Patient and family experience in pediatric spine surgery: a social media analysis

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Abstract

There is little data on patient and caregiver perceptions of spine surgery in children and youth. This study aims to characterize the personal experiences of patients, caregivers, and family members surrounding pediatric spine surgery through a qualitative and quantitative social media analysis.

The Twitter application programming interface was searched for keywords related to pediatric spine surgery from inception to March 2022. Relevant tweets and accounts were extracted and subsequently classified using thematic labels. Tweet metadata was collected to measure user engagement via multivariable regression. Sentiment analysis using Natural Language Processing was performed on all tweets with a focus on tweets discussing the personal experiences of patients and caregivers.

2424 tweets from 1847 individual accounts were retrieved for analysis. Patients and caregivers represented 1459 (79.0%) of all accounts. Posts discussed the personal experiences of patients and caregivers in 83.5% of tweets. Pediatric spine surgery research was discussed in a few posts (n=90, 3.7%). Within the personal experience category, 975 (48.17%) tweets were positive, 516 (25.49%) were negative, and 533 (26.34%) were neutral. Presence of a tag (beta: -6.1, 95% CI -9.7 to -2.5) and baseline follower count (beta<0.001, 95% CI <0.001 to <0.001) significantly affected tweet engagement negatively and positively, respectively.

Patients and caregivers actively discuss topics related to pediatric spine surgery on Twitter. Posts discussing personal experience are most prevalent, while posts on research are scarce, unlike previous social media studies. Pediatric spine surgeons can leverage this dialogue to better understand the worries and needs of patients and their families.

Introduction

Pediatric spine surgery is a multidisciplinary field. The treating surgeon often works with the patient and their family members while collaborating with nurses, technicians, and other healthcare professionals[1]. Discussion about surgery and postoperative care with the patient and their family are crucial for proper management and rehabilitation compliance[1]. Moreover, analyzing patient and caregiver experiences can promote family-oriented care in pediatric spine surgery[2].

Pediatric spine surgery offers surgical and conservative treatment options for correcting spine disorders such as spinal fusion and bracing. Spinal fusion is the most common pediatric spine intervention for the correction of juvenile idiopathic scoliosis or Scheuermann kyphosis[3]. Recent advances in this field have given rise to novel interventions such as vertebral body tethering for treating adolescent scoliosis[4]. Despite restoring spine morphology, these surgeries can be associated with high complication rates, including surgical site infections and new neurologic deficits[5]. These potential consequences can lead to preoperative anxiety among patients and parents alike. Addressing these concerns can improve patient experience and alleviate worries associated with pediatric spine surgery[2]. Perception of scoliosis and deformity surgery in adults has been extensively analyzed on social media[6–10]. These studies have
gleaned patient perspectives through various platforms such as Twitter, Instagram, Facebook, and LinkedIn. While relevant, these studies did not focus on spine surgery in children and youth, specifically, and instead analyzed social media trends for all patients undergoing scoliosis corrective surgery\(^2\).

Social media has been previously used in pediatric oncology to address the informational and emotional needs of parents and caregivers\(^11\). Healthcare providers can suggest reputable support sources accessible through social media for patients to consult. These support groups are easily accessible and can facilitate communication of patient questions or concerns. Peers educate, address concerns and motivate patients by sharing their personal experiences\(^12\). Among all social media platform, Twitter is the most used for healthcare communication\(^13\).

In the digital age, maximizing Tweet reach is important for clinicians and researchers to generate engagement with their social media content\(^14\). Tweet engagement has been previously defined in a study as the sum of likes, retweets and quotes\(^15\). The engagement level of a social media user or post is dependent on several factors. One study found that using hashtags prevails in digital communication and generates more likes, comments and shares\(^16\). Furthermore, leveraging social media platforms’ multimedia, textual and interactive features can promote a more cohesive digital ecosystem between patients, caregivers and physicians\(^17\). Using these features can accelerate navigation and improve patient-physician communication through digital media.

Social media has been used in recent years as a vehicle to disseminate medical information\(^18\). From a patient’s or caregiver’s position, it can be used to discuss personal experiences and raise awareness about a particular topic. Moreover, physicians and researchers can use social media to share the latest advances in their field\(^19\). Businesses or foundations can use it for financial and global outreach purposes such as fundraising and spreading awareness. In pediatric surgery, families and patients affected by congenital surgical conditions frequently use social media to find support groups, and surgeons can direct patients to these support groups\(^20\). Despite the widespread use of social media by family and caregivers, only 5.8% of the Pediatric Orthopedic Society of North America members had a professional Twitter account, which reveals a potential communication gap between caregivers and surgeons\(^21\). One study characterized the perception of postoperative complications in pediatric spine surgery between surgeons and patients/caregivers through a series of interviews\(^2\). Complication perceptions differed between surgeons and patients/caregivers, which suggests that open discussions should be encouraged to establish congruent expectations in surgical planning. To the best of our knowledge, this is the first social media analysis of patient, family and caregiver experiences in pediatric spine surgery. This study aims to describe the social media landscape of pediatric spine surgery, focusing on patient and family perspectives.

**Methods**

**Social media search strategy**
The Twitter application programming interface (API) for Academic Research was used to extract tweets and accounts relevant to pediatric spine surgery. The Twitter API was searched from inception (March 2006) to March 2022 with the following keywords used separately and in conjunction: spine surgery, back surgery, spinal cord surgery, son, daughter, kids, children, pediatrics, parent, guardian, adolescent, teenager. User accounts were extrapolated, and tweet engagement metrics were extracted (retweets, replies, likes, quote counts, tweet date). Simultaneously, tweet metadata was autonomously scanned for containing links, media (photos or videos), tagging, and hashtags. All bots, accounts deemed irrelevant (< 15 followers and/or < 10 tweets), and spam tweets were filtered and removed. Bots were identified through a manual query of all tweets and excluded if their username or Twitter posts specified bot activity. After removing duplicates, irrelevant accounts, and tweets from bots, a 2500 random sample size was selected. Manual query and categorization of this sample size revealed an additional 76 tweets that were unrelated to pediatric spine surgery or discussed animals. These were removed, and analysis was performed on 2424 posts.

After a 2500 random sample size taken of tweets, a manual query (L.M.E) revealed an additional 76 tweets that were unrelated or discussed animals.

**Thematic analysis**

Thematic categories were created by a preliminary screening of tweets and through consultation with a previous publication[22]. Accounts were categorized by evaluation of the handle and public profile description. User accounts were manually labeled using the following categories: “patient/caregiver”, “support group”, “medical center”, “MD/researcher”, “news/scientific discussion page”, “journal”, “foundation”, and “business”. Similarly, tweets were manually classified using thematic labels that best described the tweet: “personal experience”, “raising awareness”, “research”, “advertising”, “fundraising”, or “other”. Accounts and tweets were individually evaluated and verified by two authors (J.J.L. & L.M.E.). Conflicts in screening were resolved through discussion.

**Statistical analysis**

Unless otherwise indicated, social media engagement metrics were computed using descriptive statistics (mean, SD). Simple regression models were used to assess differences between thematic categories of tweets and engagement metrics. Subgroup analysis was conducted within the “personal experience” category to determine statistical differences in engagement metrics. Alpha was set at 0.05. R-4.1.3 statistical software was used to conduct all statistical analyses.

**Sentiment analysis**

We used TextBlob[23], a natural language processing (NLP) library, for sentiment analysis. This lexicon-based algorithm uses a tweet as an input and outputs a sentiment in the form of a polarity and subjectivity score. The polarity score is a float between [-1,1], with -1 representing a negative sentiment and 1 representing a positive sentiment. For example, words like “pain” and “satisfied” received a polarity score of -1 and 1, respectively. The subjectivity score is a float between [0,1], with 0 representing an
objective tweet and 1 representing a highly subjective one. Moreover, subjectivity scores can be intensified by the presence of an adverb. For example, “I strongly believe [...]” would be deemed highly subjective with a score of 1. Sentences were tokenized and autonomously labeled by the NLP algorithm. A dictionary of words with pre-defined scores were used to label the tweets and the mean polarity/subjectivity score for the identified words in the text provided the overall polarity/subjectivity score for the given tweet. The subjectivity and polarity scores are pooled together at a pre-defined threshold to yield an analysis score of negative (< 0), neutral (0), and positive (> 0) tweet.

**Ethical considerations**

All extracted data was archival, cross-sectional, and obtained freely from the Twitter API for Academic Research. Given the public availability of all data, the present study does not meet the inclusion criteria for approval of the Canadian Tri-Council Policy Statement which necessitates approval by an institutional board[24]. All social media names and handles were removed to preserve confidentiality.

**Results**

**Twitter data extraction**

A total of 1847 individual accounts that posted about pediatric spine surgery were retrieved from the Twitter API. The mean (SD) author followers were 687.3 (201627). Most accounts were patients/caregivers and family members posting about preoperative or postoperative experiences in pediatric spine surgery. This represented 1459 (79.0%) of all accounts. There were 153 (8.3%) news/scientific discussion accounts that discussed breaking news and sports injuries leading to spine surgery. 68 (3.7%) of accounts were businesses in the field of medical technologies or healthcare start-ups. Only 61 (3.3%) of accounts were MD/researchers that discussed the latest advances and breakthroughs in pediatric spine surgery from the USA (n = 34, 55.7%), Canada (n = 8, 13.1%), India (n = 3, 4.9%), UK (n = 2, 3.3%), Ireland (n = 2, 3.3%), Australia (n = 1, 1.6%), Saudi Arabia (n = 1, 1.6%), New Zealand (n = 1, 1.6%), Ethiopia (n = 1, 1.6%), Italy (n = 1, 1.6%), and not reported for 7 (11.5%) of these accounts. The remainder of accounts pertained to medical centers (n = 43, 2.3%), foundations (n = 33, 1.8%), support groups (n = 22, 1.2%), and scientific journals (n = 8, 0.4%). Table 1 summarizes the characteristics of the included accounts.
Table 1
Summary statistics of included Twitter accounts

<table>
<thead>
<tr>
<th>Category (%)</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>1847</td>
</tr>
<tr>
<td>Author followers (mean (SD))</td>
<td>14596.87 (201681.90)</td>
</tr>
<tr>
<td>Author followers (mean, (SD))</td>
<td>687.3 (201627)</td>
</tr>
<tr>
<td>Patient/caregiver</td>
<td>1459 (79.0)</td>
</tr>
<tr>
<td>News/scientific discussion</td>
<td>153 (8.3)</td>
</tr>
<tr>
<td>Business</td>
<td>68 (3.7)</td>
</tr>
<tr>
<td>MD/Researcher</td>
<td>61 (3.3)</td>
</tr>
<tr>
<td>Medical center</td>
<td>43 (2.3)</td>
</tr>
<tr>
<td>Foundation</td>
<td>33 (1.8)</td>
</tr>
<tr>
<td>Support group</td>
<td>22 (1.2)</td>
</tr>
<tr>
<td>Journal</td>
<td>8 (0.4)</td>
</tr>
</tbody>
</table>

A total of 15203 Tweets were extracted from the Twitter API. Upon removal of duplicates, bots, spam, and irrelevant accounts, a randomized subset of 2424 tweets was used for analysis. The category with the greatest number of posts was “personal experience” with 2024 (83.5%) tweets, followed by “fundraising” with 142 (5.9%) tweets, “awareness” with 122 (5.0%) tweets, “research” with 90 (3.7%) tweets, “advertising” with 33 (1.4%) tweets, and “other” with 13 (0.5%) tweets. Examples of tweets from the “personal experience” and “research” categories were “Happy Saturday! My "baby sister," @[...] had her back surgery & is recovering as we tweet! Healing thoughts & prayers, tweeps! XO” and “Tranexamic Acid Has Multiple Benefits in Pediatric Spine Surgery,” respectively. The tweets in the “personal experience” category discussed topics related to intraoperative complications, blood loss and rehabilitation. For example, a patient posted about “[...] a staph infection in [her] back after spine surgery.” Table 2 summarizes the tweets of the included posts.
Table 2
Summary statistics of included tweets pertaining to pediatric spine surgery

<table>
<thead>
<tr>
<th>Category (%)</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>2424</td>
</tr>
<tr>
<td>Personal experience</td>
<td>2024 (83.5)</td>
</tr>
<tr>
<td>Fundraising</td>
<td>142 (5.9)</td>
</tr>
<tr>
<td>Raising awareness</td>
<td>122 (5.0)</td>
</tr>
<tr>
<td>Research</td>
<td>90 (3.7)</td>
</tr>
<tr>
<td>Advertising</td>
<td>33 (1.4)</td>
</tr>
<tr>
<td>Other</td>
<td>13 (0.5)</td>
</tr>
<tr>
<td>Engagement (mean (SD))</td>
<td>5.03 (41.11)</td>
</tr>
<tr>
<td>Contains metadata</td>
<td></td>
</tr>
<tr>
<td>Media (%)</td>
<td>163 (6.7)</td>
</tr>
<tr>
<td>Tagging (%)</td>
<td>1196 (49.3)</td>
</tr>
<tr>
<td>Link (%)</td>
<td>909 (37.5)</td>
</tr>
<tr>
<td>Hashtag (%)</td>
<td>452 (18.6)</td>
</tr>
<tr>
<td>Retweets (mean (SD))</td>
<td>0.47 (4.51)</td>
</tr>
<tr>
<td>Likes (mean (SD))</td>
<td>3.91 (36.03)</td>
</tr>
</tbody>
</table>

Given the low number of posts related to research, a subgroup analysis was performed. A total of 28 (31.46%) tweets discussed blood loss during pediatric spine surgery, while the others posted about surgical-site infections, scoliosis, congenital spinal deformities, and novel surgical technologies. There was a 2.86-fold decrease in posts discussing research in 2016 compared to 2020 and 2021 independently. Figure 1 displays the post classified in the “research” category throughout the years.

The mean engagement (SD) per tweet, represented as the sum of likes, quotes, tweets, and retweets, was 5.03 (41.11). The mean retweets (SD) per tweet were 0.47 (4.51). Overall, 163 (6.7%) tweets contained media (video or photo), 1196 (49.3%) contained a tag, 909 (37.5%) contained a link, and 452 (18.6%) contained a hashtag. Tweet count peaked in 2021 (n = 440, 18.2%), and has been consistently increasing since 2016.

Only presence of a tag (beta=-6.1, 95% CI -9.7 to -2.5) and baseline follower count (beta < 0.001, 95% CI < 0.001 to < 0.001) significantly affected tweet engagement negatively and positively, respectively. Within
the “personal experience” category, tagging (beta = 1.5, 95% CI 1.2 to 1.7) and the presence of a link within the text (beta = 0.8, 95% CI 0.7 to 1.0) positively affected user engagement. A summary of the overall and the subgroup “personal experience” multivariable regression model characteristics can be found in Tables 3 and 4, respectively.

### Table 3
Multivariable linear regression model of categories on engagement metrics. * denotes statistical significance.

<table>
<thead>
<tr>
<th>Category</th>
<th>Beta</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>9.2</td>
<td>(4.9, 13.4)</td>
<td>0*</td>
</tr>
<tr>
<td>Follower count</td>
<td>&lt; 0.001</td>
<td>(&lt; 0.001, &lt; 0.001)</td>
<td>0.025*</td>
</tr>
<tr>
<td>Media</td>
<td>5.9</td>
<td>(-1.3, 13.2)</td>
<td>0.106</td>
</tr>
<tr>
<td>Tagging</td>
<td>-6.1</td>
<td>(-9.7, -2.5)</td>
<td>0.001*</td>
</tr>
<tr>
<td>Link</td>
<td>-3.7</td>
<td>(-7.7, 0.3)</td>
<td>0.07</td>
</tr>
<tr>
<td>Hashtag</td>
<td>-1.1</td>
<td>(-5.6, 3.3)</td>
<td>0.624</td>
</tr>
<tr>
<td>Neutral</td>
<td>-3.2</td>
<td>(-7.8, 1.4)</td>
<td>0.174</td>
</tr>
<tr>
<td>Positive</td>
<td>1.9</td>
<td>(-2.2, 5.9)</td>
<td>0.369</td>
</tr>
</tbody>
</table>

### Table 4
Multivariable linear regression model of categories within the “personal experience” category on engagement metrics. * denotes statistical significance.

<table>
<thead>
<tr>
<th>Category</th>
<th>Beta</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.4066</td>
<td>(0.1653, 0.8187)</td>
<td>0.0258*</td>
</tr>
<tr>
<td>Media</td>
<td>1.4918</td>
<td>(1.0000, 2.0138)</td>
<td>0.0508</td>
</tr>
<tr>
<td>Tagging</td>
<td>1.4918</td>
<td>(1.2214, 1.6487)</td>
<td>6.8954e-05*</td>
</tr>
<tr>
<td>Link</td>
<td>0.8187</td>
<td>(0.6703, 1.0000)</td>
<td>0.0445*</td>
</tr>
<tr>
<td>Hashtag</td>
<td>0.8187</td>
<td>(0.6703, 1.0000)</td>
<td>0.1164</td>
</tr>
<tr>
<td>Awareness</td>
<td>1.3499</td>
<td>(0.5488, 3.3201)</td>
<td>0.5623</td>
</tr>
<tr>
<td>Experience</td>
<td>2.0138</td>
<td>(1.0000, 4.9530)</td>
<td>0.0730</td>
</tr>
<tr>
<td>Fundraising</td>
<td>2.0138</td>
<td>(0.9048, 5.4740)</td>
<td>0.1041</td>
</tr>
<tr>
<td>Other</td>
<td>2.4596</td>
<td>(0.6065, 9.9742)</td>
<td>0.1874</td>
</tr>
<tr>
<td>Research</td>
<td>1.8221</td>
<td>(0.8187, 4.9530)</td>
<td>0.1639</td>
</tr>
</tbody>
</table>
A total of 1128 (46.5%) tweets were positive, 693 (28.6%) were neutral and 602 (24.9%) were negative. The mean subjectivity and polarity scores were 0.2183 (range [0,1]) and 0.0572 (range [-1,1]), respectively. Within the “personal experience” category, 975 (48.17%) tweets were positive, 516 (25.49%) were negative and 533 (26.34%) were neutral. Figure 2 summarizes the sentiment analysis for all tweets. An example of a tweet within the “personal experience” category classified as negative was: “I have issues with both. Its been an awful several years. Worked all my life, retired, took care of my husband who sadly lost his battle with cancer, now caring for my son who is finally learning to walk again after spine surgery. I hate sounding pathetic.” with a polarity and subjectivity score of -0.55 and 0.82, respectively. An example of a positive tweet within the same category was: “Making soup & trying to get warmed up. Daughter is still in icu after brain/spinal cord surgery so a bit stressed out but otherwise I’m good,” with a polarity and subjectivity score of 0.70 and 0.60, respectively. Sentiment analysis within the “personal experience” category can be found in Fig. 3.

Discussion

Herein, we present the first social media analysis of spine surgery in children and youth. Several findings are reported, including: 1) the majority of tweets are from personal accounts 2) posts discussing research were the least common 3) tweet engagement is driven by the presence of a tag and follower count 4) the overall sentiment portrayed by Twitter posts on pediatric spine surgery is positive.

Thematic trends

Several tweets within the “research” subgroup discussed intraoperative blood loss, complications, surgical site infections, and postoperative neurologic deficits after spine surgery in children and youth. These reflect common themes identified in the pediatric spine surgery literature[2, 25, 26]. However, overall, there were very few tweets (3.7%) identified that discussed research. This finding contrasts several other social media studies, where the most prevalent Tweet category is often research. For example, an unpublished (submitted) social media analysis about cervical myelopathy had 40.9% of posts related to research, while another on deep brain stimulation (DBS) had 45.2% of posts related to research[15]. Thus, we highlight that there are significantly fewer posts on Twitter pertaining to research compared to other surgical pathologies. This finding may suggest that there are relatively few papers being published pertaining to pediatric spine surgery, specifically; however, there are currently no (to our knowledge) reviews that specifically analyze publication trends in the pediatric spine surgery world[27]. One systematic review on surgical site infection following pediatric spine surgery resulted in few studies on the topic compared to the adult literature[28].

Social media can facilitate health-related research and to improve physician-patient communication and offline health services[29]. Further, social media can be used to identify research gaps and to promote patient-centered research initiatives. Concerns and opinions channeled through patient dialogue on Twitter and other platforms should prompt physicians and researchers to explore the topics being discussed. The era of big data, presented in the form of large databases (e.g., medical health records,
social media platforms, etc.) should encourage researchers to harness user-generated information to reveal large-scale patterns that can provide innovative solutions that have previously been difficult to address[30]. Despite minimal use of social media by spine surgeons, patient and family experiences channeled through social media can empower informed decision making[31]. Capturing their perspectives, either positive or negative, promotes proactive communication between surgeons and patients. Thus, healthcare professionals should leverage these platforms to align clinical decisions with patient experiences.

**Social media for information dissemination**

Previous unpublished (submitted) work from our group has identified several predictors of increased Twitter engagement metrics. The strongest predictor of tweet engagement metrics identified in a study on DBS in pediatrics and on microvascular decompression and trigeminal neuralgia was inclusion of embedded media (i.e., photo or video) in a tweet[32]. However, our study showed that the presence of media did not significantly affect engagement metrics (beta = 5.9, 95% CI -1.3 to 13.2, \( P = 0.106 \)). The media in these posts possibly brought no added value to the text, such as irrelevant graphic interchange format (GIF) animations. Nonetheless, this was unexpected considering that photos and videos typically stimulate engagement[33]. This is also inconsistent with other social media studies that correlate the presence of media to increased engagement[34]. Baseline follower count was positively, but minimally associated with tweet engagement (beta < 0.001, 95% CI < 0.001 to < 0.001, \( P = 0.025 \)). Moreover, tagging was negatively associated with tweet engagement (beta=-6.1, 95% CI -9.7 to -2.5, \( P = 0.001 \)). This may be due to tags being directed to one previous account or post, rather than being a generalized tweet targeting an entire follower audience, limiting its viewability overall[35]. However, this trend has not been observed in our two previous social media studies.

**Sentiment analysis of personal experience**

Sentiment analysis is a NLP technique used to analyze textual data. It deciphers positive, negative or neutral emotions through lexica and keyword enhancers[36]. It is commonly used in business to establish consumer trends, such as through customer reviews[37, 38]. It has been previously used in healthcare to analyze sentiments surrounding patient experience[39] and COVID-19 vaccine hesitancy[40, 41]. However, the use of sentiment analysis in healthcare is lacking, perhaps in part due to insufficient domain-specific textual data[42]. Our work presents the first large-scale sentiment analysis on social media posts discussing spine surgery in children and youth. We analyzed textual data from patients, caregivers, family members, surgeons and researchers, businesses, foundations, associations, medical centers, and businesses. When analyzing the subgroup of posts discussing personal experiences (from patients, family, and caregivers), most posts were positive (48.2%) and discussed preoperative anticipation for surgery or postoperative recovery. The proportion of tweets portraying negative sentiment within the “personal experience” subgroup was 25.5%, examples of which include: “My daughter is recovering well from pneumonia. Between back surgery earlier this year and now pneumonia, she's had a rough time.” This is consistent with pneumonia occurring in 1 in 200 adult patients after posterior lumbar fusion[43]. Thus, correlations can be drawn between tweets discussing patient experiences and clinical studies.

**Strengths and limitations**
This study has several strengths. First, it is the first study analyzing Twitter posts pertaining to spine surgery in children and youth. Second, a sentiment analysis NLP tool was used to decipher sentiments conveyed in patient and caregiver Twitter posts. Further, we correlated quantitative (engagement metrics) to qualitative (thematic labels) data to identify predictors of higher engagement metrics, which can be used by stakeholders to maximize their online reach.

This study also has several limitations. Considering our study only analyzed the Twitter database, a more comprehensive search of other social media platforms such as Instagram, Facebook, TikTok, and Linkedin would be of value. Some patients use Instagram to post visual content, as described in a scoliosis social media study[6], and others resort to Facebook to seek support groups. We used a broad search strategy to describe the general landscape of pediatric spine surgery in social media and to highlight the lack of research in this field. This could have missed posts discussing more specific pathologies such as tethered cord, scoliosis, or myelomeningocele. However, it is likely that including more specific terms would have decreased the proportion of posts included in the personal experience category.

Conclusion

This is the first qualitative and quantitative analysis of pediatric spine surgery and Twitter. Posts pertaining to personal experience are most prevalent. Unlike other pathologies, there are very few Tweets discussing research. Most accounts are patients or caregivers discussing preoperative anticipation or postoperative recovery. Family and patients mostly express positive sentiments concerning their condition or intervention. Presence of a tag and baseline follower count are associated with lower and higher tweet engagement, respectively.

Declarations

Funding: No funding was received for this study.

Compliance with ethical standards

Conflict of interest: The authors declare they have no conflict of interest.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Informed consent: Statement of informed consent was not applicable since the manuscript does not contain any patient data.

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https://doi.org/10.3171/2022.7.FOCUS22276


23. Loria S (2020) textblob Documentation. Release 0.15


Figures
Figure 1

Number of Twitter posts discussing research in pediatric spine surgery from inception to 2022
Figure 2

Percentage of tweets classified as negative, neutral and positive through sentiment analysis
Figure 3

Percentage of tweets classified as negative, neutral and positive through sentiment analysis within the “personal experience” category