

# **Changing dermatology practice in crisis and normalization processes after COVID-19 and potential problems awaiting us: Teledermatology can be a solution**

## **Abstract**

### **Aims**

We aim to reveal the effect of the crisis period and normalization process after COVID-19 on dermatology practice, to anticipate future health problems, and demonstrate the necessity of teledermatology as a solution.

### **Results**

The number of patients in the normalization (32.3%) increased compared to the crisis period (11.5%) but also it was found significantly lower than before the pandemic (56.2%). It was remarkable that the change in the distribution of stress-related diseases, such as idiopathic generalized pruritus, alopecia areata, and zona zoster, stably paralleled each other and the trend of increase and decrease during the crisis period and the normalization process, respectively. The increase in the frequency of contact dermatitis, which was not reflected in the crisis period, became evident in the normalization process ( $p < 0.001$ ). There was no significant change in the rate of scabies but the decrease in the number of patients ( $p = 0.276$ ).

### **Discussion**

The decrease in stress-related diseases indicates that the social stress started to decrease with the normalization. Rates and number of patients give an idea about the problems we may encounter aftermath pandemic. Scabies and venereal diseases, which concern public health, should not be neglected. We predicted that much more significant increases in the frequency of scabies will be recorded aftermath of COVID-19.

## **Conclusion**

The extraordinary conditions that occur after the pandemic will make the management of some diseases, especially scabies, difficult in the future. The chaos that will occur when the unusually decreasing number of patients returns to normal can be alleviated by teledermatology.

**Key words:** COVID-19, teledermatology, pandemic, normalization, scabies, contact dermatitis, zona zoster, alopecia areata

## **What is already known about this topic?**

Changes were observed in the number and diagnostic distribution of patients who applied to dermatology after the pandemic.

An increase in the frequency of zona zoster, alopecia areata, scabies, pityriasis rosea, with conflicting results and a decrease in the frequency of diseases such as warts and seborrheic keratosis have been reported.

Teledermatology is an examination method recommended during the pandemic.

## **What does this article add?**

The effects of the pandemic were presented in detail with tables and graphics showing the dramatic changes.

The change in the distribution of stress-related diseases (idiopathic generalized pruritus, alopecia areata, and zona zoster) stably paralleled each other, and the trend of increase and decrease during the crisis and the normalization, respectively.

Patients with scabies and venereal diseases must be considered and encourage primarily these patients to reach teledermatology platforms.

## **1. Introduction**

The COVID-19 disease, which emerged in China for the first time in December 2019 and our country on March 11, 2020, has affected deeply many areas such as social life, economy, and health all over the world within a very short time<sup>1,2</sup>. After the pandemic, the government introduced some regulations such as curfews, closure of schools, and common social organizations, flexible working in public institutions including hospitals. Through the effective measures taken, the number of daily cases decreased after peaking, and after a short period of about 2.5 months, the normalization process began exactly on 1 June. There were over 309790 confirmed cases and 7785 death of COVID-19 by 25 September 2020 in Turkey per Worldometer, a reference website that provides real-time world statistics<sup>3</sup>.

Considering the conditions of our country and the hospitals, we, as dermatologists, had to actively take mission and responsibilities in all fields from outpatient clinics to intensive care units related to COVID-19 after the pandemic. Until the normalization process, we also continued to run our own polyclinics to a quite limited extent, like all other medical departments. During the normalization period, the weakening of the measures, and the lack of attention to social distance due to condolences, weddings, and holidays resulted in the number of cases re-increasing after the beginning of August. After August 15, the number of dermatology outpatient clinics has been reduced by approximately 80% with all departments and these physicians have been re-located to units related to COVID-19 as a pandemic hospital. Considering the uncertainty of the process and the disrupted emergency and polyclinic services, we should think about the difficulties which we may encounter in the future in dermatology. In this study, we aim to reveal the effect of the crisis period and normalization process after COVID-19 on dermatology practice, to anticipate future health problems, and demonstrate the necessity of teledermatology as a solution.

## 2. Materials and Methods

All patients were enrolled from the Department of Dermatology and Venereology in Erzurum Regional Training and Research Hospital between February 15 and July 09, 2020, consisting of 120 workdays. We formed the months within these dates from organizing them into 4 weeks consisting of twenty following workdays, except for weekends and public holidays. So, a 24-week period comprising of 8 weeks before the COVID-19 and 16 weeks after the first confirmed case was obtained. Data such as age, sex, dates, the first three of the ICD-10 (International Classification of Diseases-10th Revision) codes, and treatment methods were received from the electronic registration database. These data were anonymized providing that individual uniqueness was kept in applications to polyclinics. Patients with repeated presentations for control or follow-up were distinguished. Then, recurrent applications with the corresponding diagnosis in ten days after the first medical examination were excluded.

The causes such as the wide diagnostic spectrum, lack of ICD-10 code and the myriads of its sub-breakings corresponding to each diagnosis, and the unique style of each physician at the usage of ICD-10 codes in the dermatology practice required the standardization of diagnostic data within a framework. Therefore, the first three ICD-10 codes for patients were re-evaluated by each patient's own physician, based on the classification of the diseases in the Dermatology textbook edited by Bologna et al.<sup>4</sup>. For the same patient, separate diagnoses associated with each other were attempted to be displayed as a single origin diagnosis (e.g. xerosis + dermatitis = xerotic eczema, pruritus + psoriasis = psoriasis, etc.). Patients without an additional dermatological diagnosis other than pruritus were evaluated as the “idiopathic pruritus and dysesthesia”. A few patients who applied for consultation only or had no significant complaints were recorded under the title of “undetermined reason for examination and observation (ICD-10=Z04.9)”. We considered only the first ICD-10 codes for patients with multiple irrelevant diagnoses. In the light of this framework, some diagnoses were

grouped and 372 distinct ICD-10 codes, including sub-breakings in the raw data, were diminished to 17 main headings and 82 sub-headings.

This single-center cross-sectional retrospective-study was approved by the Ethics Committee of Erzurum Regional Training and Research Hospital, Turkey (Decision No: 2020/14-158), and Ministry of Health Scientific Research Platform (Application form number: 2020-07-01T21\_52\_34). This study was conducted according to the latest version of the "Helsinki Declaration" and "Guidelines for Good Clinical Practice". No patient consent was required, on condition that the data such as name and citizenship numbers were anonymized by the IT team and with the permission of the ethics committee.

All statistical procedures were performed using IBM SPSS Statistics® 21.0 and MS-Excel® 2010. Python™ 3.7.5 program (Python Software Foundation, released in October 2019) was used especially in determining the control and follow-up patients and classifying the data.

Pearson's chi-squared test was used for categorical variables. In chi-square tests with a degree of freedom greater than 1, pairwise comparisons (post-hoc) were conducted using the z-test. After checking the normality distribution of scale variables by the Shapiro–Wilk test, independent samples were compared with appropriate significance tests (Kruskal-Wallis H test or Mann-Whitney U test). Results were presented as the median (interquartile range) or a number of the patients (percentage). The daily number of newly diagnosed COVID-19 cases and the daily number of patients applied to our dermatology outpatient clinic were presented with a single "scatter with straight lines" graphic. The change in the weekly diagnostic distribution of remarkable some diseases was also displayed in this graphic. Two-sided p-values of  $<0.05$  were considered statistically significant. Correction for alpha inflation (Bonferonni style) was applied as post-hoc after the Kruskal-Wallis H and chi-square tests.

### 3. Results

13218 (56.2%) of the 23530 patients who applied to the dermatology outpatient clinics in the defined 24-week period, excluding control examinations, had applied in the last 8 weeks before COVID-19. The period after COVID-19 was examined in 2 separate periods of eight weeks: Crisis period and normalization process. Accordingly, 2714 patients (11.5%) during the crisis period and 7598 (32.3%) patients after the first steps of the normalization process were taken were evaluated in our outpatient clinics. The number of novel COVID-19 daily cases in Turkey and dermatological patients in our outpatient clinics before and after the pandemic were presented in Figure 1. Accordingly, while approximately 300-400 patients were cared for in our dermatology outpatient clinic before the pandemic, it was below 50 for a long time during the crisis period. Approximately 2 weeks after the start of the normalization process, the number of patients examined per day was above 100 for the first time and after about 1 month, it was able to sit in a 200-300-band. In our study, to reveal the effect of the crisis and normalization process in dermatology practice more clearly, the periods corresponding to the transition periods, as seen in Figure 1, where there were hard breaks in the curves up or down were ignored in statistical comparisons. The change in the demographic characteristics and diagnostic distribution of the patients who applied to dermatology outpatient clinics during the periods when the number of patients examined daily remained relatively stable can be seen in Tables 1 and 2. The expanded form of Table 2, which includes all diagnoses, was presented in Table SI in the supplementary material. The weekly change in the frequency of some of the diseases with significant changes in distribution was as in Figure 2. It was remarkable that the change in the distribution of stress-related diseases, such as idiopathic generalized pruritus, alopecia areata, and zona zoster, stably paralleled each other and the trend of increase and decrease during the crisis period and the normalization process respectively (Figure 2A).

#### **4. Discussion**

In our previous study, we found an increase in the frequency of “idiopathic generalized pruritus, pityriasis rosea, alopecia areata, bacterial skin/mucosa diseases, and zona zoster/post-zoster neuralgia” during the peak period of the outbreak, and also reported that patients applied to outpatient clinics less frequently due to diseases such as verruca vulgaris, hyperpigmentation, skin tag, melanocytic nevus, seborrheic keratosis/solar lentigo<sup>5</sup>. Similarly, it has been reported in other publications that there is an increase in the number of patients presenting with alopecia areata, zona zoster, and pityriasis rosea after the pandemic<sup>6-8</sup>. While the increases in the frequency of diseases reflected in polyclinics under ordinary conditions primarily indicate an increase in incidence; in such extraordinary situations, these changes may be due to the following reasons in addition to the incidence: impact on the quality of life, unknown interesting disease-fear, desire not to interrupt treatment, perception of COVID-19 risk, asymmetric difficulty in consultation to alternative medical departments, diseases with easier diagnosis and treatment.

Dermatological diseases are important problems for adolescence<sup>9</sup>. In our study, it was observed that the frequency of children between the ages of 11-18 decreased significantly in the crisis period compared to the pre-pandemic period, and increased during the normalization period. This displays that the diseases seen in school-age children were more frequently neglected and the accumulated patient burden increased after normalization. Considering that the number of patients has increased compared to the crisis period but still does not return to its previous level, the solution of the dermatological problems in childhood and adolescence awaits us after complete normalization.

The diseases with a change in frequency were listed in Table 2 and the possible reasons for these were evaluated under 5 headings: seasonal, COVID-19 related anxiety, hygiene measures, diseases that do not seriously impair the quality of life and whose

treatment can be delayed, a shift from other medical departments. It is noteworthy that the frequency of pityriasis rosea, which was reported to increase during the crisis period, was observed with a similar frequency to the pre-pandemic period due to seasonal reasons<sup>5,6</sup>. It is understood that hyperpigmented diseases, which are thought to be neglected and decreased in frequency during the crisis period, increase significantly in summer with the frequency of vitiligo. The significant decrease in diseases such as alopecia areata, zona zoster, and idiopathic pruritus, which are thought to increase in frequency due to the high stress associated with COVID-19 during the crisis period, indicates that the COVID-19 risk perception or social stress has started to decrease with the normalization process<sup>5,7,10</sup>. We thought that the expected increase in the frequency of contact dermatitis during the crisis period compared to the pre-pandemic period might be due to the fact that these patients improved their complaints with easy, reachable, and alternative solutions<sup>5</sup>. Although the expected increase in eczema during the crisis period was not reflected in our outpatient clinics, it was reported in recent survey studies that the risk of contact dermatitis increased approximately 3.5 to 5.5 times in healthcare professionals during the crisis period<sup>11,12</sup>. Indeed, per the report of Gao et al., a significant frequency of presentations after the normalization process was composed of contact dermatitis patients, which increased compared to the pre-pandemic and crisis period<sup>13</sup>. It was observed that the frequency of diseases such as warts, callus, seborrheic keratosis, skin tag, which decreased significantly during the crisis period and for which we preferred cryotherapy, reached similar rates to the pre-pandemic period except for callus. Although cryotherapy, skin patch, and prick tests are used frequently in dermatology practice, we found that they were used so few after the pandemic. The damage caused by not using such equipment, which has certain costs and shelf lives, should be considered. The service plan must be sustainable and cost-effective.

In our country, it has been reported that the increase in the frequency of scabies that started in the second half of 2019 became more pronounced in the last quarter<sup>14</sup>. While the

rate of scabies reported in the first quarter of the year last year was 0.64%, we found in this study that it was about 2% in the same period of 2020 corresponding to the pre-pandemic<sup>5,14</sup>. Scabies and venereal diseases, which concern public health, should not be neglected. Therefore, in such a period when polyclinic services have been reduced, it should be taken into consideration that the number of applications was below the expected rather than the rate of such diseases. Because this indicates that many patients postpone seeking treatment. Considering that scabies is still a public health problem in our country and that many people cannot get the right treatment after the outbreak, it can be predicted that much more significant increases in the frequency of scabies will be recorded aftermath of COVID-19. Due to our current patient profile, we could not statistically demonstrate this situation for other diseases such as venereal diseases, autoimmune bullous diseases, and severe psoriasis. It can be inferred about the patient burden and morbidity that these diseases will cause in the future with other studies that include a sufficient number of patients. We think that attention should be paid to the epidemiological follow-up of venereal diseases and to increase social awareness.

Although there are promising developments in vaccine development studies, the facts such as the lack of large-scale vaccination in the near future and the shift of doctors from their own fields to the fight against COVID-19 will make it difficult to manage some diseases. We think that it is possible to partially solve these problems with the teledermatology method. Teledermatology is a sub-specialty of dermatology that uses information and communication technologies for remote diagnosis, monitoring, treatment, prevention, research, and education<sup>15</sup>. In our country, it has been reported that non-professional teledermatological methods, especially sending photos via WhatsApp, have been used more frequently than before the pandemic<sup>16</sup>. Many authors, including us, think that teledermatology can be an available, important step for physicians and patients who are facing new standards in the field of dermatology, enabling them to solve problems quickly and effectively<sup>17-19</sup>. Recently, Lee et

al. published a guideline on the adaptation of teledermatology to dermatology practice during the pandemic. They suggested that the highest risk or emergency patients should be enlisted and referred primarily to telemedicine visits<sup>20</sup>. The public health risks posed by venereal diseases such as scabies and syphilis must be considered and encourage primarily these patients to reach teledermatology platforms when available.

As a result, teledermatological practices should be legalized and necessary steps should be taken without delay for the benefit of public health. Through teledermatology, it is possible to treat some diseases in the early period, to reduce the risk of complications, and to protect public health, despite some difficulties in practice. We hope that our study will be useful in health system planning and dissemination of teledermatology in the COVID-19 pandemic.

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## Tables

**Table 1. Evaluation of frequency of application, age, gender, and treatment methods before and after COVID-19**

	Before COVID-19		After COVID-19		p-value	
	Normal Period	Crisis Period	Normalization Process			
	The last 4-weeks (5-8. weeks)	2 <sup>nd</sup> 4-weeks (13-16. weeks)	4 <sup>th</sup> 4-weeks (21-24. weeks)			
Number of children patients aged ≤10 years (n=1066)	618 (9.1%)	60 (7.8%)	388 (8.4%)		0.256	
Number of children patients aged 11-18 years (n=1826)	982 (14.4%)	78 (10.1%)	766 (16.5%)		<b>&lt;0.001</b> <sup>a,b,c</sup>	
Number of adult patients aged 19-64 years (n=8637)	4848 (71.1%)	595 (77.1%)	3224 (69.4%)		<b>&lt;0.001</b> <sup>a,c</sup>	
Number of elderly patients aged ≥65 years (n=672)	372 (5.5%)	38 (4.9%)	262 (5.7%)		0.709	
Number of applications to the dermatology † (n=12216)	6820 (55.7%)	771 (6.3%)	4650 (37.9%)		<b>&lt;0.001</b> <sup>a,b,c</sup>	
Age (year)	24 (21)	29 (23)	25 (20)		<b>&lt;0.001</b> <sup>a,c</sup>	
Gender	Male	2949 (43.2%)	385 (49.9%)	1920 (41.4%)		<b>&lt;0.001</b> <sup>a,c</sup>
	Female	3871 (56.8%)	386 (50.1%)	2715 (58.6%)		
Treatment methods ‡	Follow-up (only)	162 (2.4%)	9 (1.2%)	91 (2.0%)		<b>0.042</b> <sup>a</sup>
	Medical therapy (oral, sc, iv, intralesional)	5793 (86.3%)	719 (94.1%)	4111 (88.8%)		<b>&lt;0.001</b> <sup>a,b,c</sup>
	Cryotherapy	685 (10.2%)	29 (3.8%)	375 (8.1%)		<b>&lt;0.001</b> <sup>a,b,c</sup>
	Dermato-surgery	73 (1.1%)	7 (0.9%)	50 (1.1%)		0.908
Diagnostic method	Skin patch test (n)	55	0	21		-
	Skin prick test (n)	117	1	59		-

Data are expressed as the number of applications to the outpatient clinic (percentage). Kruskal Wallis-H and Pearson's chi-square tests were used. Bonferroni correction was applied as post-hoc (Mann Whitney-U and z-test, respectively) after Kruskal Wallis-H and chi-square tests. Significant values were shown in bold. sc: subcutan, iv: intravenous

† Repeated applications within 10 days after the first application were excluded. ‡ The phototherapy unit is not active in our center.

a: adjusted p value<0.05 for the difference between "the last 4-weeks before COVID-19" and "2<sup>nd</sup> 4-weeks after COVID-19"

b: adjusted p value<0.05 for the difference between "the last 4-weeks before COVID-19" and "4<sup>th</sup> 4-weeks after COVID-19"

c: adjusted p value<0.05 for the difference between "2<sup>nd</sup> 4-weeks after COVID-19"; and "4<sup>th</sup> 4-weeks after COVID-19"

Diseases	Before COVID-19		After COVID-19		p-value	Possible relationship / cause
	Normal Period	Crisis Period	Normalization Process			
	The last 4-weeks (n=6820)	2 <sup>nd</sup> 4-weeks (n=771)	4 <sup>th</sup> 4-weeks (n=4650)			
Pityriasis rosea	43 (0.6%)	12 (1.6%)	37 (0.8%)		<b>0.017<sup>a</sup></b>	Seasonal
Pityriasis versicolor	76 (1.1%)	8 (1.0%)	81 (1.8%)		<b>0.014<sup>b</sup></b>	
Xerosis cutis & xerotic eczema	363 (5.3%)	46 (6.0%)	151 (3.3%)		<b>&lt;0.001<sup>b,c</sup></b>	
Polymorph light eruption	7 (0.1%)	2 (0.3%)	65 (1.4%)		<b>&lt;0.001<sup>b,c</sup></b>	
Vitiligo & other hypopigmentation disorders	31 (0.5%)	3 (0.4%)	65 (1.4%)		<b>&lt;0.001<sup>b</sup></b>	
Hyperpigmentation (Melasma, ephelid, PIH)	109 (1.6%)	5 (0.6%)	84 (1.8%)		<b>0.043<sup>a,c</sup></b>	
Alopecia areata	95 (1.4%)	21 (2.7%)	88 (1.9%)		<b>0.008<sup>a</sup></b>	COVID-19 related anxiety
Zona zoster & post-zoster neuralgia	58 (0.9%)	22 (2.9%)	43 (0.9%)		<b>&lt;0.001<sup>a,c</sup></b>	
Idiopathic generalized pruritus	225 (3.3%)	48 (6.2%)	194 (4.2%)		<b>&lt;0.001<sup>a,b,c</sup></b>	Hygiene measures
Allergic/Irritant contact dermatitis	294 (4.3%)	33 (4.3%)	279 (6.0%)		<b>&lt;0.001<sup>b</sup></b>	
Verruca vulgaris	357 (5.2%)	12 (1.6%)	201 (4.3%)		<b>&lt;0.001<sup>a,c</sup></b>	Diseases that do not seriously impair the quality of life and whose treatment can be delayed
Corn & callus	106 (1.6%)	6 (0.8%)	35 (0.8%)		<b>&lt;0.001<sup>b</sup></b>	
Skin tags	55 (0.8%)	0 (0.0%)	30 (0.6%)		<b>0.033<sup>a</sup></b>	
Seborrheic keratosis, solar lentigo	53 (0.8%)	1 (0.1%)	23 (0.5%)		<b>0.044<sup>a</sup></b>	
Melanocytic nevus	64 (0.9%)	1 (0.1%)	33 (0.7%)		<b>0.038<sup>a</sup></b>	
Bacterial skin/mucosa diseases	185 (2.7%)	39 (5.1%)	144 (3.1%)		<b>0.001<sup>a,c</sup></b>	A shift from others †

Data are expressed as the number of patients (column percentage). Pearson's chi-square and Fisher exact tests were used. Bonferroni correction was applied as a post-hoc (z-test) after chi-square tests. Significant values were shown in bold.

See Table S1 in the supplementary file for the full list.

† From departments such as infectious diseases and internal medicine, which are at the forefront of the fight against COVID-19, were implied.

a: adjusted p value<0.05 for the difference between "the last 4-weeks before COVID-19" and "2<sup>nd</sup> 4-weeks after COVID-19"

b: adjusted p value<0.05 for the difference between "the last 4-weeks before COVID-19" and "4<sup>th</sup> 4-weeks after COVID-19"

c: adjusted p value<0.05 for the difference between "2<sup>nd</sup> 4-weeks after COVID-19"; and "4<sup>th</sup> 4-weeks after COVID-19"

**Table 2. Diseases showing changes in the diagnostic distribution in the dermatology outpatient clinic before and after COVID-19**

## **Figures Legend**

### **Figure 1. Change in daily dermatological and COVID-19 patient throughout the process**

Dermatological and COVID-19 patient numbers exhibit data from our hospital and across the country, respectively. The graph of "novel coronavirus daily cases in Turkey" was adapted from the Worldometer, a reference website that provides real-time world statistics. The green (pre-pandemic), red (crisis), and yellow (normalization process) rectangles, respectively, correspond to the regions where statistical comparison was made.

- 1.** March 11: The first COVID-19 case was confirmed in Turkey and the World Health Organization has declared a pandemic.
- 2.** March 23: Flexible schedules and shift work were implemented for hospital personnel, like other public personnel.
- 3.** May 11: The first steps of the normalization process were taken. Within this scope, shopping malls and hairdressers were the first businesses to be put into service.
- 4.** June 1: Restrictions on inter-city travel, public places (gardens, association centers, facilities, museums, etc.), tourism areas, schools, kindergartens, and similar places were removed with certain rules. The flexible working practice was terminated for all public employees, including hospital personnel.

**Figure 2. Weekly frequency of some diseases with a significant change in frequency before and after COVID-19**

1. The first COVID-19 case was confirmed in Turkey, 2. The first steps of the normalization process were taken, 3. A process of social normalization started exactly.

The green, red and yellow rectangles on the time axis, respectively, correspond to the regions where statistical comparison was made.

A. Change in frequency of the diseases presumed to be triggered by COVID-19 related anxiety: idiopathic generalized pruritus, zona zoster, alopecia areata

B. Change in the frequency of contact dermatitis assumed to be associated with hygiene

C. Change in the frequency of cryotherapy indications and verruca vulgaris, which is its most common indication.

D. Change in the frequency of pigmentation-related diseases