

# The High Prevalence of Skin Diseases in Adults Aged 70 and Older

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**BACKGROUND/OBJECTIVES:** To determine the prevalence of skin findings and skin diseases in adults aged 70 and older, and to study the association between cutaneous diseases and socioeconomic status (SES), sex, and living status in the older population.

**DESIGN:** Cross-sectional study of Finnish adults aged 70 to 93 as part of the Northern Finland Birth Cohort 1966 Study.

**SETTINGS:** Skin examination data were available for 552 adults.

**MEASUREMENTS:** A whole-body skin examination was performed by dermatologists. The associations between skin diseases and SES, sex, and living status were analyzed.

**RESULTS:** Nearly 80% of the adults had at least one skin disease that required further treatment or follow-up. More than one-third of the study cases (39.1%) had three or more simultaneous skin diseases. Skin diseases were more common in men than in women ( $P < .001$ ). The most common skin diseases were tinea pedis (48.6%), onychomycosis (29.9%), rosacea (25.6%), actinic keratosis (22.3%), and asteatotic eczema (20.8%). Some association was found between skin diseases and SES and living status.

**CONCLUSION:** A whole-body clinical skin examination is important because it reveals important diagnoses. *J Am Geriatr Soc* 00:1-7, 2020.

**Keywords:** skin diseases; older adults; epidemiology; skin tumors; birth cohort

The proportion of older individuals is growing rapidly, especially in developed countries. Globally, approximately 1.5 billion people are estimated to be aged 65 and older in 2050.<sup>1</sup> Aging causes a variety of intrinsic and extrinsic changes in the skin, making it more prone to cutaneous diseases.<sup>2</sup> Skin diseases decrease quality of life and worsen active aging.<sup>3,4</sup>

Although skin disorders are common in the older population, few epidemiological studies have detailed cutaneous diseases among older persons. Furthermore, most available data have been collected from selected geriatric populations, such as residents of nursing homes or those treated in the tertiary care setting. Studies in the general population are lacking.<sup>5</sup> Two large studies based on hospital records of 4,000 Turkish and 16,924 Taiwanese older persons revealed that the most common skin diseases in older people are eczemas, skin infections, and pruritus.<sup>6,7</sup> Two other studies carried out in dermatological clinics in India ( $n = 300$ ) and in Turkey ( $n = 7,092$ ) reported similar findings in patients aged 60 to 99, consisting mainly of cases of xerosis, skin infections, and vascular diseases.<sup>8,9</sup> Xerosis and dermatophytosis were also the most prevalent skin diseases in a study of 233 nursing home residents in Germany.<sup>5</sup> Other cutaneous disorders common in older adults include benign and malignant skin tumors, infestations, and chronic wounds.<sup>5,10,11</sup>

Because few epidemiological studies based on clinical examination have been conducted in older populations, the present study was designed primarily to determine the prevalence of abnormal skin findings and cutaneous diseases in a population of individuals aged 70 and older. The other aim was to determine whether the prevalence of skin

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diseases in older persons is associated with socioeconomic status (SES), sex, and living status.

## METHODS

### Study Cohort and Dermatological Examination

The Northern Finland Birth Cohort 1966 (NFBC1966) is an epidemiological and longitudinal research program in the two northernmost provinces in Finland (Oulu and Lapland). The NFBC1966 is composed of the offspring of the mothers who lived in either province and whose expected delivery date fell between January 1 and December 31, 1966.<sup>12</sup> The 12,058 subjects belonging to the NFBC1966 have been followed regularly since their birth, and their mothers were followed during the pregnancy.<sup>13</sup> The surviving mothers and fathers of the subjects in the NFBC1966 have participated in a comprehensive health study (Keränen et al., unpublished observations) including a skin examination.

By the end of the skin study, a total of 12,027 parents of members of the NFBC1966 were sent a diverse health questionnaire. Of these, 5,559 (46%) responded. All responders who were living in the Oulu area ( $n = 1,239$ ) were invited to participate in the clinical examination. A whole-body skin examination was performed on 552 people (346 women and 206 men), and this subpopulation was included in the final skin study analysis. The skin data were collected between May 2018 and March 2019 on the premises of the Faculty of Medicine of the University of Oulu.

All areas of the skin including the nails, hair, and scalp were observed during a 20-minute visit. All skin diseases that were observable at the time of the study were recorded. Numbers of skin tumors were calculated, and skin tumors were further observed using a dermatoscope. Diagnoses of skin disorders were based on internationally accepted criteria and classified by the International Classification of Diseases, Tenth Revision. The international classification was utilized for rosacea.<sup>14,15</sup> Participants were notified of the presence of moisture-associated skin damage (MASD) that included incontinence-associated dermatitis, intertriginous dermatitis, periwound moisture-associated dermatitis, and peristomal moisture-associated dermatitis.<sup>16</sup> Diagnoses of fungal, bacterial, and viral skin infections were based on clinical findings and partly on microbiological diagnostics.

### Analytical Methodology for the Present Study

To analyze the severity of skin diseases or skin findings, study subjects with such findings were classified into three subgroups according to their need for further intervention: (1) no further care needed, (2) expected to recover with self-treatment, and (3) need medical care by physician. If a study case showed any skin disease that required treatment (e.g., untreated eczema) or had any suspected skin malignancy, the subject was referred to a primary healthcare unit. The group “no further care needed” included those with benign skin tumors or male/female pattern hair loss and no other diagnosis.

The SES of the study subjects was defined by their educational level.<sup>17</sup> Individuals were classified into three

subgroups of education: primary school, secondary school, and postsecondary-level education/vocational college/university. The information on subjects' level of education and living status (living alone or with a spouse/other family member) was self-reported.

### Statistical Methods

The data gathered from the clinical examination were used to calculate the overall prevalence of all common skin diseases as well as the prevalence of each individual condition. The chi-square test or Fisher exact test were used appropriately to test the difference in categorical variables. Logistic regression analysis was used to estimate crude and adjusted odds ratios (ORs) and their 95% confidence intervals. The adjusted model included sex, SES, and level of education as variables. All statistical analyses were performed with SAS v.9.4 for Windows (SAS Institute, Cary, NC, USA). All significance tests were two-tailed, and values of  $P < .05$  were considered statistically significant.

### Ethical Approval

The Ethical Committee of the Northern Ostrobothnia Hospital District approved the study (115/2012) that was performed according to the principles of the 1983 Helsinki Declaration.

## RESULTS

### Prevalence of Skin Diseases

Table 1 presents the subjects' demographics and skin disease status. The overall finding of the clinical evaluation was that 75.7% of the study population had at least one skin disease that required treatment or follow-up. More than one-third of the study cases (39.1%) had three or more skin diseases, with fungal skin infections the most common. Tinea pedis (Figure 1A,B) was seen in 48.6% and onychomycosis in 29.9% of participants. To test the consistency of clinically described onychomycosis with microbiological diagnosis of the same condition, randomly selected clinically diagnosed individuals ( $n = 20$ ) were sampled for microbiological dermatophyte samples (dermatophyte polymerase chain reaction). Overall, 19 of these 20 samples were positive. The prevalence of MASD<sup>16</sup> was 9.1%. Folliculitis was diagnosed in 3.6% (Table 2).

The most frequent eczema subtype was asteatotic eczema (Figure 1C), found in 20.8% of the population. Seborrheic dermatitis (Figure 1D) affected 10.1% of the participants; nummular eczema affected 9.2%. Hand eczema was seen in 8.5%. The prevalence of rosacea was 25.0%, and 65% of rosacea cases were erythematotelangiectatic, 13.9% papulopustular (Figure 1E), and 8.0% phymatous. Cutaneous autoimmune diseases were generally infrequent, but lichen planus was the most common (2.5%), and there were no cases with bullous pemphigoid.

Previously undiagnosed actinic keratosis was found in 22.3% of the population. The prevalence of basal cell carcinoma was 5% ( $n = 28$ ). Bowen's disease was diagnosed in nine, squamous cell carcinoma in two, and malignant melanoma in three individuals.

**Table 1. Demographics and Skin Disease Status of Study Participants**

	n (%)
Sex (N = 552)	
Male	206 (37.3)
Female	346 (62.7)
Race/Ethnicity	
White	552 (100)
Living status (N = 549) <sup>a</sup>	
Living alone	164 (29.9)
Living with spouse or with other family member	385 (70.1)
Institutionalized	0 (0)
Education (N = 487) <sup>a</sup>	
No education/Primary school	104 (21.4)
Secondary school	193 (39.6)
Postsecondary-level education/ Vocational college/University	190 (39.0)
Age, y (N = 552)	
Mean (SD)	78.4 (4.18)
Age range, y	
70–75	108 (19.6)
75–80	234 (42.4)
80–85	162 (29.3)
85–90	43 (7.79)
90–93	5 (.91)
No. of simultaneous skin diseases (N = 552) <sup>b</sup>	
None	70 (12.7)
One or two	266 (48.2)
Three or more	216 (39.1)
Treatment requirement (N = 543) <sup>b</sup>	
No further care needed	132 (24.3)
Self-treatment needed	177 (32.6)
Requires further care by physician	234 (43.1)

Abbreviation: SD, standard deviation.

<sup>a</sup>All study participants did not report information on health questionnaires.

<sup>b</sup>Not including benign skin tumors and male/female pattern hair loss.

Overall, benign skin tumors were the most common skin findings in this study. Of those, seborrheic keratoses were found most often, with 78.8% of the population having at least one and 15.8% having at least 50. Nearly as common were lentigo senilis (69.5%) and cherry angiomas (63.2%), followed by melanocytic nevi (50.1%). Multiple ( $\geq 50$ ) melanocytic nevi were found in 7.4% of study cases (Table 2).

### Prevalence of Skin Diseases in the Population Stratified by Sex

Table 3 shows the sex distribution of all the studied skin disorders. Seborrheic dermatitis, nummular eczema, tinea pedis, onychomycosis, folliculitis, and actinic keratosis were more frequent in men, and asteatotic eczema, cherry angiomas, and lentigo senilis were more common in women. Men also had more simultaneous cutaneous findings than women. Female pattern hair loss was seen in 22.5% of the women and male pattern hair loss in 83.0% of the men. In an adjusted model, SES and living status did not have any effect on these results (data not shown).

### Distribution of Skin Diseases According to SES and Living Status

Cherry angiomas were more frequent in high SES individuals than in those with low SES ( $P < .05$ ), and urticaria and psoriasis were more common in those with low education status ( $P < .05$ ). Male pattern hair loss ( $P < .05$ ) and folliculitis ( $P < .05$ ) were more usual in those living with a spouse when compared with those living alone. In comparison, female pattern hair loss was found more often in those living alone when compared with those living with a spouse ( $P < .05$ ) (data not shown).

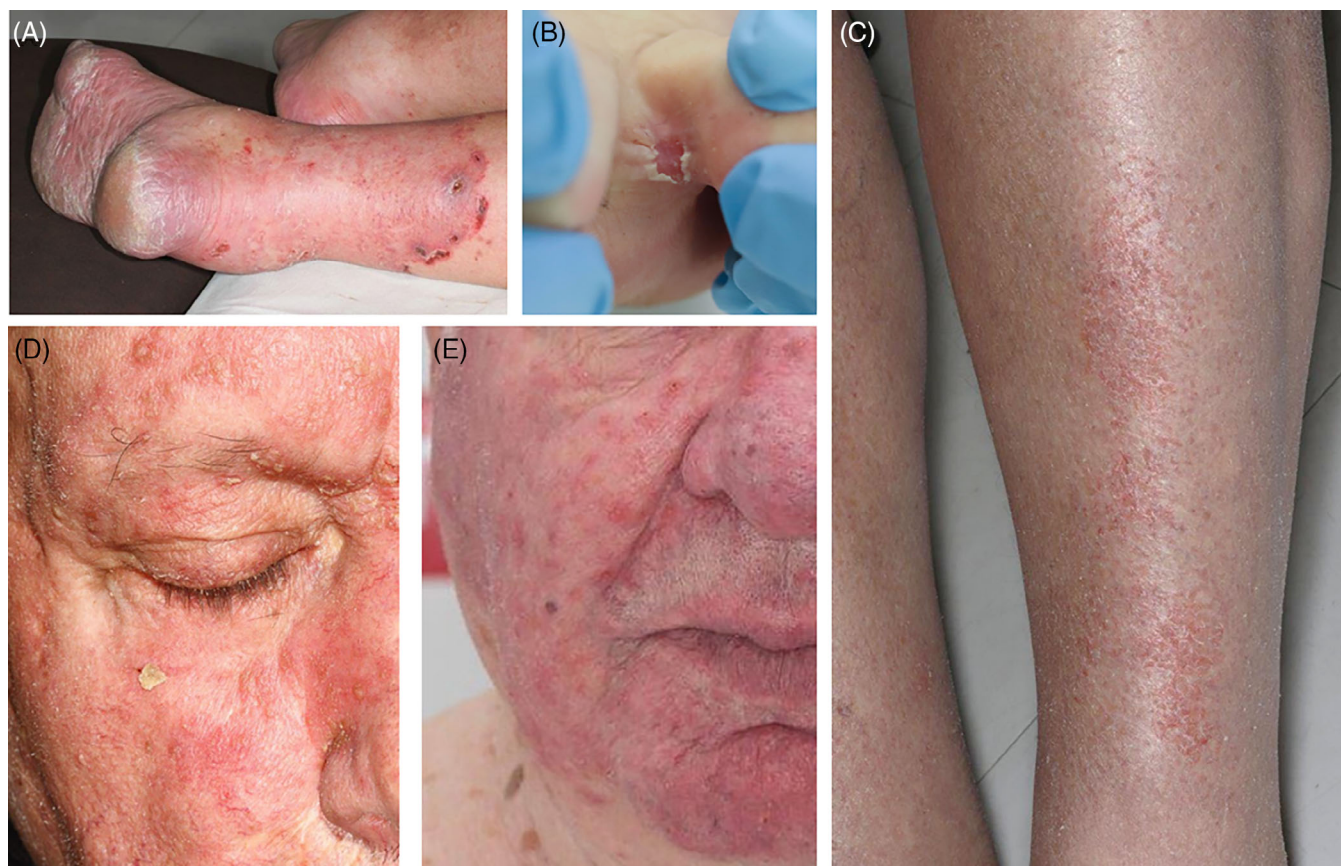
### The Need for Treatment

Nearly one-half (43.1%) of the study subjects had at least one skin disease that was considered severe enough to require further treatment by a physician. In addition, one in three (32.6%) had a dermatological finding classified as curable by self-treatment. Overall, male subjects were more likely than women to need treatment (OR = 1.63;  $P < .01$ ).

### DISCUSSION

To the best of our knowledge, ours is the largest study to date in the field of geriatric dermatology to be based on a whole-body skin examination. A previous German study of 223 persons aged 65 and older found that skin diseases were common, and almost every participant had at least one dermatological diagnosis, with xerosis the most common.<sup>18</sup> In our study, as many as 80% of participants had a skin disease requiring treatment, but rather than dry skin, the most common dermatological conditions were fungal skin infections, rosacea, actinic keratosis, and asteatotic eczema. This difference in findings could be explained by the fact that the German study assessed residents of nursing homes, whereas ours was a general population of older people. Furthermore, the mean age of our population (78.4 years) was lower than that of the population of the German study (83.6 years). One of the largest epidemiological studies in geriatric dermatology ( $n = 4,099$ ) was conducted in Turkey in 2006.<sup>6</sup> The study data were register based and collected from dermatological clinics, which may have caused selection bias. Furthermore, rather than reporting the exact incidences of individual skin conditions, the study grouped the conditions and reported the incidence of each category, making it impossible to compare the results with those of other studies.

We report a high frequency of tinea pedis (49%) and onychomycosis (30%). Our data support earlier findings that fungal skin infections are particularly common in older populations.<sup>6,8,18</sup> The increased susceptibility of older individuals to infections, including dermatological infections, probably arises from functional changes driven by the aging process of the immune system, known as immunosenescence.<sup>19</sup> This is noteworthy from a clinical point of view because tinea pedis is a known risk factor for severe bacterial infections such as cellulitis.<sup>20</sup> Previous studies found that fungal skin infections were also common in the NFBC1966 study (composed of the individuals born in 1966).<sup>21</sup>



**Figure 1.** Clinical presentations of the most common skin diseases. (A) Tinea pedis (*T. rubrum*); (B) *T. interdigita*; (C) asteatotic eczema; (D) seborrheic dermatitis; (E) papulopustular rosacea.

The most common eczema in the present study was asteatotic eczema, seen principally in the geriatric population. The development of asteatotic eczema is driven by the depletion of lipids and free fatty acids in the epidermis that is seen as part of the aging process.<sup>22</sup> It is characterized by dry fissured skin, most often on the limbs and worsened by excessive bathing with soaps. The prevalence of asteatotic eczema was reported to be approximately 15% in patients aged 60 and older.<sup>23,24</sup> The other common eczema noted in the present study was seborrheic dermatitis (10%), a particular source of morbidity in older individuals.<sup>10</sup> Seborrheic dermatitis affects the areas of the body that are rich in sebaceous glands, such as the face and trunk. Sebocyte activity diminishes with advanced age, and in light of this, that seborrheic dermatitis is common in older persons may be an unexpected finding.<sup>25</sup> Previous reports suggested that the incidence of atopic dermatitis is increasing in the geriatric population,<sup>26</sup> but we were unable to confirm this, with the condition diagnosed in only .36% of subjects. However, other eczemas (i.e., nummular eczema) that may partially overlap with atopic dermatitis were more common.

MASD conditions are common in older people, whose skin barrier function is weakened and easily irritated by several factors including chemical irritants, moisture in the environment, mechanical friction, and microorganisms such as *Candida albicans*. In geriatric care, incontinence-associated dermatitis is a particularly common finding in the geriatric care setting, affecting up to 50% of patients.<sup>27,28</sup> In

our study population, MASD was diagnosed in 9%. The lower prevalence reflects the fact that most of the individuals in our study were still in relatively good health, lived at home, and had no major mobility issues.

Rosacea affected 25% of the population, a far greater proportion than the 2% to 8% found in previous studies in older populations.<sup>29,30</sup> However, the high rate of rosacea in the present study reflects the 15% found by a previous study of NFBC1966.<sup>21</sup> These high rates in a predominantly ethnic Finnish population may be explained by the association of rosacea with fair skin types.<sup>31</sup> It is known that in men, rosacea is uncommon before age 50 and reaches its peak prevalence between age 75 and 80. This peak occurs at an earlier age in women.<sup>30</sup> Rosacea has several deleterious effects on the patient's life: it can cause embarrassment, decreased self-esteem, and isolation from society because of the visibility of facial symptoms.<sup>32</sup> Prevalence of ocular rosacea was surprisingly low (.72%) in our study. This may reflect the fact that most study participants had erythematotelangiectatic rosacea and thus milder disease. However, it is currently unclear how ocular rosacea is associated with other rosacea types.<sup>33</sup> In our opinion, the epidemiology of rosacea in older people and its effects on patients' everyday lives require further study.

The finding of previously undiagnosed actinic keratosis or skin cancer in 22.3% of our subjects was surprising, even in light of the rapid worldwide increase of the prevalence of nonmelanoma skin cancers.<sup>34</sup> The rate of benign



**Table 2. Prevalence of Skin Diseases**

Condition	Patients, n (%)
<b>Benign and malignant skin tumors</b>	
Melanocytic nevi	276 (50.1)
Cherry angiomas	348 (63.2)
Seborrheic keratosis	434 (78.8)
Lentigo senilis	383 (69.5)
Actinic keratosis	123 (22.3)
Bowen's disease	9 (1.63)
Melanoma	3 (.54)
Basal cell carcinoma	28 (5.07)
Squamous cell carcinoma	2 (.36)
<b>Eczemas and psoriasis</b>	
Atopic dermatitis	2 (.36)
Hand eczema	47 (8.51)
Seborrheic dermatitis	56 (10.1)
Nummular eczema	51 (9.24)
Contact eczema	4 (.72)
Neurodermatitis	7 (1.27)
Asteatotic eczema	115 (20.8)
Psoriasis	6 (1.09)
Psoriasis with nail symptoms	1 (.18)
Psoriasis with joint symptoms	1 (.18)
<b>Autoimmune diseases</b>	
Lichen planus	14 (2.54)
Dermatitis herpetiformis	0 (0)
Discoid lupus erythematosus	0 (0)
Vitiligo	11 (1.99)
Urticaria	4 (.73)
Bullous pemphigoid	0 (0)
<b>Sebaceous gland diseases</b>	
Rosacea	137 (25.0)
Erythematotelangiectatic	90 (64.7)
Papulopustular	19 (13.7)
Phymatous	12 (8.63)
Ocular	1 (.72)
Several types	17 (12.2)
<b>Skin infections</b>	
Pityriasis versicolor	6 (1.09)
Onychomycosis	165 (29.9)
Tinea pedis	268 (48.6)
Tinea corporis	8 (1.45)
Folliculitis	20 (3.62)
Moisture-associated skin damage	50 (9.06)
Verruca plantaris	21 (3.80)
Verruca palmaris	13 (2.36)
<b>Hair follicle and sweat glands diseases</b>	
Alopecia areata	5 (.91)
Androgenetic alopecia <sup>a</sup>	171 (83.0)
Female pattern hair loss <sup>b</sup>	78 (22.5)
Hyperhidrosis	3 (.54)
Hidradenitis suppurativa	1 (.18)

<sup>a</sup>The proportion of the males (n = 206).<sup>b</sup>The proportion of the females (n = 346).

skin tumors also increases with advanced age,<sup>11,18,29,35</sup> and therefore the recognition of premalignant and malignant skin findings may be challenging for individuals and for physicians. In our study, benign tumors were very common, seen in 70% to 80% of subjects. With the exception of

melanocytic nevi, the rates of these tumors were higher in the present population than in the NFBC1966 study.<sup>21</sup> One-half of the study cases in this cohort of parents had at least one melanocytic nevus, but only 7% had more than 50. This is consistent with the fact that at the individual level, the number of melanocytic nevi increases with age in childhood, but the rate at which new nevi appear begins to decrease after middle age.<sup>36</sup>

We found several differences in the prevalence of skin diseases between the sexes. A higher proportion of men had fungal skin infections and women had more benign tumors, which matches previous epidemiological studies.<sup>21,24,37,38</sup> In our population, men were also more likely than women to be affected by seborrheic dermatitis and nummular eczema, actinic keratosis, and folliculitis. The male predominance in some skin diseases may partly be explained by hormonal differences between men and women. For example, seborrheic dermatitis is associated with androgen levels. Its incidence in men peaks during puberty when androgen levels are high.<sup>39</sup> In addition, sex differences in the use of cosmetics can influence the appearance of skin diseases because cosmetics may alter cutaneous pH and further change microbial colonization and barrier integrity.<sup>40</sup>

The associations between SES and skin diseases are poorly studied. In general, people with a lower SES have an increased risk of general morbidity,<sup>41</sup> but when it comes to skin diseases, findings vary.<sup>42-44</sup> Skin infections, widespread nummular eczema ("eczema infectiosum"), and folliculitis were previously reported as more common among people with low SES.<sup>21</sup> According to our present findings, the influence of SES on the presence of skin diseases diminishes with advanced age. However, this finding may be partially explained by the Finnish national health insurance system that covers every Finnish citizen. We found only weak associations: psoriasis and urticaria affected more subjects with low SES than those with high SES, but the numbers of study cases in these disease groups was low, and the results cannot be generalized. To our knowledge, the association between SES and skin diseases in older persons was previously studied in only one multicenter clinical study that revealed no association.<sup>18</sup> However, this German study population consisted only of residents of long-term care facilities, in which setting the effect of SES might be considered meaningless.

The primary strength of the present study is its population. In comparison, previous studies focused on narrower, more selected populations, such as patients at dermatological clinics or tertiary care centers, approaches that may have been prone to selection bias.<sup>6,8</sup> The present study also benefited from the whole-body clinical skin examination performed by experienced dermatologists on all subjects. Interobserver reliability was tested between the two main researchers (S.P.S. and L.H.), and its degree was high.<sup>45</sup> Furthermore, we comprehensively analyzed the prevalence of all the most common skin diseases in population subgroups based on the need for further treatment. Although all population candidates were invited to participate in the study, not all did. This must be acknowledged as a potential source of sample selection bias and therefore as a weakness. Due to the study setting, only point prevalences were determined, which can be considered a limitation. The fact that all our study subjects were white may limit the generalizability of our results to those with skin of color.

Table 3. Prevalence of Skin Diseases by Sex and Analysis of Sex Differences

Condition	Prevalence, n (%)		OR (95% CI)
	Men (n = 206)	Women (n = 346)	
Melanocytic nevi	99 (48.3)	177 (51.5)	.88 (.62–1.25)
Cherry angiomas	117 (57.1)	230 (66.9)	.66 (.46–.94)
Seborrheic keratosis	169 (82.4)	264 (76.7)	1.42 (.92–2.20)
Lentigo senilis	115 (56.1)	266 (77.3)	.37 (.26–.54)
Actinic keratosis	61 (29.6)	62 (18.0)	1.91 (1.27–2.87)
Bowen's disease	4 (1.9)	5 (1.5)	1.34 (.36–5.06)
Malignant melanoma	3 (1.5)	0 (0)	—
Basal cell carcinoma	13 (6.3)	15 (4.4)	1.48 (.69–3.17)
Squamous cell carcinoma	1 (.5)	1 (.3)	1.67 (.10–26.9)
Atopic dermatitis	1 (.5)	1 (.3)	1.67 (.10–26.9)
Hand eczema	15 (7.3)	32 (9.3)	.77 (.40–1.45)
Seborrheic dermatitis	40 (19.4)	16 (4.7)	4.94 (2.69–9.08)
Nummular eczema	26 (12.6)	25 (7.3)	1.84 (1.03–3.29)
Contact eczema	2 (1.0)	2 (.6)	1.68 (.23–12.0)
Neurodermatitis	4 (1.9)	3 (.9)	2.25 (.50–10.2)
Asteatotic eczema	30 (14.6)	84 (24.4)	.53 (.33–.83)
Psoriasis	3 (1.5)	3 (.9)	1.68 (.34–8.40)
Lichen planus	5 (2.4)	9 (2.6)	.93 (.31–2.80)
Vitiligo	6 (2.9)	5 (1.5)	2.03 (.61–6.75)
Urticaria	1 (.5)	3 (.9)	.56 (.06–5.38)
Rosacea	58 (28.2)	78 (22.9)	1.32 (.89–1.96)
Pityriasis versicolor	4 (1.9)	2 (.6)	3.39 (.61–18.7)
Onychomycosis	79 (38.3)	84 (24.4)	1.93 (1.33–2.80)
Tinea pedis	124 (60.2)	143 (41.6)	2.13 (1.50–3.02)
Tinea corporis	8 (3.9)	0 (0)	—
Folliculitis	19 (9.2)	1 (.3)	34.8 (4.63–262)
Moisture-associated skin damage	21 (10.2)	29 (8.4)	1.23 (.68–2.22)
Verruca palmaris	5 (2.4)	8 (2.3)	1.05 (.34–3.24)
Alopecia areata	0 (0)	5 (1.5)	—
Androgenetic alopecia	171 (83.0)	—	—
Female pattern hair loss	—	76 (22.1)	—
Hyperhidrosis	3 (1.5)	0 (0)	—
Hidradenitis suppurativa	0 (0)	1 (.3)	—

Abbreviations: CI, confidence interval; OR, odds ratio.

In conclusion, this study provides new data about the epidemiology of skin diseases in older people. Our principal finding is that dermatological disorders are extremely common in older individuals and should be considered by physicians treating geriatric patients. A whole-body clinical skin examination should be encouraged because it may reveal hidden cutaneous symptoms and it ensures timely diagnoses and appropriate treatment.

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**Author Contributions:** *Conception and design of the study:* Sinikumpu, Huilaja, Keränen, and Keinänen-Kiukaanniemi. *Statistical analysis and interpretation of data:* Jokelainen. *Drafting and critical revision of the manuscript:*

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