Public Interest in Plastic Procedures during the COVID-19 Pandemic and What Stakeholders Could Do: An Infodemiology Study

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Abstract

Background: The unprecedented pandemic of COVID-19 brings drastic changes to the field of plastic surgery. It is critical for stakeholders to identify the change in public interest to be adequately prepared.

Objective: The present study aims to reveal change of public interest in plastic procedures caused by COVID-19. Then stakeholders could refocus their practice and survive the present hard time.

Methods: Publicly accessible tweets about plastic procedures were collected using a web crawler. Groups were determined by referring to tweeting frequency and Google Trends Index. Tweeting frequency, sentiment and word frequency analyses were performed with Python modules.

Results: 73,963 tweets about top plastic procedures were retrieved and divided into three phases. Tweeting frequency increased by 24.0% in phase 2 and decrease 9.1% in phase 3. Tweets about breast augmentation, liposuction and tummy tuck consecutively increased during pandemic. Botox and chemical peel were the first to revive when lockdown was lifted. COVID-19 was associated with a negative impact on public sentiment about plastic procedures. Public word frequency pattern significantly changed first and stay relatively stable then.

Conclusions: Public maintain their interest in plastic procedures. Stakeholders could refocus on breast augmentation, liposuction and tummy tuck for now. In case of second wave of COVID-19, stakeholders should prepare for a temporary surge of Botox and chemical peel.

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ABSTRACT

Background: The unprecedented pandemic of COVID-19 brings drastic changes to the field of plastic surgery. It is critical for stakeholders to identify the change in public interest to be adequately prepared.
Objective: Help stakeholders adjust their practice and survive current hard time.
Methods: Publicly accessible tweets about plastic procedures were collected using a web crawler. Groups were determined by referring to tweeting frequency and Google Trends Index. Tweeting frequency, sentiment and word frequency analyses were performed with Python modules.
Results: 73,963 tweets about top plastic procedures were retrieved and divided into three phases. Tweeting frequency increased by 24.0% in phase 2 and decrease 9.1% in phase 3. Tweets about breast augmentation, liposuction and tummy tuck consecutively increased during pandemic. Botox and chemical peel were the first to revive when lockdown was lifted. COVID-19 was associated with a negative impact on public sentiment about plastic procedures. Public word frequency pattern significantly changed first and stay relatively stable then.
Conclusion: Public maintain their interest in plastic procedures. Stakeholders could refocus on breast augmentation, liposuction and tummy tuck for now. In case of second wave of COVID-19, stakeholders should prepare for a temporary surge of Botox and chemical peel.

Keywords:
COVID-19; twitter; Google trends; plastic procedure

Introduction

The unprecedented pandemic of COVID-19 brings drastic changes not only to daily life, but also to the field of plastic surgery.[1–4] Due to repeated quarantine and deteriorating economy, many people are quitting non-essential medical services like plastic procedures, resulting in gloomy prospect for stakeholders including plastic surgeons, hospital administrators and clinic owners. They need better understanding of public interest in common plastic procedures to adjust their practice, so that they may survive this hard time.

Answering this critical question requires a survey including as many people as possible, which is both time- and money-consuming. Therefore, we turned to Infodemiology [5] which have long been employed to monitoring public health issue and people's status [6,7]. During current COVID-19 pandemic, lots of Infodemiology researches have deepen our understanding towards the coronavirus and human behaviors. [8] Twitter (Twitter.com) is widely applied in the field of Infodemiology. [9,10] In the field of plastic surgery, Twitter has been deployed to investigate public perception toward plastic surgery [11,12] or engagement by plastic surgeons with social media [13,14]. Therefore,Twitter data could be used to understand public thoughts in an economic and fast way. Therefore, we collected related tweets and these data may reveal public interest in plastic procedures to some extent.

In the present study, we extracted 73,963 publicly accessible tweets about the top plastic procedures from January 1 to July 22, 2020. Tweeting frequency, sentiment and word frequency analyses were applied to examine changes in public interest. The present study may help stakeholders to refocus their practice and survive the pandemic.

Methods

data acquisition

Tweets from January 1 to July 22, 2020 (UTC time) were retrieved from Twitter with web scraping tool Locoyposter (locoyposter.com). Locoyposter is a commercial web scraping tool providing visual interface, which is friendly for users with little programming experience. It provides a framework in which users can collect (Twitter) data by designing workflow, parsing target webpages, specifying Xpath expressions, and storing the content into external database. Keywords were determined by referring to the top plastic procedures in the latest annual Plastic Surgery Statistics published by the American Society of Plastic Surgeons.[15] The top five cosmetic surgical procedures and the top five minimally-invasive procedures were extracted. Among them, the term “Botulinum Toxin Type A” was too academic for public and only returned few tweets, so instead the term, “Botox” was adopted for it made up the largest portion of Botulinum Toxin Type A according to the statistics report. The term “Soft Tissue Fillers” was substituted by “Hyaluronic acid” for the same reason.

The present study focuses on first-hand and self-revealed interest in plastic procedures. Therefore, we further filtered these tweets by excluding replies and tweets with links. For tweets including them, interpretation should be made by referring to former tweets based on specific conversation context or external webpages. These tweets are heterogeneous compared counterparts which well explain themselves. Introduction of these tweets would bring uncertainty for the present study. Only tweets in English were retained in the downstream analysis. The final query was ("Breast Augmentation" OR Liposuction OR Rhinoplasty OR "Eyelid Surgery" OR "Tummy Tuck" OR "Botox" OR "Hyaluronic acid" OR "Chemical Peel" OR "Laser Hair Removal" OR Microdermabrasion) lang:en until:2020-07-22 since:2020-01-01 -filter:links -filter:replies. Readers could reproduce exact same tweets by pasting it into search box of Twitter.

We also searched these keywords with Google Trends (trends.google.com) which has previously been applied in research into COVID-19,[16,17] and cosmetic procedures.[18] We searched these keywords as topics to cover as much related searches as possible. The region was set as worldwide and categories as all. Default web search was selected and time span was from January 1 to July 22, 2020. As Google Trends normalizing data when multiply keywords were searched together [19], we searched them separately. Google Trends identified "Eyelid Surgery" under topic Blepharoplasty and “Tummy Tuck” under topic Abdominoplasty. Therefore, these topics were used other than original keywords. Google Trends failed to identify any related topic for Botox and we had to search Botox as search term only. Visualization of their Google Trends could help group division and understand corresponding Twitter data.

tweeting frequency

Tweeting frequency was used to indicate public interest in plastic procedures. It is clear that users may tweet more frequently if they are interested in certain plastic procedures. We compared overall tweeting frequency among different groups. Frequency of specific procedures and constituent ratios for all procedures were also determined. Proportions of tweets mentioned COVID-19 were also compared by calculating co-occurrence rate of covid or coronavirus in tweets.

sentiment analysis

Sentiment analysis was performed with the Natural Language Toolkit (NLTK).[20] We first tokenized the tweets and removed stopwords and punctuation. Then, sentiments were determined by

the Vader module, which is specifically attuned to sentiments expressed in social media.[21] We compared sentiments among different groups. We also compared sentiment difference for tweets mentioned COVID-19 or not to reveal overall sentiment changes caused by COVID-19. Tweets mentioned COVID-19 were tagged if they contain “covid” or “coronavirus” in their text. Sentiment changes for specific procedures and overall sentiment constituent ratio change were also determined.

word frequency

Word frequency, visualized by a word cloud, could reflect trends over topics on Twitter.[22,23] After tokenization and removal of stopwords and punctuation, all words were transferred into lowercase, labeled with a parts-of-speech tag and lemmatized. Then, word frequency was counted and compared among different groups after normalized by total number of tweets. A change in the frequently-used words may reflect change in public interest. Therefore, words with the highest change ratio were highlighted, and visualized with a word cloud. These steps were achieved with Python [24] module NLTK and Wordcloud. To better understand the word frequency result, we also provided some typical tweets for readers.

group and statistics

The collected tweets were divided into three groups. After scrutinizing the data, we found tweeting frequency and Google Trends Index fluctuated drastically around two significant events. The first one is that the World Health Organization (WHO) declared COVID-19 a pandemic (March 11, 2020). Afterwards, public attention on COVID-19 increased tremendously. The second landmark is the death of George Floyd.[25] Public rage drew their attention away for a period of time. Therefore, we excluded data around these two landmarks and divided tweets into three phases, i.e. phase 1 (2020.01.01-2020.03.04), phase 2 (2020.03.18-2020.05.24) and phase 3 (2020.06.11-2020.07.22). Readers may refer to Figure 1 for further details.

Quantitative variables were analyzed by one-way ANOVA and qualitative variables were analyzed by chi-square test with SPSS25 (International Business Machines Corporation [IBM], USA). Differences were considered significant at a p value of < 0.05.

Results

tweeting frequency

We retrieved 73,963 publicly accessible tweets about the most common plastic procedures from January 1 to July 22, 2020. We provide these tweets and their corresponding publication time in Multimedia Appendix 1. Other information was not provided to protect the privacy of their writers.

Tweeting frequency per day is shown in Figure 1. A visual check on Figure 1 could confirm that tweeting frequency is different among three phases. After WHO declared COVID-19 a pandemic, the tweeting frequency increased, i.e. tweeting frequency in phase 2 is higher than phase 1. Then tweeting frequency decreased sharply after May 25 and tweeting frequency in phase 3 is lower than phase 2. It also can be seen that there are some peaks in the curve and they were basically celebrity-related. For example, peak in February 5 was related to Nancy Pelosi and July 20 was related to Kamala Harris. Readers may refer to Multimedia Appendix 1 for further details.

We also searched the top plastic procedures with Google Trends (Figure 2).It can be inferred that

search against these plastic procedures decreased sharply after WHO declared COVID-19 a pandemic and rebound slowly after that. Public search against majority of these procedures did decrease at the end of May and the beginning of June. But the decrease was milder than its Twitter counterpart.

Further statistical analysis is consistent to results in Figure 1. As shown in Figure 3A, overall tweeting frequency per day in phase 2 increased as much as 24.0% compared to phase 1 (333.17 vs. 413.20). While tweeting frequency decreased 9.1% afterwards (413.20 vs. 375.33). When comparing tweeting frequency for specific procedures in phase 2 and phase 1, most of them increased while only tweeting frequency for eyelid surgery, laser hair removal and microdermabrasion show no statistical difference. For phase 3 and phase 2, tweeting frequency for most procedures increase or stay stable, while tweeting frequency for Botox, chemical peel and microdermabrasion decreased (Figure 3B).

Besides direct comparison of tweeting frequency, their relative change was also determined with a constituent ratio. As shown in Figure 3C, overall constituent ratio was different among different phases (χ^2=592.61, p <0.001). We further applied partition of chi-squared test to each specific procedure with a *p* value adjusted by Bonferroni corrections using SPSS. It can be inferred constituent ratio of liposuction and tummy tuck increases both in phase 2 and phase 3. Constituent ratio of breast augmentation, eyelid surgery and laser hair removal increase in phase 3 versus phase 2. While constituent ratio of Botox and chemical peel decrease in phase 3 versus phase 2. It should be noted that one tweet may mention more than one plastic procedure, therefore the sum of frequencies in Figure 3C is slightly higher than the overall tweet amount in each phase.

Proportion of tweets mention COVID-19 could reflect public concern to some extent. As shown in Figure 3D, tweets mentioned COVID-19 drop from 2.1% in phase 2 to 0.9% in phase 3. In phase 1, there only are few tweets mentioned COVID-19. Therefore, corresponding data was not analyzed.

sentiment analysis

Besides tweeting frequency, sentiment can also serve as an indicator of public interest towards plastic procedures. As shown in Figure 4A, in general the sentiments of tweets became more negative in phase 2 and show no rebound sign in phase 3. A constituent ratio analysis found a higher negative sentiment proportion and lower positive proportion in phase 2 and phase 3 than phase 1(Figure 4B), which is in line with the overall result. Sentiment analysis for specific procedures found that sentiments about Botox and laser hair removal decrease first and then rebound, while sentiments about chemical peel show opposite trends (Figure 4C).

We further analyzed tweets in which “covid” or “coronavirus” co-occurred with plastic procedures and found that their sentiment was more negative than tweets that did not mention COVID-19 in phase 2. While the difference was not statistically significant in phase 3 (Figure 4D).

word frequency

Word frequency could reflect trending over topics and change of frequently used words could reveal shift of public interest to some extent. Words with the highest frequency change in phase 2 versus phase 1 are shown in Figure 5. It should be noted that Figure 5 was slightly manually revised to exclude some words contaminated by Twitter bots.

Rising of words including quarantine, covid, pandemic, isolation, covid19, quarantined and corona indicated that COVID-19 became one major concern of those who were interested in plastic procedures. Words including canceled, spas and salons usually co-occurrence in phase 2. In fact, canceled also usually co-occurrence with plastic procedures, which did not show in Figure 5 for their milder frequency change. Their co-occurrence indicated many plastic procedures related appointments were canceled due to COVID-19. Readers may refer to Table 1 in which some related typical tweets (tweets No. 1 and 2) are provided. The reason morbidly ranking high was the surge of #morbidlyobese. The frequency of essential and business increased for many cosmetic services were considered non-essential and closed as shown in Table 1 (tweets No. 3 and 4). The increase frequency of word economy shown public concern about the economy.

Table 1. Some typical tweets. Only tweets and publish time are provided to protect privacy of their writers. Tweets were minimally revised to remove some dirty words.

	Time	Tweet
1	2020/3/20	My mom said she didn't take this pandemic serious till they canceled her laser hair removal, now she's stocking up
2	2020/3/20	I was supposed to get a chemical peel today but of course that was canceled. I just wanted to have perfect skin while quarantined but I guess that's too much to ask for.
3	2020/4/17	I wanted to get my lips and Botox redone but apparently med spas aren't essential
4	2020/4/20	Not a day goes by in which I don't feel pain that I wasn't able to get a chemical peel before non-essential businesses closed
5	2020/5/11	This is the perfect time for a chemical peel. I'll at least step out for one once salons get back running
6	2020/5/22	This would have been the perfect time to heal from some Botox n filler
7	2020/4/27	I HATE SHAVING! The worst part of quarantine is not being able to go to my laser hair removal procedures. I was almost done with my 6 months, now I have to start all over. Shaving hurts like hell too, I'm pissed.
8	2020/4/23	Influencers Are Still Getting Lip Fillers and Botox During Lockdown - Even during COVID-19's stay-at-home measures, spas and clinics are offering Botox and fillers at a reduced rate to influencers — and some are taking the riskier route of doing i
9	2020/5/2	the med spas are having covid botox sales. brb

Word frequency between phase 2 and phase 3 was also compared. Some top words are celebrity related like Kamala Harris and Kellyanne Conway. Some others are #blacklivesmatter related like Floyd and racist. These results are not well related to the aim of the present study, and therefore not shown. Readers may refer to Multimedia Appendix 2 for further details. It should be noted that plastic procedures related words, though show no significant frequency change, still dominate in all words and readers may refer to the word cloud figure of phase 3 in Multimedia Appendix 3.

Discussion

Principal findings

In the present study, we performed a survey of 73,963 publicly accessible tweets about the top plastic procedures from January 1 to July 22, 2020. By integrating tweeting frequency, sentiment and word frequency analyses, we hope to depict changes in public interest towards these plastic procedures and help stakeholders to survive this hard time. To the best of our knowledge, the present study is the first one to cover this issue.

In the present study, the keywords searched in Twitter were determined by referring to the annual Plastic Surgery Statistics published by the American Society of Plastic Surgeons. The top five cosmetic surgical procedures and top five minimally-invasive procedures could not represent all plastic procedures for sure. However, an exhaustive survey of all plastic procedures is unfeasable. The criterion of which procedures to include or exclude may be controversial. Furthermore, Twitter users may use nonstandard expressions. However, these top procedures should cover most daily practice for many stakeholders. For those procedures not included, readers may refer to our methods and make their own findings. Or they are welcome to contact us and we will try our best to help.

The definition of different groups is quite difficult as the pandemic did not happen at one static time point and evolved fast. There was no gold standard or even related research we could refer to. By scrutinizing trends in tweeting frequency and Google Trends Index, we found data fluctuated drastically around WHO declared COVID-19 a pandemic and the death of George Floyd. Naturally, we divided collected data into three groups by these two landmark events. The results from tweeting frequency, sentiment and word frequency analyses show good discrimination among these three groups. Therefore, the definition of the three groups should be competent. There are complicated epidemiological, economic or political reasons why these data shown distinct features in the three phases. However, it is not the concern of the present study. Therefore, we left this question untouched.

In regard to phase 2, tweeting frequency, tweet sentiment and word frequency all changed significantly. Tweeting frequency increased up to 24.0%, which was kind of surprising at first sight. Further analysis indicated the increase was mainly contributed by Botox and chemical peel (Figure 3B). Scrutinizing of related tweets shown many people saw the quarantine as perfect time to receive Botox and chemical, as shown in Table 1 (tweets No. 5 and 6). This may due to free time and less expose to others brought by quarantine. Tweeting frequency of most other procedures increased too (Figure 3B). Therefore, public interest in plastic procedures generally increased in phase 2 and this is silver lining during the pandemic for stakeholders. But it should be noted that public interest increase did not necessary mean more plastic procedures were performed in this phase.

Following sentiment analysis indicate that COVID-19 brought negative sentiment for public interest in plastic procedures. But negative sentiment did not always mean bad news for stakeholders. As shown in No. 7 tweet in **T**able 1, one of the most negative tweets in phase 2, the writer was in desperate need of laser hair removal. Following word frequency basically reflected huge chaos brought by COVID-19 for public.

When coming to phase 3, changes seem to be milder. Overall tweeting frequency fell back, but still higher than phase 1. Not surprisingly, this decrease was mainly contributed by Botox and chemical peel too (Figure 3B). This may not mean public are losing interest in them recently, but could due to demand release in economy restart process. In fact, people may receive more Botox and chemical peel than phase 2, which could be supported by rebounding search index in Google Trends (Figure 2). The discrimination of tweeting frequency and Google Trends Index may lie in their different nature: people express their thoughts and sentiments on Twitter, while Google is more like a tool to which people resort when they are about to take action. The lesson is Botox and chemical peel may

be the first to revive once lockdown is lifted. Since second wave of COVID-19 is not just paranoid, [26,27] stakeholders should be prepared in case of any kind of lockdown would be redeployed.

Tweets mentioned COVID-19 decreased in phase 3 (Figure 3D) and no overall sentiment difference was found (Figure 4A, 4B and 4D). There is also no major word frequency difference about plastic procedures in phase 3 versus phase 2. It seems like public are getting used to coexist to COVID-19 and their interest in plastic procedures is not fading.

At the micro level, tweeting frequency about breast augmentation, tummy tuck and laser hair removal increase in phase 3, the first two of which increase in phase 2 too. Besides overall tweeting frequency, constituent ratio should also be considered. Since the damaged economy may narrow down consumers' choice, plastic procedures may have to compete against each other for consumers' favor. Constituent ratio of liposuction and tummy tuck consecutively increase in both phase 2 and 3, while constituent ratio of breast augmentation, laser hair removal and eyelid surgery only increase in phase 3. Taken together, breast augmentation, liposuction and tummy tuck surpass other procedures for they have either better absolute increase or relative increase. This result is no surprising for breast augmentation and liposuction are the most popular cosmetic surgical procedures according to latest annual Plastic Surgery Statistics published by the American Society of Plastic Surgeons.[15] Tummy tuck, not rank as high as them, may benefit from the current life style. People have to stay at home for quarantine or cannot afford work out in the gym due to bad economy. Then they have higher chance to become over-weighted and need tummy tuck or liposuction.

In summary, stakeholders may consider refocus on breast augmentation, liposuction and tummy tuck at current stage of pandemic. If second wave of COVID-19 hit, stakeholders should prepare for a temporary surge of Botox and chemical peel. But this does not mean other procedures are unimportant and they still make up the majority of all plastic procedures.

When scrutinizing our data, we found that many stakeholders tried various strategies to survive current hard time. As shown in Table 1 (tweets No. 8 and 9), they made use of the influence of key opinion leaders and provide more flexible price. These efforts should be praised and learned by others.

Limitations

The major limitation of the present study is that the real world is much more complicated than merely tweet data, even though the present study is based on as many as 73,963 tweets and the research methods are well-established. All surveys based on online social media face this problem. Furthermore, the COVID-19 pandemic is unprecedented in many aspects. As the first and only one of its kind so far, the present study does not have much to refer to. Therefore, the results are open to wiser explanation of readers. Due to the limitation of Twitter privacy setting, we could not perform more precise analysis based on age, gender or location. Plus, the impact brought by COVID-19 could vary drastically in different district and time point. Readers should also use the results of the present study at their own risk.

Conclusions

Public still maintain their interest in plastic procedures. Stakeholders could refocus on breast augmentation, liposuction and tummy tuck at current stage of pandemic. In case of second wave of COVID-19, stakeholders should prepare for a temporary surge of Botox and chemical peel.

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Authors' Contributions

WL: Conception and design, data analysis, Manuscript writing. ZW: Collection and assembly of data, data processing and interpretation. XC: Collection and assembly of data, Manuscript modification. RP: Manuscript critiquing and modification. HZ: Data collection and process. GL: Conception and design, Final approval of manuscript

Conflicts of Interest

The authors declare no conflicts of interests.

Abbreviations

NLTK: Natural Language Toolkit
WHO: World Health Organization

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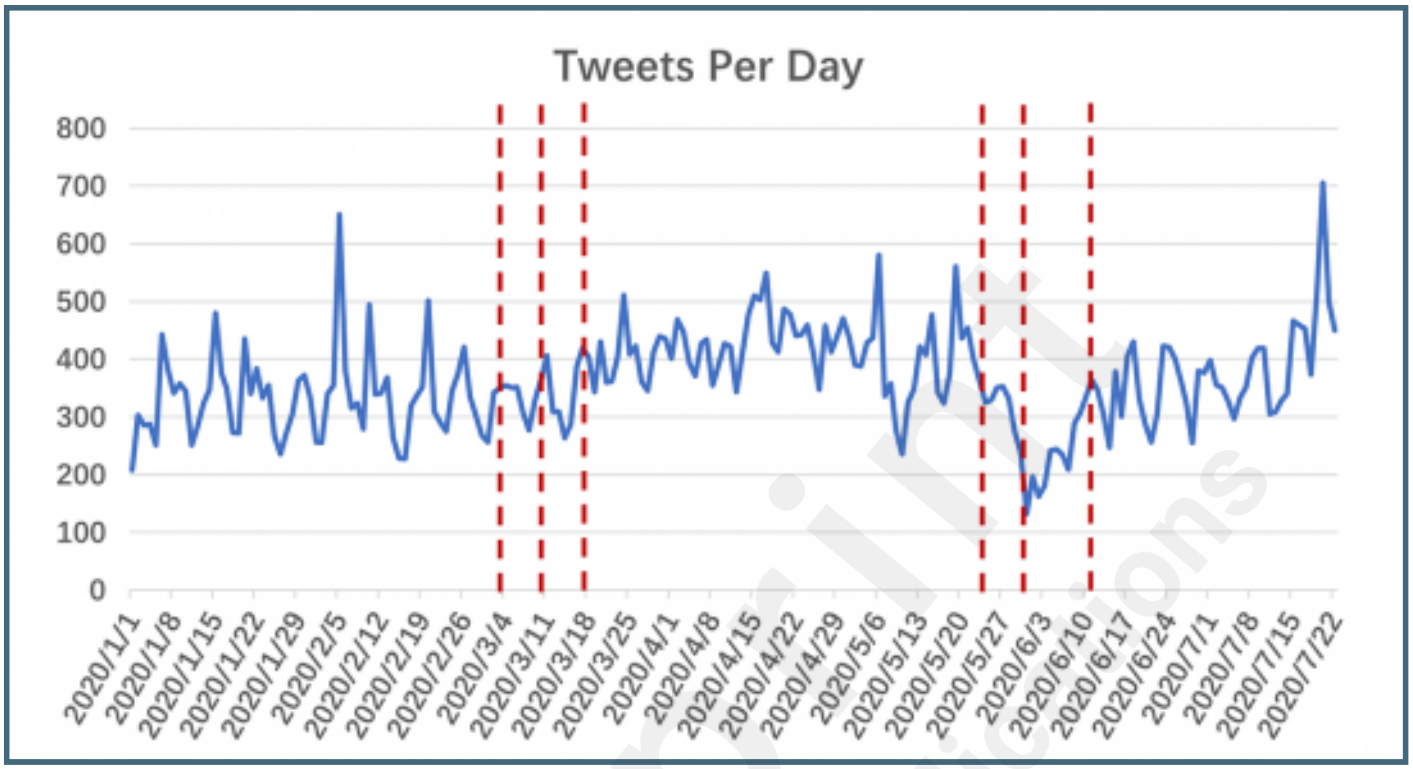
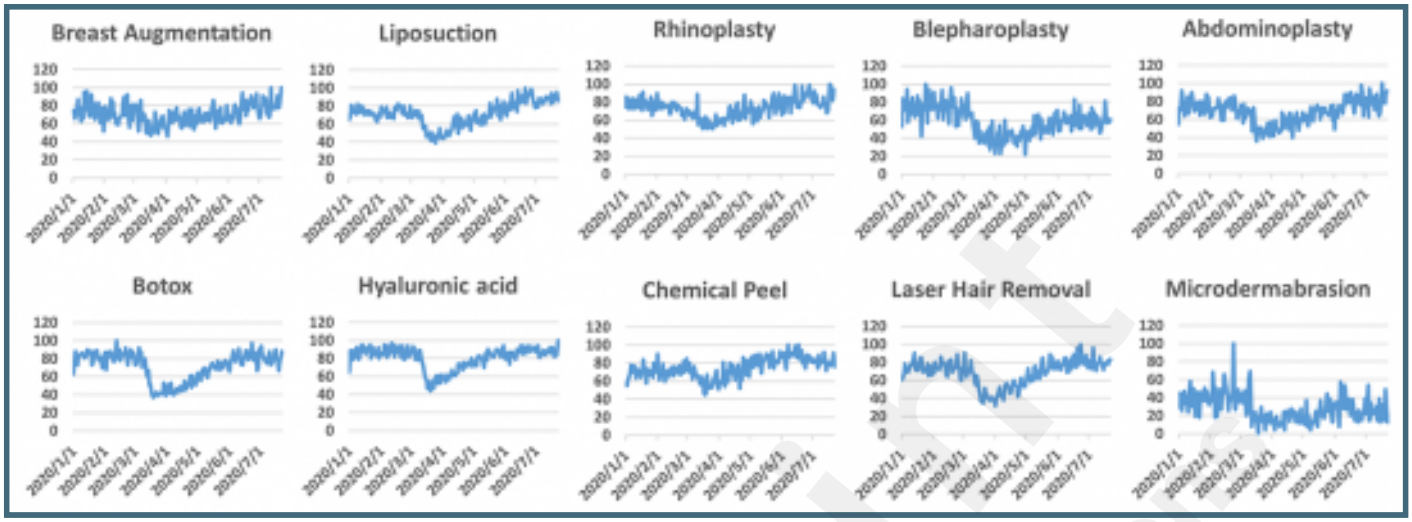
Supplementary Files

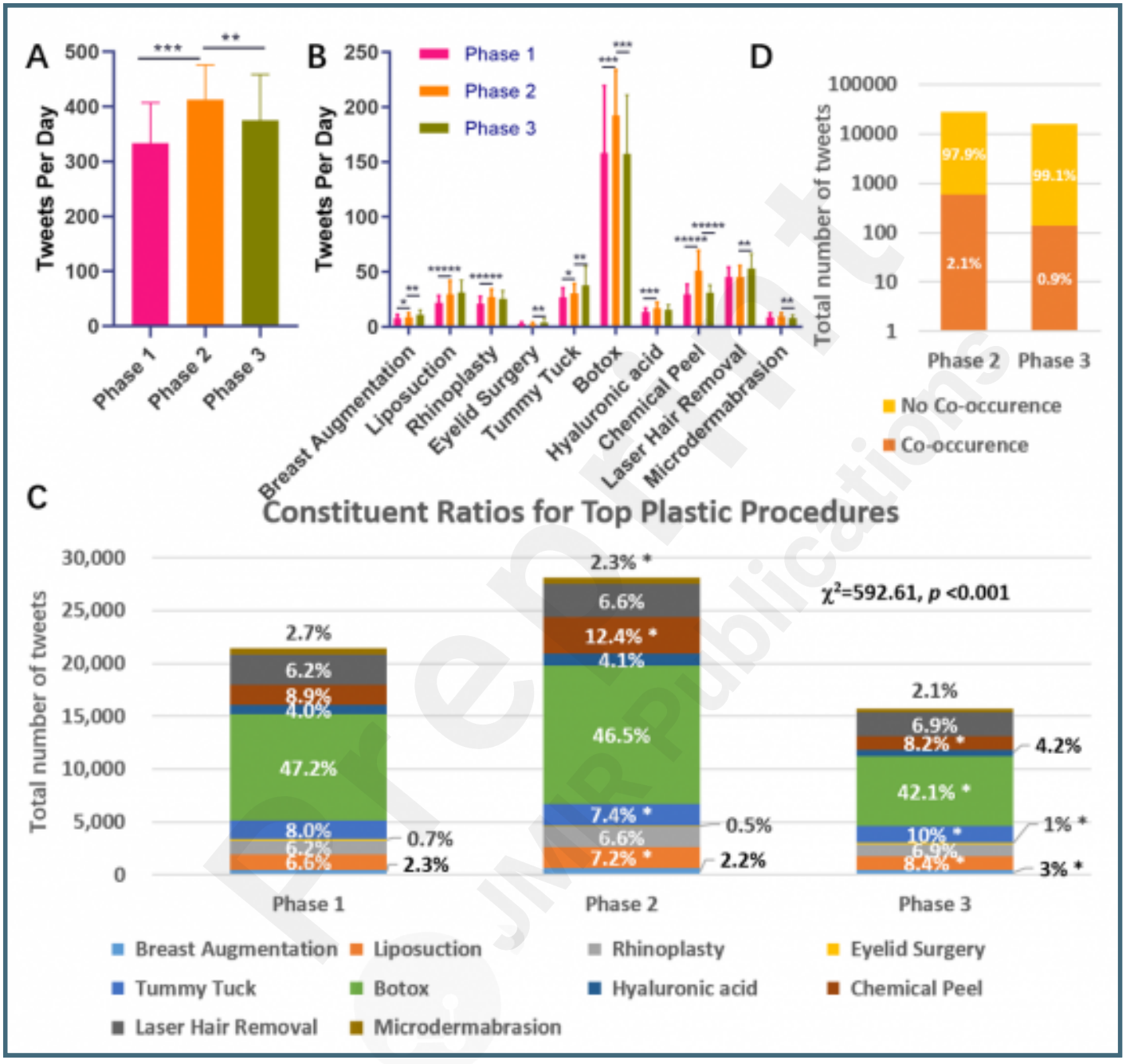
Figures

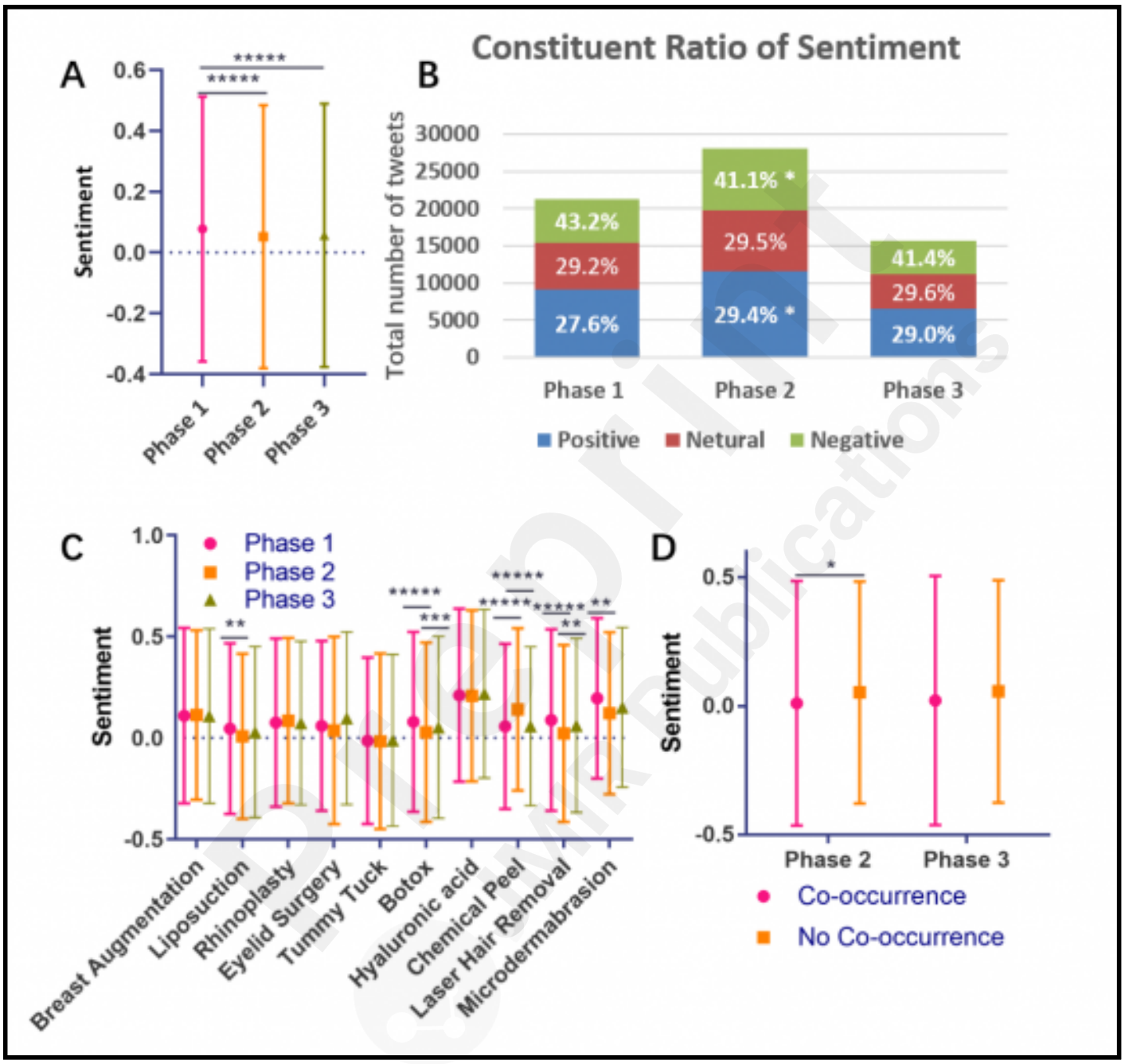
Tweeting frequency for top plastic procedures. X-axis indicates date and Y-axis indicates amount of tweets Dashed red line indicates landmark events and days to be exclude around them.



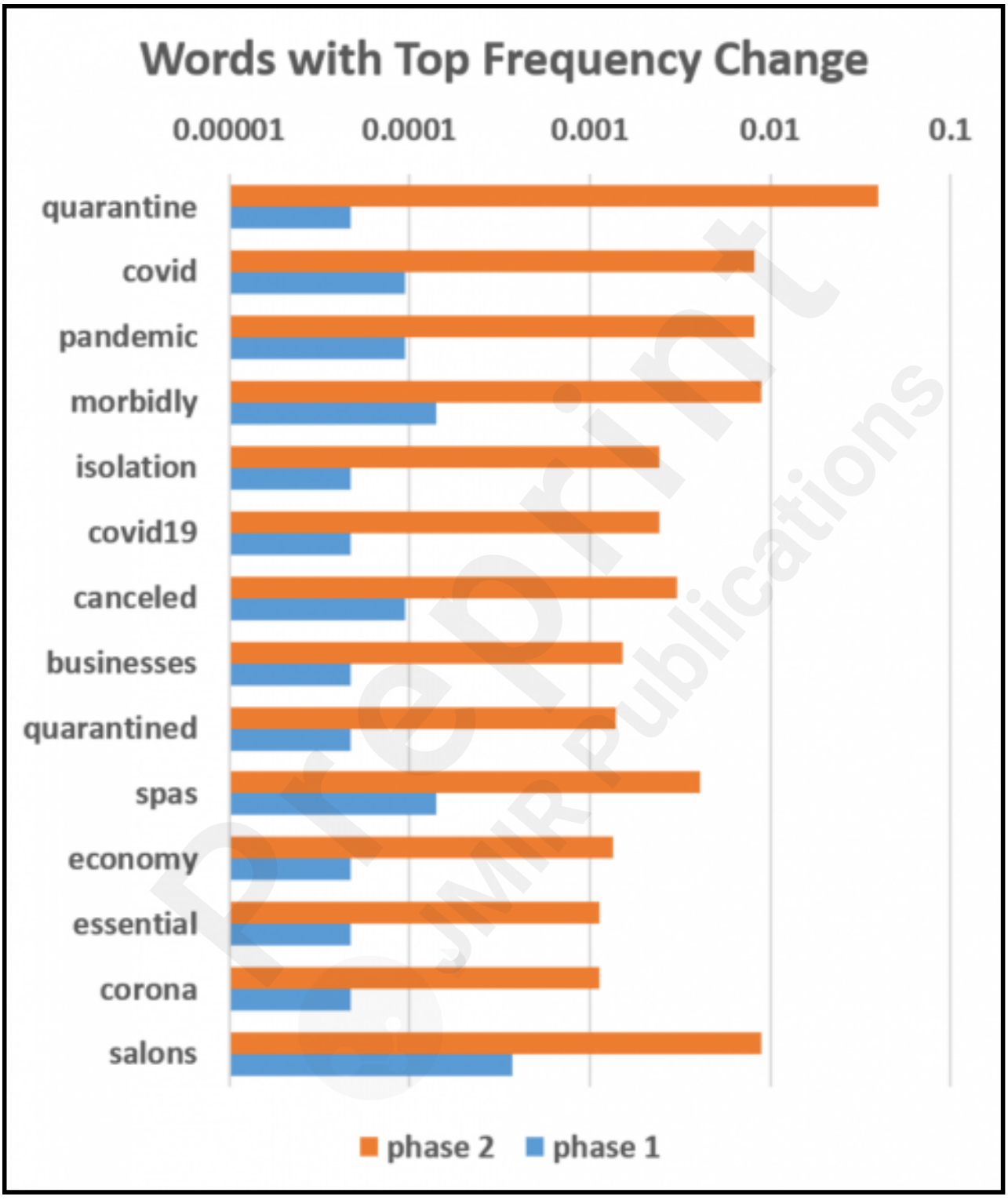
Google Trends Index for top plastic procedures. For each piece of figures, X-axis indicates date and Y-axis indicates Google Trends Index. Actual searched topics of search terms are shown instead original keywords.






A
Sentiment
0.6
0.4
0.2
0.0
-0.2
-0.4
*****
*****
Phase 1
Phase 2
Phase 3
B
Constituent Ratio of Sentiment
Total number of tweets
30000
25000
20000
15000
10000
5000
0
43.2%
29.2%
27.6%
41.1% *
29.5%
29.4% *
41.4%
29.6%
29.0%
Phase 1
Phase 2
Phase 3
Positive
Netural
Negative
C
Sentiment
1.0
0.5
0.0
-0.5
Phase 1
Phase 2
Phase 3
**
*****
***
*****
*****
**
*****
**
Breast Augmentation
Liposuction
Rhinoplasty
Eyelid Surgery
Tummy Tuck
Botox
Hyaluronic acid
Chemical Peel
Laser Hair Removal
Microdermabrasion
D
Sentiment
0.5
0.0
-0.5
*
Phase 2
Phase 3
Co-occurrence
No Co-occurrence

Words Frequency of words with top frequency change.



Multimedia Appendixes

Original tweets data. Only tweets and publish time are provided to protect writers' privacy.

URL: https://asset.jmir.pub/assets/20652f5c6a12ff95ba7e8b96ebf4664b.xlsx

Word frequecny in all three phases.

URL: https://asset.jmir.pub/assets/9efce398443f39ed125e033de03e3ba9.xlsx

Word cloud of tweets in phase 3. Word size is in proportion to their frequency.

URL: https://asset.jmir.pub/assets/d15586f1a1812970697ab9ef4922eaa2.png