

Public Perception of SARS-CoV-2 Vaccines Among Psoriasis Patients in Social Media: Content, Sentiment, and Engagement Analysis

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Abstract

Background: Psoriasis patients may seek information about the SARS-CoV-2 vaccine and their disease from social media platforms. Analyses of social media interactions may help guide dermatologists' educational efforts during this pandemic. **Objectives:** This study analyzes social media interactions among patients with psoriasis and psoriatic arthritis regarding the SARS-CoV-2 vaccine to determine the misinformation circulating and the apprehension to receiving the vaccine. **Methods:** Publicly accessible Facebook and Reddit groups regarding psoriasis and psoriatic arthritis were identified. Posts uploaded between March 1, 2021 and July 31, 2021 which contained information about the SARS-CoV-2 vaccine were extracted. First-order themes, sub-themes, sentiment scores and engagement scores were assigned to each post. **Results:** 345 posts within the first-order theme of *vaccination decision* and 1379 posts within the first-order theme of *vaccine reaction* were analyzed. Within *vaccination decision*, common sub-themes for refusing the vaccine include *fear of psoriasis flare up*, *vaccine is experimental*, *vaccine is unnecessary*, *vaccine is dangerous*, and *concern for reaction/vaccine efficacy while on psoriasis medications*. 41.4% of posts contained positive sentiment; whereas, 38.3% contained negative sentiment. Within *vaccine reaction*, common sub-themes identified were *no change to psoriasis*, *skin/joint flare up*, *skin flare up attributed specifically to stopping psoriasis medications*, *skin/joint improvement*, and *skin flare up but vaccine was worth it*. 77.8% of posts contained positive sentiment; whereas, 6.2% contained negative sentiment. **Conclusions:** Our study identified common SARS-CoV-2 vaccine concerns within the psoriasis community which should be used to guide educational efforts.

Keywords

psoriasis, psoriatic arthritis, biologic, vaccine, COVID-19

Introduction

Psoriasis is an immune-mediated disease affecting 8 million adults in the US and 125 million people worldwide.^{1,2} While patients seek medical care for the management of psoriasis and psoriatic arthritis, many also turn to social media for support from fellow patients. Social media, used by approximately 3.6 billion people worldwide,³ has become a key source in informing patients about psoriatic diseases and influencing their healthcare seeking behavior.⁴⁻⁶ For example, a German study found approximately 75% of the participating psoriasis patients to use Facebook, and 72% of those use Facebook to search for disease-related information.⁵ Aside from Facebook, patients with psoriasis and psoriatic arthritis have also been shown to turn to Twitter for advice on treatment side-effects and efficacy.⁶

With social media, there is the potential for dissemination of misinformation, which can lead to poor health decisions and behaviors based on incorrect information. Dermatology content analyzed on common social networks, including

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Facebook, Twitter, and Reddit, was below acceptable quality standards.⁷⁻⁹ Studies analyzing psoriasis content within YouTube found that nearly 2/3 of those videos containing misleading or potentially dangerous content, likely because majority were not produced by healthcare professionals.¹⁰⁻¹⁴

Since the beginning of the pandemic, the news has been dominated by COVID-19 safety practices. Social media has provided a platform for individuals to partake in discourse regarding the risk of the virus, its sequelae, and the SARS-CoV-2 vaccine. But it also has allowed false information to permeate throughout society.¹⁵ For example, an analysis of content on Twitter found the most commonly retweeted tweets regarding the AZD1222 COVID-19 vaccine to be full of misinformation.¹⁶

Even prior to the COVID-19 pandemic, the World Health Organization considered vaccine hesitancy to be a major threat to public health. Key vaccine dissuaders include complacency, inaccessibility, and lack of confidence.¹⁷ With 37.4% of the US population and 40.7% of the global population not fully vaccinated as of January 10, 2022, the global health threat of vaccine hesitancy is still relevant.^{18,19} With the rise of new SARS-CoV-2 variants, including delta and omicron, vaccine hesitancy, fueled by the amount of misinformation on social media, must be taken seriously.^{15,20,21} The repercussions of vaccine hesitancy are potentially life threatening. The SARS-CoV-2 vaccine is one of the most efficacious tools available to prevent severe consequences of COVID-19 infection.^{22(p19)}

Given the uncertainty regarding various treatments, relative swiftness of the development of the SARS-CoV-2 vaccines and the overall political discourse throughout the pandemic, it is unsurprising that misinformation is being disseminated on social media. Studies have been done to understand public perception towards SARS-CoV-2 vaccine using Twitter,^{16,23} but there have yet to be studies on the perception among psoriasis patients towards the vaccine. This study aims to characterize the content, sentiment, and engagement of online interactions between psoriasis and psoriatic arthritis patients. This analysis will enable us to determine the misinformation circulating in this community and the apprehension to receiving the vaccine.

Materials and Methods

Selection of Social Media Posts

The social media platforms Facebook and Reddit were chosen due to widespread use of Facebook and the recent rise in the use of Reddit.²⁴ Individual, public Facebook groups and subreddits were analyzed because they contain distinct community spaces where users gather to discuss specific topics. This study was determined to be exempt by the University of Southern California Institutional Review Board.

Two subreddits (r/Psoriasis, r/PsoriaticArthritis) and 2 Facebook group (FB_Psoriasis, FB_PsoriaticArthritisNetwork)

were analyzed. Posts uploaded between March 1, 2021 and July 31, 2021 that referenced psoriasis or psoriatic arthritis and the SARS-CoV-2 vaccine were identified using the search option. March 2021 was chosen as a start date in order to reflect the latest opinions towards the vaccine at the time when this study was conducted. Search terms included “vaccine,” “vaccination,” “Pfizer,” “Moderna,” “Johnson and Johnson,” and “Astrazeneca.” All posts were de-identified prior to inclusion.

Assignment of Themes, Sentiment Scores, and Engagement Scores

An iterative approach was used where each post was reviewed individually by 2 reviewers (DY, SK) to identify common first-order themes (FOT) and sub-themes (second-order themes and third-order themes) based on the content of the post. Extracted posts were individually assigned a sentiment of either positive (in favor of the vaccine), negative (against the vaccine), or neutral by the reviewer. Each sentiment was then assigned a value of 1 (positive), -1 (negative), or 0 (neutral).²⁵ Posts were also assigned an engagement score, determined by recording the sum of the likes/upvotes and comments for each post.

Statistical Analysis

Frequencies of each sentiment and sub-theme across the FOTs were calculated. Mean engagement and sentiment scores were calculated for each sub-theme and social media platform. One-way analysis of variance (ANOVA) tests were used to determine significant differences for mean engagement and sentiment scores between sub-themes. Two-sample T-test was used to determine significant differences for mean engagement and sentiment scores between the 2 social media platforms. Chi-square tests were used to detect any significant differences between sub-theme and sentiment frequencies across sub-groups. Threshold of significance was set at $P < .05$. All statistics were performed using STATA 15.0 (StataCorp LP, College Station, TX).

Results

Vaccination Decision

From both Facebook and Reddit, 2201 posts met the inclusion criteria (Figure 1). Of the initial 2201 posts, 345 posts contained content pertaining to the reasons for either getting, being unsure about, or refusing the vaccine. These posts were assigned the FOT of *vaccination decision*. Among these 345 posts, 91 were from Facebook and 254 were from Reddit. Three second-order themes and 13 third-order themes were identified. The frequencies of and sample posts for each sentiment and sub-theme are described in Table 1.

44.3% of Facebook and Reddit users reported receiving the vaccine, 37.4% reported refusing it, and 18.3% reported being

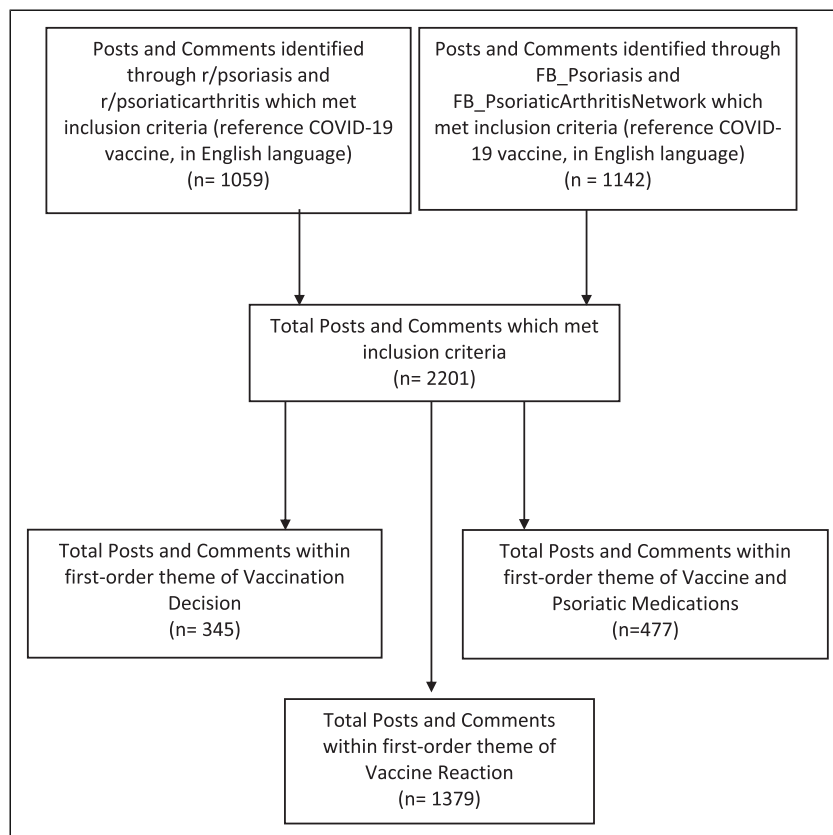


Figure 1. Flow diagram depicting data collection schema.

unsure about getting it. 17.4% of users received the vaccine for unspecified reasons, 11.3% received the vaccine because they believed it would be effective against COVID-19 infection, and 7.8% reported the vaccine as safe. 15.7% of users reported being afraid of a psoriasis flare up, 13.0% refused the vaccine for unspecified reasons, and 9.0% feared the vaccine was experimental.

Out of the 345 posts within the FOT of *vaccination decision*, 143 (41.4%) contained positive sentiment, 70 (20.3%) contained neutral sentiment, and 132 (38.3%) contained negative sentiment. Mean engagement and sentiment scores for each sub-theme and social media platform are listed in [Table 2](#).

Vaccine Reaction

Of the initial 2201 posts from both Facebook and Reddit, 1379 posts contained content pertaining to reported reactions to the vaccine. These were assigned the FOT of *vaccine reaction*. Among the 1379 posts, 878 (63.7%) were from Facebook and 501 (36.3%) were from Reddit. Eight second-order themes were identified. The frequencies of and sample posts for each sentiment and sub-theme are described in [Table 3](#). 72.2% of Facebook and Reddit users included in this study reported no change to their psoriasis, 16.0% reported

skin and/or joint flare up, and 3.7% reported skin and/or joint improvement.

Out of the 1379 posts and comments within the FOT of *vaccine reaction*, 85 (6.2%) contain negative sentiment, 221 (16.0%) contain neutral sentiment, and 1073 (77.8%) contain positive sentiment. Mean engagement and sentiment scores were calculated for each sub-theme and social media platform ([Table 4](#)).

Discussion

Since the start of the COVID-19 pandemic, there has been public uncertainty and controversy over the ideal approach to staying healthy and safe from the virus. This study is among the initial efforts to examine public perception and sentiments towards the SARS-CoV-2 vaccine through analyzing social media interactions among patients with psoriasis and psoriatic arthritis. Facebook and Reddit are 2 of the most popular social media platforms that have the potential to influence behavior and medical decisions. It is crucial to identify and understand the information being discussed online in order to guide educational efforts. This study sought to characterize online content within the psoriasis community to understand the misinformation being disseminated and the apprehensions to receiving the SARS-CoV-2 vaccine.

Table 1. Frequencies of Sentiment, Second-Order Themes, and Third-Order Themes for 345 Posts Within the First-Order Theme of Vaccination Decision.

Sentiment	Facebook n (%)	Reddit n (%)	Sample Posts
Negative	40 (44)	92 (36.2)	(r/psoriasis) Don't do it!! Trauma (needles, ink, risk of infection) begets outbreaks. I Want to tell you HELL NO DONT DO IT (r/psoriasis) None of the vaccines have FDA approval and there is no telling how they will interact with the biologics in either short or long term. So I'm not planning on getting a vaccine shot (FB_Psoriasis) Moderna or Pfizer? I'm not on any medication but I have psoriasis (r/psoriasis) Have any of you had injections in affected skin and what were your results/experience? (FB_Psoriasis) No issue with both Pfizer shots. Get vaccinated! The science supports it as SAFE! (r/psoriasis) Dont be afraid to take a jab its worth it (r/psoriasis) I'm not taking it! My psoriasis is finally getting better removing toxins from the body and the vaccine is only going to add more chemicals into the body (FB_Psoriasis) I have inverse between my buttocks and no way am I going to risk it being worse (FB_Psoriasis) following. I'm still undecided on this issue (r/psoriasis) I'm hesitant to take it (r/psoriaticarthritis) I hope it goes well for you! I figure getting the vaccine is better than getting covid... (FB_Psoriasis) I've had mine (r/psoriasis) I already have plaque psoriasis, and also have osteoarthritis in my knee and back. I won't do anything to risk making either worse...
Neutral	20 (22)	50 (19.7)	(r/psoriasis) it would be my luck that I'd flare...so I don't want to take a chance (r/psoriaticarthritis) I will not take an experimental approved drug in the emergency stage, just too fast (r/psoriasis) You really want to let these big pharma companies who have no liability, nor have done ANY tests on this vaccine and people with auto-immune disorders (psoriasis)? Helllllll no. You wanna be a guinea pig, go ahead (FB_Psoriasis) Why would you take a vaccine for a disease you already had? You already had natural immunity to it (r/psoriasis) God has protected me from it and yeah I believe true medicine is in meditation diet and exercise (r/psoriasis) Horrible idea don't do it. More dangerous getting vaccinated than getting covid (FB_Psoriasis) Stay away from that poison (FB_Psoriasis) Has anyone used Pfizer vaccine in parallel with biologic drugs for psoriasis? Please let me know if the biologic drug efficacy is reduced?
Positive	31 (34)	112 (44.1)	(FB_Psoriasis) I wont currently on tremfya (FB_Psoriasis) I refuse to get it (r/psoriasis) why does it matter to you if others dont have the vaccine, since it benefits you in no way if they do. If they dont, its no detriment to you either (r/psoriasis) Getting the vaccine is a personal choice and benefits only the recipient (FB_Psoriasis) I stand behind my decision because not only does it protect me I will also help protect my family (FB_Psoriasis) No one has died from this vaccine but plenty with covid. I'm not taking any chances (FB_Psoriasis) Yes, it is considered safe (r/psoriasis) Psoriasis flare up > being hospitalized due to covid19 (FB_Psoriasis) I'd rather have a flare than being on a ventilator w/COVID19 (FB_PsoriatcArthritisNetwork) I got Pfizer, both injections (FB_Psoriasis) Pfizer if you have a choice. People seem to have less side effects (FB_Psoriasis) for those who have been vaccinated against covid-19, which do you consider would be the best? (r/psoriasis) Anyone with psoriasis gotten the vaccine yet?
Second-order theme	89 (35)	40 (44)	
Refused the vaccine	89 (35)	40 (44)	
Unsure about getting the vaccine	46 (18)	17 (18.7)	
Received the vaccine	119 (47)	34 (37.4)	
Fear of psoriasis flare up	32 (12.6)	22 (24.2)	
Vaccine is experimental	20 (7.9)	11 (12.1)	
Vaccine is unnecessary	3 (1.2)	2 (2.2)	
Vaccine is dangerous	10 (3.9)	8 (8.8)	
Concern for reaction/vaccine efficacy while on psoriasis medications	8 (3.2)	4 (4.4)	
Refuse to get vaccine, unspecified reason	43 (16.9)	2 (2.2)	
Personal decision, vaccine benefits self only	—	6 (6.6)	
Vaccine works against COVID-19	19 (7.5)	20 (22)	
Vaccine is safe	23 (9.1)	4 (4.4)	
Vaccine is worth the side effects	4 (1.6)	6 (6.6)	
In favor of getting the vaccine, unspecified reason	59 (23.2)	1 (1.1)	
Vaccine choice	15 (5.9)	3 (3.3)	
Question about whether to get vaccinated or not	18 (7.1)	2 (2.2)	
Total	91	254	

Table 2. Mean Engagement and Mean Sentiment Scores of 345 Posts Within First-Order Theme of Vaccination Decision.

	Mean Sentiment Score	95% CI	P-value	Mean Engagement Score	95% CI	P-value
Second-order theme ^a	Refused the vaccine	-.98	-1.02---.95	P < .0001	4.06	2.83-5.29
	Unsure about getting the vaccine	-.02	-.07-.04		13.69	8.57-18.82
	Received the vaccine	0.9	.86-.96		4.39	2.28-6.49
Third-order Theme ^a	Fear of psoriasis flare up	-.39	-.53--.24	P < .0001	7.93	3.18-12.68
	Vaccine is experimental	-.04	-1.03--.84		3	1.57-4.43
	Vaccine is unnecessary	-.80	-1.36--.25		1.4	-.02-2.82
	Vaccine is dangerous	-1	—		5.11	2.21-8.01
	Concern for reaction/vaccine efficacy while on psoriasis medications	-.25	-.54-.04			1.27-3.73
	Refuse to get vaccine, unspecified reason	-1	—		5.71	3-8.42
	Personal decision, vaccine benefits self only	-1	—		1.17	.74-1.6
Social Media Platform	Vaccine works against COVID-19	1	—		1.95	1.38-2.52
	Vaccine is safe	1	—		3.3	.73-5.87
	Vaccine is worth the side effects	0.9	.67-1.13		3.5	1.58-5.32
	In favor of getting the vaccine, unspecified reason	.98	.95-1.02		3.68	1.71-5.65
	Vaccine choice	.22	-.18-.62		1.33	.38-2.28
	Question about whether to get vaccinated or not	-.05	-.15-.05		34.4	19.95-48.85
	Facebook	.08	-.03-.18	P = 0.1	6.05	4.45-7.64
	Reddit	-.10	-.28-.08		5.62	2.50-8.73

^aP < .05, significant differences observed between mean sentiment scores within second and third-order themes (results of one-way ANOVA test).

Table 3. Frequencies of Sentiment and Second-Order Themes for 1379 Posts Within First-Order Theme of Vaccination Reaction.

Sentiment	Facebook n (%)	Reddit n (%)	Sample Posts
Negative	30 (3.4)	55 (1.1)	(FB_Psoriasis) Now I got the first vaccine last Tuesday and once again I'm covered!! Scalp, ears, legs and all!! if I could go back and not get the vaccine, I wouldn't get it!
Neutral	77 (8.8)	144 (28.7)	(r/psoriasis) Pfizer caused a significant flare after over a year with it under control (r/psoriasis) Thanks for asking this! I've been wondering if folks have flared from the vaccine as well (r/psoriasis) This is about the vaccine not Psoriasis. Seen lots of side effects being posted but have not seen any definitive proof that its related to Psoriasis
Positive	771 (87.8)	302 (60.3)	(r/psoriasis) I had my 2nd shot last week and am doing fine. Don't worry! (r/psoriasis) all good after i took my first shot
Second-order Theme			
No change to psoriasis	752 (85.7)	243 (48.5)	(FB_Psoriasis) Both shots. No problems/changes
Skin/joint flare up	57 (6.5)	164 (32.7)	(FB_Psoriasis) Pfizer! No impact on my psoriasis or PSA. Get vaccinated! (FB_Psoriasis) Yes mine has flared after been clear for 7 years (FB_Psoriasis) I've had both doses of AZ and had a bad flare up
Skin flare up attributed to stopping psoriasis medications	1 (.1)	5 (1)	(r/psoriaticarthritis) However the worst thing was with holding my biologic for 2 weeks before and 2 weeks after. I Was a mess. Full on flare
Skin/joint improvement	25 (2.9)	26 (5.2)	(r/psoriasis) I stopped taking otezla on my own for 3 weeks...After the discontinuation and the immunization (pfizer covid vaccine) my psoriasis went crazy
Skin flare up, vaccine worth it	4 (.5)	13 (2.6)	(r/psoriasis) I recently got my first Pfizer shot and my psoriasis gets better (FB_Psoriasis) I had Pfizer and my psoriasis is doing good, little better than normal actually (r/psoriasis) Mine got worse. Still 100% worth it
Other non-dermatological side effects	18 (2.1)	32 (6.4)	(r/psoriasis) I honestly feel like it also made me flare too. I don't regret it tho, my sister is having a baby soon and all I want in life is to hold that baby (FB_Psoriasis) Headache for the last 3 days 2nd shot Pfizer and the first night sweat and nauseous. Terrible experience
Allergic to the vaccine	3 (.3)	4 (.8)	(r/psoriasis) Just felt a wee bit tired for the rest of the week (r/psoriaticarthritis) Unfortunately I'm allergic to the COVID vaccine and I have other conditions that make me vulnerable to serious complications from COVID.
Question about other's reactions to the vaccine	18 (2.1)	14 (2.8)	(r/psoriaticarthritis) Anaphylaxis after dose 1 (FB_Psoriasis) How many people here have gotten the covid vaccine and how did it affect you? (r/psoriasis) I've been wondering if folks have flared from the vaccine as well
Total	878	501	

Table 4. Mean Engagement and Mean Sentiment Scores of 1379 Posts Within First-Order Theme of Vaccine Reaction.

	Mean Sentiment Score	95% CI	P-value	Mean Engagement Score	95% CI	P-value
Second-order theme ^a	.97	.96-.98	P < .0001	1.27	1.11-1.43	P < .0001
No change to psoriasis	-.17	-.25--.08		3.46	2.75-4.17	
Skin/joint flare up	-.33	-.88--.21		1.83	1.40-2.26	
Skin flare up attributed to stopping psoriasis medications	.92	.85-.10		4.80	1.72-7.88	
Skin/joint improvement	1	—		2.82	1.55-4.10	
Skin flare up, vaccine worth it	-.06	-.25-.13		2.7	1.48-3.92	
Other non-dermatological side Effects	-.29	-.74-.17		2.14	.90-3.39	
Allergic to the vaccine	0	—		19.94	8.85-31.02	
Question about other's reaction to the vaccine	.84	.81-.87	P < .0001	1.23	.79-1.67	P < .0001
Social media platform ^a	.49	.43-.55		4.07	3.52-4.63	
Facebook						
Reddit						

^aP < .05, significant differences observed between mean engagement and mean sentiment score when stratified by social media platform (results of two-sample t-test); significant differences observed between mean sentiment scores within second order themes (results of one-way ANOVA test).

Published Guidelines

The National Psoriasis Foundation (NPF) COVID-19 Task Force and the International Psoriasis Council (IPC) have both published recommendations to provide guidance for the treatment of patients with psoriatic disease and to promote optimal management of psoriatic disease during the pandemic.²⁶⁻²⁹

The NPF recommends that patients who are not infected with COVID-19 continue their biologic or oral therapies in most cases. Per the IPC, emerging data from epidemiological studies do not appear to show increased risk of or poorer outcome to COVID-19 due to psoriasis treatments. The NPF recommends patients receive an mRNA-based SARS-CoV-2 vaccine as soon as it becomes available to them, unless contraindicated. Systemic psoriatic medications are not a contraindication. Patients should continue their systemic treatments when obtaining the mRNA-based SARS-CoV-2 vaccine. Lastly, all psoriasis patients should be encouraged to obtain the booster vaccine. Joint-decision making between the patient and their physician is key.

Vaccination Decision Concerns

Despite studies showing that all SARS-CoV-2 vaccines have high efficacy against the original virus strain and variants and were well tolerated overall, vaccine hesitancy remains a challenge to fighting the pandemic.^{30,31} Our study shows that this hesitancy persists in the psoriasis community as well, in spite of the published, evidence-based guidelines mentioned above. Our analysis of publicly available posts in Reddit and Facebook found that the most commonly encountered apprehensions regarding getting the SARS-CoV-2 vaccine amongst psoriasis patients were fear of a psoriasis flare up, concerns that the vaccine is experimental because it was developed too quickly, and thoughts that the vaccine is dangerous with potentially life-threatening side effects (such as clotting). Other less common concerns were that the vaccine was unnecessary due to natural immunity from previous COVID-19 infection and that their current anti-psoriatic therapies (biologics, methotrexate) would predispose them to a worse reaction to the vaccine or would prevent them from having an efficacious response to the vaccine.

Concerns with the highest mean engagement scores include fear of psoriasis flare up and that the vaccination is dangerous. Based on these scores, it can be inferred that these 2 concerns were the amongst the most discussed concerns online or that patients found these themes to be the most relevant to their own decision making. Based on the current evidence, patients with immune-mediated inflammatory diseases are at no greater risk of harm from the SARS-CoV-2 vaccine compared to healthy controls.³² For most, the theoretical risk of these vaccines is outweighed by the definite risk of severe COVID-19 infection if unvaccinated.

The circulating ideas that the SARS-CoV-2 vaccines are experimental, dangerous, and cannot be trusted are a misconception. In reality, these vaccines were able to be developed at such a rapid rate for many reasons, including the fact that the technology used had been in development for years, genetic information about COVID-19 was shared promptly, an overlapping schedule was used to conduct multiple steps simultaneously in order to gather data faster, and governments had invested in research, allowing for plenty of resources for vaccine projects.³³ An October 2021 study analyzing 19 SARS-CoV-2 vaccines found mRNA vaccines to be very effective and well tolerated.³⁰ Among adults, the main severe adverse events reported were rare and included anaphylaxis (2.5–4.8 cases per million doses) and myocarditis (6–27 cases per million). While it is true that natural infection with the virus produces some level of immunity, a study published in August 2021 suggested that the odds of reinfection in patients who were previous infected with COVID-19 was more than twice for those who were not vaccinated than those who were vaccinated.³⁴ Furthermore, it is not known how long a person is protected for with natural immunity. Data is limited with regards to the impact of biologic therapy on SARS-CoV-2 vaccine immune response. A few studies have found the most significant reduction in antibody response in patients receiving B-cell-depleting therapies, such as rituximab, when compared to other biologics and disease-modifying antirheumatic drugs.^{35,36}

Vaccine Reaction Concerns

While a majority of the posts regarding vaccine reaction reported no change to their psoriasis, 16% reported skin and/or joint flare ups and 3.6% reported other non-dermatological side effects. Both the mRNA vaccines and the adenovirus vector vaccines use technology that causes production of the SARS-CoV-2 spike protein antigen and generation of a robust T-cell-mediated immune response.³⁷ In addition to these mechanisms of upregulating a directed immune response, vaccines also contain an adjuvant that activates the innate immune system. These adjuvants cause production of type I interferons,³⁸ which are known to flare autoimmune disease. Although vaccine developers have employed modifications to reduce interferon activation and reduce risk of flare,^{39,40} it is possible that this is what is contributing to the proportion of Facebook and Reddit users reporting flares.

Educational Efforts

Understanding the apprehensions to receiving the vaccine provides a framework and guide for vaccine educational efforts. Social media has the potential to considerably influence patients' perspectives about their health and the decisions they make. Therefore, it is crucial that dermatologists understand what the most common concerns amongst psoriasis patients are in order to promote vaccine confidence and ensure that all eligible patients receive the vaccine.

Dermatologists should keep in mind the safety profile and possible side effects of the vaccine, as well as the guidelines regarding the SARS-CoV-2 vaccine and psoriatic therapies, when educating their patients on the importance of being vaccinated. Dermatologists should also be mindful that there are those who believe the vaccine only benefits the person receiving the vaccine. Therefore, it may be helpful to incorporate discussions about herd immunity into the vaccine decision making.⁴¹ Lastly, in regards to concerns about efficacy of immune response to the vaccine while on immunomodulatory drugs, there is not enough evidence currently available. Patients should be encouraged to wait the minimum 2 weeks after their final dose to consider themselves fully vaccinated as antibody titers may be slower to reach their peak in this subset of patients.³² The third booster dose may be an important consideration in these patients. Further investigation needs to be done on whether patients on immunomodulating therapies require alternative regimens to achieve an adequate immune response.³²

It is important that dermatologists are aware that negative reactions, including skin/joint flares, are being reported on Facebook and Reddit as these reports may be dissuading other patients from obtaining the vaccine. Additionally, reaction themes with the highest average engagement scores included skin/joint flare up and skin/joint improvement, indicating that patients found these reported reactions helpful. Dermatologists should continue to recommend the vaccine as a key source of disease prevention, stressing the importance of getting the vaccine for the protection of themselves and safety of those around them. They should also reassure patients that the vaccines are generally well-tolerated and that there are mechanisms in place by the vaccine developers to mitigate the risk of flare. Furthermore, 1 way to address the fear of a flare up is to make patients cognizant of the fact that infection with COVID-19 can induce a flare up. Lastly, there were social media users who attributed their psoriasis flare up to stopping their systemic therapies. Clinicians should encourage patients to remain on their medications when getting the vaccine, according to NPF guidelines.

Furthermore, it is unclear whether patients know that expert generated guidelines exist. Although many online participants are turning to Facebook and Reddit for guidance on vaccination, there are few posts and comments that reference the NPF or IPC guidelines. These physician-backed recommendations will be helpful for psoriasis patients to turn to for evidence-based guidelines on how their disease and treatments affect COVID-19 risk, what they can do to stay safe during the pandemic, how their disease management can be best optimized, and what they should do if they contract the virus. This will be especially important for patients who have limited access to a dermatologist. It may be helpful for physicians or the NPF/IPC to post the recommendations within the social media feeds as a public health intervention.

The results of this study elucidate the utility in analyzing social media interactions to guide educational efforts. Studies

analyzing social media provide insight on what questions patients have and therefore, what content is important for physicians to focus on. It also sheds light on the form of education that may be most effective for educating the general public. Through Facebook and Reddit analysis, we gained a deeper understanding on what specific concerns patients have regarding the SARS-CoV-2 vaccine and the potential barriers to vaccination that the public experiences. Patient engagement is crucial for effective education and social media provides an effective platform on which physicians can virtually meet and interact with patients to provide evidence-based information. As more patients turn to the internet and social media for medical advice, it is important that physicians meet patients where they are at and expand their social media presence to prevent the dissemination of inaccurate information.

One limitation of this study is that social media users may not be fully representative of the overall psoriasis population. In addition, only publicly available Facebook groups and subreddits were analyzed, which may not encompass the entirety of online perception. Lastly, psoriasis diagnosis is self-reported by social media users and therefore may be subject to misclassification.

Posts and comments within the online social media platforms Facebook and Reddit regarding the SARS-CoV-2 vaccine provide insight into the specific concerns of psoriasis and psoriatic arthritis patients. Common topics of discussion observed through content analysis centered around the reasons for not getting the vaccine. These included fear of psoriasis flare up, concerns that the vaccine is experimental, and concerns that the vaccine is dangerous. Other areas of apprehension for patients were the overall reaction to the vaccine, including psoriasis skin and/or joint flare up. Awareness of theme, sentiment, and engagement analysis may help physicians understand the reasons why their psoriasis patients are choosing not to get vaccinated and aid physicians in formulating ways to encourage their patients to get vaccinated. Information learned from these analyses should be used to supplement patient counseling to guide education efforts, alleviate vaccination concerns, and improve public response to the vaccine to keep patients safe and control the COVID-19 pandemic.

Declaration of Conflicting Interests

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