Social Media Responses to Elective Surgery Cancellations in the Wake of COVID-19

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Objective: To assess public response to cancellations of elective surgeries following the American College of Surgeons' (ACS) recommendation on March 13.

Methods: We queried text comments from Reddit, a social media platform and the fifth most popular website in the United States. Comments were manually reviewed to assess for relevance to elective surgery in the United States during the global coronavirus outbreak, whether the text was written by a healthcare worker (HCW), whether the user was based in the United States, and whether the text documented cancellations of surgery, expected cancellations of surgery, or surgery ongoing after the ACS announcement. Analysis of overall sentiment and negativity in comment text was performed using the Valence Aware Dictionary for sEntiment Reasoning (VADER), a validated natural language processing tool previously used in studies of health behaviors using social media. Non-parametric tests were used for subgroup comparisons based on posting date and characteristics identified during manual review.

Results: Following manual review, 1272 comments were included for analysis. Overall sentiment among non-HCWs became significantly more negative following the ACS announcement (P = 0.037). Overall sentiment did not significantly differ between HCWs and non-HCWs prior to the ACS announcement (P = 0.98), but non-HCW sentiment became significantly more negative than HCW sentiment after the announcement (P = 0.027). Negativity scores in posts describing cancellations were significantly higher among posts written by non-HCWs than HCWs (P = 0.028).

Conclusions: Cancellation of elective surgeries had an adverse emotional impact on non-HCWs. This finding highlights the importance of access to elective surgery to patients' emotional well-being.

Keywords: coronavirus, COVID-19, elective surgery, natural language processing, SARS-Cov-2, sentiment analysis, social media, surgery

On Friday, March 13, 2020 the American College of Surgeons (ACS) recommended halting elective surgery nationwide to prepare for the COVID-19 pandemic.[1] This recommendation was endorsed the following day by the US Surgeon General.[2] A recently published national health survey revealed that "not being able to get medical care," such as elective surgery, was the second highest concern among respondents besides "getting sick because of COVID-19."[3] In light of this concern, we aimed to investigate public sentiment regarding the recommendations from the ACS and Surgeon General.

METHODS

We queried online posts from Reddit, a social media platform and the fifth most popular website in the United States with 21 billion screen-views per month.[4] Several discussion forums on the site, known as "subreddits," are dedicated to topics of medical interest. We examined the subreddits r/medicine, r/surgery, and r/coronavirus, which together claim over 2.3 million members. Reddit is an ideal platform of study because (1) all posts are public, (2) user anonymity encourages reporting noncompliance with the recommendations, and (3) narrative content is encouraged through which to express sentiment.

We used the Reddit PushShift API[5] in Python to identify comments containing the keyword "elective" that were archived between December 31, 2019 (when the first COVID-19 cases were reported in China) and April 15, 2020. Each comment was manually reviewed by 3 raters (S.A.R., M.S.R., J.W.Z.) to assess for several binary characteristics: (1) relevance to elective surgery and procedures in the setting of COVID-19, (2) location of the comment's author in the United States, (3) author identification as a healthcare worker (HCW), and comment content describing (4) cancellations, (5) expected cancellations, or (6) ongoing elective cases after the ACS recommendation. Author identification as an HCW was based on admission as such either in their comment or post history; otherwise, non-HCW status was presumed. Comments were grouped by date before or after the ACS announcement.

Sentiment analysis of comment text was performed in Python using the Valence Aware Dictionary for sEntiment Reasoning (VADER), a validated natural language processing tool that has previously been used to study health behaviors with social media.[6,7] VADER is optimized for social media text, accounting for elements of the online lexicon such as slang, emoticons, "all caps," and redundant punctuation (eg, multiple exclamation points). Furthermore, VADER calculates sentiment in a context-aware manner, using textual clues to interpret negation and disambiguate multiple word meanings. Two measures, scores for negativity and sentiment, were calculated by VADER for each comment. Negativity scores ranging from 0 to 1 quantify the intensity-weighted proportion of text expressing negative sentiment; whereas, sentiment scores ranging from −1 to 1 quantify overall negative to positive sentiment. Comments with non-zero sentiment scores (implying the text included subjective viewpoints) were included for subgroup comparisons using Wilcoxon rank-sum, Kruskal-Wallis, and Chi-squared tests. Significance was determined using α = 0.05. Scores are reported as medians. Data analysis and visualization were performed in R 3.6.1. This study was deemed nonhuman subjects research.

RESULTS

A total of 1777 comments were identified and manually reviewed. Of these, 1387 (78.1%) were specific to elective surgery and procedures in the United States during the COVID-19 pandemic, of which 1272 (91.7%) had a non-zero sentiment score; these were
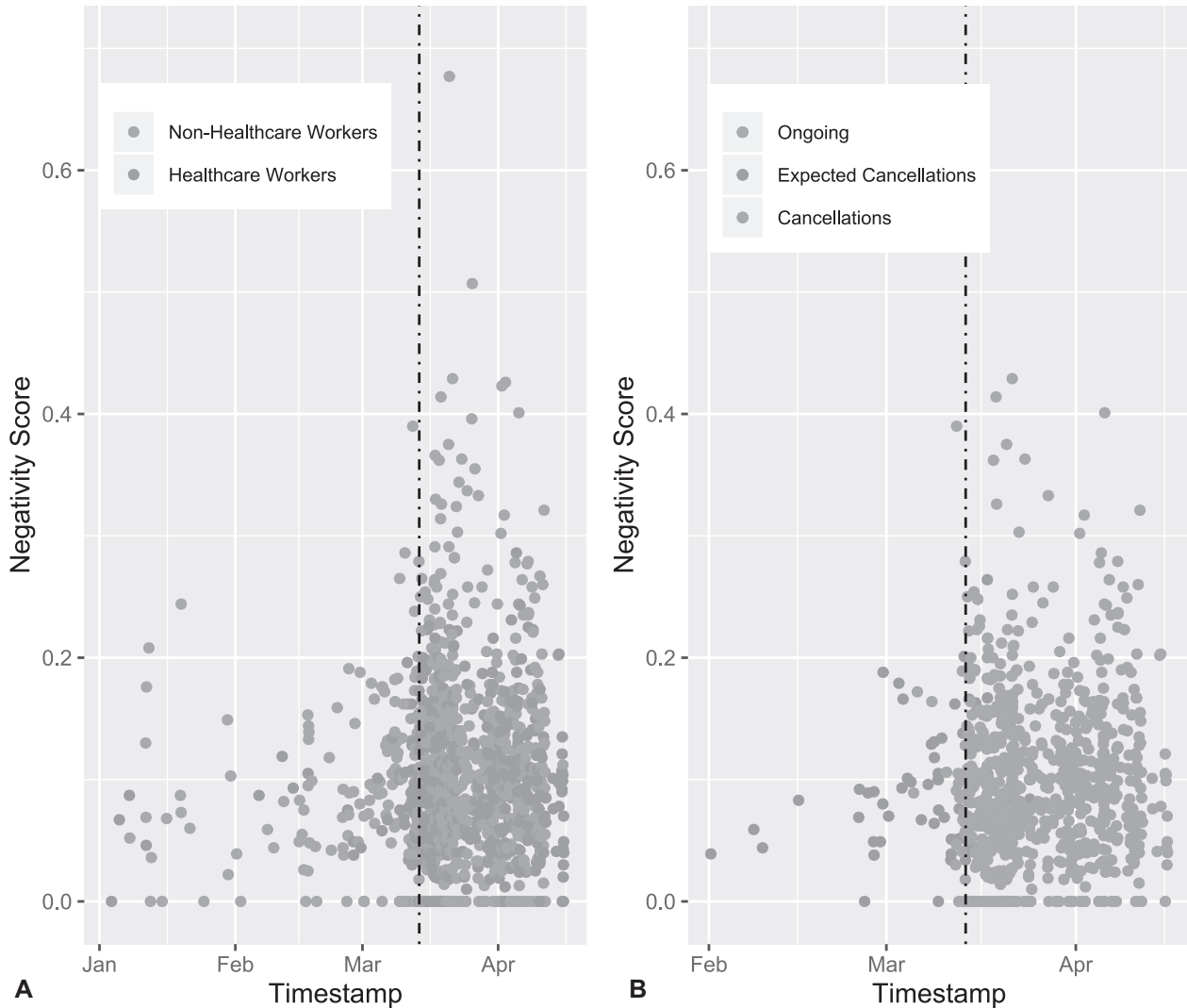
FIGURE 1. Negativity scores over time for comments relating to elective cases during the COVID-19 pandemic (A) for healthcare workers versus nonhealthcare workers and (B) for ongoing cases, expected cancellations, and cancellations. (A) Negativity scores were significantly greater in comments posted by non-HCWs compared with those posted by HCWs ($P < 0.001$). (B) Negativity scores did not significantly differ across the three groups. Panel B excludes comments with content nonspecific to the three groups. HCWs indicates healthcare workers; scores were generated using VADER, the Valence Aware Dictionary for sEntiment Reasoning.

included for analysis. A majority (1171; 84.4%) of relevant comments occurred after March 13, representing a 25-fold increase in comment frequency. Cancellations were documented in 690 comments, expected cancellations in 93, and ongoing elective cases after the recommendations in 178. The vast majority of cancellations were reported to impact those in the authors' communities rather than the authors personally. HCWs authored 480 comments whereas non-HCWs authored the remaining 792. The earliest expectation of cancellations was shared February 1, and the earliest cancellations were reported March 5. The term "elective" described surgery in 707 comments, procedures in 265 comments, and both in 132 comments; description of other words such as cases, operations, or specific medical terms comprised the remaining 168 comments.

Among the 1272 included comments, overall sentiment did not significantly differ between HCWs and non-HCWs in the period on or before March 13 (-0.08 vs -0.10, $P = 0.98$). However, sentiment among non-HCWs became significantly more negative after March 13 compared with before (-0.25 vs -0.10, $P = 0.037$). In contrast, no statistically significant change in sentiment was observed among HCWs (-0.08 vs -0.18, $P = 0.71$) between time periods. Furthermore, overall sentiment after March 13 was significantly more negative among non-HCWs than among HCWs (-0.25 vs -0.18, $P = 0.027$). Negativity scores were also higher among non-HCWs than HCWs (0.10 vs 0.08, $P < 0.001$; Fig. 1A) throughout.

Sentiment and negativity scores did not significantly differ based on whether comments described cancellations, expected cancellations, or ongoing elective cases (961 total comments; Fig. 1B). However, negativity scores of the 690 comments reporting cancellation were significantly worse among non-HCWs than HCWs (0.10 vs 0.08, $P = 0.028$). Reports of ongoing elective cases were more likely

to be reported by HCWs [odds ratio (OR) 2.30, $P < 0.001$]; whereas, non-HCWs were more likely to report cancellations (OR 1.24, $P = 0.005$) and expected cancellations (OR 1.58, $P = 0.03$).

CONCLUSIONS

To our knowledge, this is the first study to measure emotional responses to cancellation of elective surgeries and procedures in the wake of COVID-19. Sentiment regarding cancellations, gauged through social media activity, was significantly more negative among non-HCWs than HCWs. Sentiment among non-HCWs also became significantly more negative after March 13 when the ACS recommendations were published, whereas sentiment among HCWs did not change. These results highlight the importance of elective surgery to patients' emotional well-being.

Study limitations should be acknowledged. First, Reddit users may not be representative of the general public[8]; however, this limitation is inherent to research on all social media platforms.[9] Traditional polling methodologies may be helpful, but analyzing social media gives a unique perspective because doing so avoids Hawthorne effects and recall bias regarding sentiment before and after March 13. Second, sample sizes for discussion of elective surgery and coronavirus were limited before March 13, which reduces statistical power. Third, we used restrictive criteria to identify HCWs from social media posts; hence, it's possible that some HCWs were not identified as such due to intentional anonymity. The same limitation applies to our identification of non-US users for exclusion from the analysis.

Lack of timely access to elective surgery and procedures may have profound consequences for patients' emotional well-being. This study sheds light on the emotional importance of access to elective surgeries and procedures and highlights the emotional burden of canceling such surgeries. It is not known if there is a similar emotional impact from the loss of access to other forms of medical care during the COVID-19 crisis. Further research may evaluate how to better measure and mitigate the emotional burden of loss of healthcare access to patients and those who treat them.

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