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COMMENTARY

The #Tweetorial: an Underutilized Teaching Tool in Undergraduate Medical Education?

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Abstract
Tweetorials are short, self-contained Twitter threads that provide a concise overview of a topic. Recently, they have gained prominence in the Twitter medical community (#MedTwitter) as a medium for teaching and reviewing topics from foundational medical physiological concepts through to complex clinical case presentations. With medical schools increasingly utilizing case-based learning in their curricula, the Tweetorial may have a role in bridging the foundational and clinical sciences while challenging the clinical decision-making acumen of learners. We outline how Tweetorials may be utilized to support self-directed, asynchronous learning amidst increasingly brimming medical curricula and provide undergraduate medical students real-time access to educators, and discuss limitations that may hamper their implementation.

Keywords Medical education · UGME · MedTwitter · Tweetorials

Introduction

Twitter is a leading social media platform with 330 million active users recorded in 2019 [1]. Brevity encapsulates the central tenet of Twitter: users are limited to 280 characters per post or, as known in the Twittersphere, a "Tweet."

Even with this brevity, there is evidence to suggest that Twitter provides value as a digital intermediary for professional communication, collaboration, mentorship, and educational purposes [2–4]. Physicians have been using the platform for the better part of a decade to disseminate novel research, share ideas, and raise awareness of salient topics pertaining to their practice and public health [5]. Recently, Tweetorials have emerged in the Twitter medical community as a forum for teaching, peer discussion, and knowledge translation [4]. While popular with many physicians and post-graduate residents, the role of Tweetorials remains underutilized and understudied in the undergraduate medical curriculum, with concerns over privacy, content integrity, and lack of practice guidelines posing barriers to implementation.

The Tweetorial

On Twitter, users can share their thoughts by posting individual Tweets or a consecutive series of Tweets (known as a thread) that provide more comprehensive coverage of one or several topics. Tweets are commonly labeled with hashtags for indexing purposes, a system not unlike the MeSH terms utilized by the National Library of Medicine. In the medical learner community, popular hashtags include #meded, #medtwitter, #medstudent, #foamed, and #CME [6, 7]. Like other social networking sites, users can share posts created by others and provide them a readership boost by retweeting or liking Tweets.

A relatively novel teaching tool that has gained traction on MedTwitter is the "Tweetorial," a self-evident combination of "Twitter" and "tutorial." Though Tweetorials were popularized by Marc Andreessen, a software engineer [2], several physicians subsequently played a significant role in introducing the tool to mainstream #MedTwitter—Twitter medical community—discourse [8]. Among them is Tony Breu (@tony_breu), an adjunct Assistant Professor at the Boston University School of Medicine. Breu is widely

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considered a leader in the field of medical Tweetorials for his ability to leverage the tool as an effective teaching modality for both medical trainees and staff physicians.

One common format of Tweetorials involves the author—often a clinician, researcher, or educator—creating a multi-Tweet thread that poses a clinical question, provides an overview of the pertinent scientific concepts, offers an explanation to the question, and discusses its clinical implications [2, 9]. Another format of Tweetorials involves an integration of clinical cases à la case-based learning (CBL) [10, 11]. In this format, the Tweetorialist presents a clinical vignette that is often accompanied by a corresponding image such as a histopathology slide, a CT image, or a visual finding perceptible on clinical inspection. Subsequent Tweets then guide the reader through the process of differential diagnosis, workup, treatment, and associated management.

Many Tweetorial varietals have been created and posted; they cover diverse topics in medical education, ranging from navigating intern year or PGY-1, reading and interpreting ECGs, to summarizing the findings of novel research. Irrespective of format or topic, Tweetorials offer high-yield "clinical pearls" [6] that have the potential to serve as robust and dynamic educational tools to supplement the core medical school curriculum and clinical learning opportunities.

One of the primary draws of Twitter is the ability to embed interactive elements within Tweets and threads. This provides the thread creator the ability to solicit participation by incorporating multiple-choice polls or challenge readers to critically engage with the content by posing open-ended questions [3]. Additionally, Twitter's inherent functionality allows for incorporation of images, videos, and GIFs. Multimedia can augment the educational value of the thread as well as provide a whimsical element to retain the reader's interest. An unpublished survey that included physicians, residents, medical students, and allied health professionals revealed that the majority find multimedia and polling in Tweetorials to be "valuable" or "very valuable" [12].

The Tweetorial: A Supplemental Tool to Support Undergraduate Medical Education?

To prepare medical graduates for practices within increasingly complex and demanding health care systems [13, 14], North American undergraduate medical education (UGME) programs are renewing their curricula and shifting towards competency-based and integrated learning. A spiral integration model—vertical and horizontal—has emerged from these undertakings [14]. The fundamental pedagogical principles in these curricular models have to some extent been replicated on #MedTwitter through Tweetorials albeit in much smaller, bite-sized threads, through integration of clinical cases with review of foundational scientific concepts, and presentation of primary literature, or any combination thereof. Regular use of these threads, therefore, can promote the continuous formation of connections between theory and practice by medical students irrespective of their year level. Despite limited research exploring Tweetorials in the undergraduate medical context, they have the potential to perform similar functions—teaching, knowledge translation, and ongoing medical education—as those described for postgraduate medical education, especially if there is intentionality behind their use.

Tweetorials as a Teaching Tool

As a teaching tool, Tweetorials offer a unique pedagogical advantage—the ability for students to engage in comprehensive discussions with their instructors and receive ongoing feedback to questions through Twitter's "reply" mechanism. Twitter's public nature by default and equitable access to the platform allows individuals to revisit the thread on-demand and identify queries other students may have raised and subsequent responses to them. Should new research or guidelines be published, the thread creator can append the Tweetorial, allowing for further conversation. Additionally, affiliated faculty and clinicians with related expertise can effortlessly join the conversation and contribute their knowledge and clinical anecdotes. This is a unique benefit not generally available to conventional student-to-lecturer emails or course-based discussion forums [15].

The less formal nature of Twitter also has the potential to flatten some of the traditional power hierarchies in medicine and may even facilitate the type of collaborative conversations that students will invariably have with senior residents, attending physicians, and allied health professionals once they graduate into the clinical environment [3]. Tweetorials also offer an appealing solution to logistics challenges that can arise when attempting to schedule physicians with heavy clinical load as instructors or tutors [16].

It is common practice for UGME programs to integrate CBL to complement didactic lectures, labs, and seminars [13, 14]. Within this arrangement, the "case-based Tweetorial" can function as a real-time companion to the designated case (e.g., case of the week) and allow students and faculty alike to engage in productive conversations outside of allocated curricular time. The flexibility offered by this modality is particularly conductive to collaboration that transcends geographical and temporal boundaries, which may present at medical schools that adhere to a distributed medical education model [17]. For example, at the University of British Columbia's Faculty of Medicine, medical students in their pre-clinical years receive a 50-min, dedicated clinical decision-making (CDM) lecture every Friday morning to

discuss and clarify the case of the week presented in the CBL context. Typically, the presenter lacks sufficient time to address all questions in their entirety or present additional corollaries. Here, the case-based Tweetorial can provide an alternative forum to not only continue the conversation, but also to present companion cases for further consideration and independent study. As the UGME program at the University of British Columbia is distributed over four geographic sites—Vancouver, Victoria, Kelowna, and Prince George—discussion of case(s) posted by the CDM instructor can also facilitate discussion and collaboration among students irrespective of their geographic location.

Tweetorials and Knowledge Translation

Many medical students undertake research projects during the course of their education, driven by curricular requirements and for the purposes of personal and professional development [18]. Similar to medical journals, residency programs, and physicians [19–22], medical students can leverage the power of Twitter to share their findings and expand recognition of their work.

In addition to dissemination, Tweetorials may represent a tool for students and educators to foster the development of additional knowledge translation skills. While many medical schools mandate research-oriented courses that emphasize critical appraisal and communication of medical literature [23], teaching these skills can be a challenging endeavor for educators. In this context, assignment of medical literature and creation of Tweetorials to summarize their findings can promote the development of synthesis and written communication skills. If journal clubs are a component of these courses, student-generated Tweetorials can then serve as a starting point for online and in-person discussions and provide an opportunity for other students to engage in critical thinking and constructive feedback of the Tweeteorial creator's digital scholarship [24]. Moreover, the unique constraints of Twitter require students to communicate with "brevity and depth," a valuable skill that can facilitate the accurate exchange of information to protect patient safety and well-being [25].

Tweetorials and Ongoing Medical Education

Undergraduate medical education is a rigorous process of continuous learning, and personal and professional development. But with the vast quantities of information medical students are expected to learn, knowledge loss is an observable phenomenon [26]. Ongoing, periodic reinforcement can promote long-term retention and Tweetorials can support the process of revision by presenting concise primers, many with clinical correlates, on specific topics of interest. While this requires curation on the part of the student by using Twitter's "Bookmark" or "Like" functions, saving Tweetorials of interest for posterity appears to be common practice among users [12].

Tweetorials also represent an outlet through which medical students can explore their personal and professional interests beyond the scope of curricular content. Certain topics, such as pain medicine [27] and nutrition [28], are often underrepresented in medical school and extracurricular engagement with Tweetorials covering these topics can broaden an individual's understanding and appreciation for the diversity in medicine, as well as inform their decision-making on elective and residency applications. This is substantiated by results from the Breu survey [12] which indicated that the vast majority of Tweetorial readers selected "feed[ing] their curiosity" as major reason behind their following of this form of digital scholarship [2, 12]. Independent learning pursuits, with Tweetorials and other resources, is also congruent with an overarching objective of medical schools: to foster "self-directed, life-long learning skills" among their students so as to graduate informed, competent physicians capable of identifying and addressing knowledge gaps and adhering to best practices [29].

For students whose individual learning style is more compatible with self-directed learning and the use of web-based lecture recordings, Tweetorial participation—active or passive—provides an alternative opportunity to engage with fellow classmates and instructors that they would otherwise miss by virtue of their forgoing of in-person lectures. Although there is evidence to indicate that nearly half of Tweetorials users perceive them to be comparable to conventional lectures [12], it is important to recognize that Twitter's brevity mandate can place constraints on message delivery and cause granular details to be lost in translation. Notwithstanding these limitations, Tweetorials offer an approachable point of entry to review both high-yield and complex topics.

In light of the recent COVID-19 pandemic, Tweetorials and social media use in general can also play a role in community building [2] and cultivating comradery among medical students, two social processes that could be difficult to achieve while adhering to social distancing protocols.

An Unproven Commodity: Challenges and Concerns

One major indictment against Tweetorials is that they lack the systematic peer review mechanisms that conventional teaching materials (e.g., textbooks, medical journals) possess to safeguard the integrity of the content [2]. However, a growing number of Tweetorial creators are actively practicing self-imposed quality control measures whereby they enlist fellow educators to peer review their threads in advance of virtual publication. Despite this, it has been

suggested that crowdsourcing this crucial process may be inadequate [2, 5, 6, 30]. On the contrary, the process of peer review does not appear to be a priority for Tweetorials users—up to two-thirds have indicated that they believe Tweetorials should not be peer reviewed [12].

It should also be noted that Tweetorials are often rooted in evidence-based medicine supported by extensive research [2]. It is common practice for creators to provide a complete list of references along with hyperlinks to the original publication. This allows readers to visit the source material to verify the veracity of the content as well as engage in additional reading of topics of interest. Unfortunately, the public nature of Twitter threads leaves them susceptible to "trolling" behavior from mischievous individuals intending to muddle the conversation and spread misinformation. This, however, can be mitigated by active moderation of the thread by its creator.

Privacy concerns have also been raised in regard to Twitter use for the purposes of medical education [2, 22, 31]. Due to the infrequency of some medical conditions and niched practice areas of certain clinicians, it may be possible to deduce the identity of the individual presented in the case. Measures to protect patient confidentiality should therefore be implemented if faculty members or affiliated instructors elect to use Twitter to supplement their instruction.

Practicing physicians have demonstrated a keen interest in social media but have indicated a lack of understanding of its advantages and the knowhow to optimize its use [7]. In an era where prominent medical journals and professional associations are becoming increasingly proactive on social media [22, 30]—from peer-reviewing Tweets to hosting online chats and journal clubs—medical schools would be well-served to provide digital literacy and social media training for the purposes of teaching and professional development. Alternatively, instructors may, where appropriate, invite the patient or their substitute decision-maker to partake in the online conversation, which may provide additional value for the learner. The vastness of Twitter also makes it possible for Tweetorial threads to disappear into the abyss if inappropriate tags are used and crucial threads are left unpinned. This further underscores the need for social media training to communicate the nuances of the platform.

Conclusion

Tweetorials are a relatively novel addition to the online Twitter community—#MedTwitter—and are comprised of a series of threaded Tweets that cover various topics in medicine. While Tweetorials have gained popularity with residents and attending physicians and a litany of literature examining their use has been published in recent years, they remain underutilized and understudied in the context of undergraduate medical education. Tweetorials are a concise, easily accessible digital medium that can be leveraged as a teaching tool by medical educators to disseminate evidence-based knowledge and clinical pearls for the purpose of bridging the foundational and clinical sciences. They also provide a platform for knowledge translation and facilitate the sharing of research by medical students while simultaneously allowing them to engage in critical feedback of medical literature. Crucially, Tweetorials can support ongoing medical education and afford learners the ability to pursue self-directed, asynchronous learning unencumbered by geographical and temporal constraints. Along with other novel learning resources, Tweetorials can supplement undergraduate medical education by reinforcing crucial concepts, providing direct access to instructors and clinicians, and fostering collective learning and camaraderie among learners.

Concerns over privacy, content integrity, and platform misuse represent prominent barriers to widespread implementation. Nonetheless, the ubiquitous nature of social media use among medical students suggests they have a burgeoning role in supplementing twenty-first century medical education while offering the flexibility that the modern learner may find desirable.

Abbreviations #MedTwitter: medical twitter; #meded: medical education; #foamed: free open access medical education; #CME: continuing medical education; PGY: post-graduate year; CDM: clinical decision-making; UGME: undergraduate medical education

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