Socioeconomic Status and the Prevalence of Skin and Atopic Diseases in Five European Countries

Robert F. OFENLOCH[1], Marie Louise A. SCHUTTELAAR[2], Åke SVENSSON[3], Magnus BRUZE[4], Luigi NALDI[5,6], Simone CAZZANIGA[5], Peter ELSNER[7], Margarida GONCALO[8] and Thomas L. DIEPGEN[1]

[1]Department of Social Medicine, Occupational and Environmental Dermatology, University Hospital Heidelberg, Heidelberg, Germany, [2]Department of Dermatology, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands, [3]Department of Dermatology and [4]Department of Occupational and Environmental Dermatology, Skåne University Hospital, Lund University, Malmö, Sweden, [5]Centro Studi GISED – FROM Presidio Ospedaliero Matteo Rota, Bergamo, [6]Department of Dermatology, AULSS8 Berica, Ospedale San Bortolo, Vicenza, Italy, [7]Department of Dermatology, University Hospital Jena, Jena, Germany, and [8]Department of Dermatology, Coimbra University Hospital, Faculty of Medicine, University of Coimbra, Coimbra, Portugal

The aim of this study was to investigate the association between socioeconomic status and the prevalence of self-reported skin and atopic diseases in the general population of 5 European countries. A random sample was drawn from the general population aged 18–74 years, based on electoral precincts. Socioeconomic status was estimated by combining net household income with the highest education of respondents. A total of 7,904 subjects were included in this analysis. The lifetime prevalence of "contact dermatitis" ranged from 13.1% (95% confidence interval (95% CI 11.8–14.4%) in subjects with low socioeconomic status, to 19.1% (95% CI 17.5–20.8%) in those with high socioeconomic status. In younger subjects skin cancer was more prevalent in the middle or high socioeconomic status groups compared with the low socioeconomic status group (odds ratio 2.4; 95% CI 1.4–4.3); however, this effect was not found in elderly subjects. The lifetime prevalence for at least one atopic disease was 61.2% (95% CI 59.4–63.0%) in the low and 82.8% (95% CI 81.1–84.3%) in the high socioeconomic status group. Individuals with middle or high socioeconomic status reported an overall higher prevalence of skin and atopic diseases compared with those with low socioeconomic status. These findings may reflect differences in reporting, which are likely to result in an underdiagnoses, especially for skin cancer in the younger age groups with low socioeconomic status.

Key words: socioeconomic status; health inequalities; prevalence; skin diseases; European population.

Accepted Nov 14, 2018; E-published Nov 14, 2018

Acta Derm Venereol 2019; 99: 309–314.

Corr: Robert Ofenloch, Department of Social Medicine, Occupational and Environmental Dermatology, University Hospital Heidelberg, Voßstr. 2, DE-69115 Heidelberg, Germany. E-mail: Robert.Ofenloch@med.uni-heidelberg.de

SIGNIFICANCE

People living within a low socioeconomic status usually show a lower health status compared to subjects with high socioeconomic status. They are more often sick, diseases show a more severe course and life expectancy is reduced. We analyzed this health inequality for skin and atopic diseases in a sample of the general European population and found quite the contrary: people with high socioeconomic status reported more skin diseases. However, we argue that this is an issue of underreporting – in consequence preventive programs should aim at strengthening screening approaches for skin diseases in people with low socioeconomic status.

The association between socioeconomic status (SES) and health state is well known and has been studied intensively with widely corresponding results: people with low SES (i.e. low income and/or low education), in general, have a worse health status compared with individuals with middle or high SES (1). A spread in life expectancy of up to 20 years can be seen among countries as well as within countries between the different socioeconomic groups (2). Recently, Elgar et al. (3) found an increase in health inequalities in adolescents between 2002 and 2010 by analysing time-series data from 34 countries. However, for skin diseases the situation appears to be different, and there are a couple of studies with contradicting results: an early study on this topic performed in a UK population showed that childhood eczema is more prevalent in higher social classes, and this was true for self-reported as well as for diagnosed eczema (4). In the UK cancer registry rates for all types of skin cancer have been found to be higher in individuals with high SES (5, 6). This finding led to the conclusion that skin cancer cannot be attributed primarily to exposure to sunlight, since individuals with low SES are more likely to work in the sun and would therefore show higher incidence rates (6). However, in other studies occupational exposure to sunlight is clearly associated with skin cancer and differences in skin cancer mortality cannot be found between SES groups (7). In addition, the prevalence of actinic keratosis was found to be higher in individuals with low SES in a representative Italian sample investigated by trained interviewers using a photographic guide (8).

In the Netherlands no associations between SES and chronic eczema or psoriasis (9) were diagnosed in consecutive samples of patients from general practices. Another Dutch study showed that high SES was associated with a higher incidence of basal cell carcinoma

doi: 10.2340/00015555-3082
Acta Derm Venereol 2019; 99: 309–314

(BCC) among men (10). This study was based on all histologically confirmed BCC registered in the southeast Netherlands. A large study focusing on chronic diseases performed in 8 European countries found no association for skin cancer or any kind of skin disease and SES in the self-reported data (11), while allergies were more likely to occur in individuals with middle or high SES. On the other hand, in a population-based survey in Oslo, Norway, a higher prevalence of acne and hand eczema was found in households with middle income (12).

For atopic diseases it was argued that higher prevalence rates in higher SES groups reflect differences in reporting related to language and culture, and would not occur in diagnosed cases (13). However, as the studies presented above indicate, this explanation does not account for the findings concerning skin diseases. Overall, those results are confusing, and the interpretability of existing studies is limited because: (*i*) data were gained in clinical setting(s); and/or (*ii*) by using small sample sizes; and/or (*iii*) the study was not primarily focusing on skin diseases; and/or (*iv*) data were assessed in a small region only. Therefore, the current study analysed the impact of SES on the prevalence of skin diseases by using data gained in a huge epidemiological survey performed in 5 European countries, which was focused on contact allergies and skin and atopic diseases.

MATERIALS AND METHODS

This is a *post-hoc* analysis of data from a prevalence study performed by the European Dermato-Epidemiology Network (EDEN), called the EDEN fragrance study (EFS). The study design of the EFS has been published previously (14, 15). In short, EDEN conducted a population-based epidemiological survey in 5 European countries (Sweden, Germany, the Netherlands, Italy and Portugal) in order to assess the prevalence of fragrance allergies in the general European population (16, 17). A random sample was therefore drawn from the general population aged 18–74 years, using a stratified, proportional sampling with replacement design. This was done by stratifying the data received from the electoral precincts of each region by sex and age. If an individual who was randomly selected for participation declined to participate or could not be reached, a new subject was selected randomly from the same strata. This process has been described in detail elsewhere (15). Data were assessed during personal interviews performed by trained interviewers using a standardized questionnaire. The questionnaire addressed information about lifetime prevalence of 10 common skin diseases (contact dermatitis, atopic dermatitis, other eczema, psoriasis, warts, acne, urticaria, skin cancer, leg ulcer, and vitiligo) and the atopic diseases rhinitis and allergic asthma. In addition, the socioeconomic variables education and net household income were assessed. The study was performed in accordance with the Declaration of Helsinki and each centre received approval from its corresponding ethics committee.

Indicator variable for socioeconomic status

In this study the education and net household income of respondents were used to compute an indicator variable for SES. For each country the income data were split into 6 equal categories, so that within a country each category contained the same number of respondents. The educational variable was assessed in 6 categories: (*i*) compulsory education or lower, (*ii*) high school, (*iii*) vocational training, (*iv*) university training, (*v*) first-level degree (Bachelor's degree or equivalent) and (*vi*) second-level degree (Master's degree or higher). This operationalization equals the definition of the International Standard Classification of Education (ISCED) (18), where the 2 lowest and 2 highest categories were collapsed. The 2 indicator variables were summed to a score ranging from 2 to 12 and split into 3 groups representing low (score <6), middle ($6 \leq$ score ≤ 8) and high SES (score >8).

Data analyses

The lifetime prevalence was calculated for each disease and is reported together with the corresponding 95% confidence interval (95% CIs), which were calculated according to the conservative Clopper-Pearson method (19). In addition, skin diseases were grouped for analysis into "any eczema"' (contact, atopic or other dermatitis), "atopic disease" (atopic dermatitis, rhinitis or asthma) and "any skin disease". The association between SES and each disease is described using odds ratios (ORs), calculated by means of univariate and multivariate logistic regression, the latter controlling for age and sex. In order to have an adequate sample size for the comparisons, subjects with low SES were compared with the rest of the sample (subjects with middle or high SES) in all analyses. Because of testing for multiple diseases, significance levels were adjusted using the conservative Bonferroni approach (20), resulting in a significance level of $p \leq 0.0031$ ($p \leq 0.05/16$ diseases).

RESULTS

Overall, 12,370 subjects were included in the study. However, because the question on income was added after the study had already started, complete data on SES are available for only 7,904 subjects, and only these were eligible for analysis. The sample consists of 4,130 women (52.3%); this percentage was slightly lower compared with the whole study population reported earlier (53.9%; $p<0.001$) (14). The median (interquartile range; IQR) age was 42 years (28–56) , which was also lower compared with the original population (43 years (29–57); $p<0.001$). **Table I** shows that the prevalence for the investigated skin and atopic diseases did not differ significantly between both populations, only the prevalence of contact dermatitis and psoriasis were slightly higher in the subsample used for analysis.

Lifetime prevalence of skin and atopic diseases by socioeconomic status

Fig. 1 shows that the lifetime prevalence of most skin diseases is higher in the high SES group compared with the low or middle SES groups. For "other eczema" a lifetime prevalence of 10.3% (95% CI 9.2–11.6%) was found in individuals with low SES, compared with a lifetime prevalence of 18.1% (95% CI 16.5–19.8%) in the high SES group. Only for leg ulcer, which has the lowest lifetime prevalence of the skin diseases investigated (0.6%; 95% CI 0.4–0.8%) the lifetime prevalence in the group with low SES (0.7%; 95% CI 0.4–1.1%) was slightly higher compared with the high SES group

Table I. Characteristics of the analysed sample compared with the total sample of the general European population

	Sample used for analysis (*n* = 7,904)		Total sample (*n* = 12,377)	
	n (%)	95% CI	*n* (%)	95% CI
Sex*				
Women	4,130 (52.3)	51.2–53.4	6,669 (53.9)	53.0–54.8
Men	3,770 (47.7)	46.6–48.8	5,701 (46.1)	45.2–47.0
Age in years, median (IQR)*	42 (28–56)		43 (29–57)	
Contact dermatitis*	1,273 (16.1)	15.3–16.9	1,854 (15.0)	14.4–15.6
Atopic dermatitis	608 (7.8)	7.2–8.4	898 (7.9)	7.4–8.4
Other eczema	1,066 (13.7)	12.9–14.5	1,624 (14.2)	13.5–14.8
Psoriasis*	438 (5.6)	5.1–6.1	590 (5.2)	4.8–5.7
Warts	3,256 (41.9)	40.8–43.0	4,897 (41.3)	40.4–42.2
Acne	1,494 (19.3)	18.4–20.2	2,202 (19.2)	18.5–20.0
Urticaria	710 (9.2)	8.6–9.9	1,040 (9.2)	8.7–9.7
Skin cancer	219 (2.8)	2.4–3.2	292 (2.6)	2.3–2.9
Leg ulcer	44 (0.6)	0.4–0.8	78 (0.7)	0.5–0.9
Vitiligo	138 (1.8)	1.5–2.1	213 (1.9)	1.6–2.2
Allergic rhinitis	1,575 (20.3)	19.4–21.2	2,347 (20.4)	19.7–21.1
Allergic asthma	610 (7.9)	7.3–8.5	925 (8.1)	7.6–8.6
Other skin diseases*	829 (10.7)	10.0–11.4	1,281 (11.3)	10.7–11.9

*Differences significant (Bonferroni adjusted $p < 0.003$).
IQR: interquartile range; CI: confidence interval.

(0.4%; 95% CI 0.2–0.8%). The prevalence of having any skin disease was 61.2% (95% CI 59.4–63.0%) in people with low SES and 82.8% (95% CI 81.1–84.3%) in the group with high SES. The detailed prevalence data for all skin and atopic diseases investigated in this study for each SES group is shown in **Table II**.

Univariate odds ratios for socioeconomic status in different groups

Nearly all calculated univariate ORs indicated a higher prevalence for skin and atopic diseases in individuals with middle or high SES compared with those with low SES. For warts, an OR of 1.87 (95% CI 1.7–2.1) was found, indicating warts to be more prevalent in subjects with middle or high SES. The OR of having at least one of the reported skin diseases in a lifetime was 2.18 (95% CI 1.97–2.41). Only for leg ulcer was there an OR that indicated a higher prevalence in subjects with low SES

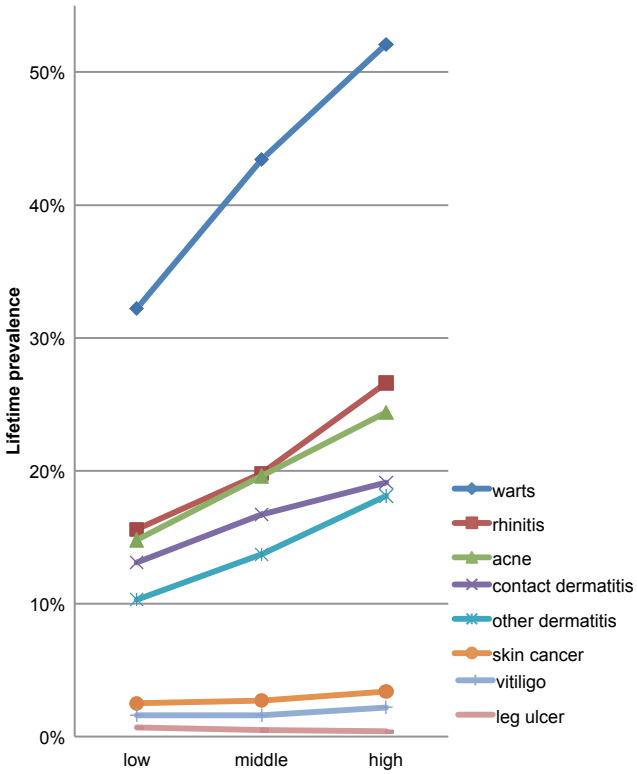

Fig. 1. Lifetime prevalence of skin diseases by socioeconomic status.

(OR 0.65; OR 0.36–1.17), but this effect was not significant. In **Table III** it can be seen, that by considering only the group of elderly subjects (60–74 years) the OR for leg ulcer indicated a lower prevalence in middle or high SES subject (OR 0.41; 95% CI 0.18–0.93). The OR for rhinitis (OR 2.19; 95% CI 1.57–3.04) also indicated rhinitis to be more prevalent in subjects with middle or high SES.

Overall the ORs in elderly age groups were slightly higher compared with the younger age groups. However, the OR for skin cancer was significant only in the younger age group (OR 2.4; 95% CI 1.35–4.28). When comparing the ORs for men and women it can be seen

Table II. Lifetime prevalence for different skin diseases by socioeconomic status

	Low (*n* = 2,789)		Middle (*n* = 2,920)		High (*n* = 2,195)		Total (*n* = 7,904)	
	n (%)	95% CI	*n* (%)	95% CI	*n* (%)	95% CI	*n* (%)	95% CI
Contact dermatitis	364 (13.1)	11.8–14.4	489 (16.7)	15.4–18.2	420 (19.1)	17.5–20.8	1,273 (16.1)	15.3–16.9
Atopic dermatitis	170 (6.2)	5.4–7.2	237 (8.3)	7.3–9.3	201 (9.2)	8.0–10.5	608 (7.8)	7.2–8.4
Other dermatitis	282 (10.3)	9.2–11.6	391 (13.7)	12.4–15.0	393 (18.1)	16.5–19.8	1,066 (13.7)	13.0–14.5
Psoriasis	128 (4.7)	3.9–5.6	166 (5.8)	5.0–6.7	144 (6.6)	5.6–7.7	438 (5.6)	5.1–6.2
Warts	880 (32.2)	30.5–34.0	1,243 (43.4)	41.5–45.2	1,133 (52.1)	49.9–54.2	3,256 (41.9)	40.8–43.0
Acne	403 (14.8)	13.5–16.2	560 (19.6)	18.1–21.1	531 (24.4)	22.6–26.3	1,494 (19.3)	18.4–20.2
Urticaria	202 (7.4)	6.5–8.5	268 (9.4)	8.3–10.5	240 (11.0)	9.7–12.4	710 (9.2)	8.5–9.8
Skin cancer	68 (2.5)	1.9–3.2	77 (2.7)	2.1–3.4	74 (3.4)	2.7–4.3	219 (2.8)	2.5–3.2
Leg ulcer	20 (0.7)	0.5–1.1	15 (0.5)	0.3–0.9	9 (0.4)	0.2–0.8	44 (0.6)	0.4–0.8
Vitiligo	44 (1.6)	1.2–2.2	47 (1.6)	1.2–2.2	47 (2.2)	1.6–2.9	138 (1.8)	1.5–2.1
Rhinitis	426 (15.6)	14.3–17.1	569 (19.8)	18.4–21.4	580 (26.6)	24.8–28.5	1,575 (20.3)	19.4–21.2
Asthma	192 (7.1)	6.1–8.1	225 (7.9)	6.9–8.9	193 (8.9)	7.7–10.1	610 (7.9)	7.3–8.5
Other skin diseases	701 (25.1)	23.5–26.8	943 (32.3)	30.6–34.0	848 (38.6)	36.6–40.7	2,492 (31.5)	30.5–32.6
Any skin disease	611 (22.3)	20.8–23.9	782 (27.2)	25.6–28.9	744 (34.1)	32.1–36.1	2,137 (27.4)	26.4–28.4
Atopic disease	1,707 (61.2)	59.4–63.0	2,145 (73.5)	71.8–75.1	1,817 (82.8)	81.1–84.3	5,669 (71.7)	70.7–72.7

CI: confidence interval.

Table III. Univariate odds ratios (ORs) for socioeconomic differences in the burden of skin diseases in different groups

	Total (n = 7,904) OR (95% CI)	Men (n = 3,770) OR (95% CI)	Women (n = 4,130) OR (95% CI)	18–59 years (n = 6,701) OR (95% CI)	60–74 years (n = 1,199) OR (95% CI)
Contact dermatitis	**1.44** (1.26–1.64)	**1.39** (1.11–1.75)	**1.52** (1.29–1.79)	**1.33** (1.16–1.54)	**1.81** (1.29–2.53)
Atopic dermatitis	**1.43** (1.19–1.72)	1.44 (1.05–1.98)	**1.46** (1.17–1.84)	1.36 (1.12–1.65)	1.46 (0.84–2.52)
Other dermatitis	**1.60** (1.38–1.85)	**2.04** (1.60–2.59)	**1.39** (1.15–1.67)	**1.59** (1.35–1.88)	1.56 (1.13–2.14)
Psoriasis	1.33 (1.08–1.64)	**1.46** (1.08–1.98)	1.21 (0.90–1.62)	1.37 (1.06–1.76)	1.36 (0.91–2.03)
Warts	**1.87** (1.70–2.07)	**2.08** (1.80–2.41)	**1.72** (1.51–1.97)	**1.80** (1.62–2.01)	**1.94** (1.56–2.43)
Acne	**1.59** (1.40–1.80)	**1.69** (1.40–2.04)	**1.52** (1.29–1.80)	**1.47** (1.28–1.68)	**1.94** (1.38–2.74)
Urticaria	**1.40** (1.18–1.66)	**1.72** (1.24–2.39)	1.33 (1.09–1.63)	**1.47** (1.20–1.79)	1.27 (0.91–1.78)
Skin cancer	1.21 (0.90–1.61)	1.22 (0.80–1.85)	1.18 (0.79–1.77)	**2.40** (1.35–4.28)	1.17 (0.81–1.67)
Leg ulcer	0.65 (0.36–1.17)	0.84 (0.35–2.03)	0.51 (0.23–1.17)	1.86 (0.62–5.62)	**0.41** (0.18–0.93)
Vitiligo	1.16 (0.81–1.66)	1.16 (0.69–1.95)	1.16 (0.70–1.91)	1.31 (0.85–2.01)	0.88 (0.44–1.77)
Rhinitis	**1.59** (1.41–1.80)	**1.78** (1.48–2.14)	**1.46** (1.24–1.72)	**1.45** (1.27–1.65)	**2.19** (1.57–3.04)
Asthma	1.19 (1.00–1.43)	1.46 (1.10–1.95)	1.05 (0.84–1.32)	1.22 (1.00–1.49)	1.06 (0.72–1.57)
Other skin diseases	**1.72** (1.46–2.03)	**1.63** (1.28–2.09)	**1.81** (1.45–2.26)	**1.86** (1.53–2.25)	1.41 (1.01–1.95)
Any skin disease	**2.18** (1.97–2.41)	**2.29** (1.99–2.65)	**2.11** (1.83–2.43)	**2.16** (1.92–2.42)	**2.08** (1.69–2.58)
Atopic disease	**1.50** (1.35–1.68)	**1.70** (1.44–2.00)	**1.38** (1.20–1.60)	**1.43** (1.27–1.61)	**1.63** (1.25–2.12)
Any eczema	**1.60** (1.45–1.78)	**1.74** (1.48–2.06)	**1.58** (1.38–1.81)	**1.53** (1.37–1.72)	**1.73** (1.35–2.20)

Bold ORs significant (Bonferroni adjusted $p < 0.003$). CI: confidence interval.

that OR in men are mostly higher compared with women; only for contact dermatitis and atopic dermatitis are the ORs higher in women.

Country-specific multivariate odds ratios for socioeconomic status

At the country level and by controlling for age and sex most ORs were smaller and no longer significant. In Germany and Italy no association between SES and one of the reported skin diseases was found after applying Bonferroni correction of the significance level (**Table IV**). The most associations were seen in Portugal; here the ORs for SES in other dermatitis (OR 3.7; 95% CI 2.32–5.93), rhinitis (OR 3.1; 95% CI 1.87–4.97), other skin diseases (OR 2.3; 95% CI 1.60–3.43) as well as in the groups for any eczema (OR 1.8; 95% CI 1.32–2.52), atopic disease (OR 2.3; 95% CI 1.55–3.30) and any skin disease (OR 1.9; 95% CI 1.44–2.61) were significant. All ORs in Portugal indicated skin and atopic diseases to be more prevalent in individuals with middle or high SES.

In Sweden and the Netherlands there was only one significant association that showed the opposite result compared with the results reported to date: in the Netherlands there was a significant OR of 0.1 (95% CI 0.05–0.41) for the effect of SES in skin cancer, indicating skin cancer to be more prevalent in individuals with low SES. Similar results were found in Sweden, where leg ulcers were more likely to occur in individuals with low SES (OR 0.19; 95% CI 0.06–0.58). In Germany and Italy no significant associations were found between SES and the burden of skin and atopic diseases.

DISCUSSION

Overall, the association between SES and dermatological and atopic conditions appears to contrast with that of other diseases: people with high SES report a higher lifetime prevalence than those with low SES. This association seems to be more relevant in elderly subjects and in men. However, for skin cancer, health inequality was found only in the younger age group (showhing higher

Table IV. Multivariate odds ratios (ORs) for socioeconomic differences in the burden of skin diseases in different countries

	Germany (n = 3,129) OR (95% CI)	Italy (n = 1,335) OR (95% CI)	Netherlands (n = 980) OR (95% CI)	Portugal (n = 850) OR (95% CI)	Sweden (n = 1,606) OR (95% CI)
Contact dermatitis	1.14 (0.94–1.38)	1.12 (0.74–1.70)	1.18 (0.73–1.92)	1.06 (0.68–1.67)	1.02 (0.72–1.45)
Atopic dermatitis	1.14 (0.88–1.49)	1.28 (0.74–2.20)	1.11 (0.60–2.05)	1.12 (0.59–2.12)	1.84 (1.15–2.95)
Other dermatitis	1.13 (0.90–1.42)	1.30 (0.63–2.69)	0.91 (0.63–1.30)	**3.71** (2.32–**5.93**)	1.20 (0.89–1.63)
Psoriasis	0.87 (0.64–1.16)	1.37 (0.67–2.79)	1.30 (0.37–4.57)	1.44 (0.47–4.38)	1.21 (0.80–1.83)
Warts	1.16 (0.98–1.38)	1.26 (0.80–1.97)	1.19 (0.86–1.64)	1.03 (0.76–1.39)	1.04 (0.81–1.34)
Acne	1.12 (0.94–1.35)	1.57 (0.98–2.50)	1.02 (0.68–1.52)	1.60 (1.08–2.38)	1.01 (0.72–1.42)
Urticaria	0.99 (0.77–1.27)	1.14 (0.60–2.16)	1.07 (0.59–1.96)	1.88 (0.86–4.10)	1.23 (0.87–1.74)
Skin cancer	1.45 (0.81–2.60)	2.62 (0.65–10.54)	**0.14** (0.05–**0.41**)	3.45 (0.35–34.03)	0.89 (0.58–1.35)
Leg ulcer	1.63 (0.36–7.36)	n.a.*	0.28 (0.07–1.09)	n.a.*	**0.19** (0.06–**0.58**)
Vitiligo	1.12 (0.64–1.97)	0.95 (0.21–4.27)	0.42 (0.17–1.04)	0.82 (0.13–5.05)	0.75 (0.35–1.59)
Rhinitis	1.15 (0.96–1.39)	0.88 (0.53–1.46)	0.82 (0.58–1.16)	**3.05** (1.87–**4.97**)	1.09 (0.83–1.45)
Asthma	0.98 (0.74–1.29)	0.71 (0.38–1.33)	0.67 (0.41–1.09)	2.16 (1.07–4.37)	0.99 (0.68–1.44)
Other skin diseases	1.33 (1.03–1.72)	1.74 (0.70–4.37)	1.78 (1.02–3.10)	**2.35** (1.60–**3.43**)	1.13 (0.77–1.65)
Any eczema	1.21 (1.02–1.43)	1.20 (0.86–1.68)	0.96 (0.70–1.31)	**1.83** (1.32–**2.52**)	1.21 (0.95–1.54)
Atopic disease	1.11 (0.94–1.32)	1.02 (0.70–1.48)	0.78 (0.57–1.07)	**2.26** (1.55–**3.30**)	1.16 (0.91–1.47)
Any skin diseases	1.18 (0.88–1.58)	1.29 (1.01–1.65)	0.93 (0.57–1.51)	**1.94** (1.44–**2.61**)	1.19 (0.96–1.47)

Bold ORs are significant (Bonferroni adjusted $p < 0.003$) *not applicable; no leg ulcers were reported in Italy or Spain. CI: confidence interval.

rates in the group with high SES) and in the Netherlands this association was reversed. The association between leg ulcers and SES also indicates that they were more prevalent in individuals with low SES.

Strengths and limitations

While most studies on this topic were perfomed using data from consecutive clinical patients we assessed the prevalence of skin and atopic diseases in a sample of the general population. This is a strength of our study, since people with high SES are likely to have better access to the health system and might therefore be overrepresented in a clinical setting. Other barriers may also exist; for example, in Germany children with low SES are less likely to visit a physician (21), even though the German health system provides ubiquitous access to healthcare through its mandatory health insurance. The discrepancies in access and behaviour between low and high SES groups do not affect the data of the representative sample of the European general population analysed in our study. Although the response rate of the EDEN fragrance study was quite low, the study sample was compared with other data sources from the general population and found to be relatively comparable (14).

Due to organizational issues we were only able to analysis a subsample of the total study population, which deviated slightly from the sample of the general population in terms of age, sex and lifetime prevalence of contact dermatitis and psoriasis. Nevertheless, we consider these deviations too small to have a relevant effect on the association between SES and skin diseases as presented in this paper. A further limitation of this study is that information about the prevalence of skin diseases was collected using self-reports from the participants. People with high SES might be: (*i*) more aware; (*ii*) better informed about potential skin diseases; or (*iii*) paying more attention to dermatological problems and therefore more likely to report them. Finally, the current study did not assess severity. There are some studies indicating that the dermatological and atopic conditions are more severe in individuals with low SES (22, 23).

Comparison with other studies

While in developing countries skin diseases are clearly an indicator for poverty and low SES (24, 25) this is not true for the western European countries investigated in this study. An increased risk was found in the higher SES group for nearly all skin diseases investigated, excluding only psoriasis, skin cancer and leg ulcers. In particular, the results regarding skin cancer, which showed only a positive association in the younger groups, and even showed an inverse association in the Dutch population, are not in agreement with earlier findings (5, 6). A Dutch study performed in the southeast Netherlands showed an association between high SES and an increased risk of skin cancer among men (10). In this study, only the incidence of BCC was investigated, while in the current Dutch population, in the northeast of the Netherlands, we investigated skin cancer in general. The 2 populations in the Netherlands might differ in terms of UV exposure (outdoor activities), which is the main risk factor for skin cancer. Considering the fact that lower survival rates in skin cancer patients with low SES have been reported (26, 27), it appears likely that skin cancer is often underdiagnosed or diagnosed later in individuals with low SES, leading to a worse prognosis in these patients. Therefore, future intervention programmes for skin cancer should focus on subjects with low SES. While the effect of SES on the prevalence of common chronic diseases (including skin diseases) in the general European population was found to be smaller in the elderly population (11), we found a slightly higher OR in the elderly population.

Future studies and conclusion

Future studies should examine why effects of SES on skin cancer and leg ulcer show the opposite direction in Sweden and the Netherlands compared to the other countries. Future studies should also explore the reason why health inequality seems to be less intense in tose two countries. It would be interesting to investigate whether the same mechanism that leads to a generally worse state of health in people with low SES (e.g. the extent of income inequality within a country (28)), leads to a worse skin morbidity in people with high SES. Future studies on the effects of SES on skin diseases should assess the point prevalence of skin diseases by applying a standardized physical examination, performed by a trained dermatologist, including a severity rating of diseases. It is evident that there are discrepancies in health equality concerning skin and atopic diseases between countries within the European community; scientists from all over Europe should work together to reduce these gaps.

ACKNOWLEDGEMENTS

The EFS was supported by the Research Institute for Fragrance Materials, Inc. We also acknowledge financial support by Deutsche Forschungsgemeinschaft within the funding programme Open Access Publishing, by the Baden-Württemberg Ministry of Science, Research and the Arts and by Ruprecht-Karls-Universität Heidelberg.

The authors have no conflicts of interest to declare.

REFERENCES

1. Mackenbach JP, Stirbu I, Roskam A-JR, Schaap MM, Menvielle G, Leinsalu M, et al. Socioeconomic inequalities in health in 22 European countries. N Engl J Med 2008; 358: 2468–2481.
2. Marmot M. Social determinants of health inequalities. Lancet 2005; 365: 1099–1104.
3. Elgar FJ, Pförtner T-K, Moor I, De Clercq B, Stevens GWJM, Currie C. Socioeconomic inequalities in adolescent health 2002–2010: a time-series analysis of 34 countries participa-

ting in the Health Behaviour in School-aged Children study. Lancet 2015; 385: 2088–2095.
4. Williams HC, Strachan DP, Hay RJ. Childhood eczema: disease of the advantaged? BMJ. 1994; 308: 1132–1135.
5. Shack L, Jordan C, Thomson CS, Mak V, Møller H. Variation in incidence of breast, lung and cervical cancer and malignant melanoma of skin by socioeconomic group in England. BMC Cancer 2008; 8: 271.
6. Doherty VR, Brewster DH, Jensen S, Gorman D. Trends in skin cancer incidence by socioeconomic position in Scotland, 1978–2004. Br J Cancer 2010; 102: 1661.
7. Freedman DM, Dosemeci M, McGlynn K. Sunlight and mortality from breast, ovarian, colon, prostate, and non-melanoma skin cancer: a composite death certificate based case-control study. Occup Environ Med 2002; 59: 257–262.
8. Naldi L, Chatenoud L, Piccitto R, Colombo P, Placchesi EB, La Vecchia C. Prevalence of actinic keratoses and associated factors in a representative sample of the Italian adult population: results from the prevalence of actinic keratoses Italian study, 2003–2004. Arch Dermatol 2006; 142: 722–726.
9. Westert GP, Schellevis FG, de Bakker DHd, Groenewegen PP, Bensing JM, Van der Zee J. Monitoring health inequalities through general practice: the Second Dutch National Survey of General Practice. Eur J Publ Health 2005; 15: 59–65.
10. Van Hattem S, Aarts MJ, Louwman WJ, Neumann HAM, Coebergh JWW, Looman CWN, et al. Increase in basal cell carcinoma incidence steepest in individuals with high socioeconomic status: results of a cancer registry study in The Netherlands. Br J Dermatol 2009; 161: 840–855.
11. Dalstra JAA, Kunst AE, Borrell C, Breeze E, Cambois E, Costa G, et al. Socioeconomic differences in the prevalence of common chronic diseases: an overview of eight European countries. Int J Epidemiol 2005; 34: 316–326.
12. Dalgard F, Svensson Å, Holm J, Sundby J. Self-reported skin morbidity in Oslo. Associations with sociodemographic factors among adults in a cross-sectional study. Br J Dermatol 2004; 151: 452–457.
13. Mercer MJ, Joubert G, Ehrlich RI, Nelson H, Poyser MA, Puterman A, et al. Socioeconomic status and prevalence of allergic rhinitis and atopic eczema symptoms in young adolescents. Pediatr Allergy Immunol 2004; 15: 234–241.
14. Naldi L, Cazzaniga S, Goncalo M, Diepgen T, Bruze M, Elsner P, et al. Prevalence of self-reported skin complaints and avoidance of common daily life consumer products in selected European Regions. JAMA Dermatol 2014; 150: 154–163.
15. Rossi M, Coenraads PJ, Diepgen T, Svensson A, Elsner P, Goncalo M, et al. Design and feasibility of an international study assessing the prevalence of contact allergy to fragrances in the general population: the European Dermato-Epidemiology Network Fragrance Study. Dermatology 2010; 221: 267–275.
16. Diepgen TL, Ofenloch R, Bruze M, Cazzaniga S, Coenraads PJ, Elsner P, et al. Prevalence of fragrance contact allergy in the general population of five European countries: a cross-sectional study. Br J Dermatol 2015; 173: 1411–1419.
17. Diepgen TL, Ofenloch RF, Bruze M, Bertuccio P, Cazzaniga S, Coenraads PJ, et al. Prevalence of contact allergy in the general population in different European regions. Br J Dermatol 2016; 174: 319–329.
18. UNESCO. International Standard Classification of Education – ISCED November 1997. Paris: UNESCO; 1997.
19. Newcombe RG. Two-sided confidence intervals for the single proportion: comparison of seven methods. Stat Med 1998; 17: 857–872.
20. Bland JM, Altman DG. Multiple significance tests: the Bonferroni method. BMJ 1995; 310: 170.
21. Kamtsiuris P, Bergmann E, Rattay P, Schlaud M. Inanspruchnahme medizinischer Leistungen. Bundesgesundheitsblatt Gesundheitsforschung-Gesundheitsschutz 2007; 50: 836–850.
22. Mahé E, Beauchet A, Reguiai Z, Maccari F, Ruer-Mulard M, Chaby G, et al. Socioeconomic inequalities and severity of plaque psoriasis at a first consultation in dermatology centers. Acta Derm Venereol 2017; 97: 632–638.
23. Mielck A, Reitmeir P, Wjst M. Severity of childhood asthma by socioeconomic status. Int J Epidemiol 1996; 25: 388–393.
24. Feldmeier H, Heukelbach J. Epidermal parasitic skin diseases: a neglected category of poverty-associated plagues. Bull World Health Organ 2009; 87: 152–159.
25. Accorsi S, Barnabas GA, Farese P, Padovese V, Terranova M, Racalbuto V, et al. Skin disorders and disease profile of poverty: analysis of medical records in Tigray, northern Ethiopia, 2005–2007. Trans R Soc Trop Med Hyg 2009; 103: 469–475.
26. Shack LG, Rachet B, Brewster DH, Coleman MP. Socioeconomic inequalities in cancer survival in Scotland 1986–2000. Br J Cancer 2007; 97: 999–1004.
27. McNally RJQ, Basta NO, Errington S, James PW, Norman PD, Craft AW. Socioeconomic patterning in the incidence and survival of children and young people diagnosed with malignant melanoma in Northern England. J Invest Dermatol 2014; 134: 2703–2708.
28. Wilkinson RG, Pickett KE. The problems of relative deprivation: why some societies do better than others. Soc Sci Med 2007; 65: 1965–1978.