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The use of social media in plastic surgery biomedical research: scoping systematic review

Amanda Beneat[1,2†*], Boris Joutovsky[3†], Victor Moon[4,5], Armen Kasabian[4,5], Alisha Oropallo[2,5]

[1]Department of Molecular Medicine, Feinstein Institutes for Medical Research, Manhasset, NY 11030, USA
[2]Northwell Comprehensive Wound Care Center, Lake Success, NY 11042, USA
[3]Department of Surgery, NYU Langone Hospital-Long Island, Mineola, NY 11501, USA
[4]Department of Plastic, Reconstructive & Hand Surgery, Northwell Health, New Hyde Park, NY 11040, USA
[5]Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, NY 11549, USA

[†]These authors contributed equally to this work.
***Correspondence:** Amanda Beneat, Feinstein Institutes for Medical Research, Manhasset, NY 11030, USA. abeneat1@northwell.edu
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Abstract

Background: Social media has become ubiquitous; its uses reach beyond connecting individuals or organizations. Many biomedical researchers have found social media to be a useful tool in recruiting patients for clinical studies, crowdsourcing for cross-sectional studies, and even as a method of intervention. Social media usefulness in biomedical research has largely been in population health and non-surgical specialties, however, its usefulness in surgical specialties should not be overlooked. Specifically in plastic surgery, social media use to understand patient perceptions, identify populations, and provide care has become an important part of clinical practice.

Methods: A scoping review was performed utilizing PubMed and Medline databases, and articles were screened for the use of social media as a method of recruitment to a clinical trial, as crowdsourcing (i.e., recruitment for a cross-sectional or survey-based study), or as a method of intervention.

Results: A total of 28 studies were included, which focused on majority females between 18–34 years old. Despite the ability of the internet and social media to connect people worldwide, nearly all the studies focused on the researchers' home countries. The studies largely focused on social media's effect on self-esteem and acceptance of cosmetic surgery, but other notable trends were analyses of patient perceptions of a disease, or surgical outcomes as reported in social media posts.

Discussion: Overall, social media can be a useful tool for plastic surgeons looking to recruit patients for a survey-based study or crowdsourcing of information.

Keywords

Plastic surgery, social media, social network, biomedical research

Introduction

Of the nearly 5.4 billion people who currently access the internet, approximately 4.9 billion also use some form of social media [1]. The most popular sites include Facebook, WhatsApp, YouTube, Instagram, and TikTok [1]. While individuals largely use social media, organizations have also increased their presence on social networks. Medical communities specifically have been able to use social networking sites to spread medical information, provide patient education, help establish their private practices, and share research-specific scientific articles [2–5]. Networks such as Instagram, Facebook, Twitter, Snapchat, TikTok, WhatsApp, and LinkedIn are commonly used and greatly impact patient care.

Social media has also played a unique role in the realm of biomedical research; however, a majority of these studies have been in non-surgical fields, and have instead used social media to study population health, and psychology, or to recruit patients with rare conditions for medical studies [6–8]. While recruitment to clinical trials is a feasible tool for biomedical researchers, another option for researchers is "crowd-sourcing", which uses a large group of people to complete a task or answer a question [9]. Crowd-sourcing can allow researchers to access larger pools of data or patient populations, improve research quality and speed, and also lower the cost of the study [10]. Crowd-sourcing can be seen as a specific form of recruitment for a research study, which utilizes the wide reach of the internet to access patients. Traditional methods of recruitment for clinical trials, or even cohort and cross-sectional studies were limited by the range of advertising, the budget of the study group, and the time taken to reach a statistically powerful sample size [11]. Additionally, in surgical specialties, recruitment can be difficult as many patients may not be eligible until the time of their surgery, which can increase the time needed to achieve a significant sample size. Surgeons have been able to use social media as a form of study recruitment, however, many focus on recruiting other surgeons to join the study and enroll patients, thereby increasing the sample size [5, 12, 13].

Little research has been shown to demonstrate the role that social media plays in the recruitment of subjects for research studies in surgical subspecialties, such as plastic surgery. This scoping review aims to describe the literature on social media use in plastic surgery biomedical research, identify knowledge gaps, and describe research trends and outcomes. A secondary aim is to determine how social media can benefit biomedical research in plastic surgery in future endeavors.

Materials and methods

We performed a comprehensive literature review following a 5-step scoping method to focus on our research questions. This method includes 1) identifying research questions, 2) creating keywords and inclusion criteria that are designed to reduce erroneous search results, 3) utilizing article review applications to help organize and screen articles, 4) creating a detailed chart of each article along with research design, question, major results, and limitations, and 5) identification of major themes among the articles [14]. Our goal was to understand how social media is used in biomedical plastic surgery research and determine major research trends. Based on the current literature, social media is used in surgical research for several purposes including, recruiting, collaboration of research groups, dissemination of information, and crowd-sourcing or direct participation of subjects [5, 15]. Given these established uses and our goal to understand how plastic surgery research is done utilizing social media; our questions were as follows: 1) is social media a useful tool in recruiting patients for plastic surgery clinical research? 2) Can social media be used as an intervention, or is it limited to cross-sectional studies in plastic surgery research? 3) What is the main focus of plastic surgery researchers who utilize social media in their studies?

The literature review was conducted using PubMed, Embase, and Ovid databases with the following search terms: "plastic surgery", "research", "social media" and "recruitment". Publications were limited to the last 10 years. Common search pitfalls and solutions have been described and all attempts were made to avoid ambiguity within our search by refining terms, using both free-text and controlled language, and utilizing multiple search platforms [16]. We initially screened articles by title and imported promising articles into Rayyan, a web-based application that allows for consolidation and screening of articles [17].

We further screened articles based on abstract, article type, and relation to the search criteria. Additional articles were obtained from cited reports in accepted articles. Full texts were further evaluated to ensure the use of social media as recruitment (to a clinical trial), crowd-sourcing (utilizing the public to obtain information), or in an interventional role. Articles were additionally screened to ensure that the topic, journal, or author affiliations were related to plastic surgery. All relevant articles, regardless of study design or quality of evidence were included. The review was completed in April of 2024.

Two reviewers (Amanda Beneat and Boris Joutovsky) independently screened each article and discussed the results. Both also updated the records to ensure consistency in assessing the study design and quality. Ultimately, 28 studies met the inclusion criteria. A detailed screening process including exclusions is outlined in Figure 1. An in-depth analysis of each article was then performed.

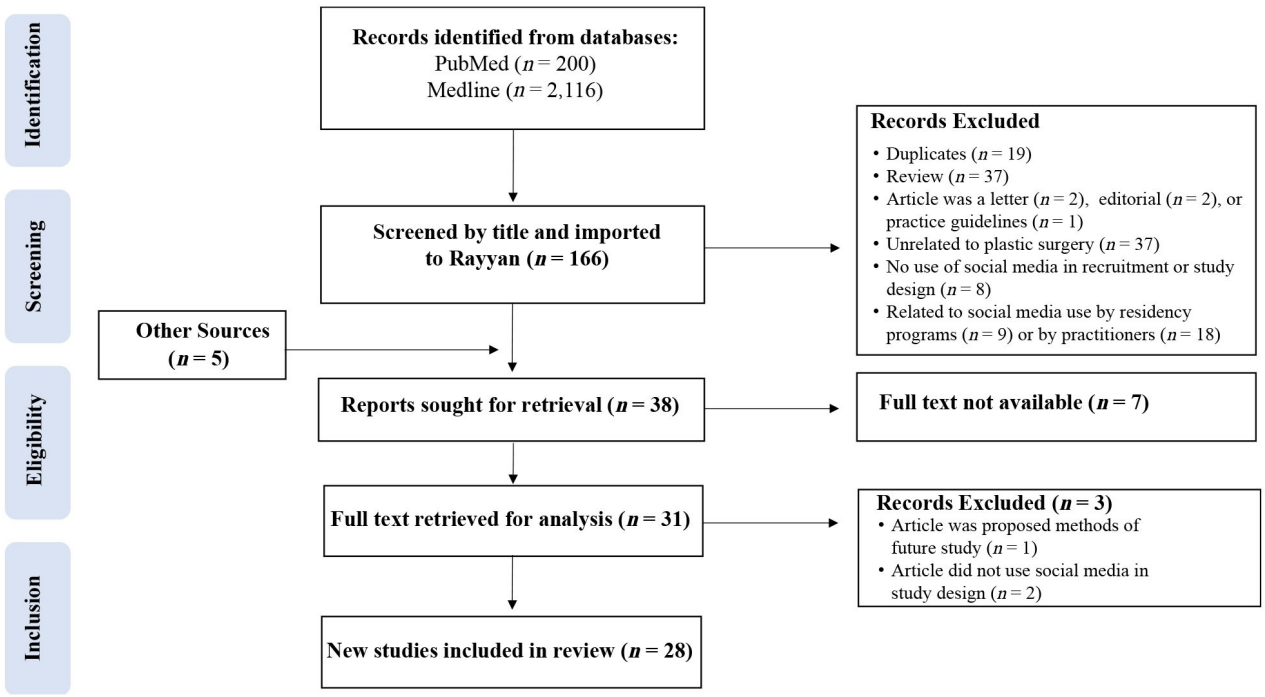

Figure 1. PRISMA flow diagram outlining the process of article screening, review, and analysis with detailed exclusion criteria

Results

Characteristics of the patient population

Geographic location

Two of the 28 reports analyzed focused on multiple countries (USA, Nigeria, Japan, and Germany) [18] or allowed for international participation [19]. Table 1 reviews the geographic focus of each study. Despite the ubiquitous nature of social media and the ability to connect users worldwide, most reports focused their efforts on users within their own country.

Average age and gender identity

Our review of the included papers demonstrated a wide age range, primarily focusing on young adults. Five of the 28 posts do not include data on age or gender, likely because these studies focused on social media posts and content rather than its effect on the population [19–23]. Similarly, these posts do not comment on gender proportions, except for the study by Tirrell et al. [23], which assessed plastic surgery Instagram accounts for diversity. The overall range seen was between 11–75 years old. Only one paper reported a patient population less than 18 years old [24]. The majority of reports were able to recruit or crowd-sourced data from participants averaging 18–34 years old, likely because this is the largest group of social

Table 1. The geographic areas of focus for each article analyzed

Geographic focus	Studies
USA	Mullens et al. [20]; Egan et al. [21]; Tirrell et al. [23]; Nayyar et al. [26]; Chen et al. [27]; Kinney et al. [29]; Sorice et al. [37]; Timberlake et al. [38]; Bater et al. [33]
Saudi Arabia	Almajnoni et al. [30]; Sindi et al. [31]; Sayegh et al. [32]; Alhujayri et al. [39]; Alhusaini et al. [40]; Ateq et al. [46]; Alkhathami et al. [43]
Netherlands	de Vries et al. [24]; Hermans et al. [36]
Turkey	Çınar et al. [22]; Sonmez et al. [41]
United Kingdom	Zargaran et al. [28]; Walker et al. [34]
Italy	Gesto et al. [42]; Nerini et al. [45]
Australia	Seekis and Barker [44]
Canada	Dengre et al. [25]
Nigeria, Japan, Germany, and USA	Wallner et al. [18]
International	Ben-Naftali et al. [19]

media users [1]. One study that exceeded this age range was Dengre et al. [25], which enrolled parents or grandparents of children with cleft lip/palate.

Of the remaining 23 studies, all included female participants, and seventeen included males. Only 5 sought to include the option for participants to define themselves as transgender or nonbinary [18, 26–29]. Tirrell et al. [23] also included this category; however, their work assessed the diversity of content of surgeon Instagram accounts and did not actively recruit or crowdsource from participants. A full breakdown of the age and gender of study participants is shown in Table 2.

Table 2. Age and gender composition of the reviewed articles

Primary study	Gender			Ages of participants
	Male	Female	Transgender/Non-binary	Age range and mean age
Wallner et al. [18]	51.2%	48.2%	< 1%	
Germany	41.4.%	56.7%	< 0.5%	Age range 18–24
Nigeria	54.4%	45.2%	< 0.5%	Age range: 25–34
USA	50%	50%	< 0.5%	Age range: 25–34
Japan	50.3%	48.4%	< 0.5%	Age range: 34–44
Nerini et al. [45]	-	100%	-	Age range: 18–52
				Mean age: 27.1
Bater et al. [33]	47.5%	52.5%	-	Age range: 18–52
				Mean age: 27.1
Nayyar et al. [26]	12.53%	82.04%	5.43%	Breast augmentation: 20–68
				Facial rejuvenation: 22–74
				Combined breast-abdominal surgery: 21–68
				Combined aesthetic: 19–85
Chen et al. [27]	26.6%	73%	0.4%	Mean age 24.7
Zargaran et al. [28]	4.7%	94.1%	1.2%	Age range: 18–74
				Mean age: 42.6
Walker et al. [34]	-	100%	-	Age range: 18–29
				Mean age: 20.71
Kinney et al. [29]	44%	55%	1%	Mean age: 37.19
Sorice et al. [37]	1%	99%	-	Age range: 17–78
				Mean age: 44/48
Sonmez et al. [41]	-	100%	-	Age range: 20–68
				Mean age: 35.3

Table 2. Age and gender composition of the reviewed articles (*continued*)

Primary study	Gender			Ages of participants	
	Male	Female	Transgender/Non-binary	Age range and mean age	
Gesto et al. [42]	-	100%	-	Age range: 19–32	
				Mean age: 23	
				Age ranges	**Percent of sample**
Alhujayri et al. [39]	13%	87%	-	18–24	39%
				25–30	22%
				31–40	22%
				> 40	18%
Alhusaini et al. [40]	17.9%	82.1%	-	< 25	41.1%
				25–35	22%
				36–45	20.1%
				46–55	13.5%
				> 55	3%
Alkhathami et al. [43]	-	100%	-	< 18	3%
				18–23	65.8%
				24–30	16.2%
				31–40	7.5%
				< 40	7.5%
Seekis and Barker [44]	-	100%	-	17–25	100%
Ateq et al. [46]	30%	70%	-	18–24	38%
				25–29	24%
				30–39	28%
				> 40	10%
Dengre et al. [25]	14%	86%	-	20–29	14%
				30–39	50%
				40–49	33%
				50–59	0%
				≥ 60	3%
de Vries et al. [24]	49.3%	50.7%	-	11–18	100%
Almajnoni et al. [30]	15%	85%	-	< 18	6%
				18–25	63%
				26–30	14%
				> 30	17%
Sindi et al. [31]	23.3%	76.7%	-	18–29	68.8%
				30–39	11.0%
				40–49	12.6%
				> 50	7.5%
Hermans et al. [36]	44%	55.6%	0.4%	18–25	100%
Sayegh et al. [32]	30.6%	69.4%	-	18–34	68.39%
				35–54	28.76%
				> 55	2.85%
Tirrell et al. [23]	No comment on the gender/age of post authors				
Ben-Naftali et al. [19]	No comment on the gender/age of post authors				
Mullens et al. [20]	No comment on the gender/age of post authors				
Timberlake et al. [38]	No comment on age/gender, studied family groups				
Egan et al. [21]	No comment on the gender/age of post authors				
Çınar et al. [22]	No comment on the gender/age of post authors				

Six articles reviewed social media postings and did not comment on the age, gender, or both of the authors of the posts. For reference 18, due to very few people did not complete the survey, so the percentage sum is less than 100%

Utilization of social media

Recruitment

Recruitment was not a major focus for the utilization of social media in plastic surgery biomedical research. Recruitment was utilized for 7 cross-sectional or survey-based studies [27, 28, 30–34]. Two of the studies also reported additional methods of recruitment, including survey distribution sites [34], or university email list-serves [27, 34]. One study utilized only one social media site for recruitment (Instagram) [34], while the remaining used combinations of Facebook, Twitter (X), Reddit, Instagram, WhatsApp, or LinkedIn [27, 28, 32]. In the study by Walker et al. [34] Instagram was notably used as both a method of recruitment as well as an inclusion criterion for their study of social media use and its effect on cosmetic surgery acceptance. A detailed overview of the utilization of social media is outlined in Table 2, including the study design and specific sites used.

Crowd-sourcing

While survey distribution can be considered a form of crowd-sourcing [10, 35], we did not count cross-sectional or survey-based studies as "crowd-sourcing" unless there was no mention of "recruitment" in the methodology of the paper. Any papers that specifically stated that social media was used in recruitment were therefore included in the above section. Crowd-sourcing specifically for survey distribution was noted in Table 3. Sixteen of the studies utilized crowd-sourcing [18, 21, 24–26, 29, 36–44]. In addition to the distribution of a survey, Timberlake et al. [38], effectively crowd-sourced genetic screening for de novo mutations in children with craniosynostosis, which were found in 10% of study patients. Another 3 studies viewed posts on social media, either by using hashtags or search terms [24], or by viewing specific Facebook groups for a particular disease or condition [35, 41].

Table 3. Study design and social media sites used in all studies reviewed

Primary study	Study design	Utilization of social media			Social media sites studied
		Recruitment	Crowd-sourcing	Intervention	
Wallner et al. [18]	Cross-sectional sampling		X		Instagram
					TikTok
Nerini et al. [45]	Experimental design with control group			X	Instagram
Bater et al. [33]	Randomized controlled trial			X	Does not mention specific site
Nayyar et al. [26]	Cross-sectional sampling		X		Facebook
					Twitter (X)
					Instagram
					YouTube
					SnapChat
					Pinterest
					Tumblr
Chen et al. [27]	Cross-sectional sampling	X			Facebook
					Instagram
					Reddit
Zargaran et al. [28]	Focus group	X			Facebook
	mixed methods qualitative and quantitative analysis				Twitter (X)
					LinkedIn
Walker et al. [34]	Cross-sectional sampling	X		X	Instagram
Kinney et al. [29]	Cross-sectional sampling		X		Facebook
					Twitter (X)
					Instagram

Table 3. Study design and social media sites used in all studies reviewed (*continued*)

Primary study	Study design	Utilization of social media			Social media sites studied
		Recruitment	Crowd-sourcing	Intervention	
					YouTube
					RealSelf
Sorice et al. [37]	Cross-sectional sampling		X		Facebook
					Twitter (X)
					Instagram
					YouTube
					SnapChat
					Pinterest
Sonmez et al. [41]	Cross-sectional sampling		X		Did not specify
Gesto et al. [42]	Cross-sectional sampling		X		Instagram
Alhujayri et al. [39]	Cross-sectional sampling		X		Facebook
					Twitter (X)
					Instagram
Alhusaini et al. [40]	Cross-sectional sampling		X		Twitter (X)
					SnapChat
					WhatsApp
					Telegram
Alkhathami et al. [43]	Cross-sectional sampling		X		Instagram
					SnapChat
					TikTok
Seekis and Barker [44]	Cross-sectional sampling		X		Facebook
					Instagram
					SnapChat
					TikTok
Ateq et al. [46]	Cross-sectional sampling		X		Twitter (X)
					WhatsApp
					Telegram
					LinkedIn
Dengre et al. [25]	Retrospective analysis of quality assurance surveys and interview data		X	X	Facebook
					Instagram
					SnapChat
de Vries et al [24]	Cross-sectional sampling		X		Hyves.nl
Almajnoni et al. [30]	Cross-sectional sampling	X			Did not mention specific site
Sindi et al. [31]	Cross-sectional sampling	X			Did not mention specific site
Hermans et al. [36]	Cross-sectional sampling		X		Facebook
					Twitter (X)
					Instagram
					YouTube
					TikTok
Sayegh et al. [32]	Cross-sectional sampling	X			Twitter (X)
					WhatsApp
					Telegram
Tirrell et al. [23]	Retrospective analysis of social media posts			X	Instagram
Ben-Naftali et al. [19]	Prospective analysis of social media posts			X	Facebook

Table 3. Study design and social media sites used in all studies reviewed (*continued*)

Primary study	Study design	Utilization of social media			Social media sites studied
		Recruitment	Crowd-sourcing	Intervention	
					Instagram
					YouTube
Mullens et al. [20]	Prospective, cross-sectional sampling			X	Instagram
					Twitter (X)
Timberlake et al. [38]	Cross-sectional Sampling		X		Facebook
Egan et al. [21]	Cross-sectional sampling		X	X	Facebook
Çınar et al. [22]	Prospective, cross-sectional sampling			X	Facebook

X: refers to the affirmation that this method was used in the paper

Intervention

In addition to recruitment and crowd-sourcing, 9 studies also included some form of intervention using social media [19–23, 25, 33, 34, 45], as noted in Table 3. Four of these studies involved showing photos to participants and measuring responses [18, 25, 34, 45]. Walker et al. [34] and Nerini et al. [45] both asked patients to view altered images or cosmetic surgery after photos and then were asked about self-esteem and acceptance of surgery. Bater et al. [33] and Dengre et al. [25] showed before and after photos and then gave surveys about their reactions. Three studies analyzed social media postings based on specific search criteria or through social media groups or communities to determine the level of engagement [19, 20, 22, 23]. Finally, Egan et al. [21], utilized social media as a database to determine patient outcomes following a surgical procedure.

Main focus and study outcomes

Table 4 provides a representation of each article and the main findings as well as limitations.

Table 4. Major findings and limitations of all studies

Primary study	Question	Main results	Limitations
Body image and acceptance of surgery			
Wallner et al. [18]	How does social media impact the perception of the female buttocks?	Satisfaction with one's own perception of their buttocks was mainly affected by factors such as sex life, country of origin, weight, and social media use. Frequency of TikTok and Instagram use was associated with decreased happiness with one's own buttocks and increased desire for cosmetic surgery. Participants in Germany and USA were more likely to consider surgery than those in Nigeria or Japan, despite having similar perceptions of their own buttocks. Favored waist-to-hip ratio was similar in Nigeria, Germany, and the USA, but favored a smaller buttock in Japan.	Web-based surveys may have reached a younger audience. Representative image for the waist-to-hip ratio was not racially diverse, which could have affected self-esteem in persons of color.
de Vries et al. [24]	Does time spent on social media lead to cosmetic surgery acceptance? Is its effect gender specific?	Social network use relates to cosmetic surgery desire through appearance investment. Girls reported more frequent use of social networking sites and had higher appearance investment and greater desire for cosmetic surgery. Desire for cosmetic surgery was not moderated by gender.	Results are only applicable to the Netherlands as the social media site analyzed is only available there.

Table 4. Major findings and limitations of all studies (*continued*)

Primary study	Question	Main results	Limitations
Almajnoni et al. [30]	What is the attitude towards cosmetic surgery in the western regions of Saudi Arabia? (Makkah and Medina regions)	Plastic surgery was accepted by 52.4% of survey participants. Factors that increased acceptance of cosmetic surgery included female gender, age > 30, and being divorced or a widow/widower. Most common procedure that participants have had was laser hair removal. More consideration was given to laser hair removal, rhinoplasty, and liposuction when asked about future procedures.	Small number of male respondents.
Sindi et al. [31]	What is the attitude towards cosmetic surgery in the western regions of Saudi Arabia? (Makkah, Medina, Jeddah, and Altaif regions)	When asked to rate themselves on attractiveness, the average rating was 5.3 out of a 7-point scale. Women were more likely to consider facial Botox and liposuction, while men considered rhinoplasty and liposuction. 82% of participants reported 2 or more hours daily of social media use. Media exposure was a significant predictor for surgery consideration in both men and women, with self-attractiveness for women, and history of cosmetic surgery for men as another factor.	Only generalizable to this region of Saudi Arabia
Hermans et al. [36]	How does passive and active usage of social media affect young adults' perception of cosmetic procedures?	Survey participants had a low overall interest in cosmetic surgery, but perceived that it was more common than it actually is. Increased frequency of using visual social media had an increased effect on cosmetic procedural intention. This was not the case for non-visual forms of social media. Increased surgery intention was seen in participants who followed influencers who were open about prior cosmetic procedures. However, surgery acceptance was not increased. Following influencers who have not had cosmetic surgery correlated with a decreased intention for surgery. Increased filter use on Instagram was positively correlated to surgery intention and acceptance.	Provides evidence of correlation but cannot infer causation.
Sayegh et al. [32]	What is the attitude towards cosmetic surgery in the Jazan region of Saudi Arabia?	Surgical procedures were accepted by 62.1% of participants. Non-surgical cosmetic procedures were accepted by 63.7% of participants. Higher acceptance scores for cosmetic surgery were seen in engaged and widowed participants. Divorced participants had a higher acceptance of non-surgical cosmetic procedures. Lower acceptance of surgery was seen in participants with higher incomes and higher levels of parental education. Increased age was associated with higher surgery acceptance.	Small sample size
Chen et al. [27]	Does the use of social media photo-editing applications lead to increased cosmetic surgery acceptance?	Social media had a positive association with cosmetic surgery consideration, with Tinder and SnapChat having the highest acceptance scores. Increased consideration for surgery was seen in Instagram users, but acceptance was not increased.	Recruitment via social media may have skewed the sample to a younger population.

Table 4. Major findings and limitations of all studies (*continued*)

Primary study	Question	Main results	Limitations
		Cosmetic surgery acceptance increased as the number of social media sites used increased.	
Alhusaini et al. [40]	How do socio-demographic characteristics and SnapChat use affect the decision to undergo cosmetic surgery and the overall acceptance of cosmetic surgery?	Overall acceptance was low among the participants. The most popular option for future surgery was rhinoplasty. Increased acceptance of surgery was seen in participants who were older, female, or who had had cosmetic surgery. The tendency to undergo cosmetic surgery increases with increased SnapChat use, following influencers, and viewing advertisements and publications on social media. Social media influencers were the most dominant factor in influencing the decision to undergo cosmetic surgery.	Provides evidence of correlation but cannot infer causation.
Ateq et al. [46]	Does social media use lead to body dysmorphia and acceptance of cosmetic surgery?	Body dysmorphic disorder (BDD) was found in 24.4% of participants. Patients with BDD were found to spend significantly more time on social media such as Instagram and SnapChat. 29% of participants with BDD spent 4–7 h per day on social media compared to 19% who spent 1 h or less per day. Younger age, being single, lower socioeconomic status, and being female were associated with BDD. Individuals with BDD had a higher acceptance of plastic surgery.	Gender bias due to nearly 70% female participation. Responses were self-reported, therefore diagnoses of BDD may be inaccurate.
Walker et al. [34]	Does looking at images of people with cosmetic enhancements increase the desire for cosmetic surgery?	Participants who viewed images of cosmetically enhanced females had an increased desire for surgery, compared to controls who were shown travel images. Social media use predicted the desire for surgery when controlled for body dissatisfaction. Social media use was more predictive than body dissatisfaction for desire for surgery. Body dissatisfaction in the control group did not predict a desire for surgery.	Survey-based study can only imply correlation but not causation.
Sonmez et al. [41]	What is the relationship between frequency of social media use, appearance-related social media pressure, BMI, and body appreciation in patients undergoing cosmetic procedures?	Pressures from social media negatively affected body appreciation. Appearance-related social media pressures and BMI had a negative effect on body image. Patients with invasive surgeries were more likely to read comments about surgeons utilizing before-and-after photos, search for information about a procedure, and look at the webpage for the surgeon.	Sample consisted of only females and was limited to one city in Turkey.
Gesto et al. [42]	How do image-based Instagram activities related to either self, friends, or celebrities affect acceptance of cosmetic surgery and body dissatisfaction?	Most image-based activities were related to friends, followed by celebrities, and then images of oneself. Viewing or interacting with images of oneself or celebrities were directly and indirectly related to acceptance of cosmetic surgery, while activities related to friends was not. Using Instagram for viewing and interacting	The study cannot make causal inferences, only correlations.

Table 4. Major findings and limitations of all studies (*continued*)

Primary study	Question	Main results	Limitations
		with images was associated with more appearance comparison, higher body dissatisfaction, and increased acceptance of surgery. The indirect effect of viewing or interacting with self- and celebrity-images on acceptance of cosmetic surgery was significant.	
Alkhathami et al. [43]	What effect does social media have on the acceptance of cosmetic surgery in Saudi women?	36.6% of those surveyed felt that social media increased the pressure they felt to undergo cosmetic surgery. 29.6% take selfies to post on social media and 27.7% utilize applications to apply filters and thereby improve their appearance before posting. There was not a significant correlation between time spent on social media and cosmetic surgery acceptance.	Female-only population. Surveys on social media are skewed toward the younger population.
Seekis and Barker [44]	Using the tripartite influence model, what is the association between women's engagement with beauty content and cosmetic surgery consideration?	There was a positive correlation between social media use, dysmorphic appearance concerns, and consideration of cosmetic surgery.	The study included women only.
Nerini et al. [45]	Does knowing that a photo has been altered have an effect on body dissatisfaction and acceptance of surgery?	Enhanced images were effective in increasing perceived attractiveness. Groups who were shown images without a disclaimer had a more internalized thin ideal and a higher acceptance of surgery for social reasons.	Small sample size. Cannot generalize to the population. Men were not included in this study. More variation in the images is needed.
Social media engagement			
Ben-Naftali et al. [19]	What does the discussion of breast implant-associated anaplastic large cell lymphoma look like on social media?	The majority of posts dealing with the disease were educational in nature. Breast augmentation was represented in a largely positive light on YouTube. While posts on Instagram and Facebook were evenly split between positive and negative attitudes. YouTube is used mostly by physicians and least by patients, while Facebook has the most non-professional authors. Posts on Instagram had the highest return on investment in terms of engagement.	Analysis of attitudes towards implants in the context of a rare condition.
Mullens et al. [20]	What are the qualitative and quantitative differences between engagement on Instagram vs. Twitter using the hashtag #plasticsurgery?	The most common author types utilizing the hashtag were surgeons or clinics. Plastic surgeons were more commonly found on Instagram compared to Twitter. Nearly half of all Twitter posts contained no visual media. Instagram posts were more likely to be promotional in nature or contain images and videos whereas Twitter posts were more educational in nature.	Only a small portion of the large amount of content was analyzed. Potential for inconsistency among reviewers. Unable to assess engagement from saving or sharing of posts by users.
Çınar et al. [22]	How do parents of children with cleft lip/palate engage with one another on Facebook groups?	The most common posts were requests for information (55.4% of posts). Additional common posts were those seeking support, showing appreciation to the other group members or clinicians, giving advice, providing support or information, and making announcements.	Limited to Facebook given the lack of a "group community" function with other social networking sites.
Nayyar et al. [26]	What are the social media preferences of patients seeking	Patients found Facebook, followed by YouTube to be the most preferred social	MTurk may have allowed one participant to fill out multiple

Table 4. Major findings and limitations of all studies (*continued*)

Primary study	Question	Main results	Limitations
	plastic surgery?	media source.	surveys.
	Breast augmentation, facial rejuvenation, and combined breast and abdominal procedures were studied.	The type of social media platform was the most important in deciding where to obtain information.	
		Patients preferred videos and content delivered by the plastic surgeon.	
		No difference in preferences between current patients of the institution and crowd-sourced participants from Amazon MTurk.	
Kinney et al. [29]	How does social media influence patient empowerment?	Facebook was associated with higher empowerment for patients to ask questions during consultation, gave them awareness of options, and empowered them to make the decision to undergo consultation.	The survey offered financial compensation, which may have attracted certain individuals and therefore results may not be generalizable to the USA population.
	Used Cyber Info-Decisional Empowerment Scale (CIDES) to analyze the impact of social media.	Social media preference was also stratified by type of procedure. Patients desiring a cosmetic procedure preferred Instagram, followed by Facebook and YouTube. Patients looking for reconstructive surgery preferred YouTube, followed by Facebook, Instagram, and Twitter (X).	
Sorice et al. [37]	How does the plastic surgery patient interface with plastic surgeons online?	Facebook had the greatest patient use and engagement. YouTube had the second most users, while Instagram was second most in engagement. The least popular was Twitter (X).	The sample size was small and restricted to a single practice.
		Social media played a minor role compared to the practitioner's own website in influencing patients to make an appointment.	Patient demographics (race, income, education, and occupation) were not identified.
		Patients prefer plastic surgeons to post before-and-after photos, contests to win procedures and practice information. Dissemination of research held the least interest by patients.	
Alhujayri et al. [39]	How has COVID-19 affected the perception of cosmetic surgery in Saudi Arabia?	The majority of patients would undergo a cosmetic procedure to correct a scar or birth defect (75.8%).	Cross-sectional study, which does not show the timing effect of the pandemic on the overall population's perception of plastic surgery.
		Factors that motivated participants to consider or undergo plastic surgery during the pandemic were having more down time to recover and the perception that clinics would be less busy.	
		The most significant factor affecting the decision not to undergo a procedure was fear of COVID-19 (49.7%), and financial instability (44.6%).	
Perceptions and outcomes			
Egan et al. [21]	How are patients discussing their experiences and outcomes from migraine surgery on social media?	84% of posts were regarding nerve radiofrequency ablation, and 12% regarding nerve stimulators. A systematic analysis was noted by the authors to report similar proportions.	Possibility of selection bias as a Facebook group specifically for migraines was used.
		When analyzed for successfulness of surgery positive outcomes were found in 81% of nerve surgery, 47% of nerve stimulators, and 49% of nerve ablation procedures. These results were comparable to those found in the literature.	
		The most common complications reported were numbness, itching, and need for further surgery.	

Table 4. Major findings and limitations of all studies (*continued*)

Primary study	Question	Main results	Limitations
		15% of posts were related to surgical advice, including which type of procedure and surgeon recommendations.	
		7% of posts reference complications.	
Zargaran et al. [28]	To gain insights into the experiences of patients with an adverse effect of cosmetic Botox injections.	Of the 511 respondents, 79% reported adverse effects, which is higher than the reported national average, suggesting underreporting.	Possibility of recall bias.
		The most common adverse effects include anxiety.	
		Other findings include that 69% of respondents had long-lasting effects and 92% felt that they were not properly informed about how to report adverse effects.	
Dengre et al. [25]	How does viewing before-and-after photos of cleft lip repair alter the expectations of parents?	50% of parents felt that the photos influenced their expectations however it did not affect parent satisfaction with the results.	Single center study.
		Parents who viewed photos via Facebook or Instagram had higher expectations than those who viewed them via Google Images.	
		Parents felt that seeing images on social media made them feel less alone and gave the photos a "real life story," while viewing the photos out of context on Google had a more negative experience.	
Bater et al. [33]	To evaluate peoples' perception of persons with hair transplants via web-based images.	Observers had a positive perception of age, attractiveness, successfulness, and approachability when looking at images of hair transplant recipients vs those who had not.	Small sample size. Non-blinded images may have primed participants to have a more positive response to hair transplant.
Putting social media to work			
Tirrell et al. [23]	How racially diverse are Instagram posts by plastic surgery professionals?	Posts were 88.14% white, 81.5% female, and 99.7% cis-gender.	Skin tone was observed and reported.
		Racial and ethnic patients were under-represented in posts, despite a reported increase in plastic surgery among Black, Hispanic, Asian, and Native American patients.	Focused primarily on academic-based plastic surgery accounts.
		Less than 12% of images represented people of color.	
		In terms of gender representation, more female or female-to-male images were shown than male or male-to-female images.	
		Reconstructive procedures were more likely to be diverse than cosmetic procedures.	
Timberlake et al. [38]	Can social media be used as a crowd-sourcing method for scientific research?	Recruitment to the study was 86% by social media and 14% by clinic visits.	Single center. Facebook group may induce selection bias for willing participants.
		Parents were able to easily understand the accompanying directions for obtaining a buccal swab and 10% of participants were found to have a novel mutation involved in craniosynostosis.	
		99.5% of participants noted that they would participate in another social media-based study because they did not need to travel and there was low monetary cost for them to participate.	

Body image and acceptance of surgery

The most commonly studied topic was plastic surgery acceptance and the effect of social media on body image and consideration for surgery (15/28 reports) [18, 24, 27, 30–32, 34, 36, 40–46]. Each study concluded that increased use of social media leads to increased body dissatisfaction and overall acceptance of cosmetic surgery. Desire to undergo cosmetic surgery was also increased in patients with increased social media use. Aspects of social media that were seen as affecting cosmetic surgery acceptance were engaging in images of celebrities, or through the use of filters [27, 36, 45]. It was also noted that viewing images of individuals who acknowledged or appeared to have had cosmetic surgery increased acceptance of surgery [36, 34].

Body image was the main focus of three papers in our review. Wallner et al. [18] studied how social media usage affected participants' perception of the appearance of their buttocks. A more negative image was associated with increased use of TikTok and Instagram in all countries, but only Germany and the USA saw an increase in desire for cosmetic surgery [18]. Sonmez et al. [41] also found that increased pressure from social media is associated with a negative body image in females. Increased time on social media leads to a more negative body image, as studied by Ateq et al. [46] in this study, 24.4% of participants surveyed met the criteria for Body Dysmorphic Disorder. Of that group, 29% spent between 4 h and 7 h per day on social media apps such as Instagram or Snapchat [46].

Time spent on social media is correlated with increased investment in one's appearance and desire for surgery [24]. Seekis et al. [44] determined that a positive correlation exists between social media, body dysmorphia, and consideration of plastic surgery. These ideas are expounded upon by several papers in our review. Social media use was determined to be more of a predictive factor than body dissatisfaction alone in a study by Walker et al. [34] in which images from social media accounts of plastic surgery recipients were shown to study participants. Gesto et al. [42] found that social media users interacted mostly with content from their friends, followed by their content, with celebrity posts being the least common. Higher levels of interaction lead directly to an increased acceptance of cosmetic surgery by increasing body dissatisfaction, and increased comparison between self and others in terms of body image [42]. In a notable contrast, Alhusaini et al. [40] found that Snapchat users specifically were more likely to consider surgery based on interactions with celebrities.

Social media often employs the use of filters or enhanced photos. Nerini et al. [45] sought to determine if knowing an image was altered would affect body image and acceptance of surgery. Both groups found the altered image equally attractive, despite one group knowing it was altered, however only the group that was not informed of the enhancement had an increased acceptance of surgery [45]. Hermans et al. [36] found that increased filter usage was positively correlated to increased acceptance of and intention for cosmetic surgery. Among these social media applications, Snapchat was found to be associated with increased acceptance of surgery, while Instagram was associated with increased consideration of surgery, as noted in a study by Chen et al. [27].

Four of the studies in our review focused on social media's effect on body image and surgery acceptance in Saudi Arabia. Alkhathami et al. [43] found that while there was no correlation between time spent on social media and surgery acceptance, 36.6% of participants felt that social media increased the pressure to change their appearance. Conversely, Sindi et al. [31] noted that social media exposure was a predictor of social media acceptance. Both surveyed the Western region of Saudi Arabia, however, Sindi et al. [31] included a much larger geographic area in this region, which could account for the differences.

Social media engagement

Researchers were also interested in how patients engage in social media either for support and education regarding a condition or specific surgery [19, 22], to gather information about a specific procedure, surgeon, or healthcare system [26, 29, 37], or through use of specific hashtags [20]. Ben-Naftali et al. [19] sought to determine the discourse on implant-associated anaplastic large-cell lymphoma, by searching hashtags related to the disease. YouTube, which had the most positive posts, was largely used by clinicians,

while Facebook and Instagram, which had a mix of positive and negative posts, were mostly used by patients [19]. Çinar et al. [22] found that most posts relate to requesting or giving information about their own experiences.

Social media can be used to empower patients to make decisions about cosmetic or reconstructive plastic surgery. Kinney et al. [29] found that this was most notable among Facebook users. However, preferences for the use of social media sites changed based on the type of surgery. Patients seeking cosmetic surgery preferred Instagram, while those seeking a reconstructive procedure preferred YouTube [29]. Nayyar et al. [26] found that most patients preferred Facebook and YouTube over Instagram when searching for information regarding cosmetic procedures such as breast augmentation, facial rejuvenation, or combined breast and abdominal procedures.

Sorice et al. [37] studied how patients from a single practice interfaced with their surgeons through social media and found that the practice website was still preferred. They additionally noted that patients preferred Facebook and least preferred Twitter (X) and were most interested in practice information, promotions such as contests, and surgery results over academic or educational posts [37].

Mullens et al. [20] used the hashtag "#plasticsurgery" to study differences in engagement between Twitter (X) and Instagram users. They found that the majority of users of this hashtag were clinicians and that they preferred Instagram over Twitter (X) [20]. Instagram posts were more likely to have visual components, while Twitter (X) was found to have more educational content. Social media usage during the COVID-19 pandemic was also the focus of one study [39]. Interestingly, this study noted that perceptions of cosmetic surgery improved during the pandemic, concerning revision of scars or birth defects, largely due to the increased downtime to recover afforded by the lockdown [39].

Perceptions and outcomes

Researchers also used social media to determine patients' perceptions of a specific procedure [25, 33] or to determine how patients may report outcomes from a surgical procedure in their postings [21, 29].

Researchers focused on patient perception of hair transplant results [33] or on parent expectations of cleft lip/palate repair [25]. Dengre et al. [25] found that parents' expectations were influenced by viewing photos, but not satisfaction. The study also noted that social media images had more positive effects than those collected from a Google image search [30]. In a non-blinded randomized control study by Bater et al. [33], perception of the recipient's age, attractiveness, approachability, and even successfulness was positively affected by the procedure.

Outcomes measurement was conducted for Botox(™) injections [28] and surgical procedures for the treatment of migraines [21]. Zargaran et al. [28] showed that patient-reported outcomes of adverse events following cosmetic Botox(™) injections on social media sites increased compared to official reports, suggesting that many patients are under-reporting adverse events to their clinicians [28]. Of the 511 respondents, 79% reported some adverse event, while in the FDA Adverse Event Reporting System Dashboard, adverse events are only 11.51% for the same year as publication (2023) [28, 47]. They determined that 92% of patients felt they were not appropriately educated on how to report adverse effects [28]. Egan et al. [21] found that rates of surgical procedures, success rates, and adverse effects reported in Facebook groups for migraine sufferers matched those from a systematic review of the literature.

Putting social media to work

Tirrell et al. [23] utilized social media to evaluate the racial and gender diversity of professional plastic surgery posts [24]. They found that while rates of plastic surgery appear to be increased in minority populations (Black, Hispanic, Asian, or Native American), they are not well represented on social media. Only 12% of posts studied were of persons of color, and females are more represented than males. Among trans patients, images of female-to-male are more common than male-to-female [24]. Timberlake et al. [38] utilized social media for data collection on an otherwise rare disease and evaluated the feasibility of this method for future research [38]. Patients were selected based on their membership to a disease-specific

Facebook group and were sent instructions and materials for sample collection. When given a satisfaction survey at the end of the study, 99.5% of respondents stated that they would be willing to participate in a similar, social media-based study, given the ease of participation, low cost to the participant, and the lack of travel [38].

Discussion

Social media is an easily accessible and popular platform. With the rise of medical information available online, researchers are beginning to find ways to incorporate social media users to collect research data. At this time, few studies investigate the role of social media as a tool in surgical subspecialties. Our scoping review offers insight into 28 research studies and the role they may play in utilizing social media in plastic surgery research. The global availability of social networks, including Instagram, Facebook, Twitter (X), YouTube, TikTok, and Snapchat, offers a cost-effective method for researchers to access data from hard-to-reach populations. Although the majority of the studies in our review were conducted within a single country, two reports did include subjects of multiple nationalities [18, 19]. Interestingly, many Asian countries were not seen in this review despite Asia being home to some of the largest populations of social media users [1]. Many Asian countries have their own social media networks, such as WeChat, although there is also high usage of worldwide networks such as Facebook, Instagram, Twitter (X), and Pinterest [1]. Our search terms were able to locate articles from countries with social media networks, such as de Vries et al. [24], who utilized a network specific to the Netherlands. This lack of representation may not be due to a lack of interest by Asian researchers but instead may indicate more specific search criteria or utilization of other databases in a formal systematic review.

While the studies that analyzed participants within a single country conducted research in North America, Europe, the Middle East, and Asia, little research was found to support comparisons within multiple patient populations based on geographical differences. A major benefit of having the ability to recruit patients from studies around the globe would be allowing researchers to encompass the viewpoints of patients from various cultural backgrounds and socioeconomic areas to establish stronger relationships on particular subjects.

An important benefit of social media in the recruitment of research participants is its capability to reach a broad age range. The studies we reviewed contained an overall age range from 11–75 years, with almost half of the studies focusing on young adults ranging from 18–34 (12/28, 43%). While having access to a broad age spectrum is beneficial, it is important to consider which social media platform to use when recruiting research participants. For example, older populations have been found to use Facebook more frequently, while younger populations tend to use newer networks such as Twitter (X) [37]. Social media allows clinical research studies to recruit subjects of numerous genders, including transgender and non-binary persons, further increasing the recruitment strength of social media.

Our literature search demonstrated that social media can be used as a form of recruitment of study subjects and can also effectively crowd-source surveys for cross-sectional sampling. While only 7 of 28 studies recruited participants via social networks [26–29, 34–36], more than half utilized social media as a way for surveys or other forms of data collection tools to be distributed. Virtual recruitment (i.e., via social media) and crowdsourcing can help improve efficacy when compared to traditional research methods. In a review by Moseson et al. [48], which compared traditional recruitment methods (in-person at clinics, flyers or advertisements, community centers, etc.) with virtual recruitment for diabetes and hypertension studies, virtual recruitment required an average of 4 months to reach the goal sample size compared to an average of 15.9 months using traditional methods. It also noted that participants were, on average, younger and predominately female in virtual studies, which is echoed in many of the studies included in this review. The ability to crowdsource data through social media can be a major benefit for online research studies in plastic surgery. Allowing research participants to answer questions online can be an effective strategy for accurately representing public opinion. This is seen in a study by Zargaran et al. [28] that suggested that crowd-sourced surveys help gather true data and prevent underreporting of adverse effects regarding cosmetic procedures. Additionally, Timberlake et al. [38], showed that social media can also be used for

some aspects of collecting biological patient samples, provided the appropriate tools and storage reagents are sent to participants. These studies suggest that social media and other forms of virtual recruitment and crowd-sourcing may be useful tools to keep in a researcher's arsenal. While traditional forms of recruitment should not be completely abandoned, it may benefit plastic surgery researchers to include these newer methods of recruitment in studies where the incidence of the condition may be lower.

A common theme of plastic surgery papers that incorporated social media was the inclusion of online data collection centered around a plastic or cosmetic surgery intervention. Social media was used to present before and after photographs to measure participant responses, as well as to determine the level of engagement of the participants. Sorice et al. [37] demonstrated that the three most popular posts that generated interest in plastic surgery patients were contests to win free treatment/products, before-and-after photographs, and information about the plastic surgery practice [37]. Other studies showed that patients with invasive surgeries commonly utilized before-and-after photos in their social media searches, suggesting that social media, with the assistance of photographs, can help analyze outcome measures by clinical researchers [42].

When reviewing how plastic surgery researchers use social media for their studies, we found their focus centered on participants' perception of both their bodies as well as plastic surgery procedures themselves. Fifteen papers demonstrated that increased social media negatively impacted body satisfaction and positively impacted both acceptance and willingness to undergo plastic surgery. Additionally, plastic surgery researchers included before and after photos to see how participants' perceptions of the procedure changed. Studies showed that social media was used to influence patient expectations and had positive effects on patient's perception of the success of cosmetic procedures [33].

The impact that social media has on influencing a person's desire to undergo cosmetic or reconstructive plastic surgery procedures was evident throughout our literature search. The frequency with which participants use visual social media was positively related to their intention of undergoing plastic surgery [32]. Those who followed influencers who were open to plastic surgery interventions were also more likely to increase their intent to surgery [32]. A study published in the US in 2019 demonstrated that corresponding participants who used social media apps were more accepting of plastic surgery, while another study published in Saudi Arabia in 2023 showed that 36.6% of surveyed participants believed that social media increased pressure to undergo cosmetic surgery [27, 43]. Increased Acceptance of Cosmetic Surgery Scale (ACSS) was seen in older, female, educated, married, and those who have had a history of cosmetic surgery [30]. Particularly, photographs posted on social media were seen to influence people's desire to undergo cosmetic surgery [18, 25, 27, 33, 34, 36, 37, 40, 42, 45].

Our review suggests that participant engagement may vary based on which social media platform is used by researchers, and thus researchers should consider this when deciding how to recruit subjects. Reports have shown that Facebook, followed by YouTube, had the greatest patient use and engagement, while Instagram was second for the number of engaged users [32]. Twitter was the least popular, with the fewest users seeking information on plastic surgery, and had the least engagement [37]. Mullens et al. [20] demonstrated that Instagram had a much higher post engagement and that more educational content was shared on Twitter. Patients seeking cosmetic surgery tended to favor Instagram, while those interested in reconstructive surgery were more commonly found using YouTube and Facebook [29]. Other studies have shown that Twitter is used more often by medical organizations to disperse research studies and articles, but is least used to engage people in regards to plastic surgery [20].

Our review has some limitations. While we attempted to provide a comprehensive review, we cannot guarantee that all available relevant literature was found. Within the papers reviewed in our scoping review, the majority (22/28) fell under level 4 evidence based on the online Elsevier Level of Evidence Hierarchy, focusing on cross-sectional studies [49]. Five papers were considered level 3 evidence—only one paper, Bater et al. [33], fell under level 2 evidence due to its randomized controlled trial study design [34]. Although the level of evidence is 4 in most of our studies, it is important to point out that studies such as Timberlake et al. [38] found social media to be adequately feasible in the utilization of patient recruitment

for basic science clinical studies. Social media can be a useful tool in plastic surgery research. It has been used to study how the effect social media has on body image relates to the desire for and acceptance of plastic surgery in many populations worldwide. Additionally, it has shown promise in terms of recruiting patients for clinical trials. Utilizing social media can help promote research on a larger scale, which in turn can provide more generalizable data and increase the longevity of results.

Declarations

Author contributions

AB: Conceptualization, Data curation, Formal analysis, Methodology, Writing—original draft, Writing—review & editing. BJ: Data curation, Formal analysis, Methodology, Writing—original draft, Writing—review & editing. VM and AK: Methodology, Supervision. AO: Conceptualization, Methodology, Supervision.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical approval

Not applicable.

Consent to participate

Not Applicable.

Consent to publication

Not Applicable.

Availability of data and materials

The primary data for this systematic review were sourced online from databases listed in the methods. Referenced articles are accessible on PubMed, Embase, and Ovid. Additional supporting data are available from the corresponding author upon request.

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