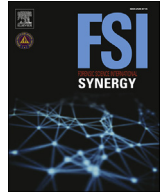


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To what extent if any has Twitter disrupted hierarchies in forensic pathology?

1. Introduction

Twitter is a free microblogging service that was launched by a quartet of tech entrepreneurs in 2006. It is a popular social media platform with more than 120 million daily users, 48.6 million of whom live in the United States. Twitter users “tweet”, have “followers” (those who subscribe to one’s tweets) and “follow” others (subscribing to the tweets of other individuals). A tweet has a 280 character limit and can be on any topic fancied by its author.

As in many branches of medicine, traditional teaching models in forensic pathology have followed the “top down” or “command” model where all or most knowledge is transmitted to learners from a single authoritative source. There was little room to debate ideas out of the classroom or seek another experts opinion, much less one located on the other side of the planet. Social media has been reported to dismantle existing hierarchies and alter the way by which individuals organize and exchange knowledge, power, and influence.

The purpose of the review is to provide a preliminary evaluation on the effect of Twitter on such hierarchies in forensic pathology.

2. Methods

Review period is from March 2006 to August 31, 2019. From a registered Twitter account, the author conducted a search under the “people” option, for forensic pathologists with Twitter accounts using the term “forensic” or “forensic pathologists”. Only those with verifiable names were further examined. Verification of status as a qualified forensic pathologist was performed by consulting (online) national registries, state or provincial medical boards, or affiliated universities/institutions. Each name was checked for cross links with other forensic pathologists. The data was further sorted by sex, location, number of tweets, nature of the tweets (forensic versus non forensic) number of followers and numbers followed.

A manual scroll through of the 100 most recent tweets of the top 10 tweeters was performed to determine what percentage of tweets had forensic content. Forensic content was defined by tweets and retweets that included any or all of the following subject matter: death investigation, autopsy protocols and safety, quality assurance, forensic pathologist recruitment, testifying in court and teaching cases of forensic relevance including images of gross and microscopic autopsy findings.

3. Results

3.1. After excluding 2 fellows in forensic pathology, 5 anatomic pathology residents and a medical student, 31 accounts belonging to forensic pathologists (FPs) were identified of which 17 were female and 14 male. Fifteen (15) were located in the United States, 4 in Canada, 3 in the UK, 2 each in Australia, Indonesia and Malaysia (total 6), and 1 each in the New Zealand, Denmark and South Africa.

The following sections are an analysis of their Twitter behavior.

3.1. Time of joining Twitter

- First account was registered in August 2008
- 13% (4) joined in 2009
- A single new account was registered in 2010
- 77% (24) joined after 2010 including 5 in 2011, 2 (2012), 3 (2013)
- 46% (14) joined after 2014
- 32% (10) joined in 2018–19 of which 7 joined in 2018 alone

The pattern indicates that although Twitter was launched in 2006, FPs have been slow to adopt it. As noted, more than 2 years passed before the first FP account was registered, the vast majority only coming 4 years after Twitter’s launch.

3.2. Characteristics of followers

- Total of 82,000+
- Range of 25–45,400; 2 had more than 10,000
- 9.6% (3) had more 4000
- 29% (9) had more than 1000

The fact that most FPs (22) had less than 1000 followers suggests that as “nano influencers” their influence is limited to their professional peers and like minded people [1].

3.3. Characteristics of those followed by the forensic pathologist

- Total of 28,776
- Range of 36 to 9,900
- Most forensic pathologists followed less than 2000 people

FPs tended to follow other FPs as well as surgical pathologists, who are a much larger group within the pathology community.

3.4. Tweet characteristics

- Total of 90,498
- 16 (51%) more than 1000 tweets
- 2 (6.5%) more than 10,000 tweets
- 10 (32%) between 2 and 10,000 tweets
- 6 (19%) between 500 and 2000 tweets
- 12 (39%) 500 tweets or less

This is an average of 2919 tweets per FP over an 11 year period which translates to 265 per pathologist per annum or less than 1 per day.

3.5. Forensic content (%) of 100 sequential tweets of the top 10 tweeters

- 2 FP - 30%
- 4 FP - 9 to 20%
- 4 FP - 5%

Clearly FPs are not necessarily using Twitter as a teaching vehicle since so few post forensic content. Most of the non-forensic tweets related to personal experiences and events.

4. Discussion

Less than 5% of FPs of a largely English speaking cohort of 762 FPs have Twitter accounts. The cohort includes 49 in Australia [2], 7 in New Zealand [3], 48 in Canada [4], 35 in Malaysia [5] 86 in South Africa [6], 37 in the United Kingdom [7] and at least 500 in the United States [8]. Is this low level of engagement sufficient to cause a disruption in knowledge transfer hierarchies in forensic pathology?

4.1. Metrics of disruption - not all the same

To determine that Twitter has disrupted hierarchies, there must be objective metrics to indicate that disruption has occurred such as;

- The number of trainees enrolled in forensic pathology fellowship programs
- The number of inquiries to forensic pathology fellowships
- The number of medical student and residents who are members of professional forensic pathology associations such as the US based National Association of Medical Examiners (NAME)
- The number of inquiries made by the public to identified experts on Twitter
- The number and frequency of person to person (“peer to peer”) connections.

These metrics permit a preliminary assessment of disruption and measure disruption in different ways. However more rigorous and detailed studies are required to demonstrate a clearer link between Twitter mediated interactions and the desired disruption.

The significance of those metrics will be a function of what is being measured and to whom the measurement is important. From the perspective of FPs seeking to maintain a sufficient cadre of well-trained experts, higher enrollments in forensic fellowships would be the most important outcome and the most useful unit of measurement. The so called “CSI” effect, which leads to an increased university enrolment in forensic science programs, supports the use of pathology resident enrollment in forensic pathology fellowship programs as a measure of the disruption in the hierarchy.

Of less measurable value is the number of inquiries to forensic pathology fellowship programs from pathology residents. While inquiries may increase as a result of increased access to forensic pathologists on Twitter, they may not necessarily translate to higher enrollment in fellowships.

For similar reasons, changes in medical student and resident participation in professional organizations such as NAME also do not necessarily indicate a direct relationship to Twitter disruption if fellowship enrollment is used as the unit of measurement. Additional research is needed to determine if medical students/residents engaged in the activities of professional organizations did so because of contact with FPs on Twitter.

Evaluating the level of public engagement with FPs via Twitter can be supported by the increase in the numbers of a pathologist’s followers. Discounting trolls and similar nuisance accounts, this would be straight forward metric. In addition, inquiries by the public to self-identified experts can be a viable surrogate for gauging the public’s level of engagement with forensic experts. In the long term such inquiries may be valuable opportunities to educate potential jurors about the limits of forensic pathology. They are also opportunities for “soft diplomacy” – the ability to communicate directly with an expert who is able and willing to respond to questions in a polite and respectful manner, paints a more favorable image of the profession; this would be welcome intangible benefit that could do a lot in the long to increase respect for the profession and quite possibly encourage more students to take it up as a career.

An analysis of a change in the number of connections between FPs may show that it is a useful proxy for their level of engagement with each other on Twitter. However the frequency and content of their interactions will be far more informative since so few post forensic related material on a regular basis.

4.2. Why are so few FPs on Twitter?

The reasons are not clear but many may be reluctant to use Twitter due to concerns about how their tweets may be admitted in evidence against them in a court of law, sometimes long after they have forgotten about the tweets. For instance a 2011 review of the use of social media platforms showed that even sitting judges were not immune to the pitfalls of social media use due to the occasional adverse effects on trial proceedings [9]. Forensic practitioners trying to separate personal from professional spaces on social media may be further distressed to find out that mere “friend” lists can be used in attempts to infer witness bias; which again can corrode the need to maintain impartiality. Other FPs may not be interested in using social media in general or Twitter in particular. The fact that a near third of FPs registered new accounts only within the prior 18 months of the study reflects the slow uptake of Twitter within the profession.

Whatever the reasons for the slow uptake of Twitter by FPs (justifiable self-preservation, social media apathy), it deprives the public and medical professionals in general of the benefits of direct and open communication with forensic experts when it is used appropriately. There is only so much material in forensic pathology that can be discussed publicly. It is up to the individual FP to find new ways to engage, inform and educate followers without violating decedent privacy or undermining judicial processes.

The slow Twitter uptake is an impediment to the disruption of traditional teaching and information transmission hierarchies in forensic pathology. On the other hand, while Twitter uptake rates among surgical pathologists is unknown, their far greater numbers and greater ability to anonymize cases (which are almost never in the public domain) mean that there has been exponentially more knowledge sharing and teaching on social media, including Twitter [10,11]. Still their behavior on social media is instructive. With all

the welcome disruption to learning hierarchies that have occurred with social media use in surgical pathology there are early but distinct elements of reconstituting hierarchies. The disparity in knowledge has had the paradox of fostering the development of on-line hierarchies [12] albeit not as rigid as their ancestors.

4.3. Hierarchies and how they can be disrupted by Twitter

Hierarchies are the inevitable consequences of humans forming groups. Humans are by nature hierarchical beings that function best when organized around a defined structure or leader whether real or virtual. Competition for leadership is influenced to a large extent by the ambitions of individual group members. This holds true for various hierarchies whether they include the transmission of knowledge, power or instructions (so called “master-servant” relationship).

Physicians being humans share these same characteristics. Within the physician group we sub-segregate into our various specialties and ultimately into subspecialties. As in other specialties, there are individuals in our fairly small group who have a strong commitment to teaching and mentoring. These would be the same individuals who are motivated to write books, give lectures, hold workshops etc. It would have been natural for these individuals to exploit the teaching models and channels of their era. For thousands of years prior to the advent of social media, from the days of Virchow (the father of microscopic pathology) till recently, training materials were channeled almost exclusively through these select pathways. The nature of these channels fit in well with the “top down” model of knowledge transmission and its limits to a direct “peer to peer” (or student to teacher) interaction.

Segue to the digital age. If the early internet heralded the possibility of making information more accessible to the masses, information exchange was still built around the same hierarchical model of its analog predecessors i.e. top – down where the user could only download content provided by the experts. Electronic mail (“email”) was the first internet age communications solution with mass consumer applications. While it allows people to interact fairly quickly, it still requires that the sender know the email addresses of every intended recipient, a restriction similar to that imposed by traditional mail. This limits instantaneous worldwide dissemination and exchange of thoughts and ideas. In addition while email does not diminish the FPs concerns of being caught in a contradiction in court, unflattering or critical email is fairly easy to ignore.

In contrast, Twitter does not require that the sender-recipient pair have a direct connection or even know of each other. A single tweet can be posted, copied, reposted and commented on around the world within seconds without its author ever having direct knowledge of who the subsequent readers or broadcasters are. The evidence of the mass appeal and speed of dissemination of tweets is the reason why it is so popular among certain elements of the entertainment and political class. In seconds the tweeter can mobilise millions of followers sometimes to fatal effect. Enter the Wirearchy.

4.4. The “Wirearchy”

First described by Husband in 1999, the “Wirearchy” is the “power structure created as the Information Age unfolded, disrupting hierarchical organizations and the fundamental construct of access to knowledge” [13]. The Wirearchy is really a disrupted hierarchy. The old command and control platforms typical of many organizations is dismantled and reconstituted as a more egalitarian communication engine through which the search for and communication of knowledge takes a more direct or an alternate path. It requires

fewer “middle men” who may insist on the payment of some sort of “toll” as a prerequisite to knowledge transfer.

Take for example the methods by which students and researchers would have conducted a literature review before 1980 when North American libraries deployed their catalogs online. The prohibitive costs of online information retrieval systems and their complexity dissuaded most users from using them [14]. To search the Index Medicus (a medical literature database launched in 1879 as a result of a medical school thesis), they were likely to transfer the task to a trained intermediary to search for themselves [15]. That meant a far less efficient, time consuming search through card catalogs and print indexes. Subsequently, users could search Index Medicus texts using Medline (the on-line database of references and journal article abstracts) by either taking advantage of paid subscriptions through their institutional library or consulting printed or CD-ROMs versions. Other online vendors of Medline such as Paper Chase and GRATEFULMED made medical information even more widely accessible, although full access was limited by a pay wall for which users were charged for online time and citations printed. Paper Chase targeted the “busy clinician” seeking answers to clinical care questions and who needed no knowledge of computer commands or of Medical Subject Headings (MeSH) [16]. PubMed followed as a freely available Medline search engine on the worldwide web in 1997 [17]. Launched in 2004, Google Scholar is one of the more widely used freely accessible scholastic databases. Although it has its limitations for the experienced researcher, it is useful for quick general queries [18,19]. These days, article authors are free to advertise their work on platforms such as [Academia.edu](https://www.academia.edu) and ResearchGate. The fact that all this occurred over a relative short time period (26 years to the introduction of Twitter) is evidence of disruption in the acquisition of knowledge due to the introduction of newer technologies. The use of Twitter as a vehicle for a modified regime of knowledge transfer is no different.

From the perspective of a FP who identifies themselves as such on Twitter and posts forensic content, there is an unspoken expectation to either respond to queries or to encourage other experts to offer their own responses. An expert who never responds to queries may eventually lose followers and in turn lose influence. Electronic media and the concept of the Wirearchy are influential in facilitating a more direct means of knowledge transfer.

4.5. Limitations of this review

Although this is a preliminary analysis, there are several factors that limit a thorough evaluation of the degree of disruption of Twitter hierarchies in forensic pathology. Noted previously is the recent registration of FPs on Twitter and the inadequate percentages of forensic related posts by a small number of individuals. Not every professional on Twitter necessarily wants or needs to limit their posts to their specialty. As well, the fairly small sample size is not sufficiently representative of the number of pathologists in English speaking countries, let alone worldwide. If the US ratio of 500 FPs to 300 million population was applied at a global scale there should be over 11,600 worldwide! Twitters automated translation feature should encourage further interaction between pathologists speaking different languages.

5. Conclusion

Twitter use by FPs is still quite limited and so a complete assessment of its effect on hierarchies at this point is impossible. However a preliminary evaluation suggests that Twitter has begun to disrupt learning hierarchies. It has broken down barriers to communication and increased opportunities to learn and collaborate. Twitter

provides an opportunity for the population at large and pathology trainees in particular to interact directly with forensic experts around the world. These changes will continue if more FPs can be persuaded to register accounts on Twitter.

Declaration of Competing Interest

The author has no competing interests to declare.

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