

Public Interest in Breast Augmentation: Analysis and Implications of Google Trends Data

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Abstract

Introduction Breast augmentation is the most common aesthetic surgery performed in the United States (US) annually. Analysis of Google Trends (GT) data may give plastic surgeons useful information regarding worldwide, national, and regional interest for breast augmentation and other commonly performed aesthetic surgeries.

Methods Data were collected using GT for breast augmentation and associated search terms from January 2004 to May 2017. Case volume was obtained from the American Society of Plastic Surgeons (ASPS) annual reports for the calendar year 2005–2016.

Results Trend analysis showed that total search term volume for breast augmentation and breast implants gradually decreased worldwide and in the US over the study period while the search term boob job slowly increased. Univariate linear regression demonstrated a statistically significant positive correlation between average annual Google search volume of “breast augmentation” and the annual volume of breast augmentations performed in the US according to ASPS data ($R^2 = 0.44$, $p = 0.018$). There was no significant correlation between national volume of

breast augmentations performed and search volume using the terms “breast implants” or “boob job” over time ($p = 0.84$ and $p = 0.07$, respectively). In addition, there appears to be country specific variation in interest based on time of year and peaks in interest following specific policies.

Conclusions To our knowledge, this is the first and only analysis of GT data in the plastic surgery literature to date. To that end, this study highlights this large and potentially powerful data set for plastic surgeons both in the US and around the world.

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Keywords Breast augmentation · Breast implants · Boob job · Cosmetic surgery · Aesthetic surgery · Internet · Google Trends

Introduction

Breast augmentation is the most popular aesthetic surgery procedure performed in the United States with nearly 300,000 cases performed last year alone [1]. While many private practice plastic surgeons use various marketing platforms, e.g., RealSelfTM, YelpTM, TwitterTM, FacebookTM, and other social media outlets, it is difficult to assess overall public interest in specific aesthetic procedures.

Despite this lack of understanding, advances in Internet surveillance technology may allow users to better gather this information. Google Trends (GT) is a public Internet

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tool that allows the user to track how frequently a search term is used among different parameters [2]. While initially created to serve journalists, it has been increasingly utilized by marketers to garner insight into consumer interest and behaviors [3]. Previous studies have identified the value of GT in tracking infectious disease outbreaks as well as assessing public health and cancer screening practices [4–10]. Recent studies have used GT to highlight trends in patient interest in bariatric and neurosurgical procedures, adding a tool to the tech-savvy surgeon [11, 12]. While other data are either difficult to find or potentially cost-prohibitive to the individual surgeon, GT is a free, easily maneuverable online application with virtually no barriers to entry.

No study to date has examined GT data on breast augmentation or any other aspect of aesthetic surgery. Thus, the purpose of this study is to shed light on this potentially powerful open-access tool by investigating public interest in breast augmentation both worldwide and in the United States.

Methods

GT allows for customizable searches based on term used, time period (the earliest date set at January 2004 when the tool was first launched), geographic location, search category (e.g., health, news, etc.), and result format (i.e., “image search,” “news search,” “Google shopping,” or “YouTube search”). With this, GT generates graphs and databases with numbers representing search interest relative to the peak popularity for that term, which is given a value of 100 [2].

Search terms for analysis included the technical term for the procedure, “breast augmentation,” a common term, “breast implants”, and a colloquial term, “boob job.” These terms were determined to encompass a spectrum of search queries and were reinforced by the “Related queries” section of GT. Terms such as “breast surgery” and “implants” were excluded due to their broad nature, and other terms suggested by GT were excluded due to their lower search yield or similarity in results.

The three search terms were input into GT individually as well as simultaneously for direct comparison. Using data from January 2004 to May 2017, we created a database for the search volume as a function of time. Geographic data and search format data were obtained using GT-generated graphs and visuals. For further subgroup analysis, search terms “saline breast implants” and “silicone breast implants” were compared in GT.

Linear regression analysis was performed to estimate a correlation between GT search volume per year based on the three main search terms and the annual number of

breast augmentations performed according to data from the American Society of Plastic Surgeons (ASPS) [1].

To analyze potential seasonal variation in interest of breast augmentation, we averaged the difference of each month against the respective calendar yearly mean for breast augmentation, breast implants, and boob job.

All statistical and trend analyses were performed using Microsoft Excel Version 14.3.9 (Redmond, WA, USA) and SPSS Statistics Version 23.0.0.0 (Chicago, IL, USA).

Results

Search Term Trends

Among the three principal search terms, “breast implants” had the highest overall search volume worldwide and within the US, followed by “breast augmentation” and then “boob job.”

Worldwide Interest by Country

Global GT demonstrated that the US had the highest level of public interest in breast augmentation (100%), followed by Australia (99%), Canada (68%), South Africa (56%), and New Zealand (50%; Fig. 1). Similarly, the same five countries had the highest interest in the search term breast implants (Australia 100%, United States 93%, Canada 77%, New Zealand 50%, and South Africa 42%; Fig. 1). The highest level of public interest in the search term boob job was the United Kingdom (100%), Australia (73%), Ireland (72%), United States (60%), and Canada (51%; Fig. 1).

United States Interest by State

United States national trends demonstrated that breast augmentation interest was highest in the following states: Utah (100%), Nevada (78%), Hawaii (72%), Oklahoma (75%), Arizona (72%), and Florida (72%; Fig. 2). The states with the highest interest in the search term breast implants were Nevada (100%), Hawaii (100%), Louisiana (96%), Oklahoma (93%), and Arizona (91%; Fig. 2). The highest level of public interest in the search term boob job was Utah (100%), Oklahoma (94%), Arizona (89%), Nevada (89%), and Idaho (88%; Fig. 2).

Longitudinal Trends Over Time

Analysis of search trends over time demonstrates an overall decrease in interest from 2004 through 2017 both worldwide and in the US for the search terms breast

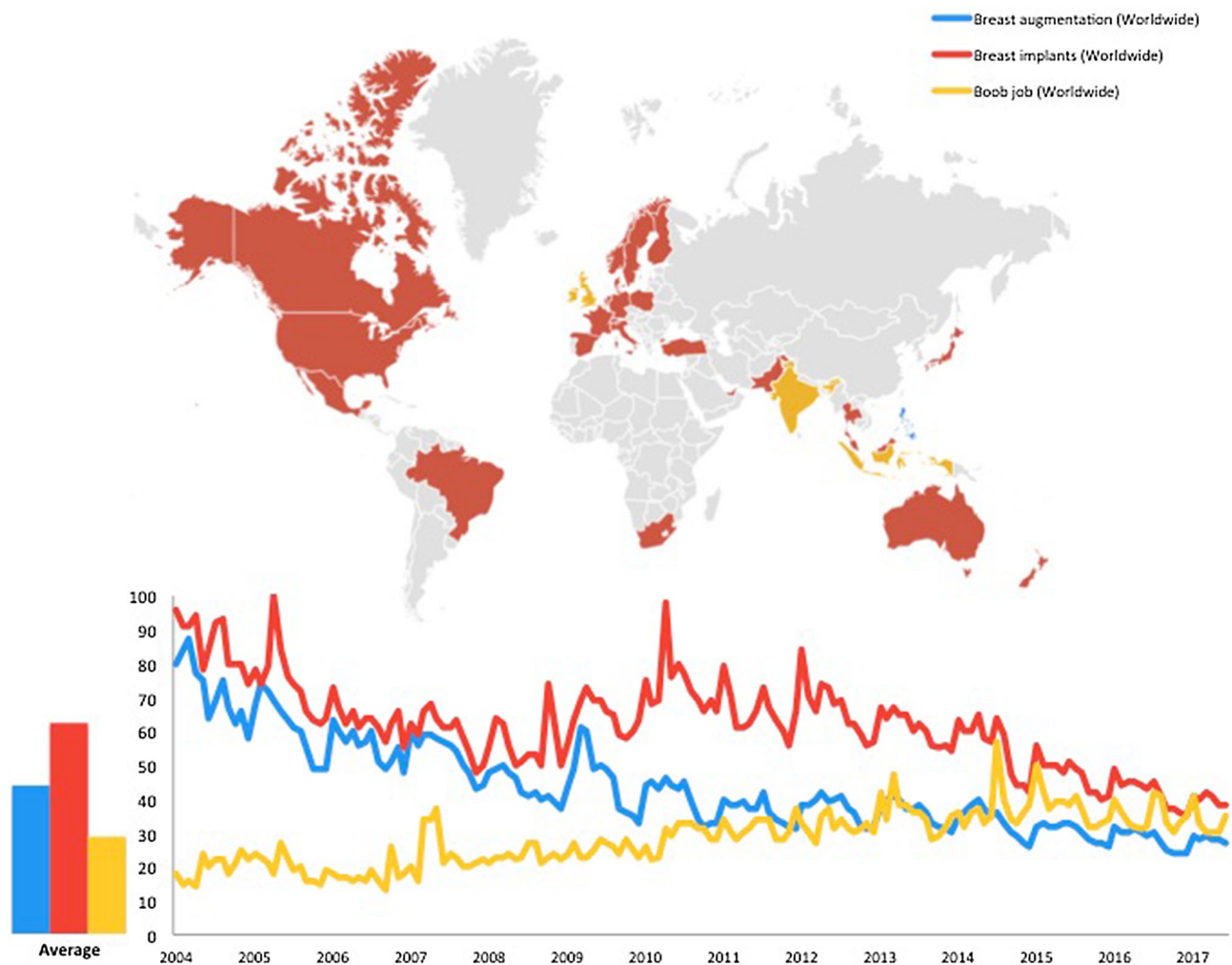


Fig. 1 Global Google Trends (GT) data demonstrated that the US had the highest level of public interest in breast augmentation (100%), followed by Australia (99%), Canada (68%), South Africa (56%), and New Zealand (50% in figure). Similarly, the same five countries had the highest interest in the search term breast implants (Australia

100%, United States 93%, Canada 77%, New Zealand 50%, and South Africa 42% in figure). The highest level of public interest in the search term boob job was the United Kingdom (100%), Australia (73%), Ireland (72%), United States (60%), and Canada. Data source: Google Trends (www.google.com/trends)

augmentation and breast implants while boob job increased over the study period (Figs. 1 and 2).

Validation of Interest

Univariate linear regression analysis over time from 2004 to 2016 demonstrated a statistically significant positive correlation between average annual Google search volume of “breast augmentation” and the annual volume of breast augmentations performed in the US according to ASPS data ($R^2 = 0.44$, $p = 0.018$). There was no significant correlation between national volume of breast augmentations performed and search volume using the terms “breast implants” or “boob job” over time ($p = 0.84$ and $p = 0.07$, respectively; Table 1).

Seasonal Effect

When looking at seasonal variation from yearly means for the search term breast augmentation, we found greatest interest in the United States in Q2 ($10.3 \pm 0.6\%$, April–June), followed by Q1 ($8.8 \pm 0.6\%$, January–March), Q3 ($-1.6 \pm 0.7\%$, July–September), and Q4 ($-16.6 \pm 0.8\%$, October–December; Fig. 3). This was similar to the seasonal variation found in United Kingdom: Q2 ($11.3 \pm 2.0\%$), Q1 ($6.4 \pm 1.9\%$), Q3 ($-1.0 \pm 1.0\%$), Q4 ($-16.1 \pm 7.4\%$; Fig. 3). In comparison, seasonal variation from yearly means for all three search terms in Australia found the greatest interest in Q3 ($4.6 \pm 1.8\%$), followed by Q4 ($3.1 \pm 1.2\%$), Q1 ($-2.0 \pm 1.9\%$), and Q2 ($-5.3 \pm 2.1\%$; Fig. 3).

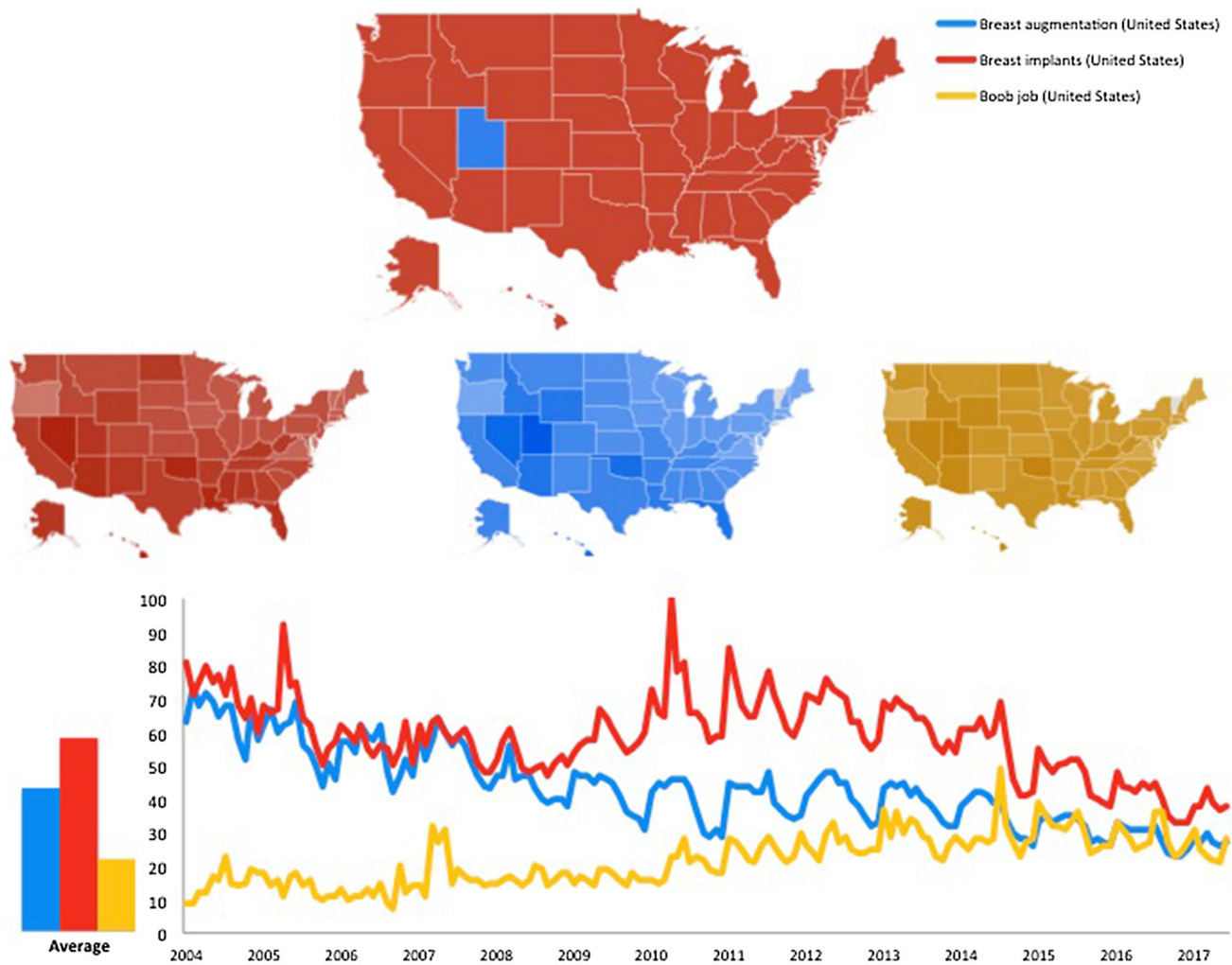


Fig. 2 United States national GT data demonstrated that breast augmentation interest was highest in the following states: Utah (100%), Nevada (78%), Hawaii (72%), Oklahoma (75%), Arizona (72%), and Florida (72% in figure). The states with the highest interest in the search term breast implants were Nevada (100%),

Hawaii (100%), Louisiana (96%), Oklahoma (93%), and Arizona (91% in figure). The highest level of public interest in the search term boob job was Utah (100%), Oklahoma (94%), Arizona (89%), Nevada (89%), and Idaho. Data source: Google Trends (www.google.com/trends)

Saline Versus Silicone Breast Implants

Interest in silicone and saline breast implants followed similar trends over time with silicone having consistently higher search results. In addition, there were several peaks in silicone breast implant searches that were most notable in April of 2005 and November of 2006 (Fig. 4).

Discussion

The results of this study show that overall search trends for breast augmentation and breast implants have steadily decreased both worldwide and in the US since 2004.

During the same period there was a slow but steady increase of the colloquial term boob job during this time. While worldwide data for breast augmentation volume is not available, data collected and published by the ASPS shows an oscillating volume of breast augmentations performed in the US during this period. Our linear regression analysis demonstrated a positive correlation between the term “breast augmentation” and annual procedural volume of breast augmentations nationally, while “breast implants” and “boob job” did not. This result has multiple implications. First, it validates GT as a useful tool in assessing consumer interest, and it may lead to accurate predictions in consumer behavior. However, only one of three search terms showed a significant correlation, which

Table 1 Univariate linear regression analysis over time from 2004 to 2016 demonstrated a statistically significant positive correlation between average annual Google search volume of “breast augmentation” and the annual volume of breast augmentations performed in the US according to ASPS data ($R^2 = 0.44$, $p = 0.018$)

Search term	β -coefficient (95% CI) ^a	p value ^a	R^{2a}
Breast augmentation	124.5 (26.2 to 222.2)	0.018	0.44
Breast implants	12.7 (− 12.2 to 146.7)	0.84	0.004
Boob job	− 136.8 (− 288.2 to 14.7)	0.017	0.29

There was no significant correlation between national volume of breast augmentations performed and search volume using the terms “breast implants” or “boob job” over time ($p = 0.84$ and $p = 0.07$, respectively). [Data source: Google Trends (www.google.com/trends)]

^aBeta-coefficients, p value, and R^2 were calculated by using univariate linear regression analysis

emphasizes the importance of choosing search terms wisely when attempting to glean insight from GT data.

Perhaps use of technical terms may be more apt in gauging consumer interest for a procedure.

In addition, our data show seasonal variation in interest for breast augmentation. When comparing the mean variation of interest each month from their respective yearly means for breast augmentation, we found a higher than average interest in Q1 and Q2. In Q3 there was average interest and less than average interest in Q4. While causation cannot be drawn from this observation, seasonal weather variation may be at least partially responsible for this finding as the inverse was found for Australia, a country in the southern hemisphere. To strengthen this claim, the US seasonal variation in breast augmentation interest was strikingly similar to those found in the United Kingdom over this time.

While it seems reasonable that the months leading into summer would have higher than average interest in an aesthetic procedure like breast augmentation, there may be other confounding variables. For instance, a recent survey

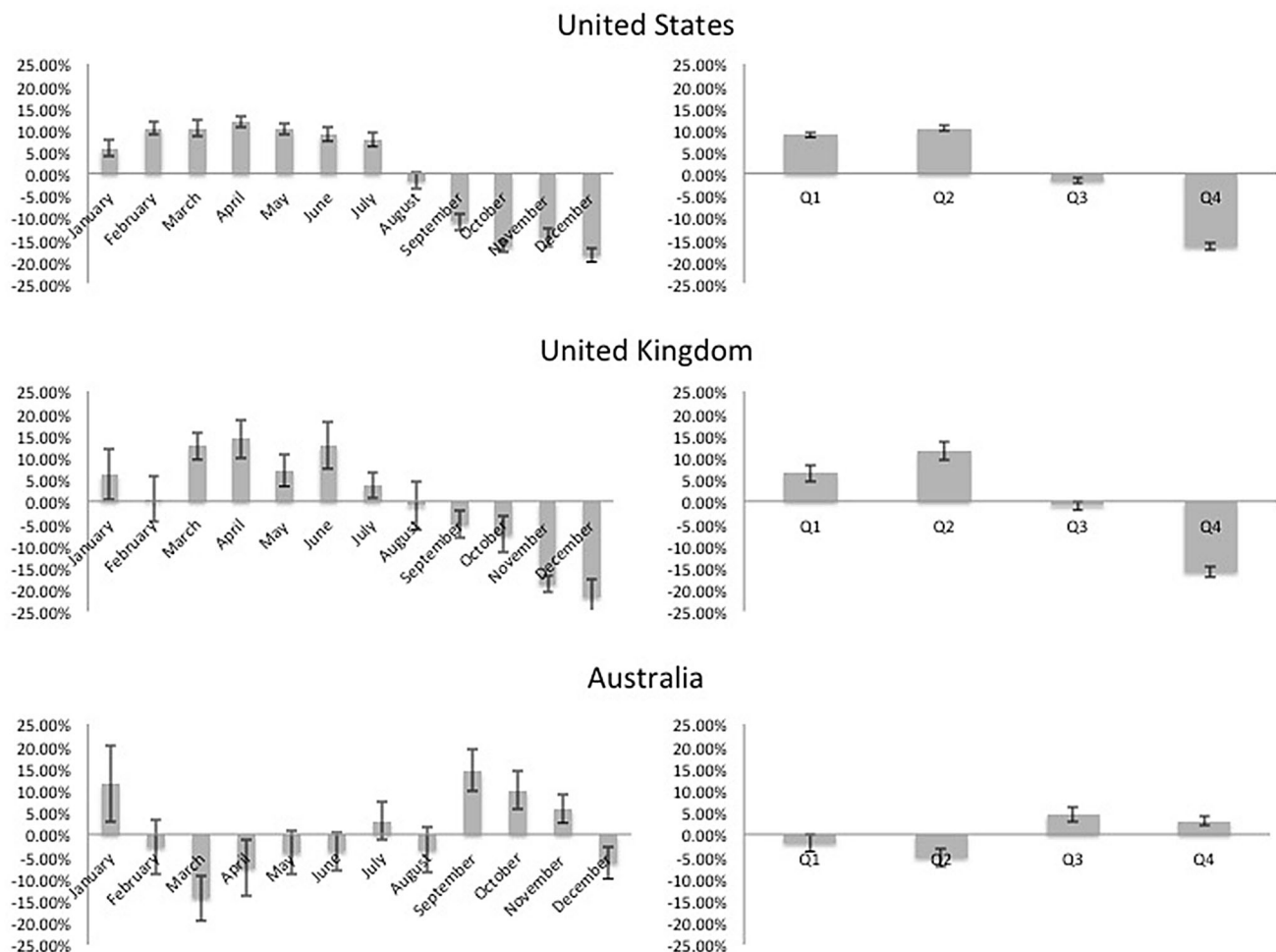


Fig. 3 Seasonal variation from yearly means for the search term breast augmentation. The United States and the United Kingdom had greatest interest in Quarter 2 (Q2) and Q1 compared to Australia

which had great interest in Q3 and Q4. Data source: Google Trends (www.google.com/trends)

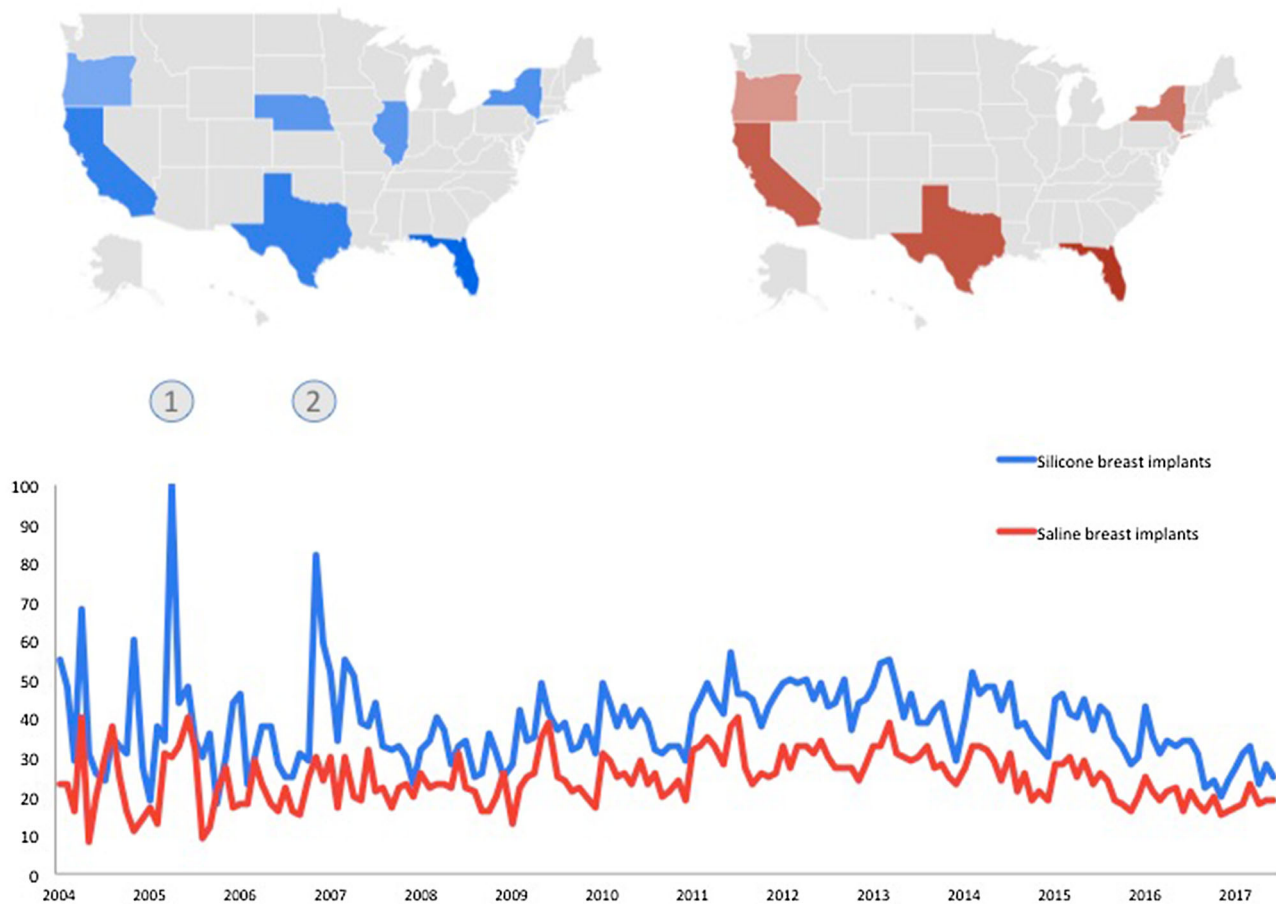


Fig. 4 Interest in silicone and saline breast implants followed similar trends over time with silicone having consistently higher search results. In addition, there were several peaks in silicone breast implant

searches that were most notable in April of 2005 (point 1) and November of 2006 (point 2). Data source: Google Trends (www.google.com/trends)

of RealSelf™ members found that 36% of those surveyed intended to use tax return dollars on cosmetic treatments, with 26% of those on breast augmentation [13]. Given that US tax returns are in Q2, UK tax returns are in Q1 and Australian tax returns are in Q3, this may partially explain the greater than average annual interest in those quarters in each country, respectively. Overall, it is fair to assume that the seasonal variation in public interest is multifactorial.

In addition, our study highlights how public interest is also influenced by specific policies and the media. When querying silicone breast implants, we found two distinct peaks that may be attributable to two major events. First, April 2005 represented the peak in overall interest during the study period. In this month, the Food and Drug Administration (FDA) expert panel voted against allowing silicone breast implants to be brought back on the market [14, 15]. The second peak occurred in November 2006 when the FDA officially approved silicone implants [16]. This finding suggests that public interest is likely subject to

policy changes and both positive and negative media attention.

While some studies have shown that cosmetic surgery procedures demonstrate a positive correlation with various economic factors including gross domestic product (GDP), personal income, and consumer price index (CPI), others have questioned its utility particularly within the United States [17–20]. Google Trends offers public interest data for both historical and real-time analysis. Specifically, GT can give minute-by-minute data for even the most recent hour of the largest and most popular search database on the planet, thus having the potential to market these types of procedures more efficiently.

While plastic surgery patient websites may cater more directly to an interested patient population, due to lack of familiarity or other factors, it may not accurately capture overall interest in cosmetic surgery. Google Trends delivers data from the largest, most popular search database, and it provides a free method of analyzing global and local search trends. In the era of “Big Data,” Google stands as

the largest repository of web searches in the world; according to a 2013 comScore public release, Google captured a 65.2% global share of the web search market since December 2012, followed most closely by Baidu with an 8.2% share [21]. Based on several estimates, Google processes over 40,000 search queries every second, translating to 1.2 trillion search per year [21].

Analysis of Internet usage with tools such as Google Trends represents a key function of the Google database as a multi-sided platform, enabling two distinct groups of users to provide each other with benefits [22]. Google has used its data technology to reduce search costs between advertisers and consumers, providing a service for targeted advertising and analysis of consumer behavior (e.g., AdWord). Similarly, as part of a two-sided network, both breast augmentation patients and plastic surgeons exhibit network effects on each other, and both are dependent on the number of each side using Google to search and analyze trends. As consumer search volume increases, the quality of data and trend predictions Google is able to deliver via GT becomes more valuable to the plastic surgeon. Breast augmentation is a procedure requiring a comprehensive understanding of not only anatomy but of what the patient truly wants. Plastic surgeons should strongly consider using this intuitive technology to better understand their patient population's desires in breast augmentation, both for insight into consumer behavior as well as strengthening the overall patient-physician partnership.

There are several limitations of this study. First, Google Trends data are de-identified and not categorized by user intent; thus, search volume likely encompasses potential consumers as well as providers or other stakeholders involved in breast augmentation. Second, GT does not provide raw data regarding search volume, precluding the ability to perform more comprehensive statistical analysis of trends and comparisons. However, the simplicity of its data presentation as a percentage of peak interest may be a strength in that its interface is highly user-friendly. In addition, there may be bias in the choice of search terms used in this study, as a broader range of terms may assist in a more accurate prediction of overall consumer trends. While we used the three most popular terms in this analysis, perhaps performing a survey of prospective patients' search term use for breast augmentation may offer more directed choice of queries.

As an aside, on cursory review of Google search results from the aforementioned studied search terms, the ASPS website was the top result for all three. The ASPS and other governing bodies within our field should be commended for their mission to improve patient education and ultimately, patient safety. Continued efforts will be needed to better understand where our patients are obtaining their

information and use this information to more efficiently offer up-to-date and easily accessible education materials.

Conclusions

This study shows both worldwide and country specific interest in breast augmentation based on public search query data. We showed trends over time and how a few of the most popular search terms are associated with actual procedure volume. In addition to describing a change in search volume over time, we offer data to suggest that public interest has seasonal variability. Lastly, we offer limited data to underscore how health care policy and media coverage may influence public interest.

To our knowledge, this is the first and only analysis of Google Trends data in the plastic surgery literature to date. To that end, this study highlights this large and potentially powerful data set for plastic surgeons both in the US and around the world.

Compliance with Ethical Standards

Conflict of interest The authors have no financial interest to declare in relation to the content of this work.

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