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# Disease and Treatment Characteristics in Geriatric Psoriasis: A Patient Survey Comparing Age Groups

Marieke E. C. VAN WINDEN<sup>1</sup>, Elke L. M. TER HAAR<sup>1</sup>, Hans M. M. GROENEWOUD<sup>2</sup>, Peter C. M. VAN DE KERKHOF<sup>1</sup>, Elke M. G. J. DE JONG<sup>1</sup> and Satish F. K. LUBEEK<sup>1</sup>

<sup>1</sup>Department of Dermatology, and <sup>2</sup>Department for Health Evidence, Radboud University Medical Centre, Nijmegen, The Netherlands

**Little is known about psoriasis in geriatric patients, whereas treating this growing population can be challenging due to comorbidities, comedication and physical impairments. To compare disease and treatment characteristics of psoriasis patients  $\geq 65$  years old with patients  $< 65$  years old, a self-assessment survey was sent to all members of the Dutch Psoriasis Association ( $n = 3,310$ ). In total, 985 (29.7%) patients returned the survey, 414 (43.6%) respondents were  $\geq 65$  years old. Patients  $\geq 65$  years old had experienced erythrodermic psoriasis significantly more frequently than patients  $< 65$  years old, other disease characteristics were highly comparable. Despite a significantly higher prevalence of comorbidities and comedication use in patients  $\geq 65$  years old, no difference was seen between the age groups regarding systemic antipsoriatic treatment (38.3% in  $\geq 65$  years old vs 42.3% in  $< 65$  years old;  $p = 0.219$ ). Remarkably, treatment-related side-effects were reported more frequently by patients  $< 65$  years old. In conclusion, age alone should not be a limiting factor in psoriasis management, and proper attention must be paid to additional patient-related factors.**

**Key words:** psoriasis; dermatological agents; frail elderly; aged; geriatric population; surveys; questionnaires.

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**Corr:** Marieke van Winden, Department of Dermatology, Radboudumc, PO Box 9101, 6500HB Nijmegen, The Netherlands. E-mail: Marieke.vanWinden@radboudumc.nl

Psoriasis is an immune-mediated inflammatory disease which is frequently seen in older adults. As the ageing world population continues to expand, dermatologists will increasingly be confronted with patients aged 65 years and older. Although the exact prevalence of psoriasis in older adults is unknown, it is estimated to range from 1% to 19% (1–3). Balancing the possible risks of antipsoriatic therapies in older adults and optimal psoriasis treatment can be challenging, due to factors such as comorbidities, concomitant medication, physical impairments and changing pharmacokinetics and pharmacodynamics (4, 5).

Little research has been conducted concerning disease and treatment characteristics in older psoriasis patients, or “geriatric psoriasis” (Fig. S1<sup>1</sup>). The few available studies show similar disease severity compared with younger patients, although prescribed therapies appear

## SIGNIFICANCE

Little is known about geriatric psoriasis, although health problems and medication can complicate the management of psoriasis. To compare characteristics of patients  $\geq 65$  years old with those  $< 65$  years old, a survey was sent to all members (3,310) of the Dutch Psoriasis Association. In total, 985 (29.7%) patients returned the survey, 414 (43.6%) respondents were  $\geq 65$  years old. Despite more comorbidities and medication use in  $\geq 65$  years old, no difference was seen between age groups regarding systemic antipsoriatic treatment (38.3% vs 42.3%). Side-effects were reported more frequently by patients  $< 65$  years old. Thus, age alone should not limit psoriasis treatment, and proper attention must be paid to patient-related factors.

to differ (6, 7). Moreover, data concerning the use of systemic treatment in geriatric psoriasis are scarce, since older adults are frequently excluded from clinical trials (8, 9). Therefore, it is currently unclear what risks are associated with antipsoriatic treatment in this growing population and whether geriatric patients with psoriasis are treated optimally.

To improve patient-centred clinical care in geriatric psoriasis, more knowledge needs to be acquired in this particular patient group. The objective of this study was therefore to provide more insight into the disease and treatment characteristics in older adults with psoriasis compared with younger patients.

## MATERIALS AND METHODS

### Study design and participants

A nationwide cross-sectional study was conducted to assess the clinical characteristics of older adult patients with psoriasis, as well as current and previous treatments. A self-assessing multimodality survey was sent to all members of the Dutch Psoriasis Association ( $n = 3,310$ ), along with study information and a prepaid envelope. In addition to this paper-based version, a hyperlink to the online web-based survey (Qualtrics, Provo, UT, USA) was provided and printed repeatedly in the Dutch Psoriasis Association Magazine. Returning the survey was construed as informed consent. Approval from the Research Ethics Committee of Radboud University Medical Centre was obtained before starting the study. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) criteria (10).

<sup>1</sup><https://www.medicaljournals.se/acta/content/abstract/10.2340/00015555-3569>

## Survey

A survey was developed based on an extensive review of the literature, patient interviews, and multiple meetings with a multidisciplinary focus group consisting of physicians in dermatology and rheumatology, (specialized) nurses, clinical researchers, and a dermato-psychologist. The survey included multiple sections enquiring about sociodemographic aspects, psoriasis characteristics and associated therapy using multiple choice questions, Likert scales, and visual analogue scales. Furthermore, open-ended questions were added to each section to further evaluate relevant items not captured by the questions included in the survey, answers were categorized for further analyses. Disease severity was measured using the Self-Administered Psoriasis Area Severity Index (SAPASI), a validated patient-assessed instrument based on the frequently used Psoriasis Area Severity Index (11). The SAPASI ranges from 0 to 72 and can be classified into 4 categories: in remission (SAPASI=0), mild ( $>0 \leq 3$ ), moderate ( $>3 \leq 15$ ) and severe ( $>15$ ) (12). Prescribed therapies were categorized into 4 different groups: topical therapy, phototherapy, conventional systemic therapy, and modern systemic therapy (biologics and small-molecule inhibitors). Body mass index (BMI) was calculated based on reported weight and height. Polypharmacy was defined as the simultaneous use of 5 or more medications (13). A pilot study was performed in 10 geriatric patients with psoriasis prior to distribution of the survey to improve its quality, and assess the relevance and comprehensibility of the questions, instructions and response options.

## Data processing and analysis

Data were processed anonymously using the automatic form identification software Remark Office Optical Mark Recognition, version 9.5 (Gravic, Inc. Malvern, PA, USA) and Castor Electronic Data Capture, a web-based data management system in compliance with Good Clinical Practice (GCP) standards (Castor Research Inc., Hoboken, NJ, USA). To ensure correct data entry, 10% of the data entry was checked manually by an independent researcher who was not involved in data entry. Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 25.0 (IBM, Armonk, NY, USA). Descriptive statistics were used to summarize categorical data as frequencies and percentages and continuous variables as mean  $\pm$  standard deviation (SD) or median (range), as appropriate according to the distribution of the data. Missing values were excluded from analyses. Patients were categorized into 2 age groups; patients  $\geq 65$  years old and patients  $<65$  years old. Comparisons were made using Student's *t*-test or Mann-Whitney *U* test for continuous variables, and the  $\chi^2$  or Fisher's exact test for categorical variables. Subgroup analyses were performed comparing outcome measures of patients  $\geq 80$  years old with patients  $<80$  years old, and comparing patients with early disease onset (onset of symptoms before the age of 40 years) and patients with late disease onset (onset of symptoms after the age of 40 years) (14). Logistic regression was used to correct for confounding variables and to determine odds ratios (ORs). Age and sex distribution of the respondent population were compared with the target population to test for non-response bias, using available current data on the members of the Dutch Psoriasis Association and previous research in this population (15).

## RESULTS

## Study participants

Between 11 December 2018 and 4 September 2019, 3,310 patients with psoriasis were approached for participation. In total, 985 (29.7%) surveys were returned.

Due to missing age values, 27 respondents were excluded from analyses. Eight more respondents were excluded from analyses due to an insufficient number of answered items (e.g. responses to age and sex only). The remaining 950 respondents were suitable for analysis. The mean  $\pm$  SD age was  $61.1 \pm 13.7$  years, range 7–95, and 414 (43.6%) of the respondents were  $\geq 65$  years old. Of these, 58 (14.0%) respondents were  $\geq 80$  years old. A full overview of responder characteristics is given in **Table I**. Although a significant difference in sex was seen between patients  $\geq 65$  years old vs those  $<65$  years old, results after stratification for sex did not differ from the main analysis (data not shown).

Non-response bias was assessed by comparing age and sex distribution of the study respondents with the target population; no significant differences were found (Table S1<sup>1</sup>). Since 95.5% ( $n=879$ ) of the surveys were returned in the winter, an additional analysis on seasonal difference was performed; no significant impact on outcome measures was seen. There were no significant differences in outcome measures between paper-based and web-based responses (data not shown).

## Comorbidities and medical history

Except for depression, all reported comorbidities were significantly more common in patients  $\geq 65$  years old, as

**Table I. Responder characteristics of geriatric psoriasis patients ( $\geq 65$  years old) compared with patients  $<65$  years old**

	$<65$ years old ( $n=536$ )	$\geq 65$ years old ( $n=414$ )	<i>p</i> -value
Sex, <i>n</i> (%)			$<0.001$
Male	247 (46.2)	246 (59.6)	
Female	288 (53.8)	167 (40.4)	
Age, years, median (range)	56 (7–64)	71 (65–95)	NA
Mean $\pm$ SD	$52.4 \pm 11.4$	$72.4 \pm 5.9$	
Age at onset, <i>n</i> (%)			NA
Early onset <sup>a</sup>	459 (85.6)	305 (73.7)	
Late onset <sup>b</sup>	74 (13.8)	108 (26.1)	
Unknown	2 (0.4)	0 (0.0)	
Family history of psoriasis, <i>n</i> (%)			0.719
Positive <sup>c</sup>	333 (62.2)	266 (64.6)	
Negative	118 (22.1)	88 (21.4)	
Unknown	84 (15.7)	58 (14.1)	
Medical history, <i>n</i> (%)			
Overweight (BMI $>25$ )	285 (53.7)	250 (62.3)	0.008
Hypertension	108 (20.5)	197 (49.0)	$<0.001$
Hypercholesterolaemia	68 (12.9)	149 (37.3)	$<0.001$
Myocardial infarction	10 (1.9)	35 (8.8)	$<0.001$
Heart failure	21 (4.0)	66 (16.6)	$<0.001$
Cerebral vascular accident	9 (1.7)	22 (5.5)	0.002
Diabetes mellitus	25 (4.7)	64 (15.9)	$<0.001$
Cancer <sup>d</sup>	44 (8.3)	94 (23.2)	$<0.001$
Depression	99 (18.9)	69 (17.3)	0.530
Use of comedication <sup>e</sup> <i>n</i> (%)	236 (44.7)	306 (75.6)	$<0.001$

Values might not add up due to missing values.

<sup>a</sup>Defined as onset of symptoms before and <sup>b</sup>after the age of 40 years (14).

<sup>c</sup>Including all family members affected by psoriasis. Separate analyses were done only including first-degree family members; 233 (43.6%) patients  $<65$  years old reported 1 or more affected first-degree family members, compared with 206 (50.0%) patients  $\geq 65$  years old ( $p=0.142$ ). <sup>d</sup>Excluding non-melanoma skin cancer ( $n=25$ ). In uncertain cases (e.g. 30 patients reported "skin cancer"), patients were included in the analysis. <sup>e</sup>Other than psoriasis medication.

NA: not applicable, since the categorization of patients in separate age groups automatically leads to differences in age-related variables; BMI: body mass index; SD: standard deviation.

is illustrated in Table I. A cardiovascular risk profile (e.g. obesity, hypertension, hypercholesterolaemia, diabetes mellitus, myocardial infarction, heart failure and cerebral vascular accident) was more prevalent in patients  $\geq 65$  years old compared with patients  $< 65$  years old. Moreover, patients  $\geq 65$  years old had a significantly higher BMI (median 26.2 (range 17.7–65.9 kg/m<sup>2</sup>) in  $\geq 65$  years old vs 25.4 (14.3–56.1 kg/m<sup>2</sup>) in  $< 65$  years old;  $p=0.006$ ). A (history of) malignancy was significantly more often reported by patients  $\geq 65$  years old compared with patients  $< 65$  years old ( $n=94$  (23.2%) vs 44 (8.3%) respectively;  $p<0.001$ ). Of all patients reporting a (history of) malignancy, 71 (43.3%) reported skin cancers (35.2% non-melanoma skin cancer, 22.5% melanoma, 42.3% unknown type of skin cancer).

The use of concomitant medication was reported by 306 (75.6%) patients  $\geq 65$  years old, vs 236 (44.7%) patients  $< 65$  years old ( $p<0.001$ ). The most frequently used types of concomitant medication were cardiovascular drugs ( $n=211$  (69.0%)  $\geq 65$  years old vs  $n=104$  (44.1%)  $< 65$  years old;  $p<0.001$ ) and antidiabetic drugs ( $n=42$  (13.7%)  $\geq 65$  years old vs  $n=21$  (8.9%)  $< 65$  years old;  $p=0.004$ ). Moreover, polypharmacy was significantly more prevalent in patients  $\geq 65$  years old ( $n=103$  (30.7%)  $\geq 65$  years old vs  $n=47$  (13.9%)  $< 65$  years old;  $p<0.001$ ).

### Disease characteristics

As shown in Table II, plaque psoriasis and psoriasis capitis were the most frequently reported clinical psoriasis types currently present in both patient groups (cumulative prevalence: 67.2% and 70.6%, respectively). Patients  $\geq 65$  years old had experienced erythrodermic psoriasis significantly more frequently than patients  $< 65$  years old ( $n=70$  (17.1%)  $\geq 65$  years old vs  $n=31$  (5.8%)  $< 65$  years old;  $p<0.001$ ). Comparable rates of psoriatic arthritis were reported in both age groups ( $n=158$  (38.5%)  $\geq 65$  years old vs  $n=193$  (36.2%)  $< 65$  years old;  $p=0.464$ ). Guttate and genital psoriasis were significantly more frequently reported by patients  $< 65$  years old. In both groups, patients experienced their first symptoms of psoriasis most frequently before the age of 18 years ( $n=136$  (32.9%)  $\geq 65$  years old vs  $n=219$  (40.9%)  $< 65$  years old). Of all patients  $\geq 65$  years old, 65 (15.7%) reported disease onset after the age of 50 years, 14 (3.4%) respondents reported disease onset after the age of 65 years, as is illustrated in Fig. S2<sup>1</sup>.

A subgroup analysis was performed to compare disease characteristics in patients  $\geq 65$  years old with early disease onset with those with late disease onset. Erythrodermic psoriasis was significantly more frequently reported by patients with early disease onset ( $n=63$  (20.8%) vs  $n=7$  (6.5%);

$p=0.001$ ), as well as psoriasis unguium ( $n=160$  (52.8%) vs  $n=42$  (39.3%);  $p=0.016$ ). Other disease characteristics did not differ between the onset groups.

The majority of all patients had never experienced a period of total skin clearance ( $n=228$  (55.6%)  $\geq 65$  years old vs  $n=302$  (56.7%)  $< 65$  years old;  $n=0.774$ ). Only 82 (8.7%) patients in the total study population experienced a period of total skin clearance longer than 3 years in a row. Although patients  $\geq 65$  years old reported a slightly lower current SAPASI score compared with patients  $< 65$  years old (median 5.24 (0–20.2) in  $\geq 65$  years old vs 5.72 (0–35.5) in  $< 65$  years old;  $p=0.016$ ), disease severity was considerably high in both groups, as most patients currently received antipsoriatic treatment. When comparing the age groups according to categorized SAPASI scores, no significant difference was seen in disease severity; a current moderate disease activity was reported by 266 (68.9%) patients  $\geq 65$  years old, severe

**Table II. Disease and treatment characteristics of geriatric patients with psoriasis ( $\geq 65$  years old) compared with patients  $< 65$  years old**

	$< 65$ years old ( $n=536$ )	$\geq 65$ years old ( $n=414$ )	$p$ -value
Type of psoriasis*, $n$ (%)			
Plaque psoriasis	371 (69.6)	263 (64.1)	0.077
Guttate psoriasis	306 (57.4)	179 (43.7)	$< 0.001$
Pustular psoriasis	24 (4.5)	20 (4.9)	0.787
Psoriasis capitis	378 (70.9)	288 (70.2)	0.821
Erythrodermic psoriasis	31 (5.8)	70 (17.1)	$< 0.001$
Psoriatic arthritis	193 (36.2)	158 (38.5)	0.464
Inverse psoriasis	136 (25.5)	79 (19.3)	0.023
Genital psoriasis	166 (31.1)	69 (16.8)	$< 0.001$
Psoriasis unguium	265 (49.7)	202 (49.3)	0.891
Self-administered PASI, median, range	5.72 (0–35.5)	5.24 (0–20.2)	0.016
Current treatment*, $n$ (%)			
Topicals <sup>a</sup>	353 (66.6)	268 (65.4)	0.691
UV therapy	26 (4.9)	20 (4.9)	0.984
Systemic	224 (42.3)	157 (38.3)	0.219
Conventional systemic <sup>b</sup>	140 (26.4)	107 (26.1)	0.913
Methotrexate	65 (12.3)	50 (12.2)	0.974
Ciclosporin	1 (0.2)	3 (0.7)	0.323
Acitretin	2 (0.4)	6 (1.5)	0.085
Fumaric acid	78 (14.7)	52 (12.7)	0.370
Modern systemic <sup>c</sup>	100 (18.9)	63 (15.4)	0.160
Apremilast	3 (0.6)	3 (0.7)	1.000
Etanercept	15 (2.8)	11 (2.7)	0.891
Adalimumab	38 (7.2)	23 (5.6)	0.336
Infliximab	1 (0.2)	2 (0.5)	0.583
Ustekinumab	31 (5.8)	16 (3.9)	0.174
Secukinumab	5 (0.9)	4 (1.0)	1.000
Ixekizumab	0 (0.0)	3 (0.7)	0.083
Brodalumab	4 (0.8)	0 (0.0)	0.136
Guselkumab	1 (0.2)	1 (0.2)	1.000
Certolizumab pegol	2 (0.4)	0 (0.0)	0.508
No prescribed therapies <sup>d</sup>	87 (16.4)	68 (16.6)	0.944
Side-effects, $n$ (%)	127 (25.9)	72 (19.8)	0.015 <sup>e</sup>

Percentages are presented in relation to all study respondents, values might not add up due to missing values and combination therapies.

\*Patients could select more than 1 answer option.

<sup>a</sup>Including keratolytic agents corticosteroids vitamin D derivatives calcineurin inhibiting agents coal tar combination therapies dithranol (anthralin). <sup>b</sup>Including methotrexate ciclosporin acitretin and fumaric acid. <sup>c</sup>Including apremilast etanercept adalimumab infliximab ustekinumab secukinumab ixekizumab brodalumab guselkumab certolizumab pegol. <sup>d</sup>Defined as no prescribed therapies and non-prescription therapies usage of emollients only homeopathic treatment over-the-counter products and dietary or lifestyle adjustments. <sup>e</sup>After correcting for type of treatment (only topical therapy, UV therapy with or without topical therapy, conventional systemic therapy with or without topical therapy, modern systemic with or without topical therapy and combined systemic therapies with or without topical therapy).

PASI: Psoriasis Area and Severity Index; SAPASI: Self-Administered Psoriasis Area and Severity Index; UV: ultraviolet.

psoriasis was reported by 17 (4.4%) patients  $\geq 65$  years old, whereas 371 (71.1%) patients  $< 65$  years old reported a moderate disease activity and 33 (6.3%) a severe disease activity ( $p=0.260$ ).

#### *Antipsoriatic treatment*

As shown in Table II, there were no significant differences in currently used therapies by patients  $\geq 65$  years old compared with patients  $< 65$  years old. No significant difference was seen between the age groups regarding the use of conventional systemic therapies ( $n=107$  (26.1%)  $\geq 65$  years old vs  $n=140$  (26.4%)  $< 65$  years old;  $p=0.913$ ), nor in the use of modern systemic therapies ( $n=63$  (15.4%)  $\geq 65$  years old vs  $n=100$  (18.9%)  $< 65$  years old;  $p=0.160$ ). A combination of systemic agents was used by 17 (4.1%) patients  $\geq 65$  years old and 22 (4.2%) patients  $< 65$  years old ( $p=0.997$ ). When comparing the specific systemic agents between the age groups, no significant differences were seen. As is shown in Fig. S3<sup>1</sup>, most frequently used systemic agents were fumaric acid, methotrexate and adalimumab in both age groups (cumulative respectively 34.1%, 30.2% and 16.0%). No significant differences between the age groups were seen in previously used therapies.

A separate analysis comparing patients  $\geq 80$  years old ( $n=58$ ) with patients  $< 80$  years old showed systemic treatment usage by 22 (38.6%) patients  $\geq 80$  years old, compared with 359 (40.7%) patients  $< 80$  years old ( $p=0.759$ ). Modern systemic therapies were used in 6 (10.5%) patients  $\geq 80$  years old, compared with 157 (17.8%) patients  $< 80$  years old ( $p=0.161$ ). A significant higher number of patients  $\geq 80$  years old were currently treated with phototherapy, although the sample size was quite small ( $n=8$  (14.0%) vs  $n=38$  (4.3%);  $p=0.001$ ), as is summarized in Table SII<sup>1</sup>.

Adverse events were reported significantly more frequently by patients  $< 65$  years old compared with patients  $\geq 65$  years old, even after correction for type of treatment (only topical therapy, UV therapy with or without topical therapy, conventional systemic therapy with or without topical or UV therapy, modern systemic with or without topical or UV therapy and combined systemic therapies with or without topical therapy, OR: 1.57; 95% CI: 1.09–2.25;  $n=0.015$ ).

Patients  $\geq 65$  years old were significantly more often dependent on assistance with treatment or skin care compared with patients  $< 65$  years old ( $n=56$  (14.9%)  $\geq 65$  years old vs  $n=46$  (9.0%)  $< 65$  years old;  $p=0.007$ ); 47 (83.9%) were helped by a partner or family member, and 9 (16.1%) relied on medical caretakers or others. Of all patients  $\geq 80$  years old, 11 (20.8%) were dependent on others, 6 (54.5%) were assisted by a partner or family member, and 5 (45.5%) by medical caretakers. No difference was seen among the age groups in the daily amount of time patients spent on their treatment or skin

care. Most patients spent less than 30 min per day on psoriasis management ( $n=352$  (92.9%)  $\geq 65$  years old vs  $n=481$  (94.3%)  $< 65$  years old;  $p=0.635$ ).

## DISCUSSION

Managing psoriasis in older adults can be a clinical challenge, due to factors such as comorbidity, concomitant medication, ageing-related organ impairment and functional deterioration. Limited data are available to guide clinicians in treating this growing patient group. The aim of this study was to evaluate disease and treatment characteristics in geriatric psoriasis patients and to identify differences compared with a younger population.

In this large cross-sectional study, plaque psoriasis and psoriasis capitis were the most frequently reported types of psoriasis in both groups. Erythrodermic psoriasis was significantly more often reported by patients  $\geq 65$  years old, in line with previous research (6, 7, 21). A possible explanation for this difference could be that patients  $\geq 65$  years old have been treated with less potent therapies in the past during prolonged periods of time, increasing the potential of developing more severe and extensive psoriasis. Furthermore, since the question was posed whether patients had ever experienced an episode of erythrodermic psoriasis in the past, the a priori chance is higher in older patients due to the higher number of cumulative disease years. This too explains the fact that erythrodermic psoriasis was reported more frequently by patients with early disease onset, as has also been stated previously (14). Other types of psoriasis have been studied to a lesser extent; Phan et al. reported a higher prevalence of guttate psoriasis in patients  $\geq 70$  years old compared with patients  $< 70$  years old (21). In other studies, including the current study, this difference was not seen (6, 7).

In this study, the majority of patients  $\geq 65$  years old reported a moderate current disease activity, although median SAPASI scores were slightly higher in patients  $< 65$  years old. Previous studies are in line with these results, showing comparable disease severity in both age groups (6, 7). Strikingly, the majority of the respondents in both groups reported never having achieved total skin clearance, while total clearance of psoriasis is frequently mentioned as one of the most important treatment goals to improve quality of life in patients with psoriasis (22, 23). It seems that psoriasis treatment in both age groups could be further improved, tailored to individualized treatment goals. Currently, little research is available assessing treatment goals and quality of life in geriatric psoriasis patients specifically, to evaluate whether patients consider themselves optimally treated.

Patients  $\geq 65$  years old reported significantly more comorbidities and concomitant medication in comparison with patients  $< 65$  years old, in line with previous research

(7, 21). Comorbidities and concomitant medication should be acknowledged when considering management options, especially with regard to contra-indications of antipsoriatic therapies. Despite a significant higher prevalence of (relative) contra-indications for several antipsoriatic systemic therapies reported by patients  $\geq 65$  years old, no significant differences were found between the age groups when comparing the individual systemic agents. Even in a subgroup analysis of patients  $\geq 80$  years old, systemic therapies did not differ significantly from in younger patients, although the number of patients  $\geq 80$  years old using modern systemic therapies was small. This is in contrast with previous studies stating that (modern) systemic therapies are less often prescribed in older patients (7, 21, 24, 25). Some studies suggest that prescription of systemic therapies increases over time, due to the fact that physicians have gained more experience with these therapies and are therefore more comfortable with prescribing systemic therapies, explaining the difference between the present study results and those found in previous studies (7, 24). Another explanation could be that the treatment goals and preferences of patients  $\geq 65$  years old have changed over time, although available literature in this field is scarce (23). Significantly more patients  $\geq 65$  years old required assistance with treatment or skin care, it is therefore important to consider this aspect in choosing antipsoriatic treatment.

In order to minimize the risks of potential drug interactions, as well as treatment-related adverse events, managing psoriasis in patients with comorbidities and concomitant medication requires extra attention. In this study, significantly fewer adverse events were reported by patients  $\geq 65$  years old, even when corrected for the type of treatment. It should be noted that this involves only self-reported side-effects and probably does not include asymptomatic treatment-related laboratory changes. Moreover, the reasons for ceasing previous therapies were not evaluated, which could be related to adverse events experienced in the past. Available research varies widely concerning the rates of adverse events and tolerability profiles in older adults, frequently stating adverse event rates do not differ between age groups (6, 7, 25–27). More real-life data is needed to provide clarity and guidance in this field.

### Limitations

This study has certain limitations due to the study design. Firstly, any survey is associated with a risk of recall bias and misinterpretation of the questions, although this risk was minimized by pre-testing the survey in a pilot study. Since all participants were members of a patient association, a risk of selection bias exists. A higher level of education was seen in the study population compared with the Dutch overall population (17), which might be associated with membership of a patient association

altogether (Table SIII<sup>1</sup>). Moreover, members of a patient association might be older (16, 18–20) and have more severe psoriasis than the overall psoriasis population (20). Since this study aimed to study a population representative of daily dermatological care, it was assumed that the Dutch Psoriasis Association closely resembles the target population. A relatively large cohort of patients  $\geq 65$  years old responded compared with the composition of the Dutch population. The survey was introduced explaining the nature of the study; to study differences in psoriasis management and characteristics among different patient age groups. Therefore, patients  $\geq 65$  years old may have been stimulated to respond, whereas patients in middle-age felt less urge to respond (sampling bias). However, age and sex distribution of the respondent population were shown to be representative for the target population. In addition, response rates were similar to previous studies with comparable study designs (15, 28). Moreover, the current study comprised one of the largest geriatric psoriasis populations described so far.

### Conclusion

Treating geriatric patients with psoriasis requires extra attention to comorbidities and the use of concomitant medication, since these were significantly more frequently seen in patients  $\geq 65$  years old than in patients  $< 65$  years old. Despite these obvious differences in patient-related characteristics, a better tolerability profile was reported by patients  $\geq 65$  years old. Based on the results of this study, chronological age alone should not be a limiting factor in choosing antipsoriatic therapy, although patient-related characteristics must be considered; physical impairments, availability and necessity of help, and possible drug-interactions can complicate treatment decisions. In order to provide personalized medicine, more research on treatment goals and patient preferences in geriatric psoriasis patients is needed to further guide clinicians in optimally treating this growing patient group.

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