Using Twitter to Assess the Public Response to the United States Preventive Services Task Force Guidelines on Lung Cancer Screening with Low Dose Chest CT

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Abstract To use Twitter to assess the immediate public response to the United States Preventive Services Task Force (USPSTF) 2013 draft guidelines on lung cancer screening with low-dose chest CT (LDCT). The number of tweets including the phrases “lung cancer screening,” “lung CT,” “chest CT,” “low dose computed tomography,” “low dose CT,” or “LDCT” was recorded for 6 days before and after guidelines release. A systematic sample of 172 tweets from the week following release was coded for user type, tweet opinion, linked article source, and article opinion. Following guidelines’ release, the number of daily tweets increased from 13 ± 8 to 311 ± 395 . The 172 tweets in the week following release were tweeted by 166 unique users including: news organizations/online news gathering accounts (34.9%), general public (21.7%), physicians (12.0%, 6 radiologists), and businesses (11.4%). 23.3% of tweets provided opinion on the guidelines (50.0% favorable, 27.5% concerned toward screening). Most (91.3%) tweets contained links to a total of 46 unique articles, which were authored by lay press (41.3%), non-peer-reviewed medical press (32.6%), and hospital/medical practice websites (10.9%). Among these, 50.0% were favorable, citing mortality reduction (87.0%), published data supporting screening (50.0%), and early detection (43.5%), while 28.3% expressed concern, including false positives (58.9%) and radiation risk (39.1%). Twitter activity rose rapidly after the USPSTF draft guidelines on LDCT. Most users were non-physicians and frequently cited non-peer-reviewed articles. Users maintained an overall favorable view of screening, while expressing various

concerns. Considerable opportunity exists for greater radiologist engagement in this online public dialog.

Keywords Lung cancer · Low-dose CT · Screening · Social media · Twitter

Introduction

The United States Preventive Services Task Force’s (USPSTF) recommendation for low dose chest CT (LDCT) for current or recent smokers aged 55 through 80 with a 30 pack-year smoking history has evoked considerable debate within the medical community [1]. Though practitioners have recognized a significant mortality benefit, as shown in the National Lung Screening Trial (NLST) [2], this benefit must be weighed against increased radiation exposure, patient anxiety, and post-procedural complications [2]. The USPSTF draft guidelines arrived at a time of increasing public interest in lung cancer screening, as indicated by an analysis of online search trends [3]. Nonetheless, insights into the public’s reaction to these guidelines are largely lacking, as investigations of its impact have primarily focused on responses by health care providers as well as subsequent utilization of LDCT [4, 5]. Public awareness of the guidelines may influence patients’ willingness to undergo the screening examination, when recommended, in the face of potential concerns. Thus, greater insights into the public’s overall perception of the guidelines would be useful to facilitate shared decision-making and improve guideline compliance.

Social media has been increasingly accepted as an approach for assessing public opinion [3, 7–10]. In particular, the social network Twitter, which is used by over 320 million active users every month who collectively send 500 million messages, or “tweets,” per day [6], has been a focus of recent

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research efforts in medicine [7–10]. Through Twitter, patients, physicians, and other healthcare providers can rapidly express and disperse opinion and relevant articles on timely health care matters among a diverse audience. For example, Twitter has been used to assess patients' opinions on such topics as medical errors and quality of care [7, 8] and to evaluate public opinion on utilization of screening tests such as prostate-specific antigen [9] and mammography [10]. In a similar fashion, Twitter may provide a means for evaluating the public's reaction to the USPSTF guidelines relating to LDCT. Thus, our aim was to use Twitter to assess the immediate public response to the 2013 USPSTF draft guidelines on lung cancer screening with LDCT.

Methods

This retrospective, HIPAA-compliant study was approved by our institutional review board, with a waiver of the requirement for written informed consent.

The Twitter analytics tool Topsy (Topsy Labs, San Francisco, CA) was initially used to search tweets in the 6 days prior to (07/23/13 through 07/28/13) and the 6 days after (07/29/13 through 08/03/13) the release of the USPSTF draft guidelines on lung cancer screening with LDCT (07/29/13). Tweets during this time containing the keywords “lung cancer screening,” “lung CT,” “chest CT,” “low dose computed tomography,” “low dose CT,” or “LDCT” were retrieved. The number of identified tweets per day using these keywords was recorded over this entire study period.

In order to further evaluate the content of tweets relating to the draft guidelines, a systematic sampling method was used to obtain a subset of the previously noted identified tweets for more detailed manual assessment. This subset was extracted from the tweets published in the 6 days immediately following release of the USPSTF draft guidelines (including the day of release). Specifically, for each day over this 6-day period, every N th tweet was extracted, where N was determined as the total number of tweets in the given day divided by 35 and rounded to the nearest whole number. This number of tweets

was initially selected with an intent to provide a final subset of approximately 200 tweets (approximately 35 tweets per day) for detailed assessment. However, some days had fewer than 35 total tweets, in which case all of the day's tweets were included. This process resulted in a subset of 191 tweets occurring in the week following the guidelines' release. Additional tweets were then excluded at the time of detailed manual review for the following reasons: not related to the topic of lung cancer screening ($n = 3$), contained a non-functioning link ($n = 13$), and duplicate tweet from a single user ($n = 3$). This process left a final subset of 172 unique relevant tweets for further analysis.

Two reviewers in consensus coded these 172 tweets with regard to the type of user posting each tweet (e.g., patient, physician, hospital), based on viewing the user's self-provided Twitter biography, as well as the nature of any content contained within the tweet (e.g., expressing favorable or concerned sentiment with respect to lung cancer screening using LDCT; advertising a particular lung screening program). For this assessment, direct quotations from linked articles within the tweet were not considered to represent the opinion of the tweeter. Separately, linked articles within tweets were classified in terms of the article source (e.g., news media, non medical press, medical society web page) and nature of the link content. Finally, in addition to the overall general categorization of tweet and link content, specific considerations regarding screening within tweets and links were tallied and grouped as favorable toward screening (e.g., mortality reduction, early detection, cost-effectiveness) or concerned regarding screening (e.g., radiation risk, false positives, overdiagnosis). For these assignments, individual tweets and links could contain multiple considerations, including combinations of favorable and concerned considerations.

Data was evaluated using standard summary statistics including overall tallies and percentages. The number of daily tweets was compared before and after release of the USPSTF guidelines using the Mann-Whitney U test. Statistics were performed in Microsoft Excel (Microsoft Corporation, Redmond, WA) and MedCalc (MedCalc Software, Ostend, Belgium).

Fig. 1 Number of daily tweets meeting various search criteria relating to lung cancer screening with low-dose chest CT before and after release of the USPSTF draft guidelines on lung cancer screening on July 29, 2013

Fig. 2 Categorization of users posting tweets during the week following release of the USPSTF draft guidelines ($n = 166$)

Results

During the 6 days prior to the release of the USPSTF draft guidelines on lung cancer screening, the average number of tweets satisfying the search criteria per day was 13 ± 8 (mean $\pm$ SD). During the 6 days following release, this increased significantly ($p=0.013$) to 311 ± 395 tweets per day (Fig. 1). The two single days with the greatest number of tweets were the first and second day immediately following release (718 and 905 tweets, respectively), with a subsequent gradual decrease in the number of tweets per day (ranging from 133 tweets on day 3 to 16 tweets on day 6 following release).

The 172 tweets from the week following release that were selected for more detailed assessment were posted by 166 unique users: 34.9% news organization or online news gathering account, 21.7% general public, 12.0% physician (including six radiologists), 7.2% professional medical organization, 11.4% business, 4.2% non-physician health care professional, 1.8% governmental or research organization, 1.8% hospital, 0.6% biomedical journal, and 4.2% indeterminate (Fig. 2).

A total of 23.3% ($n = 40$) of the 172 tweets from the week following release contained opinion regarding the USPSTF recommendations. Of these, 50.0% expressed a favorable opinion toward screening, 27.5% expressed concern regarding

screening, 12.5% were advertisements for a screening program, and 10.0% did not fall into any of these categories (Fig. 3). Specific considerations which were favorable toward screening included lives saved (35.0%), cost-effectiveness (10.0%), and presence of published data in support of screening (10.0%). Specific considerations which were concerned regarding screening included cost (45.0%), overutilization (9.0%), lack of evidence (9.0%), other/non-specific concerns (36.0%).

A total of 91.3% (157) of tweets included a link to additional information (articles or other online media) regarding lung cancer screening. A total of 46 unique links were identified within this subset. These links were authored by lay press (41.3%), non-peer-reviewed medical press (32.6%), hospital and medical practice websites (10.9%), professional medical societies (6.5%), the USPTSF (2.2%), and other sources (6.6%) (Fig. 4). These articles were favorable in 50.0%, concerned in 28.3%, and neutral in 17.4%, while 4.3% represented advertisements for a specific screening program. Specific favorable considerations in links included mortality reduction (87.0%), presence of published data in support of screening (50.0%), early detection (43.5%), and support for screening by major medical organizations (30.4%) (Fig. 5a). Specific concerned considerations in links included false positives (58.9%), radiation risk (39.1%), harms related to intervention (32.6%) and overdiagnosis (30.4%) (Fig. 5b).

Fig. 3 Categorization of tweet content during the week following release of the USPSTF draft guidelines ($n = 40$)

Fig. 4 Categorization of article sources during the week following release of the USPSTF draft guidelines ($n = 46$)

Discussion

We used Twitter to examine the immediate public response to the USPSTF draft guidelines on lung cancer screening. The number of tweets relevant to lung cancer screening rose drastically during the 2 days following the release (718 and 905 tweets) in

comparison with the two preceding days (7 and 4 tweets), with a subsequent gradual decline. This indicates a strong public interest and strong ability for information to be distributed quickly and across a diverse audience using online social media. By allowing immediate participation by all interested individuals and groups, Twitter provided a unique and powerful mechanism for disseminating information during this initial period, allowing additional potential for subsequent analysis.

A sample of tweets from the week following release indicated a generally favorable stance toward screening within both tweet opinion and link content. Key considerations in influencing favorable views included mortality benefit, early detection, cost-effectiveness, and availability of supporting data. These favorable views may be viewed as encouraging regarding potential acceptance of the draft guidelines by the public and patients' presumed willingness to undergo screening. Nonetheless, despite the overall favorable views, a range of concerns were expressed, relating to such topics as false positives, radiation exposure, increased costs, and overdiagnosis. Thus, healthcare providers and organizations must be prepared to address such concerns to facilitate even greater guideline adoption.

A majority of users who tweeted on the subject were members of the general public or a news-related agency or account. Healthcare providers and organizations were a small minority of contributors, with radiologists being particularly poorly represented ($n = 6$, 4.0%). These findings indicate a missed opportunity for radiologists to optimally contribute to public dialog regarding a medical test in which they are experts. In addition, most linked articles originated from lay press or non-peer-reviewed medical press, with a paucity of links to peer-reviewed evidence-based biomedical literature. Greater direct participation by radiologists, as well as other healthcare providers, could be valuable for ensuring provision of the highest quality of information and data, and properly representing various aspects of the issue. Involvement by radiologists also enhances the specialty's visibility to patients and the public at large, consistent with current major specialty initiatives such as RSNA Cares [11] and the American College of Radiology's Imaging 3.0 [12].

Past studies have largely focused on perceptions regarding LDCT by healthcare providers, including general practitioners

Fig. 5 **a** Favorable considerations regarding lung cancer screening within linked content. **b** Concerning considerations regarding lung cancer screening within linked content. *Ed = education, Ep = experience, St = standardization

[4, 5] and pulmonologists [13]. One additional study demonstrated the ability of radiology residents at a community health fair to effectively educate local residents regarding lung cancer screening [14]. Together, such studies indicate a range of gaps in knowledge relating to LDCT by patients and physicians alike, including an overall lack of awareness [4, 14], variable provider recommendations for screening [13], and a potential tendency to overly rely on chest radiographs rather than LDCT [15]. Nonetheless, we are unaware of prior literature that has specifically assessed the immediate public response to the draft guidelines as we have done in the present study.

Our study has several limitations. First, we categorized the content and links of only a sample of the over 1500 tweets posted during the week following the release of the draft guidelines. However, past studies have suggested that systematic sampling has the ability to capture a representative sample of tweets relevant to a given topic for further analysis [16, 17]. Also, some relevant tweets may not have been identified by our selection of search phrases; however, we searched various search terms prior to selecting the final queries based on those which returned high volumes. In addition, our system for classifying the content of tweets and links was inherently subjective in nature. Finally, though Twitter is recognized to have a large and diverse network of users from varying backgrounds and countries [18, 19], the community of Twitter users is still a small subset of the global population which may not fully be representative.

In conclusion, following the release of the USPSTF draft guidelines on lung cancer screening with LDCT, relevant activity on Twitter showed an immediate drastic increase, providing insights into the public response during this time. Participating Twitter users were primarily non-physicians and overwhelmingly non-radiologists, and largely referenced non-peer-reviewed news articles. While tweet content and referenced articles and tweet content were overall favorable regarding screening, a range of concerns regarding screening were nonetheless expressed. Greater physician- and radiologist-driven participation, incorporating high-quality evidence-based data, is encouraged to further inform such public dialog using social media.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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