The Potential of Twitter as a Data Source for Patient Safety

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ABSTRACT

Background: Error-reporting systems are widely regarded as critical components to improving patient safety; yet current systems do not effectively engage patients. We sought to assess Twitter as a source to gather patient perspective on errors.

Methods: We included publicly accessible tweets in English from any geography. To collect patient safety tweets, we consulted a patient safety expert and constructed a set of highly-relevant phrases, such as "doctor screwed up". We used Twitter's search API from January to August 2012 to identify tweets that matched the set of phrases. Two researchers used criteria to independently review tweets and choose those relevant to patient safety; a third reviewer resolved discrepancies. Variables included source and gender of tweeter, source and type of error, emotional response, and mention of litigation.

Results: Of 1006 tweets analyzed, 839 (83%) identified the type of error: 26% of which were procedural errors, 23% medication errors, 23% diagnostic errors, and 14% surgical. 850 (84%) identified a tweet source: 90% of which were by the patient; 9% by a family member. 519 (52%) identified an emotional response: 47% of which expressed anger or frustration, 21% humor or sarcasm, and 14% sadness or grief. 6.3% of tweets mentioned an intent to pursue malpractice litigation.

Conclusions: Twitter is a relevant data source to obtain the patient perspective on medical errors. Twitter may provide an opportunity for health systems and providers to identify and communicate with patients who have experienced a medical error. Further research is needed to assess the reliability of the data.

INTRODUCTION

Safety reporting systems are in their infancy – most struggle to provide feedback to those reporting errors, few have been shown to reduce patient harm, and most do not effectively engage patients. The value of reporting systems increases with the number of different stakeholders contributing error reports.[1] [2] Clinicians have increasingly reported errors over the years, with nurses reporting far more frequently than physicians. Yet patients, who can offer a personal view of health care and a valuable source of safety concerns, remain largely untapped. The World Health Organization has written extensively on the importance of patients taking an active role in defining patient safety.[3] Unfortunately, the current system of capturing safety information from patients is poorly defined. As a result, the patient voice is often unheard and their views on factors causing errors and emotional reaction to errors remain unknown.[4]

To capture the patient's voice, the Agency for Health Research and Quality (AHRQ) is developing a consumer reporting system for the United States. It is unclear if patients will engage this system in a meaningful way. Web-based patient safety reporting systems could expand the capabilities for collecting patient reports, providing a means to efficiently identify hazards from a broad base of stakeholders.[5] Social media may provide another mechanism to hear the safety concerns of patients, and have been deployed as web-based reporting systems to collect patient reports on influenza detection,[6] medication safety,[7] and other public health issues.[8] In addition to attracting a broad base of users, social media offers an immediate and expansive view of the patient perspective. Nevertheless, the potential for using social media to collect information about medical errors is largely untested.

This study explored whether Twitter was a relevant data source to learn about patient safety and capture the patient's voice.

METHODS

In this prospective study, we collected Twitter posts related to medical error from January 2012 to August 2012. Twitter is a microblogging service that allows an individual to write a brief (≤ 140 characters) text message (called tweet) that is posted to the Twitter platform for anyone to read.

Search strategy

Our search strategy included publicly accessible tweets in English from any geographic region. Private tweets were not accessed. Most tweets likely originated in the United States, given a recent study that found >57% of Twitter users were US-based.[9] We explored a sample of the tweet dataset to construct a set of keywords to query Twitter for messages likely associated with medical error (Table 1). We based the queries on pairing nouns and verbs to form phrases, such as "hospital messed up," and "doctor was wrong." We created these phrases by searching for tweets with keywords potentially related to patient safety ("doctor," "medication," "mistake") and then identifying longer phrases that were strongly indicative of a medical error. We used Twitter's search API to identify tweets that matched the search queries in Table 1.

Data collection and analysis

To identify relevant patient safety tweets, we developed the following selection criteria in consultation with a patient safety expert (PJP):

1) Does the statement explicitly express a preventable and adverse (not as originally intended) medical event?
2) Is the event care-related and explicitly ascribed to the actions of a health professional or a specific procedural mistake (e.g., doctor, pharmacist, nurse, surgeon, operation, prescription)?
3) Does the statement about the patient safety incident refer to the person sending the tweet or someone personally known by that person?

Two researchers (of AN, SGB, or RJP) independently reviewed each identified tweet using the criteria to determine the relevance to patient safety. In the case of a disagreement, a third researcher was consulted. Relevant patient safety tweets were coded along the following four dimensions: source of tweet, source of error, type of error, and emotional response to error. We coded source of tweet into the following categories: patient, family member, friend, other patient-related source, nurse, doctor, colleague, unknown. Based on review of tweets and discussions with safety experts, we coded source of error into the following categories: physician, nurse, hospital, surgeon, dentist, other medical personnel, unspecified. Using the same approach, we coded the type of error into the following categories: procedural, medication, diagnostic, surgical, birth certificate, communication or knowledge, physical exam, forms, infection. We also coded the emotional response to error into the following categories: anger/frustration, humor/sarcasm, sadness/grief, happiness, shock/disbelief, fear, relief, used prayer, paranoia, unspecified.

We considered emoticons as a form of emotional response. Depending on the context of the tweet, an unhappy emoticon [:(] was categorized as anger or sadness, a smile emoticon [:)] was categorized as happiness, and a wink-face emoticon [;)] was categorized as humor. When the tweeter attributed an error to multiple sources, or expressed multiple emotions, the coders made a subjective judgment to select the most appropriate or prevailing code. Other variables collected were malpractice claims or intent to file a claim and gender (identified by manual review of the username and screen name).

Our analysis was descriptive, reporting percentages to summarize the data. We looked at the source of each tweet and defined them as unique (the sole tweet by its author) or non-unique (one of multiple tweets by the same author).

RESULTS

Of 3000 tweets identified, 1006 met the selection criteria and were included in our analysis. Of 1006 tweets, 536 (53%) had an identifiable gender, of which 37% were female and 16% were male. Eight hundred eight-six tweets (88%) originated from a unique source and 120 (12%) from a non-unique source. Sixty-three tweets (6%) referenced an intent or desire to follow up with a malpractice lawsuit. Table 2 describes the dimensions and characteristics of patient safety-related tweets. The majority of tweets were reported by the patient, 763 of 850 (90%); placed blame on the physician, 521 of 998 (52%); were procedural errors, 219 of 839 (26%); and expressed anger or frustration, 243 of 519 (47%).

DISCUSSION

We found that Twitter can be used to collect information from patients and their families about medical errors. To our knowledge, this was the first study to investigate tweets as a mechanism to gather a rich source of patient safety-related information. We likely captured only a small number of relevant tweets, and Twitter just one of several social media platforms, which in their totality could provide an even richer source of information about errors. Our study took the important first steps of characterizing who uses Twitter to report patient safety errors, what type of patient safety information is being expressed, and what emotions are conveyed. For many people, Twitter is a safe and convenient outlet to share information about themselves, relatives, friends, or colleagues.

There were limitations in our approach. Patient interpretation of medical errors may be inaccurate if they have limited medical knowledge. At times, errors can be glaringly evident, such as this tweet: “My mom went into surgery last year and the f------ doctor messed up on the surgery and operated the wrong thing....” At other times, it was difficult to determine whether a tweet was a preventable error versus a medication side effect or an undesired medical experience. In cases of

uncertainty, the panel of three reviewers discussed the tweet and came to a consensus, but without confirmation from the tweet source, some errors may have been incorrectly coded. Another limitation was the homogeneity of the Twitter user population. Twitter attracts an older crowd when compared to other forms of social media (e.g., Facebook), but a younger crowd compared to the national population average.[10] A final limitation is the validity of coding of the type of error and the emotional response. This was the first study to use Twitter and we were not able to independently validate these error reports. As such, we may have misclassified some types of errors and the emotional response.

Despite these limitations, our study provided evidence that Twitter can be another source of information about medical errors, information presented from the patient's perspective. This could become ever more valuable given the increasing reliance on patient satisfaction data in determining physician reimbursement. In fact, in 2013, nearly $1 billion in federal Medicare payments relied in part on patient-satisfaction surveys.[11] Furthermore, according to a survey of 182 health care organizations in 2011, nearly two-thirds of hospitals, health systems, and large physician groups have annual physician incentive plans, and 62% use patient satisfaction metrics as a factor.[12] Yet, hospital reporting systems are currently underdeveloped, do not adequately engage patients, and often fail to collect the majority of patient safety errors.[1314] A recent study found that approximately 90% of all hospital errors are unreported despite the increased pressure on hospitals to accurately report medical errors.[15] Twitter, on the other hand, allows disengaged patients to freely report any perceived incidents and may have a yet unforeseen role to play in the movement toward greater responsiveness by the field to patient satisfaction data.

Health systems and providers can, in turn, engage these users to learn more about their concerns. This raises important questions, such as how a hospital system should respond to a patient safety error expressed to thousands of online users explicitly faulting the hospital system. Whether and how health care providers should engage in social media is a complex question, involving ongoing

conversations between providers, researchers, and patients.[16] [17] However, it is important to realize that these reports and associated conversations already take place online. Health care providers must decide if and how they will participate and learn from these conversations.

Given the emotional responses we found, health care providers should learn from error-related tweets. Nearly one quarter of tweets expressed anger, three fold more than those expressing sadness. Moreover, 6% of patient safety tweets included an intent to file a malpractice claim, potentially providing an opportunity to resolve the conflict and avoid a claim. This parallels recent literature, which demonstrated that in a given year 7.4% of all physicians had a malpractice claim against them.[18] Knowing that anger and frustration are the most common emotional responses to patient safety errors, hospitals should consider altering their approaches to errors and prepare staff and providers to respond appropriately. Furthermore, nearly 8% of tweets were published by a family member of the victim, indicating that family members may need to be more involved in conversations following a safety error.

Our Twitter data demonstrates a potential alignment with hospital-reported data. Although the past two decades have seen significant patient safety reporting improvements, there is still much to learn about true error rates, types of errors, and sources of these errors in our health care system. Even in the area most researched, medication error rates, significant disparities exist in the literature as to the true rates and also vary significantly from practice settings and specialty fields. For example, three studies from covering the time period of 2000 to 2007 indicate describe medication error rates that ranging widely from 29% up to 47% of total reported errors.[19] [20] Our data indicates that approximately 20% of patient-reported errors from our data related to medications.

More research is needed to determine how meaningful and accurate patient-reported Twitter data is. However, even informal reports through social media have been indicative of real-world trends and patterns. For example, online reviews of doctors have correlated with existing metrics of health

care provider quality.[21] Ultimately, the data from this study could shed light on the types of events patients recognize as errors and choose to express via Twitter. This offers the patient's perspective on the process, which is often missing from current reporting systems.

Importantly, Twitter offers a unique opportunity to democratize the patient safety improvement process and engage patients as empowered stakeholders. This falls into a larger trend of using the Internet to create "a more consumer-centric healthcare industry," [22] through websites such as Alliance Health[23] and PatientsLikeMe,[24] allowing patients and users to share advice and experiences and support one another. For example, 447 amyotrophic lateral sclerosis (ALS) patients used PatientsLikeMe to engineer their own twelve-month clinical trial, enrolling themselves in experimental and control groups, to assess lithium as a potential treatment for ALS.[25] In altering one of the most structured components of academic medicine, this trial serves as a striking example of the dynamic shift toward patient empowerment enabled by social networks. While the authors of the study admit this model is not a substitute for a double-blind randomized controlled trial, the implications are clear: patients can leverage social networks to reconstruct traditional systems and power hierarchies in health care. The findings of our study suggest that a similar opportunity exists to empower social media users in the context of patient safety. To our knowledge, this study was the first to show that Twitter users freely and openly express patient safety errors, providing a voice to more patients than previously possible.

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Authors' contributions:

Atul Nakhasi: I declare that I co-authored the primary manuscript draft and all major revisions; led analysis and interpretation of data; critically reviewed and edited manuscript; and that I have seen and approved the final version.

Ralph Passarella: I declare that I co-authored the primary manuscript draft and all major revisions; led analysis and interpretation of data; critically reviewed and edited manuscript; and that I have seen and approved the final version.

Sarah Bell: I declare that I co-authored the primary manuscript draft and all major revisions; led analysis and interpretation of data; critically reviewed and edited manuscript; and that I have seen and approved the final version.

Michael Paul: I declare that I helped develop study protocol and design, coordinated all data collection; designed statistical plan and conducted statistical analyses; critically reviewed and edited manuscript; and that I have seen and approved the final version.

Mark Dredze: I declare that I performed or directly oversaw all aspects of study from conception through completion (principal investigator); critically reviewed and edited manuscript; and that I have seen and approved the final version.

Peter Pronovost: I declare that I performed or directly oversaw all aspects of study from conception through completion (principal investigator); critically reviewed and edited manuscript; and that I have seen and approved the final version.

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Table 1: Search terms used to identify patient safety messages.

Search Queries
hospital screwed up, hospital f---ed up, hospital messed up, hospital made a mistake, hospital was wrong, hospital mistake, hospital gave me the wrong, hospital error, sue the hospital, surgeon screwed up, surgeon f---ed up, surgeon messed up, surgeon made a mistake, surgeon was wrong, surgeon mistake, surgeon gave me the wrong, surgeon error, sue the surgeon, nurse screwed up, nurse f---ed up, nurse messed up, nurse made a mistake, nurse was wrong, nurse mistake, nurse gave me the wrong, nurse error, sue the nurse, doctor screwed up, doctor f---ed up, doctor messed up, doctor made a mistake, doctor was wrong, doctor mistake, doctor gave me the wrong, doctor error, sue the doctor

* Profanity has been redacted for presentation purposes.

Table 2. Dimensions and Characteristics of Patient Safety-related Tweets (n=1006)[a]

Dimensions	No. (%)
Source of tweet, total	850 (84)
Patient	763 (90)
Family member	77 (9)
Friend of patient	3 (0.4)
Other patient-related source	3 (0.4)
Nurse	2 (0.2)
Physician	1 (0.1)
Colleague	1 (0.1)
Source of error, total	998 (99)
Physician	521 (52)
Nurse	217 (22)
Hospital	156 (16)
Surgeon	101 (10)
Dentist	2 (0.2)
Other medical professional	1 (0.1)
Type of error, total	839 (83)
Procedural error	219 (26)
Incorrect medication or prescription	197 (23)
Diagnostic error	195 (23)
Surgical error	114 (14)

Birth certificate error	52 (6)
Communication or knowledge error	50 (6)
Error during physical exam	8 (1)
Error(s) on form	3 (0.4)
Infection	1 (0.1)
Emotional response, total	519 (52)
Anger or frustration	243 (47)
Humor or sarcasm	107 (21)
Sadness or grief	72 (14)
Happiness	57 (11)
Shock or disbelief	26 (5)
Fear	4 (0.8)
Relief	4 (0.8)
Used prayer	3 (0.6)
Paranoia or mistrust	3 (0.6)

[a] Each tweet was independently reviewed and coded by two researchers, and a third research consulted in the case of a disagreement in coding. Unknown/unspecified codes are omitted from each categories totals.