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The Social Media Revolution in Nephrology Education



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The past decade has been marked by the increasing use of social media platforms, often on mobile devices. In the nephrology community, this has resulted in the organic and continued growth of individuals interested in using these platforms for education and professional development. Here, we review several social media educational resources used in nephrology education and tools including Twitter, videos, blogs, and visual abstracts. We will also review how these tools are used together in the form of games (NephMadness), online journal clubs (NephJC), interactive learning (GlomCon), and digital mentorship (Nephrology Social Media Collective [NSMC] Internship) to build unique educational experiences that are available globally 24 hours per day. Throughout this discussion, we focus on specific examples of free open-access medical education (FOAMed) tools that provide education and professional growth at minimal or no cost to the user. In addition, we discuss inclusion of FOAMed resource development in the promotion and tenure process, along with potential pitfalls and future directions.

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KEYWORDS: education; graphical abstract; nephrology; social media; Twitter

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Smartphones and tablets have achieved unprecedented penetration around the globe. Nearly 65% of adults worldwide have access to a smartphone, and this ubiquity is disrupting long-held assumptions in every field and industry.¹ In medicine, the smartphone is flattening the educational hierarchy in unprecedented ways, allowing learners, practitioners, and experts to exchange questions, comments, and knowledge with minimal friction.

The term “Web 2.0” dates from the early 2000s and refers to how Internet content is now being generated.² This change emphasized user-generated content, multi-directional communication, and efforts to display content on multiple platforms (e.g., desktop and mobile). The primary Web 2.0 product in medicine is free open-access medical education (FOAMed).³ FOAMed takes many different forms including audio (podcasts), video

(YouTube), discussions (Twitter), essays (blog posts), and live sharing of conferences (Table 1). The exchange of information and ease of accessibility around the world allows for live collaboration that is changing health care education.

Twenty years ago, one had paper textbooks and articles, and a few online resources that were usually behind a paywall. It would take weeks to get the full text of a journal article.⁴ Now, a student posts a question to Twitter, “Why does hypomagnesemia cause hypokalemia?” and within minutes the student gets a variety of answers. Some will be pithy summaries that fit inside a tweet. Others will be links to the primary literature or perhaps a video or descriptive blog post.

Health care professionals at all levels are seeking out medical education in various online formats.⁵ The past decade has seen broader growth and availability of Internet access, and this has been paralleled by enhanced and more readily available online content. Thus, students are finding alternative resources online (Table 1 details several examples of nephrology FOAMed) and are sharing them with classmates through social media. Medical students often prefer to

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Table 1. Examples of FOAMed in nephrology

Type of FOAMed	Characteristics/highlights	Examples
Twitter	Microblogging, 2-way, real time, videos, links to primary material	@NephJC #AskRenal
Facebook	Intermediate length, 2-way, real time, videos links to primary material, possibility of closed patient-centered group forums	Renal Fellow Network NephJC ISN Education ASN AJKD
Blogs	Long form, permanent, comments	See Table 2
Visual abstracts	Visual, sharable, viral, simple	See Appendix.
Video	Allows traditional lectures to be consumed at will, explains complex topics with visuals and animation	WashUPath John Roberts Pencasts ISN Education Nephrology On-Demand
Journal clubs	Two-way conversation with experts, broadcasts state-of-the-art information, publicizes new developments	Selected Journal Clubs #NephJC, nephrology #RheumJC, rheumatology #PNAJJC, pediatric nephrology #UroJC, urology #GenMedJC, internal medicine #JHMChat, hospital medicine #PathJC, pathology
Live tweeting at conferences	Engages the audience as participants rather than passive listeners, broad dissemination of conferences that may be expensive	#KidneyWk #AHA2017 #WCN2017 #NKFClinicals
Online games	Engages people new to social media; combines blogs, Twitter, visual abstracts, gamification	NephMadness
Interactive live learning	Brings expertise located globally to a larger audience, allows discussion of complex or rare cases with a broad scope of minds	GlomCon
Online communities	Closed discussion area; experts readily available for quick reply	ASN Communities AST Communities of Practice
Digital mentorship	Provides teaching, mentorship, professionalism on the use of social media in medicine to people who do not have local mentors with expertise	NSMC Internship

ASN, American Society of Nephrology; AST, American Society of Transplantation; FOAMed, free open-access medical education; GlomCon, Glomerular Disease Study and Trial Consortium; ISN, International Society of Nephrology; NephJC, Nephrology Journal Club; NSMC, Nephrology Social Media Collective; WashUPath, Washington University in St Louis Nephrology Web Episode Series; #AHA2017, 2017 American Heart Association Scientific Sessions; #KidneyWk, ASN Kidney Week; #NKFClinicals, NKF Spring Clinical Meeting; #WCN2017, 2017 World Congress of Nephrology.

stream live lectures online in a location of their choice. In addition, medical residents and fellows are using FOAMed resources.^{3,6,7} Clinicians are expanding their network and using online resources to keep up to date with current data.⁸ There has also been an unparalleled shift to reading journal articles online rather than using the paper format.⁹ Furthermore, the growth and use of FOAMed for learning has the potential to increase the validity of content and depth of knowledge for dissemination on a global scale.¹⁰

The fuel for FOAMed is a network of engaged and knowledgeable people willing to educate others. A network of educators contribute to FOAMed by explaining concepts, answering questions, or creating lasting content in a variety of formats. Other members of the community serve as curators: organizing content and directing people to the right answers. According to Metcalfe's Law, the value of a network grows exponentially with the size of the network.¹¹ In the past few years, the network of nephrology educators has also grown large enough to be a viable mechanism for learners and clinicians to discuss specialized nephrology questions and to complement traditional educational channels. The global network of participants continues

to grow and allows free exchange of medical information for rapid dissemination.¹² In this review, we will discuss evolving nephrology FOAMed tools that are useful for online education in nephrology ([Table 1](#)), along with their potential impact on the community.

FOAMed Platforms and Tools

Twitter

Twitter is a microblogging platform where users are able to post short bits of content, usually a sentence or two, with links or pictures. These posts are called tweets ([Figure 1](#)). Anyone who subscribes (called a follower) to the user will see the posts of the author. Likewise, the user will see any posts from the accounts that they follow. Unlike Facebook, there is no mutuality to the relationship, and asymmetry is common. For example, some people will subscribe to many people and be followed by few; conversely others will have many times more people who follow them than they themselves follow. Twitter is the primary platform where medical professionals exchange, comment, and discuss medical education. Just about all other social media resources (video, blogs, online conference

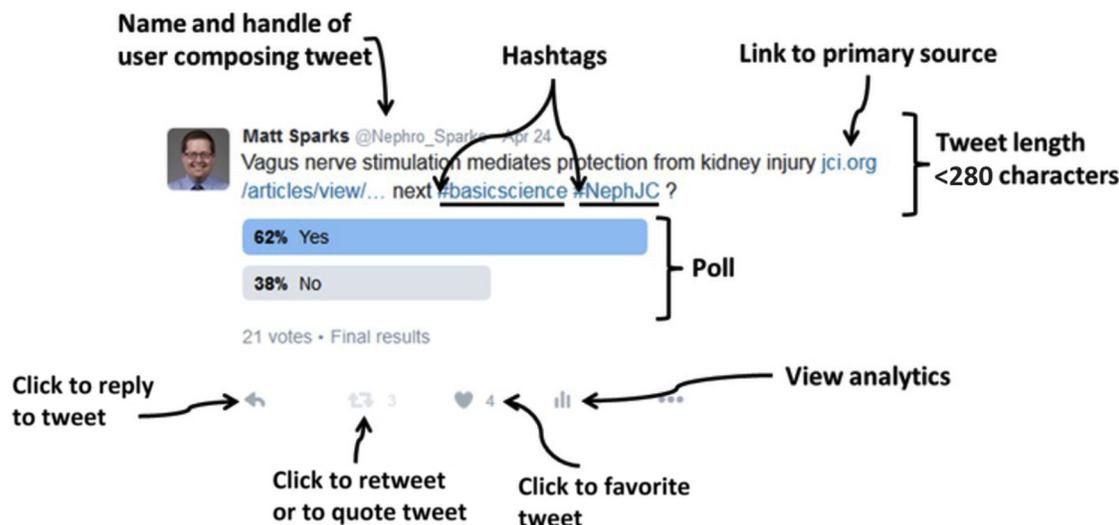


Figure 1. Examples of different components of a tweet.

coverage) will use Twitter to promote, discuss, and embellish the primary content.

Tweets often contain hashtags to aid categorization (Figure 1). For example, the hashtag #MedEd is used to mark tweets about medical education and #NephPearls marks tweets that contains tidbits of information about nephrology. One can follow a hashtag by clicking on it or searching for it. This allows the user to see all of the tweets with that hashtag without regard to whether or not the user subscribes to the author. At the same time, all of the other tweets from people whom the user follows that do not contain the hashtag are filtered out. In that way, hashtags narrow the focus while broadening the number of authors. Hashtags are essential for using Twitter to discuss a paper (see Online journal clubs) or to provide a channel to discuss a conference (see Conferences/live sharing).

One critical aspect of Twitter is its conversational nature. Because tweets are short, Twitter is conducive to rapid, almost real-time communication, simulating an in-person conversation. This is especially important when discussions occur between learners and experts. These in fact are the basis for a digital form of mentorship.

Most of the scholarship on the use of Twitter in medical education has so far been descriptive in nature. Most outcomes focus on satisfaction and participation rather than objective achievement.¹³ An exception to that rule examined directed use of Twitter in a neuroanatomy class. In this example, students were told to use a specific hashtag. The investigators in this study were unable to find a correlation with Twitter participation and examination scores. However, Twitter was identified by students as aiding their engagement with the class.¹⁴

In another example, an internal medicine residency program surveyed attitudes toward social media of their

residents and then implemented a residency Twitter feed. They tweeted pearls from conferences, links to articles, and other medical information. In a follow-up survey, the proportion of residents using Twitter as a source of medical information had increased from 9% to 54%. The benefit was generalizable, and the students used the tool to get medical information applicable to their patients. This suggests that Twitter may be an effective tool for sharing medical information.¹⁵

In another experiment in using Twitter for education, the Ohio State University Emergency Department added a Twitter and Facebook feed to their 10-month ultrasound course. The feed added a tweet every day that tracked the curriculum of the in-person course. Feedback was positive, with over 80% of participants finding the information useful and leading to 60% of participants seeking out other medical education Twitter feeds. Similar to the internal medicine experience, most of the users were new to using Twitter for medical education.¹⁶ Repeatedly, we see specific educational content bring new users to Twitter. These users were motivated to add additional educational content to their Twitter feed. Posting medical education content on Twitter acts as a positive feedback loop whereby more content leads to additional users. This feedback leads to an audience that both consumes and generates *de novo* content, and increases the medical content and potential value of Twitter.

Several medical journals have used Twitter to publicize new articles in an attempt to promote readership. The effectiveness of these endeavors is unclear. In 2 studies by Fox *et al.*, no effect was seen.^{17,18} Eysenbach found that Twitter mentions corresponded with future citations,¹⁹ although this has not been replicated by subsequent studies.²⁰ Others have found increased readership of an article when Twitter is used for

amplification.^{21–23} The disparity of the findings suggests that the key role of Twitter may lie in building an effective network of educators and learners in a specific field of medicine. The manner of sharing articles may also matter, for example, with an accompanying visual abstract (see section below).

Visual Abstracts

Images and graphics are more engaging on social media than text alone.²⁴ A visual abstract, also known as a graphical abstract, is a graphical summary of a research study in the same way that a traditional abstract is a text summary of a research study. Visual abstracts are well suited to social media, as they leverage the human ability to rapidly process visual data, thus allowing users to quickly “preview” a manuscript to see if it is relevant to them.²⁵ Visual abstracts are now being created and distributed by multiple journals and may be promoted in social media and in print form along with traditional text abstracts.

Andrew Ibrahim, the creator of the visual abstract concept as outlined above, wrote and distributes an open-access primer on visual abstracts. It includes information on the rationale for their use, examples of use, and a step-by-step instruction guide for creation.²⁶ Ibrahim argues that visual abstracts should focus on the results of a study. Nephrology visual abstracts have focused on the process of the study, with much of the slide “real estate” devoted to the cohort studied and the study design. It is likely that specialties will adopt and modify the visual abstract to fit the methods or outcomes that are most relevant to their field. This is an alternative way to engage readers with journal articles.

The *Annals of Surgery* was the first journal to use visual abstracts to disseminate research articles on social media. At the time of this manuscript writing, that number has grown to 50 journals and organizations using visual abstracts. Several nephrology journals have adopted visual abstracts, notably *Clinical Journal of the American Society of Nephrology*, *Journal of the American Society of Nephrology*, *American Journal of Nephrology*, and *American Journal of Kidney Diseases*. In addition, the online nephrology journal club NephJC and the International Society of Nephrology (ISN) Education Team are also creating visual abstracts and infographics.

The *Annals of Surgery* performed a randomized, cross-over, controlled trial to measure the effectiveness of visual abstracts to increase the reach of an article using Twitter. Articles with a visual abstract were promoted with a tweet that either did or did not contain a visual abstract. After 4 weeks (the washout period), the article was re-posted to Twitter but now with the visual abstract (for articles initially tweeted as text only) or as text only (for articles initially tweeted

with the visual abstract). The visual abstracts increased social sharing 8-fold and increased readership of the article by 3-fold.²⁷

Videos

Videos are becoming a popular medium to post medical education. These videos are published on a wide variety of platforms, with YouTube, Vimeo, and Periscope being the most popular.^{28–31} YouTube provides a license-free platform for content creators to publish and viewers to consume both on the mobile devices or desktop. One example of a successful video series is the Washington University in St Louis Nephrology Web Episode (WashUPath) series by Timothy Yau.³² In 2016, the American Society of Nephrology (ASN) awarded WashUPath an ASN Innovations in Kidney Education Contest award.

A typical WashUPath video has a nephrology fellow playing the role of nephropathologist as he or she interprets images from a kidney biopsy. An experienced nephropathologist guides the fellow through the histologic interpretation of light microscopy, immunofixation, and electron micrograph images. At the end, a diagnosis is rendered by the fellow, and a brief summary of the disease process is presented. Other episodes have included traditional lectures, board review, medical jeopardy, and a patient presentation discussing hemodialysis access issues. The videos are published monthly on YouTube, and subscribers are notified when new content is posted.

Another popular video series is from Armando Hasudungan. This author posts 10-minute videos covering all aspects of medicine and science.³³ Pencasts, made popular by Khan Academy,³⁴ are chalkboard-style teaching repackaged for video. John Roberts has created a series of pencasts published on Vimeo on core areas of nephrology aimed at medical students, residents, and fellows.³⁵ Nephrology On-Demand has used the same technique for nephrology education.³⁶ The ISN uses Periscope to live-stream conference proceedings (both oral and poster presentation) as well as to stream live lectures.³¹ Periscope allows live viewing as well as archived versions that can be watched at a later date. This learning from behind a screen can be accomplished at one’s own pace and reviewed an unlimited number of times. However, videos do not allow for a 2-way conversation to occur, like the traditional lecture format.

Online Communities

National and international medical societies are creating online communities that facilitate discussions of evidence-based medicine, opinion of experts on challenging medical questions, networking, and collaborations. For example, ASN has several communities

focusing on a specific clinical areas such as acute kidney injury, basic science research, women's health, supportive care, and onconeurology. The forum is open only to ASN members. Questions are posted by a community member, and any member can post answers or comments. Due to a robust participation and posting of article links, the online communities serve as another potential educational resource for health care professionals.

Interactive FOAMed Events

Online Journal Club

Ever since Dr. Paget's description from almost 2 centuries ago, journal clubs have served to disseminate recent advances in medicine, as well as to teach critical appraisal and systematic evaluation of the published literature.³⁷ Social media allows for conversation and discussion, and hence lends itself well to journal clubs. Outside the physical confines of academia, online journal clubs have proliferated in the past 3 years, and have also been catalogued by the National Institutes of Health PubMed Commons platform.³⁸ Specifically, with its emphasis on 2-way dialogue, Twitter has become the most common platform for hosting online journal clubs. Nephrology journal club (NephJC) is a Twitter-based online journal club, which, since its inception in April 2014, has hosted 89 journal club discussions to date (other online journal clubs of interest are listed in Table 1).

NephJC has several elements that should be highlighted.⁴ The article to be discussed is chosen by a selection committee, and a few days before the journal club, a summary of the article is posted on the NephJC website.³⁹ A newsletter is distributed to more than 1100 subscribers 2 days before the chat, which contains links to the article, the summary, and a visual abstract of the article. The actual journal club is a Twitter chat, and the hashtag #NephJC allows all interested individuals to follow along and to converse. A moderator guides the conversation. Authors, or invited experts, often join to provide additional insight and to answer questions. The open nature of Twitter also allows active participation of other specialties, trainees, other health care providers (e.g., nurses, dietitians), and patients. NephJC is held twice a month at 9 PM Eastern Standard Time, with a second session at 8 PM Greenwich Mean Time (and 12 noon Pacific Standard Time) to allow individuals in different time zones to actively participate. Using an online tool called Storify or Twitter Moments, a summary of the chat is curated that allows a quick review for those who missed the live discussion.⁴⁰ A summary of the chat with links to the Storify or Moments and summary blog post is added as a comment to the original article on PubMed

Commons. This allows readers of the article on PubMed to gain access to the NephJC discussion.⁴¹

Conferences/Live Sharing

Historically, live sharing of conference material has been difficult. Now, with the advent of blogging and Twitter, sharing of knowledge from a medical conference is simple. Blogging has become a popular way to share scientific information at nephrology meetings.⁴² Clinician-bloggers share important points of each meeting with their audience and help disseminate the most recent concepts and paradigms in nephrology. This process was initially started by personal academic blogs such as Precious Bodily Fluids⁴³ and Nephron Power,⁴⁴ but quickly expanded to medical journals such as the *American Journal of Kidney Diseases* blog and nephrology societies themselves (Table 2 contains nephrology-related blogs). Short, teaching-oriented blog entries were posted on topics presented at conferences to share with fellows and clinicians who could not attend. The types of entries that appear on these sites may depend on the interest of the blogger, and certain topics might be ignored. Live sharing of content at academic conferences has become the new norm, with conference participants tweeting summaries during a presentation using a common hashtag that is promoted by the conference. Academic societies such as the ASN and the ISN have facilitated sharing of information at conferences by providing a hashtag, Wi-Fi, and by updating their photography and sharing policies that encourage online conversation.⁴⁵

Online Games

NephMadness is an online educational game that premiered in 2013 and is modeled on the National Collegiate Athletic Association (NCAA) College Basketball yearly tournament widely known as March Madness.^{46,47} Originally 64, now 32 topics are chosen each year to "compete" head-to-head in a single elimination tournament with winners chosen by a Blue Ribbon Panel of nephrology experts. This Blue Ribbon Panel judges the matchups based on a particular topic's actual or potential ability to affect the lives of patients with kidney disease. Topics are presented in cohesive "Regions" such as the 2016 Pediatric Nephrology region; for example:

Typical Hemolytic Uremic Syndrome (HUS) versus. Atypical HUS; and

Imaging after Urinary Tract Infection (UTI) versus. Prophylactic Antibiotics after UTI.

Each topic has an accompanying blog post written to review the literature for that topic and to make the case for its importance. Those who feel strongly about a topic's significance contribute additional blog posts enriching the discussion. In addition to the longer-form

Table 2. Active nephrology education-related blogs and websites

Blog/website	Target	Author	Location
Renal Fellow Network	Residents, fellows, attendings	Various collaborators	http://renalfellow.org
NephJC	Residents, fellows, attendings	Various collaborators	http://nephjc.com
Nephron Power	Residents, fellows, attendings	Kenar Jhaveri, MD	http://nephronpower.com
Slow It Down CKD	Patients	Gail Rae-Garwood	http://gailraegarwood.wordpress.com
Dialysis from the sharp end of the needle	Patients	Bill Peckham	http://billpeckham.com
Home Dialysis Central	Patients	Various collaborators	http://homedialysis.org/news-and-research/blog
Precious Bodily Fluids	Residents, fellows, attendings	Joel Topf, MD	http://pbfluids.com
Demystifying Kidney Disease for the Average Joe	Patients	Veeraiash Chauhan, MD	http://kidneydoctorbradenton.org
Kidney Stones: Prevention And Treatment	Patients, residents, fellows, attendings	Fred Coe, MD, Elaine Worcester, MD, and Anna Zisman, MD	http://kidneystones.uchicago.edu/physicians/
Last Month in Nephrology	Residents, fellows, attendings	Tukaram Jamale, MD and Vaibhav Keskar, MD	http://lastmonthinnephrology.wordpress.com
History of Nephrology	Residents, fellows, attendings	Neil Turner, MD	http://historyofnephrology.blogspot.com
The Nephrologist	Patients, residents, fellows, attendings	Vanessa Grubbs, MD	http://thenephrologist.com/blog
UKidney	Residents, fellows, attendings	Jordan Weinstein, MD	http://ukidney.com
AJKD Blog	Residents, fellows, attendings	<i>American Journal of Kidney Diseases</i> social media team	http://www.ajkdblog.com
Ins and Outs	Residents, fellows, attendings	Brian Stotter, MD and Cathy Quinlan, MD	https://insandoutsblog.com/blog/
Leo Riella	Residents, fellows, attendings	Leo Riella, MD	http://leoriella.com/blog/
ISN Academy	Residents, fellows, attendings	ISN	https://www.theisn.org/education-external/isn-academy
Online Academy	Residents, fellows, attendings	Global Kidney Academy	http://www.gkaonlineacademy.com/

AJKD, American Journal of Kidney Diseases; CKD, chronic kidney disease; ISN, International Society of Nephrology.

blog posts, a robust discussion of each matchup ensues on Twitter, with participants extolling the virtues of each topic. People play NephMadness by predicting the outcomes of all 31 matchups. Players accrue points when their predictions match the results determined by the Blue Ribbon Panel.

NephMadness originated as a product of the *American Journal of Kidney Diseases* blog to create a social media campaign to showcase the advances in nephrology while also teaching about landmark moments and discoveries. The goal was to create an interactive social media campaign that was both engaging and educational. Participation has grown each year from 21 blog posts and 77 unique Twitter participants in the inaugural year to 33 blog posts and 782 unique Twitter users in 2017. A total of 32 fellowship programs participated in Nephmadness in 2017. This was facilitated by development of an introductory PowerPoint presentation about NephMadness and printable tournament brackets that were distributed free to fellowship programs. In addition to nephrology trainees, participants include nephrology attendings (both adult and pediatric), other attendings, residents, medical students, and patients.

Examples of using gamification in other specialties include an approach used by the general surgery residency program at the University of Connecticut.⁴⁸ Each morning, Monday through Friday, a question of the day was posted on Twitter. Residents were encouraged (by awarding gift cards) to participate via Twitter. Follow-up questions were generated to entice deeper learning. It was found that 100% of active

Twitter participants in their study engaged with academic reading more fully, and that this group also had increased in-training scores. However, only 25% of residents engaged with Twitter.

Interactive Live Video Learning

Nephropathology training is difficult to standardize across institutions because of differences in the availability of on-site nephropathology staff and services, as well as access to nephropathology conferences.⁴⁹ Online learning could enhance the knowledge and satisfaction of nephrology fellows, especially at programs that do not have a robust on-site nephropathology staff. The Glomerular Disease Study and Trial Consortium (GlomCon) is a recurrent Web-based nephropathology educational conference that won an ASN Innovations in Kidney Education Contest. In this biweekly moderated conference, a case is briefly presented by a nephrologist.⁵⁰ This is followed by a review of the pathology slides and case discussion. Participants are also allowed to ask questions and to give their opinions regarding the case.

In addition, a fellow-run, topic-based quiz session has been added to enhance the educational experience for fellows. Since its inception in July 2016, online conferences have seen a steady increase in worldwide participation. Currently, GlomCon includes more than 100 participants from more than 27 countries. A recent survey of 113 participants yielded 100% satisfaction with the conferences. In addition, 86% of participants noted that attendance had had an impact on their care, and 85% believed that their glomerular disease

knowledge improved. All survey respondents believed that the conferences improved the care of patients with glomerular kidney disease.

Online Mentorship

Although social media use by health care professionals continues to increase, formal educational programs focusing on this medium are rare. The NSMC internship, established in 2015, is a worldwide collaboration of nephrologists that aims to cultivate leaders in the use of social media in medicine by instilling knowledge, competence, and professionalism. All interns are invited to join the faculty after completing the internship.

The duration of NSMC internship is 1 year, running roughly from January through November. Interns are selected on the basis of their curriculum vitae and personal statement. All interns are required to have a Twitter account after joining the internship, because it is the primary medium of communication. There is an entrance discussion with each intern to discuss goals, followed by quarterly online meetings. Interns are paired with 2 faculty mentors; 1 is a senior mentor and the other a junior mentor. Interns spend 3 to 4 hours every month on internship-related activities. The curriculum for the internship is updated every year by the faculty. The current NSMC Internship curriculum is available online.⁵¹ The core NSMC curriculum consists of 4 projects:

- (i) participation and contribution to NephJC;
- (ii) participation and contribution to NephMadness;
- (iii) creating content for the Renal Fellow Network; and
- (iv) a final capstone individual project. Assessment of the interns is based on timely completion and quality of the projects.^{52,53}

NSMC internship provides training and mentorship on modern communication skills and increases exposure and opportunities for engagement in social media activities. The program measures success by the leadership positions that interns are subsequently offered. Of the 22 interns who have graduated, 12 interns hold leadership positions in national and international organizations, including ASN, ISN, and the *American Journal of Kidney Diseases*, among others.

Academic Promotion and Research Collaboration

Some academic promotion and tenure committees are now recognizing the value of social media portfolios in promotion decisions. In 2016, the Mayo Clinic became 1 of the first academic institutions to formally include social media scholarship as part of their metrics for promotion.⁵⁴ The Mayo Clinic published their best practice recommendations for institutions for

implementing the use of social media portfolios in promotion decisions, including offering training to faculty and development of an institution- and field-specific appraisal framework that includes objective measures of quality and impact.⁵⁴ One method for objectively measuring impact is the Altmetric score, which measures the reach of online content and includes weighted measures of tweets, shares, links from blog posts, as well as traditional media mentions.⁵⁵ The Altmetric score is an objective measure of the influence of online participants' ability to have an impact on and to lead the distribution of quality content. In addition, social media scholarship by an individual may lead to other opportunities important for promotion and tenure decisions, including leadership opportunities and recognition in medical journals (e.g., visual abstract editor, journal blog editor) and medical societies (e.g., communication committee membership, education awards). Finally, interaction online can lead to increased opportunities for traditional research collaboration with similarly focused individuals.

Pitfalls of FOAMed

As with any new technology, there are growing pains with both foreseen and unforeseen consequences after their implementation. Some concerns with social media and medical education include:

- (i) accuracy;
- (ii) professionalism (patient privacy);
- (iii) professionalism (toward colleagues); and
- (iv) unintended consequences of public data.

Because FOAMed removes much of the "accuracy infrastructure" from traditional publishing, it should face extra scrutiny when it comes to accuracy. Blog posts, tweets, podcasts, and video production are unrestricted and not always peer reviewed, and there is a greater risk of inaccurate or commercially biased information. However, social media are not entirely without checks and balances. The most powerful fact-checking system for traditional or FOAMed resources is a robust network of experts viewing the material with an easy channel back to the authors. Instead of structured letters to the editor, corrections are only a tweet or a comment away (on the blog itself or platforms such as PubPeer). However, this peer review/correction is inherently sporadic, unpredictable, and imperfect, the advantage still being that it is transparent and free. Twitter and ASN Communities are built on 2-way communication, with leaders and content experts engaged in the discussion to ensure assemblance of accuracy. Although blog posts and tweets are usually the opinion of the author, the content for high-profile projects such as NephJC, NephMadness, and Renal

Fellow Network is all internally peer reviewed before release. In addition, NephMadness 2018 will provide continuing medical education (CME), and all of its primary content underwent third-party peer review.⁴⁷ As an example of defining exactly how to review the accuracy of online information, the emergency medicine online community has developed metrics to evaluate and to appraise online educational resources.⁵⁶ To date, the nephrology online community has not adopted these metrics.

Another pitfall that must be remembered is patient health information. Patients rarely consent to their health information, imaging, laboratory values, or diagnoses being posted online. One needs to balance the benefits of sharing certain information (such as pathology or imaging findings, urinary sediment images) for educational or learning purposes, with the risk of infringing on patient privacy.⁵⁷ Although a tweet or blog may be aimed at a clinician audience, other readers such as patients, family members, and lawyers could be following as well. Although it is common to use disclaimers such as “opinions personal and do not represent institution,” one is always, either formally or informally, representing one’s institution and profession. Unconventional opinions should hence be backed up with caveats or evidence, and it is important to remain polite and courteous while voicing dissent and disagreement.

A final potential pitfall considers the risk of leaving a public data trail. We live in a world where online behavior, whether public as on Twitter, or privately as in YouTube, is being tracked, recorded, and analyzed. These data are being analyzed to make online content more compelling. Facebook, YouTube, Twitter, Netflix, and Instagram all use machine learning to keep us engaged in their services. In other parts of society, for example, in politics, social media has created tribes that live inside echo chambers. It is unclear what will emerge when these tools are used in medicine.

Future Directions

FOAMed is a new way to consume and produce medical education. This is well suited to the mobile and hyperconnected social platforms that many clinicians are using to enhance their education. As more people depend on these resources, we will see more recognition by established educational centers. The scientific organizations of nephrology are already invested in these techniques. ISN established organized online coverage of their primary meeting in Mexico City in 2017 and plans to continue this in the future. ASN established ASN Communities to capture and to enhance electronic dialog between members spread

around the country and the globe. The University of California, San Francisco has a medical student rotation whereby students review and improve medical entries on Wikipedia, the prototypical Web 2.0 FOAMed resource.⁵⁸ We expect the future to see more and more institutions sponsoring social media projects that extend FOAMed.

The future will also see continued growth and use of both older and newer technologies. An older technology that is gaining strength is e-mail. A number of e-mail newsletters are taking news, information, and opinions to people’s inboxes without the need to browse to a website. In some ways, the e-mail newsletters are replacing traditional blogs.⁵⁹ Newsletters offer a way to access a specific audience and to provide them curated content on a regular basis. Medical podcasts represent another form of FOAMed with the potential for growth in nephrology. The use of other social media platforms such as Facebook, Instagram, LinkedIn, and Snapchat (among others) have robust audiences and are ripe for further development and expansion. Many of these platforms are currently being used in nephrology to disseminate content (Table 1). However, they still lack deep 2-way conversation in topics relating to nephrology. Thus, further development of these tools could be expanded in the future.

We believe that nephrology should continue to be a leader in FOAMed. If nephrology does not create and be a leader in these resources, those educational holes will be filled by endocrinologists, intensivists, and cardiologists. Nephrology has an opportunity to take advantage of its early strength in FOAMed to be a major contributor to this form of medical education. The field of FOAMed is also ripe for Nephrology to enhance medical education research in this area.

Conclusion

A clinician can now be completely immersed in learning and collaboration throughout the typical work day. During the morning drive or train ride to work, the clinician can listen to a podcast on a current topic.⁶⁰ After seeing a difficult case, she or he may tweet the scenario to colleagues or to the community at large using hashtags such as #AskRenal. At lunch break, she or he can catch a brief 10-minute reading session from a blog post. While waiting for that last clinic patient, she or he can watch a YouTube nephropathology video. Finally, to end the day, a clinician can participate in an online, interactive journal club with other clinicians, patients, and researchers from around the world.

Clinicians can begin to build a social media presence by maintaining a clearly professional account, following individuals and organizations and journals in

their field, tweeting articles that they have authored or that are in their area of interest, providing commentary and analysis on published papers, and interacting with others in conversations about nephrology topics during journal clubs or *ad hoc* discussions. Clinicians' presence online through publication, content creation, and communication provides a means of promoting their work and ideas. This may be beneficial for nephrologists or researchers in small centers, niche fields, or international locations where they may not have the opportunity to publish widely.

All of the available social media tools complement and build upon each other but also serve as distinct methods of education. Some content is meant to be a delivery of ideas, as with podcast or video interviews with experts, whereas others are organic collaborations of participants, such as Twitter chats or online games. The possibilities of learning and content generation continue to grow and remain available online for easy viewing and reviewing at opportune times. We are witnessing a new model of medical education that is focused on incorporating more educators and learners to achieve more perspectives at minimal cost.

DISCLOSURE

GBC, JT, KDJ, TO, MNR, SS, SH, and MAS are members of the NephJC team. JT, KDJ, and MAS are members of the *American Journal of Kidney Diseases* Social Media Advisory Board. GBC, JT, KDJ, TO, MNR, SS, SH, and MAS are faculty members of the Nephrology Social Media Collective. JT and MNR are members of the *Clinical Journal of the American Society of Nephrology* Visual Abstract Team. JT is a member of the *American Journal of Nephrology* Visual Abstract Team. MAS is a faculty advisor to the Renal Fellow Network. KDJ is the creator of Nephron Power. JT is the creator of Precious Bodily Fluids.

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The views expressed in this article are those of the authors and do not necessarily represent the policy or position of the US Department of Veterans Affairs or the US government.

SUPPLEMENTARY MATERIAL

Appendix. Examples of Visual Abstracts. Reprinted with permission from the following: Zinman B, Wanner C, Lachin JM, et al. Empagliflozin, cardiovascular outcomes,

and mortality in type 2 diabetes. *N Engl J Med.* 2015;373:2117–2128. <https://doi.org/10.1056/NEJMoa1504720>.

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Supplementary material is linked to the online version of the paper at www.kireports.org.

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