Who Posts on Instagram? Using Natural Language Processing to Assess the Relationship Between Training Background and Content of 700,000 Posts

Cameron A. Etebari, MD⊕; Sterling E. Braun, MD⊕;
Maria C. Vazquez-Machado, BS; and James A. Butterworth, MBBCh

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Abstract

Background: Instagram (Menlo Park, CA) is a major platform for the dissemination of plastic surgery (PS) information, but the training background of users is difficult to ascertain.

Objectives: We sought to better characterize the source and content of PS-related posts on Instagram.

Methods: Metadata from publicly available Instagram posts containing PS relevant hashtags was collected from December 2018 to August 2020 using Node.js (Node.js Foundation, San Francisco, CA). The data was characterized by account type, and post topics were analyzed using a custom dictionary of PS procedures applied with natural language processing. All data analyses were performed with R (The R Foundation, Vienna, Austria).

Results: Board-certified plastic surgeons account for 38% of posts on Instagram, followed by organizations (31%), nonplastics-trained physicians (19%), facial plastics (5%), oculoplastics (1%), and nonphysician providers (5%). Oculoplastics had the highest engagement rate with their posts (3.7 ± 5.1), whereas plastic surgeons had the lowest (2.7 ± 4.2). Breast aesthetics was the predominant topic posted by plastic surgeons (42%, $P < .001$), and board certification phrases distinguished their posts from other account types (23%, $P < .001$). Nonphysician posts focused on nonsurgical aesthetics like Botox and fillers (80%). However, nonplastics-trained physicians and organizations significantly contributed to procedural subcategories in a similar distribution to plastic surgeons.

Conclusions: Board-certified plastic surgeons are not the predominant source of PS content on Instagram. Furthermore, posts by plastic surgeons have the lowest rate of engagement out of all account types studied. Although declarations of board certification distinguish content from plastics disciplines, they are only used in 21% of posts.

Dr Etebari is a resident, Integrated Plastic Surgery, Department of Plastic Surgery, University of Kansas Medical Center, Kansas City, KS, USA. Dr Braun is a microsurgery fellow, Division of Plastic Surgery, The University of Pennsylvania Health System, Philadelphia, PA, USA. Ms Vazquez-Machado is a medical student, Ponce Health Sciences University, Ponce, Puerto Rico. Dr Butterworth is a professor, Department of Plastic Surgery, University of Kansas Medical Center, Kansas City, KS, USA.

Corresponding Author:
Dr Cameron A. Etebari, 3901 Rainbow Boulevard, Mailstop 3015, Kansas City, KS 66160, USA.
E-mail: cetebari@kumc.edu

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Social media has become a major platform for the dissemination of plastic surgery (PS) information.[1-4] Of all social media outlets, Instagram (Menlo Park, CA) is among the most used by patients to evaluate a potential surgeon and garner information about procedures.[5] For providers, it serves as an important tool to enhance patient outreach and promote their practice.

PS-related content on Instagram has extensive international reach, accounting for >2 million posts between 2018 and 2020.[6] Although Instagram's use in PS continues to rise, what remains a significant challenge for patients is discerning the source and veracity of available information.[7] Preliminary research demonstrated that American Board of Plastic Surgery (ABPS) board-certified plastic surgeons are not the predominant source of PS content on Instagram, and the training background of users is difficult to ascertain. The purpose of this study was to better characterize the training background and the topics discussed in PS content on Instagram.

METHODS

Metadata from publicly available Instagram posts containing the hashtag #PlasticSurgery was collected from December 2018 to August 2020 using Node.js (Node.js Foundation, San Francisco, CA). Posts were included if there was a location tag within the United States and the detected primary language was English. We then characterized the data using previously described and validated natural language processing techniques to classify the account type (ie, PS, oculoplastics, facial plastics, nonplastics-trained physician, advanced practice practitioner, or organization) while excluding posts that were not characterized into one of the aforementioned groups.[6]

The post topic was analyzed using a custom dictionary of PS procedures applied with natural language processing techniques to identify hashtags and keywords pertinent to PS procedures. The dictionary then allowed categorization of such hashtags and keywords into procedural categories.[6] Engagement was defined as the number of likes and comments a post received in proportion to the number of followers the account possessed. All data analyses were performed with R (The R Foundation, Vienna, Austria). Chi-squared test and analysis of variance were used to compare categorical and continuous variables, respectively, between account types.

RESULTS

A total of 699,481 Instagram posts were included in the study (Table 1). Board-certified plastic surgeons accounted for the largest group with 193,543 posts (38%). Organizations, defined as any organizational accounts of a practice (ie, clinic, medical spa, ambulatory surgical center, etc.), accounted for the second most with 152,546 posts (31%). Nonplastics-trained physicians (19%), Ear, Nose and Throat (ENT) facial plastics (5%), oculoplastics (1%), and nonphysician providers, including advanced practice practitioners and nurses (5%), accounted for the remaining posts. Of the account types studied, oculoplastics had the highest rate of engagement (3.7 ± 5.1), followed by nonphysicians (3.5 ± 6.0), nonplastics-trained physicians (3.0 ± 5.9), facial plastics (2.9 ± 5.4), and plastic surgeons (2.7 ± 4.2). Natural language processing was used to identify phrases, and tags in a custom dictionary to characterize the subject of the post and a total of 6,995,100 relevant tags were identified. Tags were then grouped according to the reflected procedure and sorted by account type (Table 2, Figure 1). Lexical keyness was then determined using χ^2 analysis of proportions that each discipline made of a given procedural topic (Figure 2). For plastic surgeons, breast aesthetics was the predominant topic (42%) and was distinct from topics of other account types ($P < .001$). Also, distinguishing was the inclusion of phrases indicating board certification (22%, $P < .001$). ENT facial plastics posts included rhinoplasty (34%), nonsurgical aesthetic procedures (28%), and facial aesthetics (17%). Oculoplastics posts primarily discussed periocular rejuvenation (48%). Most nonphysician posts focused on nonsurgical aesthetics, including botox and filler injections (80%). Nonplastics-trained physicians and organizations had significant contributions to all groups and between 16,000 and 125,000 tags in each respective procedural subcategory with a similar distribution to PS (Figure 1).

DISCUSSION

In our assessment of 699,481 Instagram posts, we found that although a significant portion of PS content on Instagram is curated from board-certified plastic surgeons

Table 1. Characteristics of Instagram Posts Categorized by Type of Account

Variable	Plastic surgery	ENT facial plastics	Oculoplastics	Physician	APP & RN	Organization	Other	*P*-value
No.	193,543	26,831	5675	93,512	27,543	152,546	199,831	
Board certified	43,811 (22.6)	2714 (10.1)	1251 (22.0)	7819 (8.4)	370 (1.3)	15,345 (10.1)	6235 (3.1)	<.001
Media type (%)								<.001
Image	138,763 (71.7)	17,391 (64.8)	4258 (75.0)	64,908 (69.4)	19,268 (70.0)	108,929 (71.4)	143,359 (71.7)	
Story	19,111 (9.9)	4481 (16.7)	597 (10.5)	11,189 (12.0)	3940 (14.3)	13,923 (9.1)	22,941 (11.5)	
Video	35,669 (18.4)	4959 (18.5)	820 (14.4)	17,415 (18.6)	4335 (15.7)	29,694 (19.5)	33,531 (16.8)	
Response (SD)								
Engagement	2.7 (4.2)	2.9 (5.4)	3.7 (5.1)	3.0 (5.9)	3.5 (6.0)	2.5 (7.3)	3.7 (9.7)	<.001
Views	2511 (10,828)	3478 (15,295)	2716 (5527)	5646 (29,246)	4757 (15,844)	3186 (17,555)	3579 (22,155)	<.001
Likes	149.8 (511)	205.8 (761)	204.6 (362)	283.8 (1462)	233.0 (701)	156.7 (831)	197.7 (1246)	<.001
Comments	7.4 (59.1)	10.6 (48.9)	12.0 (28.2)	13.1 (162.8)	15.4 (46.0)	7.3 (108.1)	8.1 (48.8)	<.001

(38%) and other disciplines with training in PS (6%), this still comprises the minority of content being advertised to the public. The majority of PS-related Instagram content (56%) originates from non-PS-trained physicians, advanced practice providers, registered nurses, and other organizations (Table 1).

Regarding the specific procedure referenced in Instagram posts, board-certified plastic surgeons had significant contributions to all procedural groups, including body contouring, breast aesthetics, facial aesthetics, liposuction, nonsurgical aesthetics, periocular rejuvenation, and rhinoplasty. Other disciplines with training in PS, such as ENT facial plastics and oculoplastics, tended to post about procedures within their scope of practice. Facial aesthetics, nonsurgical aesthetics, and rhinoplasty comprised 79% of posts by ENT facial plastic surgeons, whereas nonsurgical aesthetics and periocular rejuvenation comprised 83% of posts by oculoplastic surgeons. Out of all posts by nonphysicians, 80% focused on nonsurgical aesthetics, such as botox and filler injections. Posts by non-PS-trained physicians and organizations were more problematic, as they significantly contributed to all procedural subcategories in a similar distribution to board-certified plastic surgeons (Table 2, Figure 1). The dissemination of information on PS by practitioners or organizations without PS training makes it increasingly difficult for viewers to identify reliable sources and accurate information. As patients increasingly rely on platforms such as Instagram when choosing a provider, non-PS-trained physicians and organizations referencing surgical procedures in their posts is particularly worrisome for both patient safety and outcomes.[8,9]

Declarations of board certification were found to be a distinguishing metric for plastic surgeons posting on Instagram (*P* < .001) and could be a potential way for viewers to discern reliable from unreliable sources (Figure 2). However, only 22% of posts on Instagram by board-certified plastic surgeons utilized such language. Further challenges include the proliferation of nonrecognized or self-designated board certifications, misleading marketing tactics, and the unregulated growth of the aesthetic surgery marketplace.[10] In 2019, Fan et al demonstrated that 96% of the public were unclear about the type of board certification a plastic surgeon should hold.[11] When it comes to the distinction between certification by the ABPS and the American Board of Cosmetic Surgery (ABCS), only 3% of respondents understood that physicians certified by the ABCS are not plastic surgeons and may not have trained in a surgical discipline at all.

In an effort to educate the public on this distinction, the American Society of Plastic Surgeons (ASPS) launched their "Trust ASPS" campaign, providing information on board certification and encouraging patients to verify the qualifications of their surgeon.[12] This campaign resulted in changes, such as the ASPS website offering an easy-to-use board verification feature that only requires the name or address of the provider. This change was also implemented on their Instagram page, which is available to their 65,000 followers. Despite the availability of this information, what remains a challenge is how to connect patients with these resources. In the context of a largely unregulated social media platform such as Instagram, individual contributions to patient education are of great importance. Every plastic surgeon posting on Instagram should include a declaration of board certification and links to the ASPS and ABPS verification features in their Instagram bio to provide patients with the necessary information to make informed decisions when choosing a provider.

Table 2. Frequency of Procedures Referenced in Instagram Posts by Account Type

|	Body contouring	Breast aesthetics	Facial aesthetics	Liposuction	Nonsurgical aesthetics	Periocular rejuvenation	Rhinoplasty
Overall	326,418	378,891	104,197	152,476	480,619	79,086	141,300
By account type (%)							
Plastic Surgery	133,587 (40.9)	217,365 (57.4)	35,661 (34.2)	61,592 (40.4)	127,136 (26.5)	24,210 (30.6)	47,049 (33.3)
ENT Facial Plastics	3808 (1.2)	3111 (0.8)	15,515 (14.9)	3042 (2.0)	25,473 (5.3)	9353 (11.8)	31,233 (22.1)
Oculoplastics	362 (0.1)	260 (0.1)	1144 (1.1)	585 (0.4)	5188 (1.1)	8442 (10.7)	399 (0.3)
Physician	59,594 (18.3)	58,578 (15.5)	22,793 (21.9)	32,280 (21.2)	87,732 (18.3)	19,379 (24.5)	30,674 (21.7)
APP & RN	6358 (1.9)	2485 (0.7)	2705 (2.6)	3283 (2.2)	76,194 (15.9)	1600 (2.0)	3076 (2.2)
Organization	122,709 (37.6)	97,092 (25.6)	26,379 (25.3)	51,694 (33.9)	158,896 (33.1)	16,102 (20.4)	28,869 (20.4)

ENT, Ear, Nose and Throat; APP, Advanced Practice Practitioner; RN, Registered Nurse.
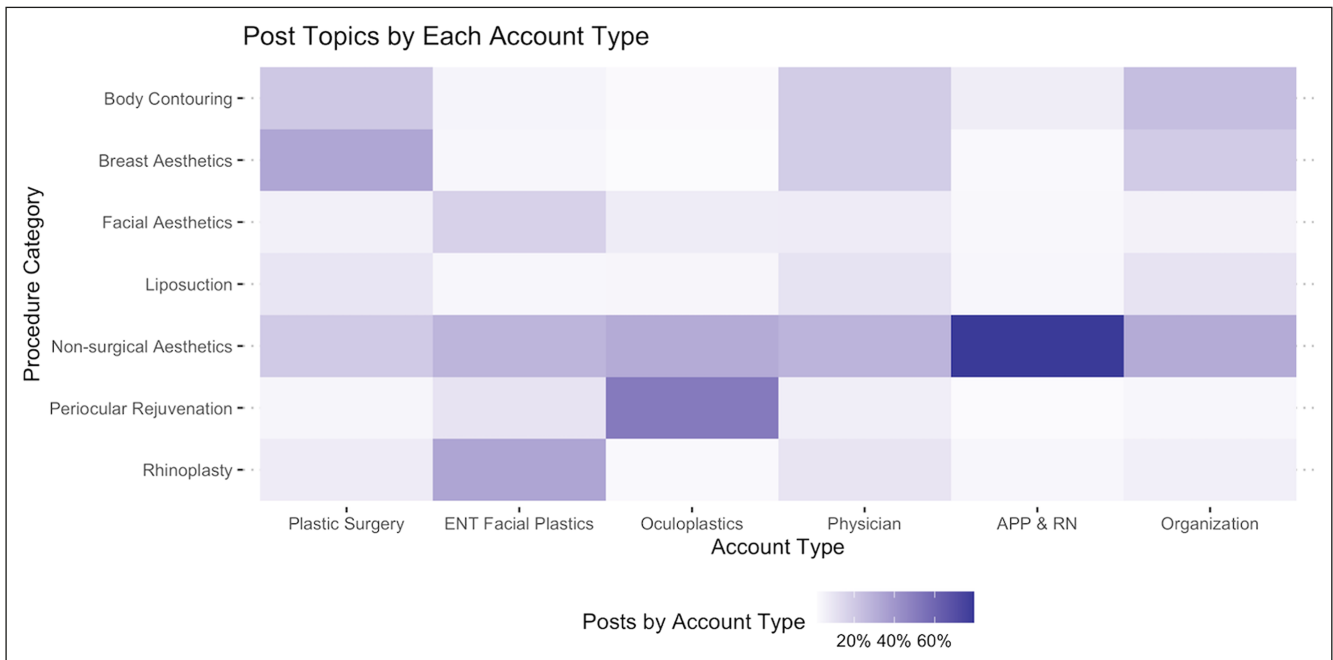
Figure 1. Heat map graph of post topics by account type. ENT, Ear, Nose and Throat; APP, Advanced Practice Practitioner; RN, Registered Nurse.

The rate of engagement for posts by board-certified plastic surgeons was also found to be lower than all other account types studied other than "Organizations." Although the media type (image, story, and video) posted across all account types was found to be comparable, posts by plastic surgeons received on average less likes and comments in proportion to their number of followers. Total views on videos posted by plastic surgeons also fell short of all other groups studied (Table 1). When determining how to circulate content, Instagram considers a combination of metadata, hashtags, and engagement metrics. A consequence of this so called "Instagram algorithm" could result in less circulation and dissemination of information contained in posts by board-certified plastic surgeons who do not receive adequate engagement. In a 2018 study, Dorfman et al evaluated 189 "top" Instagram posts associated with 21 PS-related hashtags, and it was found that ABPS board-certified plastic surgeons accounted for only 17.8% of top posts.[7] This is strikingly low, considering that most of the
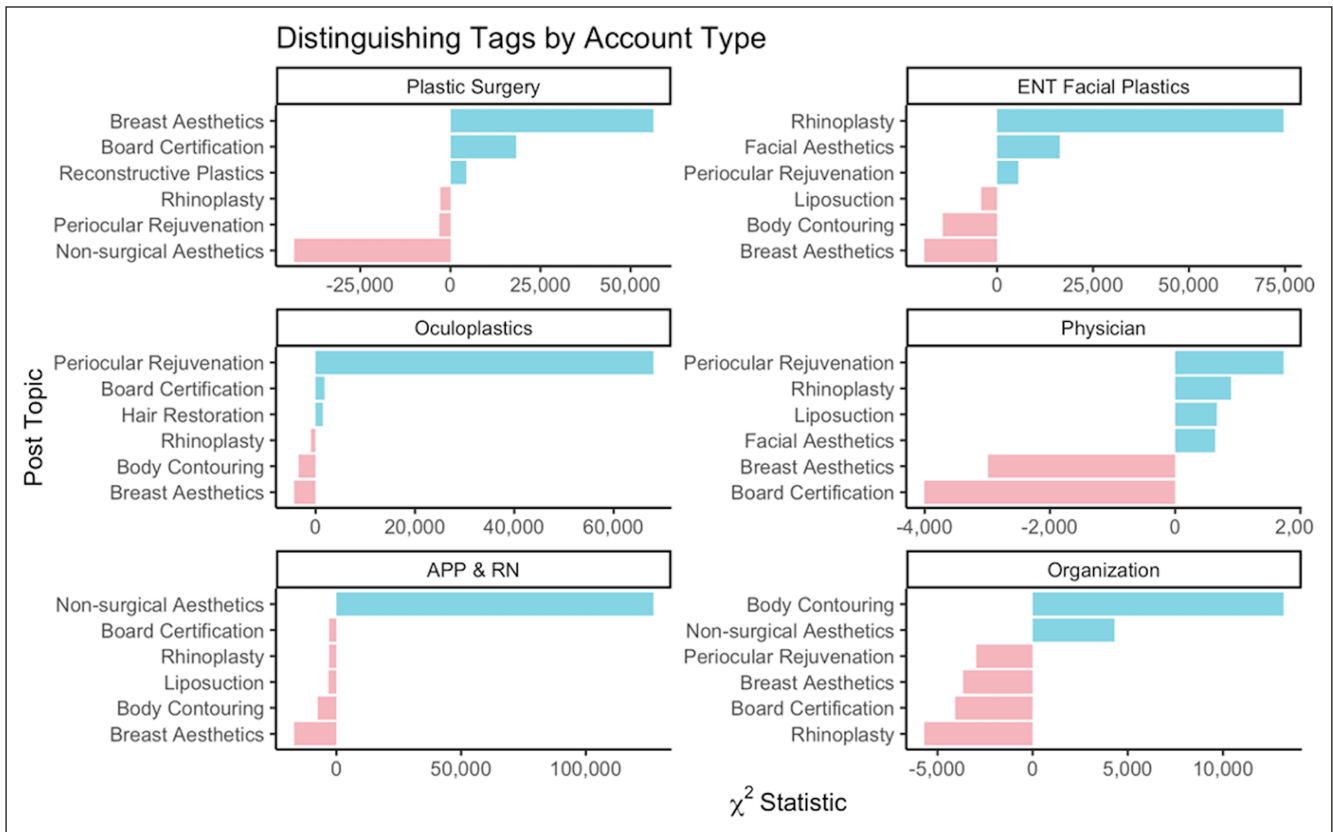
Figure 2. The most distinguishing procedural references used by each account type. ENT, Ear, Nose and Throat; APP, Advanced Practice Practitioner; RN, Registered Nurse.

hashtags studied referred to surgical procedures, such as #rhinoplasty, #rhitidectomy, and #liposuction. Although our study demonstrates that board-certified plastic surgeons account for 38% of all PS-related posts on Instagram, the lack of engagement with these posts likely results in the discrepancy found when only analyzing the most popular content.

A possible explanation for plastic surgeons' low rate of engagement is posts that reflect an incomplete understanding of their target audience. A significant amount of current social media engagement by plastic surgeons focuses on providing educational content.[13-16] However, what captures the interest of plastic surgeons and patients is not the same, and the way in which educational content is presented on social media has been shown to be closely intertwined with patient engagement. For instance, posts that link PS-related articles have been rated among the least interesting content by patients while before and after photographs and information about procedures have been shown to be the most interesting content for patients.[5,17] Although additional research is needed to determine what comprises the majority of content posted by plastic surgeons beyond media type, prioritizing the interest of

the target audience is essential in maximizing post engagement.

So how can board-certified plastic surgeons change this narrative and become the predominant, relevant source of PS content on Instagram? Individual solutions previously mentioned include incorporating declarations of board certification and ASPS verification features into Instagram profiles and posting content that is not only educational, but also engaging to the target audience. Although a full discussion on developing a successful social media presence is outside the scope of this article, it is important for plastic surgeons to reflect on the engagement their posts garner. If few people are interacting with the content, then what impact is the post creating? Posting regularly and interacting with comments are 2 strategies to increase outreach. Additionally, working educational content such as board certification or PS studies into more entertaining subject matter is more likely to succeed in attracting attention.

Another potential solution to distinguish content from board-certified plastic surgeons lies in Instagram's existing verification feature. Instagram reserves a blue verification badge that is given to well-known brands, celebrities, and public figures to prevent impersonation and ensure

Instagram users are viewing the content they intend to. If Instagram created a verification badge specific to physicians certified by American Board of Medical Specialties (ABMS) member boards, it would drastically reduce the confusion and misinformation created by the rise of self-designated or non-ABMS-recognized boards, such as ABCS. This would go lengths in distinguishing posts from board-certified plastic surgeons and educating the public on the importance of board certification and adequate training in PS. The 2018 Medical Board of California's decision to deny members of ABCS the right to advertise as "board-certified" cosmetic surgeons established this distinction between ABMS- and non-ABMS-recognized boards at the state government level.[18] The next appropriate step would be to protect this distinction on Instagram—one of the most important advertising platforms available to plastic surgeons today. Continued change in medical advertising restrictions at both the government and private sector levels should be the next focus of ASPS and The Aesthetic Society (TAS) as patients continue to query social media when evaluating providers and gathering information on PS procedures.

Limitations

Our study and analysis included several limitations. The model used for classifying account types sorted a significant number of posts into the "organizations" category, which represented organizational accounts of a practice such as a clinic, medical spa, or ambulatory surgical center. It was not able to determine the qualifications of the providers at these locations. Additionally, social media is a rapidly evolving space and post characteristics may have changed from the time this analysis was performed. It should also be mentioned that only one social media platform was evaluated in this study. It would be worthwhile to repeat this study on other highly used platforms, such as Facebook (Menlo Park, CA) and TikTok (Culver City, CA, USA), to see whether our findings persist.

CONCLUSIONS

Although a significant portion of PS content on Instagram is curated from board-certified plastic surgeons and other disciplines with training in PS, this remains the minority. Furthermore, the distinction is difficult as nonplastics-trained physicians and organizations contribute significantly to all post categories. Although declarations of board certification clearly distinguish posts from PS disciplines, they are used in only 22% of such posts.

This study underscores the need for board-certified plastic surgeons to distinguish their content on Instagram from the multitude of other contributors. Patients are increasingly using Instagram as a tool to gather information on PS and choose a provider. We must provide ways for patients to evaluate sources of content on Instagram and, in turn, empower them to make informed decisions regarding their care.

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