Received: 17 February 2021 | Accepted: 29 May 2021

DOI: 10.1111/dth.15014

ORIGINAL ARTICLE

DERMATOLOGIC THERAPY WILEY

Impact of treatment delays on vitiligo during the COVID-19 pandemic: A retrospective study

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Funding information
National Natural Science Foundation of China, Grant/Award Numbers: 81872544, 82073456

Abstract

Due to the COVID-19 pandemic, *routine* treatments are *delayed to some extent and their negative impacts have been widely reported*. However, virtually *nothing* is known about vitiligo in the context of COVID-19. Therefore, we analyzed treatment delays and its impact on vitiligo, aiming to provide suggestions on *vitiligo management within this special period*. We performed a retrospective cohort study on 322 patients who visited our clinics at least 2 times from January to December 2020, and their medical records and photographs were reviewed. Patients were divided into normal ($n = 155$) and late group ($n = 167$) based on whether experienced treatment delays. As for the active cases, the late group showed higher progression rate than normal group (35 of 86 [40.7%] vs. 10 of 81 [12.3%]; $p = 0.002$). Moreover, we observed higher recurrence rate in delay group than those of normal group (26 of 81[32.1%] vs. 9 of 74 [12.2%]; $p = 0.018$) among stable cases. Further univariate and multivariate analysis determined treatment delays as the most important independent risk factor for disease progression and recurrence, and maintenance therapy (>2 years) as a protective factor against recurrence. This study, for the first time, revealed the independent adverse *impact of* treatment delays on the progression and recurrence of vitiligo and indicated the significance of continuous treatment for halting progression and long-term maintenance therapy for preventing recurrence for vitiligo, which should be highly valued in the management of vitiligo during the COVID-19 pandemic.

KEYWORDS
COVID-19, progression, recurrence, treatment delays, vitiligo

1 | INTRODUCTION

The *COVID-19* pandemic is currently sweeping across the world and has contributed to 108,153,741 confirmed cases and 2,381,295 deaths globally by 14 February 2021.[1] The global healthcare system are *under* unprecedented *pressure*. Moreover, a series of interventions such as social distancing measures and mobility restrictions are implemented to contain the spreading of *COVID-19*.[2,3] Under the influence of multiple COVID-19 associated factors, health-seeking behaviors in the patients with non-COVID-19 related disease have also been influenced and delayed to some extent, imposing a huge burden on the management of chronic disease for physicians during this special period.[4–6] In response, the corresponding recommendations have been made based on available data to guide clinician judgments balancing the risks of potential *COVID-19* transmission and treatment delays in patients.[7,8]

In the context of *COVID-19* dermatology practice has also been inevitably compromised as *reported by* studies from various countries.[9–11] However, virtually *nothing* is known about vitiligo, a common chronic autoimmune cutaneous depigmenting disorder, requiring active treatment to halt progression,[12] maintenance therapy to prevent recurrence.[13] *These clinical characteristics of vitiligo may confer*

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greater risk of adverse outcomes in disease condition under the influence of treatment delays. Yet, there is no relevant literature assessing how treatment delays affect vitiligo outcomes before or during the COVID-19 pandemic. We therefore sought to investigate the impact of treatment delays on the disease condition of vitiligo, aiming to provide useful evidence and suggestions for better management of *vitiligo* in response to the current pandemic wave.

2 | MATERIALS AND METHODS

This retrospective cohort study was carried out at Department of Dermatology, Huashan Hospital, Shanghai, which reviewed the available medical records and photographs of patients with vitiligo visited our outpatient at least 2 times from January to December 2020, during the *COVID-19* pandemic. The study was approved by the Ethics Committee of Huashan Hospital, Fudan University. Written informed consent to publish images was obtained from the patients.

The included patients were categorized into two groups according to whether experienced the treatment delays (late group) or not (normal group). A discontinuation of original treatments (>1 month) was considered as treatment delays, while changes due to improved condition were excluded. Clinical data, including demographics, vitiligo characteristics, previously therapies and clinical outcomes were extracted from medical records of patients. Clinical outcomes were also evaluated based on clinical photographs taken at each visit. Patients who exhibited a blurry boundary of lesions under Wood light or had a VETF spreading score of +1 to +5 were considered as active, and as stable otherwise.[14] Progression *was considered* in the patients with active vitiligo if they exhibited larger affected body surface area (BSA) than last follow-up.[15] Recurrence was defined as depigmentation in previously repigmented lesions or appearance of new lesions in patients with stable vitiligo.[16]

Although this *study* was performed in *retrospective* fashion, *patients* were treated according to a unified protocol: systemic corticosteroid therapy for patients with active vitiligo, topical therapy with calcineurin inhibitors on the lesions twice daily for all patients, and narrowband ultraviolet B (NB-UVB) therapy twice weekly for the patients with stable vitiligo.

All statistical testing in our study was performed with the SPSS version 21.0 (IBM, Armonk, NY). For comparison of quantitative variables, Kruskal-Wallis test or Student's *t* test was used. Categorical variables were compared with χ^2 test or Fishers exact test. The independent factors associated with disease aggravation or recurrence were analyzed using univariable logistic *regression*, followed by multivariable logistic *regression* (variables with *p*-value < 0.1). For all analysis, differences were considered significant if $p < 0.05$.

3 | RESULTS

In total, 322 patients were finally included in the present study, consisting *of* 167 (51.9%) experienced treatment delays (late group) and 155 (48.1%) received normal treatment (normal group) (Table 1). The patients experienced treatment delays with a mean duration of 4.46 ± 2.02 months, which mainly occurred at February–April (Figure 1). Among treatment modalities, systemic corticosteroid therapy (38.9%) was the most frequently delayed, followed by combination therapy (two or more therapies, 25.7%) and phototherapy (12.6%; Figure 2). Patients in the two groups did not significantly differ with regard to demographic and vitiligo characteristics (all $p > 0.05$; Table 1).

Representative photographs of disease progression and recurrence were shown in Figure 3(A)-(B). Comparison of progression rate were conducted in the 167 active cases (late, $n = 86$; normal, $n = 81$) and disease progression was more commonly observed in the late group (40.7% vs. 12.3%, $p = 0.002$; Figure 4). In addition, disease recurrence was analyzed in the 155 stable cases (late, $n = 81$; normal, $n = 74$). The late group also showed higher rate of recurrence than those of normal group (32.1% vs. 12.2%, $p = 0.018$; Figure 4).

To further investigate whether treatment delays was the independent factor for disease progression and recurrence, univariate, and multivariate analyses were performed (Table 2). On univariate analysis, we found that treatment delays was associated with both disease progression (all $p < 0.05$) and recurrence (all $p < 0.05$ except for delays less than 3 months; Table 2). Treatment delays, along with other significant variables in univariate analysis were entered in the final multivariate analysis. The results revealed that treatment delays, large affected body surface area (BSA, >10%),[17] emotional dysregulation and fatigue as independent risk factors for progression (all $p < 0.05$; Table 2). As for recurrence, treatment delays (>3 months), large affected BSA, long disease duration (>5 years), emotional dysregulation and fatigue were the independent risk factors (all $p < 0.05$), whereas maintenance therapy (>2 years) was protective ($p = 0.016$; OR: 0.21; CI 95%: 0.06–0.75) (Table 2). Strikingly, treatment delays were the most important risk factor associated with both progression and recurrence. The longer duration of treatment delays, the higher risk for progression and recurrence.

4 | DISCUSSION

Treatment delays caused by the *COVID-19* pandemic and its related restrictions are serious challenges for the management of chronic disease faced by clinicians currently.[6] Considering the importance of long-term active treatment for vitiligo and its high *global incidence* (0.5%–1%),[12,18] there is an urgency to develop a clear recommendation for vitiligo management during pandemics based on fully understanding the impact of treatment delays on vitiligo. To date, however, the data is limited. Therefore, the impact of treatment delays on disease condition of vitiligo during the *COVID-19* pandemic was investigated for the first time in the present study.

Our study revealed that the patients mainly experienced treatment delays between February 2020 and April 2020, and gradually decreased in the number since May 2020, which was basically consistent with the epidemic *situation in China*.[19] It is well-recognized that the skin-infiltration of melanocyte-specific CD8 + T cells

TABLE 1 Demographic and clinical characteristics of both groups

	Late group ($n = 167$)	Normal group ($n = 155$)	p
Demographic characteristics			
Female, *n* (%)	79 (47.3)	88 (56.8)	0.325
Age (years), mean ± SD	29.30 ± 15.43	27.27 ± 16.40	0.244
Vitiligo characteristics			
Onset age, *n* (%)			0.273
≤12 years	76 (45.5)	80 (51.6)	
>12 years	91 (54.5)	75 (48.4)	
Subtypes, *n* (%)			0.432
NSV	134 (80.2)	115 (74.2)	
SV	29 (17.4)	35 (22.6)	
Mixed	4 (2.4)	5 (3.2)	
Disease duration			0.388
≤5 years	91 (54.5)	77 (49.7)	
>5 years	76 (45.5)	78 (50.3)	
Affected BSA			0.616
≤10%	88 (52.7)	86 (55.5)	
>10%	79 (47.3)	69 (44.5)	
Disease stage, *n* (%)			0.891
Active stage	86 (51.5)	81 (52.3)	
Stable stage	81 (48.5)	74 (47.7)	
Autoimmune comorbidities, *n* (%)	15 (9.0)	19 (12.3)	0.339
Family history, *n* (%)	14 (8.4)	9 (5.8)	0.370

Note: $p < 0.05$ was considered statistical significantly.
Abbreviations: BSA, body surface area; Mixed, mixed vitiligo; NSV, nonsegmental vitiligo; SV, segmental vitiligo.

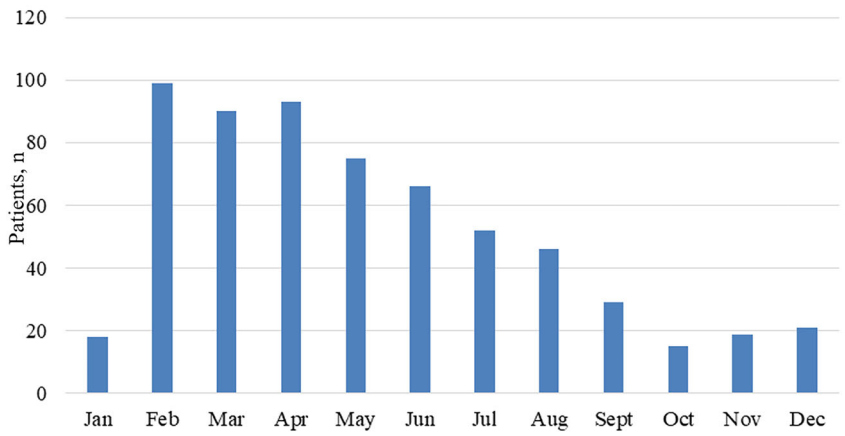

FIGURE 1 Timeline of treatment delays. The blue bar chart represented the number of patients experienced treatment delays in each month during the COVID-19 pandemic

mediate the progressive destruction of melanocytes and play the key role in the progression of vitiligo.[12] Hence, halting the progressive depigmentation is the foremost step in the treatment of active vitiligo. Currently, systemic corticosteroid therapy combined with other therapies are widely utilized to promote disease stabilization through its immunomodulatory effects.[20] However, systemic corticosteroid therapy and combination therapy were mainly delayed during the pandemic as showed in the present study. Different from active vitiligo, maintenance therapy such as topical tacrolimus ointment is emphasized in stable vitiligo to maintain achieved repigmentation and prevent disease recurrence,[13] which was also found to be delayed in our study. In this study, we compared the progression and recurrence rate between the two groups and detected the higher rates in late group, preliminarily indicating the adverse impact of treatment delays on the condition of vitiligo. Furthermore, we showed in the univariate and multivariate analysis that treatment delays was the most important independent risk factor for both disease progression and recurrence.

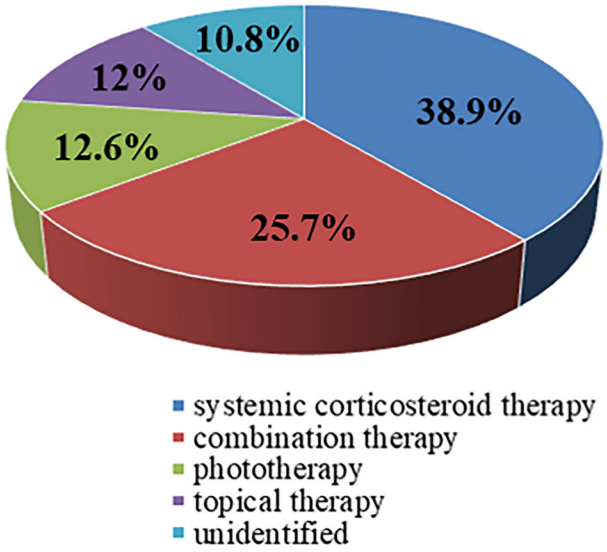

FIGURE 2 Treatment modalities delayed during the COVID-19 pandemic. The pie charts showed the proportion of various treatment modalities for vitiligo delayed during the COVID-19 pandemic

The treatment duration of vitiligo is a major concern for both dermatologists and patients. However, there is *no consensus exists* regarding the optimal course of treatment for vitiligo and the clinical practice varies widely between dermatologists. Generally, 3–6 months of systemic corticosteroid therapy is recommended to halt the disease

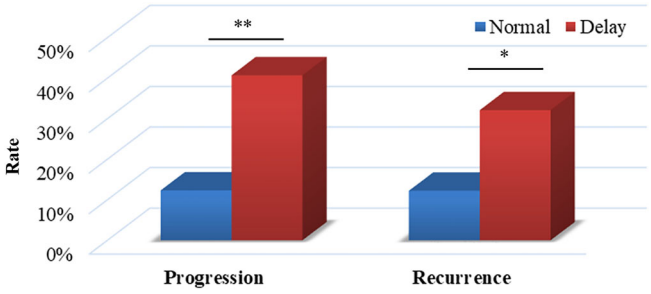

FIGURE 4 Comparison of disease progression and recurrence between two groups. The rates of aggravation and recurrence were compared between late and normal group, respectively.
*$p < 0.05$; **$p < 0.01$

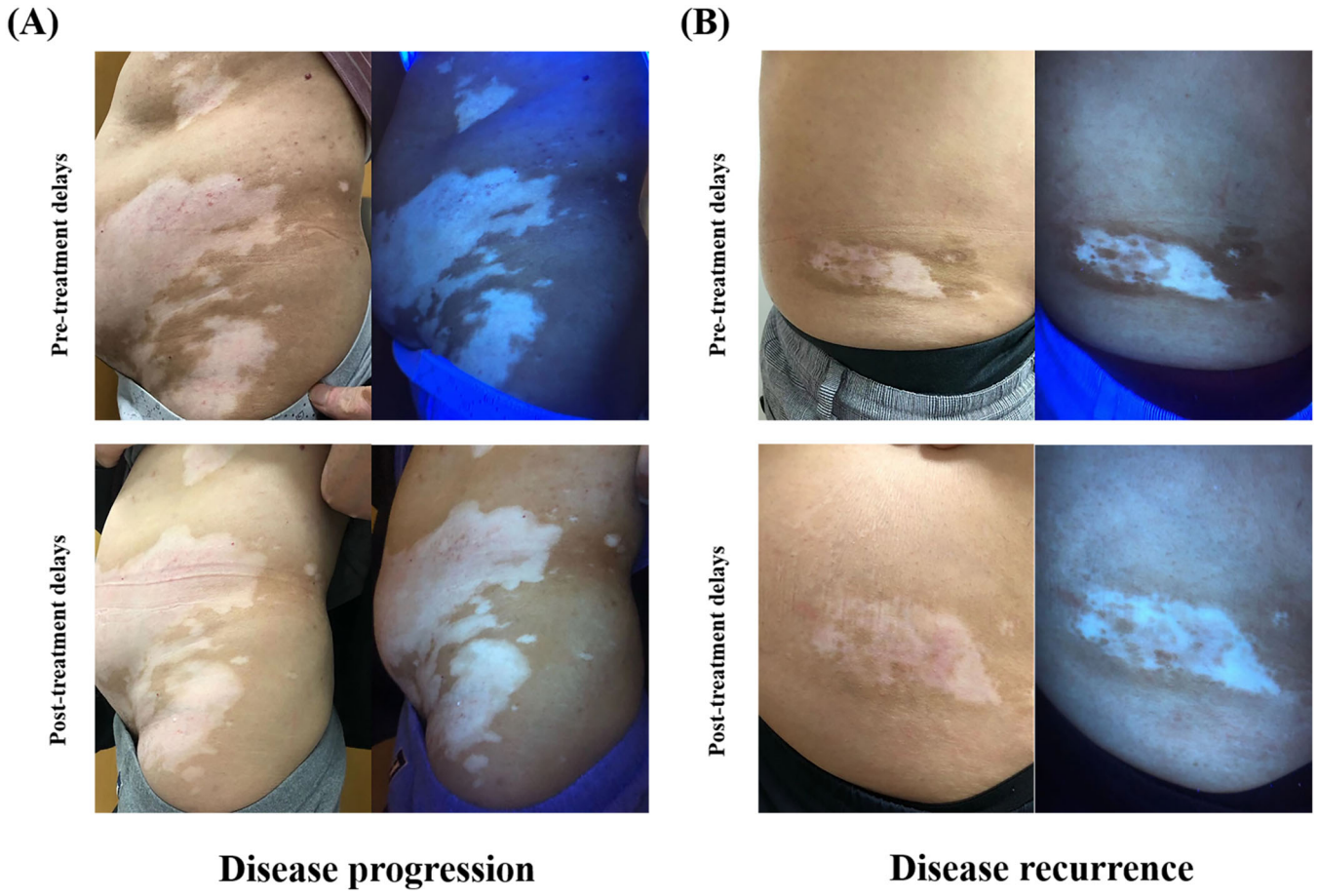

FIGURE 3 Representative photographs of disease progression and recurrence. (A) Photographs of a patients with disease progression taken at pre- and post-treatment delays; (B) Photographs of a patients with disease recurrence taken at pre- and post-treatment delays

TABLE 2 Univariate and multivariate analysis of factors associated with disease progression and recurrence

		Progression						Recurrence					
		No	Yes	Univariate analysis		Multivariate analysis		No	Yes	Univariate analysis		Multivariate analysis	
		n (%)	*n* (%)	OR	*p*	OR	*p*	*n* (%)	*n* (%)	OR	*p*	OR	*p*
Gender	**Male**	59 (71.1)	24 (28.9)	1.64 (0.81–3.31)	0.167			52 (72.2)	20 (27.8)	1.74 (0.82–3.73)	0.149		
	Female	63 (75)	21 (25)	Reference				68 (81.9)	15 (18.1)	Reference			
Age, y	**≤12**	37 (74)	13 (26)	Reference				29 (80.6)	7 (19.4)	Reference			
	>12	85 (72.6)	32 (27.4)	1.07 (0.51–2.27)	0.857			91 (76.5)	28 (23.5)	1.28 (0.50–3.19)	0.608		
Onset age, y	**≤12**	57 (68.7)	26 (31.3)	1.56 (0.78–3.11)	0.205			54 (74.0)	19 (26.0)	1.45 (0.68–3.09)	0.333		
	>12	65 (77.4)	19 (22.6)	Reference				66 (80.5)	16 (19.5)	Reference			
Duration, y	**≤5**	56 (68.3)	26 (31.7)	1.61 (0.81–3.22)	0.173			72 (83.7)	14 (16.3)	Reference		Reference	
	>5	66 (77.6)	19 (22.4)	Reference				48 (69.6)	21 (30.4)	2.25 (1.04–4.85)	0.036	2.21 (1.02–4.80)	0.045
Affected BSA	**≤10%**	71 (83.5)	14 (16.5)	Reference		Reference		76 (85.4)	13 (14.6)	Reference		Reference	
	>10%	51 (62.2)	31 (37.8)	3.08 (1.49–6.37)	0.002	2.45 (1.16–5.18)	0.019	44 (66.7)	22 (33.3)	2.92 (1.34–6.38)	0.006	2.33 (1.05–5.18)	0.038
Subtype	**SV**	28 (77.8)	8 (22.2)	Reference				23 (82.1)	5 (17.9)	Reference			
	NSV	90 (71.4)	36 (28.5)	1.40 (0.58–3.36)	0.450			94 (76.4)	29 (23.6)	1.42 (0.50–4.07)	0.513		
	Mix	4 (80)	1 (20)	1.14 (0.11–11.72)	0.910			3 (75)	1 (25)	1.53 (0.13–17.97)	0.732		
Treatment delays, mo	**No**	71 (87.7)	10 (12.3)	Reference		Reference		65 (87.8)	9 (12.2)	Reference		Reference	
	1–3	20 (64.5)	11 (35.5)	3.91 (1.45–10.51)	0.005	3.10 (1.19–8.09)	0.021	22 (88)	3 (12)	0.99 (0.25–3.97)	0.983	1.24 (0.34–4.52)	0.745
	3–6	21 (58.3)	15 (41.6)	5.07 (1.99–12.94)	<0.001	3.71 (1.39–9.92)	0.009	21 (63.6)	12 (36.4)	4.13 (1.53–11.16)	0.004	2.95 (1.04–8.37)	0.023
	>6	10 (52.6)	9 (47.4)	6.39 (2.09–19.54)	<0.001	4.78 (1.47–15.51)	0.008	12 (52.2)	11 (47.8)	6.62 (2.26–19.39)	<0.001	4.98 (1.57–15.80)	0.006
Upfront therapy, mo	**<3**	53 (67.9)	25 (32.1)	Reference									
	3–6	41 (75.9)	13 (24.1)	0.67 (0.31–1.47)	0.320								
	6–12	28 (80)	7 (20)	0.53 (0.20–1.38)	0.189								
Maintenance therapy, mo	**<6**							13 (59.1)	9 (40.9)	Reference			
	6–12							38 (77.6)	11 (22.4)	0.42 (0.14–1.24)	0.110	0.57 (0.17–1.92)	0.368
	12–24							37 (77.1)	11 (22.9)	0.43 (0.15–1.27)	0.122	0.60 (0.20–1.86)	0.377
	>24							32 (88.9)	4 (11.1)	0.18 (0.05–0.69)	0.008	0.21 (0.06–0.75)	0.016
Emotional dysregulation	**No**	67 (82.7)	14 (17.3)	Reference		Reference		46 (68.7)	21 (31.3)	Reference		Reference	
	Yes	55 (64.0)	31 (36.0)	2.70 (1.31–5.57)	0.006	2.41 (1.12–5.20)	0.024	74 (84.1)	14 (15.9)	2.41 (1.12–5.21)	0.023	2.33 (1.05–5.18)	0.038
Fatigue	**No**	75 (82.4)	16 (17.6)	Reference		Reference		39 (67.2)	19 (32.8)	Reference		Reference	
	Yes	47 (61.8)	29 (38.2)	2.89 (1.42–5.89)	0.003	2.60 (1.20–5.63)	0.026	81 (83.5)	16 (16.5)	2.47 (1.15–5.31)	0.019	2.29 (1.06–4.96)	0.035
Autoimmune comorbidities	**No**	110 (74.3)	38 (25.7)	Reference				109 (77.9)	31 (22.1)	Reference			
	Yes	12 (63.2)	7 (36.8)	1.69 (0.62–4.60)	0.302			11 (73.3)	4 (26.7)	1.28 (0.38–4.30)	0.690		
Family history	**No**	115 (73.7)	41 (26.3)	Reference				111 (77.6)	32 (22.4)	Reference			
	Yes	7 (63.6)	4 (36.4)	1.60 (0.45–5.76)	0.466			9 (75)	3 (25)	1.16 (0.30–4.53)	0.835		

Note: $p < 0.05$ was considered statistical significantly.

Abbreviations: BSA, body surface area; Mix, mix vitiligo; NSV, nonsegmental vitiligo; SV, segmental vitiligo.

progression for active vitiligo.[18,20] However, no protective effect of upfront therapy against disease progression was found in our study *even if the* time of upfront therapy exceeded 6 months. These findings may be explained by the still existing low-grade immune reaction against melanocytes, which need low-dose immunosuppression treatment instead of abrupt withdrawal. Therefore, continuous treatment including subsequent low-dose immunosuppression treatment should be stressed for halting progression in the active vitiligo. Limited data are available for the course of maintenance therapy in stable vitiligo. Interestingly, we noted that maintenance therapy for more than 2 years was an independent protective factor for recurrence, suggesting the relative stability of treatment cessation after 2-year maintenance therapy for the patients with stable vitiligo.

Moreover, large BSA, emotional dysregulation and fatigue were also identified as independent factors for both progression and recurrence. Large BSA has been confirmed to be correlated with active immune status, which is strongly implicated in the progression and recurrence of vitiligo.[12,21,22] As reported previously, emotional dysregulation and fatigue exert adverse effects on autoimmune disease and the mechanisms linking them have been well-established.[23–25] In the current study, we confirmed and *extended the associations to vitiligo*. Similar with psoriatic arthritis,[26] long disease duration was found to be another independent risk factor for recurrence in our study, further strengthening the significance of early intervention for vitiligo.

Several limitations existed in this study, including the retrospective design, small sample size and patients selection bias. In addition, our study was limited by our reliance on the self-reported emotional dysregulation and fatigue without any formally assessment. Accordingly, large prospective cohort studies with objective scoring systems for assessing emotional dysregulation and fatigue are warrant to validate our observations in the furture.

In conclusion, our findings revealed the independent adverse *impact of* treatment delays on the progression and recurrence of vitiligo and protective effect of maintenance therapy (>2 years) against recurrence, indicating the significance of continuous treatment for halting progression and long-term maintenance therapy for preventing recurrence. Therefore, teledermatology[27] and home phototherapy[28] would be recommended, especially for the patients with risk factors. Additionally, keeping emotional stability and avoiding excessive fatigue are equally important. Hopefully, our data and suggestions will provide reference for dermatologists worldwide on the management of vitiligo in response to current pandemic wave.

ACKNOWLEDGMENT

This work was supported by the National Natural Science Foundation of China (No. 82073456 and No. 81872544).

CONFLICT OF INTEREST

The authors declared no conflict of interest.

AUTHOR CONTRIBUTION

Xinya Xu, Chengfeng Zhang performed the study and collected the data; Xinya Xu and Min Jiang analyzed the data; Leihong Flora Xiang and Xinya Xu conceived and designed the study; Leihong Flora Xiang obtained funding and provided overall supervision for the study; all authors *participated in writing, data interpretation and final approval* of the manuscript.

DATA AVAILABILITY STATEMENT

Data used in this study is available with the 1st author and corresponding author.

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REFERENCES

1. WHO Coronavirus Disease (COVID-19) Dashboard. Geneva: World Health Organization, 2021
2. Kraemer MUG, Yang CH, Gutierrez B, et al. The effect of human mobility and control measures on the COVID-19 epidemic in China. *Science*. 2020;368(6490):493-497.
3. Jarvis CI, Van Zandvoort K, Gimma A, et al. Quantifying the impact of physical distance measures on the transmission of COVID-19 in the UK. *BMC Med*. 2020;18(1):124.
4. Quaquarini E, Saltalamacchia G, Presti D, et al. Impact of COVID-19 outbreak on Cancer patient care and treatment: data from an outpatient oncology Clinic in Lombardy (Italy). *Cancers*. 2020;12(10):2941.
5. Kumar D, Dey T. Treatment delays in oncology patients during COVID-19 pandemic: a perspective. *J Glob Health*. 2020;10(1):010367.
6. Chudasama YV, Gillies CL, Zaccardi F, et al. Impact of COVID-19 on routine care for chronic diseases: a global survey of views from healthcare professionals. *Diabetes Metab Syndr*. 2020;14(5):965-967.
7. Mirsky JB, Horn DM. Chronic disease management in the COVID-19 era. *Am J Manag Care*. 2020;26(8):329-330.
8. Baumann BC, MacArthur KM, Brewer JD, et al. Management of primary skin cancer during a pandemic: multidisciplinary recommendations. *Cancer*. 2020;126(17):3900-3906.
9. Bhargava S, Sarkar R. Impact of COVID-19 pandemic on dermatology practice in India. *Indian Dermatol Online J*. 2020;11(5):712-719.
10. Kutlu Ö, Metin A. Relative changes in the pattern of diseases presenting in dermatology outpatient clinic in the era of the COVID-19 pandemic. *Dermatol Ther*. 2020;33(6):e14096.
11. Zhang Y, Wen J, Alamgir M, et al. Impact of the COVID-19 pandemic on inpatient dermatology: a multicentre study from Hubei, China. *J Eur Acad Dermatol Venereol*. 2021;35(3):e179-e181.
12. Boniface K, Seneschal J, Picardo M, Taïeb A. Vitiligo: focus on clinical aspects, Immunopathogenesis, and therapy. *Clin Rev Allergy Immunol*. 2018;54(1):52-67.
13. Cavalié M, Ezzedine K, Fontas E, et al. Maintenance therapy of adult vitiligo with 17.1% tacrolimus ointment: a randomized, double blind, placebo-controlled study. *J Invest Dermatol*. 2015;135(4):970-974.
14. Komen L, Da Graça V, Wolkerstorfer A, De Rie MA, Terwee CB, Van der Veen JP. Vitiligo area scoring index and vitiligo European task force assessment: reliable and responsive instruments to measure the degree of depigmentation in vitiligo. *Br J Dermatol*. 2015;172(2):437-443.
15. Mazereeuw-Hautier J, Bezio S, Mahe E, et al. Segmental and non-segmental childhood vitiligo has distinct clinical characteristics: a prospective observational study. *J Am Acad Dermatol*. 2010;62(6):945-949.
16. Park JH, Jung MY, Lee JH, Yang JM, Lee DY, Park KK. Clinical course of segmental vitiligo: a retrospective study of eighty-seven patients. *Ann Dermatol*. 2014;26(1):61-65.

17. Teulings HE, Ceylan E, Overkamp M, et al. Nonsegmental vitiligo disease duration and female sex are associated with comorbidity and disease extent: a retrospective analysis in 1307 patients aged ≥ 50 years. *Br J Dermatol*. 2016;175(4):821-824.
18. Ezzedine K, Eleftheriadou V, Whitton M, van Geel N. Vitiligo *Lancet* 2015;386(9988):74-84.
19. Leung K, Wu JT, Liu D, Leung GM. First-wave COVID-19 transmissibility and severity in China outside Hubei after control measures, and second-wave scenario planning: a modelling impact assessment. *Lancet*. 2020;395(10233):1382-1393.
20. Rodrigues M, Ezzedine K, Hamzavi I, Pandya AG, Harris JE. Current and emerging treatments for vitiligo. *J Am Acad Dermatol*. 2017;77(1):17-29.
21. Zhang L, Kang Y, Chen S, Wang L, Jiang M, Xiang L. Circulating CCL20: a potential biomarker for active vitiligo together with the number of Th1/17 cells. *J Dermatol Sci*. 2019;93(2):92-100.
22. Riding RL, Harris JE. The role of memory $CD8^+$ T cells in vitiligo. *J Immunol*. 2019;203(1):11-19.
23. Andersson NW, Gustafsson LN, Okkels N, et al. Depression and the risk of autoimmune disease: a nationally representative, prospective longitudinal study. *Psychol Med*. 2015;45(16):3559-3569.
24. Kamiya K, Kishimoto M, Sugai J, Komine M, Ohtsuki M. Risk factors for the development of psoriasis. *Int J Mol Sci*. 2019;20(18):4347.
25. Zielinski MR, Systrom DM, Rose NR. Fatigue, sleep, and autoimmune and related disorders. *Front Immunol*. 2019;10:1827.
26. Araujo EG, Finzel S, Englbrecht M, et al. High incidence of disease recurrence after discontinuation of disease-modifying antirheumatic drug treatment in patients with psoriatic arthritis in remission. *Ann Rheum Dis*. 2015;74(4):655-660.
27. Gupta R, Ibraheim MK, Doan HQ. Teledermatology in the wake of COVID-19: advantages and challenges to continued care in a time of disarray. *J Am Acad Dermatol*. 2020;83(1):168-169.
28. Lim HW, Feldman SR, Van Voorhees AS, Gelfand JM. Recommendations for phototherapy during the COVID-19 pandemic. *J Am Acad Dermatol*. 2020;83(1):287-288.

How to cite this article: Xu X, Zhang C, Jiang M, Xiang LF. Impact of treatment delays on vitiligo during the COVID-19 pandemic: A retrospective study. *Dermatologic Therapy*. 2021; 34(4):e15014. https://doi.org/10.1111/dth.15014