posted in this period. These tweets were exported in transcript form. Tweets that did not meet the inclusion criteria (highlighted in figure 1) were excluded. This sorting allowed for the removal of duplicate material, known as ‘retweets’.

Included tweets were coded using a data extraction template in Microsoft Excel, which was used to record the individual or institutional account posting the tweet, the country of origin of the account and the verbatim text of the tweet. Information about Twitter user accounts was collected using a combination of online biographies, user names and links to websites, in order to establish the professional backgrounds of contributors. Locations of tweets were determined according to the country listed in the biography of the user in order to establish the geographical spread of those posting, where this was available. Tweets posted in languages other than English were translated to English using web-based translation software (Google Translate) prior to analysis. A thematic analysis was used to explore and categorise all included tweets, with a focus on how the content of tweets related to knowledge management. Initial analysis of the data was used to build a coding framework, and two authors (MAR and SWLY) then undertook independent analysis of all data.

In order to demonstrate how tweet content related to an established knowledge management framework, the subthemes generated by our analysis were in turn analysed according to the four dimensions of the Wiig knowledge management cycle framework described earlier. Two authors (AR and WLSY)

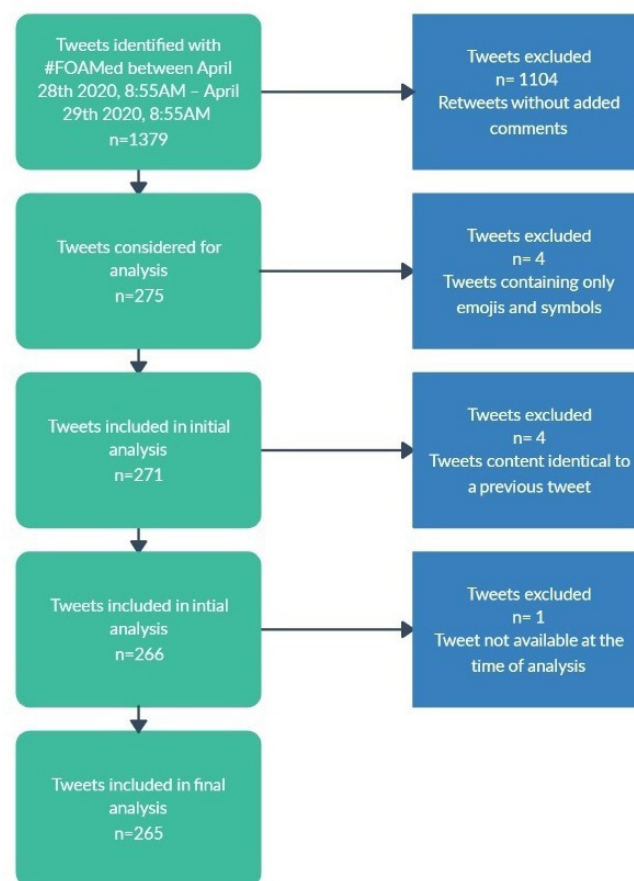


Figure 1 Summary of included tweets. FOAMed, Free Open Access Medical Education.

independently reviewed the tweets to ensure the framework captured the breadth of topics covered in the tweets. Final codings were agreed by all authors and consensus meetings were used to resolve areas of disagreement. Given the inherent brevity of tweets, they typically included a single message, so authors were able to agree on a single subtheme for each individual post.

RESULTS

Between 28 April 2020 (08:55 GMT (Greenwich mean time)) and 29 April 2020 (08:55 GMT), a total of 1379 tweets were posted using #FOAMed. Of these, 1113 were excluded following screening against the inclusion criteria and 265 unique #FOAMed tweets were included in the qualitative analysis, as shown in figure 1. This high number of exclusions indicates that a high proportion of #FOAMed tweets are content reshared from others—‘retweets’. Of the tweets 58 (21.9%) were posted by emergency and critical care medicine doctors, 69 (26.0%) by doctors in other specialties and medical students, 49 (18.5%) by other individual accounts including non-medical clinicians and scientists, and the remaining 89 (33.6%) were by organisation accounts including medical journals and medical education companies. Figure 2 shows the range of different countries of origin of posting users, recognising that the locations of 17 user accounts were not available. Of the 266 included tweets 25 were originally posted in non-English languages (Arabic, French, German and Spanish).

Three overarching themes were identified: (1) signposting and appraising evidence and guidelines; (2) sharing specialist and technical advice; and (3) personal and social engagement.

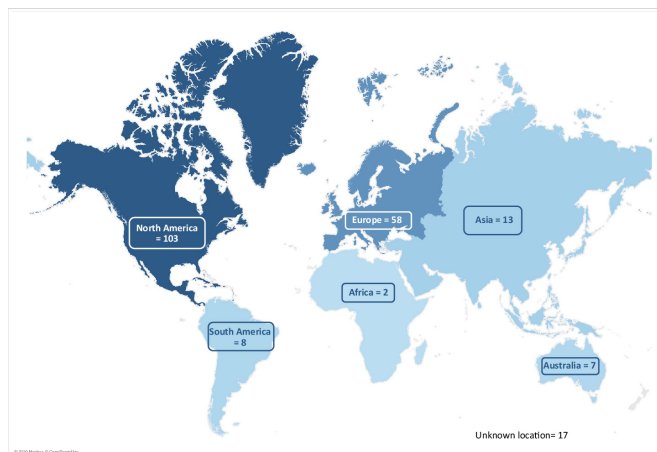


Figure 2 Geographical distribution of contributing Twitter users.

As shown in [table 1](#) and [figure 3](#), each of these themes contains a number of subthemes. [Figure 3](#) also demonstrates that across these 12 subthemes, all four dimensions of the Wiig knowledge management cycle feature, indicating the content of these posts spans the full spectrum of knowledge management functions. Of the tweets 105 (39.5%) related to COVID-19, and each of the 12 themes included tweets with both COVID-19 related and

non-related content. Descriptions of each theme are provided in the following sections.

Signposting and appraising evidence and guidelines

Tweets focused on this theme related to the sharing of, and commentary on, emerging medical evidence and guidelines. A number of tweets shared clinical guidance, which varied widely in topic area, from atopic dermatitis to urinary tract infection, to cardiopulmonary resuscitation. Notably, a subset of tweets shared specific COVID-19 guidance, particularly related to the optimal process of using personal protective equipment. Other tweets in this theme related to highlighting novel evidence, which was typically clinical research relevant to emergency care, and again included a diverse range of clinical topic areas. COVID-19-related research papers were in areas as diverse as paediatrics, mask-wearing and ethical decision making. A final group of tweets in this theme represented expert commentary and included a widely shared thread on COVID-19 in children by a paediatric infectious diseases expert, which generated much discussion and debate.

Sharing specialist and technical advice

Tweets in this theme related to specialist and technical advice for medical students, trainees and practising physicians. One group of included tweets were seeking advice, including both specific topics such as anticoagulation in COVID-19, as well as more

Table 1 Included themes, subthemes and indicative example tweets

Theme	Subtheme	Example tweet
Signposting and appraising evidence and guidance	Sharing guidance	'Important info from @PICSociety - we see more #Kawasaki disease here in Australia than I saw in the U.K., but important considerations for us in the #COVID_19 era #FOAMed #FOAMPed https://t.co/vT3KHT7A5v
	Highlighting novel evidence	'Droplets Spread More than 2 Meters (A Systematic Review) via @First10EM #FOAMed #COVID19 #COVID19FOAM There is no such thing as the "2 meter rule" https://t.co/dtpv1Xs8fN
	Providing expert commentary	'We can no longer say there's a lack of evidence, but there's some signal that we should stop using DOACs as off-label indication for LV thrombus despite some case reports of success, warfarin is the way to go for these patients #cardiotwitter #thombus'.
Sharing specialist and technical advice	Seeking advice	'Any Pre hospital system using Fascia iliaca block for fractures? What is your experience? #FOAMed'.
	Interpreting investigations	'Clues that this is hyperK over STEMI: - Tall, peaked T waves in V5/V6 - Absent P waves (K from 7 to 9 typically progresses with PR prolongation to P wave disappearance) - Wide QRS - Beginning of sine wavy-ness is precordial leads Anything else? #MedTwitter #MedStudentTwitter'.
	Imparting specialist advice	'Great list! I've also been using reverse Trendelenburg position (briefly) in some folks on cpap who had acute desats and it seemed to help their sats recover (probably not a great long term idea though)'.
	Sharing clinical cases	'Older patient. Severe abdominal pain. BP low/tachy. Resident states has pulsatile mass-ruptured AAA. POCUS obviously-Midpigastic TRV. See thread. #POCUS #FOAMed #FOAMus #FOAMcc #MedEd #Medtwitter @medpedshosp @gropmed @NephroP @cianmcdermott https://t.co/vVJ9SDyxEv
	Bookmarking written resources	'Wiki For Doctors: Check out PR Bleeding https://t.co/Hc2K8Einjr ' #TipsForNewDocs #FOAMed #FY1 #JuniorDoctor #NHS #MedEd #MedicalEducation #FY1'.
	Bookmarking audio-visual resources	'Morning walk with this guy and a good podcast by @thecurbsiders. God is good. Kidney Transplant for the Internist #FOAMed #Meded #MedTwitter #internalmedicine https://t.co/qxh54Jnx8l
Personal and social engagement	Marketing products and services	'Noninvasive Ventilation MasterClass plus full course library available free to hospitals/healthcare leaders treating #COVID19 pts. Overview https://t.co/P24cvtKwh5 Registration https://t.co/CVslQyN3DI #FOAMed #foamcovid #MedEd #Covid_19 #healthcare #AAMC @AmerMedicalAssn'.
	Offering well-being advice	'#SwitchingOff For a productive day and night: Don't check emails (or social media) first thing in the morning. Don't check emails (or social media) last thing at night. #Foam4GPs #Foamed #MentalHealth https://t.co/bp3U1AdesB
	Building social networks	'Welcome new followers, we look forward to sharing #hypermobility and #EhlersDanlos syndromes info and tips with you #EDS #HSD #hEDS #Fibro #Fibromyalgia #POTS #MCAS #MedEd #FOAMed #doctors #nurses #genetics #MedTwitter #rheumatology #zebras #pain #CVID'.

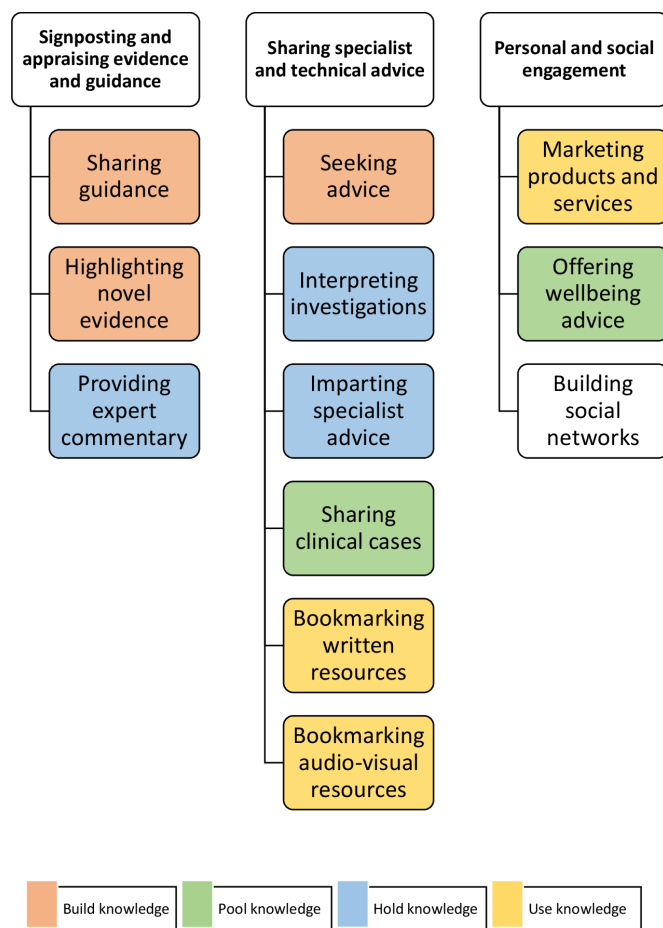


Figure 3 Included subthemes arranged by Wiig knowledge management cycle framework dimensions.

generic requests about professional networks and resources. Another group related to interpreting investigations and included radiology tests as well as ECGs. A significant subset of these focused on point of care ultrasound ('POCUS'), including its potential use in COVID-19. Other tweets in this theme related to imparting specialist knowledge and included specific advice of note for those in particular fields, such as pharmacology in renal ischaemic injury and optimal ventilator settings for patients with COVID-19. A further group of tweets shared clinical cases, ranging from scrotal swelling to traumatic brain injury, and including a number of COVID-19 case studies. Finally, tweets in this theme bookmarked learning resources, including written resources such as blogs, and audio-visual resources including podcasts, webinars and videos. A number of topic areas were covered in these resources, including mental health, surgery, topics covered in the US Medical Licensing Examination, as well as a variety of aspects of COVID-19, including oxygen therapy, domestic violence and clinician resilience.

Personal and social engagement

The final theme related to tweets that sought to engage in an individual and social way. A noteworthy group of tweets sought to recommend and advertise educational products and services. These tweets were almost exclusively from organisation user accounts, and included journals, conferences, exam preparation resources and registration for online courses. Notably, some of the links posted in these tweets led to paid-for content. Another group of tweets offered well-being advice and included mental

health and social advice, both in general and specifically relating to the additional pressures posed by COVID-19. A final group of tweets in this theme welcomed and thanked other users, shared jokes and memes, provided advice on online bullying, and teasingly mocked particular medical specialty areas, such as radiology and urology. A number of the resources or tweets being referred to in these tweets related to COVID-19, although no tweets specifically included jokes about it.

As demonstrated in figure 3, 11 of the 12 subthemes aligned with one of the Wiig knowledge management cycle framework dimensions, and each of the four dimensions had two or more subthemes linked to it. The single subtheme that did not align with the framework related to the building of social networks, perhaps as a phenomenon widely understood by those in the field as facilitator of social learning.

DISCUSSION

This study analysed the content of Twitter posts shared using #FOAMed and revealed the way in which some elements of this movement operated as an established knowledge management system during the early part of the COVID-19 pandemic in April 2020. The volume and range of advice and resources shared, including content directly related to the COVID-19 pandemic, as well as a variety of other medical topic areas, are notable. Tweets shared using #FOAMed covered all aspects of the Wiig knowledge management cycle, indicating the breadth and maturity of the user community. Given that contributing users were from a variety of different disciplinary backgrounds and from countries all around the world, the sophisticated and coherent demonstration of knowledge management identified in this study is striking.

In an article written by the founders of the FOAMed movement, they highlight that although its focus is on sharing tools and resources, it is also 'an ethos and an exciting global movement'.²² The findings of this study confirm this by demonstrating a clear sense of network and purpose to the tweets shared. Indeed, the close alignment of these tweets to the knowledge management cycle, which has been used to improve productivity in organisations, suggests the movement has far exceeded this aim by providing an efficient and advanced platform for constructing, sharing and using medical knowledge. A study analysing trends in #FOAMed between 2002 and 2013 found a rapid rise in blogs and podcasts as resources for sharing information, which were the most common resources bookmarked in this study, suggesting this trend has continued in subsequent years since.²³ The particular benefits of international networking have previously been recognised in the context of #FOAMed,²⁴ and the diversity of geographical locations of users and languages of tweets in this study reaffirms this.

The interaction of doctors online is a topic of considerable interest in the field of medical education. In a previous study examining the sharing of advice for new doctors on Twitter using #tipsfornewdocs, we found, much like in this study, a wide breadth of content and styles of tweets, including in the areas of camaraderie and humour.²⁵ Indeed, humour,²⁶ and in particular cynical or 'black' humour,²⁷ has widely been noted as a feature of healthcare education and practice. Our finding that Twitter can be used to create and maintain personal and professional medical networks has also been previously noted, and such groups have been referred to as 'Twibes'.²⁸

COVID-19 has had a dramatic impact on healthcare and health professions education, and educators have sought to quickly adapt their approaches in order to meet changing demands

caused by the pandemic.²⁹ Emerging scholarship from this period has demonstrated that social media, and in particular Twitter, has enormous potential to help support knowledge exchange and education delivery during this period of disruption for teachers³⁰ and learners.³¹ Moreover, many of the COVID-19 subject areas in this study, such as clinician well-being,³² the uncertainty about the impact on children,³³ the debate around optimal ventilator support approaches³⁴ and the controversy about the evidence supporting mask-wearing for the public,³⁵ have been widely covered in the emerging medical literature on the pandemic. However, this study showed that despite the vast global consequences of COVID-19, the medical community continued to share advice and information in many other areas, reflecting that, unlike many other sectors, healthcare and health professions education continued to remain active despite global lockdowns.

The strengths of this study include its organised approach to identifying and analysing tweets, the theoretical lens applied, the translation and inclusion of non-English-language tweets, and the independent categorisation by two medically qualified reviewers. Although the sampling window was relatively narrow, it was selected during the peak of the pandemic, and the analysis of the 14-day period before and after it demonstrated that it was broadly representative in terms of volume of activity on the hashtag. While this window meant the overall sample of tweets was relatively small, it did mean that an indepth analysis of posts was possible. A further limitation relates to the fact that some potential contributors may have been excluded if they misspelled #FOAMed, or used a linked alternative hashtag, such as #FOAM.

The indepth thematic analysis of social media posts is an evolving methodology in the field of medical education and could be used in future studies to examine a wide array of research questions, which may become more pressing if the disruption to face-to-face medical education continues due to the COVID-19 pandemic. Given the finding in this research, consistent with previous studies, that humour and camaraderie are important elements of healthcare education on Twitter, this warrants more detailed examination and may focus in a more detailed way on key medical users who consistently portray a comedic Twitter persona. A surprising finding of this study was that despite the FOAMed movement being inherently about accessibility and transparency, it is being used for social media marketing, including sometimes for commercial, paid-for resources. Given the relatively small number of posts this applied to in this study, it was not possible to analyse in detail, but is worthy of further study.

This study helps medical educators to recognise the wide variety of opportunities that arise from the FOAMed movement for engaged contributors, with a diverse pool of content ranging in relevance from early-years medical students through to practising specialist doctors. The alignment of the content with an established framework for knowledge management suggests the FOAMed online community operates in a cohesive and sophisticated way to construct, share and use various types of medical knowledge. This study also demonstrates that COVID-19 has been a significant part of the content of this movement while not dominating it completely. The fact that COVID-19-related tweets featured across all subthemes and knowledge management cycle dimensions suggests that FOAMed has been a comprehensive source of information and support for healthcare practitioners and learners during the pandemic.

CONCLUSION

This study demonstrates that tweets posted using #FOAMed during the COVID-19 pandemic were posted by a variety of

medical and non-medical users from around the world and included a broad range of resources, advice and support. Despite the geographical, language and disciplinary variation of contributing users and the lack of organisational structure uniting them, some elements of the FOAMed movement nonetheless operated as a mature and sophisticated knowledge management system. This study demonstrates that as well as offering community and well-being support, social media medical communities are well placed to construct and share emerging technical knowledge through a time of extraordinary challenge and uncertainty for the global medical community.

Main messages

- ▶ Approximately 40% of Free Open Access Medical Education (FOAMed) posts during the peak of the COVID-19 pandemic related to various aspects of its epidemiology, diagnosis and management.
- ▶ A significant majority of posts shared using #FOAMed on Twitter related to the sharing of medical knowledge and a smaller subset related to networking.
- ▶ The types of medical knowledge shared using FOAMed during the COVID-19 pandemic aligned with an established knowledge management framework, suggesting a cohesive and resourceful participating community.

What is already known on the subject

- ▶ Social media is widely used by doctors, both for networking and sharing medical knowledge.
- ▶ FOAMed is a global movement that is designed to democratise the sharing of free medical resources.
- ▶ The COVID-19 pandemic has created a need for rapid sharing of medical knowledge on a global scale.

Twitter Mohammed Ahmed Rashid @Dr_A_Rashid and Deborah Gill @doctordeborah

Contributors MAR conceived the study and applied for ethics approval. SWLY and AR extracted data and conducted initial analysis. All authors contributed to subsequent analyses. MAR drafted the paper and SWLY, DG and ZA made important contributions and approved the final version. MAR is the guarantor.

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Patient consent for publication Not required.

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