Burden of illness, medication adherence, and unmet medical needs in Japanese patients with atopic dermatitis: A retrospective analysis of a cross-sectional questionnaire survey

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Abstract
Atopic dermatitis (AD) negatively affects patients’ daily lives. Poor medication adherence is a major barrier to treatment success. However, factors causing patients’ poor adherence are unclear. This study aimed to identify factors associated with improvement of medication adherence in Japanese patients with AD and to evaluate illness burden and unmet medical needs for AD. We retrospectively analyzed Web-based questionnaire surveys conducted in 2018 in patients with AD aged 15 years and above who had been in- or outpatients within the past year from the survey. Quality of life using the EuroQol 5-Dimension (EQ-5D), and work productivity and activity impairment using Work Productivity and Activity Impairment Questionnaire (WPAI) were compared between patients and matched controls who had not visited a hospital for any disease within the past year. Subpopulation analysis was performed to explore factors affecting medication adherence. Unmet medical needs in AD treatment were identified by the percentage of patients who rated issues on the questionnaire as important but who were unsatisfied with them. In this study, we identified 1739 patients with AD. The scores of EQ-5D and WPAI showed that patients had statistically lower quality of life and higher impairment of work and activities than controls. High medication adherence scores were seen in patients with high health literacy levels and those who were well satisfied with communication with health-care providers, information received from them, or explanations of AD. Current unmet medical needs for AD were medical treatment costs, ease of hospital visits and explanations about disease prognosis. Patients tended to put a higher priority on communication with physicians than on that with nurses and pharmacists. In conclusion, we have identified patients’ higher health literacy levels and satisfaction with the communication with their health-care provider as potential factors to improve medication adherence.

KEYWORDS
atopic dermatitis, cross-sectional studies, health literacy, medication adherence, quality of life

1 INTRODUCTION

Atopic dermatitis (AD) is a pruritic eczematous dermatitis with symptoms that fluctuate between remissions and relapses.1 In most cases, AD presents in childhood and – although the disease may resolve by adolescence – it often becomes a chronic and lifelong condition. Chronic itching impairs patients’ health-related quality of life (HRQoL) because of its negative impact on sleep, work productivity, and mental health.2 Patients with more severe AD have poorer HRQoL; however, AD treatment can improve their HRQoL.2,3

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Topical corticosteroids (TCS) and tacrolimus ointment are the main anti-inflammatory treatments used for AD. Patients’ interruption and inadequate use of these topical anti-inflammatory drugs can lead to aggravation of AD and non-adherence to therapy is problematic and has been associated with poor therapeutic outcomes. To improve adherence, health-care providers are expected to explain the importance of medications to patients and motivate them to adhere to treatment.

Health literacy is defined as the ability to access, understand, appraise, and apply health information. Miller et al. conducted a systematic meta-analysis to evaluate health literacy and medication adherence in patients with chronic and acute illness. Although they did not include AD in their analysis, they concluded that health literacy interventions increase medication adherence in patients. If this finding applies to patients with AD, improvement of health literacy may be a useful approach to improve treatment outcome in this disease.

In this study, we retrospectively analyzed the Medilead Healthcare Panel (MHP) database (Medilead Inc.), one of the largest databases in Japan with patient-reported information obtained in a Web-based questionnaire survey. The analysis aimed to evaluate the impact of AD on daily life and how communication between patients and health-care providers or patients’ health literacy affects medication adherence in AD. Furthermore, issues that patients felt were important but with which they were unsatisfied (defined as unmet medical needs) were also identified.

2 | METHODS

2.1 | Data source

For this retrospective study, we purchased and analyzed the MHP database managed by Medilead Inc. The database contains the results of a survey on general health (e.g., current and past symptoms/diseases, HRQoL scores, work productivity loss scores, health literacy scores), and a disease-specific survey (e.g., prescriptions, medication adherence scores, medical expenses) on more than 500 kinds of symptoms/diseases in 347,659 people in Japan. These surveys were conducted from August to November in 2018 in accordance with the Declaration of Helsinki. All respondents filled the consent form for each survey, and data was anonymized not to be able to identify a specific individual. In accordance with the regulations of the Japanese Marketing Research Association, all respondents were 15 years of age or older.

2.2 | Analysis cohorts

Patients with AD (AD patients) were identified as those who answered “AD” to the questions “What is your main disease?” and “Which disease made you in- or outpatient in the past year?” and completed the AD-specific survey. Among those who answered “No history” to the question “Which disease made you in- or outpatient in the past year?”, we selected control individuals (controls) and matched them with AD patients in a 2:1 ratio on the basis of the demographic variables age, sex, occupation, and district of residence (matching criteria are shown in Table S1).

2.3 | Outcome measures

Generic HRQoL was assessed by the Japanese version of EuroQOL 5-dimension 5-level (EQ-SD-SL), including the subscores for mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, which ranged 1–5 (worst impairment). The respondents who selected “1” in all subscores were defined as having a full health state with an overall index score of 1. Overall index scores ranged from −0.025 to 1 (best health status).

Impairments in work and activities were assessed by the Japanese version of the Work Productivity and Activity Impairment Questionnaire: General Health (WPAI-GH). This questionnaire assesses absenteeism, presenteeism, overall work impairment, and activity impairment. Respondents with no occupation were instructed to answer the question on activity impairment only.

Health literacy was assessed by the Japanese version of the European Health Literacy Survey Questionnaire (HLS-EU-Q47). This questionnaire produces an overall index score called the general health literacy index (GEN-HL) and three subindices: the health care health literacy index (HC-HL), disease prevention health literacy index (DP-HL), and health promotion health literacy index (HP-HL). In each index, scores range 0–50 (excellent) and respondents’ health literacy is classified as inadequate (range, 0–25), problematic (range, >25 to 33), sufficient (range, >33 to 42), and excellent (range, >42 to 50).

Medication adherence was assessed with the Ueno method. Ueno et al. developed the medication adherence scale for Japanese patients with chronic disease, including AD. The total scale ranges 14–70 (excellent) and includes four factors: medication compliance (range, 3–15); collaboration with health-care providers (range, 3–15); willingness to access and use information about medication (range, 5–25); and acceptance to take medication and how taking medication fits the patient’s lifestyle (range, 3–15).

The issues which patients felt important but with which they were unsatisfied were defined as unmet medical needs and assessed with the 25 questions originally included in the MHP database (Figure 2). Patients rated the importance level of each topic on a scale of 1–5. Issues were divided into three groups on the basis of patients’ ratings: important (score 1 or 2); neutral (3); and not important (4 or 5). Similarly, patients also rated their level of satisfaction with the issues, as follows: satisfied (score 1 or 2); neutral (3); or unsatisfied (4 or 5). The percentage of patients who rated issues as important but who were unsatisfied with them were plotted in a scatter graph.

Patient responses to the original question “Which symptoms made you an in- or outpatient for AD?” were included in the analysis: patients selected all symptoms that applied to them from a list of 17
different symptoms (Table S2) and chose the key symptom that had the most impact on their decision-making.

## 2.4 Subpopulation analysis

Atopic dermatitis patients were classified by sex, age, education level, health literacy scores, and their rating of the issues listed in Figure 1. Medication adherence scores were evaluated in each subpopulation.

## 2.5 Statistical analysis

Continuous variables are reported as median with range and mean ± standard deviation. Categorical variables were summarized as frequencies and percentages of the study population and by subgroups, where appropriate. Differences in continuous variables between two groups were statistically analyzed with the Wilcoxon rank-sum test because the data were expected to be non-normal. Differences in continuous variables between more than two groups were statistically analyzed with the Kruskal–Wallis test, and differences in categorical variables with the $\chi^2$-test. All statistical analyses were performed with SPSS version 24.0.0.0 (IBM) and Cross Finder 2 (Cross Marketing).

## 3 RESULTS

### 3.1 Characteristics of patients with AD

We identified 1739 patients in the MHP database who were treated as in- or outpatients for AD in the year before the 2018 survey; 1516 patients (87.2%) of these patients stated that they were receiving any treatment for AD (Table 1). The sample consisted of 944 women (54.3%) and the mean age of the sample was 42.1 ± 12.1 years. Other demographic information and detailed treatment options are shown in Table 1 and Table S3.

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**FIGURE 1** Medication adherence in patients with atopic dermatitis (AD). Medication adherence was evaluated by the Ueno method. A higher score indicates higher medication adherence (range: 14–70). Patients with AD were classified by sex, age, education level, health literacy scores, and the answers to the questions regarding the level of satisfaction. *$p < 0.005$ in the Kruskal–Wallis test. DP-HL, disease prevention health literacy index; GEN-HL, general health literacy index; HC-HL, health-care health literacy index; HP-HL, health promotion health literacy index.
Table 2 shows the AD symptoms for which patients sought treatment as in- or outpatients. Most patients named itchy skin as the symptom that made them seek the treatment (60.0%). When patients were allowed to name multiple symptoms, 93.1%, 72.1%, and 57.2% named itchy skin, rough skin, and dry skin, respectively.

### Controls

The controls were 3478 persons who had no history of visiting hospital for any disease in the past year. In the matched sample, sex ($p = 1.000$), age ($p = 0.998$), district of residence ($p = 1.000$), and occupation ($p = 1.000$) showed no significant difference between AD patients and controls (Table 1 and Table S2), indicating that they were appropriately matched for confounding covariates.

### Health-related quality of life

The median EQ-5D-5L score was lower in the AD patients than in the controls ($p < 0.005$) (Table 3). Furthermore, the percentage of respondents reporting full health (indicated by “no problem” in all domains) was 40.0% in the AD patients and 59.3% in the controls ($p < 0.005$).

### Impairments in work and activities

Atopic dermatitis patients had higher presenteeism, activity impairment, and overall work impairment than controls ($p < 0.005$; Table 3). On the other hand, absenteeism was not statistically significantly different between the two groups ($p = 0.320$).

### Health literacy

The median GEN-HL total health literacy score was 29.1 (interquartile range [IQR], 22.0–33.3) in AD patients and 28.8 (IQR, 19.4–33.3) in controls (Table 4). The subindex HC-HL was slightly higher in AD patients than in controls ($p = 0.007$), but no statistical difference was found in DP-HL ($p = 0.063$) or HP-HL ($p = 0.904$).

### Factors associated with medication adherence in patients with AD

The total medication adherence score was 49.2 ± 10.2 in male AD patients and 49.3 ± 10.2 in female ones. To examine which factors affect medication adherence, we performed a subpopulation analysis. As shown on the right-hand side of Figure 1, medication adherence was high in patients who were satisfied with the communication with health-care providers (physician, nurses, and pharmacists), the information given to them from these providers, and the explanation of its content (disease overview, prognosis of disease, importance of treatment, and treatment options). Furthermore, patients with higher health literacy showed better medication adherence (shown in the lower left part of Figure 1). On the other hand, when patients were divided according to demographic characteristics such as age, sex, and education level, no significant differences were found in any subpopulation.

### Unmet medical needs for atopic dermatitis

The X-axis in Figure 2 shows the percentage of patients who rated the 25 issues on AD as important. The top three issues were communication with physicians (74.4%), ease of hospital visit (71.8%), and information from physicians (70.0%). The results for items 1–3 (Figure 2) showed that patients tended to place greater importance on communication with physicians (item 1, 74.4%) than on...
communication with nurses (item 2, 45.9%) or pharmacists (item 3, 57.5%). A similar tendency was also observed regarding the health-care providers who provide information to patients: physicians (item 4, 70.0%), nurses (item 5, 43.1%), and pharmacists (item 6, 57.7%).

The Y-axis in Figure 2 shows the percentage of patients who stated that they were unsatisfied with issues regarding AD. The top three issues were medication costs (item 18, 22.4%), launch of new drugs that can prevent disease onset (item 21, 21.2%), and launch of new drugs that can cure the disease or make it possible to have a normal daily life (item 20, 19.3%). Three issues ranked in both the top 10 of important issues and the top 10 of unsatisfied issues: medical treatment costs, explanation about prognosis of disease, and ease of hospital visit (items 9, 17, and 18), suggesting that these are unmet medical needs in AD.

### TABLE 2
Trigger symptoms that made patients seek in-/outpatient treatment for atopic dermatitis

| Symptoms | Decision-making symptoms | All trigger symptoms |
|----------|--------------------------|----------------------|
| Non-visible symptoms | Itchy skin 882 (60.0) | 1370 (93.1) |
| | Skin pain 66 (4.5) | 408 (27.7) |
| Visible symptoms | Rough skin 240 (16.3) | 1061 (72.1) |
| | Dry skin 34 (2.3) | 842 (57.2) |
| | Reddened skin/something similar to moles and freckles occurred 81 (5.5) | 635 (43.2) |
| | Skin swelling 47 (3.2) | 393 (26.7) |
| | Red spot on the skin 76 (5.2) | 368 (25.0) |

* Patients selected one symptom that made them seek in-/outpatient treatment for atopic dermatitis (AD). Symptoms with a response rate of 1% are shown.

* Patients selected all symptoms that made them seek in-/outpatient treatment for AD. Symptoms with a response rate of 10% are shown.

### TABLE 3
Health-related quality of life and work productivity and activity impairment in patients with atopic dermatitis and controls

|                      | AD patients, median (IQR) | Controls, median (IQR) | p* | AD patients, mean (SD) | Controls, mean (SD) |
|----------------------|---------------------------|------------------------|----|------------------------|---------------------|
| EQ-SD-5L             | 0.895 (0.823–1.000)       | 1.000 (0.867–1.000)    | <0.005 | 0.879 (0.137) | 0.898 (0.182) |
| WPAI                 |                           |                        |     |                        |                     |
| Absenteeism          | 0.0 (0.0–0.0)             | 0.0 (0.0–0.0)          | 0.320 | 6.3 (19.1)          | 6.5 (20.0)         |
| Presenteeism         | 20.0 (0.0–50.0)           | 10.0 (0.0–50.0)        | <0.005 | 27.4 (27.8) | 24.9 (27.7) |
| Overall work impairment | 20.0 (0.0–51.0)           | 20.0 (0.0–50.0)        | <0.005 | 30.4 (30.7) | 28.0 (30.8) |
| Activity impairment  | 30.0 (0.0–50.0)           | 20.0 (0.0–50.0)        | <0.005 | 31.4 (28.8) | 25.6 (27.7) |

Abbreviations: AD, atopic dermatitis; EQ-SD-5L, EuroQOL 5-dimension 5-level; IQR, interquartile range; SD, standard deviation; WPAI, Work Productivity and Activity Impairment.

* Wilcoxon rank-sum test.

### TABLE 4
Health literacy score of patients with atopic dermatitis and controls

|                      | AD patients, median (IQR) | Controls, median (IQR) | p* | AD patients, mean (SD) | Controls, mean (SD) |
|----------------------|---------------------------|------------------------|----|------------------------|---------------------|
| GEN-HL               | 29.1 (22.0–33.3)          | 28.8 (19.4–33.3)       | 0.047 | 28.8 (9.7)           | 28.1 (11.2)         |
| HC-HL                | 29.2 (21.9–33.3)          | 28.1 (18.8–33.3)       | 0.007 | 28.7 (9.8)           | 27.9 (11.5)         |
| DP-HL                | 31.1 (22.6–34.9)          | 30.6 (20.0–34.4)       | 0.063 | 30.0 (10.6)          | 29.3 (11.7)         |
| HP-HL                | 28.1 (19.8–33.3)          | 28.1 (17.8–33.3)       | 0.904 | 27.7 (10.6)          | 27.6 (11.6)         |

Abbreviations: AD, atopic dermatitis; DP-HL, disease prevention health literacy index; GEN-HL, general health literacy index; HC-HL, health care health literacy index; HP-HL, health promotion health literacy index; IQR, interquartile range; SD, standard deviation.

* Wilcoxon rank-sum test.
In this study, we obtained and retrospectively analyzed survey-based data to examine the effects of AD on the daily life of Japanese patients and the effects of various factors on medication adherence. We showed that Japanese patients with AD have impaired HRQoL, work productivity, and activity, which supports the findings of previous studies.\textsuperscript{16–19} For example, Arima \textit{et al.}\textsuperscript{16} reported that in Japanese patients with AD absenteeism, presenteeism, overall work impairment, and activity impairment were 4.0 ± 12.3%, 28.6 ± 25.3%, 30.6 ± 27.2%, and 32.2 ± 27.9%, respectively. In our study, the respective values were 6.3 ± 19.1%, 27.4 ± 27.8%, 30.4 ± 30.7%, and 31.4 ± 28.8%, indicating that the participants in our study represented typical Japanese patients with AD. These findings suggest the need for controlling patients’ symptoms so that they can achieve a satisfactory HRQoL.\textsuperscript{1}

Medication adherence and persistence are the cornerstones of effective treatment of AD. In our study, medication adherence was positively associated with patients’ health literacy and their satisfaction with communication with health-care providers and the information provided by them. Nakayama \textit{et al.}\textsuperscript{14} reported that Japanese health literacy was lower than that of Europeans: this difference may be partly due to issues related to the Japanese primary health-care system. Furthermore, it is difficult for patients in Japan to access reliable and understandable health information because no comprehensive national online platform exists.\textsuperscript{14} Health literacy can be improved by provision of information, effective communication, and structured education.\textsuperscript{20,21} Therefore, physicians should identify patients with lower health literacy and support them, in cooperation with other health-care providers, in developing a better understanding of their condition.

In this study, we evaluated medication adherence by the Ueno method and the scores were lower than those with chronic diseases reported by Ueno \textit{et al.}\textsuperscript{15} The result is supported by the results of Furue \textit{et al.}\textsuperscript{22} who showed that medication adherence was lower in patients with AD than in those with urticaria, psoriasis or tinea. Their group also identified messiness of treatment, forgetfulness, and feeling better as the major reasons for forgetting to take topical medication.\textsuperscript{23} To avoid recurrence, advising patients to continue topical treatment is regarded as helpful even after they think their skin lesions have cleared up.\textsuperscript{23} We found that patients with AD tended to put a higher priority on communication with physicians than on that with nurses and pharmacists. In Japan, the duration of consultations with physicians is often limited.\textsuperscript{24,25} Such short consultations make it difficult for physicians to have enough time to explain the condition of AD and treatment methods until their patients understand them completely. One of the realistic solutions to this problem is that, besides physicians, nurses and pharmacists also explain these issues to patients, while acknowledging that patients would prefer to receive explanations from physicians.

Explanation about prognosis of the disease and medical treatment costs were identified as two unmet medical needs. The latest Japanese guidelines for AD recommend explaining the disease and treatment goal to patients before initiating treatment.\textsuperscript{1} However, our results suggest that, in most cases, these issues are not adequately

4 | DISCUSSION

FIGURE 2 Percentages of patients with atopic dermatitis (AD) who responded "important" or "unsatisfied" regarding the 25 issues (listed on the right-hand side)
explained to patients. Furthermore, some patients might think that treatment for AD is not worth the cost because they do not fully understand how their skin inflammation will be controlled by the treatment. Further study is required because this possibility remains purely speculative.

Our results showed that patients with AD tended to decide to visit physicians not because of symptoms affecting their appearance but because of itchy skin. Because severe itching disturbs patients’ daily life, we speculate that they seek treatment to alleviate it. At present, in daily clinical practice most physicians ask their patients if they have itching. In addition to that, physicians can utilize quantitative tools to evaluate the intensity of the itch, for example with the Numerical Rating Scale or Visual Analog Scale.

The treatment landscape of AD has been changing in the last 2 years because an anti-interleukin-4 receptor α monoclonal antibody and a systemic Janus kinase (JAK) inhibitor were launched as treatments for severe AD. Furthermore, other biologics (e.g., nemolizumab) and JAK inhibitors (e.g., abrocitinib) are under development. In line with the availability of new treatment options for severe cases, the treatment strategy and goals in AD are expected to change in the future, which is expected to also change the willingness of patients to adhere to AD treatment. Our findings will also be valuable as comparative data for the results of future patient surveys performed after the introduction of new therapeutic options because differences between our results and those of new surveys can show the change in patients’ perspectives as a result of the advances in treatment.

Our study has some limitations. Survey respondents comprised a self-selected sample, which may not reflect the entire population. Patient-reported outcome is subjective, and some outcomes might not be valid from a medical perspective. Data on children and younger adolescents were lacking. Finally, controls were defined as people who had no history of visiting a hospital for any disease in the past year. Therefore, if patients with AD had not visited any hospital in the past year and they participated in the survey, they may have been included in the control group.

In conclusion, we showed that medication adherence in patients with AD was positively associated with patients’ health literacy level and their level of satisfaction with communication with health-care providers. Considering the health literacy level, health-care providers are expected to explain AD to their patients and ensure that they understand the disease, prognosis, importance of treatment, and treatment options.

ACKNOWLEDGMENTS
Pfizer Japan Inc. funded this study and medical writing support. The authors thank Ayako Shoji, Ph.D., Hiroko Fukushima, and Takashi Konishi of Medilead Inc. for analyzing the MHP database, and Tsuishi Uenishi of Medilead Inc. for writing this manuscript.

CONFLICT OF INTEREST
K.K. is an employee of Pfizer Japan Inc. T.H. and N.Y. are employees of Pfizer Japan Inc. and shareholders of Pfizer Inc. A.T. received honorarium from Maruho Co., Ltd. and Sanofi K.K. Medilead Inc. was paid for analyzing database and medical writing support.

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REFERENCES
1. Kato N, Ohya Y, Ikeda M, Ebihara T, Katayama I, Saeki H, et al. Japanese guidelines for atopic dermatitis 2020. Allergol Int. 2020;69:356–69.
2. Koszoru K, Borza J, Gulaci S, Sardy M. Quality of life in patients with atopic dermatitis. Cutis. 2019;104:174–7.
3. Coutanceau C, Stalder JF. Analysis of correlations between patient-oriented SCORAD (PO-SCORAD) and other assessment scores of atopic dermatitis severity and quality of life. Dermatol. 2014;229:248–55.
4. Wollenburg A, Barbarot S, Bieber T, Christen-Zaech S, Deleuran M, Fink-Wagner A, et al. Consensus-based European guidelines for treatment of atopic eczema (atopic dermatitis) in adults and children: part I. J Eur Acad Dermatol Venereol. 2018;32:657–82.
5. Eichenfield LF, Tom WL, Berger TG, Krol A, Paller AS, Schwarzenberger K, et al. Guidelines of care for the management of atopic dermatitis Section 2. Management and treatment of atopic dermatitis with topical therapies. J Am Acad Dermatol. 2014;71:116–32.
6. Otsuka R, Tanaka A, Takahashi M, Saito R, Iwamoto K, Takahagi S, et al. The relationship between the development of erythroderma in patients with atopic dermatitis and the avoidance of anti-inflammatory topical drugs. Allergol Int. 2021;70:376–78.
7. Torrelo A, Ortiz J, Alomar A, Ros S, Pedrosa E, Cuervo J. Health-related quality of life, patient satisfaction, and adherence to treatment in patients with moderate or severe atopic dermatitis on maintenance therapy: the CONDA-SAT study. Actas Dermosifiliogr. 2013;104:409–17.
8. Sørensen K, Van den Broucke S, Fullam J, Doyle G, Pelikan J, Slonska Z, et al. Health literacy and adherence to medical treatment in chronic and acute illness: a meta-analysis. Patient Educ Couns. 2016;99:1079–86.
9. Yamaguchi H, Iwaski K, Shoji A, Kokubo K, Igarashi A. Health-related quality of life (QoL) in Japanese patients with cancer: a large-scale questionnaire survey using EQ-5D-5L. Ther Res. 2020;41:949–55 (in Japanese).
10. Ikeda S, Shiroiwa T, Igarashi A, Saito S, Fukuda T, Saito S, et al. Developing a Japanese version of the EQ-5D-5L value set. J Nihl Inst Public Health. 2015;64:47–55. (in Japanese).
11. Shiroiwa T, Fukuda T, Ikeda S, Igarashi A, Saito S, Saito S, et al. Japanese population norms for preference-based measures: EQ-5D-3L, EQ-5D-5L, and SF-6D. Qual Life Res. 2020;69:356–69.
12. Reilly MC, Zbrozek AS, Dukes EM. The validity and reproducibility of a work productivity and activity impairment instrument. Pharmacoeconomics. 1993;4:353–65.
13. Nakayama K, Osaka W, Togari T, Ishikawa H, Yonekura Y, Sekido AI, et al. Comprehensive health literacy in Japan is lower than in Europe: a validated Japanese-language assessment of health literacy. BMC Public Health. 2015;15:505.
14. Ueno H, Yamazaki Y, Ishikawa H. Reliability and validity of medication adherence scale for patients with chronic disease in Japan. Jpn J Health Educ Promo. 2014;22:13–29. (in Japanese).
16. Arima K, Gupta S, Gadkari A, Hiragun T, Kono T, Katayama I, et al. Burden of atopic dermatitis in Japanese adults: analysis of data from the 2013 National Health and Wellness Survey. *J Dermatol*. 2018;45:390–6.

17. Murota H, Inoue S, Yoshida K, Ishimoto A. Cost of illness study for adult atopic dermatitis in Japan: a cross-sectional Web-based survey. *J Dermatol*. 2020;47:689–98.

18. Whiteley J, Emir B, Seitzman R, Makinson G. The burden of atopic dermatitis in US adults: results from the 2013 National Health and Wellness Survey. *Curr Med Res Opin*. 2016;32:1645–51.

19. Eckert L, Gupta S, Gadkari A, Mahajan P, Gelfand JM. Burden of illness in adults with atopic dermatitis: analysis of National Health and Wellness Survey data from France, Germany, Italy, Spain, and the United Kingdom. *J Am Acad Dermatol*. 2019;81:187–95.

20. Nutbeam D, McGill B, Premkumar P. Improving health literacy in community populations: a review of progress. *Health Promot Int*. 2018;33:901–11.

21. Ishikawa H, Yamaguchi I, Nutbeam D, Kato M, Okuhara T, Okada M, et al. Improving health literacy in a Japanese community population – a pilot study to develop an educational programme. *Health Expect*. 2018;21:814–21.

22. Furue M, Onozuka D, Takeuchi S, Murota H, Sugaya M, Masuda K, et al. Poor adherence to oral and topical medication in 3096 dermatological patients as assessed by the Morisky Medication Adherence Scale-8. *Br J Dermatol*. 2015;172:272–5.

23. Murota H, Takeuchi S, Sugaya M, Tanioka M, Onozuka D, Hagihara A, et al. Characterization of socioeconomic status of Japanese patients with atopic dermatitis showing poor medical adherence and reasons for drug discontinuation. *J Dermatol Sci*. 2015;79:279–87.

24. Nakahara T, Fujita H, Arima K, Taguchi Y, Motoyama S, Furue M. Perception gap between patients and physicians regarding disease burden and treatment satisfaction in atopic dermatitis: findings from an on-line survey. *Jpn J Dermatol*. 2018;128:2843–55. (in Japanese).

25. Patient’s behavior survey in 2017 [homepage on the internet]. Tokyo: Ministry of Health Labour and Welfare. https://www.mhlw.go.jp/toukei/saikin/hw/jyuryo/17/dl/kekka-gaiyo.pdf. Accessed 21 Apr 2021. (in Japanese).

26. Phan NQ, Blome C, Fritz F, Gerss J, Reich A, Ebata T, et al. Assessment of pruritus intensity: prospective study on validity and reliability of the visual analogue scale, numerical rating scale and verbal rating scale in 471 patients with chronic pruritus. *Acta Derm Venereol*. 2012;92:502–7.

27. Silverberg JI, Yosipovitch G, Simpson EL, Kim BS, Wu JJ, Eckert L, et al. Dupilumab treatment results in early and sustained improvements in itch in adolescents and adults with moderate to severe atopic dermatitis: analysis of the randomized phase 3 studies SOLO 1 and SOLO 2, AD ADOL, and CHRONOS. *J Am Acad Dermatol*. 2020;82:1328–36.

28. Reich K, DeLozier AM, Nunes FP, Thyssen JP, Eichenfield LF, Wollenberg A, et al. Baricitinib improves symptoms in patients with moderate-to-severe atopic dermatitis and inadequate response to topical corticosteroids: patient-reported outcomes from two randomized monotherapy phase III trials. *J Dermatolog Treat*. 2020;22:1–10.

29. De Bruin-Weller M, Biedermann T, Bissonnette R, Deleuran M, Foley P, Girolomoni G, et al. Treat-to-target in atopic dermatitis: an international consensus on a set of core decision points for systemic therapies. *Acta Derm Venereol*. 2021;101:adv00402.

**SUPPORTING INFORMATION**

Additional supporting information may be found online in the Supporting Information section.

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**How to cite this article:** Kamei K, Hirose T, Yoshii N, Tanaka A. Burden of illness, medication adherence, and unmet medical needs in Japanese patients with atopic dermatitis: A retrospective analysis of a cross-sectional questionnaire survey. *J Dermatol*. 2021;48:1491-1498. [https://doi.org/10.1111/1346-8138.16054](https://doi.org/10.1111/1346-8138.16054)