Clinical Service Capacity for Atopic Dermatitis in China: A National Cross-Sectional Baseline Service-Capacity Assessment

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Abstract

Background: Atopic dermatitis (AD) is a chronic inflammatory skin disease with high heterogeneity, posing issues such as low diagnostic rates and non-standard treatment in China. This study aimed to gain a deeper understanding of the current state of healthcare quality for AD in China, assess the existing challenges, and provide guidance for further improvement.

Materials and methods: A cross-sectional analysis was conducted using a survey questionnaire designed to evaluate the clinical service capabilities for AD. Data were collected from hospitals of various levels across China between January 1, 2023 and December 31, 2023. Hospital characteristics and AD-related practices were summarized descriptively, and differences across hospital levels and regions were compared using χ^2 tests, nonparametric tests, analysis of covariance (ANCOVA), and multivariable regression models.

Results: A total of 1,591 valid questionnaires were collected, with 62.3% being tertiary hospitals. Among these, 23.7% had established AD specialty clinics, with a lower proportion observed in Southwest China (13.1%) and primary hospitals (4.1%). The overall AD diagnostic rate was 21.3%, with significantly regional and hospital-level variation. Most hospitals (87.5%) reported following a stepwise treatment, and 95.3% reported implementing proactive therapy. About two-thirds of hospitals conducted pre-treatment and on-treatment screenings for immunosuppressants, biologics, and small-molecule targeted therapies. In addition, 84.5% of hospitals provided health education, with oral education (94.2%) and brochures (72.2%) being the most commonly used methods.

Conclusion: These findings reveal that significant gaps persist in the availability of specialty clinics, diagnostic rates,

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severity assessment, safety monitoring of systemic therapies, and patient education. These deficiencies are accompanied by pronounced disparities across hospital levels and geographic regions.
Keywords: atopic dermatitis; clinical service capacity; cross-sectional survey; China

Introduction

Atopic dermatitis (AD) is a chronic, relapsing inflammatory skin disease whose prevalence is rapidly increasing both in China and worldwide[1–3]. Patients with AD frequently experience intense pruritus that significantly impairs quality of life, leading to sleep disturbance, psychological distress, and an elevated risk of comorbidities such as anxiety and depression[4–6]. The disease also imposes a considerable economic burden on patients, families, and society through direct medical costs, lost productivity, and psychological impacts[7–9].

AD is highly heterogeneous, with marked clinical variation according to age, sex, and lesion distribution[10,11]. In China, dermatologists commonly encounter patients with atypical presentations, which frequently result in misdiagnosis or missed diagnosis[12]. In recent years, biologics and small-molecule targeted therapies have demonstrated favorable efficacy and high response rates in moderate-to-severe AD[13,14]. However, the clinical management of these systemic treatments, particularly pre-treatment screening and ongoing safety monitoring, remains inadequate in many institutions. Consequently, there is an urgent need to establish quality-control indicators and evaluation systems for AD in China to improve diagnostic accuracy, promote standardized treatment, and strengthen patient education.

The present study conducted a nationwide cross-sectional survey to evaluate the current status of dermatology outpatient services, the establishment of AD specialty clinics, and the practices of severity assessment, diagnosis, and treatment across hospitals of different levels and geographic regions in China. The aim was to comprehensively identify existing gaps in AD healthcare quality and provide evidence-based insights for future quality-improvement efforts.

Materials and methods

Study design and setting

A cross-sectional survey was conducted to evaluate the clinical service capabilities for three inflammatory skin diseases, including AD, across hospitals in the Chinese mainland. A structured questionnaire was developed based on relevant national and international clinical guidelines, expert consensus statements, national dermatology and venereology professional quality-control guidance documents, and disease-specific quality-control indicators. The questionnaire was reviewed by a panel of dermatologists and pilot-tested in several hospitals in Shanghai prior to formal distribution to ensure clarity, content validity, and consistency of the items.

The questionnaire was distributed electronically by the Umer Doctor platform and WeChat groups to dermatology departments of hospitals of all levels (tertiary, secondary, and primary) nationwide. One designated respondent (a dermatologist or the head of the dermatology department) from each hospital was invited to complete the questionnaire. Respondents were instructed to provide hospital-level data (including annual case numbers, staffing, and operation of specialty clinics) by consulting the hospital information system or confirming the information with the department head. Different campuses of the same hospital were treated as a single institution. Duplicate submissions were identified and removed by cross-checking hospital names and unique identifiers.

Data collection was carried out in 2024, with respondents reporting information pertaining to the full calendar year 2023 (1 January, 2023 to 31 December, 2023). A total of 1,726 questionnaires were received. After excluding 79 duplicate submissions from the same hospitals and 56 questionnaires with illogical responses or severe missing information, 1,591 valid questionnaires were included in the final analysis.

The questionnaire collected information on hospital level, geographic region, healthcare settings, establishment of specialty clinics, diagnostic practices, treatment approaches, and patient health education. The full survey questionnaire is provided in the Supplementary File.

Statistical analysis

All statistical analyses were performed using Python 3.12 and SPSS 29.0. Descriptive statistics were expressed as frequencies and percentages (%).

Differences in AD diagnosis rates, specialty clinic establishment rates, and pre-treatment or on-treatment screening rates across hospital levels were compared using the Pearson χ^2 test (or Fisher's exact test when appropriate), with *post hoc* pairwise comparisons performed using Bonferroni correction. Differences in the number of physicians, associate chief physicians and above, nurses, technicians, consultation desks, and hospital beds across hospital levels were compared using the Kruskal–Wallis H test, followed by Mann–Whitney U tests with Bonferroni correction.

Regional differences in the number of physicians, associate chief physicians and above, nurses, technicians, consultation desks, and hospital beds were assessed by analysis of covariance (ANCOVA), with hospital level included as a covariate. *Post hoc* pairwise comparisons among regions were conducted using Tukey's honestly significant difference (HSD) test. Regional differences in AD diagnostic rates were first compared using the Pearson χ^2 test, followed by a binomial generalized linear model weighted by outpatient volume, with hospital level and number of physicians included as covariates. The overall effect of region was evaluated by a likelihood-ratio test. Adjusted diagnosis rates were obtained as model-predicted marginal means, and then Bonferroni-corrected *post hoc* pairwise comparisons were performed. Specialty clinic establishment rates and pre-treatment/on-treatment screening rates were analyzed using multivariable binary logistic regression with hospital level and number of physicians as covariates. The overall effect of region was also evaluated by the likelihood-ratio test. Adjusted establishment/screening rates were estimated as marginal predicted probabilities, and Bonferroni-corrected *post hoc* pairwise comparisons were performed.

All statistical tests were two-sided, and $P < 0.05$ was considered statistically significant.

Results

Distribution characteristics of surveyed hospitals

A total of 1,591 valid questionnaires were collected from hospitals of all levels across 31 provinces, municipalities, and autonomous regions in China (Fig. S1). Of these, 992 (62.3%) were tertiary hospitals, 550 (34.6%) secondary hospitals, and 49 (3.1%) primary hospitals.

Healthcare settings in dermatology departments

Among the 1,591 surveyed hospitals, 49.0% of dermatology departments had no inpatient beds, 24.6% had 1–10 beds, and only 26.4% had more than 10 beds (Fig. 1A). In the outpatient setting, 78.4% of hospitals had 1–5 consultation desks, while only 5.3% had more than 20 consultation desks (Fig. 1B).

The composition of medical staff in dermatology departments was also assessed. In the majority of hospitals, the numbers of physicians, associate chief physicians and above, nurses, and medical technicians were predominantly within range of 1–5 persons. Notably, 19.7% of hospitals had no nurses, and 57.4% had no medical technicians (Fig. 1C–1F).

Further analysis revealed significant differences in the healthcare resources and staffing of dermatology departments across hospitals of different levels and geographic regions (Tables S1 and S2).

Establishment of AD specialty clinics

Among the 1,591 surveyed hospitals, only 23.7% (n = 376) had established AD specialty clinics (Fig. 2A). A statistically significant difference was observed in the establishment rates of AD specialty clinics across hospitals of different levels ($\chi^2 = 114.465$, $P < 0.001$, Cramer's $V = 0.268$). The establishment rate in tertiary hospitals (32.5%) was significantly higher than that in secondary hospitals (9.5%) and primary hospitals (4.1%)

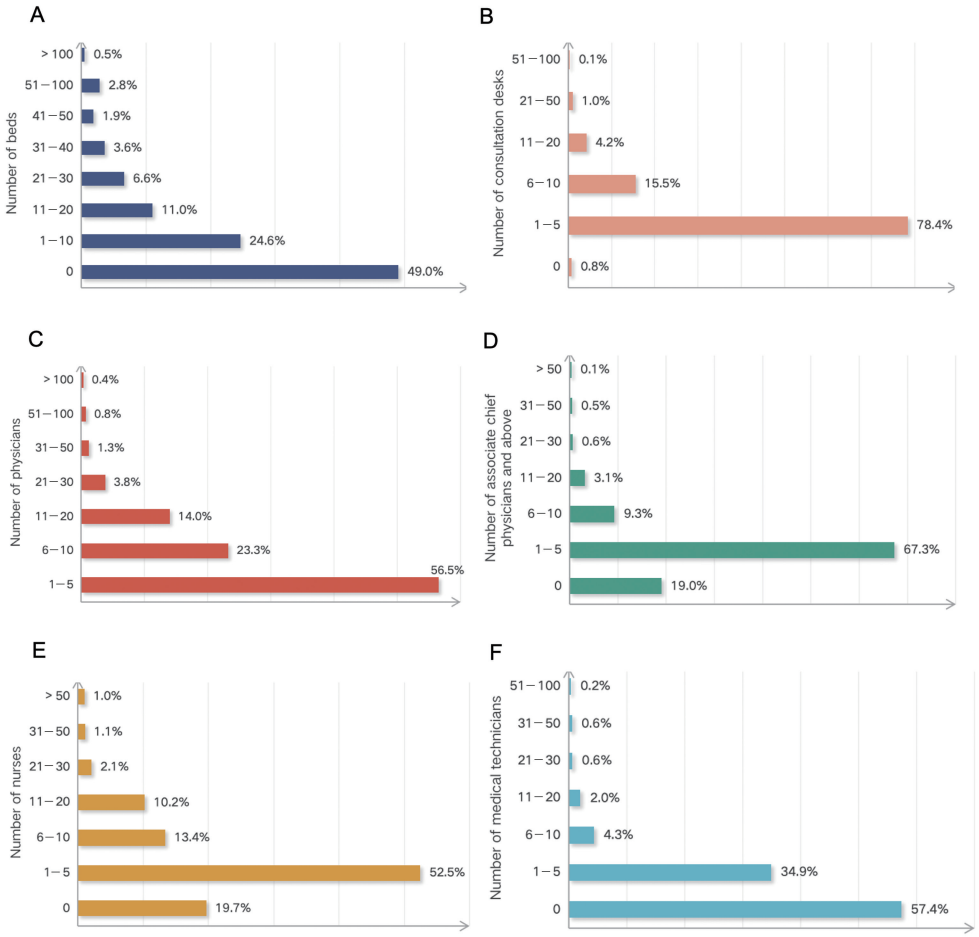

Figure 1: Distribution of healthcare resources in the dermatology departments of the surveyed hospitals.

(A) Number of beds. (B) Number of consultation desks. (C) Number of physicians. (D) Number of associate chief physicians and above. (E) Number of nurses. (F) Number of medical technicians.

Percentages indicate the proportion of hospitals in each category.

(all Bonferroni-adjusted $P < 0.001$; Fig. 2B). Significant differences were also found in the establishment rates of AD specialty clinics across geographic regions ($\chi^2 = 48.931$, $P < 0.001$, Cramer's $V = 0.175$). Adjusted for hospital level and number of physicians, the odds of establishing AD specialty clinics in Southwest China were significantly lower, whereas no significant differences were observed between other regions and North China (Table S3). *Post hoc* pairwise comparisons further indicated that the establishment rate in Southwest China was significantly lower than that in Central China (odds ratio [OR] = 3.12, adjusted $P = 0.021$) and North China (OR = 2.11, adjusted $P = 0.033$) (Fig. 2C).

Of the hospitals with AD specialty clinics, only 66.1% had implemented AD electronic medical records (Fig. 2D). Regarding the weekly frequency of AD specialty clinics, 51.5% conducted sessions one to two times each week and 34.8% conducted sessions three to six times each week (each half-day defined as one session), together accounting for 86.3% of these hospitals (Fig. 2E). Furthermore, 63.2% of these clinics managed 0–50 AD patients each week (Fig. 2F).

Diagnosis of AD in dermatology outpatient clinics

Among the surveyed hospitals, 60.5% diagnosed 0–500 cases of AD annually in their dermatology outpatient departments, 12.1% diagnosed 501–1,000 cases, and

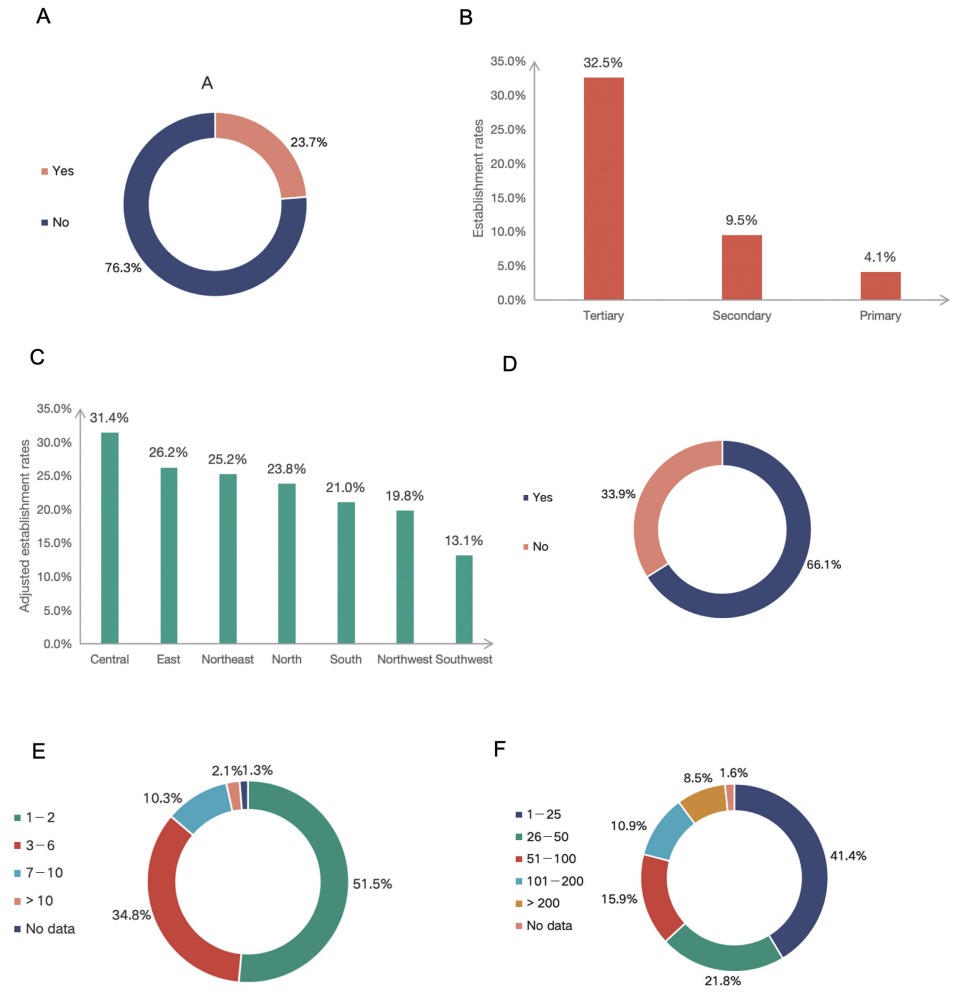

Figure 2: **Establishment of atopic dermatitis (AD) specialty clinic and use of electronic medical records in dermatology departments.**

(A) Proportion of hospitals with an AD specialty clinic. (B) Establishment rates of AD specialty clinics by hospital level. (C) Adjusted establishment rates of AD specialty clinics by geographical region. (D) Proportion of AD specialty clinics using electronic medical records. (E) Weekly frequency of AD specialty clinics. (F) Number of patients seen each week in AD specialty clinics.

Tertiary vs. Secondary and Tertiary vs. Primary (all Bonferroni-adjusted $P < 0.001$), Secondary vs. Primary (Bonferroni-adjusted $P > 0.05$), Southwest vs. Central (adjusted $P = 0.021$), Southwest vs. North China (adjusted $P = 0.033$).

17.6% diagnosed 1,001–5,000 cases (Fig. 3A). For eczema, 38.1% of hospitals reported 1,001–5,000 cases annually, followed by 1–500 cases (18.7%) and 501–1,000 cases (14.5%) (Fig. 3B).

The overall AD diagnostic rate was 21.3% (Fig. 3C). This rate was calculated as the number of AD patients divided by the sum of AD and eczema patients. There was a statistically significant difference in the AD diagnostic rate among hospitals of different levels ($\chi^2 = 44{,}925.5$, $P < 0.001$, Cramer's $V = 0.058$). The diagnostic rate in tertiary hospitals (22.0%) was significantly higher than that in secondary hospitals (15.6%) and primary hospitals (9.1%), and the rate in secondary hospitals was also significantly higher than that in primary hospitals (all Bonferroni-adjusted $P < 0.001$; Fig. 3D). Significant differences were also observed in the diagnostic rates across geographic regions ($\chi^2 = 152{,}900$, $P < 0.001$, Cramer's $V = 0.107$). After adjustment for hospital level and number of physicians, with North China as the reference, the diagnostic rate of AD was significantly lower in Southwest, Northeast, and East China, but significantly higher in Central, Northwest, and South China (Table S4). *Post hoc* pairwise comparisons further

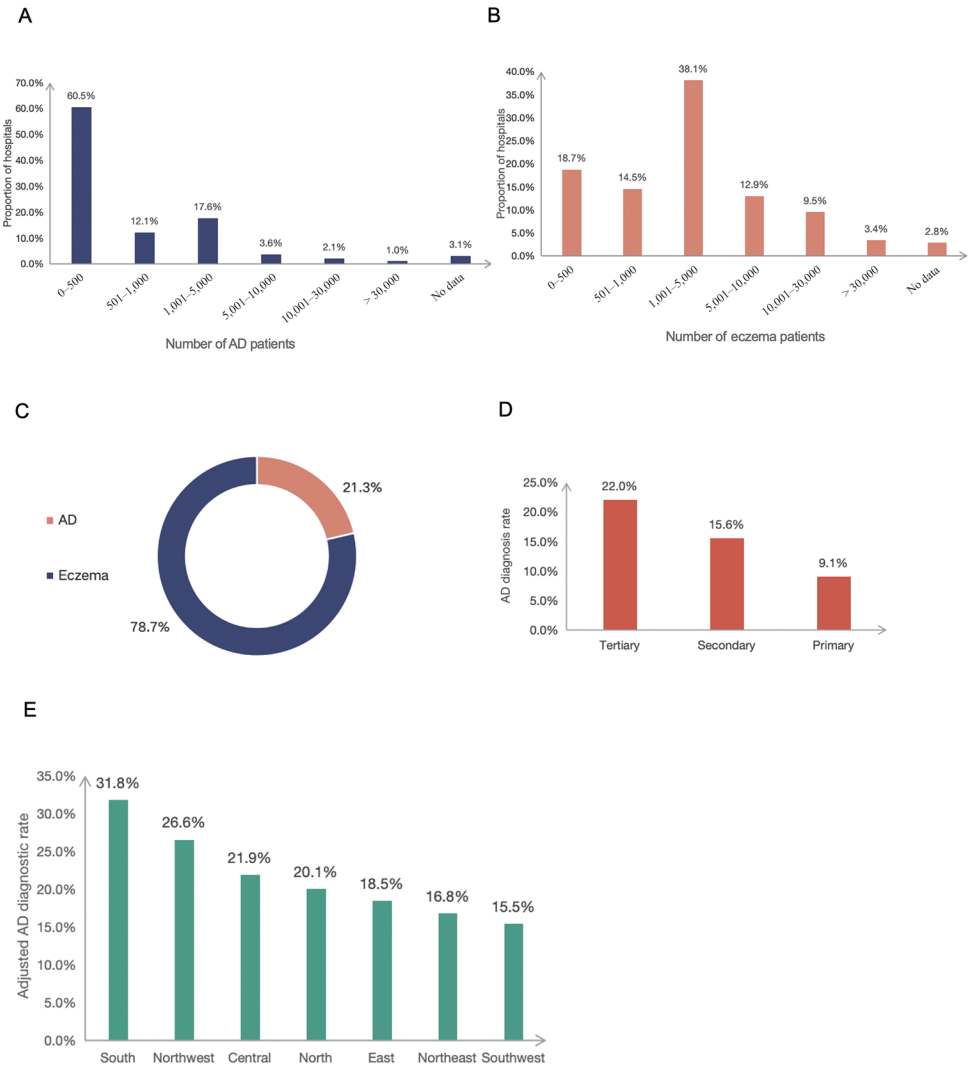

Figure 3: Diagnosis of atopic dermatitis (AD) in dermatology outpatient clinics of the surveyed hospitals.

(A) Distribution of hospitals according to the number of patients diagnosed with AD. (B) Distribution of hospitals according to the number of patients diagnosed with eczema. (C) Overall AD diagnosis rate in dermatology outpatient clinics. (D) AD diagnosis rate by hospital level. (E) Adjusted AD diagnosis rate by geographic region.

The AD diagnostic rate was calculated as the number of AD patients divided by the sum of AD and eczema patients. *Post hoc* pairwise comparisons among the three hospital levels (all Bonferroni-adjusted $P < 0.001$), *Post hoc* pairwise comparisons among the seven geographic regions (all Bonferroni-adjusted $P < 0.001$).

revealed significant differences between all pairs of the seven regions (all Bonferroni-adjusted $P < 0.001$; Fig. 3E and Table S5).

Severity assessment of AD

Assessment tools for AD severity are generally categorized into two main types: physician-assessed measures and patient-reported outcome measures. Commonly used physician-assessed tools include the Eczema Area and Severity Index (EASI)[15], Investigator's Global Assessment (IGA)[16], Scoring Atopic Dermatitis (SCORAD)[17], and Body Surface Area (BSA)[18]. Patient-reported tools allow patients to self-evaluate their disease severity and treatment experience. The most frequently employed instruments include the Visual Analogue Scale (VAS) or Numeric Rating Scale (NRS) for itch severity[19,20], Dermatology Life Quality Index (DLQI)[21], Atopic Dermatitis Control Tool (ADCT)[22], and Patient-Oriented Eczema Measure (POEM)[23].

In the present survey, 62.1% of the 1,591 hospitals

performed physician-assessed severity evaluations (Fig. 4A). The five most common assessment approaches were the combination of IGA + EASI + SCORAD + BSA (19.0%), BSA alone (14.3%), EASI alone (12.4%), SCORAD alone (11.6%), and IGA alone (11.5%) (Fig. 4C). Overall, EASI was the most frequently used individual tool (55.7%), followed by BSA (54.3%), SCORAD (47.1%), and IGA (41.9%) (Fig. 4E).

Patient-reported outcomes were assessed in 48.1% of the hospitals (Fig. 4B). The five most frequent methods were NRS/VAS alone (29.0%), DLQI alone (18.2%), the combination of DLQI + NRS/VAS + ADCT + POEM (14.0%), DLQI + NRS/VAS (10.3%), and ADCT alone (7.7%) (Fig. 4D). Among individual instruments, NRS/VAS for itch severity was the most widely used (63.4%), followed by DLQI (57.4%), which evaluates quality of life. Usage rates of ADCT (35.4%) and POEM (22.4%) were comparatively lower (Fig. 4F).

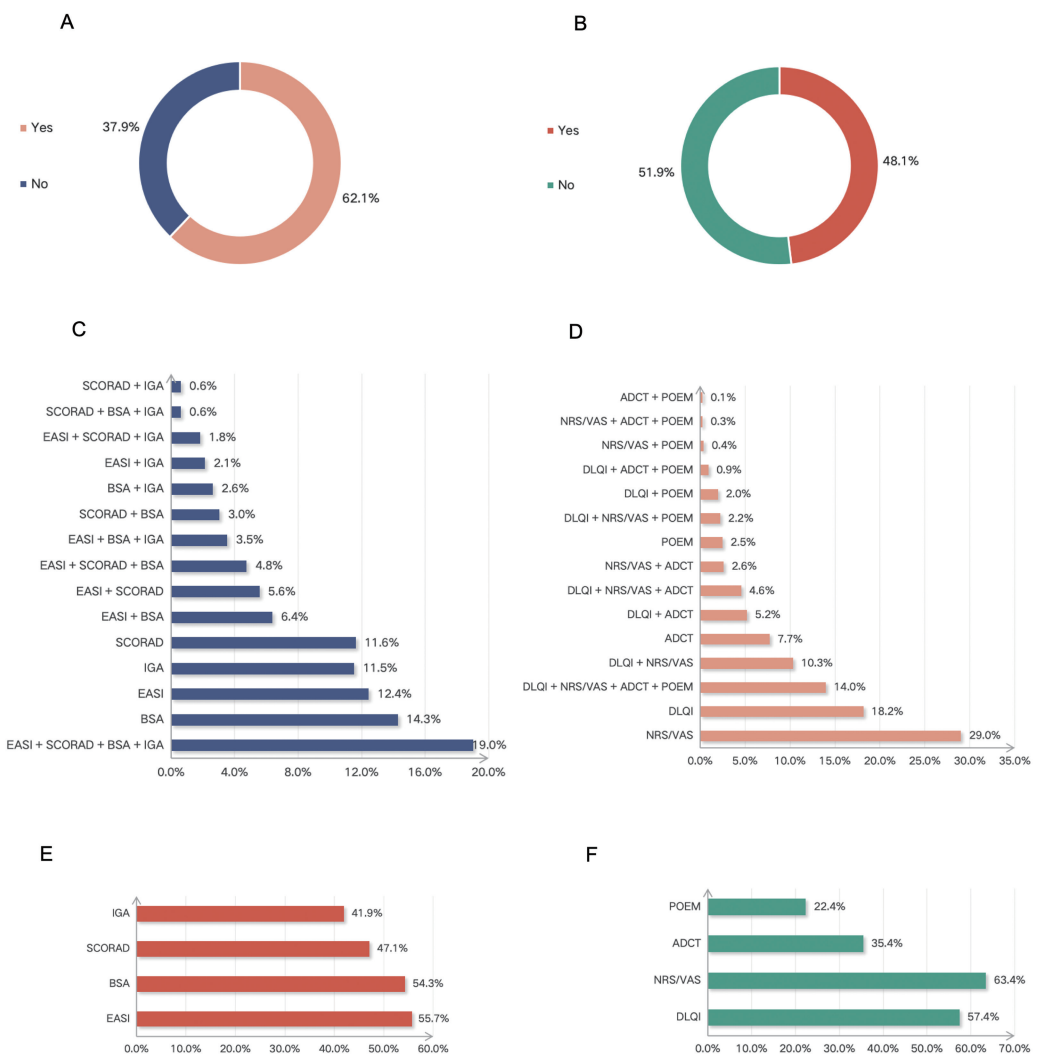

Figure 4: Severity assessment of atopic dermatitis (AD) in dermatology outpatient clinics of the surveyed hospitals.

(A) Proportion of hospitals conducting Physician-assessed severity for AD. (B) Proportion of hospitals conducting patient-reported outcome measures for AD. (C) Distribution of hospitals according to the combinations of Physician-assessed severity tools used. (D) Distribution of hospitals according to the combinations of patient-reported outcome tools used. (E) Usage rates of individual Physician-assessed severity tools. (F) Usage rates of individual patient-reported outcome tools.

Multiple responses were allowed in severity assessment tools.

Abbreviations: IGA, Investigator's Global Assessment; BSA, Body Surface Area; EASI, Eczema Area and Severity Index; SCORAD, Scoring Atopic Dermatitis; NRS, Numeric Rating Scale; VAS, Visual Analogue Scale; DLQI, Dermatology Life Quality Index; ADCT, Atopic Dermatitis Control Tool; POEM, Patient-Oriented Eczema Measure.

Documentation of medical history

Given the frequent coexistence of atopic and non-atopic comorbidities as well as the hereditary nature of AD, comprehensive documentation of medical history is essential[24–26]. Among the surveyed hospitals, 81.6% (n = 1,298) recorded patients' personal comorbidities, 83.5% (n = 1,329) documented underlying health conditions, and 87.3% (n = 1,389) collected family history of atopic diseases.

Treatment practices for AD

Stepwise treatment based on disease severity and proactive therapy with topical medications represent the two core treatment principles for AD[27,28]. Among the 1,591 surveyed hospitals, 87.5% reported following the stepwise treatment, while 95.3% reported adopting proactive therapy (Fig. 5A and 5B).

For systemic therapies, including immunosuppressants, biologics, and small-molecule targeted agents, 66.0% of hospitals performed pre-treatment screening and 64.0% conducted on-treatment safety monitoring (Fig. 5C and 5D). Statistically significant differences were observed in both pre-treatment and on-treatment screening rates among hospitals of different levels (pre-treatment: $\chi^2 = 301.226$, $P < 0.001$, Cramer's $V = 0.435$; on-treatment: $\chi^2 = 297.990$, $P < 0.001$, Cramer's $V = 0.433$). For both pre-treatment and on-treatment, the screening rates in tertiary hospitals were significantly higher than those in secondary hospitals and primary hospitals, and the rates in secondary hospitals were also significantly higher than those in primary hospitals (all Bonferroni-adjusted $P < 0.01$; Fig. 5E and 5F).

Significant differences were also found across geographic regions for both pre-treatment screening ($\chi^2 = 110.970$, $P < 0.001$; Cramer's $V = 0.264$) and on-treatment monitoring ($\chi^2 = 99.142$, $P < 0.001$; Cramer's $V = 0.250$). After adjustment for hospital level and the number of physicians, and using North China as the reference, both screening rates were significantly lower in South, Northwest, and Southwest China; no significant differences were observed between the other regions and North China (Tables S6 and S7). *Post hoc* pairwise comparisons further indicated that both screening rates in Southwest China were significantly lower than those in North, East, Northeast, and Central China. In addition, the pre-treatment screening rate in East China was also significantly higher than that in South China (all Bonferroni-adjusted $P < 0.05$; Fig. 5G and 5H).

Health education for patients with AD

Health education was provided by 84.5% of the surveyed hospitals (Fig. 6A). The most frequently used methods were oral education during consultations (94.2%), educational brochures or pamphlets (72.2%), offline lectures or group sessions (42.6%), web-based infographics (41.7%), and online short videos (32.6%) (Fig. 6B).

Discussion

This nationwide cross-sectional survey provides a comprehensive baseline assessment of clinical service capacity for AD across hospitals of all levels in China. The findings reveal substantial gaps and marked disparities in healthcare resources and staffing, specialty clinic development, diagnostic, and treatment practices.

A total of 1,591 hospitals were included, the majority of which were tertiary institutions (62.3%). Only 23.7% of hospitals had established dedicated AD specialty clinics, indicating a critical shortage of specialized service that may hinder optimal disease management. Establishment rates were significantly higher in tertiary hospitals than in secondary and primary hospitals, and also showed marked geographic disparities. Specifically, the establishment rate was significantly lower in Southwest China compared with both Central China and North China. Moreover, among hospitals with AD specialty clinics, the majority reported relatively low weekly patient volume, and a proportion of responses indicated "no data". These findings suggest that some clinics may operate with limited functional capacity or primarily in name only, highlighting the need to establish clear minimum standards for the organization, staffing, and service delivery of AD specialty clinics.

The overall AD diagnostic rate in dermatology outpatient clinics was 21.3% in 2023. This relatively low rate, calculated as the proportion of AD diagnoses among combined AD and eczema cases, indicates ongoing

Figure 5: Treatment principles and medication safety screening for patients with atopic dermatitis (AD).

(A) Proportion of hospitals that reported following stepwise treatment. (B) Proportion of hospitals that reported adopting proactive treatment. (C) Proportion of hospitals conducting pre-treatment screening before the use of immunosuppressants, biologics, or small-molecule targeted agents. (D) Proportion of hospitals conducting on-treatment monitoring during the use of immunosuppressants, biologics, or small-molecule targeted agents. Proportion of hospitals conducting pre-treatment screening (E) and on-treatment monitoring (F) by hospital level. Proportion of hospitals conducting pre-treatment screening (G) and on-treatment monitoring (H) by geographic region.

Post hoc pairwise comparisons among hospitals of different levels regarding the rates of conducting pre-treatment screening or on-treatment monitoring (all Bonferroni-adjusted $P < 0.001$). *Post hoc* pairwise comparisons of North vs. Southwest, East vs. Southwest, Northeast vs. Southwest, Central vs. Southwest for both pre-treatment screening and on-treatment monitoring (all Bonferroni-adjusted $P < 0.05$), South vs. East for pre-treatment screening (Bonferroni-adjusted $P < 0.05$).

inconsistencies in disease recognition. Diagnostic rates increased significantly with hospital levels (tertiary > secondary > primary). After multivariable adjustment for hospital level and physician numbers, rates were significantly higher in South China, Northwest China, and Central China, and significantly lower in Southwest China, Northeast China, and East China, relative to North China. These adjusted regional patterns highlight persistent geographic differences.

Physician-assessed severity assessment was performed in 62.1% of hospitals, most commonly using combinations or individual applications of EASI, BSA, SCORAD, and IGA. Patient-reported outcome measures were used in 48.1% of hospitals, with NRS/VAS and DLQI being the most frequent instruments. Although recommended tools are available in a substantial proportion of institutions, the incomplete adoption of both physician-assessed and patient-reported measures indicates that standardized severity assessment has not yet been fully implemented in routine clinical practice.

Most hospitals reported following a stepwise treatment approach (87.5%) and self-reported adoption of the

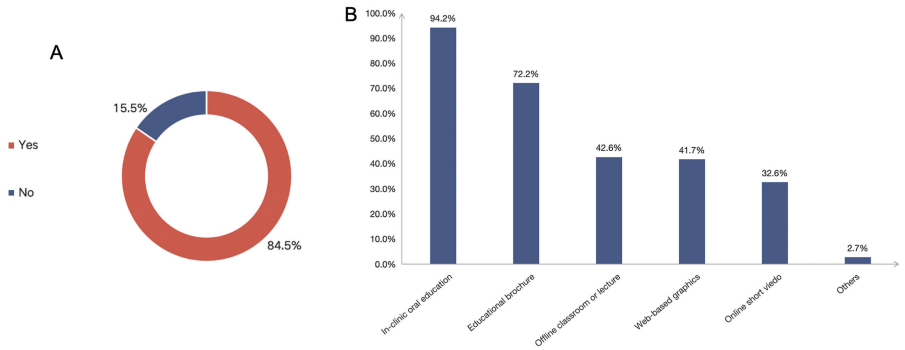

Figure 6: Health education for atopic dermatitis (AD) in dermatology outpatient clinics.

(A) Proportion of hospitals providing patient health education for AD. (B) Distribution of patient education methods used in dermatology outpatient clinics. Multiple responses were allowed in assessment of education methods.

proactive therapy concept with topical medications (95.3%). For systemic therapies including immunosuppressants, biologics, and small-molecule targeted agents, 66.0% of hospitals performed pre-treatment screening and 64.0% conducted on-treatment safety monitoring. Both screening and monitoring rates were significantly higher in tertiary hospitals than in secondary and primary hospitals. After adjustment, rates remained significantly lower in South China, Northwest China, and Southwest China, demonstrating significant differences across geographic regions. It should be noted that our questionnaire did not differentiate among traditional immunosuppressants, biologics, and small-molecule agents. Therefore, the reported practices reflect overall institutional approaches rather than drug-specific protocols.

Health education was offered by 84.5% of hospitals. The most common modalities were oral education during consultations and printed brochures, indicating that traditional approaches remain prevalent. There is a growing need to incorporate more innovative and interactive methods (including online videos, web-based resources, and patient education apps) to better support patient engagement. Given the rapid expansion of digital health platforms, further integration of these tools may help to strengthen patient education efforts[29]. In addition, continuous training in communication skills for healthcare providers is warranted to optimize educational delivery[30]. Our data only captured the educational formats employed and did not evaluate educational content, delivery frequency, personnel, patient comprehension, adherence, or clinical outcomes. Consequently, no conclusions can be drawn regarding the effectiveness of online resources in improving understanding or adherence.

This study has several limitations. Its cross-sectional design precludes causal inference and temporal analysis. Data were self-reported by a single designated respondent per hospital, which may introduce reporting bias or inconsistencies in the interpretation of concepts such as proactive therapy. The questionnaire did not capture detailed information on education quality, drug-specific screening protocols, or clinical outcomes. Primary hospitals were underrepresented, potentially limiting generalizability to lower-level facilities. Finally, because the electronic questionnaire was distributed by open platforms rather than point-to-point invitation, a formal response rate could not be calculated.

In summary, although progress has been made in AD management across China, important gaps remain in the availability of specialty clinics, diagnostic proportion, standardized severity assessment, safety monitoring for systemic therapies, and comprehensive patient education. Tertiary hospitals and certain regions demonstrate relatively stronger capacity, whereas secondary and primary hospitals as well as several geographic areas (particularly Southwest China) face greater challenges. Targeted policy and institutional efforts are needed to strengthen specialized services, promote standardized diagnostic and assessment practices, expand safe access to advanced therapies, and improve the quality and evaluation of patient education, thereby advancing more equitable and high-quality AD care nationwide.

Conclusion

This nationwide survey provides a baseline map of AD service capacity and shows that AD specialty care, diagnosis, severity assessment, safety monitoring, and patient education in China remain uneven across hospital levels and regions. Targeted efforts are needed to close these gaps and promote more equitable, high-quality care.

Author contributions

Jinhua Xu, Yong Cui, and Wei Li conceived the study and provided resources, Haihong Qin and Chaoying Gu designed the survey questionnaire and drafted the manuscript. Wen Huang and Yiping Sun supervised the work. Zhong Lu and Wenyu Wu revised the manuscript. All authors reviewed, edited, and approved the final version of the manuscript and agreed to its publication.

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Ethics statement

This study was conducted in accordance with the ethical standards of the Declaration of Helsinki and its later amendments. According to Article 3 of the Administrative Measures for Ethical Review of Life Science and Medical Research Involving Humans, issued in 2023 by the Department of Science, Technology, and Education of the National Health Commission of China, formal ethical review approval was not required for this study.

All figures are either original to this work or properly attributed. No original images have been previously published, and all images comply with research integrity standards without inappropriate manipulation or misrepresentation.

Data availability statement

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

AI statement

The authors declare that no generative artificial intelligence (AI) or AI-assisted technologies were used in the preparation, analysis, writing, image generation, or image processing of this manuscript.

Conflicts of interest

Yong Cui serves as one of the Editors-in-Chief of this journal, and Wenyu Wu serves as a member of the Editorial Board of this journal. They were not involved in the editorial review or decision-making process for this manuscript. All editorial decisions were made independently by other members of the Editorial Board who have no conflicts of interest. The remaining authors declare no conflicts of interest.

Supplementary files

Electronic supplementary material is available in the online version of this article at doi.org/10.2738/SKIN.2026.0031 and is accessible for authorized users.

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