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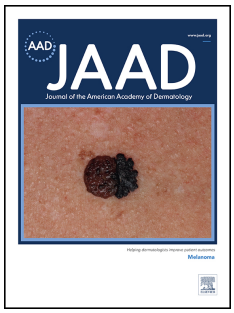

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Cutaneous Reactions Reported after Moderna and Pfizer COVID-19 Vaccination: A Registry-Based Study of 414 Cases

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Ethics: The registry was reviewed by the Partners Healthcare (MGH) Institutional Review Board (IRB) and was determined to not meet the definition of Human Subjects Research.

Capsule Summary

- Across 414 cutaneous reactions to the mRNA COVID-19 vaccines in our registry, the most common morphologies were delayed large local reactions, local injection site reactions, urticaria, and morbilliform eruptions.
- Less than 50% of patients with cutaneous reactions after the first dose experienced second dose recurrence. None reported serious adverse events.

Abstract

Background: Cutaneous reactions after mRNA-based COVID-19 vaccines have been reported but are not well characterized.

Objective: To evaluate morphology and timing of cutaneous reactions after mRNA COVID-19 vaccines.

Methods: A provider-facing registry-based study collected cases of cutaneous manifestations after COVID-19 vaccination.

Results: From December 2020-February 2021, we recorded 414 cutaneous reactions to mRNA COVID-19 vaccines from Moderna (83%) and Pfizer (17%). Delayed large local reactions were most common, followed by local injection site reactions, urticarial eruptions, and morbilliform eruptions. Forty-three percent of patients with first dose reactions experienced second dose recurrence.

Limitations: Registry analysis does not measure incidence. Morphologic misclassification is possible.

Conclusion: We report a spectrum of cutaneous reactions after COVID-19 mRNA vaccines. Most patients with first dose reactions did not develop a second dose reaction, and no patients in the registry developed serious adverse events after the first or second dose. These data provide reassurance to patients and providers.

Background

In December 2020, the Food and Drug Administration (FDA) issued Emergency Use Authorizations (EUAs) for Pfizer/BioNTech (BNT162b2) and Moderna (mRNA-1273) COVID-19 vaccines.

Clinical trials for both vaccines reported local injection site reactions and systemic symptoms commonly after both doses.[1, 2] Moderna additionally noted delayed injection site reactions (on/after Day 8) in 244 participants (0.8%) after first dose and in 68 participants (0.2%) after second dose.[1] Moderna's trial also described vesicular, urticarial, exfoliative, and maculopapular rashes, as well as facial swelling after cosmetic filler injections.[1] However, trials did not fully characterize cutaneous reactions and did not describe whether subjects with reactions after the first dose also had reactions with the second.

Given the importance of widespread vaccination in curbing the pandemic, we aimed to collect cases of cutaneous side effects to the mRNA COVID-19 vaccines to i) describe the morphology and timing of cutaneous reactions to the Pfizer and Moderna vaccines and ii) understand differences in cutaneous reactions between the two vaccine doses to guide vaccine counseling.

Methods

Our international registry of cutaneous manifestations of SARS-CoV-2, established in March 2020 as a collaboration between the American Academy of Dermatology and International League of Dermatological Societies, expanded to collect COVID-19 vaccine cutaneous reactions on December 24 2020 shortly after FDA EUAs (www.aad.org/covidregistry).[3] Case entry in the registry was open to healthcare workers only. Collected data were de-identified.

The vaccine registry collected dates for both doses, morphology of cutaneous reaction(s), timing and duration of reaction(s), and treatments. We defined local site reactions as occurring within 3 days of first dose vaccination and delayed large local reactions as 4 or more days after first vaccination. A wheal at the vaccine site was considered an immediate or delayed large local reaction depending on timing.[4] Conversely, we defined urticarial reactions as wheals in a distribution beyond the injection site.

We only included cutaneous reactions reported after vaccination with FDA-approved Pfizer or Moderna mRNA vaccines, which at the time of analysis were being administered mostly to healthcare workers and elderly patients. Both vaccines require two doses 3-4 weeks apart. All respondents who only entered a cutaneous reaction to the first vaccine dose were sent a follow-up email to solicit the presence/absence of a cutaneous reaction to the second vaccine dose. We contacted providers who entered partially completed records to

complete all fields. We excluded records where the provider was ultimately unable to provide key variables, e.g. vaccine brand or which vaccine dose the patient reacted to. We used Stata (Version 16) to descriptively analyze data. The Massachusetts General Brigham (MGB) Institutional Review Board exempted this study as not Human Subjects Research.

Results

From December 24 2020-February 14 2021, 414 unique patients reported one or more cutaneous reactions to Moderna (83%) or Pfizer (17%) COVID-19 vaccines (Figure 1). Patients were median age 44 (IQR 36-59), 90% female, 78% white, and primarily from the United States (98%) (Table 1). Cases were reported by dermatologists (30%), other physicians (26%), mid-level practitioners (8.8%), nurses (13%), and other healthcare workers (22%).

Of 414 records, information about both vaccine doses was available for 180 (43% of cases). Of these, 38/180 (21%) reported reactions after the first dose only, 113/180 (63%) reported a reaction after the second dose only, and 29/180 (16%) reported reactions to both doses (Supplemental Figure 1). Therefore, 29 of 67 patients (43%) of patients who had a cutaneous reaction to the first dose also had a cutaneous reaction to the second dose. Of these 29 patients who reported reactions after both doses, 8 (28%) reported similar reactions to both doses, 8 (28%) reported a lesser reaction to second dose, and 13 (45%) reported a more robust reaction to second dose (Figure 2).

There were 343 unique reports of cutaneous manifestations after Moderna vaccination, including 267 reported after first dose and 102 reported after second dose. The most common cutaneous reactions were delayed large local reactions (n=175 first; n=31 second dose), local injection site reaction (n=117 first; n=69 second), urticaria (n=16 first; n=7 second), morbilliform (n=11 first; 7 second) and erythromelalgia (n=5 first; n=6 second) (Table 2). For 215/343 patients (63%), only reactions to the first dose were recorded. Of these, 203 (94%) planned to receive the second dose and 12 (5.6%) were not planning to receive the second dose due to concerns regarding their first dose cutaneous reactions. Of those who reported information for both doses (n=130), 28 (22%) reported a reaction to first dose only, 76 (58%) reported a reaction to second dose only, and 26 (20%) reported reactions to both doses.

There were 71 reports of Pfizer vaccine cutaneous manifestations, including 34 after first dose and 40 after second dose. Most common were urticaria (n=8 first; n=6 second dose), local injection site reaction (n=8 first; n=8 second), and morbilliform rash (n=6 first; n=3 second). For 21/71 (30%) cases, only reactions to the first

dose were recorded. These included patients who were planning to receive their second dose (n=12) and patients not planning to receive their second dose (n=4) due to concerns regarding their first cutaneous reactions. Of 50 patients with information entered for both Pfizer doses, 10 (20%) reported reactions after the first dose only, 37 (74%) after the second dose only, and 3 (6.0%) had cutaneous reactions after both doses.

Of the 414 records, 350 (85%) had timing information. Median time from first vaccination to onset of cutaneous symptoms was 7 days (IQR 2-8), which occurred in two clusters, one between day 1-3 and the other between day 7-8 (Figure 3). The majority of timing data came from patients with reactions on the vaccinated arm only, with local injection site reaction occurring median 1 day (IQR 0-1) and delayed large local reactions occurring median 7 days (IQR 7-8) after vaccination (Supplemental Table 1). Median time from second dose vaccination to cutaneous symptom onset was shorter, occurring at day 1 (IQR 1-2). No urticaria or angioedema reports after the first dose were immediate in onset; all came after one day or more. Of 18 patients who reported urticaria after their first vaccine dose for which information about their second vaccine dose was entered, only 4 (22%) developed urticaria after their second dose with most (n=3) reporting more widespread urticaria.

Delayed large local arm reactions occurred primarily after Moderna vaccination (94%) median 7 days (IQR 7-8) after first vaccine and lasted median 4 days (IQR 3-6) (Figure 3). The reaction occurred more quickly after the second vaccine dose at median 2 days (IQR 1-3) and lasted median 3 days (IQR 2-5). For patients who had delayed large local reactions after both doses (n=11), 3 (27%) had a larger reaction with the second dose. A smaller group of patients who did not develop any cutaneous reaction after the first vaccine dose developed delayed large local reaction to the second (n=23), which occurred a median of 2 days (IQR 1-3) after second vaccination. 116/207 (56%) of patients with delayed large local reactions also had local site injection reactions.

Less common reports of other cutaneous findings with both vaccines included 9 reports of swelling at the site of cosmetic fillers, 8 pernio/chilblains, 10 varicella zoster, 4 herpes simplex flares, 4 pityriasis rosea-like reactions and 4 rashes in infants of vaccinated breastfeeding mothers.

Discussion

In this registry-based study, we characterized the morphology and timing of cutaneous reactions for the novel Moderna and Pfizer mRNA COVID-19 vaccines. We observed a broad spectrum of reported reactions after vaccination, from local injection site reactions and delayed large local reactions, to urticaria and morbilliform eruptions, to more unusual reactions such as erythromelalgia, pernio/chilblains, filler reactions, and pityriasis-rosea-like eruptions. Among 67 patients with cutaneous findings after the first dose and where information on both

doses was available, only 29 (43%) developed cutaneous symptoms after the second dose. This analysis should provide reassurance to healthcare providers counseling patients who had a cutaneous reaction after first dose of Moderna or Pfizer vaccine regarding their second dose, as there were no cases of anaphylaxis or other serious adverse events.[5]

The most commonly reported cutaneous finding after vaccine administration was delayed large local reaction, median 7 days after the first vaccine dose, primarily after Moderna (95%). Second dose delayed reactions generally occurred more quickly (Day 2), and were generally lesser. Similarly, the Moderna clinical trial described 0.8% participants who developed delayed large local reactions after day 8 from the first dose and only 0.2% of participants with the second dose, but did not link the reactions from one dose to another, and thus would have missed detecting if patients reacted more quickly to the second dose.[1, 6] Rarely, delayed-type hypersensitivity reactions have been described after vaccination with symptoms such as large localized swelling, skin nodules and/or induration. These reactions, thought to be T-cell-meditated, have been attributed to ingredients such as neomycin or thimersol and have not been considered a contraindication to subsequent vaccination.[4] Although the etiology of these Moderna delayed large local reactions is unclear, a delayed type hypersensitivity reaction to the excipient polyethylene glycol is one potential etiology.[6]

In our registry, there were no severe sequelae identified after the second dose in patients experiencing a delayed large reaction after the first dose. Patients responded well to topical corticosteroids, oral antihistamines, and/or pain-relieving medications. These reactions resolved after a median of 3-4 days. Antibiotics were not required for resolution but were sometimes given by providers concerned that the reaction might be cellulitis, as reported elsewhere.[7] Taken together, these data provide reassurance to clinicians tasked with counseling patients who experience a delayed cutaneous arm reaction after their first Moderna dose that i) patients tolerated the second dose without developing severe adverse or allergic events, ii) the rash may recur the second time but is, on average, likely to be less severe and may develop faster, and iii) symptomatic therapies (e.g. ice/pain-relief/antihistamines/topical corticosteroids) can be used for treatment without antibiotics.

We additionally observed reactions to Moderna and Pfizer vaccines that had been noted after SARS-CoV-2 infection itself, including pernio/chilblains (e.g., “COVID toes”), erythromelalgia, and pityriasis-rosea-like exanthems.[3, 8, 9] That these exanthems mimic dermatologic manifestations of COVID-19 potentially suggests that a) the host immune response to the virus is being replicated by the vaccine and b) some components of these dermatologic manifestations of the virus are likely to be from immune response to the virus rather than direct viral

effects.[10, 11] Erythromelalgia and pityriasis rosea have been noted in response to other vaccines such as those for influenza and hepatitis B, although uncommonly.[12-14]

We additionally identified rare patients with facial swelling after both Moderna and Pfizer vaccines associated with prior use of injectable cosmetic filler. This phenomenon was similarly described in 3 subjects in Moderna trial reporting; Pfizer did not report any cases.[1] These reactions may represent delayed hypersensitivity to filler following introduction of an immunologic trigger,[15] and have been previously noted after other viral illnesses[16] and influenza vaccines.[1, 17]

It is important to distinguish immediate hypersensitivity reactions, defined by the CDC as including pruritus, urticaria, flushing, angioedema occurring within the first four hours of an injection, from similar reactions that occur >4 hours after injection.[18] This distinction is particularly relevant for urticaria and angioedema, which are potential contraindications for a second vaccine dose.[18] Although this registry captured time between vaccination and skin reaction in days rather than hours, none of the first dose urticaria reports or angioedema reports occurred on the day of vaccination, and therefore would not be classified as immediate hypersensitivity. Of the 18 urticaria reports where information was available for both vaccine doses, only 4 had urticaria with their second dose, and none reported anaphylaxis, which should provide reassurance regarding patients who develop urticaria >4 hours after vaccination. Importantly, allergic cutaneous symptoms reported in this study, such as urticaria, angioedema, and/or morbilliform eruptions, may not be caused by allergy to the vaccine but instead related to host immune response or an immunologic reaction to nonsteroidal anti-inflammatory agents commonly taken for pain and fever after vaccination.

Another limitation of this registry analysis includes incomplete record follow-up. Since providers only enter data at one point in time, patients have differential lengths of follow-up. To overcome this, we reached out via email to all providers after such patients received second doses; nevertheless, we still mostly report information regarding first vaccine dose reactions. Reporting on the second vaccine dose may be more common when there are symptoms (rather than no reaction) to report. As such, this reporting bias might result in our study demonstrating a “worst case scenario” for the second dose. Still, less than half of patients had recurrence with the second dose. An additional limitation is that the morphology description of vaccine reactions is provider-dependent. Future studies are needed to classify morphologies with objectively classifiable clinical images and histopathologic evaluation.

We are unable to measure incidence of cutaneous reactions to COVID-19 vaccination through a registry-based study, which lacks a denominator. There may be confirmation bias, as providers were more likely to enter

cases with severe or rare manifestations. The registry noted 343 reactions from the Moderna vaccine and only 71 from the Pfizer vaccine, but it will require further population level data to understand if this is a true difference or related to reporting bias. As of February 22 2021, 53% of allocated vaccine doses in the United States were Moderna and 47% Pfizer.[19, 20]

Ninety percent of vaccine reactions were reported in female patients. It is difficult to assess if there is a true sex difference in likelihood of developing a cutaneous reaction, or whether it might reflect reporting bias, or stem from the healthcare workforce being 76% female.[21] Further, vaccine reactions in this registry were primarily in white (78%) patients, which highlights important concerns about disparities in vaccine access, healthcare access after experiencing a potential side effect, differential likelihood of reporting to the registry, and/or recognition of skin reactions by healthcare providers in patients with skin of color.[22, 23] Patients were primarily located in the United States (97%); at this time, there were no reports in the registry of cutaneous reactions from patients in low and middle income countries, raising attention to global inequities in COVID-19 vaccine access.[24]

We characterize a spectrum of cutaneous reactions reported with novel mRNA vaccines for COVID-19. Certain dermatologic findings echo prior vaccine hypersensitivity knowledge, while newer findings, such as the delayed large local reactions to the Moderna vaccine and filler reactions may suggest new immunologic mechanisms. Pernio/chilblains post-vaccine may suggest an immunologic connection to infection with SARS-CoV-2.[8, 9] Overall, our data support that cutaneous reactions to COVID-19 vaccination are generally minor and self-limited, and should not discourage vaccination.[1, 2] Presence of a cutaneous reaction to the first vaccine dose, when it appears >4 hours after injection, is not a contraindication to receiving the second dose of the Pfizer or Moderna. No patients with these findings experienced anaphylaxis or another severe adverse event. Healthcare workers must be aware of these potential vaccine reactions and advise patients accordingly. Counseling patients about potential benefits to receiving a COVID-19 vaccine is equally, if not more, important.

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Table 1: Characteristics of cutaneous reactions reported after Moderna or Pfizer COVID-19 vaccination

	Moderna Vaccine Unique Reports N(%) (n=343)	Pfizer Vaccine Unique Reports N(%) (n=71)	Total Unique Reports N (%) (n=414)
Reporter Title			
Dermatologist	96 (28)	30 (42)	126 (30)
Other Physician	79 (23)	29 (41)	108 (26)
Physician Assistant	10 (2.9)	1 (1.4)	11 (2.6)
Nurse Practitioner	24 (6.9)	2 (2.8)	26 (6.2)
Nurse	49 (14)	5 (7.0)	54 (13)
Other medical professional	85 (25)	4 (5.6)	89 (21)
Patient Age (Median, IQR)	45 (36-60)	42 (36-54)	44 (36-59)
Patient Sex (Female)	314 (92)	60 (85)	374 (90)
Patient Race/Ethnicity			
White	265 (77)	57 (80)	323 (78)
Asian	38 (11)	8 (11)	46 (11)
Black/African American	8 (2.3)	2 (2.8)	10 (2.4)
Hispanic/Latino	27 (7.9)	4 (5.6)	31 (7.5)
Unknown	4 (1.2)	0	4 (1.0)
Patient Country			
United States	337 (99)	66 (93)	403 (98)
Canada	2 (0.58)	1 (1.4)	3 (0.7)
Germany	1 (0.3)	1 (1.4)	2 (0.5)
Israel	-	1 (1.4)	1 (0.2)
Italy	-	1 (1.4)	1 (0.2)
United Kingdom	-	1 (1.4)	1 (0.2)
Puerto Rico	1 (0.3)	-	1 (0.2)
Guam	1 (0.3)	-	1 (0.2)
Prior SARS-CoV-2 infection			
No	272 (79)	46 (65)	318 (77)
PCR+	7 (2.0)	4 (5.6)	11 (2.7)
Antibody+	2 (0.6)	2 (2.8)	4 (1.0)
Laboratory+ but type unknown	1 (0.3)	0	1 (0.2)
Clinical suspicion only	10 (2.9)	2 (2.8)	12 (2.9)
Unknown	51 (15)	17 (24)	68 (16)
Past Dermatologic History			
None	296 (86)	53 (75)	349 (84)
Atopic dermatitis	12 (3.5)	5 (7.0)	17 (4.1)
Contact dermatitis	10 (2.9)	2 (2.8)	12 (2.9)
Psoriasis	6 (1.7)	3 (4.2)	9 (2.2)
Urticaria	5 (1.5)	2 (2.8)	7 (1.7)
Acne vulgaris	4 (1.2)	2 (2.8)	6 (1.4)
Other	10 (2.9)	4 (5.6)	14 (3.4)
Vaccine Allergy History			
None	316 (92)	64 (90)	380 (92)
Prior local site reaction	11 (3.2)	2 (2.8)	13 (3.1)
Prior urticaria	2 (0.6)	0	2 (0.5)
Other	3 (0.9)	1 (1.4)	4 (1.0)
Unknown	12 (3.5)	4 (5.6)	16 (3.9)
Past Medical History			
None	210 (61)	46 (65)	256 (62)
Hypertension	55 (16)	8 (11)	63 (15)
Obstructive lung disease	18 (5.2)	2 (2.8)	20 (4.8)
Morbid obesity	14 (4.1)	3 (4.2)	17 (4.1)
Diabetes mellitus	14 (4.1)	1 (1.4)	15 (3.6)
Cardiovascular disease	8 (2.3)	2 (2.8)	10 (2.4)
Rheumatologic disease	6 (1.7)	4 (5.6)	10 (2.4)
Malignancy	5 (1.5)	3 (4.2)	8 (1.9)
Other	29 (8.5)	11 (15)	40 (10)
Unknown	18 (5.2)	1 (1.4)	19 (4.6)

Table 2: Dermatologic findings reported after the Pfizer or Moderna COVID-19 vaccines. Patients who reported dermatologic findings after both vaccine doses are counted in both the first dose and second dose columns (n=29).

Characteristic	Moderna First Dose (n=267) N(%)	Moderna Second Dose (n=102) N(%)	Pfizer First Dose (n=34) N(%)	Pfizer Second Dose (n=40) N(%)
Cutaneous Reactions[†,*]				
Delayed large local reaction	175 (66)	31 (30)	5 (15)	7 (18)
Local Injection Site Reaction	143 (54)	71 (70)	8 (24)	10 (25)
Swelling	117 (44)	69 (68)	6 (18)	6 (15)
Erythema	132 (49)	68 (67)	6 (18)	8 (20)
Pain	94 (35)	60 (59)	8 (24)	7 (18)
Urticaria within 24 hours	0	2 (2.0)	0	1 (2.5)
Urticaria after 24 hours	13 (4.8)	5 (4.9)	9 (26)	7 (18)
Urticaria unknown timing	3 (1.1)	0	0	0
Morbilliform	11 (4.1)	7 (6.9)	6 (18)	3 (7.5)
Erythromelalgia	5 (1.9)	6 (5.9)	1 (2.9)	2 (5.0)
Flare of existing dermatologic condition**	3 (1.1)	1 (1.0)	8 (24)	3 (7.5)
Vesicular	4 (1.5)	1 (1.0)	3 (8.8)	2 (5.0)
Pernio/chilblains	3 (1.1)	0	3 (8.8)	2 (5.0)
Zoster (VZV)	5 (1.9)	0	1 (2.9)	4 (10)
Angioedema	5 (1.9)	0	0	1 (2.5)
Pityriasis rosea	1 (0.4)	0	2 (5.9)	1 (2.5)
Erythema multiforme	3 (1.1)	0	0	0
Filler reaction	3 (1.1)	5 (4.9)	0	1 (2.5)
Vasculitis	2 (0.7)	0	1 (2.9)	0
Contact dermatitis	3 (1.1)	1 (1.0)	0	2 (5.0)
Reaction in breastfed infant	0	1 (1.0)	2 (5.9)	1 (2.5)
Onset of new dermatologic condition***	2 (0.7)	0	0	2 (5.0)
Petechiae	1 (0.4)	2 (2.0)	1 (2.9)	0
Other[‡]	7 (2.6)	8 (7.8)	2 (5.9)	3 (7.5)
Systemic Reactions in Patients Reporting Cutaneous Reactions				
Fatigue	58 (22)	63 (62)	11 (32)	13 (33)
Myalgia	55 (21)	63 (62)	10 (29)	10 (25)
Headache	46 (17)	54 (53)	9 (26)	6 (15)
Fever	18 (6.7)	42 (41)	4 (12)	4 (10)
Arthralgia	16 (6.0)	28 (27)	5 (15)	8 (20)
Nausea	15 (5.6)	28 (27)	4 (12)	3 (7.5)
Chills	14 (5.2)	47 (46)	4 (12)	5 (13)
Lymphadenopathy	13 (4.9)	9 (8.8)	2 (5.9)	3 (7.5)
Diarrhea	9 (3.4)	4 (3.9)	1 (2.9)	0
Other[¶]	10 (3.7)	10 (10)	4 (12)	1 (2.5)

[†] Providers were able to check off multiple dermatologic conditions in each patient

[*] A subset of patients reporting vaccine reactions had prior laboratory confirmed SARS-CoV-2 infection, including 11 who were PCR+ and 4 who were antibody+. Cutaneous reactions for these patients included local injection site reactions (n=5), delayed large local reactions (n=3), urticaria (n=2), morbilliform eruption (n=1), pernio/chilblains (n=1), erythromelalgia (n=1), erythema multiforme (n=1), pityriasis rosea (n=1), and reaction in breastfed infant (n=1).

**Includes flare of herpes simplex virus (n=4), atopic dermatitis (n=2), psoriasis (n=2), urticarial vasculitis (n=1), and unspecified eczema (n=2)

***Includes Raynaud's (n=2), lichen planus (n=1) and unspecified eczema (n=1)

[‡] Other cutaneous first dose reactions included full body skin pain/burning (n=2), hypopigmentation (n=2), Sweet's-like fixed urticarial plaque (n=1), pseudovesiculated patches (n=2), and spongiotic dermatitis (n=1). Other cutaneous second dose reactions included canker sore on tongue (n=1), aphthous ulceration on labium (n=1), monomorphic papular eruption (n=2), eczematous pigmented purpura (n=1), spongiotic dermatitis (n=1), and full body skin pain/burning (n=2)

[¶] Other systemic reactions included vomiting (n=4 first dose; n=3 second dose), nasal congestion (n=4; n=3), arm tingling/numbness (n=2; n=1), syncope (n=1; n=2), dizziness (n=1; n=2), hot flashes (n=1 first dose only), metallic taste in mouth (n=1 first dose only), and hematuria (n=1 second dose only)

Figure 1: Timeline representing the time to onset and duration of the top five most common dermatologic findings reported after the Moderna and Pfizer COVID-19 vaccines. Circles represent median time to onset of the cutaneous reaction and lines represent median duration of the cutaneous reaction. See Supplemental Table 1 for detailed information about timing of vaccine reactions.

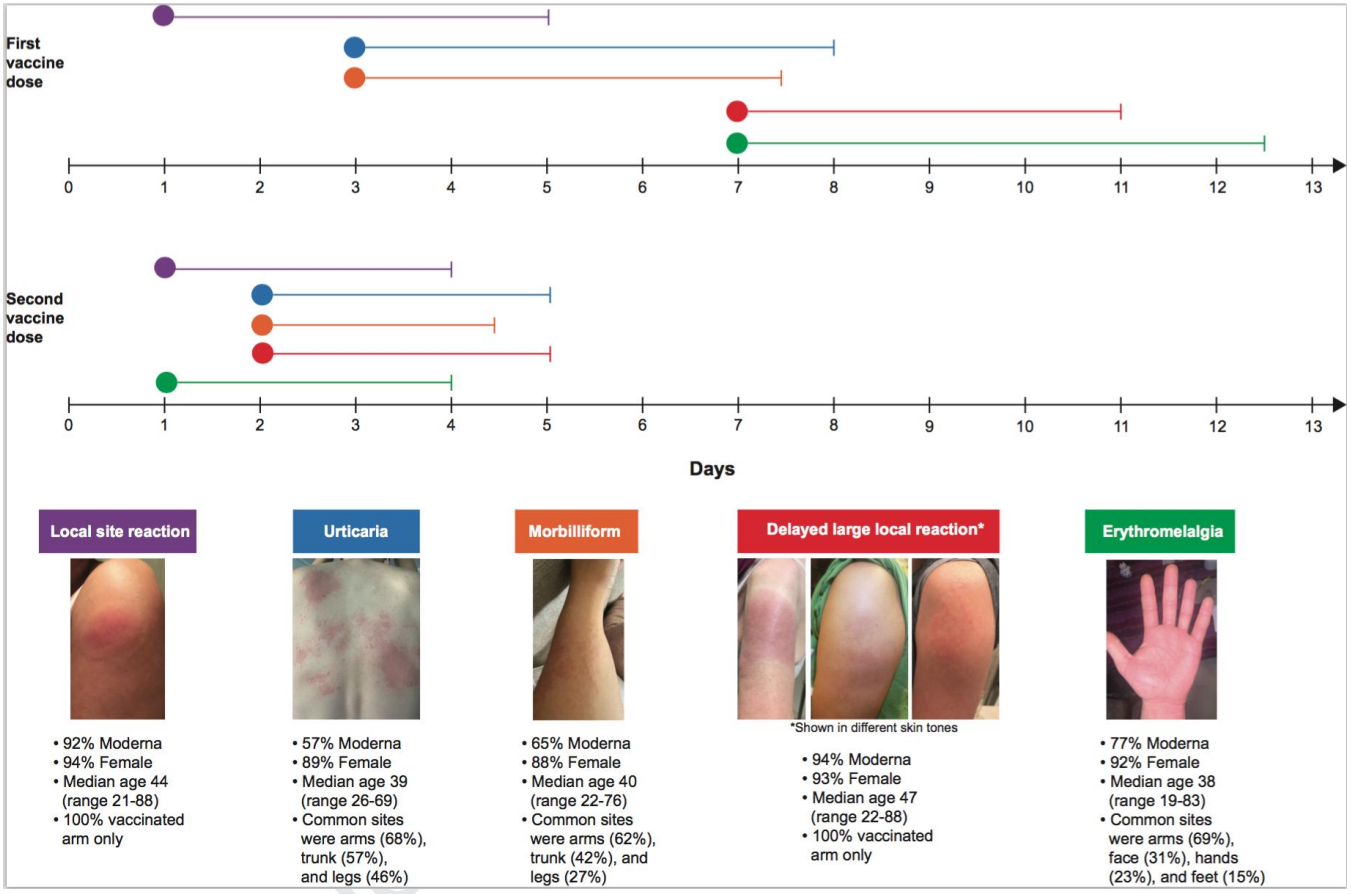
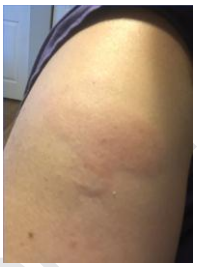
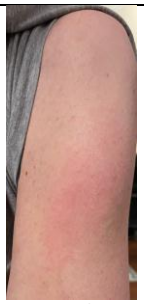
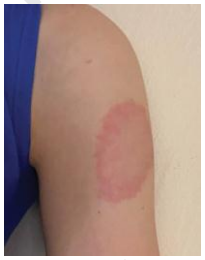
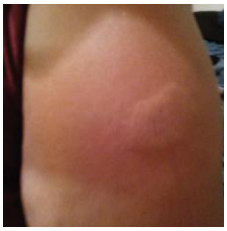
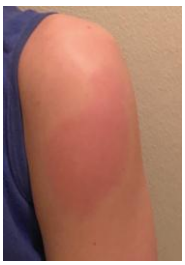
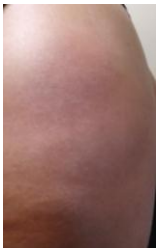
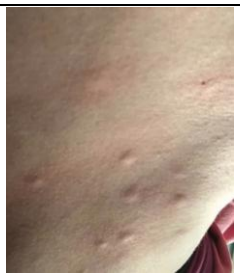
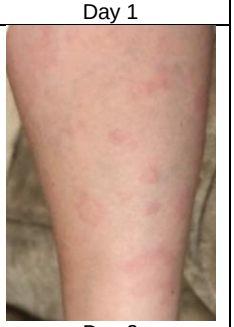


Figure 2: A depiction of the characteristics of the subset of patients who experienced the same dermatologic finding after both the first and second COVID-19 vaccine dose. No patient experienced anaphylaxis or another severe adverse event after the second COVID-19 vaccine dose.

	Number patients with reactions after both doses	% Moderna	% Larger reaction with second dose	Onset of reaction in days after first vaccine Median (IQR)	Onset of reaction in days after second vaccine Median (IQR)	Representative First Dose Photo	Representative Second Dose Photo
Local site injection reaction	21	95%	45%	1 (0-1)	1 (0-1)	 Day 1*	 Day 2*
Delayed large local reaction	11	100%	27%	7.5 (7-8)	2 (1-3)	 Day 8  Day 7	 Day 2  Day 1
Urticaria	4	75%	75%	2 (1-3)	0 (0-2)	 Day 2	 Day 2

*****Different patient photos are used for local site injection reaction photos. All other photos follow individual patients' reaction after vaccine dose 1 and dose 2.

Figure 3: Number of days from vaccination (Day 0) until development of cutaneous reaction after COVID-19 vaccine. Panel A and B show first and second dose dermatologic findings after Moderna (purple) or Pfizer (orange) vaccination. Panel C and D are restricted to patients who received Moderna and developed a rash on the vaccinated arm showing local symptoms (light blue) and delayed large local symptoms (dark blue). A – top left, B – top right, C – bottom left, D – bottom right