ORIGINAL ARTICLE

Poor adherence to medication as assessed by the Morisky Medication Adherence Scale-8 and low satisfaction with treatment in 237 psoriasis patients

Hidehisa SAEKI,[1] Shinichi IMAFUKU,[2] Masatoshi ABE,[3] Yoichi SHINTANI,[4] Daisuke ONOZUKA,[5] Akihito HAGIHARA,[5] Norito KATOH,[6] Hiroyuki MUROTA,[7] Satoshi TAKEUCHI,[8] Makoto SUGAYA,[9] Miki TANIOKA,[10] Sakae KANEKO,[11] Koji MASUDA,[6] Takaaki HIRAGUN,[12] Naoko INOMATA,[13] Yuki KITAMI,[14] Yuichiro TSUNEMI,[15] Shinya ABE,[16] Miwa KOBAYASHI,[17] Donald E. MORISKY,[18] Masutaka FURUE[19]

[1]Department of Dermatology, Nippon Medical School, Tokyo, [2]Department of Dermatology, Faculty of Medicine, Fukuoka University, Fukuoka, [3]Kojinkai Sapporo Skin Clinic, Sapporo, [4]Department of Geriatric and Environmental Dermatology, Nagoya City University Graduate School of Medical Sciences, Nagoya, [5]Department of Health Services Management and Policy, Kyushu University, Fukuoka, [6]Department of Dermatology, Kyoto Prefectural University of Medicine Graduate School of Medical Science, Kyoto, [7]Department of Dermatology, Graduate School of Medicine, Osaka University, Osaka, [8]Department of Dermatology, Federation of National Public Service Personnel Mutual Aid Associations, Hamanomachi Hospital, Fukuoka, [9]Department of Dermatology, Faculty of Medicine, University of Tokyo, Tokyo, [10]Department of Dermatology, Graduate School of Medicine, Kyoto University, Kyoto, [11]Department of Dermatology, Shimane University Faculty of Medicine, Shimane, [12]Department of Dermatology, Integrated Health Sciences, Institute of Biomedical and Health Sciences, Hiroshima University, Hiroshima, [13]Department of Environmental Immuno-Dermatology, Yokohama City University Graduate School of Medicine, Kanagawa, [14]Department of Dermatology, Showa University School of Medicine, [15]Department of Dermatology, Tokyo Women's Medical University, Tokyo, [16]Department of Dermatology, Kanazawa Medical University, Ishikawa, [17]Department of Dermatology, University of Occupational and Environmental Health, Kitakyushu, Japan, [18]Department of Community Health Sciences, UCLA Fielding School of Public Health, Los Angeles, California, USA, [19]Department of Dermatology, Kyushu University, Fukuoka, Japan

ABSTRACT

Previously we assessed the medication adherence for oral and topical remedies by a translated Japanese version of the Morisky Medication Adherence Scale-8 (MMAS-8) together with socioeconomic backgrounds in 3096 Japanese dermatological patients, and found the medication adherence, especially to topical drugs, was poor in these patients. In order to elucidate the disease-specific sociomedical factors, we further sub-analyzed the medication adherence in 237 psoriasis patients and compared it with that in other dermatological diseases such as atopic dermatitis, urticaria or tinea. This study was conducted among patients registered in monitoring system and 3096 eligible patients were enrolled. Our web-based questionnaire included the following items such as age, sex, annual income, main health-care institution, experience of effectiveness by oral or topical medication, overall satisfaction with treatment, and MMAS-8 for oral or topical medication. Mean adherence score by MMAS-8 was 5.2 for oral and 4.3 for topical medication. More patients with psoriasis used a university hospital and fewer used a private clinic compared with those with the other skin disease patients. Experience of drug effectiveness by oral medication and overall satisfaction with treatment was lower in psoriasis patients than in other patients. In oral medication, significantly better adherence was observed in those of higher age and with higher annual income. The adherence to medication, especially to topical drugs, was poor in 237 psoriasis patients. We speculated that some severe psoriasis patients were not sufficiently treated systemically and were resistant to topical therapy, leading to poor adherence.

Key words: adherence, Morisky Medication Adherence Scale-8, psoriasis, sociomedical factor, treatment satisfaction.

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INTRODUCTION

Recent studies have shown that adherence to treatment is an important factor for good therapeutic outcome in various chronic disorders such as hypertension, diabetes and inflammatory bowel disease.[1–3] Poor adherence often results in treatment failure and relapse of a disease. In dermatology, a patient's non-adherence to therapy is also problematic and has been associated with a poor therapeutic outcome in common skin diseases such as atopic dermatitis and psoriasis.[4,5] Recently, an eight-item self-reporting scale has been developed by Morisky *et al.*[6] called the Morisky Medication Adherence Scale-8 (MMAS-8). Although this scale originally targeted oral medication for hypertensive patients, we recently assessed the medication adherence for oral and topical remedies using a translated Japanese version of MMAS-8 together with socioeconomic backgrounds in 3096 Japanese patients with atopic dermatitis, urticaria, psoriasis or tinea.[7] Because the Cronbach's alpha score was more than 0.7, the Japanese version of MMAS-8 was considered to have a moderate to high level of reliability. The medication adherence, especially to topical drugs, was very poor in these dermatological patients. Poor adherence to topical remedies was variably associated with younger age, female sex, experience of drug effectiveness and dissatisfaction with treatment. In order to elucidate the disease-specific sociomedical factors, we further sub-analyzed the medication adherence in 237 psoriasis patients and compared it with that in other dermatological diseases such as atopic dermatitis, urticaria or tinea.

METHODS

Setting and study population

This study was conducted among patients registered in a monitoring system established by Macromill (Tokyo, Japan), which was described elsewhere.[7] In brief, a total of 3096 eligible patients (atopic dermatitis [*n* = 1327], urticaria [*n* = 751], psoriasis [*n* = 237] or tinea [*n* = 781]) were enrolled. Our web-based questionnaire included the following items: age, sex, marital status, annual income, employment status, educational status, smoking habit, alcohol consumption, frequency of hospital visits, main health-care institution, oral or topical medication, experience of effectiveness by oral or topical medication, experience of adverse events by oral or topical medication, overall satisfaction with treatment, and MMAS-8 for oral or topical medication.

Translation of MMAS-8

The original MMAS-8 was translated into Japanese according to international guidelines as described elsewhere.[7,8] In brief, translation of the original questionnaire from English to Japanese was done by two qualified independent linguistic translators. One of the Japanese researchers reviewed the two primary versions and compared them with the original. Translation back to English from Japanese was carried out by another translator and sent to the original author. Inconsisten-

Table 1. Basic characteristics of psoriasis patients (*n* = 237)

Characteristics	*n*	%
Age, mean (SD; range, years	51.8 (13.5; 19–84)	
Sex		
Male	176	74.3
Female	61	25.7
Marital state		
Married	71	30.0
Unmarried	166	70.0
Annual income		
≥6 million yen	84	38.4
<6 million yen	135	61.6
Employment		
Employed	154	69.1
Unemployed	69	30.9
Education		
University graduates	122	51.7
Did not graduate	114	48.3
Smoking		
Smoker	59	25.0
Non-smoker	177	75.0
Alcohol		
≥Once a month	166	70.3
<Once a month	70	29.7
Frequency of hospital visits		
≥Once a half year	214	90.3
<Once a half year or unknown	23	9.7
Main health-care institution		
University hospital	31	13.3
Municipal hospital	59	25.2
Private clinics and others	144	61.5
Oral medication		
Experience of drug effectiveness		
Yes	78	69.6
No	34	30.4
Experience of adverse events		
Yes	24	21.4
No	88	78.6
Topical medication		
Experience of drug effectiveness		
Yes	179	82.9
No	37	17.1
Experience of adverse events		
Yes	33	15.3
No	183	84.7
Overall satisfaction with treatment		
Satisfied	102	43.0
Unsatisfied	135	57.0
Adherence, mean (SD; range)		
Oral medication (*n* = 112)	5.2 (2.0; 0.25–8)	
Topical medication (*n* = 216)	4.3 (2.0; 0.25–8)	
Cronbach's alpha of adherence measure		
Oral medication	0.711	
Topical medication	0.694	

SD, standard deviation.

cies were resolved after repeated discussion among the original author, English translator and Japanese investigators, and a final version was generated. According to the MMAS-8

Table 2. Selected basic characteristics of patients ($n = 3096$)

Characteristics	Atopic dermatitis, $n = 1327$ (42.9%)	Urticaria, $n = 751$ (24.3%)	Psoriasis, $n = 237$ (7.7%)	Tinea, $n = 781$ (25.2%)	P
Main health-care institution					
University hospital	58 (4.4)	25 (3.4)	31 (13.3)	27 (3.5)	<0.001
Municipal hospital	216 (16.4)	135 (18.1)	59 (25.2)	145 (18.6)	
Private clinics and others	1044 (79.2)	586 (78.6)	144 (61.5)	607 (77.9)	
Oral medication					
Experience of drug effectiveness					
Yes	720 (78.4)	611 (90.8)	78 (69.6)	225 (80.4)	<0.001
No	199 (21.7)	62 (9.2)	34 (30.4)	55 (19.6)	
Experience of adverse events					
Yes	163 (17.7)	124 (18.4)	24 (21.4)	38 (13.6)	0.204
No	756 (82.3)	549 (81.6)	88 (78.6)	242 (86.4)	
Overall satisfaction with treatment					
Satisfied	749 (56.4)	440 (58.6)	102 (43.0)	507 (64.9)	<0.001
Unsatisfied	578 (43.6)	311 (41.4)	135 (57.0)	274 (35.1)	

Table 3. Adherence levels by the type of medications among psoriasis patients

	High, n (%)	Medium, n (%)	Low, n (%)	P
Oral medication ($n = 112$)	14 (12.5)	36 (32.1)	62 (55.4)	<0.001
Topical medication ($n = 216$)	12 (5.6)	39 (18.1)	165 (76.4)	

(0–8 points), adherence was categorized as high adherence (score, 8), medium adherence (score, 6 to <8) and low adherence (score, <6).[6]

Statistical analysis

Descriptive statistics were used to describe demographic and disease classification of the patients and their medication adherence scores. Proportions and frequencies for categorical variables were calculated, while means and standard deviations were calculated for continuous variables. The characteristics of the whole sample and of the adherent groups produced by the MMAS-8 score were presented. The χ^2-test for categorical variables or ANOVA for continuous variables was used to evaluate the prevalence of study variables among the three adherent groups. Internal consistency was assessed using Cronbach's alpha. Known group validity was assessed through the association of item and MMAS categories by correlation coefficient and covariance. All analyses were performed using STATA version 9 (StataCorp, College Station, TX, USA). The significance level was set at $P < 0.05$.

RESULTS

Demographic data

Demographic data of 237 psoriasis patients are summarized in Table 1. Mean age of the subjects was 51.8 years (range, 19–84) and 74.3% of the participants were male. We also report their marital status, annual income, employment status, educational status, smoking habit and alcohol consumption in

Table 1. A total of 90.3% of subjects visited their hospitals once a half year or more and 61.5% used a private clinic or other local facility as their main health-care institution. As for the experience of drug effectiveness, 69.6% and 82.9% of the subjects had experienced effectiveness of oral and topical medication, respectively, and 21.4% and 15.3% had experienced adverse events from such medication, respectively. In terms of their overall satisfaction with treatment, 43.0% of subjects expressed satisfaction. Among 237 participants, a total of 112 took oral medication and 216 were treated with topical medication. Mean adherence score by MMAS-8 was 5.2 for oral and 4.3 for topical. Reliability score (i.e. Cronbach's alpha) was 0.711 for oral MMAS-8 and 0.694 for topical MMAS-8, which confirmed moderate to high reliability of the Japanese version of the MMAS-8 also in psoriasis patients.

Next, we compared demographic data among patients with four diseases: atopic dermatitis, urticaria, psoriasis and tinea (Table 2, Table S1). With regard to the main health-care institution, more patients with psoriasis used a university hospital and fewer used a private clinic compared with those with atopic dermatitis, urticaria or tinea. Experience of drug effectiveness by oral medication and overall satisfaction with treatment was lower in psoriasis patients than in other disease patients (Table 2).

Adherence levels by the type of medication

Adherence levels were compared by the type of medication (i.e. oral and topical) (Table 3). Percentages of high, medium

Table 4. Prevalence of study variables for the three adherence levels among psoriasis patients: oral medication (*n* = 112)

Characteristics	High adherence *n* = 14 (12.5%)	Medium adherence *n* = 36 (32.1%)	Low adherence *n* = 62 (55.4%)	P
Age, mean (SD), years	58.64 (12.71)	54.78 (13.30)	46.73 (13.18)	0.001
Sex				
Male	12 (15.0)	25 (31.3)	43 (53.8)	0.551[†]
Female	2 (6.3)	11 (34.4)	19 (59.4)	
Marital state				
Married	3 (7.5)	13 (32.5)	24 (60.0)	0.475
Unmarried	11 (15.3)	23 (31.9)	38 (52.8)	
Annual income				
≥6 million yen	10 (27.0)	9 (24.3)	18 (48.7)	0.007[†]
<6 million yen	3 (4.7)	24 (37.5)	37 (57.8)	
Employment				
Employed	7 (9.6)	22 (30.1)	44 (60.3)	0.468[†]
Unemployed	5 (16.7)	10 (33.3)	15 (50.0)	
Education				
University graduates	5 (9.6)	13 (25.0)	34 (65.4)	0.117
Did not graduate	9 (15.3)	23 (39.0)	27 (45.8)	
Smoking				
Smoker	3 (9.7)	10 (32.3)	18 (58.1)	0.872[†]
Non-smoker	11 (13.8)	26 (32.5)	43 (53.8)	
Alcohol				
≥Once a month	8 (11.1)	23 (31.9)	41 (56.9)	0.720[†]
<Once a month	6 (15.4)	13 (33.3)	20 (51.3)	
Frequency of hospital visits				
≥Once a half year	13 (12.2)	34 (31.8)	60 (56.1)	0.531[†]
<Once a half year or unknown	1 (20.0)	2 (40.0)	2 (40.0)	
Main health-care institution				
University hospital	4 (28.6)	6 (42.9)	4 (28.6)	0.062[†]
Municipal hospital	4 (14.8)	5 (18.5)	18 (66.7)	
Private clinics and others	6 (8.7)	24 (34.8)	39 (56.5)	
Experience of drug effectiveness				
Yes	10 (12.8)	30 (38.5)	38 (48.7)	0.064[†]
No	4 (11.8)	6 (17.7)	24 (70.6)	
Experience of adverse events				
Yes	1 (4.2)	11 (45.8)	12 (50.0)	0.182[†]
No	13 (14.8)	25 (28.4)	50 (56.8)	
Overall satisfaction with treatment				
Satisfied	5 (9.8)	22 (43.1)	24 (47.1)	0.073
Unsatisfied	9 (14.8)	14 (23.0)	38 (62.3)	

[†]Fisher's exact test. SD, standard deviation.

and low adherence were 12.5%, 32.1% and 55.4% for oral medication, and 5.6%, 18.1% and 76.4% for topical medication, respectively. Overall adherence status was thus significantly higher for oral than for topical medication (Table 3).

Prevalence of study variables among the high, medium and low adherence levels

As the adherence levels varied depending upon the type of medication, we next analyzed the association between study variable and the level of adherence in subjects with oral medication (*n* = 112) and with topical medication (*n* = 216). In oral medication, the variable which significantly influenced the adherence level was age and annual income (Table 4). Significantly better adherence was observed in those of higher age and with higher annual income (≥6 million yen). In topical medi-

cation, there were no variables which significantly affected the adherence level (Table 5).

DISCUSSION

Low adherence rate has been reported in patients with the chronic dermatological diseases atopic dermatitis, psoriasis, urticaria and tinea,[4,5,9–13] however, few comparative studies have been performed among these diseases. We recently investigated the MMAS-8 in 3096 Japanese dermatological patients with one of the above four diseases, and found apparently lower adherence rates compared with other systemic diseases such as hypertension, diabetes and osteoporosis.[2,6,7,14,15] In this study, we sub-analyzed the medication adherence in 237 psoriasis patients and compared it with that in other dermatological

Table 5. Prevalence of study variables for the three adherence levels among psoriasis patients: topical medication (n = 216)

Characteristics	High adherence n = 12 (5.6%)	Medium adherence n = 39 (18.1%)	Low adherence n = 165 (76.4%)	P
Age, mean (SD), years	57.00 (10.19)	54.23 (12.65)	50.87 (13.71)	0.144
Sex				
Male	9 (5.7)	29 (18.2)	121 (76.1)	1.000[†]
Female	3 (5.3)	10 (17.5)	44 (77.2)	
Marital state				
Married	4 (6.1)	10 (15.2)	52 (78.8)	0.790[†]
Unmarried	8 (5.3)	29 (19.3)	113 (75.3)	
Annual income				
≥6 million yen	7 (9.1)	12 (15.6)	58 (75.3)	0.193[†]
<6 million yen	4 (3.3)	24 (19.8)	93 (76.9)	
Employment				
Employed	6 (4.3)	22 (15.8)	111 (79.9)	0.480[†]
Unemployed	4 (6.2)	14 (21.5)	47 (72.3)	
Education				
University graduates	4 (3.7)	15 (14.0)	88 (82.2)	0.117
Did not graduate	8 (7.4)	24 (22.2)	76 (70.4)	
Smoking				
Smoker	1 (1.9)	11 (20.4)	42 (77.8)	0.436[†]
Non-smoker	11 (6.8)	28 (17.4)	122 (75.8)	
Alcohol				
≥Once a month	5 (3.2)	28 (18.1)	122 (78.7)	0.075[†]
<Once a month	7 (11.7)	11 (18.3)	42 (70.0)	
Frequency of hospital visits				
≥Once a half year	11 (5.6)	38 (19.5)	146 (74.9)	0.238[†]
<Once a half year or unknown	1 (4.8)	1 (4.8)	19 (90.5)	
Main health-care institution				
University hospital	1 (4.2)	1 (4.2)	22 (91.7)	0.060[†]
Municipal hospital	6 (11.5)	8 (15.4)	38 (73.1)	
Private clinics and others	5 (3.6)	30 (21.7)	103 (74.6)	
Experience of drug effectiveness				
Yes	12 (6.7)	29 (16.2)	138 (77.1)	0.096[†]
No	0 (0.0)	10 (27.0)	27 (73.0)	
Experience of adverse events				
Yes	1 (3.0)	3 (9.1)	29 (87.9)	0.294[†]
No	11 (6.0)	36 (19.7)	136 (74.3)	
Overall satisfaction with treatment				
Satisfied	6 (6.5)	22 (23.9)	64 (69.6)	0.117
Unsatisfied	6 (4.8)	17 (13.7)	101 (81.5)	

[†]Fisher's exact test.

diseases to elucidate the disease-specific sociomedical factors. A total of 74.3% of participants were male, which reflected a survey showing that approximately twice as many males as females have psoriasis in Japan.[16] With regard to main health-care institutions, more patients with psoriasis used a university hospital and fewer used a private clinic compared with patients with other dermatological diseases (Table 2). The low prevalence of psoriasis in Asian people in general as compared with Caucasians is well recognized, and the prevalence of Japanese psoriasis patients is estimated at approximately 0.1%,[17] which is apparently much lower than that of the other dermatological disorders such as atopic dermatitis, urticaria and tinea. In Japan, however, a nationwide, cross-sectional, hospital-based study showed that the top seven skin diseases were miscellaneous eczema followed, in order, by atopic dermatitis, tinea pedis, urticaria/angioedema, tinea unguium, viral warts and psoriasis;[18] this indicated that more patients with psoriasis tended to visit hospitals compared with those with other dermatological diseases, which is consistent with our result. Although the severity of skin diseases was not investigated in this study, it seems that patients with psoriasis were afflicted more severely and were more resistant to treatment than those with other skin diseases. Actually, experience of effectiveness by oral medication and overall satisfaction with treatment was lower in psoriasis patients than in other disease patients (Table 2).

There have been studies indicating that the adherence to topical remedies is poorer than that to systemic drugs,[5,19] which was also confirmed by the present study (Table 3). Because the adherence to oral and topical drugs was different, we further analyzed the association between study variable

and the level of adherence in oral and topical medication. There were no variables which significantly affected the adherence level in topical medication (Table 5), whereas significantly better adherence was observed in patients of higher age and with higher annual income in oral medication (Table 4). Although the contents of the latter were not investigated in this study, it is possible that in patients of higher age and annual income, more were treated with potent and expensive drugs such as cyclosporin and etretinate than those of lower age and lower annual income group. It seems that the adherence to potent and expensive drugs is higher than that to mild and inexpensive drugs such as antihistamines and anti-allergic drugs for pruritus. The effectiveness by topical medication was relatively high but the topical adherence and treatment satisfaction were low, indicating that a large number of psoriasis patients have locally refractory lesions which caused low adherence and satisfaction. It is very important to improve the application methods for locally refractory lesions. The combined use of local phototherapy also seems effective to overcome this situation. In addition, we cannot rule out the possibility that some severe psoriasis patients were not sufficiently treated systemically and were resistant to topical therapy, leading to poor adherence. In order to overcome this situation and achieve better adherence to topical treatment, it seems necessary not only to educate severe psoriasis patients on effective topical therapy, but also to provide enough systemic treatment to make the skin lesions smaller and thereby suitable for topical treatment.

There were some limitations in the present study. The number of psoriasis patients was relatively small. In addition, the marital status showed that unmarried patients was 70.0%, which seemed high, and the annual income lower than 6 million yen was 61.6%, which seemed relatively high. We cannot rule out the possibility that the population of this study does not precisely reflect the real distribution of psoriasis patients, causing some bias in the result of this study. Furthermore, because of the length of the questionnaire, we did not include items about clinical types of psoriasis, disease severity, and the contents of topical and oral treatments. It seems interesting to compare the MMAS-8 scores in different clinical types and different treatments including biologics.

In conclusion, the adherence to medication, especially to topical drugs, was poor in 237 psoriasis patients. Experience of drug effectiveness and overall satisfaction with treatment was lower in psoriasis patients compared with other skin disease patients. In oral medication, significantly better adherence was observed in those of higher age and higher annual income. Further adherence studies on a large scale will be necessary to elucidate the psoriasis-specific sociomedical factors in more detail.

CONFLICT OF INTEREST: None declared.

REFERENCES

1 Krousel-Wood M, Islam T, Webber LS et al. New medication adherence scale versus pharmacy fill rates in seniors with hypertension. Am J Manag Care 2009; 15: 59–66.
2 Al-Qazaz HKh, Hassali MA, Shafie AA, Sulaiman SA, Sundram S, Morisky DE. The eight-item Morisky Medication Adherence Scale MMAS: translation and validation of the Malaysian version. Diabetes Res Clin Pract 2010; 90: 216–221.
3 Trindade AJ, Ehrlich A, Kornbluth A, Ullman TA. Are your patients taking their medicine? Validation of a new adherence scale in patients with inflammatory bowel disease and comparison with physician perception of adherence. Inflamm Bowel Dis 2011; 17: 599–604.
4 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: 409–417.
5 Zschocke I, Mrowietz U, Karakasili E, Reich K. Non-adherence and measures to improve adherence in the topical treatment of psoriasis. J Eur Acad Dermatol Venereol 2014; 28 (Suppl 2): 4–9.
6 Morisky DE, Ang A, Krousel-Wood M, Ward HJ. Predictive validity of a medication adherence measure in an outpatient setting. J Clin Hypertens (Greenwich) 2008; 10: 348–354.
7 Furue M, Onozuka D, Takeuchi S et al. Poor adherence to oral and topical medication in 3096 dermatological patients as assessed by Morisky Medication Adherence Scale-8. Br J Dermatol 2015; 172: 272–275.
8 Wild D, Grove A, Martin M et al. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: report of the ISPOR task force for translation and cultural adaptation. Value Health 2005; 8: 94–104.
9 Krejci-Manwaring J, Tusa MG, Carroll C et al. Stealth monitoring of adherence to topical medication: adherence is very poor in children with atopic dermatitis. J Am Acad Dermatol 2007; 56: 211–216.
10 Brown KK, Rehmus WE, Kimball AB. Determining the relative importance of patient motivations for nonadherence to topical corticosteroid therapy in psoriasis. J Am Acad Dermatol 2006; 55: 607–613.
11 Gokdemir G, Ari S, Köşlü A. Adherence to treatment in patients with psoriasis vulgaris: Turkish experience. J Eur Acad Dermatol Venereol 2008; 22: 330–335.
12 Conlon NP, Edgar JD. Adherence to best practice guidelines in chronic spontaneous urticaria (CSU) improves patient outcome. Eur J Dermatol 2014; 24: 385–386.
13 Koehler AM, Maibach HI. Electronic monitoring in medication adherence measurement. Implications for dermatology. Am J Clin Dermatol 2001; 2: 7–12.
14 Wilke T, Müller S, Morisky DE. Toward identifying the causes and combinations of causes increasing the risks of nonadherence to medical regimens: combined results of two German self-report surveys. Value Health 2011; 14: 1092–1100.
15 Reynolds K, Viswanathan HN, Muntner P et al. Validation of the Osteoporosis-Specific Morisky Medication Adherence Scale in long-term users of bisphosphonates. Qual Life Res 2014; 23: 2109–2120.
16 Kawada A, Tezuka T, Nakamoto Y et al. A survey of psoriasis patients in Japan from 1982 to 2001. J Dermatol Sci 2003; 31: 59–64.
17 Aso K, Amano M. Number of psoriasis patients patients in Yamagata prefecture. Hifu Rinsho 1984; 26: 585–589. (In Japanese.)
18 Furue M, Yamazaki S, Jimbow K et al. Prevalence of dermatological disorders in Japan: a nationwide, cross-sectional, seasonal, multicenter, hospital-based study. J Dermatol 2011; 38: 310–320.
19 Dréno B, Thiboutot D, Gollnick H et al. Large-scale worldwide observational study of adherence with acne therapy. Int J Dermatol 2010; 49: 448–456.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:
Table S1. Basic characteristics of patients (*n* = 3096).