



The Virtual Toxicology Journal Club: the Dissemination and Discussion of Noteworthy Manuscripts Using Twitter

Peter R. Chai^{1,2} · Anne-Michelle Ruha³ · Kelly E. Wong⁴ · Derek L. Monette¹ · Meghan B. Spyres⁵ · Jeff Lapointe⁶ · Howard Greller⁷ · Mark B. Mycyk⁸

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Abstract

Background Twitter-based chat groups (tweetchats) structured as virtual journal clubs have been demonstrated to provide value to learners. In order to promote topics in medical toxicology, we developed the #firesidetox tweetchat as a virtual journal club to discuss and disseminate topics in medical toxicology.

Methods A group of medical toxicologists from the American College of Medical Toxicology (ACMT) Public Affairs Committee and editorial board of the *Journal of Medical Toxicology (JMT)* developed a quarterly one hour tweetchat featuring *JMT* manuscripts. We gathered basic twittergraphics and used a healthcare hashtag aggregator to measure the number of impressions, participants, and tweets per tweetchat session. A qualitative analysis of important themes from #firesidetox was also completed.

Results During five tweetchats over 12 months, we attracted a mean of 23 participants generating a mean of 150 tweets per #firesidetox tweetchat. Tweets generated a mean of 329,200 impressions (unique user views): these impressions grew by 300% from the first through fifth #firesidetox. The majority of participants self-identified as medical toxicologists or physician learners. Although most were from the USA, participants also came from Australia, Poland, and Qatar. Most tweets centered on medical education and 7.9% tweets were learner-driven or questions asking for a medical toxicologist expert opinion.

Conclusion The #firesidetox attracted a diverse group of toxicologists, learners, and members of the public in a virtual journal club setting. The increasing number of impressions, participants, and tweets during #firesidetox demonstrates the tweetchat model to discuss pertinent toxicology topics is feasible and well received among its participants.

Keywords Medical education · Twitter · Journal clubs · Toxicology

Introduction

The use of social media platforms like Twitter by patients, physicians, and physicians-in-training has increased dramatically

over the past few years [1]. Twitter allows medical toxicologists to participate in a growing social media-based medical education movement alongside a new generation of learners [2, 3]. Like other social media platforms, Twitter is designed to disseminate

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✉ Peter R. Chai
Pchai@bwh.harvard.edu

¹ Division of Medical Toxicology, Department of Emergency Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, MA 02115, USA

² The Fenway Institute, Boston, MA, USA

³ Division of Medical Toxicology and Precision Medicine, Department of Medicine, University of Arizona College of Medicine, Tucson, AZ, USA

⁴ Department of Emergency Medicine, Rhode Island Hospital, Brown University, Providence, USA

⁵ Division of Medical Toxicology, Department of Emergency Medicine, University of Southern California, Keck School of Medicine, Los Angeles, CA, USA

⁶ Division of Medical Toxicology, Department of Emergency Medicine, Southern California Permanente Medical Group, Pasadena, CA, USA

⁷ Division of Medical Toxicology, Department of Emergency Medicine, SBH Health Systems, New York City, NY, USA

⁸ Department of Emergency Medicine, Cook County Health and Hospitals System, Chicago, IL, USA

information rapidly in short “tweets”, or messages of 280 characters, using mobile technology such as a smartphone, tablet, or computer. Tweets can contain additional information linking to other sources such as a manuscript, an educational blog, or other news media. Additionally, Twitter has been used to provide illustrative clinical images like electrocardiograms, point of care ultrasound videos, or guides to medical procedures. Tweets relating to a specific topic can be tagged using a hashtag (#) to allow users to search and aggregate messages of interest.

Using existing tools on Twitter, structured chat groups (i.e., tweetchats) have emerged as a supplement to the traditional journal club in healthcare [4]. The conversational nature of Twitter lends itself to real-time discussion, thereby connecting moderators, authors, and discussants directly. The ability to follow a hashtag allows users who may be in disparate time zones to access the conversation in real time or contribute asynchronously to the tweetchat. In order to reach a diverse audience, showcase important publications by medical toxicologists, and foster discussion regarding current topics in medical toxicology, we created a quarterly tweetchat with the hashtag “firesidetox.” Our objective here is to describe the development of #firesidetox, discuss the feasibility of conducting a tweetchat in collaboration with a peer-reviewed journal, and propose a framework for conducting a specialty-specific tweetchat.

Materials and Methods

This is a descriptive study, determined by our institutional review board at Partners Healthcare to be exempt from human subject research. We developed a structured twitter-based chat group (tweetchat), tagged “#firesidetox”, with the primary aim of promoting manuscripts relevant to current issues in

medical toxicology beyond traditional journal networks. A working group of medical toxicologists, members of the American College of Medical Toxicology (ACMT) Public Affairs Committee, and the editorial board of the *Journal of Medical Toxicology (JMT)* were convened in 2017 to develop the #firesidetox tweetchat. The group selects manuscripts based on their potential to generate significant online discussion among medical toxicologists, physicians, other academicians, learners, and the public. Manuscripts that are recently published and determined by the working group to be of high importance to clinicians and the general public, including research studies, review articles, and even society position statements, are eligible for a tweetchat. Once the manuscript is selected after a majority vote by the firesidetox group, we contact the authors of the selected manuscript and secure participation of at least one of the authors for each tweetchat. Authors unfamiliar with Twitter technology are given a one-on-one training session on the basic mechanics of Twitter and techniques for participating effectively in a tweetchat by one of the firesidetox moderators before the scheduled tweetchat session.

We created a standardized structure to moderate each 1-hour tweetchat using the ACMT twitter handle, @acmt (Fig. 1). The first 5 minutes of each tweetchat are used to introduce firesidetox participants (moderators, authors, and other guests). Next, we tweet three sequential topics pertaining to major themes in the manuscript or the clinical experience of participants. These topics are developed by the firesidetox working group and discussed with participating authors prior to the scheduled tweetchat. Each topic is allotted 15 minutes for tweetchat discussion. Participants are encouraged to answer or discuss any additional related topics at any time during the tweetchat as if having an interactive conversation in a conference room. Finally, the last 5 minutes are

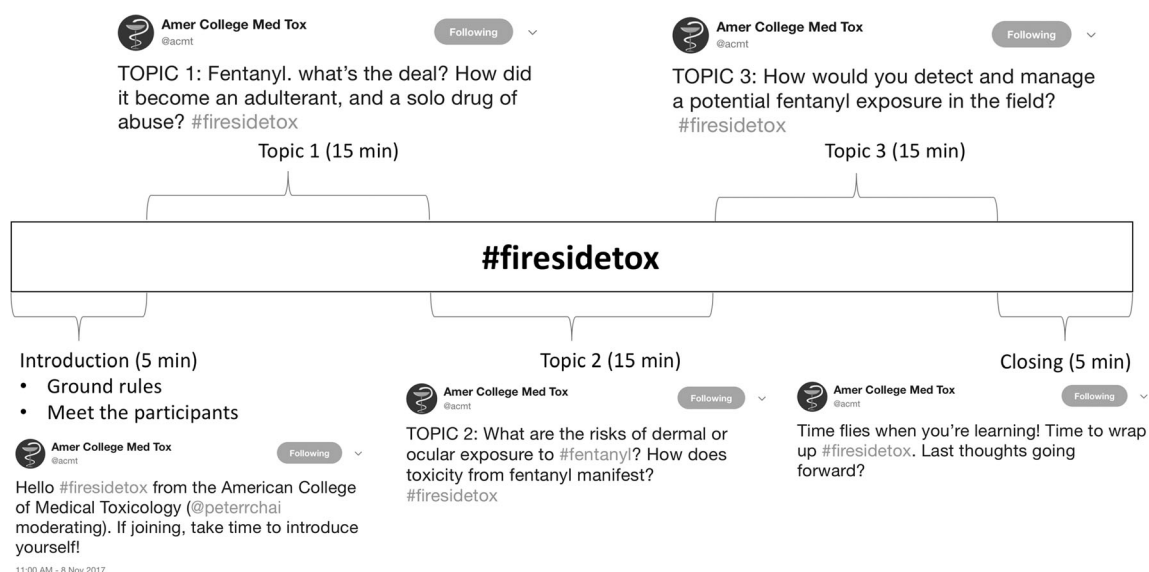


Fig. 1 General structure of #firesidetox tweetchat with illustrative tweets from @acmt

used to wrap up the threads of conversation, thank participants, and invite participants to the next scheduled firesidetox. We provided occasional moderation using the official ACMT twitter account (@acmt) to keep the discussion on track and tweets pertinent figures or graphics from the manuscript to enhance the conversation (Fig. 2). Tweetchats are promoted through tweets from @acmt (2397 followers) as well as the personal handles of the authors and moderators. For the latest tweetchat, our moderator (@PeterRChai) and principal manuscript author (@PharmERToxGuy) had a combined 15,282 followers. Reminders for scheduled tweetchats are emailed to a private listserv of medical toxicology fellowship directors to stimulate trainee participation. The authors of featured manuscripts, as well as the regular participants of our tweetchats, are recruited to help advertise #firesidetox to colleagues.

Forty-eight hours after the conclusion of the tweetchat hour, we download Twitter metrics using a free, online, healthcare-oriented social media analytics tool (Symplur Analytics, Upland CA). Symplur Analytics aggregates tweets using specific hashtags during a specific time period, in this instance, #firesidetox. These metrics include the number of participants, number of total tweets, impressions (the number of times a tweet is viewed by a unique user), tweets per hour and tweets per participant. Impressions are used as a measure of the reach and dissemination of a tweet; the higher the number of impressions, the more widely disseminated a specific tweet is considered.

Next, we download #firesidetox transcripts verbatim from Symplur using search parameters designated by the date and time of the tweetchat. For example, we downloaded tweets composed with the hashtag “firesidetox” during the 1-hour tweetchat, but also included tweets using #firesidetox for the next 48 hours to include additional content tweeted by asynchronous learners. We adapted the technique of applied

thematic content analysis to interpret key themes that appear. This technique has previously been utilized by the lead author of this study group (PRC) [5]. We adhered as closely as we could to the consolidated criteria for reporting qualitative research (COREQ) [6]. Codes are developed inductively based on themes that emerge from aggregated tweets. Transcripts are read independently by two team members (KW, DM) who were not involved in preparing the tweetchat authors or themes, a list of independently generated codes is generated, and these codes are then grouped into themes. Discrepant themes are reconciled by a third study investigator (PRC). The list of final themes is then reviewed by the study group as a whole.

Results

Over the course of 12 months, we conducted five tweetchats (Table 1). Each #firesidetox was attended by an average of 23.4 unique users, and generated an average of 150 tweets per chat (Table 2). One hundred eleven participants were from the USA, but we were also able to attract 6 international participants. Ninety-nine participants were identified as pharmacists or toxicologists, while 4 participants were residents, 4 were medical students, and 7 were members of the public. We were able to generate a mean of 329,200 impressions per tweetchat. Over the course of five tweetchats, we increased the rate of impressions by 300%.

In our qualitative analysis, most tweets generated during #firesidetox centered on the theme of medical education (Table 3). Other tweets centered on learner-driven questions asking for expert toxicologist opinion and experiences managing the clinical effects of poisonings.

a Multiple participant interaction during #firesidetox

- Participant 1
I want an ED pharmacist for any critical patient. My nurses don't have to draw up or mix meds, they can focus on other tasks. My residents aren't calculating doses, the pharmacist helps. I get all the emergent meds I need faster and at correct doses, #firesidetox
- Participant 2
About 12 years ago we started a pilot with two smart ED Praharmacists. Thought was they'd help docs with ABX choices, etc. turned out they were amazing resources for the nurses (and occ docs) and I only wish I had them 24/7.
- Participant 3
I would love to spend all my time in ED. Problems arise when staff shortages occur, pulled back into pharmacy we do TTOs. Also need 24 hrs cover in ED - so a few pharmacists to cover all shifts. A whole team of us 🙌 Some EDs don't ever see a pharmacist!
- Participant 4
As an ED pharmacist, I feel these are the patients that benefit most from my clinical accumen. It is highly rewarding to help RNs and residents with these patients.

b Real-time international participation in #firesidetox

- Amer College Med Tox @acmt
Hello #firesidetox from the American College of Medical Toxicology (@peterrrchai moderating). If joining, take time to introduce yourself!
- Participant 1
It's an early morning here in AUS! [redacted] Lead Pharmacist Specialty Practice [redacted] #firesidetox Loving the twitter chat so far
- Amer College Med Tox @acmt · Jan 30
Replying to Participant 1
Morning Courtney! We would love to hear your thoughts on emergency department pharmacy practices in AUS! #firesidetox

c Sample image tweeted by @ACMT for #firesidetox



Fig. 2 Tweets from #firesidetox demonstrating interaction among multiple tweetchat participants (a), feedback from international participants (b), and sample images used to help moderate #firesidetox (c)

Table 1 List of #firesidetox tweetchats

| Date | Topic | Manuscript |
|---------|----------------------------------|---|
| 1/12/17 | Kratom | Suspected adulteration of commercial Kratom products with 7-hydroxymitraginine |
| 4/20/17 | Cannabinoid hyperemesis | Cannabinoid hyperemesis syndrome: diagnosis, pathophysiology and treatment: a systematic review |
| 7/20/17 | Synthetic cannabinoids | Characteristics and treatment of patients with clinical illness due to synthetic cannabinoid inhalation reported by medical toxicologists: a toxic database study |
| 11/8/17 | Fentanyl | ACMT and AACT position statement: preventing occupational fentanyl and fentanyl analog exposure to emergency responders |
| 1/30/18 | Role of clinical pharmacologists | ACMT position statement: the role of clinical pharmacists in the emergency department |

Discussion

Our #firesidetox is the first recurring tweetchat conceived and successfully deployed by a multi-institutional group of medical toxicologists. We developed a mechanism to select manuscripts with a focus on medical toxicology and moderated five successful tweetchats that attracted a diverse group of domestic and international toxicologists, learners, and members of the public. The increasing number of impressions, participants, and tweets during consecutive tweetchats demonstrates we developed an engaging model that leverages Twitter to discuss pertinent toxicology topics and manuscripts. The majority of our tweetchat content focused on educational content from toxicologists, but we also noted the use of #firesidetox as a forum for learners to ask questions of the featured manuscript authors and of other practicing toxicologists. Finally, unlike a traditional journal club setting, we were also able to gather patient and non-physician insights and experiences during each #firesidetox. For instance, some of the non-physician participants during our synthetic cannabinoid tweetchat added information to the discussion that was previously unknown even to our expert authors.

A quarterly tweetchat focusing on medical toxicology is feasible. Although we have only conducted this for 12 months, we noted a 300% increase in impressions and threefold increase in unique participants over the course of five tweetchats. These data suggest that Twitter users are willing to interact and participate in #firesidetox. Additionally, our

model of collaborating with a journal and authors is feasible. We were able to secure the participation of featured manuscript authors for each tweetchat, and we shared tweetchat metrics with participating authors that will hopefully inform their continued work. Despite our varying institutions, we were able to coordinate an hour of the day that maximizes the availability of participants across time zones in the USA. An additional benefit of using the tweetchat format is the ability to receive asynchronous commentary from international toxicologists. Because any Twitter user can search for #firesidetox, toxicologists and learners from other time zones can view and discuss #firesidetox, and continue to contribute to the conversation even after the scheduled tweetchat has ended.

Medical toxicology is an important component of the Model of the Clinical Practice of Emergency Medicine [7]. Unfortunately, not every emergency medicine residency program has a medical toxicologist available to teach this core curriculum [8]. Learners have therefore traditionally sought toxicology education through a combination of local poison centers, away rotations, or interaction with residency programs which have affiliated medical toxicology fellowships. In the era of social media, learners increasingly turn towards Twitter to digest key concepts in medical education on demand. A move towards social media, blogs, and podcasts has changed the dynamic of medical education during residency. Offering #firesidetox in a medium that is recognizable by modern-day learners can be an important supplement to

Table 2 Mean #firesidetox tweetchat participants, tweets, and impressions

| Topic | Number of participants | Tweets | Impressions |
|----------------------------------|------------------------|--------|-------------|
| Kratom | 24 | 156 | 212,701 |
| Cannabinoid hyperemesis | 16 | 160 | 159,042 |
| Synthetic cannabinoids | 18 | 133 | 143,869 |
| Fentanyl | 27 | 166 | 315,893 |
| Role of clinical pharmacologists | 32 | 137 | 814,493 |
| Totals | 117 | 752 | 1,645,998 |
| Mean | 23.4 | 150.4 | 329,200 |

Table 3 #firesidetox thematic content

| Topic | Announcement, promotion, or invitation | Introductions/networking | Topic introduction | Medical education | Personal experience | Learner-driven question | Humor/miscellaneous | Totals |
|----------------------------------|--|--------------------------|--------------------|-------------------|---------------------|-------------------------|---------------------|--------|
| Kratom | 33 | 19 | 3 | 57 | 22 | 22 | 0 | 156 |
| Cannabinoid hyperemesis | 26 | 17 | 3 | 95 | 0 | 17 | 2 | 160 |
| Synthetic cannabinoids | 34 | 7 | 3 | 81 | 0 | 3 | 5 | 133 |
| Fentanyl | 25 | 20 | 3 | 96 | 0 | 13 | 9 | 166 |
| Role of clinical pharmacologists | 24 | 20 | 3 | 74 | 11 | 5 | 0 | 137 |
| Totals | 142 | 83 | 15 | 403 | 33 | 60 | 16 | 752 |
| Percent of total | 18.86% | 11.02% | 1.99 | 53.52% | 4.38% | 7.97% | 2.13% | |

traditional methods of teaching medical toxicology in residency programs. Importantly, our primary aim in this study was to determine the feasibility of hosting #firesidetox. We did not determine whether participation in #firesidetox actually improved participants' knowledge of the topics, or whether lessons learned in #firesidetox were applied to direct patient care.

In the spirit of the original journal club that William Osler first led in Montreal in 1875, our #firesidetox expands the experience beyond the traditional physical boundaries of a conference room, residency, or fellowship program [9]. Much like other virtual journal clubs from nephrology (#nephJC: 50 participants), urology (#uroJC: 39 participants), geriatrics (#gerimedJC: 25 participants), and many others, we hope to adapt our educational efforts and discussion of important topics in medical toxicology to using Twitter [4, 10–12]. One of our core missions as medical toxicologists is the education of learners, and our experience with #firesidetox demonstrates the feasibility of disseminating important toxicology teaching points through Twitter.

The tweetchat format lends itself to attracting a diverse audience and promoting the specialty of medical toxicology. Although we are one of the smallest subspecialties in the USA with only 596 board-certified members, medical toxicologists have demonstrated their value in improving the care of the poisoned patient [13, 14]. Promoting our research and expertise through social media can lead to increased recognition of our specialty and may result in attracting additional trainees into toxicology fellowship programs. Using firesidetox to demonstrate our expertise in medical toxicology will help us gain recognition as essential teachers in the free open access medication (FOAM) movement. Professionally, we were also able to harness #firesidetox to create strong collaborations with other toxicology societies (American Academy of Clinical Toxicology-AACT), and other specialties (American Pharmacists Association—APA). The ability to reach members of other professional healthcare groups, share our publications, and jointly promote the dissemination of toxicology literature is a strength of #firesidetox.

For specialists seeking to develop similar tweetchats, it is important to consider several factors. First, we suggest developing a working group to select topics or manuscripts for tweetchats. Second, a designated moderator should be chosen to coordinate tweetchats. Ideally, this moderator should be experienced in conducting a tweetchat and facile with Twitter. If such a person is unavailable, we recommend observing several tweetchats to understand the structure of a tweetchat. Finally, we cannot underscore the importance of advertising to publicize tweetchats. We experienced difficulty coordinating publicity for #firesidetox initially. We found that our most successful tweetchats were those that we collaborated with other professional organizations. We recommend advertising the tweetchat on Twitter and through email listservs to generate interest.

This study has several limitations. First, in comparison to other twitter-based journal clubs, #firesidetox is still in a nascent state. Second, due to the nature of Twitter, we are only able to attract participants who have a Twitter account. Further investigations could consider the use of other social media platforms to facilitate an interactive journal club. Third, in the time that we started #firesidetox, ACMT decided to hire a dedicated communications staff member which may help in our future efforts to generate publicity and attract users to #firesidetox. Fourth, the featured manuscripts were all peer-reviewed and published in the *Journal of Medical Toxicology (JMT)*. Other peer-reviewed journals may have variable success conducting tweetchats depending on topic content and social media expertise.

Conclusion

A toxicology-focused tweetchat discussing manuscripts from a peer-reviewed journal is feasible to develop and well received among its participants.

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Compliance with Ethical Standards

Conflict of Interest None

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