BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (http://bmjopen.bmj.com).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

BMJ Open

Enhanced impact of psoriasis severity on the treatment demands of patients during the COVID-19 pandemic: A cross-sectional study based on a national psoriasis registry in China

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2023-079627
Article Type:	Original research
Date Submitted by the Author:	06-Sep-2023
Complete List of Authors:	Yang, Zhihui; Peking University First Hospital, Department of Dermatology and Venerology Jin, Yu; Peking University Cancer Hospital, Department of Cancer Epidemiology Wang, Mingyue; Peking University First Hospital, Li, Ruo Yu; Peking University First Hospital, Dermatology Li, Wenqing; Peking University Cancer Hospital, Department of Cancer Epidemiology Li, Hang; Peking University First Hospital, Department of Dermatology and Venerology
Keywords:	Psoriasis < DERMATOLOGY, COVID-19, China, Chronic Disease

SCHOLARONE™
Manuscripts

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

Original Research

Enhanced impact of psoriasis severity on the treatment demands of patients during the COVID-19 pandemic: A cross-sectional study based on a national psoriasis registry in China

Zhihui Yang[1†], Yu Jin[2†], Mingyue Wang[1], Ruoyu Li[1], Wenqing Li[2], Hang Li[1,3]

[1]Department of Dermatology and Venerology, Peking University First Hospital, Beijing, China; Beijing Key Laboratory of Molecular Diagnosis of Dermatoses, Peking University First Hospital, Beijing, China; National Clinical Research Center for Skin and Immune Diseases, Peking University First Hospital, Beijing, China; and NMPA Key Laboratory for Quality Control and Evaluation of Cosmetics, Peking University First Hospital, Beijing, China.

[2]Key Laboratory of Carcinogenesis and Translational Research (Ministry of Education/Beijing), Department of Cancer Epidemiology, Peking University Cancer Hospital & Institute, Beijing 100142, China

[3]Peking University - Yunnan Baiyao International Medical Research Center, Peking University, Beijing, China

[†]These authors contributed equally.

Short Title: Enhanced impact of psoriasis severity on treatment demands during pandemic

Corresponding Author:

Wenqing Li

Department of Cancer Epidemiology

Peking University Cancer Hospital & Institute

No.52 Fucheng Road

Beijing, 100143, P. R. China.

Tel: (86)18010276738

E-mail: wenqing_li@bjmu.edu.cn

Hang Li

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Enseignement Superieur (ABES) .

Department of Dermatology and Venerology

Peking University First Hospital

No.8 Xishiku Street

Beijing, 100034, P. R. China.

Tel: (86)-10-83573075

E-mail: drlihang@126.com

Number of Tables: 3

Number of Figures: 1

Word count: 3672

Keywords: psoriasis; treatment demands; COVID-19; real-world study; personalized treatment.

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

Abstract

Objectives: The personalized treatment demands of patients with psoriasis did not get significant attention during the pandemic lockdown. This study aimed to investigate the treatment demands of patients with psoriasis with different severities, stratified by COVID-19 pandemic conditions.

Design: Cross-sectional study design.

Setting: Multicenter study based on a national psoriasis registry in China.

Participants: A total of 22,425 adult patients with psoriasis were enrolled between August 2020 and September 2021.

Primary and Secondary Outcome Measures: The primary outcomes were patient demands for quick healing of skin lesions and improving mental health, which were collected by questionnaires. Multivariable logistic models were used to examine the impact of disease severity, as measured by Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and Investigator's Global Assessment (IGA), on treatment demands, as stratified by COVID-19 pandemic conditions (lockdown vs. non-lockdown).

Results: Increasing PASI score significantly increased patient demands for rapid healing of skin lesions and improving mental health during non-lockdown periods. The magnitude of both associations further increased during the COVID-19 lockdown from an odds ratio (OR) of 1.45 (95% confidence interval [CI] 1.27–1.65) to 2.19 (95% CI 1.57–3.05) and 2.11 (95% CI 2.03–2.40) to 2.81 (95% CI 2.24–3.55), respectively. The skin lesion healing demand was more triggered by the overall irritation level (measured by IGA, OR=1.64, 95% CI 1.35–1.99 during non-lockdown periods versus OR=2.70, 95% CI 1.63–4.49 during lockdowns); while the mental health improving demand was more triggered by lesion coverage (measured by BSA, OR=2.01, 95% CI 1.85–2.19 versus OR=3.27, 95% CI 2.57–4.15).

Conclusions: Psoriasis aggravation significantly increased patients' treatment demands, especially during lockdowns. The used psoriasis severity measures highlighted patients' treatment demands differently. This suggests more accessible and personalized healthcare for patients with psoriasis should be available during future pandemics.

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

Strengths and limitations of this study

- This is, to date, the largest study investigating the association between psoriasis severity and treatment demands from the patients' perspective, and the first study comparing the aforementioned association between a lockdown and a non-lockdown period.
- Since the used measures assessed different aspects of disease severity, this study compared multiple perspectives of disease severity on each treatment demand, aiming to help recognize patients' needs according to their clinical manifestations.
- As most previous studies focused on the quality of life of patients with psoriasis, this study further investigated the impact of psoriasis on treatment demands mediated by quality of life.
- The study enrolled patients from specific dermatological clinics, and a certain proportion of patients declined the enrollment request. Thus, the study population may not represent the general psoriasis population.
- There was an issue regarding missing data in this study. However, as the missing rate was not high, and missing at random was considered, a complete case analysis was considered sufficient for handling missing data and was, therefore, used.

INTRODUCTION

Psoriasis is a chronic, non-fatal disease primarily affecting the skin. The prevalence of psoriasis varies geographically, with 0.14% and 1.99% of the population in East Asia and Australasia being affected, respectively [1]. In China, the prevalence was 0.12% in 1987 and 0.47% in 2012 [2]. Apart from skin lesions, psoriasis is also now recognized as a systemic inflammatory disorder that relates to various comorbidities, such as metabolic syndrome, arthritis, malignancy, and so on [3]. Poor appearances, together with comorbidities, significantly impair patients' daily functioning and cause significant psychological distress [4], which can result in depression, suicidal ideation, and substance abuse [5,6], causing high social burdens, especially during the recurrent coronavirus disease 2019 (COVID-19) pandemics [7,8].

Current clinical diagnosis and treatment for psoriasis must follow appropriate guidelines and consensus. Therefore, the choice of treatment for psoriasis primarily depends on the objective assessment of lesion severity of the disease, yet the demands of the patient are often neglected [9,10]. However, due to the chronic, non-fatal characteristics of psoriasis,

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

individual perceptions of the disease can determine the impact of psoriasis on the quality of life of patients, which may then affect their treatment demands [11,12]. Thus, the treatment decisions should be driven by the real needs and expectations of each individual.

Furthermore, since healthcare access (e.g. emerged telemedicine) [13-16], as well as the clinicians' treatment considerations to control psoriasis, have all changed during the recurrent COVID-19 pandemics [17], patients' perception of psoriasis and further their treatment demands may altered accordingly. From a healthcare-seeking behavior perspective, common changes among patients with psoriasis during the COVID-19 pandemic included the canceling or deferring of appointments, nonadherence to treatment, prolonged prescription, and treatment-change requirements [7,18]. Patients may become more anxious about their psoriasis lesions due to the difficulty in accessing healthcare. In contrast, from a quality of life perspective, the social-activity aspect assessed in a quality of life questionnaire became irrelevant during lockdown, which led to paradoxically improved quality of life among patients with psoriasis during the COVID-19 lockdown [19]. Patients may perceive their psoriasis lesions as more acceptable because they are less worried about skin lesion appearances due to restricted social activities, and are more fearful of COVID-19 than non-fatal psoriasis. As a result, how patients' treatment demands changed during pandemics remains unknown. Thus, it is essential to re-assess patients' treatment demands to improve personalized treatment during the pandemic. However, studies on changes in treatment demands from patients' perspectives during pandemics are limited.

This study aimed to examine the treatment demands of patients with psoriasis with varying disease severity and other clinical and personal characteristics in a real-world setting throughout the recurrent COVID-19 pandemics, hoping to provide references for personalized treatment strategies not only for patients with psoriasis during COVID-19 pandemic but also for patients with all other chronic diseases in any future pandemic lockdowns.

MATERIALS AND METHODS

Study design, patients, and data collected

This was a cross-sectional, multicenter study based on a nationwide real-world big data collection platform established by the Psoriasis Standardized Diagnosis and Treatment Center (also named Psoriasis Center) and led by the National Clinical Research Center for Skin and Immune Disease [20]. This data platform is the first and currently the largest psoriasis registry in China, and as of September 2021, had included data of 32,014 patients with psoriasis from 228 hospitals across China. The registry collects data on demographics,

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

medical history, clinical assessment, previous and current treatments for psoriasis, self-reported quality of life, and treatment demands at enrollment. All patients provided informed consent for publication before their details were entered into the registry. The establishment of this big data collection platform was approved by the Human Genetic Resources Management Office of the Ministry of Science and Technology of China (approval number: 2022-CJ0021) and the ethics committee of Peking University First Hospital (approval number: 2020-scientific research-255) for use in clinical studies. The data preprocessing standards for derived variables and variables with potentially mistaken values are listed in Table S1 (Supplemental Material).

All patients aged ≥18 years enrolled between August 2020 to September 2021 with complete baseline data were included. The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (Supplemental Material).

Patient and public involvement

Patients were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Study measures

The study outcomes were patients' treatment demands, which were collected in the form of multiple choices in a questionnaire containing the two primary treatment demands: healing skin lesions quickly and improving mental health. The questionnaire also asked about other demands, including reducing social discrimination, working and socializing normally, relieving itchy feelings, relieving painful or burning feelings, and reducing the side effects of treatment and disease relapses. Quality of life was additionally assessed by the Dermatology Life Quality Index (DLQI).

The main exposure was psoriasis severity, which was assessed by the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and the 5-point Investigator's Global Assessment (IGA) [9,10]. According to the guidelines for the diagnosis and treatment of psoriasis in China (2018), PASI score was categorized as mild (<3), moderate (3-<10) and severe (≥10), whereas BSA (%) was categorized as mild (<3%), moderate (3% to <10%), and severe (≥10%) [21]. The 5-point IGA categorized the severity level as clear/almost clear (0/1), mild (2), moderate (3), and severe (4).

Provincial COVID-19 data was summarized from the official website of the National Health Commission of the People's Republic of China (http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml). Considering the maintenance period of both epidemic control measures and public response to the pandemic, the 7 days following

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

the last day in which a new case was recorded were further classified into the same pandemic period. The COVID-19 pandemic variable was treated as binary according to the geographical location and enrolled day of each patient.

Statistical analysis

Descriptive statistics were performed for each variable stratified by each treatment demand using frequencies (percentages) for categorical variables and median (interquartile range [IQR]) for continuous variables. Categorical variables were compared using chi-squared tests, whereas continuous variables were compared using the Kruskal–Wallis H test.

Multivariable logistic regression models were used to investigate the impact of psoriasis severity, as measured by PASI, BSA, and IGA, separately, on each treatment demand stratified by whether the patient was enrolled during the COVID pandemic. To reduce potential confounding factors, all models were adjusted for demographic characteristics (sex, age, body mass index [BMI], marriage status, education, employment, and smoking habits) and clinical characteristics (psoriasis duration, family history, disease phenotype, nail/scalp/genital/palmoplantar involvement, comorbidities, and previous treatment). PASI, BSA, and IGA values were separately modeled in relation to each treatment demand, and were treated as continuous and categorical variables separately. A Q-test attached to the fixed effect model was performed to detect the heterogeneity between the impact of psoriasis severity on treatment demands during the COVID-19 pandemic lockdowns and normal periods. Mediation analysis was employed to investigate the effect of PASI/BSA/IGA on treatment demands mediated by DLQI, adjusting for the same confounding set above and additionally for COVID-19 lockdowns. Other potential factors influencing the treatment demands were examined using the same multivariable logistic regression models investigating the impact of PASI on quick skin healing and mental health improvement demands while adding the COVID-19 pandemic as a covariate. All data analysis was conducted using STATA/SE (StataCorp LLC 2021, Stata Statistical Software: Release 17, College Station, TX), and a *P*-value <0.05 was considered statistically significant.

RESULTS

General characteristics

Among the 29,412 adult patients enrolled as of September 2021 (Table S2, see Supplemental Material), 22,425 with complete baseline information from 212 tertiary hospitals across China were enrolled in this study. Exactly 65.0% of patients were men (n=14,567). The median age was 40 (IQR, 31–54) years, and the percentages of different age groups were as follows: 18-45 years, 60.3% (n = 13,515); 46-60 years, 26.9% (n =

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

6,033); ≥61 years, 12.8% (n = 2,877). The median PASI and DLQI scores were 7.2 and 8, respectively. Exactly 12.1% of the patients (n = 2,706) were enrolled during a COVID-19 lockdown in their provinces. Moreover, 89.7% (n = 20,111) and 38.0% (n = 8,531) of the patients demanded a speedy healing of the skin lesions and mental health improvement, respectively (Table 1).

Patients demanding the rapid healing of skin lesions tended to be female, younger, employed, unmarried, have a college degree, have current smoking habits, enrolled during a normal period without the COVID-19 lockdown, have a shorter psoriasis duration, have a positive family history, have pustular or guttate psoriasis, have nail or scalp involvement, and have a severer psoriasis condition, as measured by PASI, BSA, and IGA, while not having palmoplantar involvement, comorbidities, such as psoriatic arthritis (PsA), or a history of use of biologics (all P <0.05). By comparison, patients demanding mental health improvement tended to be unemployed, have a longer psoriasis duration, have plaque, pustular, or arthropathic psoriasis, have lesions on special areas including nails, scalps, hands/soles, and genitals, have more severe psoriasis conditions, while not having a college degree, smoking habits, erythrodermic or guttate psoriasis, or comorbidities (all P <0.05). Patients' characteristics stratified by other treatment demands are shown in Table S3 (Supplemental Material).

Impact of psoriasis severity on treatment demands stratified by the COVID-19 pandemic

Both multivariable logistic regression and trend tests confirmed that the increasing psoriasis severity, as measured by PASI, significantly stimulated patients' primary treatment demands of healing skin lesions rapidly (odds ratio [OR], 1.45; 95% confidence interval [CI], 1.27–1.65; P <0.001 for severe PASI versus mild PASI; and OR, 1.02; 95% CI, 1.01–1.02; P <0.001 in the trend test) and improving mental health (OR, 2.21; 95% CI, 2.03–2.40; P <0.001 for severe PASI versus mild PASI; and OR, 1.03; 95% CI, 1.02–1.03; P <0.001 in the trend test) during a normal period without COVID-19 lockdown (shown in Fig. 1a–b; and Table S4 [Supplemental Material]). The disease severity-triggered primary treatment demands further increased during the COVID lockdowns, including healing skin lesions rapidly (OR, 2.19; 95% CI, 1.57–3.05 for severe PASI versus mild PASI; P <0.001) and improving mental health (OR, 2.82; 95% CI, 2.24–3.55 for severe PASI versus mild PASI, P <0.001), despite the statistical insignificance (both P=0.064 in the heterogeneity Q-test). Other treatment demands, including reducing social discrimination, working and socializing normally, relieving painful or burning feelings, relieving itchy feelings, and reducing the treatment side effects, were also significantly stimulated by deteriorated skin conditions measured by PASI (all P

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Superieur (ABES) .

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

For peer review only

Enseignement Superieur (ABES) .

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

<0.05); moreover, the degree of this stimulation further intensified during the COVID-19 lockdown (shown in Fig. 1c–g). The exception was the demand for reducing relapses, which significantly declined as PASI increased. Nevertheless, the magnitude of this decline decreased during the pandemic lockdown (OR, 0.61; 95% CI, 0.49–0.75, *P* <0.001 for severe PASI versus mild PASI during a non-COVID-19 period; and OR, 0.81; 95% CI, 0.58–1.12; *P*=0.196 during a COVID-19 lockdown; heterogeneity Q-test, *P*=0.001; shown in Fig. 1h).

Impact of psoriasis severity by different instruments on treatment demands stratified by the COVID-19 pandemic

Similar patterns of change in each treatment demand were also found as BSA and IGA increased during the normal period. However, the two measures motivated the treatment demands slightly differently during the pandemic lockdowns. Specifically, the magnitude of increasing BSA-triggered demands of rapidly healing skin lesions hardly increased during the pandemic lockdowns (OR, 1.33; 95% CI, 1.17–1.50; *P* <0.001 for severe BSA versus mild BSA during a normal period; and OR, 1.38; 95% CI, 0.999–1.896; *P*=0.051 during the pandemic lockdown; heterogeneity Q-test, *P*=0.663), whereas that of IGA-triggered demands significantly increased (OR, 1.64; 95% CI, 1.35–1.99; *P* <0.001 for IGA=4 versus IGA=0/1 during the normal period; and OR, 2.70; 95% CI, 1.63–4.49; *P* <0.001 during the pandemic lockdown; heterogeneity Q-test, *P*=0.005). In contrast, the magnitude of the increase in demands of improving mental health triggered by BSA significantly increased during the pandemic (OR, 2.01; 95% CI, 1.85–2.19; *P* <0.001; and OR, 3.27; 95% CI, 2.57–4.15; *P* <0.001; heterogeneity Q-test, *P* <0.001), whereas that triggered by IGA hardly changed (OR, 2.21; 95% CI, 1.94–2.51; *P* <0.001; and OR, 1.91; 95% CI, 1.36–2.68; *P* <0.001; heterogeneity Q-test, *P*=0.971; shown in Fig. 1a–b and Table sS5 & S6 [Supplemental Material]).

Impact of psoriasis severity on treatment demands mediated by quality of life

Further mediation analysis showed that increasing PASI motivated patients' treatment demands mainly by deteriorating their quality of life, including reducing social discrimination (mediated proportion, 49.0%), improving mental health (47.1%), working and socializing normally (72.1%), relieving painful (40.8%) or itchy (73.2%) feelings, and reducing the treatment side effects (74.3%) (Table 2). However, the proportion of the DLQI-mediated effect was small in the total effect of PASI on the demands for reducing relapses (7.6%) and quickly healing skin lesions (0.6%). The abovementioned results were replicated when disease severity was examined by BSA and IGA.

Potential factors influencing treatment demands

Apart from disease severity, multivariable logistic regression analysis also identified female sex (OR, 1.23; 95% CI, 1.11–1.36; *P* <0.001), smoking status (OR, 1.17; 95% CI, 1.04–1.30; *P*=0.005), pustular psoriasis (OR, 1.71; 95% CI, 1.26–2.32; *P*=0.001), and nail involvement (OR, 1.28; 95% CI, 1.14–1.44, *P* <0.001) to be significantly correlated with a higher demand for quick skin lesion healing. However, older age (OR, 0.994; 95% CI, 0.991–0.998; *P*=0.004), married status (OR, 0.82; 95% CI, 0.72–0.94; *P*=0.003), unemployed status (OR, 0.82; 95% CI, 0.70–0.95; *P*=0.010), COVID-19 lockdown (OR, 0.87; 95% CI, 0.77–0.99; *P*=0.037), arthropathic psoriasis (OR, 0.55; 95% CI, 0.47–0.64; *P* <0.001), palmoplantar involvement (OR, 0.75; 95% CI, 0.67–0.85; *P* <0.001), and comorbidities (OR, 0.86; 95% CI, 0.76–0.97; *P*=0.018) were found to be significantly correlated with lower demand (Table 3).

Moreover, the demand for the improvement of mental health was significantly higher in patients with arthropathic psoriasis (OR, 1.22; 95% CI, 1.09–1.37; *P*=0.001), guttate psoriasis (OR, 0.78; 95% CI, 0.71–0.84; *P* <0.001), and palmoplantar involvement (OR, 1.09; 95% CI, 1.01–1.18, *P*=0.027). However, this was lower among patients with older age (OR, 0.993; 95% CI, 0.991–0.996, *P* <0.001), higher BMI (OR, 0.9955; 95% CI, 0.9914–0.9996; *P*=0.030), a college education (OR, 0.90; 95% CI, 0.84–0.95; *P*=0.001), smoking status (OR, 0.81; 95% CI, 0.75–0.86; *P* <0.001), pustular psoriasis (OR, 0.77; 95% CI, 0.65–0.92; *P*=0.003), and comorbidities (OR, 0.90; 95% CI, 0.83–0.97; *P*=0.012).

DISCUSSION

In this cross-sectional study, it was observed that patient demands for healing skin lesions and improving mental health significantly increased as psoriasis worsened, especially during the COVID-19 pandemic. Different psoriasis severity measures have different emphases in reflecting patients' treatment demands, which were magnified during the pandemic. The impact of disease severity on most treatment demands was mediated by deteriorated quality of life, except for the demands of rapid skin healing and relapse reduction, and thus other factors that stratified major treatment demands were also examined.

Patient-centered intervention is crucial for the treatment of psoriasis due to the chronic and non-fatal characteristics of the condition, in addition to the considerable disparity in prices of various treatment choices, especially in recent years with recurrent pandemic lockdowns. During a normal period, all treatment demands, ranging from improving the appearance of skin lesions and relieving irritating symptoms to psychological and daily functional support, significantly increased as psoriasis deteriorated, suggesting the need for more intensive treatment and psychological counseling for patients. The only exception was the demand for reducing relapses, which was demanded in only 4.7% of patients and further decreased as disease severity increased, indicating that most Chinese patients have recognized the

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

chronic nature of psoriasis and accepted the recurrent relapses and living with a small number of skin lesions and thereby suggesting that clinicians should be aware that patients may have poor compliance in their remission periods.

Compared to normal periods, all treatment demands, including those for rapidly healing skin lesions and improving mental health, were further triggered by disease severity during pandemic lockdowns (shown in Fig. 1). This differed from previous reports, which demonstrated that patients' quality of life, as measured by DLQI, was less influenced by psoriasis during pandemic lockdowns [19]. The reason for the difference in results is complex. On one hand, because social activities were restricted, patients worried less about skin lesion appearance when socializing and were more fearful about contracting infectious diseases rather than the non-fatal psoriasis. Thus, better quality of life, as indicated by DLQI, was observed. Our multivariable logistic models also showed that the COVID-19 pandemic itself was a protective factor in reducing the demands of healing skin lesions (Table 3). On the other hand, the restrictions in traveling and difficulties in accessing medical resources for common chronic diseases may enhance treatment demands. Taking all these factors together, the study showed enhanced treatment demands in patients with more severe psoriasis during the pandemic lockdowns, suggesting that patients' treatment demands were more influenced by psoriasis conditions and difficulties in accessing healthcare facilities rather than the reduced need for socializing. The restrictions in traveling and difficulties in accessing medical resources for common chronic diseases may further contribute to an enhanced treatment demand during the pandemic lockdowns, indicating for clinicians that a more intensive treatment strategy with lasting effects and enhanced mental support is needed during lockdown, despite the reduced concern regarding socialization caused by lesion appearances. A more accessible pathway, such as telemedicine and online medicine service, should also be promoted to facilitate access to healthcare during pandemic lockdowns. All these factors might be generalized and integrated into the management of other chronic non-fatal diseases, such as atopic diseases, during future pandemics to meet patients' treatment needs.

To further help recognize patients' needs according to their clinical manifestations in daily clinics, this study compared the impact of disease severity by different measures on each treatment demand. PASI, BSA, and IGA are all instruments measuring psoriasis severity and were found to be significantly correlated with one another [22]. PASI takes both the area coverage and lesion appearance into account, yet it is time consuming to calculate. In contrast, BSA and IGA are easier to understand, yet only represent the lesion coverage or lesion appearance [9,10]. In this study, an overall more irritating skin appearance presented

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

by a higher IGA further stimulated the demands for the quick relief of skin lesions themselves during the pandemic lockdown, whereas the larger lesion coverage presented by higher BSA further motivated demands for psychological solutions, including improving mental health and reducing social discrimination. Since PASI is difficult to obtain, this study suggests that BSA should be used as a “first-line” surrogate to represent the enhanced psychological needs of patients, whereas IGA should be used to represent the increased need for more intensive therapy during pandemic lockdowns.

As most previous studies focused on the quality of life of patients with psoriasis, which revealed that worsened quality of life was associated with worsened psoriasis [23,24], this study further investigated the impact of psoriasis on treatment demands mediated by quality of life. In this study, quality of life was measured by DLQI, which reflected patients’ lesion feelings, daily activities, leisure, work and study, personal relationships, and treatment burden. We confirmed that increasing disease severity deteriorated patients’ quality of life based on the abovementioned aspects, which further motivated corresponding treatment demands. However, although prevalent in the psoriasis population, <2% of the demand for quick skin lesion healing was mediated by deteriorated quality of life, indicating the existence of other factors influencing treatment demands.

Thus, this study further examined other factors potentially stratifying treatment demands. Young and female patients were found to have worse quality of life in previous studies [23,25,26], as well as higher treatment demands for rapid skin lesion healing in this study. Unmarried and employed patients without comorbidities were also found to have stronger demands for quick healing. These might be because female, young, unmarried, and employed patients have higher requirements for self-image, and patients without comorbidities have fewer concerns regarding polypharmacy and drug interactions due to underlying diseases. Additionally, the same demands for quick healing were higher in patients with pustular psoriasis, which presents with fever, painful skin, and frequent flare-ups [27], and nail psoriasis, which undermines daily function [28]. Thus, a more intensive treatment strategy is needed for these patients. Additionally, more psychological care should be provided to younger patients without a college education, as they may lack a basic understanding of the disease and were found to have higher demands for mental support in this study. The same support was also needed in patients with arthropathic psoriasis and palmoplantar psoriasis, which were linked with internalized stigma and poorer quality of life [29,30].

Although, to our knowledge, this study is the largest real-world study to date investigating the treatment demands of patients with psoriasis during the pandemic lockdowns, there were

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

limitations. First, the Psoriasis Center program enrolled patients from specific dermatological clinics, and a certain proportion of patients declined the enrollment request. Thus, the study population may not represent the general psoriasis population. Second, there was an issue regarding the missing data for this data platform. However, as the missing rate was not high, and missing at random was considered (Table S2 [Supplemental Material]), a complete case analysis was considered sufficient for handling missing data and, therefore, used. Third, since the information on residence place was not collected, the COVID-19 pandemic information was matched to each patient only at a province level, even though the pandemic was prevented with a precise approach in China.

CONCLUSION

An increase in psoriasis severity significantly stimulates patients' treatment demands from quickly healing skin lesions and improving mental health aspects, especially during the pandemic lockdowns, indicating the need for an accessible pathway for patients with psoriasis getting more intensive treatment and mental support during future pandemics. To better recognize and meet patients' treatment demands during the pandemic, we suggest that BSA is used to determine the psychological needs of patients, while IGA should be used to reflect the desire to quickly heal lesions. Other demographic and clinical characteristics of each patient should also be considered for a more personalized treatment strategy during future pandemics. Moreover, since the COVID-19 pandemic is nearing its end in many countries, the results of this study could provide hints for personalized treatment for patients with non-fatal chronic diseases in future pandemic lockdowns.

On peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

Acknowledgements

The authors would like to acknowledge the contributions made by all collaborating units of the Psoriasis Center with data collection. The authors would also like to thank all patients who participated in this study.

Statement of Ethics

Study approval statement: This study protocol was reviewed and approved by ethics committee of the Peking University First Hospital (approval number: 2020-scientific research-255) and the Human Genetic Resources Management Office of the Ministry of Science and Technology of China (approval number: 2022-CJ0021).

Consent to participate statement: All patients provided informed consent for publication before entering the registry.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

This work was supported by PKU-Baidu Fund (grant number: 2020BD012). The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Author Contributions

All authors were involved in the study design. Zhihui Yang cleaned the clinical data, conducted the statistical analysis, created the initial manuscript, and revised the manuscript according to the suggestions of other authors. Yu Jin provided statistical support and helped revise the manuscript. Mingyue Wang and Ruoyu Li helped provide clinical guidance and revise the manuscript. Wenqing Li provided statistical guidance and revised the manuscript. Hang Li revised the manuscript and supervised the overall research project. All authors read and approved the final manuscript.

Data Availability Statement

This study was conducted using deidentified data from the real-world data collection platform of the Psoriasis Standardized Diagnosis and Treatment Center (http://www.psocenter.cn/). Data are publicly available upon request.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

REFERENCES

1 Parisi R, Iskandar I, Kontopantelis E, Augustin M, Griffiths CEM, Ashcroft DM. National, regional, and worldwide epidemiology of psoriasis: systematic analysis and modelling study on behalf of the Global Psoriasis Atlas. BMJ. 2020;369:m1590. doi: 10.1136/bmj.m1590

2 Ding X, Wang T, Shen Y, Wang X, Zhou C, Tian S, et al. Prevalence of psoriasis in China: a population-based study in six cities. Eur J Dermatol. 2012;22(5):663–7. doi: 10.1684/ejd.2012.1802

3 Takeshita J, Grewal S, Langan SM, Mehta NN, Ogdie A, Van-Voorhees AS, et al. Psoriasis and Comorbid Diseases: Epidemiology. J Am Acad Dermatol. 2017;76(3):377–90. doi: 10.1016/j.jaad.2016.07.064

4 Armstrong AW, Schupp C, Wu J, Bebo B. Quality of life and work productivity impairment among psoriasis patients: findings from the National Psoriasis Foundation survey data 2003–2011. PLoS One. 2012;7(12):e52935. doi: 10.1371/journal.pone.0052935

5 Kurd SK, Troxel AB, Crits-Christoph P, Gelfand J. The risk of depression, anxiety, and suicidality in patients with psoriasis: a population-based cohort study. Arch Dermatol. 2010;146(8):891–5. doi: 10.1001/archdermatol.2010.186

6 Dalgard FJ, Gieler U, Tomas-Aragones L, Lien L, Poot F, Jemec GBE, et al. The psychological burden of skin diseases: a cross-sectional multicenter study among dermatological out-patients in 13 European countries. J Invest Dermatol. 2015;135(4):984–91. doi: 1038/jid.2014.530

7 Chiu H-Y, Chang Liao N-F, Lin Jr Y, Huang Y-H. Perception of the threat, mental health burden, and healthcare-seeking behavior change among psoriasis patients during the COVID-19 pandemic. PLoS One. 2021;16(12):e0259852. doi: 10.1371/journal.pone.0259852

8 Lada G, Chinoy H, Talbot PS, Warren RB, Kleyn CE. Impact of the COVID-19 Pandemic on the Mental Health and Quality of Life of Patients with Psoriasis in Tertiary Care; A One-year Follow-up. Acta Derm Venereol. 2022;102:adv00814–adv14. doi: 10.2340/actadv.v102.2464

9 Armstrong AW, Siegel MP, Bagel J, Boh EE, Buell M, Cooper KD, et al. From the Medical Board of the National Psoriasis Foundation: treatment targets for plaque psoriasis. J Am Acad Dermatol. 2017;76(2):290–8. doi: 10.1016/j.jaad.2016.10.017

10 Langley RGB, Feldman SR, Nyirady J, van de Kerkhof P, Papavassilis C. The 5-point Investigator's Global Assessment (IGA) Scale: A modified tool for evaluating plaque psoriasis

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

severity in clinical trials. J Dermatolog Treat. 2015;26(1):23–31. doi: 10.3109/09546634.2013.865009 [published Online First: 2013/12/21]

11 Abrouk M, Nakamura M, Zhu TH, Farahnik B, Koo J, Bhutani T. The impact of PASI 75 and PASI 90 on quality of life in moderate to severe psoriasis patients. J Dermatolog Treat. 2017;28(6):488–91. doi: 10.1080/09546634.2016.1278198 [published Online First: 2017/01/04]

12 Blome C, Gosau R, Radtke MA, Reich K, Rustenbach SJ, Spehr C, et al. Patient-relevant treatment goals in psoriasis. Arch Dermatol Res. 2016;308(2):69–78. doi: 10.1007/s00403-015-1613-8

13 Hoffman DA. Increasing access to care: telehealth during COVID-19. J Law Biosci. 2020;7(1). doi: 10.1093/jlb/lsaa043

14 Mistry SK, Ali AM, Yadav UN, Ghimire S, Hossain MB, Das-Shuvo S, et al. Older adults with non-communicable chronic conditions and their health care access amid COVID-19 pandemic in Bangladesh: Findings from a cross-sectional study. PLoS One. 2021;16(7):e0255534. doi: 10.1371/journal.pone.0255534

15 Nouri S, Khoong EC, Lyles CR, Karliner L. Addressing equity in telemedicine for chronic disease management during the Covid-19 pandemic. NEJM Catal Innov in Care Deliv. 2020;1(3). doi: 10.1056/CAT.20.0123

16 Singh K, Kondal D, Mohan S, Jaganathan S, Deepa M, Venkateshmurthy N, et al. Health, psychosocial, and economic impacts of the COVID-19 pandemic on people with chronic conditions in India: a mixed methods study. BMC Public Health. 2021;21(1):685. doi: 10.1186/s12889-021-10708-w

17 Elmas ÖF, Demirbaş A, Kutlu Ö, Bağcıer F, Metin MS, Özyurt K, et al. Psoriasis and COVID-19: A narrative review with treatment considerations. Dermatol Ther. 2020;33(6):e13858. doi: 10.1111/dth.13858

18 Ninosu N, Roehrich F, Diehl K, Peitsch WK, Schaarschmidt M-L. Psoriasis care during the time of COVID-19: real-world data on changes in treatments and appointments from a German university hospital. Eur J Dermatol. 2021;31(2):183–91. doi: 10.1684/ejd.2021.4016

19 Boch K, Zillikens D, Ludwig RJ, Thaçi D. Paradoxical improvement of life quality in the COVID-19 era in psoriasis patients. PLoS One. 2022;17(9):e0275293. doi: 10.1371/journal.pone.0275293

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

20 Yang Z, Yao X, Wang M, Li H, Li R. Updates in psoriasis diagnosis and treatment status in China: results from the National Psoriasis Center Registry. Chin Med J. 2023. doi: 10.1097/cm9.0000000000002563 [published Online First: 2023/04/07]

21 Committee on Psoriasis, Chinese Society of Dermatology. Guideline for the diagnosis and treatment of psoriasis in China (2018 complete edition). Chin J Dermatol. 2019;52(10):667–710. doi: 10.35541/cjd.20190847

22 Lane S, Lozano-Ortega G, Wilson J, Chambenoit O, Barbeau M, Gagné-Henley A, et al. Assessing severity in psoriasis: Correlation of different measures (PASI, BSA, and IGA) in a Canadian real-world setting. Value Health. 2016;19(3):A122. doi: 10.1016/j.jval.2016.03.490

23 Daudén E, Pujol R, Sánchez-Carazo J, Toribio J, Vanaclocha F, Puig L, et al. Demographic characteristics and health-related quality of life of patients with moderate-to-severe psoriasis: The VACAP study. Actas Dermosifiliogr. 2013;104(9):807–14. doi: 10.1016/j.ad.2013.03.005

24 Strober B, Greenberg JD, Karki C, Mason M, Guo N, Hur P, et al. Impact of psoriasis severity on patient-reported clinical symptoms, health-related quality of life and work productivity among US patients: real-world data from the Corrona Psoriasis Registry. BMJ Open. 2019;9(4):e027535. doi: 10.1136/bmjopen-2018-027535

25 Merola JF, Qureshi A, Husni ME. Underdiagnosed and undertreated psoriasis: Nuances of treating psoriasis affecting the scalp, face, intertriginous areas, genitals, hands, feet, and nails. Dermatol Ther. 2018;31(3):e12589. doi: 10.1111/dth.12589

26 Maul JT, Navarini AA, Sommer R, Anzengruber F, Sorbe C, Mrowietz U, et al. Gender and age significantly determine patient needs and treatment goals in psoriasis–a lesson for practice. J Eur Acad Dermatol Venereol. 2019;33(4):700–8. doi: 10.1111/jdv.15324

27 Choon SE, Lai NM, Mohammad NA, Nanu NM, Tey KE, Chew SF. Clinical profile, morbidity, and outcome of adult-onset generalized pustular psoriasis: analysis of 102 cases seen in a tertiary hospital in Johor, Malaysia. Int J Dermatol. 2014;53(6):676–84. doi: 10.1111/jdv.15324

28 Thomas L, Azad J, Takwale A. Management of nail psoriasis. Clin Exp Dermatol. 2021;46(1):3–8. doi: 10.1111/ijd.12070

29 Alpsoy E, Polat M, FettahlıoGlu-Karaman B, Karadag AS, Kartal-Durmazlar P, YalCın B, et al. Internalized stigma in psoriasis: A multicenter study. J Dermatol. 2017;44(8):885–91. doi: 10.1111/1346-8138.13841

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

30 Sampogna F, Tabolli S, Söderfeldt B, Axtelius B, Aparo U, Abeni D. Measuring quality of life of patients with different clinical types of psoriasis using the SF-36. Br J Dermato.l 2006;154(5):844–9. doi: 10.1111/j.1365-2133.2005.07071.x

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

FIGURE LEGENDS

Fig. 1. Odds ratio for the association between each treatment demand and psoriasis severity by different measures (PASI/BSA/IGA) during COVID-19 lockdowns (red line) and non-lockdown periods (blue line).

Fig. 1. a Treatment demand for healing skin lesions rapidly

Fig. 1. b. Treatment demand for improving mental health

Fig. 1. c. Treatment demand for reducing social discrimination

Fig. 1. d. Treatment demand for working and socializing normally

Fig. 1. e. Treatment demand for relieving painful or burning feelings

Fig. 1. f. Treatment demand for relieving itchy feelings

Fig. 1. g. Treatment demand for reducing the side effects of treatment

Fig. 1. h. Treatment demand for reducing relapses.

PASI: Psoriasis Area and Severity Index; BSA: Body Surface Area; IGA: Investigator's Global Assessment.

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

Tables

Table 1. Demographic and clinical characteristics stratified by primary treatment demands

	Healing skin lesions rapidly			Improving mental health			Total (n=22,425)
	Yes (n=20,111)	No (n=2314)	*P* value	Yes (n=8531)	No (n=13,894)	*P* value	
Male, n (%)	13,005 (64.7)	1562 (67.5)	0.007	5491 (64.4)	9076 (65.3)	0.144	14,567 (65.0)
Age, y, median (IQR)	40 (31–53)	42 (33–55)	<0.001	40 (31–53)	40 (31–54)	0.227	40 (31–54)
BMI, kg/m^2, median (IQR)	24.0 (21.7–24.0)	24.2 (21.9–26.9)	0.099	24.0 (21.8–26.7)	24.1 (21.8–26.8)	0.405	24.0 (21.7–26.7)
Unemployment*, n (%)	1755 (8.7)	239 (10.3)	0.010	833 (9.8)	1161 (8.4)	<0.001	1994 (8.9)
Married, n (%)	15,316 (76.2)	1888 (81.6)	<0.001	6544 (76.7)	10,660 (76.7)	0.979	17,204 (76.7)
Bachelor's degree, n (%)	7064 (35.1)	764 (33.0)	0.044	2860 (33.5)	4968 (35.8)	0.001	7828 (34.9)
Current smoker, n (%)	5443 (27.1)	580 (25.1)	0.040	2119 (24.8)	3904 (28.1)	<0.001	6023 (26.9)
COVID-19 lockdowns, n (%)	2394 (11.9)	312 (13.5)	0.027	1032 (12.1)	1674 (12.1)	0.913	2706 (12.1)
Psoriasis duration, y, median (IQR)	6 (2-14)	8 (2-15)	<0.001	8 (2-15)	6 (1–14)	<0.001	6 (2-14)
Family history, n (%)	3459 (17.2)	357 (15.4)	0.032	1452 (17.0)	2364 (17.0)	0.991	3816 (17.0)
Psoriasis phenotype†, n (%)							
Plaque psoriasis	16,335 (81.2)	1896 (81.9)	0.406	7105 (83.3)	11,126 (80.1)	<0.001	18,231 (81.3)
Erythrodermic psoriasis	219 (1.1)	23 (1.0)	0.675	121 (1.4)	121 (0.9)	0.005	242 (1.1)
Pustular psoriasis	609 (3.0)	49 (2.1)	0.014	216 (2.5)	442 (3.2)	<0.001	658 (2.9)
Guttate psoriasis	2739 (13.6)	277 (12.0)	0.028	978 (11.5)	2038 (14.7)	<0.001	3016 (13.4)

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Arthropathic psoriasis	1293 (6.4)	297 (12.8)	<0.001	668 (7.8)	922 (6.6)	0.001	1590 (7.1)
Lesions on special areas, n (%)							
Nail	4861 (24.2)	504 (21.8)	0.011	2130 (25.0)	3235 (23.3)	0.004	5365 (23.9)
Scalp	13,127 (65.3)	1451 (62.7)	0.014	5709 (66.9)	8869 (63.8)	<0.001	14,578 (65.0)
Palmoplantar	3928 (19.5)	530 (22.9)	<0.001	1863 (21.8)	2595 (18.7)	<0.001	4458 (19.9)
Genital	2681 (13.3)	333 (14.4)	0.157	1281 (15.0)	1733 (12.5)	<0.001	3014 (13.4)
Disease severity, median (IQR)							
PASI	7.2 (3.0–15.0)	5.9 (2.6–12.0)	<0.001	9.1 (3.9–17.4)	6.0 (2.7–12.6)	<0.001	7.2 (3.0–14.6)
BSA, %	10.0 (3.0–30.0)	9.2 (3.0–22.4)	<0.001	14.0 (5.0–30.0)	8.0 (3.0–20.0)	<0.001	10.0 (3.0–30.0)
IGA	3 (2-3)	2 (2-3)	<0.001	3 (2–3)	3 (2-3)	<0.001	3 (2–3)
DLQI, median (IQR)	8 (3-12)	8 (2-12)	0.072	10 (6–15)	6 (2-10)	<0.001	8 (3–12)
Comorbidity‡, n (%)	2850 (14.2)	395 (17.1)	<0.001	1177 (13.8)	2068 (14.9)	0.010	3245 (14.5)
Previous use of biologics§	1726 (8.6)	256 (11.1)	<0.001	732 (8.6)	1250 (9.0)	0.286	1982 (8.8)

BMI, body mass index; BSA, Body Surface Area; DLQI, Dermatology Life Quality Index; IGA, Investigator's Global Assessment; IQR, interquartile range; and PASI, Psoriasis Area and Severity Index.

*The unemployment rate was calculated in the working-age population, which excluded retired patients and students.

†Phenotypes were not mutually exclusive, thus the total percentage was higher than 100%.

‡Comorbidity presented the existence of any disease conditions, including cardiovascular diseases, respiratory diseases, kidney diseases, rheumatic diseases, digestive diseases, tumors, endocrine diseases, and so on.

§Biologics included tumor necrosis factor-α inhibitors and interleukin inhibitors.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

For peer review only

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table 2. Proportion of causal effect of disease severity on treatment demands, as mediated by life quality

Treatment demands	PASI			BSA			IGA		
	Indirect effect*	Total effect†	Mediated proportion‡	Indirect effect*	Total effect†	Mediated proportion‡	Indirect effect*	Total effect†	Mediated proportion‡
Healing skin lesions rapidly	<0.001	0.001	0.6%	<0.001	0.001	1.4%	<0.001	0.019	0.3%
Improving mental health	0.009	0.020	47.1%	0.004	0.007	56.7%	0.098	0.186	52.6%
Reducing social discrimination	0.006	0.013	49.0%	0.003	0.005	53.5%	0.064	0.118	54.3%
Working and socializing normally	0.025	0.035	72.1%	0.010	0.015	67.7%	0.260	0.289	90.0%
Relieving painful or burning feelings	0.010	0.024	40.8%	0.004	0.009	45.5%	0.102	0.212	48.2%
Relieving itchy feelings	0.011	0.015	73.2%	0.004	0.003	139.4%	0.106	0.244	43.3%
Reducing the side effects of treatment	0.016	0.021	74.3%	0.006	0.007	83.4%	0.162	0.145	111.9%
Reducing relapses	<0.001	0.003	7.6%	<0.001	0.001	5.9%	0.004	0.079	5.4%

BSA, Body Surface Area; IGA, Investigator's Global Assessment; and PASI, Psoriasis Area and Severity Index.

*The indirect effect refers to the effect of PASI/BSA/IGA on each treatment demand mediated by life quality.

†The total effect refers to the sum of direct effects of PASI/BSA/IGA on each treatment demand and the indirect effects mediated by life quality.

‡The mediated proportion equals to the indirect effect divided by the total effect.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training and similar technologies.

Table 3. Relationship between other patient characteristics and primary treatment demands identified by the same logistic regression models examining the impact of PASI on treatment demands

Patient characteristics	Healing skin lesions rapidly		Improving mental health	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Sex (reference: male)	1.23 (1.11–1.36)	<0.001	1.04 (0.98–1.11)	0.205
Age	0.994 (0.991–0.998)	0.004	0.993 (0.991–0.996)	<0.001
Body mass index	0.997 (0.990–1.003)	0.281	0.9955 (0.9914–0.9996)	0.030
Marriage (reference: unmarried)	0.82 (0.72–0.94)	0.003	1.06 (0.98–1.14)	0.166
Bachelor's degree	1.01 (0.92–1.12)	0.912	0.90 (0.84–0.95)	0.001
Unemployment	0.82 (0.70–0.95)	0.010	1.08 (0.98–1.20)	0.112
Current smoker	1.17 (1.04–1.30)	0.005	0.81 (0.75–0.86)	<0.001
COVID-19 lockdowns	0.87 (0.77–0.99)	0.037	1.02 (0.93–1.11)	0.726
Disease course	0.9996 (0.9989–1.0004)	0.319	0.9999 (0.9993–1.0005)	0.744
Family history	0.93 (0.82–1.05)	0.225	1.03 (0.95–1.11)	0.457
Psoriasis phenotype (reference: plaque psoriasis)				
Erythrodermic psoriasis	1.19 (0.76–1.86)	0.435	1.09 (0.84–1.42)	0.503
Pustular psoriasis	1.71 (1.26–2.32)	0.001	0.77 (0.65–0.92)	0.003
Guttate psoriasis	1.14 (0.9995–1.31)	0.051	0.78 (0.71–0.84)	<0.001
Arthropathic psoriasis	0.55 (0.47–0.64)	<0.001	1.22 (1.09–1.37)	0.001
Lesions on specific areas				
Nail	1.28 (1.14–1.44)	<0.001	0.97 (0.90–1.04)	0.373
Scalp	1.07 (0.97–1.18)	0.158	1.0005 (0.94–1.06)	0.987
Palmoplantar	0.75 (0.67–0.85)	<0.001	1.09 (1.01–1.18)	0.027
Genital	0.93 (0.81–1.07)	0.323	1.08 (0.99–1.17)	0.087
Comorbidity	0.86 (0.76–0.97)	0.018	0.90 (0.83–0.97)	0.012
Previous use of biologics	0.87 (0.75–1.01)	0.077	1.02 (0.92–1.13)	0.682

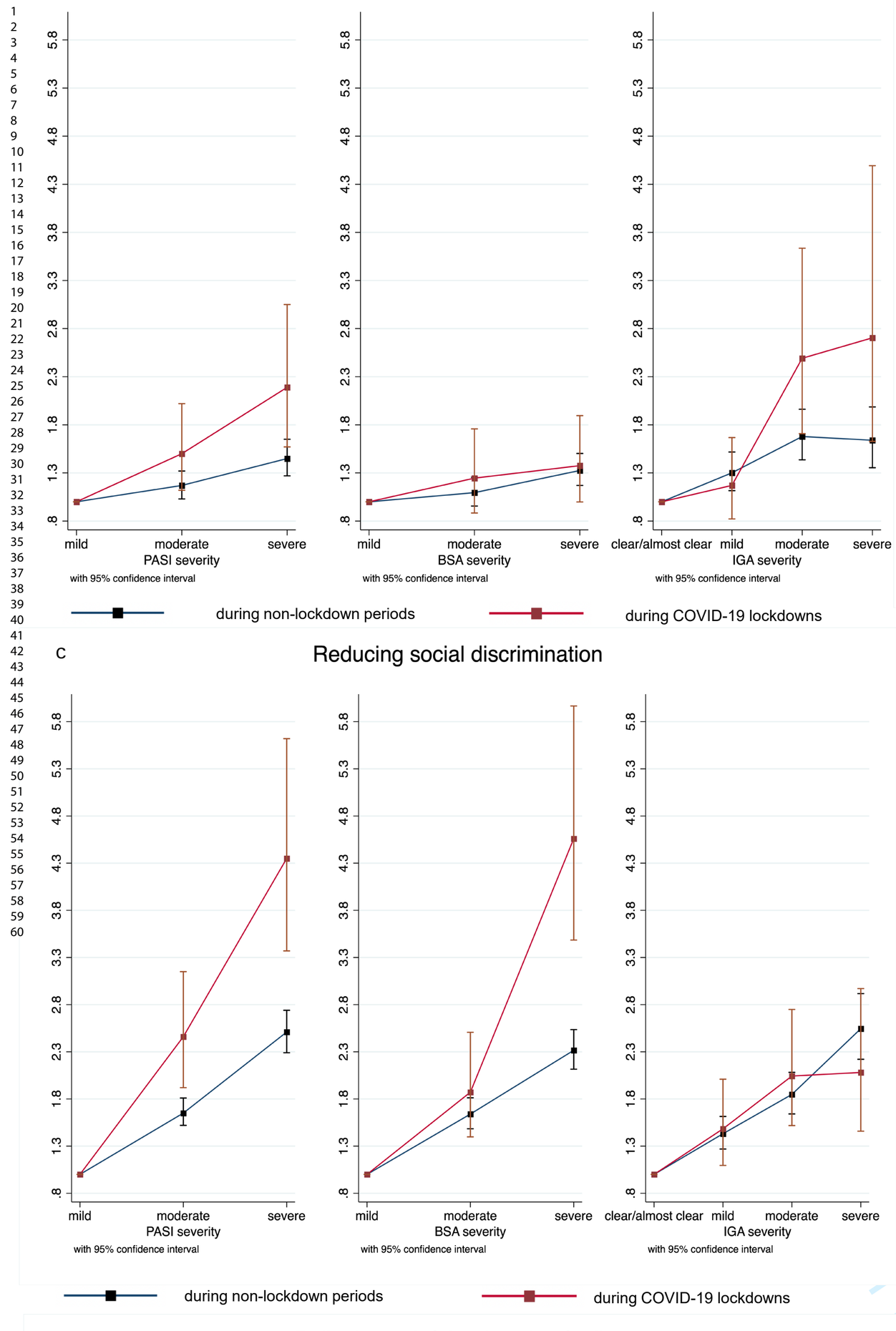
OR: odds ratio; and CI, confidence interval.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

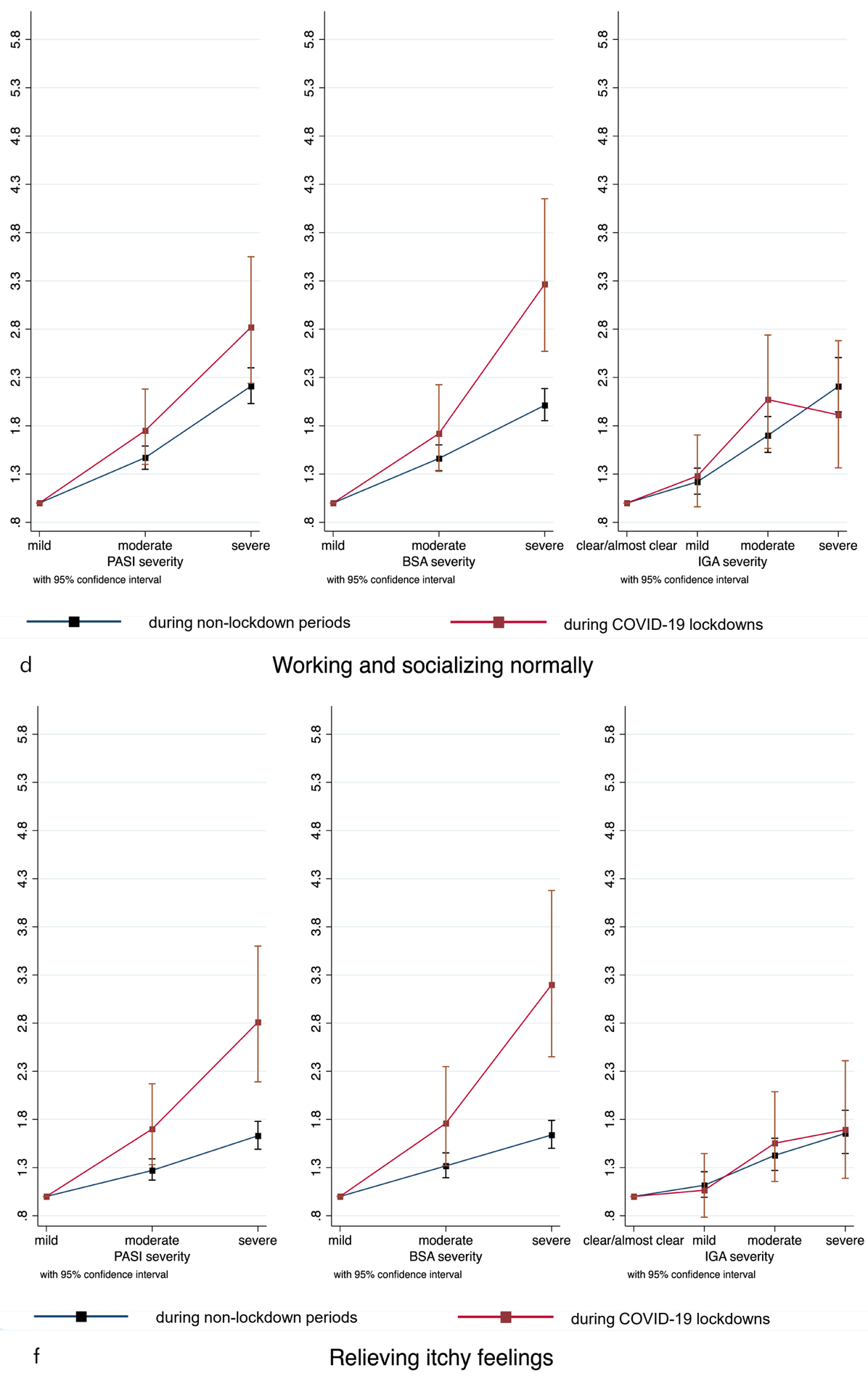
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Enseignement Superieur (ABES) .

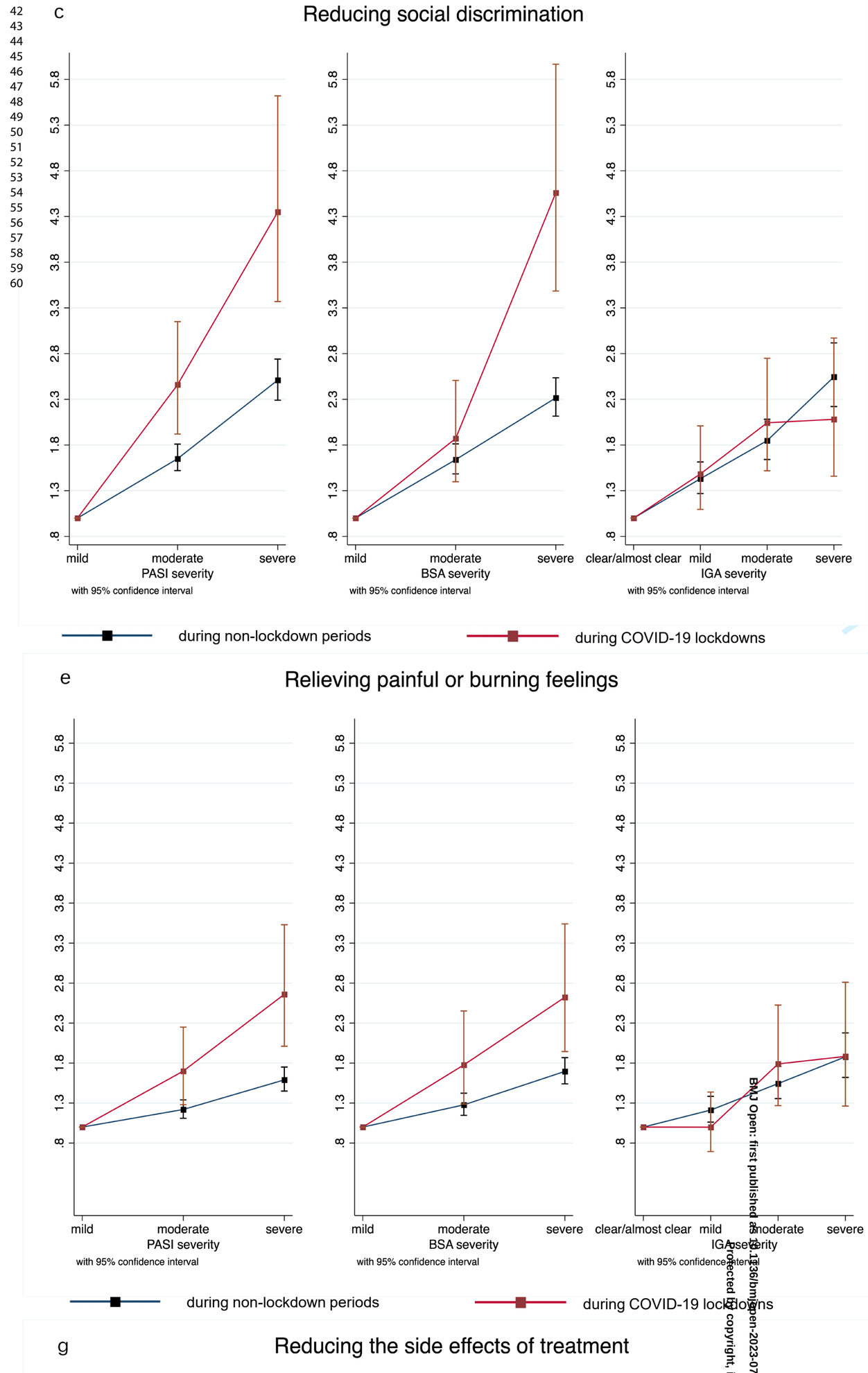
a



b



c

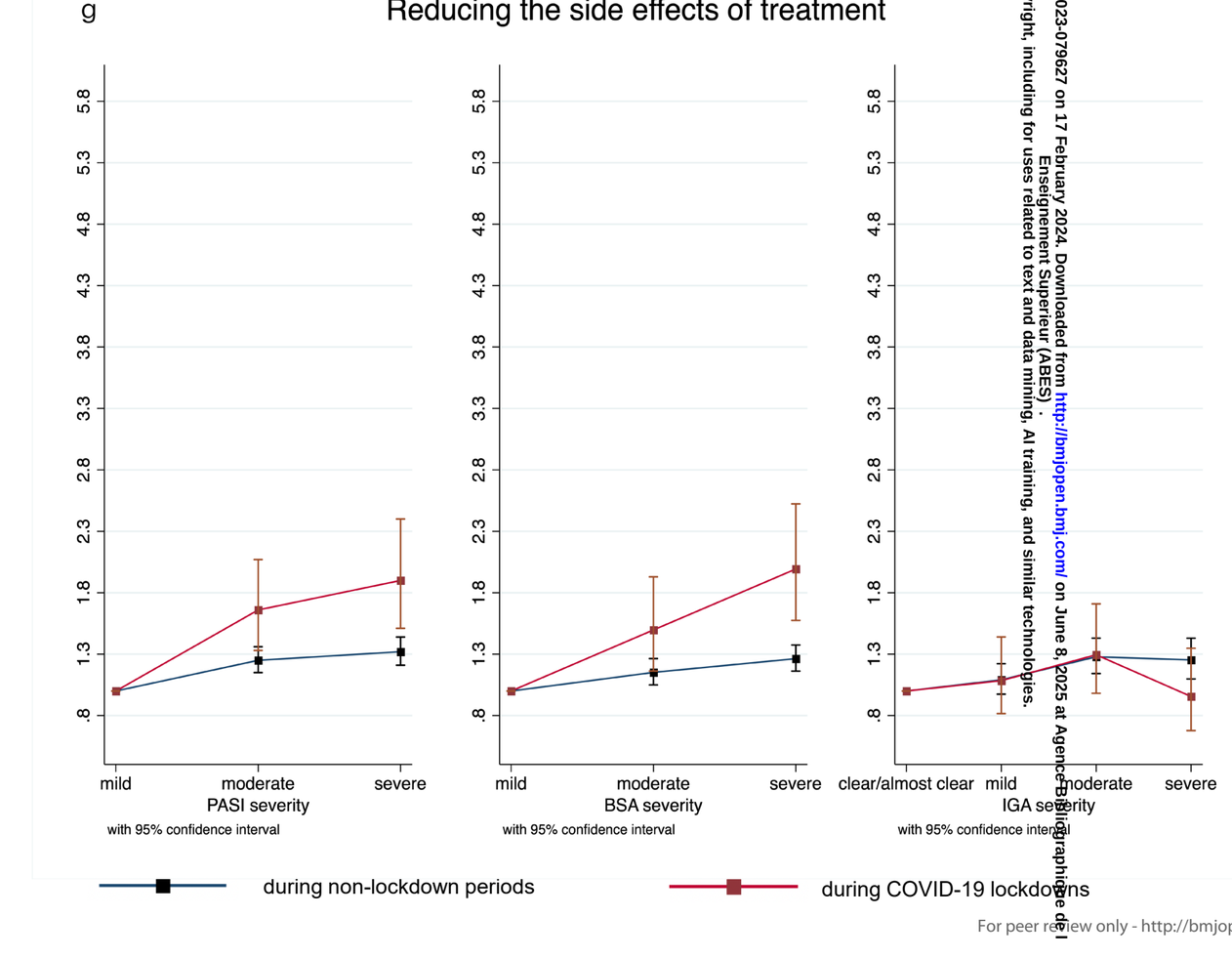


d

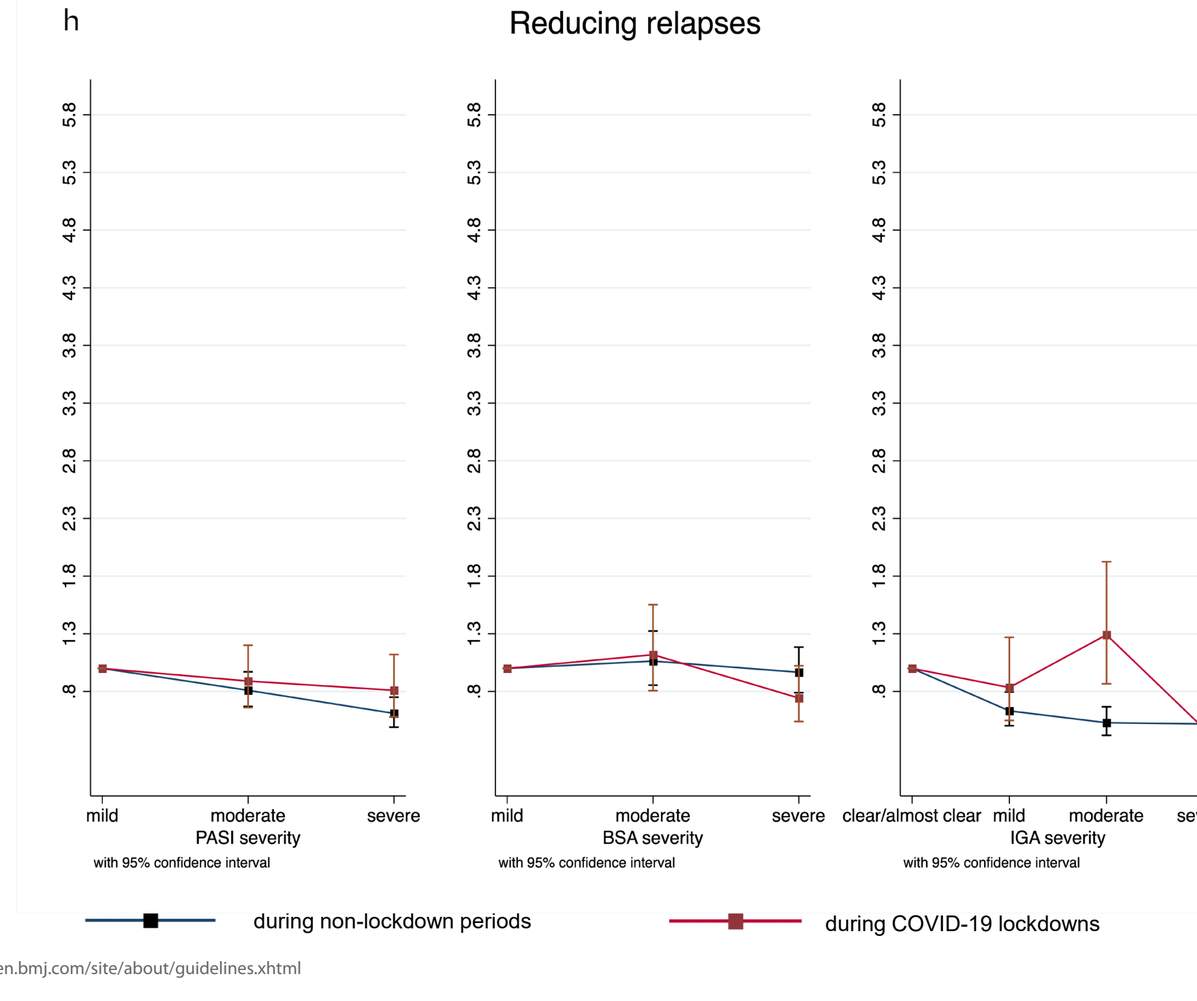
e

f

g



h



BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Article type: Original Article

Title: Enhanced impact of psoriasis severity on treatment demands of patients during the COVID–19 pandemic: A cross–sectional study based on a national psoriasis registry in China

Authors: Z. Yang, MD[1†]; Y. Jin, PhD[2†]; M. Wang, MD[1]; R. Li, MD[1]; W. Li, PhD[2*]; H. Li, MD[1,3*]

[1]*Department of Dermatology and Venerology, Peking University First Hospital, Beijing 100034, China; Beijing Key Laboratory of Molecular Diagnosis of Dermatoses, Peking University First Hospital, Beijing 100034, China; National Clinical Research Center for Skin and Immune Diseases, Beijing 100034, China; and NMPA Key Laboratory for Quality Control and Evaluation of Cosmetics, Peking University First Hospital, Beijing 100034, China.*

[2]*Key Laboratory of Carcinogenesis and Translational Research (Ministry of Education/Beijing), Department of Cancer Epidemiology, Peking University Cancer Hospital & Institute, Beijing 100142, China*

[3]*Peking University – Yunnan Baiyao International Medical Research Center*

[†]These authors contributed equally.

Corresponding author (W. Li and H. Li contributed equally):

Wenqing Li, PhD, Prof.

No.52 Fucheng Road, Haidian District

Beijing, P. R. China. 100143

Tel: (86)18010276738

Email: wenqing_li@bjmu.edu.cn

Hang Li, MD., Prof.

No.1 Xi'anmen Street, Xicheng District

Beijing, P. R. China. 100034

Tel: (86)–10–83573075

Email: drlihang@126.com

ORCID: 0000–0002–7343–3865

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Supplemental Material

Table S1. Data preprocessing standards for derived variables and variables with potential mistaken values.....3

Table S2. Comparison of baseline characteristics between full population and study population with complete data 4

Table S3. Baseline characteristics stratified by treatment demands.....6

Table S4. Mutlivariable logistic regression models examining the impact of PASI on treatment demands stratified by COVID–19 lockdowns 10

Table S5. Mutlivariable logistic regression models examining the impact of BSA on treatment demands stratified by COVID–19 lockdowns 12

Table S6. Mutlivariable logistic regression models examining the impact of IGA on treatment demands stratified by COVID–19 lockdowns 14

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S1. Data preprocessing standards for derived variables and variables with potential mistaken values

Patient characteristics	Data preprocessing standards
Height	Was treated as a missing value if height<80cm for adult patients
Weight	Was treated as a missing value if weight<25kg for adult patients
Psoriasis duration	The year of enrollment minus the year of diagnosis
Family history	Was treated as a missing value if the patient was unsure about the family history
Psoriatic arthritis	Was treated as “yes” if the patient was diagnosed with arthropathic psoriasis or psoriatic arthritis
Body Surface Area	Was treated as a missing value if BSA<75% for patients diagnosed with erythrodermic psoriasis

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S2. Comparison of baseline characteristics between full population and study population with complete data

Patient characteristics	Full population (n=29 412)[a]	Study population (n=22 425)	Missing number and proportion
Male, No. (%)	19 120 (65.1)	14 567 (65.0)	53 (0.2)
Age, median (IQR), y	41 (32–54)	40 (31–54)	241 (0.8)
BMI, median (IQR), kg/m^2	24.0 (21.6–26.6)	24.0 (21.7–26.7)	678 (2.3)
Unemployment[b], No. (%)	2544 (11.5)	1994 (11.4)	1019 (3.5)
Married, No. (%)	22 004 (77.5)	17 204 (76.7)	1018 (3.5)
Bachelor's degree or higher, No. (%)	9277 (34.5)	7828 (34.9)	2487 (8.5)
Current smoker, No. (%)	7101 (25.0)	6023 (26.9)	1018 (3.5)
Enrolled during the COVID–19 lockdowns	4178 (14.3)	2706 (12.1)	159 (0.5)
Psoriasis duration, median (IQR), y	6 (2–14)	6 (2–14)	27 (0.1)
Family history, No. (%)	21 924 (16.5)	3816 (17.0)	3166 (10.8)
Psoriasis phenotype, No. (%)			
Plaque psoriasis	24 574 (83.6)	18 231 (81.3)	17 (0.1)
Erythrodermic psoriasis	376 (1.3)	242 (1.1)	
Pustular psoriasis	968 (3.3)	658 (2.9)	
Guttate psoriasis	3670 (12.5)	3016 (13.4)	
Psoriatic arthritis	2302 (7.8)	1590 (7.1)	
Lesions on special areas, No. (%)			
Nail involvement	6440 (23.1)	5365 (23.9)	1527 (5.2)
Scalp involvement	18 190 (64.0)	14 578 (65.0)	986 (3.4)
Palm or/and sole involvement	5705 (20.3)	4458 (19.9)	1288 (4.4)
Genital involvement	3702 (13.3)	3014 (13.4)	1544 (5.2)
Disease severity, median (IQR)			
PASI	7.2 (3.0–14.7)	7.2 (3.0–14.6)	507 (1.7)
BSA	10.0 (3.4–30.0)	10.0 (3.0–30.0)	494 (1.7)
IGA	3 (2–3)	3 (2–3)	500 (1.7)
DLQI	8 (3–13)	8 (3–12)	1 261 (4.3)
Comorbidities No. (%)	4101 (13.9)	3245 (14.5)	2630 (8.9)
Previous biological treatment[c], No. (%)	2603 (8.9)	1982 (8.8)	23 (0.1)
Treatment demands			
Healing skin lesions rapidly	25 213 (88.8)	20 111 (89.7)	1021 (3.5)
Improving mental health	10 706 (37.7)	8531 (38.0)	
Reducing social discrimination	8854 (31.2)	7042 (31.4)	
Working and socializing normally	8120 (28.6)	6604 (29.4)	
Relieving painful/ burning feelings	6979 (24.6)	5476 (24.4)	
Relieving itchy feelings	10 668 (37.6)	8549 (38.1)	

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Reducing side effects of treatment	8708 (30.7)	7162 (31.9)
Reducing relapses	1651 (5.8)	1063 (4.7)

Abbreviations: BMI, body mass index; PASI, Psoriasis Area and Severity Index; BSA, Body Surface Area; IGA, Investigator's Global Assessment; DLQI, Dermatology Life Quality Index.

[a] Totally 29,412 adults were enrolled in the registry by September 2021.

[b] Unemployment rate was calculated in the working–age population, which excluded retired patients and students.

[c] Biological treatment included Tumor Necrosis Factor-α Inhibitors and Interleukin Inhibitors.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S3. Baseline characteristics stratified by treatment demands

	Reducing social discrimination			Working and socializing normally			Relieving painful or burning feelings			Relieving itchy feelings			Reducing the side effects of treatment			Reducing relapses		
	Yes (n=7042)	No (n=15383)	*P* value	Yes (n=6604)	No (n=15821)	*P* value	Yes (n=5476)	No (n=16949)	*P* value	Yes (n=8531)	No (n=13894)	*P* value	Yes (n=4626)	No (n=17126)	*P* value	Yes (n=1063)	No (n=21362)	*P* value
Demographics																		
Male, n (%)	4664 (66.2)	9903 (64.4)	0.007	4438 (67.2)	10129 (64.0)	<0.001	3631 (66.3)	10936 (64.5)	0.016	5506 (64.4)	9061 (65.3)	0.173	3016 (65.2)	10010 (65.6)	0.004	675 (63.5)	13892 (65.0)	0.307
Age,y,median(IQR)	40(31–53)	40(31–54)	0.121	38(30–51)	41(31–54)	<0.001	43(32–56)	39(31–53)	<0.001	41(32–55)	39(31–52)	<0.001	40(31–54)	40(31–54)	0.935	39(30–53)	40(31–54)	0.142
BMI,kg/m^2,median(IQR)	24.1(21.9–26.7)	24.0(21.6–26.8)	0.608	24.2(21.9–27.0)	24.0(21.7–26.7)	<0.001	24.1(21.9–26.7)	24.0(21.7–26.7)	0.159	24.2(21.8–27.0)	24.0(21.7–26.6)	0.002	24.1(21.8–27.0)	24.0(21.7–26.6)	0.002	23.4(21.3–26.0)	24.1(21.8–26.8)	<0.001
Unemployment[a], n (%)	658 (9.3)	1336 (8.7)	0.108	668 (10.1)	1326 (8.4)	<0.001	575 (10.5)	1419 (8.4)	<0.001	873 (10.2)	1121 (8.1)	<0.001	440 (9.5)	1254 (8.2)	<0.001	85 (8.0)	1909 (8.9)	0.293
Married, n (%)	5486 (77.9)	11718 (76.2)	0.004	4915 (74.4)	12289 (77.7)	<0.001	4419 (80.7)	12785 (75.4)	<0.001	6666 (78.0)	10538 (75.9)	<0.001	3560 (77.0)	11644 (76.3)	0.027	806 (75.8)	16398 (76.8)	0.479
Bachelor's degree, n (%)	2246 (31.9)	5582 (36.3)	<0.001	2460 (37.3)	5368 (33.9)	<0.001	1546 (28.2)	6282 (37.1)	<0.001	2794 (32.7)	5034 (36.3)	<0.001	1457 (31.5)	5371 (35.2)	0.196	380 (35.8)	7448 (34.9)	0.556
Current smoker, n (%)	1685 (23.9)	4338 (28.2)	<0.001	1854 (28.1)	4169 (26.4)	0.008	1447 (26.4)	4576 (27.0)	0.405	2351 (27.5)	3672 (26.5)	0.089	1253 (27.1)	4068 (26.7)	0.310	259 (24.4)	5764 (27.0)	0.060
COVID–19 lockdown, n (%)	889 (12.6)	1817 (11.8)	0.083	799 (12.1)	1907 (12.1)	0.925	647 (11.8)	2059 (12.1)	0.551	1051 (12.3)	1655 (11.9)	0.413	938 (13.3)	1768 (11.6)	0.001	344 (32.4)	2362 (11.1)	<0.001
Duration,y, median(IQR)	8(2–15)	6(1–14)	<0.001	8(2–15)	6(1–14)	<0.001	7(2–15)	6(1–14)	<0.001	6(2–14)	6(1–14)	0.983	7(2–15)	6(1–14)	<0.001	6(2–14)	6(2–14)	0.873

Continued

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

	Reducing social discrimination			Working and socializing normally			Relieving painful or burning feelings			Relieving itchy feelings			Reducing the side effects of treatment			Reducing relapses		
	Yes (n=7042)	No (n=15383)	*P* value	Yes (n=6604)	No (n=15821)	*P* value	Yes (n=5476)	No (n=16949)	*P* value	Yes (n=8531)	No (n=13894)	*P* value	Yes (n=2663)	No (n=7126)	*P* value	Yes (n=1063)	No (n=21362)	*P* value
Family history, n (%)	1100 (15.6)	2716 (17.7)	<0.001	1201 (18.2)	2615 (16.5)	0.003	862 (15.7)	2954 (17.4)	0.004	1458 (17.1)	2358 (17.0)	0.906	383 (14.4)	2492 (16.3)	<0.001	184 (17.3)	3632 (17.0)	0.795
Psoriasis phenotype[b], n (%)																		
Plaque psoriasis	5934 (84.3)	12297 (79.9)	<0.001	5417 (82.0)	12814 (81.0)	0.071	4473 (81.7)	13758 (81.2)	0.339	7016 (82.1)	11215 (80.8)	0.020	2158 (81.0)	12408 (81.3)	0.986	929 (87.4)	17302 (81.0)	<0.001
Erythrodermic psoriasis	93 (1.32)	149 (0.97)	0.018	120 (1.8)	122 (0.77)	<0.001	116 (2.1)	126 (0.7)	<0.001	124 (1.5)	118 (0.9)	<0.001	42 (1.6)	129 (0.8)	<0.001	13 (1.2)	229 (1.1)	0.642
Pustular psoriasis	184 (2.6)	474 (3.1)	0.054	156 (2.4)	502 (3.2)	0.001	230 (4.2)	428 (2.5)	<0.001	250 (2.9)	408 (2.9)	0.945	89 (3.6)	469 (3.1)	0.073	25 (2.4)	633 (3.0)	0.249
Guttate psoriasis	735 (10.4)	2281 (14.8)	<0.001	809 (12.3)	2207 (13.9)	0.001	533 (9.7)	2483 (14.6)	<0.001	1063 (12.4)	1953 (14.1)	<0.001	334 (13.6)	2082 (13.6)	0.020	88 (8.3)	2928 (13.7)	<0.001
Arthropathic psoriasis	595 (8.5)	995 (6.5)	<0.001	498 (7.5)	1092 (6.9)	0.089	606 (11.1)	984 (5.8)	<0.001	631 (7.4)	959 (6.9)	0.183	186 (7.5)	1054 (6.9)	0.116	60 (5.6)	1530 (7.2)	0.060
Lesions on special areas, n (%)																		
Nail involvement	1791 (24.2)	3664 (23.8)	0.583	1943 (29.4)	3422 (21.6)	<0.001	1548 (28.3)	3817 (22.5)	<0.001	2280 (26.7)	3085 (22.2)	<0.001	701 (28.4)	3346 (21.9)	<0.001	286 (26.9)	5079 (23.8)	0.020
Scalp involvement	4538 (64.4)	10040 (65.3)	0.229	4662 (70.6)	9916 (62.7)	<0.001	3693 (67.4)	10885 (64.2)	<0.001	5937 (69.5)	8641 (62.3)	<0.001	1801 (70.8)	9567 (62.7)	<0.001	694 (65.3)	13884 (65.0)	0.845
Palmoplantar involvement	1519 (21.6)	2939 (19.1)	<0.001	1482 (22.4)	2976 (18.8)	<0.001	1390 (25.4)	3068 (18.1)	<0.001	1906 (22.3)	2552 (18.4)	<0.001	590 (22.2)	2868 (18.8)	<0.001	209 (19.7)	4249 (19.9)	0.455

Continued

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 6, 2025 at Agence Bibliographique de l'Enseignement Supérieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

	Reducing social discrimination			Working and socializing normally			Relieving painful or burning feelings			Relieving itchy feelings			Reducing the side effects of treatment			Reducing relapses		
	Yes (n=7042)	No (n=15383)	*P* value	Yes (n=6604)	No (n=15821)	*P* value	Yes (n=5476)	No (n=16949)	*P* value	Yes (n=8531)	No (n=13894)	*P* value	Yes (n=2663)	No (n=7126)	*P* value	Yes (n=1063)	No (n=21362)	*P* value
Lesions on special areas, n (%)																		
Genital involvement	1020 (14.5)	1994 (13.0)	0.002	1088 (16.5)	1926 (12.2)	<0.001	936 (17.1)	2078 (12.3)	<0.001	1403 (16.4)	1611 (11.6)	<0.001	393 (14.8)	1828 (12.0)	<0.001	164 (15.4)	2850 (13.3)	0.052
Disease severity, median (IQR)																		
PASI	9.6 (4.2–17.4)	6.0 (2.7–13.2)	<0.001	9.0 (3.7–17.1)	6.4 (2.8–13.5)	<0.001	9.2 (3.9–18.0)	6.4 (2.8–13.6)	<0.001	7.9 (3.3–16.1)	6.6 (2.8–13.8)	<0.001	6.5 (2.8–13.9)	<0.001	5.8 (2.6–12.0)	7.2 (3.0–14.7)	<0.001	
BSA, %	15.0 (5.0–31.0)	8.0 (3.0–25.0)	<0.001	13.0 (5.0–34.0)	10.0 (3.0–25.0)	<0.001	15.0 (5.0–35.0)	10.0 (3.0–25.0)	<0.001	10.0 (3.3–30.0)	10.0 (3.0–27.0)	<0.001	10.0 (3.0–30.0)	10.0 (3.0–27.0)	<0.001	9.0 (3.0–30.0)	10.0 (3.0–30.0)	0.086
IGA	3 (2–3)	2 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001
DLQI, median (IQR)	10(6–16)	6(2–10)	<0.001	10(6–17)	6(2–11)	<0.001	10(6–16)	7(2–11)	<0.001	9(4–14)	7(2–12)	<0.001	8(4–15)	7(2–11)	<0.001	8(3–12)	8(3–12)	0.194
Comorbidity[c], n (%)	906 (12.9)	2339 (15.2)	<0.001	990 (15.0)	2255 (14.3)	0.003	872 (15.9)	2373 (14.0)	<0.001	1404 (16.4)	1841 (13.3)	<0.001	436 (16.4)	2087 (13.7)	<0.001	152 (14.3)	3093 (14.5)	0.890
Previous use of biologics[d]	631 (9.0)	1351 (8.8)	0.663	608 (9.2)	1374 (8.7)	0.209	414 (7.6)	1568 (9.3)	<0.001	557 (6.5)	1425 (10.3)	<0.001	197 (8.3)	1385 (9.1)	0.069	114 (10.7)	1868 (8.7)	0.026

Abbreviations: BMI, body mass index; BSA, Body Surface Area; DLQI, Dermatology Life Quality Index; IGA, Investigator's Global Assessment; IQR, interquartile range; PASI, Psoriasis Area and Severity Index.

[a]The unemployment rate was calculated in the working–age population, which excluded retired patients and students.

[b]Phenotypes were not mutually exclusive, thus the total percentage was higher than 100%.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079622 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 6, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

[c]Comorbidity presented the existence of any disease conditions including cardiovascular diseases, respiratory diseases, kidney diseases, rheumatic diseases, digestive diseases, tumors, endocrine diseases, etc.

[d]Biologics included Tumor Necrosis Factor -α Inhibitors and Interleukin Inhibitors.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) .
d by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S4. Mutlivariable logistic regression models examining the impact of PASI on treatment demands stratified by COVID–19 lockdowns

Odds ratios (95% CI)	Without COVID–19 lockdowns				With COVID–19 lockdowns				Heterogeneity test	
	Mild PASI<3	Moderate PASI 3–<10	Severe PASI≥10	Trend Test[a]	Mild PASI<3	Moderate PASI 3–<10	Severe PASI≥10	Trend Test	Q (df)	*P* value
Healing skin lesions rapidly	1.0	1.17 (1.03–1.32)*	1.45 (1.27–1.65)***	1,02 (1.01–1.02)***	1.0	1.50 (1.12–2.02)**	2.19 (1.57–3.05)***	1.04 (1.02–1.06)***	3.42 (1)	0.064
Improving mental health	1.0	1.47 (1.35–1.59)***	2.21 (2.03–2.40)***	1.03 (1.02–1.03)***	1.0	1.75 (1.40–2.18)***	2.82 (2.24–3.55)***	1.04 (1.03–1.05)***	3.44 (1)	0.064
Reducing social discrimination	1.0	1.65 (1.52–1.81)***	2.51 (2.29–2.74)***	1.03 (1.02–1.03)***	1.0	2.46 (1.92–3.15)***	4.35 (3.37–5.62)***	1.05 (1.04–1.06)***	12.82 (1)	<0.001
Working and socializing normally	1.0	1.27 (1.17–1.39)***	1.63 (1.49–1.78)***	1.02 (1.01–1.02)***	1.0	1.70 (1.33–2.17)***	2.81 (2.19–3.60)***	1.03 (1.02–1.04)***	9.09 (1)	0.003
Relieving painful or burning feelings	1.0	1.22 (1.11–1.34)***	1.59 (1.45–1.75)***	1.02 (1.02–1.02)***	1.0	1.70 (1.28–2.25)***	2.66 (2.01–3.53)***	1.04 (1.03–1.05)***	9.74 (1)	0.002
Relieving itchy feelings	1.0	1.07 (0.99–1.16)	1.11 (1.03–1.21)*	1.01 (1.004–1.01)***	1.0	1.32 (1.06–1.63)*	1.69 (1.35–2.11)***	1.02 (1.01–1.03)***	8.27 (1)	0.004
Reducing the side effects of treatment	1.0	1.25 (1.15–1.36)***	1.32 (1.21–1.44)***	1.01 (1.01–1.01)***	1.0	1.66 (1.33–2.07)***	1.90 (1.51–2.40)***	1.02 (1.01–1.03)***	2.44 (1)	0.118
Reducing relapses	1.0	0.81 (0.67–0.97)*	0.61 (0.49–0.75)***	0.98 (0.98–0.99)***	1.0	0.89 (0.66–1.20)	0.81 (0.58–1.12)	1.01 (0.997–1.02)	10.88 (1)	0.001

Abbreviations: PASI, Psoriasis Area and Severity Index. All the models adjusted for sex, age, BMI, marriage, education, smoke, disease course, family history, disease phenotype, whether special areas were affected, comorbidities, and previous treatment, stratified by whether was enrolled during the COVID pandemic.

[a]PASI was treated as a continuous variable in the trend test.

*Significant at *P*<0.050; **Significant at *P*<0.010; ***Significant at *P*<.001.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training and similar technologies.

For peer review only

Table S5. Mutlivariable logistic regression models examining the impact of BSA on treatment demands stratified by COVID–19 lockdowns

Odds ratios (95% CI)	Without COVID–19 lockdowns				With COVID–19 lockdowns				Heterogeneity test	
	Mild BSA<3%	Moderate BSA 3–<10%	Severe BSA≥10%	Trend Test[a]	Mild BSA<3%	Moderate BSA 3–<10%	Severe BSA≥10%	Trend Test	Q (df)	*P* value
Healing skin lesions rapidly	1.0	1.10 (0.96–1.26)	1.33 (1.17–1.50)***	1.01 (1.01–1.01)***	1.0	1.25 (0.88–1.76)	1.38 (0.99–1.89)	1.01 (1.001–1.01)*	0.19 (1)	0.663
Improving mental health	1.0	1.46 (1.33–1.60)***	2.01 (1.85–2.19)***	1.01 (1.01–1.01)***	1.0	1.72 (1.33–2.23)***	3.27 (2.57–4.15)***	1.02 (1.01–1.02)***	22.0 1 (1)	<0.001
Reducing social discrimination	1.0	1.64 (1.48–1.81)***	2.32 (2.12–2.54)***	1.01 (1.01–1.01)***	1.0	1.87 (1.40–2.51)***	4.56 (3.48–5.97)***	1.02 (1.02–1.03)***	37.0 8 (1)	<0.001
Working and socializing normally	1.0	1.32 (1.19–1.45)***	1.64 (1.50–1.79)***	1.01 (1.01–1.01)***	1.0	1.76 (1.32–2.35)***	3.20 (2.45–4.18)***	1.02 (1.01–1.02)***	13.2 5 (1)	<0.001
Relieving painful or burning feelings	1.0	1.28 (1.15–1.42)***	1.70 (1.54–1.87)***	1.01 (1.01–1.01)***	1.0	1.78 (1.29–2.45)***	2.62 (1.94–3.54)***	1.01 (1.01–1.02)***	3.84 (1)	0.050
Relieving itchy feelings	1.0	0.98 (0.89–1.07)	1.07 (0.99–1.16)	1.001 (0.999–1.002)	1.0	1.10 (0.86–1.39)	1.41 (1.13–1.76)	1.01 (1.004–1.01)***	11.3 4 (1)	0.001
Reducing the side effects of treatment	1.0	1.15 (1.05–1.26)**	1.26 (1.16–1.37)***	1.003 (1.002–1.005)***	1.0	1.50 (1.16–1.93)**	1.99 (1.57–2.52)***	1.01 (1.003–1.01)***	3.66 (1)	0.056
Reducing relapses	1.0	1.06 (0.85–1.32)	0.97 (0.79–1.18)	0.997 (0.99–1.001)	1.0	1.12 (0.81–1.55)	0.74 (0.54–1.02)	0.996 (0.99–1.003)	0.07 (1)	0.785

Abbreviations: BSA, Body Surface Area. All the models adjusted for sex, age, BMI, marriage, education, smoke, disease course, family history, disease phenotype, whether special areas were affected, comorbidities, and previous treatment, stratified by whether was enrolled during the COVID pandemic.

[a]BSA was treated as a continuous variable in the trend test.

*Significant at *P*<0.050; **Significant at *P*<0.010; ***Significant at *P*<.001.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Supérieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S6. Mutlivariable logistic regression models examining the impact of IGA on treatment demands stratified by COVID–19 lockdowns

Odds ratios (95% CI)	Without COVID–19 lockdowns					With COVID–19 lockdowns					Heterogeneity test	
	Almost clear IGA=0/1	Mild IGA=2	Moderate IGA=3	Severe IGA=4	Trend Test	Almost clear IGA=0/1	Mild IGA=2	Moderate IGA=3	Severe IGA=4	Trend Test	Q (df)	*P* value
Healing skin lesions rapidly	1.0	1.30 (1.12–1.52)**	1.68 (1.44–1.96)***	1.64 (1.35–1.99)***	1.21 (1.14–1.27)***	1.0	1.17 (0.82–1.67)	2.49 (1.71–3.64)***	2.70 (1.63–4.49)***	1.49 (1.30–1.71)***	7.75 (1)	0.005
Improving mental health	1.0	1.22 (1.09–1.36)***	1.70 (1.52–1.90)***	2.21 (1.94–2.51)***	1.30 (1.26–1.35)***	1.0	1.28 (0.96–1.70)	2.07 (1.57–2.74)***	1.91 (1.36–2.68)***	1.30 (1.18–1.43)***	<0.01 (1)	0.971
Reducing social discrimination	1.0	1.43 (1.27–1.61)***	1.85 (1.64–2.08)***	2.55 (2.22–2.92)***	1.32 (1.28–1.37)***	1.0	1.48 (1.10–2.01)*	2.04 (1.52–2.75)***	2.08 (1.46–2.97)***	1.29 (1.17–1.43)***	0.21 (1)	0.646
Working and socializing normally	1.0	1.12 (0.99–1.26)	1.43 (1.27–1.60)***	1.65 (1.45–1.89)***	1.19 (1.14–1.23)***	1.0	1.06 (0.78–1.44)	1.55 (1.16–2.09)**	1.69 (1.19–2.41)**	1.24 (1.12–1.37)***	0.54 (1)	0.461
Relieving painful or burning feelings	1.0	1.21 (1.06–1.38)**	1.54 (1.36–1.76)***	1.88 (1.62–2.18)***	1.23 (1.18–1.28)***	1.0	1.00 (0.69–1.44)	1.79 (1.27–2.53)**	1.88 (1.26–2.81)**	1.32 (1.18–1.48)***	1.29 (1)	0.256
Relieving itchy feelings	1.0	1.21 (1.08–1.35)**	1.45 (1.30–1.62)***	1.61 (1.41–1.83)***	1.17 (1.13–1.21)***	1.0	1.04 (0.78–1.37)	1.53 (1.16–2.01)**	1.16 (0.83–1.63)	1.13 (1.03–1.24)*	0.38 (1)	0.539
Reducing the side effects of treatment	1.0	1.09 (0.97–1.22)	1.28 (1.14–1.43)***	1.25 (1.10–1.43)**	1.09 (1.05–1.13)***	1.0	1.08 (0.82–1.44)	1.30 (0.98–1.72)	0.96 (0.69–1.35)	1.02 (0.93–1.13)*	1.37 (1)	0.241
Reducing relapses	1.0	0.63 (0.50–0.79)***	0.53 (0.42–0.67)***	0.52 (0.39–0.70)***	0.79 (0.73–0.87)***	1.0	0.83 (0.55–1.27)	1.29 (0.87–1.92)	0.48 (0.27–0.85)*	0.98 (0.85–1.13)*	5.86 (1)	0.016

Abbreviations: IGA, Investigator's Global Assessment. All the models adjusted for sex, age, BMI, marriage, education, smoke, disease course, family history, disease phenotype, whether special areas were affected, comorbidities, and previous treatment, stratified by whether was enrolled during the COVID pandemic.

*Significant at *P*<0.050; **Significant at *P*<0.010; ***Significant at *P*<.001

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

For peer review only

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	Enhanced impact of psoriasis severity on treatment demands of patients during the COVID-19 pandemic: A cross-sectional study based on a national psoriasis registry in China
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3	**Objectives:** The personalized treatment demands of patients with psoriasis did not get significant attention during the pandemic lockdown. This study aimed to investigate the treatment demands of patients with psoriasis with different severities, stratified by COVID-19 pandemic conditions. **Design:** Cross-sectional study design. **Setting:** Multicenter study based on a national psoriasis registry in China. **Participants:** A total of 22,425 adult patients with psoriasis were enrolled between August 2020 and September 2021. **Primary and Secondary Outcome Measures:** The primary outcomes were patient demands for quick healing of skin lesions and improving mental health, which were collected by questionnaires. Multivariable logistic models were used to examine the impact of disease severity, as measured by Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and Investigator's Global Assessment (IGA), on treatment demands, as stratified by COVID-19 pandemic conditions (lockdown vs. non-lockdown). **Results:** Increasing PASI score significantly increased patient demands for rapid healing of skin lesions and improving mental health during non-lockdown periods. The magnitude of both associations further increased during the COVID-19 lockdown from an odds ratio (OR) of 1.45 (95% confidence interval [CI] 1.27–1.65) to 2.19 (95% CI 1.57–3.05) and 2.11 (95% CI 2.03–2.40) to 2.81 (95% CI 2.24–3.55), respectively. The skin lesion healing demand was more triggered by the overall irritation level (measured by IGA, OR=1.63, 95% CI 1.35–1.99 during non-lockdown periods versus OR=2.70, 95% CI 1.63–4.49 during lockdowns); while the mental health improving demand was more triggered by lesion coverage (measured by BSA, OR=2.01, 95% CI 1.83–2.19 versus OR=3.27, 95% CI 2.57–4.15). **Conclusions**: Psoriasis aggravation significantly increased patients' treatment demands, especially during lockdowns. The used psoriasis severity measures highlighted patients' treatment demands differently. This suggests more accessible and personalized healthcare for patients with psoriasis should be available during future pandemics.
Introduction				
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5	Psoriasis is a chronic, non-fatal disease primarily affecting the skin. The prevalence of psoriasis varies geographically, with 0.14% and 1.99% of the population in East Asia and Australasia being affected, respectively [1]. In China, the prevalence was 0.12% in 1987 and 0.47% in 2012 [2]. Apart from skin lesions, psoriasis is also now recognized as a systemic inflammatory disorder that relates to various comorbidities, such as metabolic syndrome, arthritis, malignancy, and so on [3]. Poor appearances, together with comorbidities, significantly impair patients' daily functioning and cause significant psychological distress [4], which can result in depression, suicidal ideation, and substance abuse [5,6], causing high social burdens, especially during the recurrent coronavirus disease 2019 (COVID-19) pandemics [7,8]. Current clinical diagnosis and treatment for psoriasis must follow appropriate guidelines and consensus. Therefore, the

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES).

				choice of treatment for psoriasis primarily depends on the objective assessment of lesion severity of the disease, yet the demands of the patient are often neglected [9,10]. However, due to the chronic, non-fatal characteristics of psoriasis, individual perceptions of the disease can determine the impact of psoriasis on the quality of life of patients, which may then affect their treatment demands [11,12]. Thus, the treatment decisions should be driven by the real needs and expectations of each individual. Furthermore, since healthcare access (e.g. emerged telemedicine) [13–16], as well as the clinicians' treatment considerations to control psoriasis, have all changed during the recurrent COVID-19 pandemics [17], patients' perception of psoriasis and further their treatment demands may also change accordingly. From a healthcare-seeking behavior perspective, common changes among patients with psoriasis during the COVID-19 pandemic included the canceling or deferring of appointments, nonadherence to treatment, prolonged prescription, and treatment-change requirements [7,18]. Patients may become more anxious about their psoriasis lesions due to the difficulty in accessing healthcare. In contrast, from a quality of life perspective, the sociality activity aspect assessed in a quality of life questionnaire became irrelevant during lockdown, which led to paradoxically improved quality of life among patients with psoriasis during the COVID-19 lockdown [19]. Patients may perceive their psoriasis lesions as more acceptable because they are less worried about skin lesion appearances due to restricted social activities, and are more fearful of COVID-19 than non-fatal psoriasis. As a result, how patients' treatment demands changed during pandemics remains unknown. Thus, it is essential to re-assess patients' treatment demands to improve personalized treatment during the pandemic. However, studies on changes in treatment demands from patients' perspectives during pandemics are limited.
Objectives	3	State specific objectives, including any prespecified hypotheses	5	This study examined the treatment demands of patients with varying severities of psoriasis in the setting of recurrent COVID-19 lockdowns, hoping to provide references for personalized treatment during these periods, as for patients with other chronic diseases in future lockdowns.
Methods				
Study design	4	Present key elements of study design early in the paper	5	**Study Design, Patients, and Data Collected** This cross-sectional, multicenter study was based on a nationwide data collection platform established by the Psoriasis Standardized Diagnosis and Treatment Center and led by the National Clinical Research Center for Skin and Immune Disease
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6	**Study Design, Patients, and Data Collected** This cross-sectional, multicenter study was based on a nationwide data collection platform established by the Psoriasis Standardized Diagnosis and Treatment Center and led by the National Clinical Research Center for Skin and Immune Disease.[20,21] The platform is the first and largest psoriasis registry in China, and as of September 2021, had included data of 32 014 patients with psoriasis from 228 hospitals. The registry collects data on demographics, medical history, clinical assessment, previous and current treatments for psoriasis, self-reported life quality, and treatment demands at enrollment. All patients provided informed consent for publication before their details were entered into the registry. The registry was approved by the Human Genetic Resources Management Office of the Ministry of Science and Technology of China (2022-CJ0021) and the ethics committee of Peking University First Hospital (2020-scientific research-255) for use in clinical studies. The data preprocessing standards for derived variables and variables with potential mistaken values are listed in Table S1 (see Supplemental Material).
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of	(a) 6	All patients aged ≥18 years enrolled between August 2020 and September 2021 with complete baseline data were included. The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (see Supplemental Material).

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-069207 on 17 February 2023. Downloaded from http://bmjopen.bmj.com/ on June 3, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

		selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants		
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6	**Study Measures** Treatment demands were collected using multiple choice questionnaire containing two primary treatment demands: healing skin lesions rapidly and improving mental health. Other demands were included, such as reducing social discrimination; normal work and socializing; relieving itchiness, pains, or burning; and reducing treatment side effects and disease relapses. Life quality was assessed using the Dermatology Life Quality Index (DLQI). Psoriasis severity was assessed using the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and the 5-point Investigator's Global Assessment (IGA).[9,10] According to the guidelines for the diagnosis and treatment of psoriasis in China (2018), PASI score was categorized as mild (<3), moderate (3–<10) and severe (≥10), while BSA percentages were categorized as mild (<3%), moderate (3%–<10%) and severe (≥10%).[22] The 5-point IGA categorized severity as clear/almost clear (0/1), mild (2), moderate (3), and severe (4). Provincial COVID-19 data was summarized from the official website of the National Health Commission of the People's Republic of China (http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml). Considering the maintenance period of both epidemic control measures and public response to the pandemic, the 7 days following the last day with a new case were furtherclassified into the same pandemic period. The COVID-19 pandemic variable was treated as binary according to the geographical location and enrolled day of each patient.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement).	*6-7*	**Study Measures** Treatment demands were collected using multiple choice questionnaire containing two primary treatment demands: healing skin lesions rapidly and improving mental health. Other demands were included, such as reducing social discrimination; normal work and socializing; relieving itchiness, pains, or burning; and reducing treatment side effects

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

		Describe comparability of assessment methods if there is more than one group		and disease relapses. Life quality was assessed using the Dermatology Life Quality Index (DLQI). Psoriasis severity was assessed using the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and the 5-point Investigator's Global Assessment (IGA).[9,10] According to the guidelines for the diagnosis and treatment of psoriasis in China (2018), PASI score was categorized as mild (<3), moderate (3–<10) and severe (≥10), while BSA percentages were categorized as mild (<3%), moderate (3%–<10%) and severe (≥10%).[22] The 5-point IGA categorized severity as clear/almost clear (0/1), mild (2), moderate (3), and severe (4). Provincial COVID-19 data was summarized from the official website of the National Health Commission of the People's Republic of China (http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml). Considering the maintenance period of both epidemic control measures and public response to the pandemic, the 7 days following the last day with a new case were furtherclassified into the same pandemic period. The COVID-19 pandemic variable was treated as binary according to the geographical location and enrolled day of each patient.
Bias	9	Describe any efforts to address potential sources of bias	7	Multivariable logistic regression models were used to investigate the impact of psoriasis severity (measured separately by PASI/BSA/IGA) on each treatment demand, stratified by whether the patient was enrolled during the COVID-19 lockdown. To reduce potential confounding, all models were adjusted for demographic characteristics (sex, age, BMI, marriage, education, employment, and smoking) and clinical characteristics (psoriasis duration, family history, disease phenotype, nail/scalp/genital/palmoplantar involvement, comorbidities, and previous treatment).
Study size	10	Explain how the study size was arrived at	5-6	The platform is the first and largest psoriasis registry in China, and as of September 2021, had included data of 32 014 patients with psoriasis from 228 hospitals. All patients aged ≥18 years enrolled between August 2020 and September 2021 with complete baseline data were included.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6	According to the guidelines for the diagnosis and treatment of psoriasis in China (2018), PASI score was categorized as mild (<3), moderate (3–<10) and severe (≥10), while BSA percentages were categorized as mild (<3%), moderate (3%–<10%) and severe (≥10%).[22] The 5-point IGA categorized severity as clear/almost clear (0/1), mild (2), moderate (3), and severe (4). Provincial COVID-19 data was summarized from the official website of the National Health Commission of the People's Republic of China (http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml). Considering the maintenance period of both epidemic control measures and public response to the pandemic, the 7 days following the last day with a new case were furtherclassified into the same pandemic period. The COVID-19 pandemic variable was treated as binary according to the geographical location and enrolled day of each patient. Continuous and categorized PASI, BSA, and IGA values were separately modeled in relation to each treatment demand.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7	To reduce potential confounding, all models were adjusted for demographic characteristics (sex, age, BMI, marriage, education, employment, and smoking) and clinical characteristics (psoriasis duration, family history, disease phenotype, nail/scalp/genital/palmoplantar involvement, comorbidities, and previous treatment).
		(*b*) Describe any methods used to examine subgroups and interactions	7	A Q-test attached to the fixed effect model was performed to detect heterogeneity between the impact of psoriasis severity on treatment demands during the COVID-19 pandemic and a normal period.
		(*c*) Explain how missing data were addressed	6	All patients aged ≥18 years enrolled between August 2020 and September 2021 with complete baseline data were included. The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (see Supplemental Material).
		(*d*) *Cohort study*—If	N/A	N/A

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079227 on 14 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

		applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy		
		(*e*) Describe any sensitivity analyses	N/A	N/A
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7	All patients aged ≥18 years enrolled between August 2020 and September 2021 with complete baseline data were included. The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (see Supplemental Material). Among the 29 412 adult patients enrolled as of September 2021 (Table S2; see Supplemental Material), 22 425 with complete baseline information from 212 tertiary hospitals across China were enrolled.
		(b) Give reasons for non-participation at each stage	N/A	N/A
		(c) Consider use of a flow diagram	N/A	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7	Exactly 65.0% were male (n = 14 567). The median age was 40 (IQR: 31–54) years, and the percentages of different age groups were as follows: 18–45 years, 60.3% (n = 13 515); 46–60 years, 26.9% (n = 6033); ≥61years, 12.8% (n = 2877). The median PASI and DLQI scores were 7.2 and 8, respectively. Exactly 12.1% (n = 2706) were enrolled during a COVID-19 lockdown.
		(b) Indicate number of participants with missing data for each variable of interest	6	The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (see Supplemental Material).
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A	N/A
Outcome data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time		
		Case-control study—Report numbers in each exposure		

For peer review only

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) .
d by copyright, including for uses related to text and data mining, AI training, and similar technologies.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

		category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures	*8*	Moreover, 89.7% (n = 20 111) and 38.0% (n = 8531) of the patient demanded rapid healing of skin lesions and mental health improvement, respectively (Table 1).
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7, 8-10	To reduce potential confounding, all models were adjusted for demographic characteristics (sex, age, BMI, marriage, education, employment, and smoking) and clinical characteristics (psoriasis duration, family history, disease phenotype, nail/scalp/genital/palmoplantar involvement, comorbidities, and previous treatment). Multivariable logistic regression and trend tests confirmed that increasing psoriasis severity (measured by PASI) significantly stimulated patients' primary treatment demands of rapid lesion healing (odds ratio [OR] 1.45, 95% confidence interval [CI] 1.27–1.65 for severe PASI versus mild PASI and OR 1.02, 95% CI 1.01–1.02 in the trend test, both $P < 0.001$) and improving mental health (OR 2.21, 95% CI 2.03–2.40 for severe PASI versus mild PASI and OR 1.03, 95% CI 1.02–1.03 in the trend test, both $P < 0.001$) during normal periods without COVID-19 lockdowns (Table S4; see Supplemental Material). Disease severity-triggered treatment demands further increased during COVID-19 lockdowns, including rapid lesion healing (OR 2.19, 95% CI 1.57–3.07 for severe PASI versus mild PASI, $P < 0.001$) and improving mental health (OR 2.82, 95% CI 2.24–3.55 for severe PASI versus mild PASI), despite statistical insignificance (both $P = 0.064$ in the heterogeneity Q-test) (Figure 4a-g). Additionally, other treatment demands, including reducing social discrimination, working and socializing normally, relieving pain, burning, or itching, and reducing treatment side effects, were significantly stimulated by deteriorated skin conditions measured by PASI (all $P < 0.05$), and the degree of stimulation further magnified during the COVID-19 lockdowns (Figure S1a-e, see Supplemental Material). The exception was the demand for reducing relapses, which significantly declined as PASI increased. Still, the magnitude of this decline decreased during the COVID-19 pandemic (OR 0.61, 95% CI 0.49–0.75 for severe PASI versus mild PASI during a non-COVID-19 period versus OR 0.81, 95% CI 0.58–1.12 during a COVID-19 lockdown, heterogeneity Q-test $P = 0.001$) (Figure S1f, see Supplemental Material). **Impact of Psoriasis Severity on Treatment Demands Mediated by Life Quality** Further mediation analysis showed that increasing PASI motivated patients' treatment demands mainly by deteriorating life quality, including reducing social discrimination (mediated proportion: 49.0%), improving mental health (47.1%), working and socializing normally (72.1%), relieving pain (40.8%) or itchiness (73.2%), and reducing treatment side effects (74.3%) (Table 2). However, the proportion of the DLQI-mediated effect was small in the total effect of PASI on the demand for reducing relapses (7.6%) and quickly healing lesions (0.6%). These results were replicated when disease severity was examined using BSA and IGA. **Potential Factors Influencing Treatment Demands** Apart from disease severity, multivariable logistic regression analysis identified female sex (OR 1.23; 95% CI 1.11–1.36), smoking (OR 1.17; 95% CI 1.04–1.30), pustular psoriasis (OR 1.71; 95% CI 1.26–2.32), and nail involvement (OR 1.28; 95% CI 1.14–1.44) as significantly correlated with higher demand for rapid lesion healing. However, older age (OR 0.994; 95% CI 0.991–0.998), married status (OR 0.82; 95% CI 0.72–0.94), unemployment (OR 0.82; 95% CI 0.70–0.95), COVID-19 pandemic (OR 0.87; 95% CI 0.77–0.99), arthropathic psoriasis (OR 0.55; 95% CI 0.47–0.64), palmoplantar involvement (OR 0.75; 95% CI 0.67–0.85) and comorbidities (OR 0.86; 95% CI 0.76–0.97) were significantly correlated with lower demand (Table 3). In addition, the demand for improvement of mental health was significantly higher in patients with arthropathic psoriasis (OR 1.22; 95% CI 1.09–1.37), guttate psoriasis (OR 0.78; 95% CI 0.71–0.84) and palmoplantar involvement

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2024 at Agence Bibliographique de l
Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

				(OR 1.09; 95% CI 1.01–1.18). However, this was lower in patients with older age (OR 0.993; 95% CI 0.991–0.996), higher BMI (OR 0.995; 95% CI 0.991–1.000), college education (OR 0.90; 95% CI 0.84–0.95), smoking (OR 0.81; 95% CI 0.75–0.86), pustular psoriasis (OR 0.77; 95% CI 0.65–0.92) and comorbidities (OR 0.90; 95% CI 0.83–0.97).
		(*b*) Report category boundaries when continuous variables were categorized	6	According to the guidelines for the diagnosis and treatment of psoriasis in China (2018), PASI score was categorized as mild (<3), moderate (3–<10) and severe (≥10), while BSA percentages were categorized as mild (<3%), moderate (3%–<10%) and severe (≥10%).[22] The 5-point IGA categorized severity as clear/almost clear (0/1), mild (2), moderate (3), and severe (4).
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-9 subgroup analyses	Multivariable logistic regression and trend tests confirmed that increasing psoriasis severity (measured by PASI) significantly stimulated patients' primary treatment demands of rapid lesion healing (odds ratio [OR] 1.45, 95% confidence interval [CI] 1.27–1.65 for severe PASI versus mild PASI and OR 1.02, 95% CI 1.01–1.02 in the trend test, both $P < 0.001$) and improving mental health (OR 2.21, 95% CI 2.33–3.40 for severe PASI versus mild PASI and OR 1.03, 95% CI 1.02–1.03 in the trend test, both $P < 0.001$) during non-COVID periods without COVID-19 lockdowns (Table S4; see Supplemental Material). Disease severity-triggered treatment demands further increased during COVID-19 lockdowns, including rapid lesion healing (OR 2.19, 95% CI 1.57–3.05 for severe PASI versus mild PASI, $P < 0.001$) and improving mental health (OR 2.82, 95% CI 2.24–3.55 for severe PASI versus mild PASI), despite statistical insignificance (both $P = 0.064$ in the heterogeneity Q-test) (Figure 4a-b).
Key results	18	Summarise key results with reference to study objectives	10	In this cross-sectional study, it was observed that patient demands for healing skin lesions and improving mental health significantly increased as psoriasis worsened, especially during the COVID-19 pandemic. Different psoriasis severity measures have different emphases in reflecting patients' treatment demands, which were magnified during the pandemic. The impact of disease severity on most treatment demands was mediated by deteriorated quality of life, except for the demands of rapid skin healing and relapse reduction, and thus other factors that stratified major treatment demands were also examined.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13	our study was not free from limitations. First, the Psoriasis Center program enrolled patients from specific dermatological clinics, and a certain proportion of patients declined enrollment. Thus, the study population may not represent the general psoriatic population. Second, there was missing data within this platform. However, as the missing rate was not high and missing at random was considered (Table S2; see Supplemental Material), a complete case analysis was used and considered to sufficiently handle missing data. Third, since information on residence was not collected, the COVID-19 pandemic information was matched to each patient only at a province level, although the lockdown was administrated with a precise approach in China.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13	An increase in psoriasis severity significantly stimulates patients' demands for quickly healing skin lesions and improving mental health, especially during the pandemic lockdowns, indicating the need for an accessible pathway for patients with psoriasis getting more intensive treatment and mental support during future pandemics. To better recognize and meet patients' treatment demands during the pandemic, we suggest BSA to determine the psychological needs of patients, while IGA should be used to reflect the desire to quickly heal lesions. Other demographic and clinical patient characteristics should further be considered for more personalized treatment during future pandemics. Moreover, because the COVID-19 lockdown restrictions have been released in many countries, our findings could

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

bmjopen-2023-079274 on 13 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Supérieur (ABES).

				provide guidance for personalized treatment in patients with non-fatal chronic diseases in future pandemic lockdowns.
Generalisability	21	Discuss the generalisability (external validity) of the study results	13	Moreover, because the COVID-19 lockdown restrictions have been released in many countries, our findings could provide guidance for personalized treatment in patients with non-fatal chronic diseases in future pandemic lockdowns.
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14	**Funding Source:** This study was supported by the Project of Process Reform for Skin Disease Diagnosis and Treatment, which was funded by PKU-Baidu Fund (reference number: 2020BD012).

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

For peer review only

bmjopen-2023-079027 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

BMJ Open

Enhanced impact of psoriasis severity on the treatment demands of patients during the COVID-19 pandemic: A cross-sectional study based on a national psoriasis registry in China

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2023-079627.R1
Article Type:	Original research
Date Submitted by the Author:	02-Jan-2024
Complete List of Authors:	Yang, Zhihui; Peking University First Hospital, Department of Dermatology and Venerology Jin, Yu; Peking University Cancer Hospital, Department of Cancer Epidemiology Wang, Mingyue; Peking University First Hospital, Department of Dermatology and Venerology Li, Ruo Yu; Peking University First Hospital, Department of Dermatology and Venerology Li, Wenqing; Peking University Cancer Hospital, Department of Cancer Epidemiology Li, Hang; Peking University First Hospital, Department of Dermatology and Venerology
Primary Subject Heading:	Dermatology
Secondary Subject Heading:	Public health, Mental health, Epidemiology, Patient-centred medicine
Keywords:	Psoriasis < DERMATOLOGY, COVID-19, China, Chronic Disease

SCHOLARONE™
Manuscripts

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) .
Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

Original Research

Enhanced impact of psoriasis severity on the treatment demands of patients during the COVID-19 pandemic: A cross-sectional study based on a national psoriasis registry in China

Zhihui Yang[1†], Yu Jin[2†], Mingyue Wang[1], Ruoyu Li[1], Wenqing Li[2], Hang Li[1,3]

[1]Department of Dermatology and Venerology, Peking University First Hospital, Beijing, China; Beijing Key Laboratory of Molecular Diagnosis of Dermatoses, Peking University First Hospital, Beijing, China; National Clinical Research Center for Skin and Immune Diseases, Peking University First Hospital, Beijing, China; and NMPA Key Laboratory for Quality Control and Evaluation of Cosmetics, Peking University First Hospital, Beijing, China.

[2]State Key Laboratory of Holistic Integrative Management of Gastrointestinal Cancers, Beijing Key Laboratory of Carcinogenesis and Translational Research, Department of Cancer Epidemiology, Peking University Cancer Hospital & Institute, Beijing 100142, China

[3]Peking University - Yunnan Baiyao International Medical Research Center, Peking University, Beijing, China

[†]These authors contributed equally.

Short Title: Enhanced impact of psoriasis severity on treatment demands during pandemic

Corresponding Author:

Wenqing Li

Department of Cancer Epidemiology

Peking University Cancer Hospital & Institute

No.52 Fucheng Road

Beijing, 100143, P. R. China.

Tel: (86)18010276738

E-mail: wenqing_li@bjmu.edu.cn

Hang Li

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Enseignement Superieur (ABES) .

Department of Dermatology and Venerology

Peking University First Hospital

No.8 Xishiku Street

Beijing, 100034, P. R. China.

Tel: (86)-10-83573075

E-mail: drlihang@126.com

Number of Tables: 3

Number of Figures: 1

Word count: 3857

Keywords: psoriasis; treatment demands; COVID-19; real-world study; personalized treatment.

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

Abstract

Objectives: The personalized treatment demands of patients with psoriasis did not get significant attention during the pandemic lockdown. This study aimed to investigate the treatment demands of patients with psoriasis with different severities, stratified by COVID-19 pandemic conditions.

Design: Cross-sectional study design.

Setting: Multicenter study based on a national psoriasis registry in China.

Participants: A total of 22,425 adult patients with psoriasis were enrolled between August 2020 and September 2021.

Primary and Secondary Outcome Measures: The primary outcomes were patient demands for quick healing of skin lesions and improving mental health, which were collected by questionnaires. Multivariable logistic models were used to examine the impact of disease severity, as measured by Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and Investigator's Global Assessment (IGA), on treatment demands, as stratified by COVID-19 pandemic conditions (lockdown vs. non-lockdown).

Results: Increasing PASI score significantly increased patient demands for rapid healing of skin lesions and improving mental health during non-lockdown periods. The magnitude of both associations further increased during the COVID-19 lockdown from an odds ratio (OR) of 1.45 (95% confidence interval (CI) 1.27–1.65) to 2.19 (95% CI 1.57–3.05) and 2.11 (95% CI 2.03–2.40) to 2.82 (95% CI 2.24–3.55), respectively. The skin lesion healing demand was more triggered by the overall irritation level (measured by IGA, OR=1.64, 95% CI 1.35–1.99 during non-lockdown periods versus OR=2.70, 95% CI 1.63–4.49 during lockdowns); while the mental health improving demand was more triggered by lesion coverage (measured by BSA, OR=2.01, 95% CI 1.85–2.19 versus OR=3.27, 95% CI 2.57–4.15).

Conclusions: Psoriasis aggravation significantly increased patients' treatment demands, especially during lockdowns. The used psoriasis severity measures highlighted patients' treatment demands differently. This suggests more accessible and personalized healthcare for patients with psoriasis should be available during future pandemics.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Enseignement Superieur (ABES) .

Strengths and limitations of this study

- This is, to date, the largest study investigating the association between psoriasis severity and treatment demands from the patients' perspective, and the first study comparing the aforementioned association between a lockdown and a non-lockdown period.
- Disease severity was assessed with different measures and from different aspects, making the results comprehensive and robust.
- Subjects who participated in our program were enrolled from specific dermatological clinics, and thus may not represent the general psoriasis population.
- The demand for improving mental health was collected as a binary variable without professional psychological assessment.

INTRODUCTION

Psoriasis is a chronic, non-fatal disease primarily affecting the skin. The prevalence of psoriasis varies geographically, with 0.14% and 1.99% of the population in East Asia and Australasia being affected, respectively.(1) In China, the prevalence was 0.12% in 1987 and 0.47% in 2012.(2) Apart from skin lesions, psoriasis is also now recognized as a systemic inflammatory disorder that relates to various comorbidities, such as metabolic syndrome, arthritis, malignancy, and so on.(3) Poor appearances, together with comorbidities, significantly impair patients' daily functioning and cause significant psychological distress,(4) which can result in depression, suicidal ideation, and substance abuse,(5-8) causing high social burdens, especially during the recurrent coronavirus disease 2019 (COVID-19) pandemics.(9-11)

Current clinical diagnosis and treatment for psoriasis must follow appropriate guidelines and consensus. Therefore, the choice of treatment for psoriasis primarily depends on the objective assessment of lesion severity of the disease, yet the demands of the patient are often neglected.(12,13) However, due to the chronic, non-fatal characteristics of psoriasis, individual perceptions of the disease can determine the impact of psoriasis on the quality of life of patients, which may then affect their treatment demands.(14,15) Thus, the treatment decisions should be driven by the real needs and expectations of each individual.

Furthermore, since healthcare access (e.g. emerged telemedicine),(16-19) as well as the clinicians' treatment considerations to control psoriasis, have all changed during the

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

recurrent COVID-19 pandemics,(20) patients' mental health condition, their perception of psoriasis and further treatment demands may altered accordingly.(21-23) From the treatment-decision aspect, the initiation of biologics for psoriasis decreased sharply during the COVID-19 pandemic, possibly due to the poor access to healthcare for patients and the lack of evidence on the relationship between COVID-19 infection and biological therapies for psoriasis at the beginning of the pandemic.(24,25) From a healthcare-seeking behavior perspective, patients with psoriasis tended to cancel or defer their appointments, lose adherence to treatment, and require prolonged prescription or treatment-change during the COVID-19 pandemic.(9,26-28) All the above changes may be associated with deterioration of psoriasis and further symptoms of anxiety and depression,(11,22,29,30) although the association is complex and undetermined.(10,27) In contrast, from a quality of life perspective, the social-activity aspect assessed in a quality of life questionnaire became irrelevant during lockdown, which led to paradoxically improved quality of life among patients with psoriasis during the COVID-19 lockdown.(10,31) Patients may perceive their psoriasis lesions as more acceptable because they are less worried about skin lesion appearances due to restricted social activities, and are more fearful of COVID-19 when receiving immunosuppressive treatment for psoriasis.(32) As a result, how patients' treatment demands changed during pandemics remains unknown. Thus, it is essential to re-assess patients' treatment demands to improve personalized treatment during the pandemic. However, studies on changes in treatment demands from patients' perspectives during pandemics are limited.

This study aimed to examine the treatment demands of patients with psoriasis with varying disease severity and other clinical and personal characteristics in a real-world setting throughout the recurrent COVID-19 pandemic, hoping to provide references for personalized treatment strategies not only for patients with psoriasis during the COVID-19 pandemic but also for patients with all other chronic diseases in any future pandemic lockdowns.

MATERIALS AND METHODS

Study design, patients, and data collected

This was a cross-sectional, multicenter study based on a nationwide real-world big data collection platform established by the Psoriasis Standardized Diagnosis and Treatment Center (also named Psoriasis Center) and led by the National Clinical Research Center for Skin and Immune Disease.(33) This data platform is the first and currently the largest psoriasis registry in China, and as of September 2021, had included data of 32,014 patients with psoriasis from 228 hospitals across China. The registry collects data on demographics,

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

medical history, clinical assessment, previous and current treatments for psoriasis, self-reported quality of life, and treatment demands at enrollment. All patients provided informed consent for publication before their details were entered into the registry. The establishment of this big data collection platform was approved by the Human Genetic Resources Management Office of the Ministry of Science and Technology of China (approval number: 2022-CJ0021) and the ethics committee of Peking University First Hospital (approval number: 2020-scientific research-255) for use in clinical studies. The data preprocessing standards for derived variables and variables with potentially mistaken values are listed in Table S1 (Supplemental Material).

All patients aged ≥18 years enrolled between August 2020 to September 2021 with complete baseline data were included. The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (Supplemental Material).

Patient and public involvement

Patients were not involved in the design, conduct, reporting, or dissemination plans of our research.

Study measures

The study outcomes were patients' treatment demands, which were all collected through "yes-or-no" questions in a face-to-face interview. The two primary treatment demands contained healing skin lesions quickly and improving mental health. The questionnaire also asked about other demands, including reducing social discrimination, working and socializing normally, relieving itchy feelings, relieving painful or burning feelings, and reducing the side effects of treatment and disease relapses. All the aforementioned treatment demands were treated as binary variables. Quality of life was additionally assessed by the Dermatology Life Quality Index (DLQI).

The main exposure was psoriasis severity, which was assessed by the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and the 5-point Investigator's Global Assessment (IGA).(12,13) According to the guidelines for the diagnosis and treatment of psoriasis in China (2023),(34) PASI score was categorized as mild (<3), moderate (3 to <10) and severe (≥10), whereas BSA (%) was categorized as mild (<3%), moderate (3% to <10%), and severe (≥10%). The 5-point IGA categorized the severity level as clear/almost clear (0/1), mild (2), moderate (3), and severe (4).

Provincial COVID-19 data was summarized from the official website of the National Health Commission of the People's Republic of China

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

(http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml). Considering the maintenance period of both epidemic control measures and public response to the pandemic, the 7 days following the last day in which a new case was recorded were further classified into the same pandemic period. The COVID-19 pandemic variable was treated as binary according to the geographical location and enrolled day of each patient.

Statistical analysis

Descriptive statistics were performed for each variable stratified by each treatment demand using frequencies (percentages) for categorical variables and median (interquartile range [IQR]) for continuous variables. Categorical variables were compared using chi-squared tests, whereas continuous variables were compared using the Kruskal–Wallis H test.

Multivariable logistic regression models were used to investigate the impact of psoriasis severity, as measured by PASI, BSA, and IGA, separately, on each treatment demand stratified by whether the patient was enrolled during the COVID-19 pandemic. To reduce potential confounding factors, all models were adjusted for demographic characteristics (sex, age, body mass index [BMI], marriage status, education, employment, and smoking habits) and clinical characteristics (psoriasis duration, family history, disease phenotype, nail/scalp/genital/palmoplantar involvement, comorbidities, and previous treatment). PASI, BSA, and IGA values were separately modeled in relation to each treatment demand, and were treated as continuous and categorical variables separately. A Q-test attached to the fixed effect model was performed to detect the heterogeneity between the impact of psoriasis severity on treatment demands during the COVID-19 pandemic lockdowns and normal periods. Mediation analysis was employed to investigate the effect of PASI/BSA/IGA on treatment demands mediated by DLQI, adjusting for the same confounding set above and additionally for COVID-19 lockdowns. Other potential factors influencing the treatment demands were examined using the same multivariable logistic regression models investigating the impact of PASI on quick skin healing and mental health improvement demands while adding the COVID-19 pandemic as a covariate. All data analysis was conducted using STATA/SE (StataCorp LLC 2021, Stata Statistical Software: Release 17, College Station, TX), and a *P*-value <0.05 was considered statistically significant.

RESULTS

General characteristics

Among the 29,412 adult patients enrolled as of September 2021 (Table S2, see Supplemental Material), 22,425 with complete baseline information from 212 tertiary hospitals across China were enrolled in this study. Exactly 65.0% of patients were men

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

(n=14,567). The median age was 40 (IQR, 31–54) years, and the percentages of different age groups were as follows: 18-45 years, 60.3% (n = 13,515); 46-60 years, 26.9% (n = 6,033); ≥61 years, 12.8% (n = 2,877). The median PASI and DLQI scores were 7.2 and 8, respectively. Exactly 12.1% of the patients (n = 2,706) were enrolled during a COVID-19 lockdown in their provinces. Moreover, 89.7% (n = 20,111) and 38.0% (n = 8,531) of the patients demanded a speedy healing of the skin lesions and mental health improvement, respectively (Table 1).

Patients demanding the rapid healing of skin lesions tended to be female, younger, employed, unmarried, have a college degree, have current smoking habits, enrolled during a normal period without the COVID-19 lockdown, have a shorter psoriasis duration, have a positive family history, have pustular or guttate psoriasis, have nail or scalp involvement, and have a severer psoriasis condition, as measured by PASI, BSA, and IGA, while not having palmoplantar involvement, comorbidities, such as psoriatic arthritis (PsA), or a history of use of biologics (all P <0.05). By comparison, patients demanding mental health improvement tended to be unemployed, have a longer psoriasis duration, have plaque, erythrodermic, or arthropathic psoriasis, have lesions on special areas including nails, scalps, hands/soles, and genitals, have more severe psoriasis conditions, and have deteriorated quality of life, while not having a college degree, smoking habits, pustular or guttate psoriasis, or comorbidities (all P <0.05). Patients' characteristics stratified by other treatment demands are shown in Table S3 (Supplemental Material).

Impact of psoriasis severity on treatment demands stratified by the COVID-19 pandemic

Both multivariable logistic regression and trend tests confirmed that the increasing psoriasis severity, as measured by PASI, significantly stimulated patients' primary treatment demands of healing skin lesions rapidly (odds ratio [OR], 1.45; 95% confidence interval (CI), 1.27–1.65; P <0.001 for severe PASI versus mild PASI; and OR, 1.02; 95% CI, 1.01–1.02; P <0.001 in the trend test) and improving mental health (OR, 2.21; 95% CI, 2.03–2.40; P <0.001 for severe PASI versus mild PASI; and OR, 1.03; 95% CI, 1.02–1.03; P <0.001 in the trend test) during a normal period without COVID-19 lockdown (shown in Fig. 1a–b; and Table S4 (Supplemental Material)). The disease severity-triggered primary treatment demands further increased during the COVID-19 lockdowns, including healing skin lesions rapidly (OR, 2.19; 95% CI, 1.57–3.05 for severe PASI versus mild PASI; P <0.001) and improving mental health (OR, 2.82; 95% CI, 2.24–3.55 for severe PASI versus mild PASI, P <0.001), despite the statistical insignificance (both P=0.064 in the heterogeneity Q-test). Other treatment demands, including reducing social discrimination, working and socializing

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

normally, relieving painful or burning feelings, relieving itchy feelings, and reducing the treatment side effects, were also significantly stimulated by deteriorated skin conditions measured by PASI (all *P* <0.05); moreover, the degree of this stimulation further intensified during the COVID-19 lockdown (shown in Fig. 1c–g). The exception was the demand for reducing relapses, which significantly declined as PASI increased. Nevertheless, the magnitude of this decline decreased during the pandemic lockdown (OR, 0.61; 95% CI, 0.49–0.75, *P* <0.001 for severe PASI versus mild PASI during a non-COVID-19 period; and OR, 0.81; 95% CI, 0.58–1.12; *P*=0.196 during a COVID-19 lockdown; heterogeneity Q-test, *P*=0.001; shown in Fig. 1h).

Impact of psoriasis severity by different instruments on treatment demands stratified by the COVID-19 pandemic

Similar patterns of change in each treatment demand were also found as BSA and IGA increased during the normal period. However, the two measures motivated the treatment demands slightly differently during the pandemic lockdowns. Specifically, the magnitude of increasing BSA-triggered demands of rapidly healing skin lesions hardly changed during the pandemic lockdowns (OR, 1.33; 95% CI, 1.17–1.50; *P* <0.001 for severe BSA versus mild BSA during a normal period; and OR, 1.38; 95% CI, 0.999–1.896; *P*=0.051 during the pandemic lockdown; heterogeneity Q-test, *P*=0.663), whereas that of IGA-triggered demands significantly increased (OR, 1.64; 95% CI, 1.35–1.99; *P* <0.001 for IGA=4 versus IGA=0/1 during the normal period; and OR, 2.70; 95% CI, 1.63–4.49; *P* <0.001 during the pandemic lockdown; heterogeneity Q-test, *P*=0.005). In contrast, the magnitude of the increase in demands of improving mental health triggered by BSA significantly increased during the pandemic (OR, 2.01; 95% CI, 1.85–2.19; *P* <0.001; and OR, 3.27; 95% CI, 2.57–4.15; *P* <0.001; heterogeneity Q-test, *P* <0.001), whereas that triggered by IGA hardly changed (OR, 2.21; 95% CI, 1.94–2.51; *P* <0.001; and OR, 1.91; 95% CI, 1.36–2.68; *P* <0.001; heterogeneity Q-test, *P*=0.971; shown in Fig. 1a–b and Table sS5 & S6 [Supplemental Material]).

Impact of psoriasis severity on treatment demands mediated by quality of life

Further mediation analysis showed that increasing PASI motivated patients' treatment demands mainly by deteriorating their quality of life, including improving mental health (47.1%), reducing social discrimination (mediated proportion, 49.0%), working and socializing normally (72.1%), relieving painful (40.8%) or itchy (73.2%) feelings, and reducing the treatment side effects (74.3%). However, the proportion of the DLQI-mediated effect was small in the total effect of PASI on the demands for reducing relapses (7.6%) and

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

quickly healing skin lesions (0.6%). The aforementioned results were replicated when disease severity was examined by BSA and IGA (Table 2).

Potential factors influencing treatment demands

Apart from disease severity, multivariable logistic regression analysis also identified female sex (OR, 1.23; 95% CI, 1.11–1.36; *P* <0.001), smoking status (OR, 1.17; 95% CI, 1.04–1.30; *P*=0.005), pustular psoriasis (OR, 1.71; 95% CI, 1.26–2.32; *P*=0.001), and nail involvement (OR, 1.28; 95% CI, 1.14–1.44, *P* <0.001) to be significantly correlated with a higher demand for quick skin lesion healing. However, older age (OR, 0.994; 95% CI, 0.991–0.998; *P*=0.004), married status (OR, 0.82; 95% CI, 0.72–0.94; *P*=0.003), unemployed status (OR, 0.82; 95% CI, 0.70–0.95; *P*=0.010), COVID-19 lockdown (OR, 0.87; 95% CI, 0.77–0.99; *P*=0.037), arthropathic psoriasis (OR, 0.55; 95% CI, 0.47–0.64; *P* <0.001), palmoplantar involvement (OR, 0.75; 95% CI, 0.67–0.85; *P* <0.001), and comorbidities (OR, 0.86; 95% CI, 0.76–0.97; *P*=0.018) were found to be significantly correlated with lower demand (Table 3).

Moreover, the demand for the improvement of mental health was significantly higher in patients with arthropathic psoriasis (OR, 1.22; 95% CI, 1.09–1.37; *P*=0.001) and palmoplantar involvement (OR, 1.09; 95% CI, 1.01–1.18, *P*=0.027). However, this was lower among patients with older age (OR, 0.993; 95% CI, 0.991–0.996, *P* <0.001), higher BMI (OR, 0.9955; 95% CI, 0.9914–0.9996; *P*=0.030), a college education (OR, 0.90; 95% CI, 0.84–0.95; *P*=0.001), smoking status (OR, 0.81; 95% CI, 0.75–0.86; *P* <0.001), pustular psoriasis (OR, 0.77; 95% CI, 0.65–0.92; *P*=0.003), guttate psoriasis (OR, 0.78; 95% CI, 0.71–0.84; *P* <0.001), and comorbidities (OR, 0.90; 95% CI, 0.83–0.97; *P*=0.012).

DISCUSSION

In this cross-sectional study, it was observed that patient demands for healing skin lesions and improving mental health significantly increased as psoriasis worsened, especially during the COVID-19 pandemic. Different psoriasis severity measures have different emphases in reflecting patients' treatment demands, which were magnified during the pandemic. The impact of disease severity on most treatment demands was mediated by deteriorated quality of life, except for the demands of rapid skin healing and relapse reduction, and thus other factors that stratified major treatment demands were also examined.

Patient-centered intervention is crucial for the treatment of psoriasis due to the chronic and non-fatal characteristics of the condition, in addition to the considerable disparity in prices of various treatment choices, especially in recent years with recurrent pandemic lockdowns. During a normal period, all treatment demands, ranging from improving the appearance of skin lesions and relieving irritating symptoms to psychological and daily functional support,

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

significantly increased as psoriasis deteriorated, suggesting the need for more intensive treatment and psychological counseling for patients. The only exception was the demand for reducing relapses, which was demanded in only 4.7% of patients and further decreased as disease severity increased, indicating that most Chinese patients have recognized the chronic nature of psoriasis and accepted the recurrent relapses and living with a small number of skin lesions, thereby suggesting that clinicians should be aware that patients may have poor compliance in their remission periods.

Compared to normal periods, all treatment demands, including those for rapidly healing skin lesions and improving mental health, were further triggered by disease severity during pandemic lockdowns (shown in Fig. 1). This differed from previous reports, which demonstrated that patients' quality of life, as measured by DLQI, was less influenced by psoriasis during pandemic lockdowns.(10,31) The reason for the difference in results is complex. On one hand, because social activities were restricted, patients worried less about skin lesion appearance when socializing and were more fearful about contracting infectious diseases rather than the non-fatal psoriasis. Thus, better quality of life, as indicated by DLQI, was observed.(10,31) Our multivariable logistic models also showed that the COVID-19 pandemic itself was a protective factor in reducing the demands of healing skin lesions (Table 3). On the other hand, the restrictions in traveling and difficulties in accessing medical resources may exacerbate psoriasis and enhance treatment demands.(22) Although the pandemic lockdowns reduced the impact of psoriasis on socializing, the pandemic and self-isolations themselves could exert psychological impact on patients with psoriasis, such as health anxiety and low mood,(10,21) creating a vicious circle of worsening mental health and deteriorated psoriasis. Taking all these factors together, the study showed enhanced treatment demands in patients with more severe psoriasis during the pandemic lockdowns, suggesting that patients' treatment demands were more influenced by psoriasis and stress conditions rather than the reduced need for socializing. These indicate for clinicians that a more intensive treatment strategy with lasting effects and enhanced mental support is needed during lockdown. In addition, increasing evidence in recent years has shown that immunosuppressive treatment for psoriasis, including biologics, does not increase the risk of COVID-19 infection or the related complications, reinforcing the necessity of more intensive therapy during the pandemic.(28,35,36) Besides, a more accessible pathway, such as telemedicine and online medicine service, should be promoted as an "add-on" for in-person clinics,(22,30) to facilitate access to healthcare during pandemic lockdowns. All these factors might be generalized and integrated into the management of other chronic non-fatal diseases,(21) such as atopic diseases, during future pandemics to meet patients' treatment needs.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

To further help recognize patients' needs according to their clinical manifestations in daily clinics, this study compared the impact of disease severity by different measures on each treatment demand. PASI, BSA, and IGA are all instruments measuring psoriasis severity and were found to be significantly correlated with one another.(37) PASI takes both the area coverage and lesion appearance into account, yet it is time-consuming to calculate. In contrast, BSA and IGA are easier to understand, yet only represent the lesion coverage or lesion appearance.(12,13) In this study, an overall more irritating skin appearance presented by a higher IGA further stimulated the demands for the quick relief of skin lesions themselves during the pandemic lockdown, whereas the larger lesion coverage presented by higher BSA further motivated demands for psychological solutions, including improving mental health and reducing social discrimination. Since PASI is difficult to obtain, this study suggests that BSA should be used as a "first-line" surrogate to represent the enhanced psychological needs of patients, whereas IGA should be used to represent the increased need for more intensive therapy during pandemic lockdowns.

As most previous studies focused on the quality of life of patients with psoriasis, which revealed that worsened quality of life was associated with worsened psoriasis,(38,39) this study further investigated the impact of psoriasis on treatment demands mediated by quality of life. In this study, quality of life was measured by DLQI, which reflected patients' lesion feelings, daily activities, leisure, work and study, personal relationships, and treatment burden. We confirmed that increasing disease severity deteriorated patients' quality of life based on the aforementioned aspects, which further motivated corresponding treatment demands. However, although prevalent in the psoriasis population, <2% of the demand for quick skin lesion healing was mediated by deteriorated quality of life, indicating the existence of other factors influencing treatment demands.

Thus, this study further examined other factors potentially stratifying treatment demands. Young and female patients were found to have worse quality of life in previous studies,(38,40,41) as well as higher treatment demands for rapid skin lesion healing in this study. Unmarried and employed patients without comorbidities were also found to have stronger demands for quick healing. These might be because female, young, unmarried, and employed patients have higher requirements for self-image, and patients without comorbidities have fewer concerns regarding polypharmacy and drug interactions due to underlying diseases. Additionally, the same demands for quick healing were higher in patients with pustular psoriasis, which presents with fever, painful skin, and frequent flare-ups,(42) and in patients with nail psoriasis, which undermines daily function.(43) Thus, a more intensive treatment strategy is needed for these patients. Additionally, more

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

psychological care should be provided to younger patients without a college education, as they may lack a basic understanding of the disease and were found to have higher demands for mental support in this study. The same support was also needed in patients with arthropathic psoriasis and palmoplantar psoriasis, which were linked with internalized stigma and poorer quality of life.(44,45)

Although, to our knowledge, this study is the largest real-world study to date investigating the treatment demands of patients with psoriasis during the pandemic lockdowns, there were limitations. First, the Psoriasis Center program enrolled patients from specific dermatological clinics, and a certain proportion of patients declined the enrollment request. Thus, the study population may not represent the general psoriasis population. Second, the demand for improving mental health was collected as a binary variable, while the psychological or psychiatric condition was not systematically assessed using specialized scales, such as Generalized Anxiety Disorder-2, Patient Health Questionnaire-2 and Short Form-12 Health Survey.(11,22,46) Further studies are warranted to quantitatively investigate patients' mental health condition and the degree of each treatment demand using specialized scales. Third, there was an issue regarding the missing data for this data platform. However, as the missing rate was not high, and missing at random was considered (Table S2 [Supplemental Material]), a complete case analysis was considered sufficient for handling missing data and, therefore, used. Fourth, since the information on residence place was not collected, the COVID-19 pandemic information was matched to each patient only at a province level, even though the pandemic was prevented with a precise approach in China.

CONCLUSION

An increase in psoriasis severity significantly stimulates patients' treatment demands from quickly healing skin lesions and improving mental health aspects, especially during the pandemic lockdowns, indicating the need for an accessible pathway for patients with psoriasis getting more intensive treatment and mental support during future pandemics. To better recognize and meet patients' treatment demands during the pandemic, we suggest that BSA is used to determine the psychological needs of patients, while IGA should be used to reflect the desire to quickly heal lesions. Other demographic and clinical characteristics of each patient should also be considered for a more personalized treatment strategy during future pandemics. Moreover, since the COVID-19 pandemic is nearing its end in many countries, the results of this study could provide hints for personalized treatment for patients with non-fatal chronic diseases in future pandemic lockdowns.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

Acknowledgements

The authors would like to acknowledge the contributions made by all collaborating units of the Psoriasis Center with data collection. The authors would also like to thank all patients who participated in this study.

Statement of Ethics

Study approval statement: This study protocol was reviewed and approved by ethics committee of the Peking University First Hospital (approval number: 2020-scientific research-255) and the Human Genetic Resources Management Office of the Ministry of Science and Technology of China (approval number: 2022-CJ0021).

Consent to participate statement: All patients provided informed consent for publication before entering the registry.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

This work was supported by the National Key Research and Development Program of China (2023YFC2508100), PKU-Baidu Fund (grant number: 2020BD012). The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Contributors

All authors were involved in the study design. Zhihui Yang cleaned the clinical data, conducted the statistical analysis, created the initial manuscript, and revised the manuscript according to the suggestions of other authors. Yu Jin provided statistical support and helped revise the manuscript. Mingyue Wang and Ruoyu Li helped provide clinical guidance and revise the manuscript. Wenqing Li provided statistical guidance and revised the manuscript. Hang Li revised the manuscript and supervised the overall research project. All authors read and approved the final manuscript.

Data Availability Statement

This study was conducted using deidentified data from the real-world data collection platform of the Psoriasis Standardized Diagnosis and Treatment Center (http://www.psocenter.cn/). Data are publicly available upon request.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Superieur (ABES) .

REFERENCES

1. Parisi R, Iskandar I, Kontopantelis E, et al. National, regional, and worldwide epidemiology of psoriasis: systematic analysis and modelling study on behalf of the Global Psoriasis Atlas. *BMJ* 2020;369:m1590. doi: 10.1136/bmj.m1590

2. Ding X, Wang T, Shen Y, et al. Prevalence of psoriasis in China: a population-based study in six cities. *Eur J Dermatol* 2012;22(5):663-67. doi: 10.1684/ejd.2012.1802

3. Takeshita J, Grewal S, Langan SM, et al. Psoriasis and Comorbid Diseases: Epidemiology. *J Am Acad Dermatol* 2017;76(3):377-90. doi: 10.1016/j.jaad.2016.07.064

4. Armstrong AW, Schupp C, Wu J, et al. Quality of life and work productivity impairment among psoriasis patients: findings from the National Psoriasis Foundation survey data 2003–2011. *PLoS One* 2012;7(12):e52935. doi: 10.1371/journal.pone.0052935

5. Bang CH, Yoon JW, Chun JH, et al. Association of psoriasis with mental health disorders in South Korea. *JAMA dermatology* 2019;155(6):747-49. doi: 10.1001/jamadermatol.2019.0315

6. Dalgard FJ, Gieler U, Tomas-Aragones L, et al. The psychological burden of skin diseases: a cross-sectional multicenter study among dermatological out-patients in 13 European countries. *J Invest Dermatol* 2015;135(4):984-91. doi: 1038/jid.2014.530

7. Liu L, Lin N-x, Yu Y-t, et al. Epidemiology of mental health comorbidity in patients with psoriasis: An analysis of trends from 1986 to 2019. *Psychiatry research* 2023;321:115078. doi: 10.1016/j.psychres.2023.115078

8. Schielein MC, Tizek L, Knobloch L, et al. Psoriasis and addiction: assessing mental health based on a cross-sectional study in Germany. *European Journal of Dermatology* 2021;31(6):722-29. doi: 10.1684/ejd.2021.4146

9. Chiu H-Y, Chang Liao N-F, Lin Jr Y, et al. Perception of the threat, mental health burden, and healthcare-seeking behavior change among psoriasis patients during the COVID-19 pandemic. *PLoS One* 2021;16(12):e0259852. doi: 10.1371/journal.pone.0259852

10. Lada G, Chinoy H, Talbot PS, et al. Impact of the COVID-19 Pandemic on the Mental Health and Quality of Life of Patients with Psoriasis in Tertiary Care; A One-year Follow-up. *Acta Derm Venereol* 2022;102:adv00814-adv14. doi: 10.2340/actadv.v102.2464

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Enseignement Superieur (ABES) .

11. Mahil SK, Yates M, Yiu ZZN, et al. Describing the burden of the COVID-19 pandemic in people with psoriasis: findings from a global cross-sectional study. *J Euro Acad Dermatol Venereol* 2021;35(10):e636-e40. doi: 10.1111/jdv.17450

12. Armstrong AW, Siegel MP, Bagel J, et al. From the Medical Board of the National Psoriasis Foundation: treatment targets for plaque psoriasis. *J Am Acad Dermatol* 2017;76(2):290-98. doi: 10.1016/j.jaad.2016.10.017

13. Langley RGB, Feldman SR, Nyirady J, et al. The 5-point Investigator's Global Assessment (IGA) Scale: A modified tool for evaluating plaque psoriasis severity in clinical trials. *J Dermatolog Treat* 2015;26(1):23-31. doi: 10.3109/09546634.2013.865009

14. Abrouk M, Nakamura M, Zhu TH, et al. The impact of PASI 75 and PASI 90 on quality of life in moderate to severe psoriasis patients. *J Dermatolog Treat* 2017;28(6):488-91. doi: 10.1080/09546634.2016.1278198

15. Blome C, Gosau R, Radtke MA, et al. Patient-relevant treatment goals in psoriasis. *Arch Dermatol Res* 2016;308(2):69-78. doi: 10.1007/s00403-015-1613-8

16. Hoffman DA. Increasing access to care: telehealth during COVID-19. *J Law Biosci* 2020;7(1) doi: 10.1093/jlb/lsaa043

17. Mistry SK, Ali AM, Yadav UN, et al. Older adults with non-communicable chronic conditions and their health care access amid COVID-19 pandemic in Bangladesh: Findings from a cross-sectional study. *PLoS One* 2021;16(7):e0255534. doi: 10.1371/journal.pone.0255534

18. Nouri S, Khoong EC, Lyles CR, et al. Addressing equity in telemedicine for chronic disease management during the Covid-19 pandemic. *NEJM Catal Innov Care Deliv* 2020;1(3) doi: 10.1056/CAT.20.0123

19. Singh K, Kondal D, Mohan S, et al. Health, psychosocial, and economic impacts of the COVID-19 pandemic on people with chronic conditions in India: a mixed methods study. *BMC Public Health* 2021;21(1):685. doi: 10.1186/s12889-021-10708-w

20. Elmas ÖF, Demirbaş A, Kutlu Ö, et al. Psoriasis and COVID-19: A narrative review with treatment considerations. *Dermatol Ther* 2020;33(6):e13858. doi: 10.1111/dth.13858

21. Lada G, Talbot PS, Bewley A, et al. Mental health and dermatology practice in the COVID-19 pandemic. *Clin Exp Dermatol* 2020;45(7):816-17. doi: 10.1111/ced.14330

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Superieur (ABES) .

22. Kuang Y, Shen M, Wang Q, et al. Association of outdoor activity restriction and income loss with patient-reported outcomes of psoriasis during the COVID-19 pandemic: a web-based survey. *J Am Acad Dermatol* 2020;83(2):670-72. doi: 10.1016/j.jaad.2020.05.018

23. Rodríguez-Villa Lario A, Vega-Díez D, González-Cañete M, et al. Patient's perspective: psychological burden of the COVID-19 pandemic in 146 psoriatic patients treated with biological drugs and small molecules in real clinical practice. *Journal of Dermatological Treatment* 2022;33(2):1185-87. doi: 10.1080/09546634.2020.1790485

24. Penso L, Dray-Spira R, Weill A, et al. Drop in biological initiation for patients with psoriasis during the COVID-19 pandemic. *Br J Dermatol* 2021;185(3):671-73. doi: 10.1111/bjd.20406

25. Pirro F, Caldarola G, Chiricozzi A, et al. The impact of COVID-19 pandemic in a cohort of Italian psoriatic patients treated with biological therapies. *J Dermatol Treat* 2022;33(2):1079-83. doi: 10.1080/09546634.2020.1800578

26. Ninosu N, Roehrich F, Diehl K, et al. Psoriasis care during the time of COVID-19: real-world data on changes in treatments and appointments from a German university hospital. *Eur J Dermatol* 2021;31(2):183-91. doi: 10.1684/ejd.2021.4016

27. Quirke-McFarlane S, Weinman J, Cook ES, et al. Nonadherence to systemic immune-modifying therapy in people with psoriasis during the COVID-19 pandemic: findings from a global cross-sectional survey. *Br J Dermatol* 2022;188(5):610-17. doi: 10.1093/bjd/ljac144

28. Polat Ekinci A, Pehlivan G, Gökalp MO. Surveillance of psoriatic patients on biologic treatment during the COVID-19 pandemic: A single-center experience. *Dermatol Ther* 2021;34(1):e14700. doi: 10.1111/dth.14700

29. Wang Q, Luo Y, Lv C, et al. Nonadherence to treatment and patient-reported outcomes of psoriasis during the COVID-19 epidemic: a web-based survey. *Patient Prefer Adherence* 2020:1403-09. doi: 10.2147/PPA.S263843

30. van de Kerkhof PCM. Future perspectives on care for patients with psoriasis. What did we learn during the COVID-19. *Journal of Dermatological Treatment* 2021;32(5):477-77. doi: 10.1080/09546634.2021.1945655

31. Boch K, Zillikens D, Ludwig RJ, et al. Paradoxical improvement of life quality in the COVID-19 era in psoriasis patients. *PLoS One* 2022;17(9):e0275293. doi: 10.1371/journal.pone.0275293

32. Rodríguez-Villa Lario A, Vega-Díez D, González-Cañete M, et al. Patient's perspective: psychological burden of the COVID-19 pandemic in 146 psoriatic patients treated with biological

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Enseignement Superieur (ABES) .

drugs and small molecules in real clinical practice. *J Dermatol Treat* 2022;33(2):1185-87. doi: 10.1080/09546634.2020.1790485

33. Yang Z, Yao X, Wang M, et al. Updates in psoriasis diagnosis and treatment status in China: results from the National Psoriasis Center Registry. *Chin Med J (Engl)* 2023;136(23):2874-76. doi: 10.1097/cm9.0000000000002563

34. Committee on Psoriasis, Chinese Society of Dermatology. Guideline for the diagnosis and treatment of psoriasis in China (2023 edition). *Chin J Dermatol* 2023;56(7):573-625. doi: 10.35541/cjd.20220839

35. Penso L, Dray-Spira R, Weill A, et al. Psoriasis-related treatment exposure and hospitalization or in-hospital mortality due to COVID-19 during the first and second wave of the pandemic: cohort study of 1 326 312 patients in France*. *Br J Dermatol* 2022;186(1):59-68. doi: 10.1111/bjd.20659

36. Kartal SP, Çelik G, Yılmaz O, et al. The impact of COVID-19 pandemic on psoriasis patients, and their immunosuppressive treatment: a cross-sectional multicenter study from Turkey. *J Dermatol Treat* 2022;33(4):2137-44. doi: 10.1080/09546634.2021.1927947

37. Lane S, Lozano-Ortega G, Wilson J, et al. Assessing severity in psoriasis: Correlation of different measures (PASI, BSA, and IGA) in a Canadian real-world setting. *Value Health* 2016;19(3):A122. doi: 10.1016/j.jval.2016.03.490

38. Daudén E, Pujol R, Sánchez-Carazo J, et al. Demographic characteristics and health-related quality of life of patients with moderate-to-severe psoriasis: The VACAP study. *Actas Dermosifiliogr* 2013;104(9):807-14. doi: 10.1016/j.ad.2013.03.005

39. Strober B, Greenberg JD, Karki C, et al. Impact of psoriasis severity on patient-reported clinical symptoms, health-related quality of life and work productivity among US patients: real-world data from the Corrona Psoriasis Registry. *BMJ Open* 2019;9(4):e027535. doi: 10.1136/bmjopen-2018-027535

40. Merola JF, Qureshi A, Husni ME. Underdiagnosed and undertreated psoriasis: Nuances of treating psoriasis affecting the scalp, face, intertriginous areas, genitals, hands, feet, and nails. *Dermatol Ther* 2018;31(3):e12589. doi: 10.1111/dth.12589

41. Maul JT, Navarini AA, Sommer R, et al. Gender and age significantly determine patient needs and treatment goals in psoriasis–a lesson for practice. *J Eur Acad Dermatol Venereol* 2019;33(4):700-08. doi: 10.1111/jdv.15324

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Superieur (ABES) .

42. Choon SE, Lai NM, Mohammad NA, et al. Clinical profile, morbidity, and outcome of adult-onset generalized pustular psoriasis: analysis of 102 cases seen in a tertiary hospital in Johor, Malaysia. *Int J Dermatol* 2014;53(6):676-84. doi: 10.1111/ijd.12070

43. Thomas L, Azad J, Takwale A. Management of nail psoriasis. *Clin Exp Dermatol* 2021;46(1):3-8. doi: 10.1111/ced.14314

44. Alpsoy E, Polat M, FettahlıoGlu-Karaman B, et al. Internalized stigma in psoriasis: A multicenter study. *J Dermatol* 2017;44(8):885-91. doi: 10.1111/1346-8138.13841

45. Sampogna F, Tabolli S, Söderfeldt B, et al. Measuring quality of life of patients with different clinical types of psoriasis using the SF-36. *Br J Dermatol* 2006;154(5):844-9. doi: 10.1111/j.1365-2133.2005.07071.x

46. Grozdev I, Kast D, Cao L, et al. Physical and mental impact of psoriasis severity as measured by the compact Short Form-12 Health Survey (SF-12) quality of life tool. *J Invest Dermatol* 2012;132(4):1111-16. doi: 10.1038/jid.2011.427

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

FIGURE LEGENDS

Fig. 1. Odds ratio for the association between each treatment demand and psoriasis severity by different measures (PASI/BSA/IGA) during COVID-19 lockdowns (red line) and non-lockdown periods (blue line).

Fig. 1. a Treatment demand for healing skin lesions rapidly

Fig. 1. b. Treatment demand for improving mental health

Fig. 1. c. Treatment demand for reducing social discrimination

Fig. 1. d. Treatment demand for working and socializing normally

Fig. 1. e. Treatment demand for relieving painful or burning feelings

Fig. 1. f. Treatment demand for relieving itchy feelings

Fig. 1. g. Treatment demand for reducing the side effects of treatment

Fig. 1. h. Treatment demand for reducing relapses

PASI: Psoriasis Area and Severity Index; BSA: Body Surface Area; IGA: Investigator's Global Assessment.

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Superieur (ABES) .

Tables

Table 1. Demographic and clinical characteristics stratified by primary treatment demands

	Healing skin lesions rapidly			Improving mental health			Total (n=22,425)
	Yes (n=20,111)	No (n=2314)	*P* value	Yes (n=8531)	No (n=13,894)	*P* value	
Male, n (%)	13,005 (64.7)	1562 (67.5)	0.007	5491 (64.4)	9076 (65.3)	0.144	14,567 (65.0)
Age, y, median (IQR)	40 (31–53)	42 (33–55)	<0.001	40 (31–53)	40 (31–54)	0.227	40 (31–54)
BMI, kg/m^2, median (IQR)	24.0 (21.7–26.7)	24.2 (21.9–26.9)	0.099	24.0 (21.8–26.7)	24.1 (21.7–26.8)	0.405	24.0 (21.7–26.7)
Unemployment*, n (%)	1755 (11.2)	239 (13.3)	0.001	833 (12.3)	1161 (10.8)	0.003	1994 (11.4)
Married, n (%)	15,316 (76.2)	1888 (81.6)	<0.001	6544 (76.7)	10,660 (76.7)	0.979	17,204 (76.7)
Bachelor's degree, n (%)	7064 (35.1)	764 (33.0)	0.044	2860 (33.5)	4968 (35.8)	0.001	7828 (34.9)
Current smoker, n (%)	5443 (27.1)	580 (25.1)	0.040	2119 (24.8)	3904 (28.1)	<0.001	6023 (26.9)
COVID-19 lockdown, n (%)	2394 (11.9)	312 (13.5)	0.027	1032 (12.1)	1674 (12.1)	0.913	2706 (12.1)
Psoriasis duration, y, median (IQR)	6 (2-14)	8 (2-15)	<0.001	8 (2-15)	6 (1–14)	<0.001	6 (2-14)
Family history, n (%)	3459 (17.2)	357 (15.4)	0.032	1452 (17.0)	2364 (17.0)	0.991	3816 (17.0)
Psoriasis phenotype†, n (%)							
Plaque psoriasis	16,335 (81.2)	1896 (81.9)	0.406	7105 (83.3)	11,126 (80.1)	<0.001	18,231 (81.3)
Erythrodermic psoriasis	219 (1.1)	23 (1.0)	0.675	121 (1.4)	121 (0.9)	<0.001	242 (1.1)
Pustular psoriasis	609 (3.0)	49 (2.1)	0.014	216 (2.5)	442 (3.2)	0.005	658 (2.9)
Guttate psoriasis	2739 (13.6)	277 (12.0)	0.028	978 (11.5)	2038 (14.7)	<0.001	3016 (13.4)
Arthropathic psoriasis	1293 (6.4)	297 (12.8)	<0.001	668 (7.8)	922 (6.6)	0.001	1590 (7.1)
Lesions on special areas, n (%)							
Nail	4861 (24.2)	504 (21.8)	0.011	2130 (25.0)	3235 (23.3)	0.004	5365 (23.9)
Scalp	13,127 (65.3)	1451 (62.7)	0.014	5709 (66.9)	8869 (63.8)	<0.001	14,578 (65.0)
Palmoplantar	3928 (19.5)	530 (22.9)	<0.001	1863 (21.8)	2595 (18.7)	<0.001	4458 (19.9)
Genital	2681 (13.3)	333 (14.4)	0.157	1281 (15.0)	1733 (12.5)	<0.001	3014 (13.4)
Disease severity, median (IQR)							
PASI	7.2 (3.0–15.0)	5.9 (2.6–12.0)	<0.001	9.1 (3.9–17.4)	6.0 (2.7–12.8)	<0.001	7.2 (3.0–14.6)
BSA, %	10.0 (3.0–30.0)	9.2 (3.0–22.4)	<0.001	14.0 (5.0–30.0)	8.0 (3.0–25.0)	<0.001	10.0 (3.0–30.0)
IGA	3 (2-3)	2 (2-3)	<0.001	3 (2–3)	3 (2-3)	<0.001	3 (2–3)
DLQI, median (IQR)	8 (3-12)	8 (2-12)	0.072	10 (6–15)	6 (2-10)	<0.001	8 (3–12)
Comorbidity‡, n (%)	2850 (14.2)	395 (17.1)	<0.001	1177 (13.8)	2068 (14.9)	0.010	3245 (14.5)
Previous use of biologics§	1726 (8.6)	256 (11.1)	<0.001	732 (8.6)	1250 (9.0)	0.286	1982 (8.8)

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.
Enseignement Superieur (ABES) .

BMI, body mass index; BSA, Body Surface Area; DLQI, Dermatology Life Quality Index; IGA, Investigator's Global Assessment; IQR, interquartile range; and PASI, Psoriasis Area and Severity Index.

*The unemployment rate was calculated in the working-age population, which excluded retired patients and students.

†Phenotypes were not mutually exclusive, thus the total percentage was higher than 100%.

‡Comorbidity presented the existence of any disease conditions, including cardiovascular diseases, respiratory diseases, kidney diseases, rheumatic diseases, digestive diseases, tumors, endocrine diseases, and so on.

§Biologics included tumor necrosis factor-α inhibitors and interleukin inhibitors.

For peer review only

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Superieur (ABES) .

Table 2. Proportion of causal effect of disease severity on treatment demands, as mediated by quality of life

Treatment demands	PASI			BSA			IGA		
	Indirect effect*	Total effect†	Mediated proportion‡	Indirect effect*	Total effect†	Mediated proportion‡	Indirect effect*	Total effect†	Mediated proportion‡
Healing skin lesions rapidly	<0.001	0.001	0.6%	<0.001	0.001	1.4%	<0.001	0.019	0.3%
Improving mental health	0.009	0.020	47.1%	0.004	0.007	56.7%	0.098	0.186	52.6%
Reducing social discrimination	0.006	0.013	49.0%	0.003	0.005	53.5%	0.064	0.118	54.3%
Working and socializing normally	0.025	0.035	72.1%	0.010	0.015	67.7%	0.260	0.289	90.0%
Relieving painful or burning feelings	0.010	0.024	40.8%	0.004	0.009	45.5%	0.102	0.212	48.2%
Relieving itchy feelings	0.011	0.015	73.2%	0.004	0.003	139.4%	0.106	0.244	43.3%
Reducing the side effects of treatment	0.016	0.021	74.3%	0.006	0.007	83.4%	0.162	0.145	111.9%
Reducing relapses	<0.001	0.003	7.6%	<0.001	0.001	5.9%	0.004	0.079	5.4%

BSA, Body Surface Area; IGA, Investigator's Global Assessment; and PASI, Psoriasis Area and Severity Index.

*The indirect effect refers to the effect of PASI/BSA/IGA on each treatment demand mediated by quality of life.

†The total effect refers to the sum of direct effects of PASI/BSA/IGA on each treatment demand and the indirect effects mediated by quality of life.

‡The mediated proportion equals to the indirect effect divided by the total effect.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table 3. Relationship between other patient characteristics and primary treatment demands

Patient characteristics	Healing skin lesions rapidly		Improving mental health	
	OR (95% CI)	*P* value	OR (95% CI)	*P* value
Sex (reference: male)	1.23 (1.11–1.36)	<0.001	1.04 (0.98–1.11)	0.205
Age	0.994 (0.991–0.998)	0.004	0.993 (0.991–0.996)	<0.001
Body mass index	0.997 (0.990–1.003)	0.281	0.9955 (0.9914–0.9996)	0.030
Marriage (reference: unmarried)	0.82 (0.72–0.94)	0.003	1.06 (0.98–1.14)	0.166
Bachelor's degree	1.01 (0.92–1.12)	0.912	0.90 (0.84–0.95)	0.001
Unemployment	0.82 (0.70–0.95)	0.010	1.08 (0.98–1.20)	0.112
Current smoker	1.17 (1.04–1.30)	0.005	0.81 (0.75–0.86)	<0.001
COVID-19 lockdowns	0.87 (0.77–0.99)	0.037	1.02 (0.93–1.11)	0.726
Disease course	0.9996 (0.9989–1.0004)	0.319	0.9999 (0.9993–1.0005)	0.744
Family history	0.93 (0.82–1.05)	0.225	1.03 (0.95–1.11)	0.457
Psoriasis phenotype (reference: plaque psoriasis)				
Erythrodermic psoriasis	1.19 (0.76–1.86)	0.435	1.09 (0.84–1.42)	0.503
Pustular psoriasis	1.71 (1.26–2.32)	0.001	0.77 (0.65–0.92)	0.003
Guttate psoriasis	1.14 (0.9995–1.31)	0.051	0.78 (0.71–0.84)	<0.001
Arthropathic psoriasis	0.55 (0.47–0.64)	<0.001	1.22 (1.09–1.37)	0.001
Lesions on specific areas				
Nail	1.28 (1.14–1.44)	<0.001	0.97 (0.90–1.04)	0.373
Scalp	1.07 (0.97–1.18)	0.158	1.0005 (0.94–1.06)	0.987
Palmoplantar	0.75 (0.67–0.85)	<0.001	1.09 (1.01–1.18)	0.027
Genital	0.93 (0.81–1.07)	0.323	1.08 (0.99–1.17)	0.087
Comorbidity	0.86 (0.76–0.97)	0.018	0.90 (0.83–0.97)	0.012
Previous use of biologics	0.87 (0.75–1.01)	0.077	1.02 (0.92–1.13)	0.682

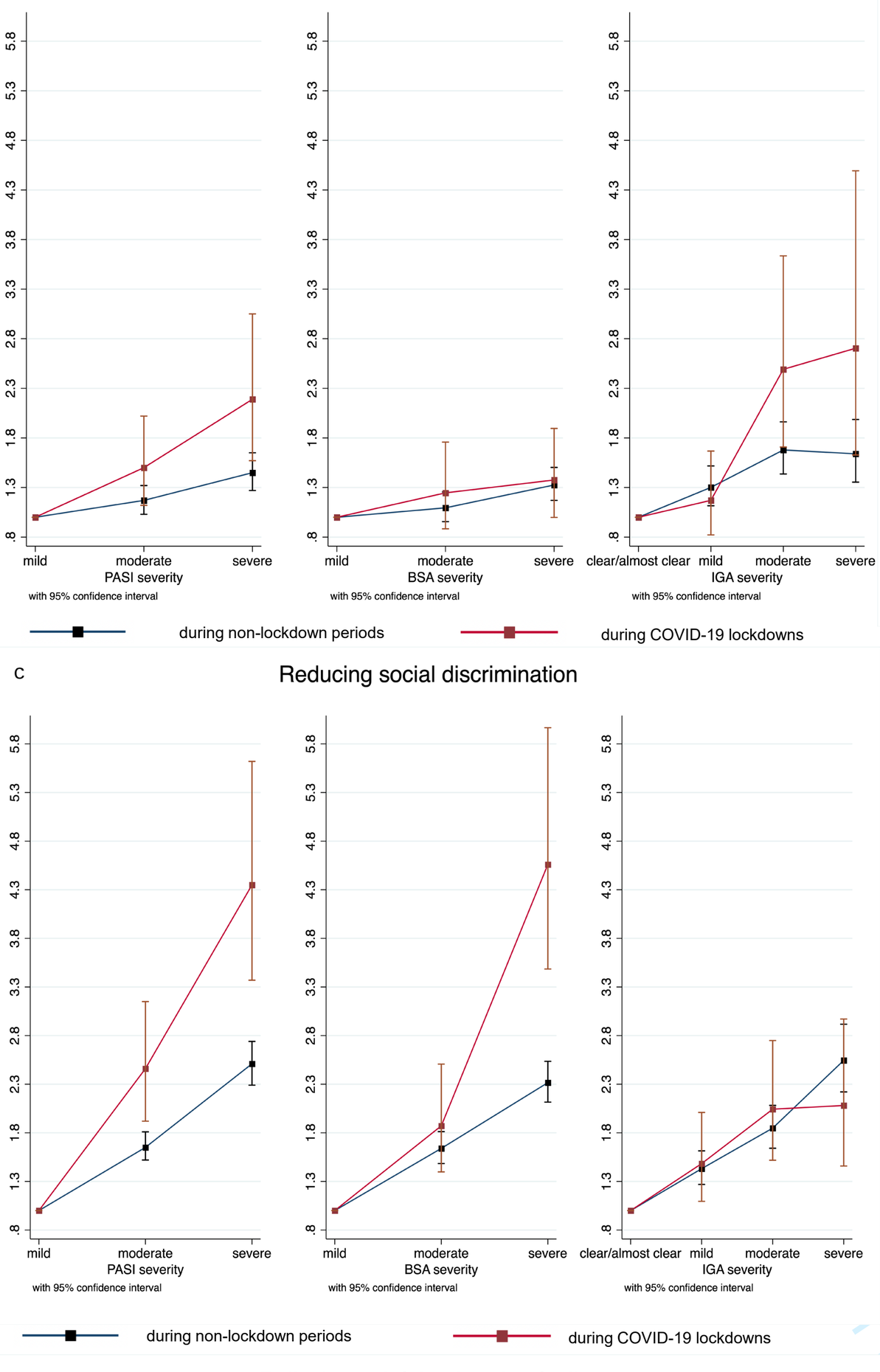
OR: odds ratio; and CI, confidence interval.

The relationship between other patient characteristics and primary treatment demands was identified by the same logistic regression models examining the impact of PASI on treatment demands.

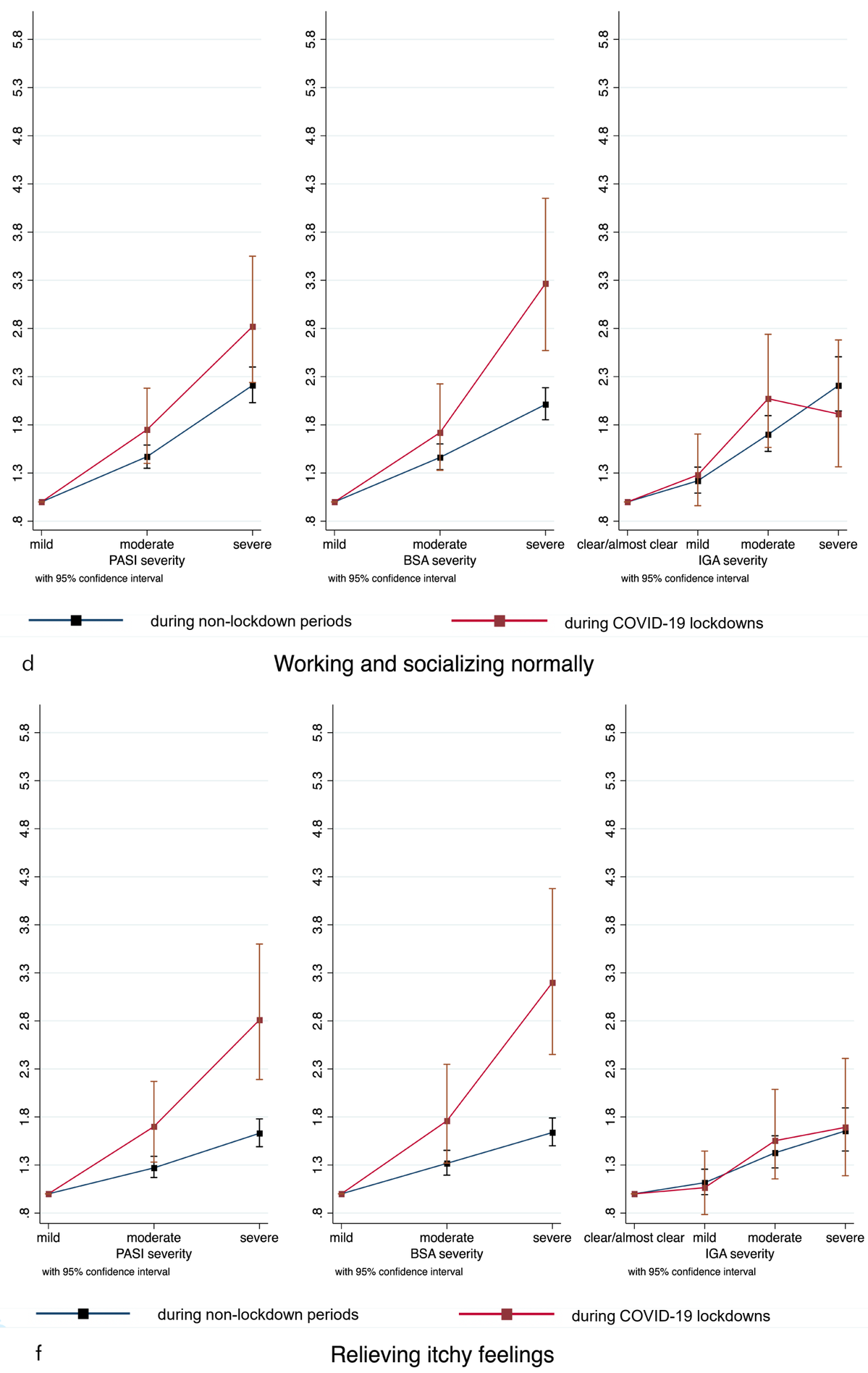
For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies. Enseignement Superieur (ABES) .

a



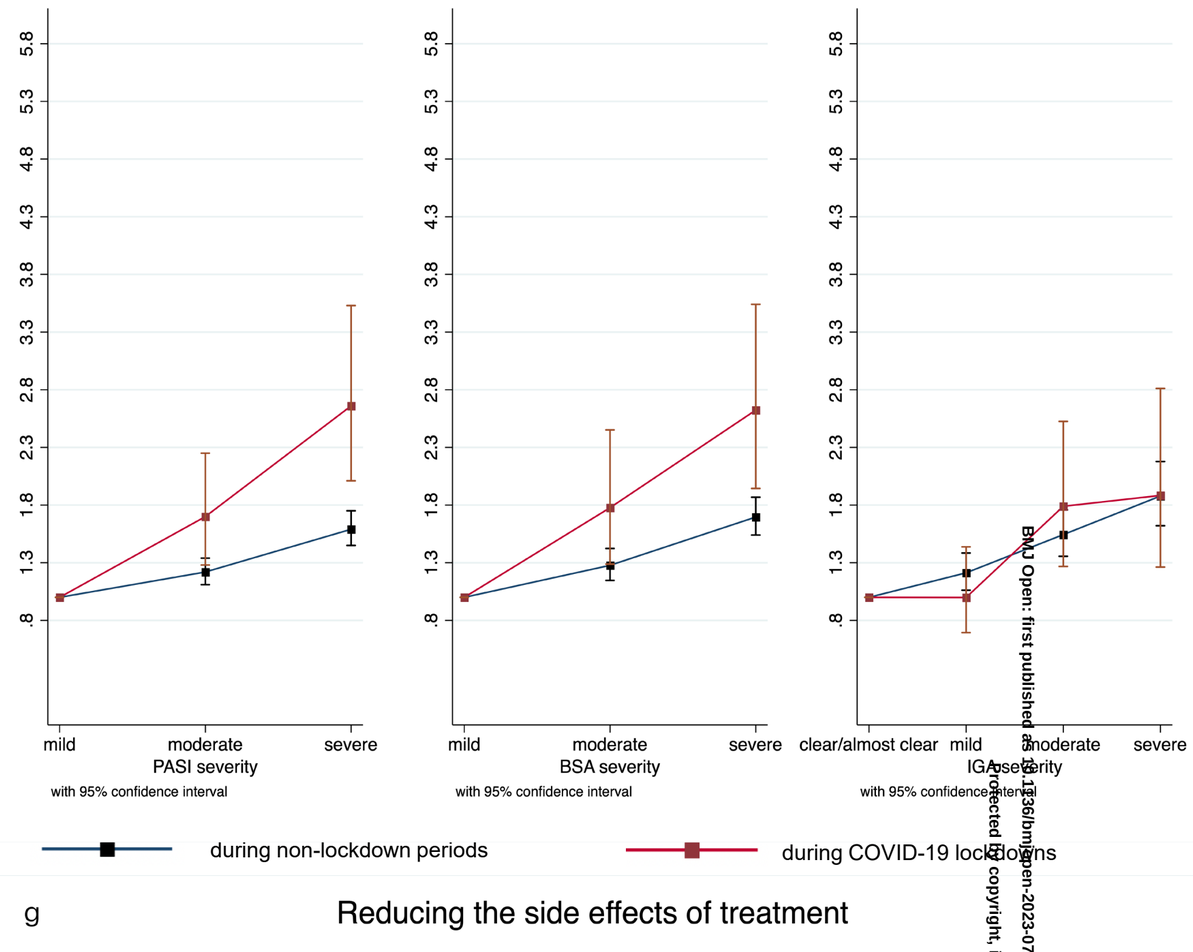
b



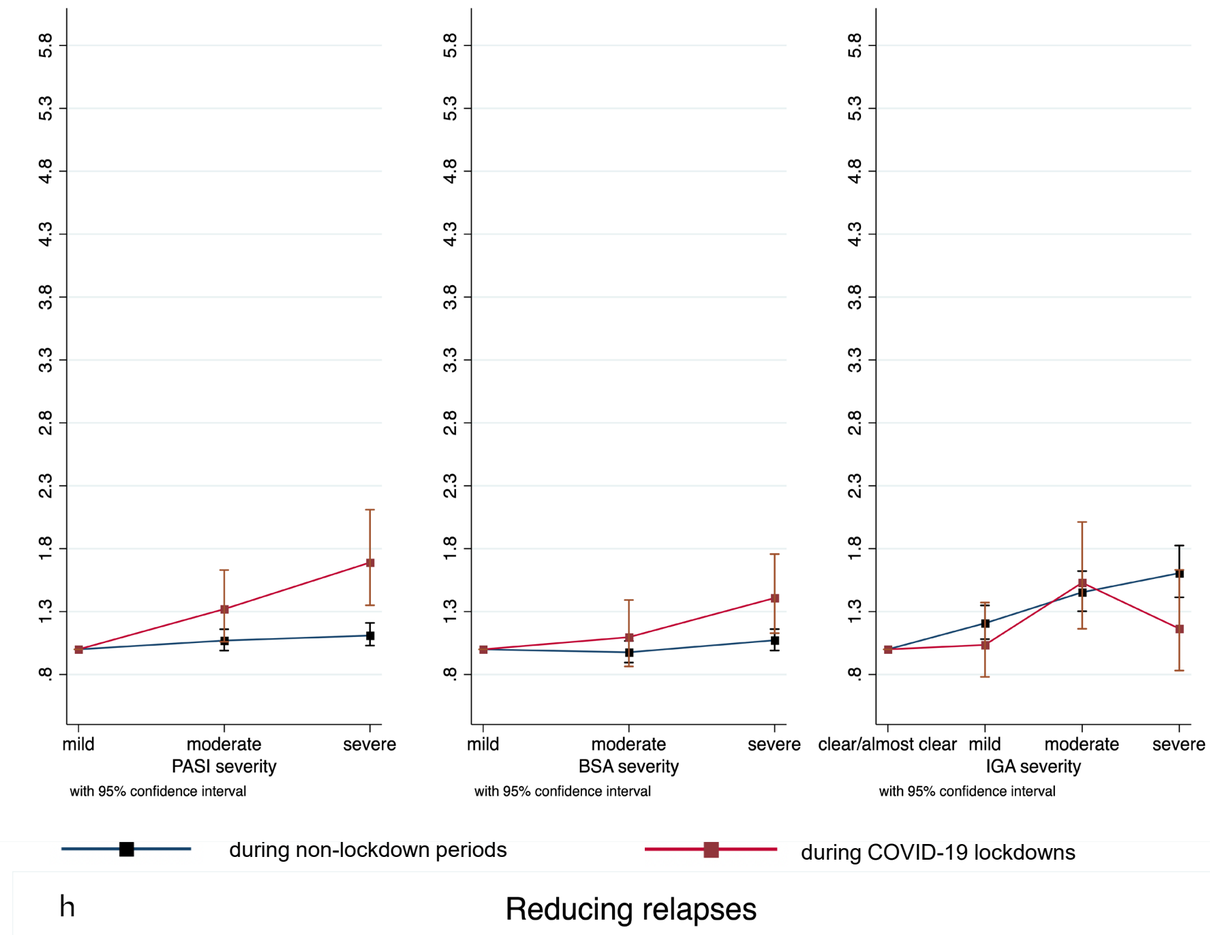
c

d

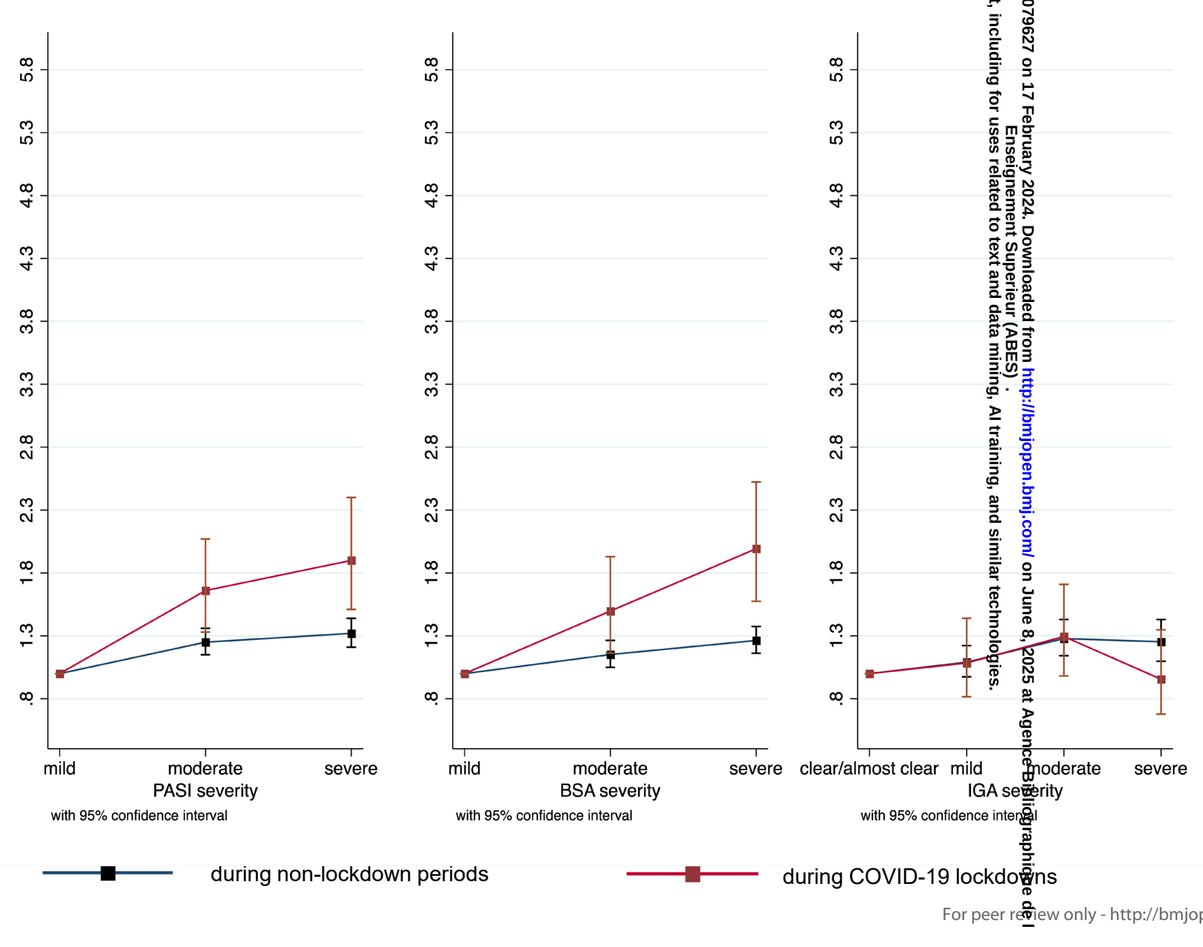
e



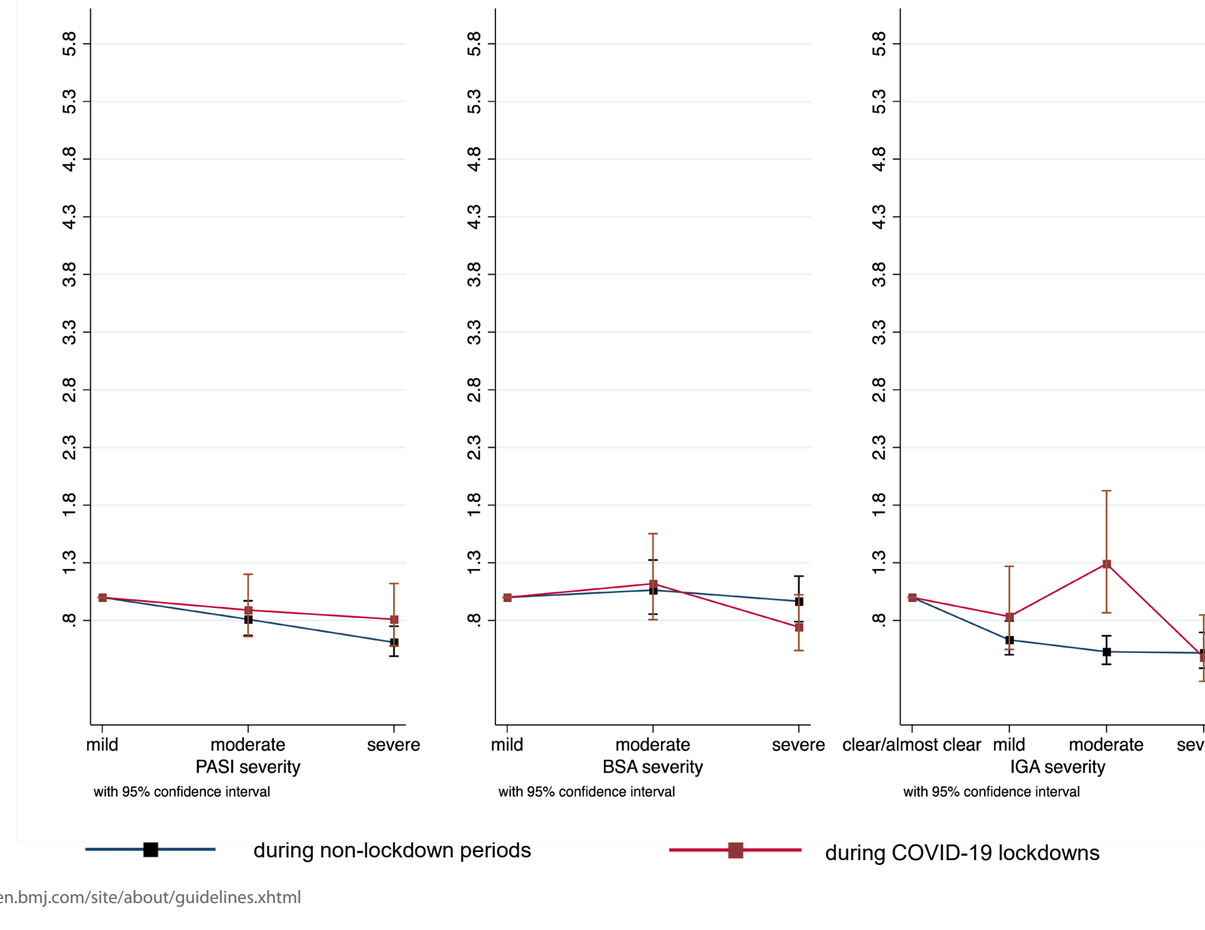
f



g



h



BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Article type: Original Article

Title: Enhanced impact of psoriasis severity on treatment demands of patients during the COVID–19 pandemic: A cross–sectional study based on a national psoriasis registry in China

Authors: Z. Yang, MD[1†]; Y. Jin, PhD[2†]; M. Wang, MD[1]; R. Li, MD[1]; W. Li, PhD[2*]; H. Li, MD[1,3*]

[1]*Department of Dermatology and Venerology, Peking University First Hospital, Beijing 100034, China; Beijing Key Laboratory of Molecular Diagnosis of Dermatoses, Peking University First Hospital, Beijing 100034, China; National Clinical Research Center for Skin and Immune Diseases, Beijing 100034, China; and NMPA Key Laboratory for Quality Control and Evaluation of Cosmetics, Peking University First Hospital, Beijing 100034, China.*

2State Key Laboratory of Holistic Integrative Management of Gastrointestinal Cancers, Beijing Key Laboratory of Carcinogenesis and Translational Research, Department of Cancer Epidemiology, Peking University Cancer Hospital & Institute, Beijing 100142, China

[3]*Peking University – Yunnan Baiyao International Medical Research Center*

[†]These authors contributed equally.

Corresponding author (W. Li and H. Li contributed equally):

Wenqing Li, PhD, Prof.

No.52 Fucheng Road, Haidian District

Beijing, P. R. China. 100143

Tel: (86)18010276738

Email: wenqing_li@bjmu.edu.cn

Hang Li, MD., Prof.

No.1 Xi'anmen Street, Xicheng District

Beijing, P. R. China. 100034

Tel: (86)–10–83573075

Email: drlihang@126.com

ORCID: 0000–0002–7343–3865

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

For peer review only

Supplemental Material

Table S1. Data preprocessing standards for derived variables and variables with potential mistaken values 3

Table S2. Comparison of baseline characteristics between full population and study population with complete data.....4

Table S3. Baseline characteristics stratified by treatment demands 6

Table S4. Mutlivariable logistic regression models examining the impact of PASI on treatment demands stratified by COVID–19 lockdowns 10

Table S5. Mutlivariable logistic regression models examining the impact of BSA on treatment demands stratified by COVID–19 lockdowns 11

Table S6. Mutlivariable logistic regression models examining the impact of IGA on treatment demands stratified by COVID–19 lockdowns 12

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S1. Data preprocessing standards for derived variables and variables with potential mistaken values

Patient characteristics	Data preprocessing standards
Height	Was treated as a missing value if height<80cm or >200cm
Weight	Was treated as a missing value if weight <25kg or >200kg
Psoriasis duration	The year of enrollment minus the year of diagnosis
Family history	Was treated as a missing value if the patient was unsure about the family history
Psoriatic arthritis	Was treated as "yes" if the patient was diagnosed with arthropathic psoriasis or psoriatic arthritis
Body Surface Area	Was treated as a missing value if BSA<75% for patients diagnosed with erythrodermic psoriasis

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S2. Comparison of baseline characteristics between full population and study population with complete data

Patient characteristics	Full population (n=29 412)[a]	Study population (n=22 425)	Missing number and proportion
Male, No. (%)	19 120 (65.1)	14 567 (65.0)	53 (0.2)
Age, median (IQR), y	41 (32–54)	40 (31–54)	241 (0.8)
BMI, median (IQR), kg/m^2	24.0 (21.6–26.6)	24.0 (21.7–26.7)	678 (2.3)
Unemployment[b], No. (%)	2544 (11.5)	1994 (11.4)	1019 (3.5)
Married, No. (%)	22 004 (77.5)	17 204 (76.7)	1018 (3.5)
Bachelor's degree or higher, No. (%)	9277 (34.5)	7828 (34.9)	2487 (8.5)
Current smoker, No. (%)	7101 (25.0)	6023 (26.9)	1018 (3.5)
Enrolled during the COVID–19 lockdowns	4178 (14.3)	2706 (12.1)	159 (0.5)
Psoriasis duration, median (IQR), y	6 (2–14)	6 (2–14)	27 (0.1)
Family history, No. (%)	21 924 (16.5)	3816 (17.0)	3166 (10.8)
Psoriasis phenotype, No. (%)			
Plaque psoriasis	24 574 (83.6)	18 231 (81.3)	17 (0.1)
Erythrodermic psoriasis	376 (1.3)	242 (1.1)	
Pustular psoriasis	968 (3.3)	658 (2.9)	
Guttate psoriasis	3670 (12.5)	3016 (13.4)	
Psoriatic arthritis	2302 (7.8)	1590 (7.1)	
Lesions on special areas, No. (%)			
Nail involvement	6440 (23.1)	5365 (23.9)	1527 (5.2)
Scalp involvement	18 190 (64.0)	14 578 (65.0)	986 (3.4)
Palm or/and sole involvement	5705 (20.3)	4458 (19.9)	1288 (4.4)
Genital involvement	3702 (13.3)	3014 (13.4)	1544 (5.2)
Disease severity, median (IQR)			
PASI	7.2 (3.0–14.7)	7.2 (3.0–14.6)	507 (1.7)
BSA	10.0 (3.4–30.0)	10.0 (3.0–30.0)	494 (1.7)
IGA	3 (2–3)	3 (2–3)	500 (1.7)
DLQI	8 (3–13)	8 (3–12)	1 261 (4.3)
Comorbidities No. (%)	4101 (13.9)	3245 (14.5)	2630 (8.9)
Previous biological treatment[c], No. (%)	2603 (8.9)	1982 (8.8)	23 (0.1)
Treatment demands			
Healing skin lesions rapidly	25 213 (88.8)	20 111 (89.7)	1021 (3.5)
Improving mental health	10 706 (37.7)	8531 (38.0)	
Reducing social discrimination	8854 (31.2)	7042 (31.4)	
Working and socializing normally	8120 (28.6)	6604 (29.4)	
Relieving painful/ burning feelings	6979 (24.6)	5476 (24.4)	
Relieving itchy feelings	10 668 (37.6)	8549 (38.1)	

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Reducing side effects of treatment	8708 (30.7)	7162 (31.9)
Reducing relapses	1651 (5.8)	1063 (4.7)

Abbreviations: BMI, body mass index; PASI, Psoriasis Area and Severity Index; BSA, Body Surface Area; IGA, Investigator's Global Assessment; DLQI, Dermatology Life Quality Index.

[a] Totally 29,412 adults were enrolled in the registry by September 2021.

[b] Unemployment rate was calculated in the working–age population, which excluded retired patients and students.

[c] Biological treatment included Tumor Necrosis Factor-α Inhibitors and Interleukin Inhibitors.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

BMJ Open: first published as 10.1136/bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S3. Baseline characteristics stratified by treatment demands

	Reducing social discrimination			Working and socializing normally			Relieving painful or burning feelings			Relieving itchy feelings			Reducing the side effects of treatment			Reducing relapses		
	Yes (n=7042)	No (n=15383)	*P* value	Yes (n=6604)	No (n=15821)	*P* value	Yes (n=5476)	No (n=16949)	*P* value	Yes (n=8549)	No (n=13876)	*P* value	Yes (n=2263)	No (n=15263)	*P* value	Yes (n=1063)	No (n=21362)	*P* value
Demographics																		
Male, n (%)	4664 (66.2)	9903 (64.4)	0.007	4438 (67.2)	10129 (64.0)	<0.001	3631 (66.3)	10936 (64.5)	0.016	5506 (64.4)	9061 (65.3)	0.173	1510 (66.7)	10010 (65.6)	0.004	675 (63.5)	13892 (65.0)	0.307
Age,y,median(IQR)	40(31–53)	40(31–54)	0.121	38(30–51)	41(31–54)	<0.001	43(32–56)	39(31–53)	<0.001	41(32–55)	39(31–52)	<0.001	40(31–54)	40(31–54)	0.935	39(30–53)	40(31–54)	0.142
BMI,kg/m^2,median(IQR)	24.1(21.9–26.7)	24.0(21.6–26.8)	0.608	24.2(21.9–27.0)	24.0(21.7–26.7)	<0.001	24.1(21.9–26.7)	24.0(21.7–26.7)	0.159	24.2(21.8–27.0)	24.0(21.7–26.6)	0.002	24.2(21.8–27.0)	24.0(21.7–26.6)	0.002	23.4(21.3–26.0)	24.1(21.8–26.8)	<0.001
Unemployment[a], n (%)	658 (11.7)	1336 (11.2)	0.332	668 (12.4)	1326 (11.0)	0.008	575 (13.8)	1419 (10.7)	<0.001	873 (13.4)	1121 (10.2)	<0.001	340 (13.6)	1254 (10.6)	<0.001	85 (10.4)	1909 (11.5)	0.643
Married, n (%)	5486 (77.9)	11718 (76.2)	0.004	4915 (74.4)	12289 (77.7)	<0.001	4419 (80.7)	12785 (75.4)	<0.001	6666 (78.0)	10538 (75.9)	<0.001	1766 (77.8)	11644 (76.3)	0.027	806 (75.8)	16398 (76.8)	0.479
Bachelor's degree, n (%)	2246 (31.9)	5582 (36.3)	<0.001	2460 (37.3)	5368 (33.9)	<0.001	1546 (28.2)	6282 (37.1)	<0.001	2794 (32.7)	5034 (36.3)	<0.001	745 (34.4)	5371 (35.2)	0.196	380 (35.8)	7448 (34.9)	0.556
Current smoker, n (%)	1685 (23.9)	4338 (28.2)	<0.001	1854 (28.1)	4169 (26.4)	0.008	1447 (26.4)	4576 (27.0)	0.405	2351 (27.5)	3672 (26.5)	0.089	953 (27.3)	4068 (26.7)	0.310	259 (24.4)	5764 (27.0)	0.060
COVID–19 lockdown, n (%)	889 (12.6)	1817 (11.8)	0.083	799 (12.1)	1907 (12.1)	0.925	647 (11.8)	2059 (12.1)	0.511	1051 (12.3)	1655 (11.9)	0.413	938 (13.3)	1768 (11.6)	0.001	344 (32.4)	2362 (11.1)	<0.001
Duration,y, median(IQR)	8(2–15)	6(1–14)	<0.001	8(2–15)	6(1–14)	<0.001	7(2–15)	6(1–14)	<0.001	6(2–14)	6(1–14)	0.983	7(2–15)	6(1–14)	<0.001	6(2–14)	6(2–14)	0.873

Continued

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

For peer review only

	Reducing social discrimination			Working and socializing normally			Relieving painful or burning feelings			Relieving itchy feelings			Reducing the side effects of treatment			Reducing relapses		
	Yes (n=7042)	No (n=15383)	*P* value	Yes (n=6604)	No (n=15821)	*P* value	Yes (n=5476)	No (n=16949)	*P* value	Yes (n=8549)	No (n=13876)	*P* value	Yes (n=3263)	No (n=15263)	*P* value	Yes (n=1063)	No (n=21362)	*P* value
Family history, n (%)	1100 (15.6)	2716 (17.7)	<0.001	1201 (18.2)	2615 (16.5)	0.003	862 (15.7)	2954 (17.4)	0.004	1458 (17.1)	2358 (17.0)	0.906	383 (16.3)	2492 (16.3)	<0.001	184 (17.3)	3632 (17.0)	0.795
Psoriasis phenotype[b], n (%)																		
Plaque psoriasis	5934 (84.3)	12297 (79.9)	<0.001	5417 (82.0)	12814 (81.0)	0.071	4473 (81.7)	13758 (81.2)	0.339	7016 (82.1)	11215 (80.8)	0.020	2583 (81.3)	12408 (81.3)	0.986	929 (87.4)	17302 (81.0)	<0.001
Erythrodermic psoriasis	93 (1.32)	149 (0.97)	0.018	120 (1.8)	122 (0.77)	<0.001	116 (2.1)	126 (0.7)	<0.001	124 (1.5)	118 (0.9)	<0.001	129 (0.8)	<0.001	13 (1.2)	229 (1.1)	0.642	
Pustular psoriasis	184 (2.6)	474 (3.1)	0.054	156 (2.4)	502 (3.2)	0.001	230 (4.2)	428 (2.5)	<0.001	250 (2.9)	408 (2.9)	0.945	89 (2.6)	469 (3.1)	0.073	25 (2.4)	633 (3.0)	0.349
Guttate psoriasis	735 (10.4)	2281 (14.8)	<0.001	809 (12.3)	2207 (13.9)	0.001	533 (9.7)	2483 (14.6)	<0.001	1063 (12.4)	1953 (14.1)	<0.001	434 (13.3)	2082 (13.6)	0.209	88 (8.3)	2928 (13.7)	<0.001
Arthropathic psoriasis	595 (8.5)	995 (6.5)	<0.001	498 (7.5)	1092 (6.9)	0.089	606 (11.1)	984 (5.8)	<0.001	631 (7.4)	959 (6.9)	0.183	236 (7.5)	1054 (6.9)	0.161	60 (5.6)	1530 (7.2)	0.060
Lesions on special areas, n (%)																		
Nail involvement	1701 (24.2)	3664 (23.8)	0.583	1943 (29.4)	3422 (21.6)	<0.001	1548 (28.3)	3817 (22.5)	<0.001	2280 (26.7)	3085 (22.2)	<0.001	901 (28.4)	3346 (21.9)	<0.001	286 (26.9)	5079 (23.8)	0.020
Scalp involvement	4538 (64.4)	10040 (65.3)	0.291	4662 (70.6)	9916 (62.7)	<0.001	3693 (67.4)	10885 (64.2)	<0.001	5937 (69.5)	8641 (62.3)	<0.001	2011 (70.8)	9567 (62.7)	<0.001	694 (65.3)	13884 (65.0)	0.845
Palmoplantar involvement	1519 (21.6)	2939 (19.1)	<0.001	1482 (22.4)	2976 (18.8)	<0.001	1390 (25.4)	3068 (18.1)	<0.001	1906 (22.3)	2552 (18.4)	<0.001	1590 (22.8)	2868 (18.8)	<0.001	209 (19.7)	4249 (19.9)	0.551

Continued

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079622 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 6, 2025 at Agence Bibliographique de l'Enseignement Supérieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

	Reducing social discrimination			Working and socializing normally			Relieving painful or burning feelings			Relieving itchy feelings			Reducing the side effects of treatment			Reducing relapses		
	Yes (n=7042)	No (n=15383)	*P* value	Yes (n=6604)	No (n=15821)	*P* value	Yes (n=5476)	No (n=16949)	*P* value	Yes (n=8549)	No (n=13876)	*P* value	Yes (n=3263)	No (n=15263)	*P* value	Yes (n=1063)	No (n=21362)	*P* value
Lesions on special areas, n (%)																		
Genital involvement	1020 (14.5)	1994 (13.0)	0.002	1088 (16.5)	1926 (12.2)	<0.001	936 (17.1)	2078 (12.3)	<0.001	1403 (16.4)	1611 (11.6)	<0.001	382 (11.7)	1828 (12.0)	<0.001	164 (15.4)	2850 (13.3)	0.052
Disease severity, median (IQR)																		
PASI	9.6 (4.2–17.4)	6.0 (2.7–13.2)	<0.001	9.0 (3.7–17.1)	6.4 (2.8–13.5)	<0.001	9.2 (3.9–18.0)	6.4 (2.8–13.6)	<0.001	7.9 (3.3–16.1)	6.6 (2.8–13.8)	<0.001	6.5 (2.8–13.9)	<0.001	5.8 (2.6–12.0)	7.2 (3.0–14.7)	<0.001	
BSA, %	15.0 (5.0–31.0)	8.0 (3.0–25.0)	<0.001	13.0 (5.0–34.0)	10.0 (3.0–25.0)	<0.001	15.0 (5.0–35.0)	10.0 (3.0–25.0)	<0.001	10.0 (3.3–30.0)	10.0 (3.0–27.0)	<0.001	10.0 (3.0–30.0)	10.0 (3.0–27.0)	<0.001	9.0 (3.0–30.0)	10.0 (3.0–30.0)	0.086
IGA	3 (2–3)	2 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001	3 (2–3)	3 (2–3)	<0.001
DLQI, median (IQR)	10(6–16)	6(2–10)	<0.001	10(6–17)	6(2–11)	<0.001	10(6–16)	7(2–11)	<0.001	9(4–14)	7(2–12)	<0.001	7(2–11)	<0.001	8(3–12)	8(3–12)	0.194	
Comorbidity[c], n (%)	906 (12.9)	2339 (15.2)	<0.001	990 (15.0)	2255 (14.3)	0.003	872 (15.9)	2373 (14.0)	<0.001	1404 (16.4)	1841 (13.3)	<0.001	536 (16.4)	2087 (13.7)	<0.001	152 (14.3)	3093 (14.5)	0.890
Previous use of biologics[d]	631 (9.0)	1351 (8.8)	0.663	608 (9.2)	1374 (8.7)	0.209	414 (7.6)	1568 (9.3)	<0.001	557 (6.5)	1425 (10.3)	<0.001	297 (8.3)	1385 (9.1)	0.069	114 (10.7)	1868 (8.7)	0.026

Abbreviations: BMI, body mass index; BSA, Body Surface Area; DLQI, Dermatology Life Quality Index; IGA, Investigator's Global Assessment; IQR, interquartile range; PASI, Psoriasis Area and Severity Index.

[a]The unemployment rate was calculated in the working–age population, which excluded retired patients and students.

[b]Phenotypes were not mutually exclusive, thus the total percentage was higher than 100%.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

For peer review only

bmjopen-2023-079622 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 6, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

[c]Comorbidity presented the existence of any disease conditions including cardiovascular diseases, respiratory diseases, kidney diseases, rheumatic diseases, digestive diseases, tumors, endocrine diseases, etc.

[d]Biologics included Tumor Necrosis Factor -α Inhibitors and Interleukin Inhibitors.

For peer review only

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S4. Mutlivariable logistic regression models examining the impact of PASI on treatment demands stratified by COVID–19 lockdowns

Odds ratios (95% CI)	Without COVID–19 lockdowns				With COVID–19 lockdowns				Heterogeneity test	
	Mild PASI<3	Moderate PASI 3 to <10	Severe PASI≥10	Trend Test[a]	Mild PASI<3	Moderate PASI 3 to <10	Severe PASI≥10	Trend Test	Q (df)	*P* value
Healing skin lesions rapidly	1.0	1.17 (1.03–1.32)*	1.45 (1.27–1.65)***	1.02 (1.01–1.02)***	1.0	1.50 (1.12–2.02)**	2.19 (1.57–3.05)***	1.04 (1.02–1.06)***	3.42 (1)	0.064
Improving mental health	1.0	1.47 (1.35–1.59)***	2.21 (2.03–2.40)***	1.03 (1.02–1.03)***	1.0	1.75 (1.40–2.18)***	2.82 (2.25–3.55)***	1.04 (1.03–1.05)***	3.44 (1)	0.064
Reducing social discrimination	1.0	1.65 (1.52–1.81)***	2.51 (2.29–2.74)***	1.03 (1.02–1.03)***	1.0	2.46 (1.92–3.15)***	4.35 (3.37–5.62)***	1.05 (1.04–1.06)***	12.82 (1)	<0.001
Working and socializing normally	1.0	1.27 (1.17–1.39)***	1.63 (1.49–1.78)***	1.02 (1.01–1.02)***	1.0	1.70 (1.33–2.17)***	2.81 (2.19–3.60)***	1.03 (1.02–1.04)***	9.09 (1)	0.003
Relieving painful or burning feelings	1.0	1.22 (1.11–1.34)***	1.59 (1.45–1.75)***	1.02 (1.02–1.02)***	1.0	1.70 (1.28–2.25)***	2.66 (2.01–3.53)***	1.04 (1.03–1.05)***	9.74 (1)	0.002
Relieving itchy feelings	1.0	1.07 (0.99–1.16)	1.11 (1.03–1.21)*	1.01 (1.004–1.01)***	1.0	1.32 (1.06–1.63)*	1.69 (1.35–2.11)***	1.02 (1.01–1.03)***	8.27 (1)	0.004
Reducing the side effects of treatment	1.0	1.25 (1.15–1.36)***	1.32 (1.21–1.44)***	1.01 (1.01–1.01)***	1.0	1.66 (1.33–2.07)***	1.90 (1.52–2.40)***	1.02 (1.01–1.03)***	2.44 (1)	0.118
Reducing relapses	1.0	0.81 (0.67–0.97)*	0.61 (0.49–0.75)***	0.98 (0.98–0.99)***	1.0	0.89 (0.66–1.20)	0.81 (0.59–1.12)	1.01 (0.997–1.02)	10.88 (1)	0.001

Abbreviations: PASI, Psoriasis Area and Severity Index. All the models adjusted for sex, age, BMI, marriage, education, smoke, disease course, family history, disease phenotype, whether special areas were affected, comorbidities, and previous treatment, stratified by whether was enrolled during the COVID pandemic.

[a]PASI was treated as a continuous variable in the trend test.

*Significant at *P*<0.050; **Significant at *P*<0.010; ***Significant at *P*<.001.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

For peer review only

Table S5. Mutlivariable logistic regression models examining the impact of BSA on treatment demands stratified by COVID–19 lockdowns

Odds ratios (95% CI)	Without COVID–19 lockdowns				With COVID–19 lockdowns				Heterogeneity test	
	Mild BSA<3%	Moderate BSA 3 to <10%	Severe BSA≥10%	Trend Test[a]	Mild BSA<3%	Moderate BSA 3 to <10%	Severe BSA≥10%	Trend Test	Q (df)	*P* value
Healing skin lesions rapidly	1.0	1.10 (0.96–1.26)	1.33 (1.17–1.50)***	1.01 (1.01–1.01)***	1.0	1.25 (0.88–1.76)	0.998 (0.999–1.006)	1.01 (1.001–1.01)*	0.19 (1)	0.663
Improving mental health	1.0	1.46 (1.33–1.60)***	2.01 (1.85–2.19)***	1.01 (1.01–1.01)***	1.0	1.72 (1.33–2.23)***	3.37 (2.57–4.45)***	1.02 (1.01–1.02)***	22.01 (1)	<0.001
Reducing social discrimination	1.0	1.64 (1.48–1.81)***	2.32 (2.12–2.54)***	1.01 (1.01–1.01)***	1.0	1.87 (1.40–2.51)***	4.56 (3.48–5.97)***	1.02 (1.02–1.03)***	37.08 (1)	<0.001
Working and socializing normally	1.0	1.32 (1.19–1.45)***	1.64 (1.50–1.79)***	1.01 (1.01–1.01)***	1.0	1.76 (1.32–2.35)***	3.20 (2.45–4.18)***	1.02 (1.01–1.02)***	13.25 (1)	<0.001
Relieving painful or burning feelings	1.0	1.28 (1.15–1.42)***	1.70 (1.54–1.87)***	1.01 (1.01–1.01)***	1.0	1.78 (1.29–2.45)***	2.62 (1.94–3.54)***	1.01 (1.01–1.02)***	3.84 (1)	0.050
Relieving itchy feelings	1.0	0.98 (0.89–1.07)	1.07 (0.99–1.16)	1.001 (0.999–1.002)	1.0	1.10 (0.86–1.39)	1.47 (1.13–1.92)**	1.01 (1.004–1.01)***	11.34 (1)	0.001
Reducing the side effects of treatment	1.0	1.15 (1.05–1.26)**	1.26 (1.16–1.37)***	1.003 (1.002–1.005)***	1.0	1.50 (1.16–1.93)**	1.99 (1.57–2.52)***	1.01 (1.003–1.01)***	3.66 (1)	0.056
Reducing relapses	1.0	1.06 (0.85–1.32)	0.97 (0.79–1.18)	0.997 (0.99–1.001)	1.0	1.12 (0.81–1.55)	0.72 (0.54–1.03)	0.996 (0.99–1.003)	0.07 (1)	0.785

Abbreviations: BSA, Body Surface Area. All the models adjusted for sex, age, BMI, marriage, education, smoke, disease course, family history, disease phenotype, whether special areas were affected, comorbidities, and previous treatment, stratified by whether was enrolled during the COVID pandemic.

[a]BSA was treated as a continuous variable in the trend test.

*Significant at *P*<0.050; **Significant at *P*<0.010; ***Significant at *P*<.001.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079647 on 17 February 2023. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Table S6. Mutlivariable logistic regression models examining the impact of IGA on treatment demands stratified by COVID–19 lockdowns

Odds ratios (95% CI)	Without COVID–19 lockdowns					With COVID–19 lockdowns					Heterogeneity test	
	Almost clear IGA=0/1	Mild IGA=2	Moderate IGA=3	Severe IGA=4	Trend Test[a]	Almost clear IGA=0/1	Mild IGA=2	Moderate IGA=3	Severe IGA=4	Trend Test	Q (df)	*P* value
Healing skin lesions rapidly	1.0	1.30 (1.12–1.52)**	1.68 (1.44–1.96)***	1.64 (1.35–1.99)***	1.21 (1.14–1.27)***	1.0	1.17 (0.82–1.67)	2.49 (1.71–3.64)***	2.70 (1.63–4.49)***	1.49 (1.30–1.71)***	7.75 (1)	0.005
Improving mental health	1.0	1.22 (1.09–1.36)***	1.70 (1.52–1.90)***	2.21 (1.94–2.51)***	1.30 (1.26–1.35)***	1.0	1.28 (0.96–1.70)	2.07 (1.57–2.74)***	1.91 (1.36–2.68)***	1.30 (1.18–1.43)***	<0.01 (1)	0.971
Reducing social discrimination	1.0	1.43 (1.27–1.61)***	1.85 (1.64–2.08)***	2.55 (2.22–2.92)***	1.32 (1.28–1.37)***	1.0	1.48 (1.10–2.01)*	2.04 (1.52–2.75)***	2.08 (1.46–2.97)***	1.29 (1.17–1.43)***	0.21 (1)	0.646
Working and socializing normally	1.0	1.12 (0.99–1.26)	1.43 (1.27–1.60)***	1.65 (1.45–1.89)***	1.19 (1.14–1.23)***	1.0	1.06 (0.78–1.44)	1.55 (1.16–2.09)**	1.69 (1.19–2.41)**	1.24 (1.12–1.37)***	0.54 (1)	0.461
Relieving painful or burning feelings	1.0	1.21 (1.06–1.38)**	1.54 (1.36–1.76)***	1.88 (1.62–2.18)***	1.23 (1.18–1.28)***	1.0	1.00 (0.69–1.44)	1.79 (1.27–2.53)**	1.88 (1.26–2.81)**	1.32 (1.18–1.48)***	1.29 (1)	0.256
Relieving itchy feelings	1.0	1.21 (1.08–1.35)**	1.45 (1.30–1.62)***	1.61 (1.41–1.83)***	1.17 (1.13–1.21)***	1.0	1.04 (0.78–1.37)	1.53 (1.16–2.01)**	1.16 (0.83–1.63)	1.13 (1.03–1.24)*	0.38 (1)	0.539
Reducing the side effects of treatment	1.0	1.09 (0.97–1.22)	1.28 (1.14–1.43)***	1.25 (1.10–1.43)**	1.09 (1.05–1.13)***	1.0	1.08 (0.82–1.44)	1.30 (0.98–1.72)	0.96 (0.69–1.35)	1.02 (0.93–1.13)	1.37 (1)	0.241
Reducing relapses	1.0	0.63 (0.50–0.79)***	0.53 (0.42–0.67)***	0.52 (0.39–0.70)***	0.79 (0.73–0.87)***	1.0	0.83 (0.55–1.27)	1.29 (0.87–1.92)	0.48 (0.27–0.85)*	0.98 (0.85–1.13)	5.86 (1)	0.016

Abbreviations: IGA, Investigator's Global Assessment. All the models adjusted for sex, age, BMI, marriage, education, smoke, disease course, family history, disease phenotype, whether special areas were affected, comorbidities, and previous treatment, stratified by whether was enrolled during the COVID pandemic.

[a]IGA was treated as a continuous variable in the trend test.

*Significant at *P*<0.050; **Significant at *P*<0.010; ***Significant at *P*<.001

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

For peer review only

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Supérieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1	Enhanced impact of psoriasis severity on treatment demands of patients during the COVID-19 pandemic: A cross-sectional study based on a national psoriasis registry in China
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3	**Objectives:** The personalized treatment demands of patients with psoriasis did not get significant attention during the pandemic lockdown. This study aimed to investigate the treatment demands of patients with psoriasis with different severities, stratified by COVID-19 pandemic conditions. **Design:** Cross-sectional study design. **Setting:** Multicenter study based on a national psoriasis registry in China. **Participants:** A total of 22,425 adult patients with psoriasis were enrolled between August 2020 and September 2021. **Primary and Secondary Outcome Measures:** The primary outcomes were patient demands for quick healing of skin lesions and improving mental health, which were collected by questionnaires. Multivariable logistic models were used to examine the impact of disease severity, as measured by Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and Investigator's Global Assessment (IGA), on treatment demands, as stratified by COVID-19 pandemic conditions (lockdown vs. non-lockdown). **Results:** Increasing PASI score significantly increased patient demands for rapid healing of skin lesions and improving mental health during non-lockdown periods. The magnitude of both associations further increased during the COVID-19 lockdown from an odds ratio (OR) of 1.45 (95% confidence interval (CI) 1.27–1.65) to 2.19 (95% CI 1.57–3.05) and 2.11 (95% CI 2.03–2.40) to 2.82 (95% CI 2.24–3.55), respectively. The skin lesion healing demand was more triggered by the overall irritation level (measured by IGA, OR=1.63, 95% CI 1.35–1.99 during non-lockdown periods versus OR=2.70, 95% CI 1.63–4.49 during lockdowns); while the mental health improving demand was more triggered by lesion coverage (measured by BSA, OR=2.01, 95% CI 1.8–2.19 versus OR=3.27, 95% CI 2.57–4.15). **Conclusions**: Psoriasis aggravation significantly increased patients' treatment demands, especially during lockdowns. The used psoriasis severity measures highlighted patients' treatment demands differently. This suggests more accessible and personalized healthcare for patients with psoriasis should be available during future pandemics.
Introduction				
Background/ rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5	Psoriasis is a chronic, non-fatal disease primarily affecting the skin. The prevalence of psoriasis varies geographically, with 0.14% and 1.99% of the population in East Asia and Australasia being affected, respectively.[1] In China, the prevalence was 0.12% in 1987 and 0.47% in 2012.[2] Apart from skin lesions, psoriasis is also now recognized as a systemic inflammatory disorder that relates to various comorbidities, such as metabolic syndrome, arthritis, malignancy, and so on.[3] Poor appearances, together with comorbidities, significantly impair patients' daily functioning and cause significant psychological distress,[4] which can result in depression, suicidal ideation, and substance abuse,[5-8] causing high social burdens. especially during the recurrent coronavirus disease 2019 (COVID-19) pandemics.[9-11]

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

				Current clinical diagnosis and treatment for psoriasis must follow appropriate guidelines and consensus. Therefore, the choice of treatment for psoriasis primarily depends on the objective assessment of lesion severity of the disease, yet the demands of the patient are often neglected.[12 13] However, due to the chronic, non-fatal characteristics of psoriasis, individual perceptions of the disease can determine the impact of psoriasis on the quality of life of patients, which may then affect their treatment demands.[14 15] Thus, the treatment decisions should be driven by the real needs and expectations of each individual. Furthermore, since healthcare access (e.g. emerged telemedicine),[16-19] as well as the clinicians' treatment considerations to control psoriasis, have all changed during the recurrent COVID-19 pandemics,[20] patients' mental health condition, their perception of psoriasis and further treatment demands may altered accordingly.[21-23] From the treatment-decision aspect, the initiation of biologics for psoriasis decreased sharply during the COVID-19 pandemic, possibly due to the poor access to healthcare for patients and the lack of evidence on the relationship between COVID-19 infection and biological therapies for psoriasis at the beginning of the pandemic.[24 25] From a healthcare-seeking behavior perspective, patients with psoriasis tended to cancel or defer their appointments, lose adherence to treatment, and require prolonged prescription or treatment-change during the COVID-19 pandemic.[9 26-28] All the above changes may be associated with deterioration of psoriasis and further symptoms of anxiety and depression,[11 22 29 30] although the association is complex and undetermined.[10 27] In contrast, from a quality of life perspective, the social-activity aspect assessed in a quality of life questionnaire became important during lockdown, which led to paradoxically improved quality of life among patients with psoriasis during the COVID-19 lockdown.[10 31] Patients may perceive their psoriasis lesions as more acceptable because they are less worried about skin lesion appearances due to restricted social activities, and are more fearful of COVID-19 when receiving immunosuppressive treatment for psoriasis.[32] As a result, how patients' treatment demands changed during pandemics remains unknown. Thus, it is essential to re-assess patients' treatment demands to improve personalized treatment during the pandemic. However, studies on changes in treatment demands from patients' perspectives during pandemics are limited. This study aimed to examine the treatment demands of patients with psoriasis with varying disease severity and other clinical and personal characteristics in a real-world setting throughout the recurrent COVID-19 pandemic, hoping to provide references for personalized treatment strategies not only for patients with psoriasis during the COVID-19 pandemic but also for patients with all other chronic diseases in any future pandemic lockdowns.
Objectives	3	State specific objectives, including any prespecified hypotheses	5	This study aimed to examine the treatment demands of patients with psoriasis with varying disease severity and other clinical and personal characteristics in a real-world setting throughout the recurrent COVID-19 pandemic, hoping to provide references for personalized treatment strategies not only for patients with psoriasis during the COVID-19 pandemic but also for patients with all other chronic diseases in any future pandemic lockdowns.
Methods				
Study design	4	Present key elements of study design early in the paper	5	**Study design, patients, and data collected** This was a cross-sectional, multicenter study based on a nationwide real-world big data collection platform established by the Psoriasis Standardized Diagnosis and Treatment Center (also named Psoriasis Center) and led by the National Clinical Research Center for Skin and Immune Disease.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment,	5-6	**Study design, patients, and data collected** This was a cross-sectional, multicenter study based on a nationwide real-world big data collection platform established by the Psoriasis Standardized Diagnosis and Treatment Center (also named Psoriasis Center) and led by the National

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079027 on 11 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

		exposure, follow-up, and data collection		Clinical Research Center for Skin and Immune Disease.[33] This data platform is the first and currently the largest psoriasis registry in China, and as of September 2021, had included data of 32,014 patients with psoriasis from 228 hospitals across China. The registry collects data on demographics, medical history, clinical assessment, previous and current treatments for psoriasis, self-reported quality of life, and treatment demands at enrollment. All patients provided informed consent for publication before their details were entered into the registry. The establishment of this big data collection platform was approved by the Human Genetic Resources Management Office of the Ministry of Science and Technology of China (approval number: 2022-CJ0021) and the ethics committee of Peking University First Hospital (approval number: 2020-scientific research-255) for use in clinical studies. The data preprocessing standards for derived variables and variables with potentially mistaken values are listed in Table S1 (Supplemental Material).
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants	(a) 6	All patients aged ≥18 years enrolled between August 2020 to September 2021 with complete baseline data were included. The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (Supplemental Material).
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed *Case-control study*—For matched studies, give matching criteria and the number of controls per case		
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if	6-7	**Study measures** The study outcomes were patients' treatment demands, which were all collected through "yes-or-no" questions in a face-to-face interview. The two primary treatment demands contained healing skin lesions quickly and improving mental health. The questionnaire also asked about other demands, including reducing social discrimination, working

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

For peer review only

		applicable		and socializing normally, relieving itchy feelings, relieving painful or burning feelings, and reducing the side effects of treatment and disease relapses. All the aforementioned treatment demands were treated as binary variables. Quality of life was additionally assessed by the Dermatology Life Quality Index (DLQI). The main exposure was psoriasis severity, which was assessed by the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and the 5-point Investigator's Global Assessment (IGA).[12 13] According to the guidelines for the diagnosis and treatment of psoriasis in China (2023),[34] PASI score was categorized as mild (<3), moderate (3 to <10) and severe (≥10), whereas BSA (%) was categorized as mild (<3%), moderate (3% to <10%), and severe (≥10%). The 5-point IGA categorized the severity level as clear/almost clear (0/1), mild (2), moderate (3), and severe (4). Provincial COVID-19 data was summarized from the official website of the National Health Commission of the People's Republic of China (http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml). Considering the maintenance period of both epidemic control measures and public response to the pandemic, the 7 days following the last day in which a new case was recorded were further classified into the same pandemic period. The COVID-19 pandemic variable was treated as binary according to the geographical location and enrolled day of each patient.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-7	**Study measures** The study outcomes were patients' treatment demands, which were all collected through "yes-or-no" questions in a face-to-face interview. The two primary treatment demands contained healing skin lesions quickly and improving mental health. The questionnaire also asked about other demands, including reducing social discrimination, working and socializing normally, relieving itchy feelings, relieving painful or burning feelings, and reducing the side effects of treatment and disease relapses. All the aforementioned treatment demands were treated as binary variables. Quality of life was additionally assessed by the Dermatology Life Quality Index (DLQI). The main exposure was psoriasis severity, which was assessed by the Psoriasis Area and Severity Index (PASI), Body Surface Area (BSA), and the 5-point Investigator's Global Assessment (IGA).[12 13] According to the guidelines for the diagnosis and treatment of psoriasis in China (2023),[34] PASI score was categorized as mild (<3), moderate (3 to <10) and severe (≥10), whereas BSA (%) was categorized as mild (<3%), moderate (3% to <10%), and severe (≥10%). The 5-point IGA categorized the severity level as clear/almost clear (0/1), mild (2), moderate (3), and severe (4). Provincial COVID-19 data was summarized from the official website of the National Health Commission of the People's Republic of China (http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml). Considering the maintenance period of both epidemic control measures and public response to the pandemic, the 7 days following the last day in which a new case was recorded were further classified into the same pandemic period. The COVID-19 pandemic variable was treated as binary according to the geographical location and enrolled day of each patient.
Bias	9	Describe any efforts to address potential sources of bias	7	Multivariable logistic regression models were used to investigate the impact of psoriasis severity, as measured by PASI, BSA, and IGA, separately, on each treatment demand stratified by whether the patient was enrolled during the COVID-19 pandemic. To reduce potential confounding factors, all models were adjusted for demographic characteristics (sex, age, body mass index [BMI], marriage status, education, employment, and smoking habits) and clinical characteristics (psoriasis duration, family history, disease phenotype, nail/scalp/genital/palmoplantar involvement, comorbidities, and previous treatment). Mediation analysis was employed to investigate the effect of PASI/BSA/IGA on treatment demands mediated by DLQI, adjusting for the same confounding set above and additionally for COVID-19 lockdowns.
Study size	10	Explain how the study size	5-6	This data platform is the first and currently the largest psoriasis registry in China, and as of September 2021, had

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

For peer review only

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 3, 2026 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

		was arrived at		included data of 32,014 patients with psoriasis from 228 hospitals across China. All patients aged ≥18 years enrolled between August 2020 to September 2021 with complete baseline data were included.
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-7	According to the guidelines for the diagnosis and treatment of psoriasis in China (2023),[34] PASI score was categorized as mild (<3), moderate (3 to <10) and severe (≥10), whereas BSA (%) was categorized as mild (<3%), moderate (3% to <10%), and severe (≥10%). The 5-point IGA categorized the severity level as clear/almost clear (0/1), mild (2), moderate (3), and severe (4). Provincial COVID-19 data was summarized from the official website of the National Health Commission of the People's Republic of China (http://www.nhc.gov.cn/xcs/yqtb/list_gzbd.shtml). Considering the maintenance period of both epidemic control measures and public response to the pandemic, the 7 days following the last day in which a new case was recorded were further classified into the same pandemic period. The COVID-19 pandemic variable was treated as binary according to the geographical location and enrollment time of each patient. PASI, BSA, and IGA values were separately modeled in relation to each treatment demand, and were treated as continuous and categorical variables separately.
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7	Descriptive statistics were performed for each variable stratified by each treatment demand using frequencies (percentages) for categorical variables and median (interquartile range [IQR]) for continuous variables. Categorical variables were compared using chi-squared tests, whereas continuous variables were compared using the Kruskal–Wallis H test. Multivariable logistic regression models were used to investigate the impact of psoriasis severity, as measured by PASI, BSA, and IGA, separately, on each treatment demand stratified by whether the patient was enrolled during the COVID-19 pandemic. To reduce potential confounding factors, all models were adjusted for demographic characteristics (sex, age, body mass index [BMI], marriage status, education, employment, and smoking habits) and clinical characteristics (psoriasis duration, family history, disease phenotype, nail/scalp/genital/palmoplantar involvement, comorbidities, and previous treatment). PASI, BSA, and IGA values were separately modeled in relation to each treatment demand, and were treated as continuous and categorical variables separately. A Q-test attached to the fixed effect model was performed to detect the heterogeneity between the impact of psoriasis severity on treatment demands during the COVID-19 pandemic lockdowns and normal periods. Mediation analysis was employed to investigate the effect of PASI/BSA/IGA on treatment demands mediated by DLQI, adjusting for the same confounding set above and additionally for COVID-19 lockdowns. Other potential factors influencing the treatment demands were examined using the same multivariable logistic regression models investigating the impact of PASI on quick skin healing and mental health improvement demands while adding the COVID-19 pandemic as a covariate. All data analysis was conducted using STATA/SE (StataCorp LLC 2021, Stata Statistical Software: Release 17, College Station, TX), and a *P*-value <0.05 was considered statistically significant.
		(*b*) Describe any methods used to examine subgroups and interactions	7	A Q-test attached to the fixed effect model was performed to detect the heterogeneity between the impact of psoriasis severity on treatment demands during the COVID-19 pandemic lockdowns and normal periods.
		(*c*) Explain how missing data were addressed	6	All patients aged ≥18 years enrolled between August 2020 to September 2021 with complete baseline data were included. The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (Supplemental Material).

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079637 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 6, 2025 at Agence Bibliographique de l'Enseignement Supérieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed *Case-control study*—If applicable, explain how matching of cases and controls was addressed *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy	N/A	N/A
		(*e*) Describe any sensitivity analyses	N/A	N/A
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7	All patients aged ≥18 years enrolled between August 2020 to September 2021 with complete baseline data were included. The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (Supplemental Material). Among the 29,412 adult patients enrolled as of September 2021 (Table S2, see Supplemental Material), 22,425 with complete baseline information from 212 tertiary hospitals across China were enrolled in this study.
		(b) Give reasons for non-participation at each stage	N/A	N/A
		(c) Consider use of a flow diagram	N/A	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7-8	Exactly 65.0% of patients were men (n=14,567). The median age was 40 (IQR, 31–54) years, and the percentages of different age groups were as follows: 18-45 years, 60.3% (n = 13,505); 46-60 years, 26.9% (n = 6,033); ≥61 years, 12.8% (n = 2,877). The median PASI and DLQI scores were 7.2 and 8, respectively. Exactly 12.1% of the patients (n = 2,706) were enrolled during a COVID-19 lockdown in their provinces.
		(b) Indicate number of participants with missing data for each variable of interest	6	The differences in baseline characteristics between patients with complete and incomplete data are shown in Table S2 (Supplemental Material).
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A	N/A
Outcome	15*	*Cohort study*—Report		

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

data		numbers of outcome events or summary measures over time		
		Case-control study—Report numbers in each exposure category, or summary measures of exposure		
		Cross-sectional study—Report numbers of outcome events or summary measures	8	Moreover, 89.7% (n = 20,111) and 38.0% (n = 8,531) of the patients demanded a speedy healing of the skin lesions and mental health improvement, respectively (Table 1).
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7-10	To reduce potential confounding factors, all models were adjusted for demographic characteristics (sex, age, body mass index [BMI], marriage status, education, employment, and smoking habits) and clinical characteristics (psoriasis duration, family history, disease phenotype, nail/scalp/genital/palmoplantar involvement, comorbidities, and previous treatment). Mediation analysis was employed to investigate the effect of PASI/BSA/IGA on treatment demands mediated by DLQI, adjusting for the same confounding set above and additionally by COVID-19 lockdowns. Other potential factors influencing the treatment demands were examined using the same multivariable logistic regression models investigating the impact of PASI on quick skin healing and mental health improvement demands while adding the COVID-19 pandemic as a covariate. **Impact of psoriasis severity on treatment demands stratified by the COVID-19 pandemic** Both multivariable logistic regression and trend tests confirmed that the increasing psoriasis severity, as measured by PASI, significantly stimulated patients' primary treatment demands of healing skin lesions rapidly (odds ratio [OR], 1.45; 95% confidence interval (CI), 1.27–1.65; *P* <0.001 for severe PASI versus mild PASI; and OR, 1.02; 95% CI, 1.01–1.02; *P* <0.001 in the trend test) and improving mental health (OR, 2.21; 95% CI, 2.03–2.40; *P* <0.001 for severe PASI versus mild PASI; and OR, 1.03; 95% CI, 1.02–1.03; *P* <0.001 in the trend test) during a normal period without COVID-19 lockdown (shown in Fig. 1a–b; and Table S4 (Supplemental Material)). The disease severity-triggered primary treatment demands further increased during the COVID-19 lockdowns, including healing skin lesions rapidly (OR, 2.19; 95% CI, 1.57–3.05 for severe PASI versus mild PASI; *P* <0.001) and improving mental health (OR, 2.82; 95% CI, 2.24–3.55 for severe PASI versus mild PASI, *P* <0.001), despite the statistical insignificance (both *P*=0.064 in the heterogeneity Q-test). Other treatment demands, including reducing social discrimination, working and socializing normally, relieving painful or burning feelings, relieving itchy feelings, and reducing the treatment side effects, were also significantly stimulated by deteriorated skin conditions measured by PASI (all *P* <0.05); moreover, the degree of this stimulation further intensified during the COVID-19 lockdown (shown in Fig. 1c–g). The exception was the demand for reducing relapses, which significantly declined as PASI increased. Nevertheless, the magnitude of this decline decreased during the pandemic lockdown (OR, 0.61; 95% CI, 0.49–0.75, *P* <0.001 for severe PASI versus mild PASI during a non-COVID-19 period; and OR, 0.81; 95% CI, 0.58–1.13; *P*=0.196 during a COVID-19 lockdown; heterogeneity Q-test, *P*=0.001; shown in Fig. 1h). **Impact of psoriasis severity by different instruments on treatment demands stratified by the COVID-19 pandemic** Similar patterns of change in each treatment demand were also found as BSA and IGA increased during the normal

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

For peer review only

		period. However, the two measures motivated the treatment demands slightly differently during the pandemic lockdowns. Specifically, the magnitude of increasing BSA-triggered demands of rapidly healing skin lesions hardly changed during the pandemic lockdowns (OR, 1.33; 95% CI, 1.17–1.52; P <0.001 for severe BSA versus mild BSA during a normal period; and OR, 1.38; 95% CI, 0.999–1.896; P=0.051 during the pandemic lockdown; heterogeneity Q-test, P=0.663), whereas that of IGA-triggered demands significantly increased (OR, 1.64; 95% CI, 1.35–1.99; P <0.001 for IGA=4 versus IGA=0/1 during the normal period; and OR, 2.70; 95% CI, 1.63–4.49; P <0.001 during the pandemic lockdown; heterogeneity Q-test, P=0.005). In contrast, the magnitude of the increase in demands of improving mental health triggered by BSA significantly increased during the pandemic (OR, 2.01; 95% CI, 1.85–2.19; P <0.001; and OR, 3.27; 95% CI, 2.57–4.15; P <0.001; heterogeneity Q-test, P <0.001), whereas that triggered by IGA hardly changed (OR, 2.21; 95% CI, 1.94–2.51; P <0.001; and OR, 1.91; 95% CI, 1.36–2.68; P <0.001; heterogeneity Q-test, P=0.971; shown in Fig. 1a–b and Table sS5 & S6 [Supplemental Material]). **Impact of psoriasis severity on treatment demands mediated by quality of life** Further mediation analysis showed that increasing PASI motivated patients' treatment demands mainly by deteriorating their quality of life, including improving mental health (21%), reducing social discrimination (mediated proportion, 49.0%), working and socializing normally (72.1%), relieving painful (40.8%) or itchy (73.2%) feelings, and reducing the treatment side effects (74.3%). However, the proportion of the DLQI-mediated effect was small in the total effect of PASI on the demands for reducing relapses (7.6%) and quickly healing skin lesions (0.6%). The aforementioned results were replicated when disease severity was determined by BSA and IGA (Table 2). **Potential factors influencing treatment demands** Apart from disease severity, multivariable logistic regression analysis also identified female sex (OR, 1.23; 95% CI, 1.11–1.36; P <0.001), smoking status (OR, 1.17; 95% CI, 1.04–1.32; P=0.005), pustular psoriasis (OR, 1.71; 95% CI, 1.26–2.32; P=0.001), and nail involvement (OR, 1.28; 95% CI, 1.13–1.44, P <0.001) to be significantly correlated with a higher demand for quick skin lesion healing. However, older age (OR, 0.994; 95% CI, 0.991–0.998; P=0.004), married status (OR, 0.82; 95% CI, 0.72–0.94; P=0.003), unemployed status (OR, 0.82; 95% CI, 0.70–0.95; P=0.010), COVID-19 lockdown (OR, 0.87; 95% CI, 0.77–0.99; P=0.037), arthropathic psoriasis (OR, 0.55; 95% CI, 0.47–0.64; P <0.001), palmoplantar involvement (OR, 0.75; 95% CI, 0.67–0.83; P <0.001), and comorbidities (OR, 0.86; 95% CI, 0.76–0.97; P=0.018) were found to be significantly correlated with lower demand (Table 3). Moreover, the demand for the improvement of mental health was significantly higher in patients with arthropathic psoriasis (OR, 1.22; 95% CI, 1.09–1.37; P=0.001) and palmoplantar involvement (OR, 1.09; 95% CI, 1.01–1.18, P=0.027). However, this was lower among patients with older age (OR, 0.993; 95% CI, 0.991–0.996, P <0.001), higher BMI (OR, 0.9955; 95% CI, 0.9914–0.9996; P=0.030), a college education (OR, 0.90; 95% CI, 0.84–0.95; P=0.001), smoking status (OR, 0.81; 95% CI, 0.75–0.86; P <0.001), pustular psoriasis (OR, 0.77; 95% CI, 0.65–0.92; P=0.003), guttate psoriasis (OR, 0.78; 95% CI, 0.71–0.84; P <0.001), and comorbidities (OR, 0.90; 95% CI, 0.83–0.97; P=0.012).
(*b*) Report category boundaries when continuous variables were categorized	6	According to the guidelines for the diagnosis and treatment of psoriasis in China (2023),[34] PASI score was categorized as mild (<3), moderate (3 to <10) and severe (≥10), whereas BSA (%) was categorized as mild (<3%), moderate (3% to <10%), and severe (≥10%). The 5-point IGA categorized the severity level as clear/almost clear (0/1), mild (2), moderate (3), and severe (4).
(*c*) If relevant, consider	N/A	N/A

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

		translating estimates of relative risk into absolute risk for a meaningful time period		
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	8-9 subgroup analyses	**Impact of psoriasis severity on treatment demands stratified by the COVID-19 pandemic** Both multivariable logistic regression and trend tests confirmed that the increasing psoriasis severity, as measured by PASI, significantly stimulated patients' primary treatment demands of healing skin lesions rapidly (odds ratio [OR], 1.45; 95% confidence interval (CI), 1.27–1.65; *P* <0.001 for severe PASI versus mild PASI; and OR, 1.02; 95% CI, 1.01–1.02; *P* <0.001 in the trend test) and improving mental health (OR, 2.21; 95% CI, 2.03–2.40; *P* <0.001 for severe PASI versus mild PASI; and OR, 1.03; 95% CI, 1.02–1.03; *P* <0.001 in the trend test) during a normal period without COVID-19 lockdown (shown in Fig. 1a–b; and Table S4 (Supplemental Material)). The disease severity-triggered primary treatment demands further increased during the COVID-19 lockdowns, including healing skin lesions rapidly (OR, 2.19; 95% CI, 1.57–3.05 for severe PASI versus mild PASI; *P* <0.001) and improving mental health (OR, 2.82; 95% CI, 2.24–3.55 for severe PASI versus mild PASI, *P* <0.001), despite the statistical insignificance (both *P*=0.064 in the heterogeneity Q-test). Other treatment demands, including reducing social discrimination, working and socializing normally, relieving painful or burning feelings, relieving itchy feelings, and reducing the treatment side effects, were also significantly stimulated by deteriorated skin conditions measured by PASI (all *P* <0.05); moreover, the degree of this stimulation further intensified during the COVID-19 lockdown (shown in Fig. 1c–g). The exception was the demand for reducing relapses, which significantly declined as PASI increased. Nevertheless, the magnitude of this decline decreased during the pandemic lockdown (OR, 0.61; 95% CI, 0.49–0.75, *P* <0.001 for severe PASI versus mild PASI during a non-COVID-19 period; and OR, 0.81; 95% CI, 0.58–1.13; *P*=0.196 during a COVID-19 lockdown; heterogeneity Q-test, *P*=0.001; shown in Fig. 1h). **Impact of psoriasis severity by different instruments on treatment demands stratified by the COVID-19 pandemic** Similar patterns of change in each treatment demand were also found as BSA and IGA increased during the normal period. However, the two measures motivated the treatment demands slightly differently during the pandemic lockdowns. Specifically, the magnitude of increasing BSA-triggered demands of rapidly healing skin lesions hardly changed during the pandemic lockdowns (OR, 1.33; 95% CI, 1.17–1.50; *P* <0.001 for severe BSA versus mild BSA during a normal period; and OR, 1.38; 95% CI, 0.999–1.896; *P*=0.051 during the pandemic lockdown; heterogeneity Q-test, *P*=0.663), whereas that of IGA-triggered demands significantly increased (OR, 1.64; 95% CI, 1.35–1.99; *P* <0.001 for IGA=4 versus IGA=0/1 during the normal period; and OR, 2.70; 95% CI, 1.63–4.49; *P* <0.001 during the pandemic lockdown; heterogeneity Q-test, *P*=0.005). In contrast, the magnitude of the increase in demands of improving mental health triggered by BSA significantly increased during the pandemic (OR, 2.01; 95% CI, 1.85–2.19; *P* <0.001; and OR, 3.27; 95% CI, 2.57–4.15; *P* <0.001; heterogeneity Q-test, *P* <0.001), whereas that triggered by IGA hardly changed (OR, 2.21; 95% CI, 1.94–2.51; *P* <0.001; and OR, 1.91; 95% CI, 1.36–2.68; *P* <0.001; heterogeneity Q-test, *P*=0.971; shown in Fig. 1a–b and Table sS5 & S6 [Supplemental Material]).
Discussion				
Key results	18	Summarise key results with reference to study objectives	10	In this cross-sectional study, it was observed that patient demands for healing skin lesions and improving mental health significantly increased as psoriasis worsened, especially during the COVID-19 pandemic. Different psoriasis severity measures have different emphases in reflecting patients' treatment demands, which were magnified during the pandemic. The impact of disease severity on most treatment demands was mediated by deteriorated quality of life,

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2024 at Agence Bibliographique de l'Enseignement Supérieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

				except for the demands of rapid skin healing and relapse reduction, and thus other factors that stratified major treatment demands were also examined.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13	Although, to our knowledge, this study is the largest real-world study to date investigating the treatment demands of patients with psoriasis during the pandemic lockdowns, there were limitations. First, the Psoriasis Center program enrolled patients from specific dermatological clinics, and a certain proportion of patients declined the enrollment request. Thus, the study population may not represent the general psoriasis population. Second, the demand for improving mental health was collected as a binary variable, while the psychological or psychiatric condition was not systematically assessed using specialized scales, such as Generalized Anxiety Disorder-2, Patient Health Questionnaire-2 and Short Form-12 Health Survey.[11 22 46] Further studies are warranted to quantitatively investigate patients' mental health condition and the degree of each treatment demand using specialized scales. Third, there was an issue regarding the missing data for this data platform. However, as the missing rate was not high, and missing at random was considered (Table S2 [Supplemental Material]), a complete case analysis was considered sufficient for handling missing data and, therefore, used. Fourth, since the information on residence place was not collected, the COVID-19 pandemic information was matched to each patient only at province level, even though the pandemic was prevented with a precise approach in China.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13	An increase in psoriasis severity significantly stimulates patients' treatment demands from quickly healing skin lesions and improving mental health aspects, especially during the pandemic lockdowns, indicating the need for an accessible pathway for patients with psoriasis getting more intensive treatment and mental support during future pandemics. To better recognize and meet patients' treatment demands during the pandemic, we suggest that BSA is used to determine the psychological needs of patients, while IGA should be used to reflect the desire to quickly heal lesions. Other demographic and clinical characteristics of each patient should also be considered for a more personalized treatment strategy during future pandemics. Moreover, since the COVID-19 pandemic is nearing its end in many countries, the results of this study could provide hints for personalized treatments for patients with non-fatal chronic diseases in future pandemic lockdowns.
Generalisability	21	Discuss the generalisability (external validity) of the study results	13	Moreover, since the COVID-19 pandemic is nearing its end in many countries, the results of this study could provide hints for personalized treatment for patients with non-fatal chronic diseases in future pandemic lockdowns.
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14	This work was supported by the National Key Research and Development Program of China (2023YFC2508100), PKU-Baidu Fund (grant number: 2020BD012). The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

bmjopen-2023-079627 on 1 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l'Enseignement Superieur (ABES). Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

For peer review only

bmjopen-2023-076227 on 17 February 2024. Downloaded from http://bmjopen.bmj.com/ on June 8, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.