

Data-Driven Insights on the Effects of COVID-19 on Aesthetics: Part I (Passive Analysis)

Akash Chandawarkar, MD; Hillary Jenny, MD MPH; and Roy Kim, MD

Drs Chandawarkar and Jenny are Resident Physicians, Department of Plastic and Reconstructive Surgery, Johns Hopkins Hospital. Baltimore, MD. Dr Kim is a plastic surgeon in private practice in San Francisco, CA.

Corresponding Author: Dr Akash Chandawarkar, Department of Plastic and Reconstructive Surgery, 1800 Orleans Street, Baltimore, MD 21287, USA

E-mail: AChandMD@gmail.com; Instagram: @DrAkashChand

Disclosures: Dr Chandawarkar is a consultant for Cypris Medical. Drs Jenny and Kim declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

Funding: The authors received no financial support for the research, authorship, and publication of this article.

Abstract

Background: Since COVID-19 was declared to be a worldwide pandemic and US national emergency in March (week 11), it has significantly changed aesthetic plastic surgery. As plastic surgeons now move towards reopening practices, understanding public interest in medical aesthetics will be critical to maximize efforts and resource allocation in procedures and treatments that patients want.

Objective: This study passively queries public interest in aesthetics using Google Trends search data.

Methods: Google Trends was used to quantify relative search volumes over the past four years for a variety of categories: patient-related, surgery-related, injectables, breast procedures, face procedures, and body procedures. Data were deseasonalized and represented graphically. Z-scores of each time-point differing from the expected values was determined using least squares regression.

Results: Of the 204 significantly anomalous search term data points in 2020, 172 (84.0%) occurred after week 11 (pandemic/national emergency declaration). 60% of searches in all time-points after week 11 were significantly different, and 25/26 (96.0%) of search terms experienced significant changes after week 11. Eighteen terms saw decreased interest with variable recovery. Procedural nadirs for decreased search volume troughs occurred between weeks 11-14. Six patient-related chief complaints saw increased search interest after COVID-19, with peak interest between weeks 11-17.

Conclusions: This is the first study to assess real-time, national data about the impact of COVID-19 on public interest in aesthetics.

The COVID-19 pandemic has caused a major disruption to elective aesthetic surgery in the United States.¹ COVID-19 was announced to be a world pandemic by the World Health Organization on March 11, 2020,² and the United States declared a national emergency on March 13, 2020³ (both during week 11 of 2020). While government-mandated restrictions closed aesthetic offices and prevented access to a variety of aesthetic procedures, there are likely significant effects on the aesthetic market and changes in public interest in aesthetics.

It is widely known that the aesthetics market is sensitive to economic changes, including recessions. During the 2008-2009 recession, the aesthetics business experienced a “V-shaped recovery”, and current experience with clinics reopening in China suggest that decreased usage of aesthetic interventions due to COVID-19 will be transient.⁴ Unfortunately, this is the only available data to aid in predicting how and when the aesthetic market in the United States may recover. Additionally, the economy is but one of many factors that can affect public interest in medical aesthetics, which will in turn have a profound impact on how quickly practices can increase their operations as restrictions are slowly lifted.

The COVID-19 pandemic and resulting social distancing policies have self-quarantined the public and affected many aspects of life, which could both negatively or positively change an individual’s interest in medical aesthetics. Potential negative influences may be financial (change in spending priorities, loss of job or other sources of income), health-related (focus on other parts of health, fear of transmission in a medical facility), or social (positive changes in personal appearance, changes in relationship status, unable to take time off). Potential positive influences could be related to downstream effects of self-quarantine, including increased time at home (increased time on social media, seeing self in mirror more often, weight gain, seeing self on video conferencing, opinions of others in household), change in social support systems (desire to look better post-COVID-19, desire to pamper self post-COVID-19, change in relationship status), or financial improvements (stimulus check for those who have not lost income). As the pandemic evolves, these factors may contribute differently over time, shaping the curve of changing public interest in aesthetic procedures.

To passively assess public interest in aesthetic medicine, internet search analysis can be used to see how the public is searching for terms. When lay individuals are interested in learning more about something, internet search engines are often the first resource the public uses for more information. The Google Trends (Google, Mountainview, CA) tool facilitates temporal analysis of relative volumes of Google search trends for specific terms. This methodology has been used in medicine and plastic surgery to assess public interest for a variety of subfields, including aesthetics.⁵⁻

¹⁰ As we have access to granular data about week-to-week search dynamics, we can analyze how search volumes have changed throughout the COVID-19 pandemic compared to prior years with search as a proxy for medical interest.

In this study, we analyze Google search trends for a variety of patient-related, surgery-related, and procedure-specific searches to passively get a pulse of the changes in public interest in aesthetic procedures.

METHODS

We identified a variety of common, patient-driven aesthetic search terms in different categories to be queried using Boolean expression: patient-related (“double chin”, “jawline” OR “jaw line”, forehead, “tired eyes”, “dark circles”, “wrinkles”, “crooked nose” OR “nose hump”, “love handles), surgery-related (“cosmetic surgery” OR “plastic surgery” OR “aesthetic surgery”, “cosmetic surgeon” OR “plastic surgeon” OR “aesthetic surgeon”), injectables (“botox”, “lip filler” OR “lip injection”, “kybella”), facial surgery (“face lift” OR “facelift”, “neck lift” OR “necklift”, “rhinoplasty” OR “nose job”, “blepharoplasty” OR “eyelid surgery”), breast surgery (“breast augmentation” OR “breast aug” OR “boob job”, “breast implant” OR “breast implants”, “mastopexy” OR “breast lift”, “breast reduction”, “breast reconstruction” OR “breast recon”), and body surgery (“liposuction” OR “lipo”, “abdominoplasty” OR “tummy tuck”, “bbl” OR “brazilian butt lift”, “coolsculpting” OR “coolsculpt”). Of note, searches for “wrinkles” were converted to “wrinkles” NOT “clowns” to remove conflicting searches for a 2019 movie *Wrinkles the Clown*. Each of the preceding terms were input into the Google Trends website (<https://trends.google.com>) with the following settings for location (United States), time range (6/5/2016-6/5/2020), categories (All Categories), search type (Web Search). This data analysis was completed on 6/7/2020 by one of the authors (A.C.). Google trends was used preferentially to the Google Trends API or Health Trends API as each search term was searched for independently, and we sought information related to the temporal changes of search volume rather than comparing absolute volumes. Raw data with week and relative search volume (RSV, a ratio from <1 to 100 of the search volume value compared to the highest search volume during the queried period) were downloaded directly in .csv format and manipulated in Microsoft Excel (Microsoft, Seattle, WA).

Data were split into consecutive 52-week periods, ending with the most recent week. Time-series data were deseasonalized to remove seasonal patterns to isolate any underlying trends, such as the effects of COVID-19. To deseasonalize the data: (1) the annual average RSV was calculated as a simple mean of the RSVs in each 52-week period; (2) the yearly proportion for each week was calculated as the ratio between the RSV for each week and the annual average calculated in (1) for that particular year; (3) the seasonal index for each week was calculated as the average of yearly proportions (calculated in [2]) for each year (2017, 2018, 2019, 2020); and (4) the deseasonalized relative search value for each week was calculated by dividing the RSV for that week by the seasonal index for that particular week calculated in (3). For each search term, the deseasonalized RSVs for the first 18 weeks of each calendar year from 2017-2020 were plotted as a time-series to include a pre-COVID-19 period and the start of the COVID-19 pandemic/national emergency (announced week

11). A graphical representation of an example of deseasonalization is shown in Figure 1. For statistical analysis of each search term, least-squares regression was performed with all deseasonalized RSVs prior to 1/1/2020. The resulting regression formula was used to predict expected deseasonalized RSVs for the full time series. Z-scores were calculated for each deseasonalized RSV data point, and p-values were calculated and reported as significant at a 95% confidence interval. Qualitative descriptive analysis was performed detailing whether deseasonalized RSV was decreased, unchanged, or increased, and describing curves of any COVID-related peaks/troughs including onset, peak/nadir (respectively), and recovery.

RESULTS

Interest in search terms followed four trends, examples of which are exhibited in graphical representations (Figures 2-5: patient-related, surgery-related, injectable, and procedure, respectively). Graphs for each search term can be seen in Appendix A. Z-scores of the magnitude of aberrancy from expected search volumes for each term are shown in Figure 6. Of the 204 significantly anomalous ($Z < -1.96$ or $Z > 1.96$) data points for all search terms at all time points in 2020, 172 (84.0%) occurred after the week 11 pandemic/national emergency. 60% of all time-points for each search term after week 11 were significantly different. 25/26 (96.0%) of search terms experienced significant changes after week 11. A qualitative summary of each search curve is presented in Table 1. Of the 26 search terms queried, 18 had decreasing interest compared to prior years with variable rates of recovery to normal levels (all of which except for one term were procedural in nature). Onset of declining interest for procedures varied between weeks 7-10. Fifteen of these recovered to normal or higher-than-normal volumes, occurring between weeks 17-20. Procedural nadirs (lowest search volume) for decreased search volume troughs occurred between weeks 11-14. Search interest was increased for 6 search terms, all patient-related chief complaints, with peak interest between weeks 11-17. Two search terms were unchanged from expected: “crooked nose” OR “nose hump”, and “rhinoplasty” OR “nose job”.

DISCUSSION

This is the first study to show data-driven trends of public interest through the COVID-19 crisis via analysis of search volumes for aesthetic-related terms. Our data suggest that the COVID-19 outbreak and resultant self-quarantine significantly altered public interest in all areas of medical aesthetics. These findings also provide surgeons both the magnitude and temporality of shifting public interest in different aspects of aesthetic treatment. Understanding these dynamics can in turn facilitate resource allocation and scheduling logistics to align practice reopening with patient interests in the current COVID-19 recovery period.

Using Google search data as a proxy for public interest has been validated throughout the literature in plastic surgery.⁵⁻¹⁰ Search data can be used as a proxy because Google search is often the

first stop for a consumer trying to research or learn more about almost any topic of interest. Google Trends have even been used to associate and predict public interest in outbreaks such as COVID-19 in real time.^{11,12} Google is also frequently the first resource used for potential patients looking for more intervention on aesthetic interventions, and as such, analyzing Google search volumes for these procedures can capture even the earliest stages of public interest. To most accurately assess this interest, our methodology involved querying the Google Trends database for both medical and layperson terms for these procedures. For example, to probe interest about breast augmentation, “breast augmentation”, “breast aug”, and “boob job” were all queried.

Our findings show obvious deviations from normal search volume curves and statistically significant changes in search popularity after week 11, the week during which the pandemic was announced and national emergency was declared. Compared to pre-COVID-19 time periods, search volumes for procedures almost universally significantly declined, likely signifying initial loss of interest in aesthetic procedures. However, this could also indicate temporary shifting interests or distraction by the new pandemic at hand. As self-quarantining and shelter-in-place/stay-at-home continued, the search terms had variable recovery from the initial decline. Some patient-related chief complaints ultimately continue to have rising search volumes compared to previous years. Despite the initial shock of the pandemic resulting in expected declines in attention to medical aesthetics, changes in daily life during shelter-in-place result in dynamic reversals in some instances of patient interests just within a few weeks.

Searches for surgery (cosmetic surgery/plastic surgery/aesthetic surgery) and surgeons (cosmetic surgeons/plastic surgeons/aesthetic surgeons) (Figure 2) both dropped during the COVID-19 period. Four weeks into the pandemic, searches for surgery started to recover, while searches for surgeons continued to be stalled. Searches for surgery recovered by week 18 and, in fact, are exhibiting higher-than-expected interest in more recent weeks. Meanwhile, searches for surgeons has lagged behind and is now almost approaching expected levels. This suggests renewed interest in surgery, but this interest may not have been serious enough to search for a surgeon. Marketing therefore should be focused at conversion of this interest into action to support practice volume.

Specific chief complaints (double chin, jawline, dark circles, love handles) initially saw decreased search volumes but increased to above-normal values starting approximately 3-5 weeks into the pandemic. This may represent an initial shock and shifted interest during the onset of the COVID-19 pandemic, with eventual acceptance of the new normal, closely mimicking the Kübler-Ross Change Curve.¹³ Additionally, a variety of quarantine-specific changes to daily life (eg, increased time analyzing oneself in the mirror at home, lack of exercise options resulting in weight gain, etc.) may have contributed to rejuvenated or new interest in certain aesthetic procedures. While the reasons for changing interests of these quantitative changes is purely speculative, a future survey-based study by our group explored patient reasons for changed interests in aesthetics during the COVID-19 pandemic.

Injectable treatments all saw sharp immediate declines in interest but reached minima within a few weeks. While these searches for these procedures had slow recoveries, we may see increasing interests as the effects of treatments received prior to practice shutdown may wear off. Additionally, the dynamics of chief complaints such as “forehead” (significantly higher) and “wrinkles” (recovered) may predict similar delayed interest spikes for “botox” (similar for “double chin” dynamics predicting recovery in interest for Kybella). This is important information for injectors to understand as these potential patients may need to be directed from their chief complaint to product or procedure via marketing and patient counseling. It is important to note that these shifts in interest are also occurring in the context of “botox” and “lip filler” enjoying annual increases in popularity, with the highest interest volumes to date occurring in the 2020 pre-COVID-19 period.

Most of the breast, facial, and body surgical-related search terms have similar search volume dynamics, with an initial decline and slow increase towards normal values, with the exception of rhinoplasty. This is corroborated by a lack of changed interest in nose-related chief complaint search terms. Chief complaint search volumes curves related to jawline, dark circles, and love handles coincide with search interest for related procedures for facelift/necklift, blepharoplasty, and liposuction/abdominoplasty/CoolSculpting, respectively, suggesting potential successful conversion of interest in these problem areas into procedures. Conversion rates and timing of conversion may be influenced by time-of-year, particular procedure, patient demographics, geographic considerations, etc. The scope of this study does not give us information about the lag time of search term to consultation. Surgeons can utilize this information about public interest to reallocate resources or focus on certain areas, and predict volume based on their known conversion lag for that particular practice.

During the 2008 financial crisis, many surgeons noted that lower cost items in the aesthetic marketplace, such as neurotoxin, remained strong, while more costly items, like surgery, were put on hold. It is difficult to extrapolate what happened in 2008 to predict the interest curves and recovery during this pandemic. The 2008 financial crisis resulted in decreased disposable income for patients, which served as the major driving factor in decreased interest. Decreased disposable income is likely only one of many contributors to the downturn in interest during COVID-19. Therefore, linking the cost and amount of downturn or recovery may correlate, but certainly difficult to prove to be causative. We take a look at these variables in terms of different procedures via a survey of the public in Part II of this study.

Google Trends shows what is trending in US and worldwide search, and can help predict what topics or keywords are more or less popular over time. There is no other specific consumer leading indicator for the aesthetics market. For overall consumer sentiment, the University of Michigan Survey of Consumers is the most popular survey used. Other conceivable indicators are all lagging, as they report data after the event has occurred. We believe this to be a leading indicator because of the sensitivity of the data to show rising, falling, or stagnant trends in search volume for a

specific word over a several week period in real-time. Aesthetic surgery itself has been previously noted to be a leading economic indicator, using data such as practice profits as a proxy. Other contenders for luxury consumer sentiment are high-end purses, high-end hotels, private jet bookings, high-value real estate, etc. Macroeconomic indicators include Federal Reserve rates, housing statistics, quarterly GDP numbers per country or region, unemployment, etc.

Recommendations from our study for each plastic surgeon will be dependent on the diversity of procedures and demographics of patients of their practice. For surgeons with a focused practice, understanding the dynamics of public interest can help reallocate resources and plan for staffing to minimize losses during slow times and maximize productivity with recovery. For practices that are more diverse with respect to procedure, shifting resources such as marketing to procedures that are recovering sooner than others would be prudent. The rebound of most procedures can give practices some sense of optimism that things may start to recover overall.

Limitations

When using Google searches to estimate public interest, we make the assumption that almost all registered searches are from the public rather than professional/surgeon searches. While this is likely true given the relatively miniscule numbers of professionals compared to the rest of the public, it cannot be proven. However, we do get a sense of the intent of the search by looking at the “Related Search” functionality on Google Trends, which provides frequently-searched-for terms related to the given input term. While not systematically studied, these related terms tended to suggest consumer searches (eg, “cost”, “before and after”, etc.). Because general interest does not indicate opinion or sentiment, any reason to explain reduced activity based solely on the search data would be purely conjecture. In Part II of this study, we use crowdsourced data to elucidate some of the reasons for decreased interest on some of these topics.

Additionally, although this study delineates public interest in aesthetic procedures over time, it does not assess interest on a more individual level, and therefore cannot account for the underlying reasons for these interest shifts. Google Trends also does not allow for assessment of interest for individuals without access to internet-capable technology, such as laptops and smartphones. However, one can reasonably expect those interested in aesthetic interventions to have access to these devices. Furthermore, as Google Trends allows for concurrent surveyal of country-wide interest, these findings represent the national population, and are therefore fully generalizable and less subject to selection bias.

Our methodology utilized deseasonalization as a statistical tool to remove cyclical variations due to normal seasonal changes, as would be expected for some procedures. If a search trend does not have seasonal variation, deseasonalization has minimal effect on the data. Removal of seasonal effects on search volumes facilitates visualization and statistical analysis of true aberrations from expected norms, allowing us to identify time points where there is likely true changed interest. As a positive

control, searches for “breast implant OR breast implants” show interest spikes in previous years (Figure 5B) in Mar 2017, Feb 2019, and Mar 2019, which correspond to FDA releases about breast implants. While deseasonalization may affect the magnitude of change of aberrations, the time-related dynamics are not affected by deseasonalization. Deseasonalizing the data was the only data manipulation that was done in order to remove expected cyclical seasonal effects. Instead of doing further smoothing, which could potentially hide trends that change on a week-by-week basis, a least-squared regression line was generated to all of the data in our set prior to January 1, 2020, and the value of each time point was converted to a z-score to determine how aberrant a search value is from the expected value. This provides a quantitative and unbiased way to identify trends.

Our methodology using the Google Trends public site used relative search values rather than absolute. Using relative search values is only comparable within a search term over the period of time searched for. With this method, one is not able to compare the relative search values of different searches to each other that were independently input into Google Trends. However, our study does not compare search terms to each other, as absolute search volume differences between terms are too varied to extract any useful information out from. The goal of our study was to determine deviations from expected search volumes for each search term. Statistically, we were able to calculate z-scores for each time point for each search term to determine how aberrant the value is from what would be predicted by least-squares regression based on historical data. Because these z-scores relate to a normal distribution, we can see how far off from expected search volumes particular time points are, which is comparable between search terms (Figure 6).

Our study shows that public interest in aesthetic surgery has been sensitive to the COVID-19 pandemic, but has the potential for quick recovery to baseline interest levels as the pandemic evolves. Prior studies confirm the association with aesthetic surgery volumes with changes in the economy,¹⁴⁻¹⁶ however no studies to date have directly and objectively assessed this during the current COVID-19 pandemic. Following these data over-time will provide a better understanding of the recovery process. Until then, practices can utilize our findings to drive interested patients back into their offices and focus on procedures with recovering public interest, rather than those that are slower to recover.

As these data can be examined over time rather than cross-sectionally, we were able to get a pulse on the rapidly changing public interest in medical aesthetics by quantitatively analyzing these dynamics real-time as they have evolved. This study answers the question of “How is public interest in aesthetics changing during the pandemic?” but does not answer why. Another study by our group looks at the drivers of both decreased in and increased interest that is out of the scope for this paper.

CONCLUSIONS

This is the first study to assess real-time, national data about the impact of COVID-19 on public interest in aesthetics. Google search data serves as an interest proxy and demonstrates an almost universal change in public interest from expected norms and varied rates of normalization.

Understanding the public's dynamic interest in aesthetic offerings can facilitate resource allocation and procedure prioritization as practices reopen.

Supplementary Material

This article contains supplementary material located online at www.aestheticsurgeryjournal.com.

Accepted Manuscript

REFERENCES

1. Jewell ML, Jewell ML, Singer R. Practice management during a pandemic: common issues that affect all of us. *Aesthetic Surg J Open Forum*. 2020;2(2): doi: ojaa017.
2. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Biomed*. 2020;91(1):157-160.
3. Trump DJ. Proclamation on Declaring a National Emergency Concerning the Novel Coronavirus Disease (COVID-19) Outbreak. *The White House*. March 13, 2020.
4. AbbVie Inc. *Q1 2020 Earnings Conference Call*. May 1, 2020.
5. Motosko CC, Zakhem GA, Saadeh PB, Hazen A. Googling aesthetic plastic surgery for patient insights into the latest trends. *Plast Reconstr Surg*. 2018;142(6):1478-1485.
6. Tijerina JD, Morrison SD, Nolan IT, Parham MJ, Richardson MT, Nazerali R. Celebrity influence affecting public interest in plastic surgery procedures: Google Trends analysis. *Aesthetic Plast Surg*. 2019;43(6):1669-1680.
7. Dayani F, Tijerina JD, Morrison SD, Nazerali RS. Public interest in textured breast implants recall: a Google Trends analysis. *Aesthetic Plast Surg*. 2020. doi: 10.1007/s00266-020-01724-z.
8. Wilson SC, Daar DA, Sinno S, Levine SM. Public interest in breast augmentation: analysis and implications of Google Trends data. *Aesthetic Plast Surg*. 2018;42(3):648-655.
9. Ward B, Ward M, Paskhover B. Google Trends as a resource for informing plastic surgery marketing decisions. *Aesthetic Plast Surg*. 2018;42(2):598-602.
10. Tijerina JD, Morrison SD, Nolan IT, Parham MJ, Nazerali R. Predicting public interest in nonsurgical cosmetic procedures using Google Trends. *Aesthet Surg J*. 2019:sjz264. doi: 10.1093/asj/sjz264.
11. Effenberger M, Kronbichler A, Shin JI, Mayer G, Tilg H, Perco P. Association of the COVID-19 pandemic with internet search volumes: a Google Trends™ analysis. *Int J Infect Dis*. 2020;95:192-197.
12. Springer S, Menzel LM, Zieger M. Google Trends provides a tool to monitor population concerns and information needs during COVID-19 pandemic. *Brain Behav Immun*. 2020;87:109-110.
13. Berinato S. That discomfort you're feeling is grief. *Harvard Business Review*. March 23, 2020. <https://hbr.org/2020/03/that-discomfort-youre-feeling-is-grief>. Accessed August 18, 2020.
14. Wong WW, Davis DG, Son AK, Camp MC, Gupta SC. Canary in a coal mine: does the plastic surgery market predict the American economy? *Plast Reconstr Surg*. 2010;126(2):657-666.
15. Wilson SC, Soares MA, Reavey PL, Saadeh PB. Trends and drivers of the aesthetic market during a turbulent economy. *Plast Reconstr Surg*. 2014;133(6):783e - 789e.
16. Gordon CR, Pryor L, Afifi AM, et al. Cosmetic surgery volume and its correlation with the major US stock market indices. *Aesthet Surg J*. 2010;30(3):470-475.

Figure Legend

Figure 1. Example of deseasonalization of “liposuction” OR “lipo” relative search volumes over a four-year period. Blue curve represents relative search volumes (dotted blue line is regression line). Orange curve represents deseasonalized relative search volumes (dotted orange line is regression line).

Figure 2. Patient-related interest: deseasonalized relative search volumes for weeks 1-18 of 2017 (blue), 2018 (orange), 2019 (green), and 2020 (red). Search terms examples shown are (A) “double chin”, (B) “wrinkles”, and (C) “love handles”.

Figure 3. Surgery-related interest: deseasonalized relative search volumes for weeks 1-18 of 2017 (blue), 2018 (orange), 2019 (green), and 2020 (red). Search terms shown are (A) [“cosmetic surgery” OR “plastic surgery” OR “aesthetic surgery”] and (B) [“cosmetic surgeon” OR “plastic surgeon” OR “aesthetic surgeon”].

Figure 4. Injectables interest: deseasonalized relative search volumes for weeks 1-18 of 2017 (blue), 2018 (orange), 2019 (green), and 2020 (red). Search term example shown is “botox”.

Figure 5. Procedure (facial, breast, body) interest: deseasonalized relative search volumes for weeks 1-18 of 2017 (blue), 2018 (orange), 2019 (green), and 2020 (red). Search terms examples shown are (A) [“blepharoplasty OR eyelid surgery”], (B) [“breast implant” OR “breast implants”], and (C) [“abdominoplasty” OR “tummy tuck”].

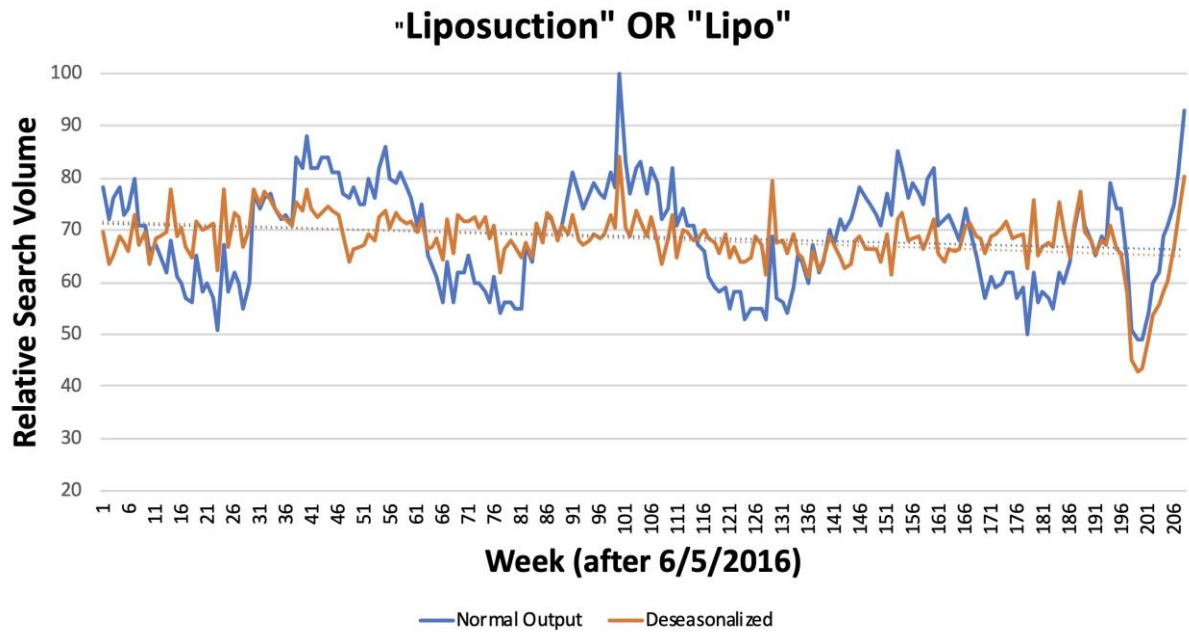
Figure 6. Quantitative summary of each search term deseasonalized relative search volume curves. Each cell represents a time point (by week) and Z-score of magnitude of deviation from normal based on least-squared regression. Green fill: Positive Z-score (higher than expected) with darker shading representing higher Z-score. Red fill: Negative Z-score (lower than expected) with darker shading representing higher Z-score. Z-scores of <1.96 and >1.96 are statistically significant at a 95% confidence level. Blue line denotes announcement of COVID-19 pandemic (week 11).

Table 1. Qualitative Summary of Each Search Term Deseasonalized Relative Search Volume Curves

		Overall change	Onset (week)	Nadir/peak (week)	Recovery (week)	Other notes
Patient-related	“Double Chin”	Increase	13	17	N/A	Initial decline prior to increase Slow return
	“Jawline” OR “Jaw Line”	Increase	11	17	N/A	Initial decline prior to increase Slow return
	“Forehead”	Increase	9	11	N/A	Initial decline prior to increase Slow return
	“Tired Eyes”	Increase	18	N/A	N/A	Late increasing growth
	“Dark Circles”	Increase	13	15	N/A	Initial decline prior to increase Continued rise
	“Wrinkles”	Decrease	9	11	20	Possible late increase
	“Crooked Nose” OR “Nose Hump”	No change	N/A	N/A	N/A	Possible late increase
	“Love Handles”	Increase	11	16	21	
Surgery-related	“Cosmetic Surgery” OR “Plastic Surgery” OR “Aesthetic Surgery”	Decrease	9	13	18	Increasing growth after recovery
	“Cosmetic Surgeon” OR “Plastic Surgeon” OR “Aesthetic Surgeon”	Decrease	10	14	N/A	Approaching recovery
Injectables	“Botox”	Decrease	8	13	N/A	Approaching recovery (Rising annual interest)
	“Lip Filler” OR “Lip Injection”	Decrease	10	13	20	(Rising annual interest)
	“Kybella”	Decrease	9	11	18	
Facial Surgery	“Facelift” OR “Face Lift”	Decrease	7	13	19	
	“Necklift” OR “Neck Lift”	Decrease	9	12	19	
	“Rhinoplasty” OR “Nose Job”	No change	N/A	N/A	N/A	Possible late increase

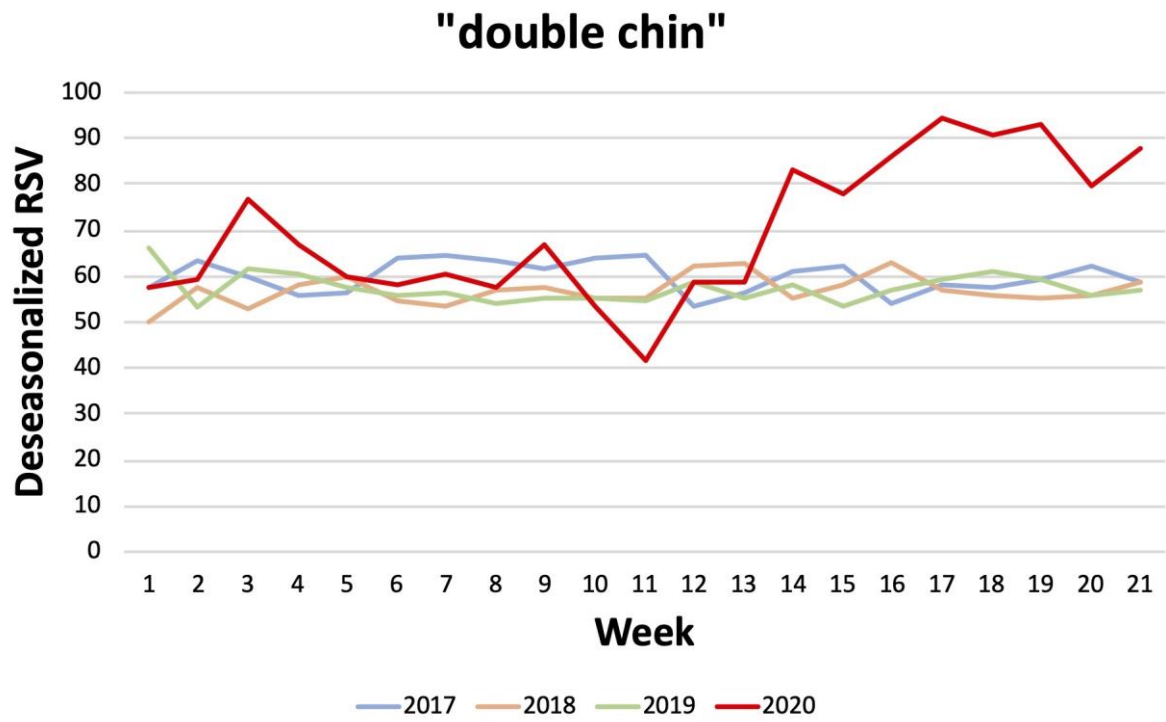
	“Blepharoplasty” OR “Eyelid Surgery”	Decrease	8	13	19	
Breast Surgery	“Breast Augmentation” OR “Breast Aug” OR “Boob Job”	Decrease	9	11	20	(Slightly decreasing annual interest)
	“Breast Implant” OR “Breast Implants”	Decrease	8	11	20	2017 (Week 12) and 2019 (Week 6 and 13) de-seasonalized spikes related to FDA activity
	“Mastopexy” OR “Breast Lift”	Decrease	8	11	20	
	“Breast Reduction”	Decrease	8	11	20	
	“Breast Reconstruction”	Decrease	11	13	20	Possible 2 nd wave decrease
Body Surgery	“Liposuction” OR “Lipo”	Decrease	7	12	19	Increasing growth after recovery
	“Abdominoplasty” OR “Tummy Tuck”	Decrease	8	13	20	Increasing growth after recovery
	“CoolSculpting” OR “CoolSculpt”	Decrease	10	13	N/A	Slow recovery
	“Brazilian Butt Lift” OR “BBL”	Decrease	10	11	17	Increasing growth after recovery (in context of increased interest compared to prior years)

Figure 1



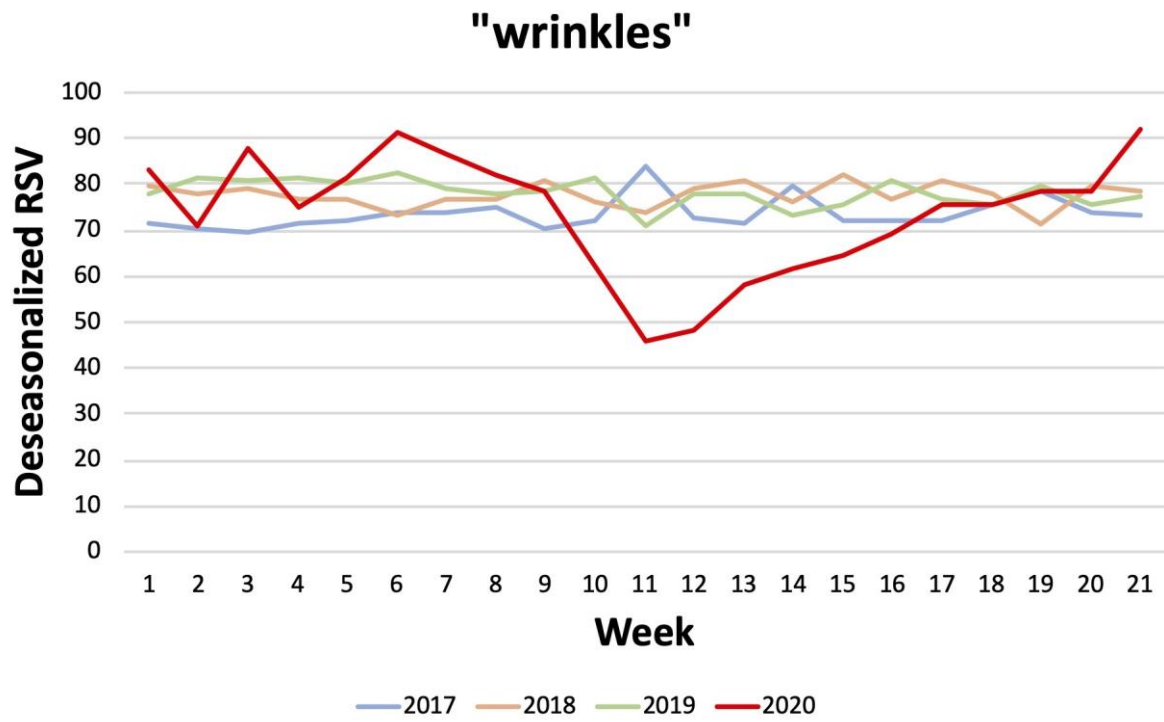
Accepted Manuscript

Figure 2a



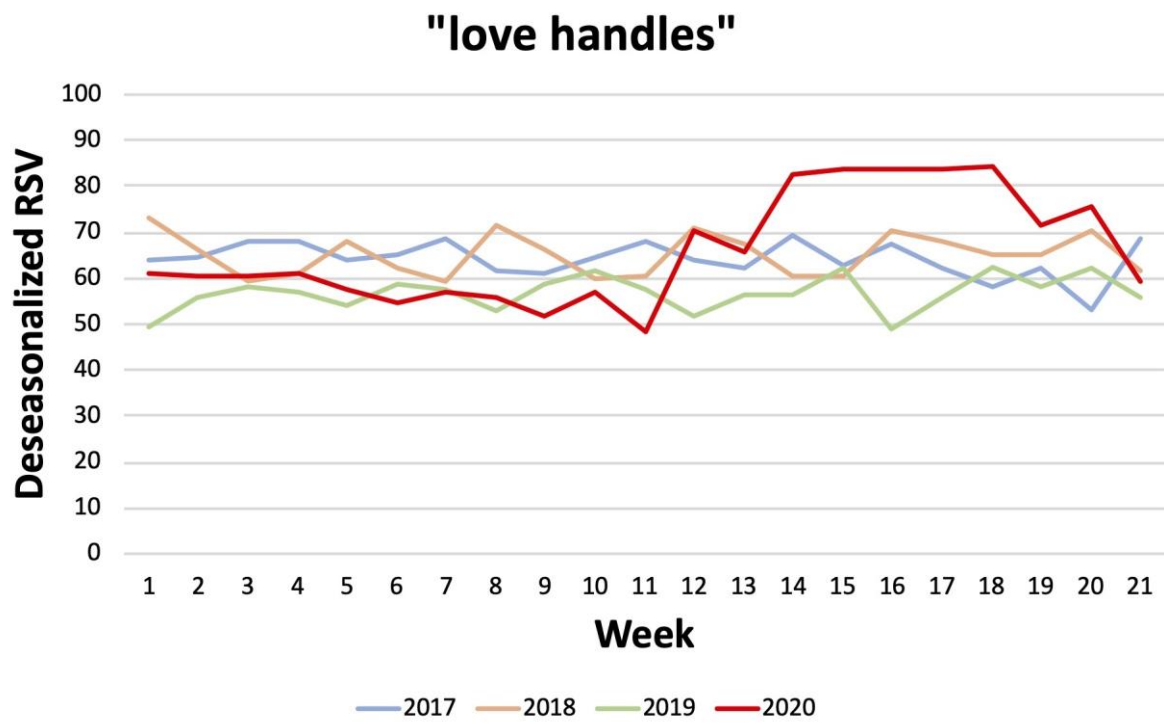
Accepted Manuscript

Figure 2b



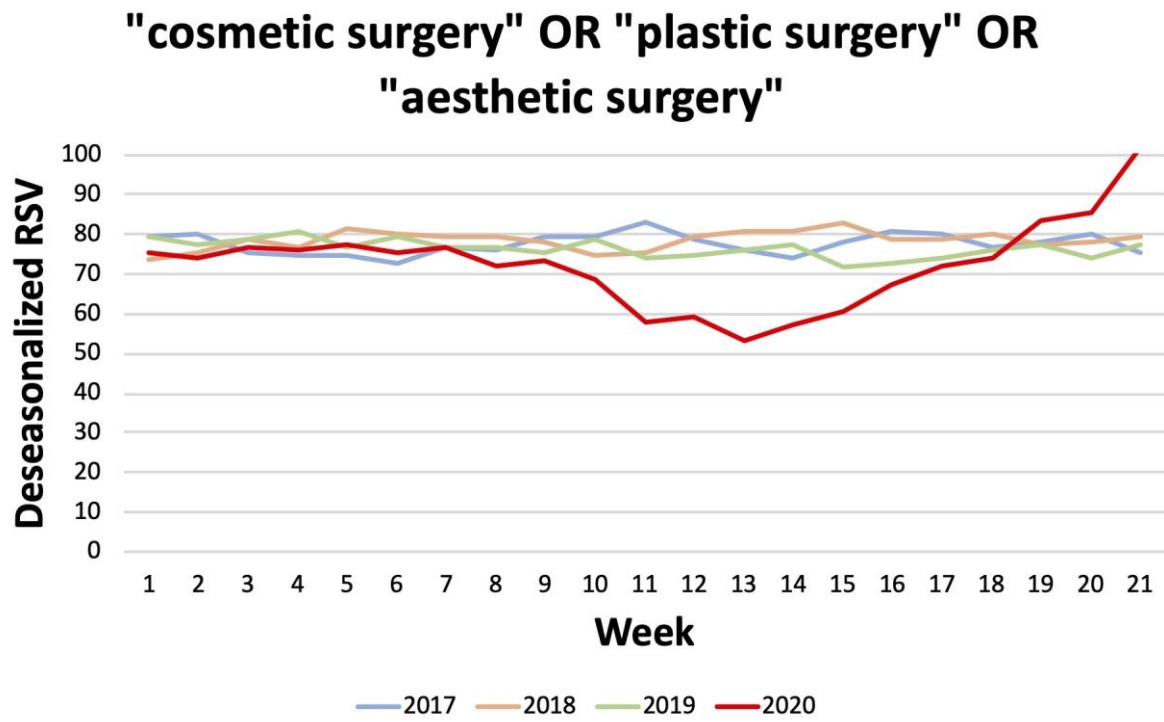
Accepted Manuscript

Figure 2c



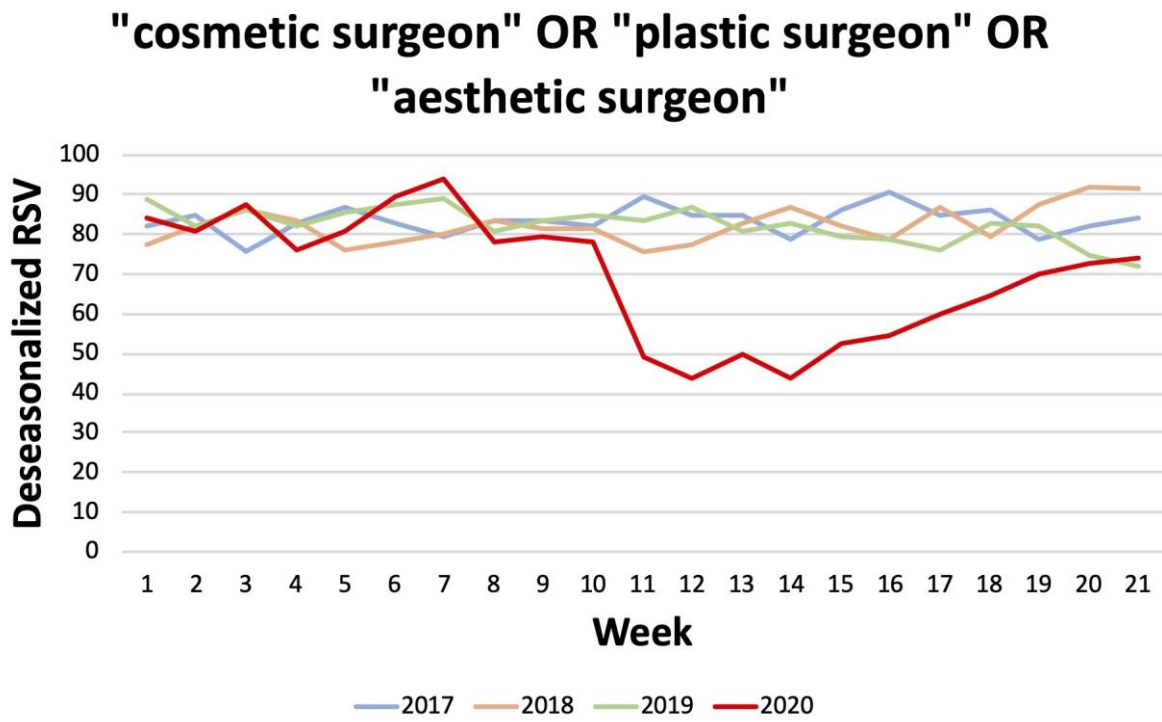
Accepted Manuscript

Figure 3a



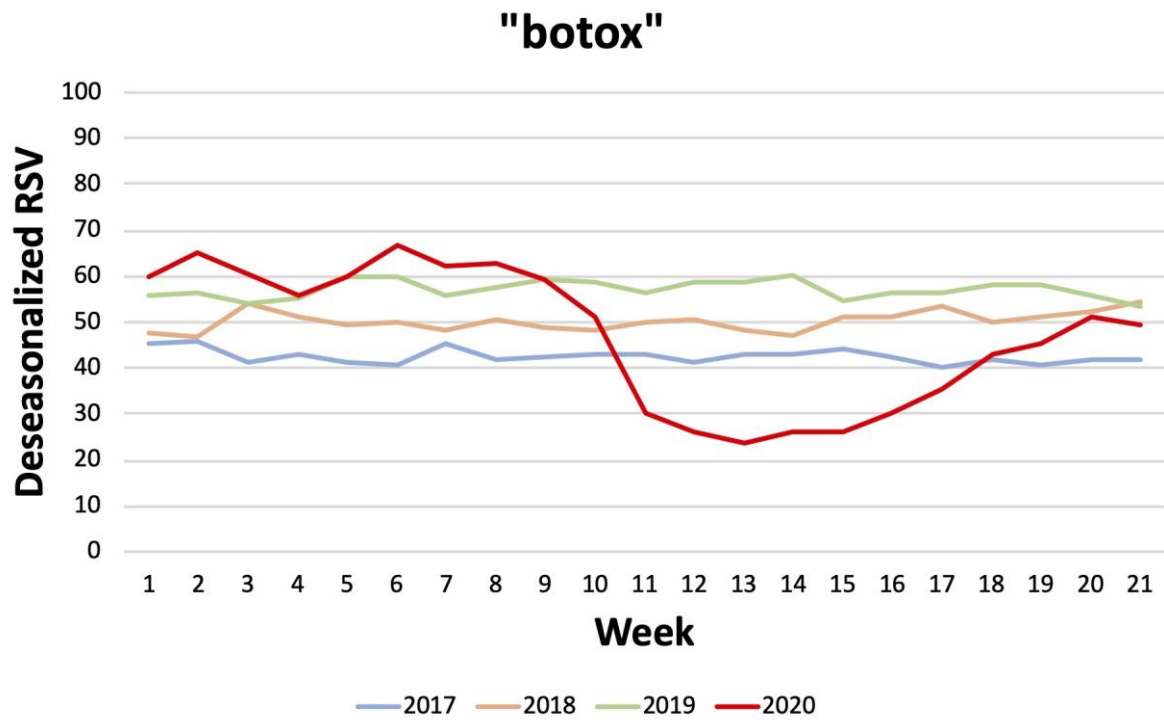
Accepted Manuscript

Figure 3b



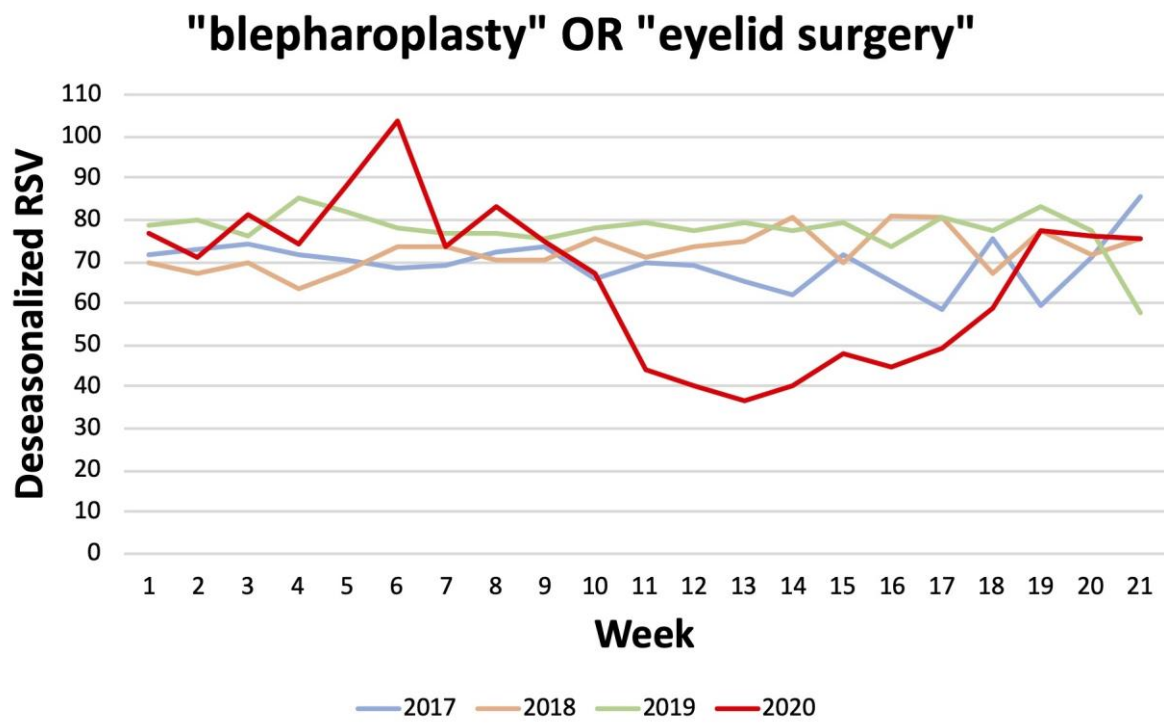
Accepted Manuscript

Figure 4



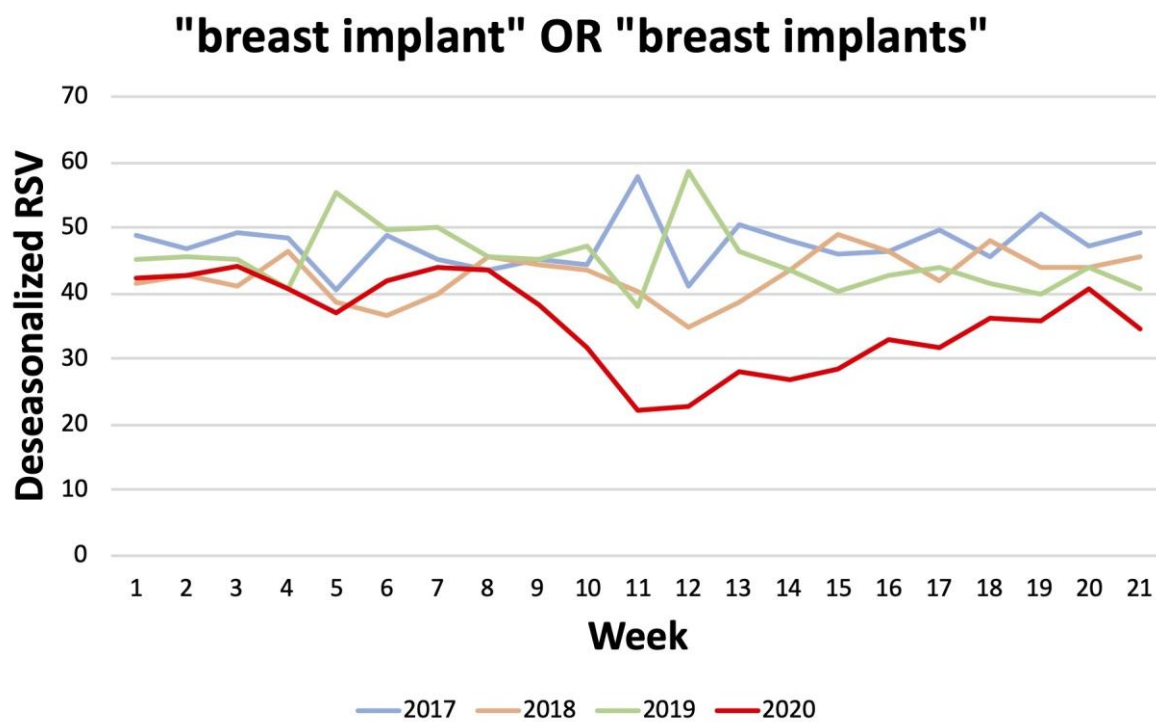
Accepted Manuscript

Figure 5a



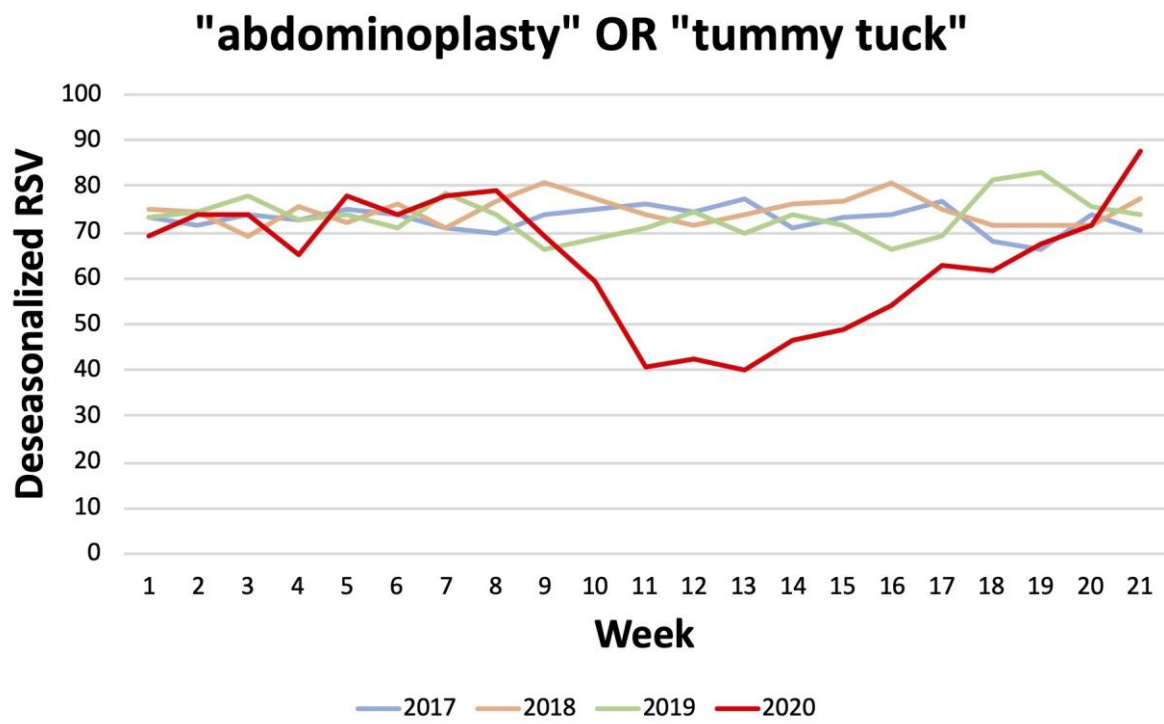
Accepted Manuscript

Figure 5b



Accepted Manuscript

Figure 5c



Accepted Manuscript

Figure 6

Week ending...	Patient-related								Surgery-related		Injectables			Facial Procedures				Breast Procedures					Body Procedures			
	Double Chin	Jawline	Forehead	Tired Eyes	Dark Circles	Wrinkles	Nose Factors	Love Handles	Surgery	Surgeon	Botox	Lip Filler	Kybella	Facelift	Necklift	Rhinoplasty	Blepharoplasty	Breast Aug	Breast Implant	Mastopexy	Breast Reduction	Breast Recon	Liposuction	Abdominoplasty	CoolSculpting	BBL
1/5/2020	-0.46	0.92	0.25	2.63	-0.22	-0.11	1.46	0.73	-0.18	0.30	-1.18	0.60	-0.27	0.39	0.27	1.65	-0.06	2.34	0.31	0.44	-0.04	-0.90	2.73	-0.85	0.24	4.08
1/12/2020	-0.06	-1.00	0.06	-1.36	-1.53	-3.61	-0.02	0.67	-0.57	-0.38	0.24	0.78	-0.26	0.65	-1.45	-0.31	-0.99	0.21	0.37	0.44	1.08	0.14	0.67	0.47	-0.34	2.23
1/19/2020	3.53	0.54	-0.75	0.70	0.10	1.15	1.33	0.66	0.12	0.99	-1.12	0.49	-0.15	0.91	-1.47	1.10	0.61	0.10	0.68	0.10	0.50	0.23	0.23	0.56	-0.35	2.53
1/26/2020	1.47	-1.20	-0.88	-1.33	-0.87	-2.56	1.77	0.75	-0.09	-1.38	-2.34	0.48	0.80	0.65	-1.06	1.04	-0.48	-1.15	-0.05	1.51	-1.82	1.86	-0.51	-2.01	-1.18	0.95
2/2/2020	0.05	1.05	1.12	3.24	-2.98	-0.78	-1.17	0.20	0.41	-0.38	-1.25	0.75	0.48	-0.09	0.51	2.13	1.64	0.27	-0.83	-0.21	0.14	0.53	0.22	1.72	-0.74	0.76
2/9/2020	-0.32	-0.35	-0.38	0.25	0.07	1.93	0.36	-0.37	-0.17	1.49	0.47	1.42	-0.39	0.34	1.21	2.73	4.00	-0.11	0.18	-0.98	0.28	1.62	-0.05	0.58	-1.09	0.62
2/16/2020	0.17	-0.98	0.75	-0.80	-0.70	0.67	-1.15	0.02	0.13	2.45	-0.85	0.26	-0.09	0.84	0.82	3.16	-0.59	1.29	0.68	-0.46	0.87	1.17	1.03	1.65	-0.72	1.76
2/23/2020	-0.45	0.69	5.03	0.07	-0.17	-0.60	-1.24	-0.21	-1.24	-1.02	-0.60	0.71	0.71	-0.17	-1.51	2.41	0.86	-0.22	0.59	1.47	0.37	-0.07	-0.19	2.00	-0.98	1.46
3/1/2020	1.48	0.32	-1.80	-0.28	-1.65	-1.69	1.84	-0.96	-0.85	-0.69	-1.67	0.90	0.52	-0.42	1.84	2.11	-0.48	1.13	-0.53	0.52	-0.29	-0.29	-0.49	-0.81	-1.13	0.68
3/8/2020	-1.38	0.32	9.76	-1.77	-3.61	-6.27	-0.51	0.11	-2.30	-0.97	-3.91	0.56	-1.25	-1.14	-1.88	-0.14	-1.62	-0.78	-1.99	-2.30	-2.89	-1.59	-2.52	-3.64	-1.52	0.71
3/15/2020	-3.87	-2.32	13.02	-1.50	-5.66	-10.83	0.14	-1.58	-5.64	-7.31	9.52	-2.95	-1.90	-2.46	-4.55	0.70	-5.14	-1.68	-4.01	-4.19	-5.72	-0.12	-6.07	8.95	-2.83	-2.75
3/22/2020	-0.28	0.42	10.38	3.40	-2.06	-10.11	-0.34	2.63	-5.10	-8.47	-10.55	-2.94	-1.61	-2.59	-5.47	0.10	-5.74	-1.43	-3.83	-4.06	-3.58	-0.42	-6.64	8.54	-3.22	-1.98
3/29/2020	-0.28	2.30	7.48	1.62	-3.03	-7.44	1.75	1.79	-7.00	-7.23	-11.26	-3.23	-0.92	-2.75	-4.06	-0.96	-6.33	-1.66	-2.72	-3.27	-3.90	-3.36	-6.48	9.21	-3.40	-2.10
4/5/2020	4.93	2.07	7.14	-0.15	-0.89	-6.46	1.15	5.05	-5.72	-8.48	-10.63	-2.18	-0.51	-1.40	-1.75	1.93	-5.79	-1.60	-2.97	-2.58	-4.00	-2.97	-4.92	-7.28	-3.24	-1.14
4/12/2020	3.78	1.89	3.42	-1.56	3.44	-5.73	0.68	5.34	-4.71	-6.60	-10.62	-2.03	-0.18	-1.10	-2.88	1.05	-4.62	0.45	-2.63	-2.14	-4.17	-1.42	-3.60	-6.70	-3.01	0.19
4/19/2020	5.55	2.15	6.30	2.15	3.45	-4.33	2.62	5.36	-2.76	-6.21	-9.70	-2.19	-1.36	-2.15	-3.06	1.89	-5.13	0.02	-1.61	-2.68	-1.74	-0.01	-3.06	-5.13	-2.98	0.49
4/26/2020	7.28	3.74	7.24	1.52	3.13	-2.55	1.01	5.27	-1.25	-4.92	-8.20	-1.32	-0.48	-0.37	-1.23	1.85	-4.40	0.43	-1.87	-0.87	-1.18	-1.91	-2.47	-2.65	-2.70	2.07
5/3/2020	6.48	2.77	5.89	-0.69	2.32	-2.59	-0.38	5.44	-0.65	-4.00	-6.34	0.39	0.25	-0.68	0.46	1.79	-2.96	2.12	-0.93	-0.36	-1.93	-1.58	-1.84	-2.98	-2.43	0.59
5/10/2020	6.93	3.36	6.15	-0.17	2.40	-1.88	3.38	2.98	2.27	-2.79	-5.69	-0.54	-0.01	0.88	1.18	2.49	-0.16	2.31	-1.03	-0.40	-0.91	-1.11	-0.01	-1.36	-2.43	-0.36
5/17/2020	4.17	3.41	4.48	1.94	3.52	-1.83	-0.50	3.78	2.82	-2.21	-4.20	1.40	-0.06	0.13	-1.36	1.81	-0.32	2.95	0.10	1.91	-0.07	1.15	1.57	-0.03	-1.88	5.11
5/24/2020	5.93	2.74	3.76	5.68	4.04	1.89	5.20	0.67	7.95	-1.90	-4.68	0.40	0.66	-0.18	-1.42	6.81	-0.47	2.15	-1.25	-1.46	-1.88	-3.18	3.68	4.55	-2.18	6.16

Accepted Manuscript