

Professional Cleaners' and Healthcare Workers' Ability to Recognize Hand Eczema

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Timely intervention reduces the risk of a poor prognosis in hand eczema, making early recognition of symptoms important in high-risk professions. However, limited data exist regarding the ability of cleaners and healthcare workers to recognize hand eczema. The aim of this study was to examine cleaners' and healthcare workers' ability to recognize hand eczema in clinical photographs and to assess the severity of the disease. Cleaners and healthcare workers completed a questionnaire consisting of 16 questions and participated in a structured interview referring to a validated photographic severity guide for chronic hand eczema, which comprised clinical photographs of hand eczema at varying levels of severity. Eighty cleaners and 201 healthcare workers (total N = 281) participated in the study. The rates of correctly identified hand eczema in clinical photographs (cleaners/ healthcare workers) were: 41.2%/57.7% (mild hand eczema), 81.2%/92.0% (moderate hand eczema), 85.0%/94.5% (severe hand eczema) and 82.5%/97.0% (very severe hand eczema). The proficiency of healthcare workers in recognizing hand eczema was significantly higher than that of cleaners. The results indicate that a large proportion of cleaners and healthcare workers fail to recognize mild hand eczema in clinical photographs. Healthcare workers had higher success rates in recognizing hand eczema in all severity categories. Symptom underestimation may lead to under-reporting of the true prevalence of hand eczema, with consequent loss of opportunities for prevention.

Key words: contact dermatitis; occupational dermatitis; occupational diseases; perception; symptom assessment.

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Hand eczema (HE) is a common inflammatory skin disease that occurs in 9.1% of the general population (1). In high-risk jobs, such as cleaners, healthcare workers (HCW), hairdressers and bakers, the prevalence of HE may reach 30% (1–5). HE can lead to increased sick leave, change of profession or, ultimately, job loss (6–8). In this context it is hardly surprising that HE also has a negative impact on health-related quality

SIGNIFICANCE

The prevalent reliance on self-reported history for hand eczema data in epidemiological studies of hand eczema lacks insight into the ability of high-risk professions to recognize the signs and symptoms of hand eczema. Timely intervention mitigates poor prognosis risks in hand eczema, emphasizing the importance of early recognition. This study assessed the ability of cleaners and healthcare workers to recognize hand eczema from clinical photographs, revealing challenges in recognizing mild cases. These findings underscore the need for targeted strategies and educational material to enhance awareness of hand eczema, particularly regarding mild cases, which is where preventative efforts can be expected to have the greatest impact.

of life (9, 10). HE is the most common acknowledged work-related skin disease in Denmark, accounting for 32% of the occupational diseases acknowledged from 2015 to 2021 (11). Prompt recognition is paramount for diagnosis, treatment and registration as an occupational skin disease. Thus, the ability to identify and act on symptoms and signs of HE from the skin is essential. It is known that early intervention reduces the risk of a poor prognosis of HE (12). In particular, the recognition of mild HE is important, as it is thought to identify the disease at a stage at which treatment and prevention are likely to be most effective (1, 13, 14).

Knowledge of HE may influence the ability to recognize symptoms and seek help. A recent study among Danish patients with HE found that the level of knowledge of HE was associated with education, age and sex (15). An education of 3–4 years' duration was generally associated with a high level of knowledge of HE (15). One way of understanding the problem is therefore to compare 2 groups with different educational backgrounds, such as cleaners and HCW, which are both high-risk professions for development of HE.

Several studies have shown significant under-reporting of occupational HE to the authorities (3, 16), and it is well established that questionnaire-based studies underestimate the true prevalence of HE (17–20), yet this is the predominant method of collecting data in epidemiological studies of HE. One possible reason for under-reporting of the disease may be that patients simply do not recognize HE or perceive symptoms correctly. In some cases, this

may be a reflection of patients expecting a certain degree of HE whilst the need to retain an income may influence the perception of others. Finally, the patient's comprehension of treatment options may influence the number of individuals seeking medical care for the disease (21). However, to the authors' best knowledge, no studies have yet investigated the workers' ability to recognize HE in clinical photographs in different professions, which is especially relevant in high-risk professions.

The aim of this study was to examine the ability of cleaners and healthcare workers to recognize HE in clinical photographs and to assess the severity of the disease as mild, moderate, severe or very severe.

MATERIALS AND METHODS

Data were collected using questionnaires and structured interviews, in that order. Inclusion criteria were: age ≥ 18 years, currently occupied as a cleaner or HCW with sufficient Danish skills to complete a questionnaire and participate in the structured interview. Inclusion was limited to employees in either the day or evening shift during the inclusion period. Exclusion criteria were: current sick leave or being a student or trainee. Participation was voluntarily and anonymous.

Participants from private cleaning companies (working in laboratories, office buildings or schools) and public healthcare institutions were recruited from small-to-medium-sized cities near the capital region (population sizes ranging from 20,000 to 55,000) reflecting the general working population in Denmark. Participants were invited to join the study through their workplace management representatives. The management representatives were contacted and informed about the study in detail, and they helped with the recruitment of participants, who joined the study voluntarily during September to October 2022.

Participants were initially informed verbally that this was a study of HE, which involved a questionnaire and a brief interview about HE. If a participant had not heard of HE before, a short explanation and definition of HE (a rash on the hands or fingers presenting with redness, blistering, scaling, cracking or itching) was provided by the interviewer. Subsequently, all participants completed the questionnaire with a time limit of 20 min. The ability to recognize and assess the severity of HE was investigated in a structured interview (see Table SI for interview guide) based on a validated photographic guide of chronic hand eczema (CHE) (22).

Questionnaire

The questionnaire comprised 16 questions covering demographics, prior history of HE, work experience and atopy (Table SII). Questions regarding prior history of HE and atopy were partly based on the Nordic Occupational Skin Questionnaire (NOSQ) (23). Prevalence of HE was explored by using the D1 question "Have you ever had hand eczema?". Level of education was measured with Statistic Denmark's classification system for education (DISCED-15) (24) equivalent to the International Standard Classification of Education (ISCED-P) (25). Knowledge of HE was explored by asking participants to rate their knowledge of HE (self-evaluated knowledge) on a numerical rating scale (NRS) from 0 to 10, with the anchor points 0=no knowledge and 10=sufficient knowledge. The questionnaire was tested in a pilot study ($n=11$ auxiliary nurses and $n=10$ cleaners at Zealand University Hospital), by asking the following question: "What do you think this question means" (think-aloud). If a question was not understood it was reformulated in order to explain the inten-

ded meaning. The participants were then asked how the question could be improved for a better understanding. The question was subsequently modified and the process iterated until clarity was achieved. This required 1 iteration.

Structured interview

The structured interview referred to a modified guide of clinical photographs (22) containing 16 photographs of CHE on hands of exclusively Caucasian patients presenting different severities of HE. Severity groups in the guide were determined through individual expert assessments and a consensus panel meeting between dermatologists. The 4 photographs selected for each grade aimed to visually encompass the entire range within each level of severity (26). The photographs, measuring 16×12 cm, were presented on a computer screen with a 1440×900 pixel resolution. Photographs depicting different severities of HE were presented 1 at a time in random order (using the online tool Random Image Picker; imagepicker.org). Due to the participants' time constraints, only 4 photographs were used. One photograph from each severity category was presented using a random photograph of almost clear (mild), moderate, severe and very severe HE. Both the investigator and participants were blinded to the order of the photographs and no indication was provided to the participants regarding the specific number of photographs presented. Answers were collected with a brief structured interview in an allocated undisturbed room and each interview was completed within 5 min. Participants were initially asked if HE was present in the photographs. If the answer was affirmative the participants were asked to grade the severity from mild to moderate, severe and very severe.

Statistical analysis

Data were analysed with SPSS statistical software version 24.0 (IBM Corp., Armonk, NY, USA). Study variables were summarized using descriptive statistics. The data did not meet the assumptions of parametric data and the χ^2 test or Fisher's exact test were used to compare variables (Tables I–IV, SII–SIV). In the analyses the

Table I. Participants' characteristics

Variable	Cleaners N = 80 n (%)	Healthcare workers N = 201 n (%)	p-value
Sex			
Male	28 (35.0)	55 (27.4)	0.205
Female	52 (65.0)	146 (72.6)	
Age group,			
18–34 years	16/78 (20.5)	55/196 (28.1)	0.032
35–54 years	49/78 (62.8)	89/196 (45.4)	
≥ 55 years	13/78 (16.7)	52/196 (26.5)	
Educational level			
Low education	37 (46.3)	17 (8.5)	<0.001
Medium education	16 (20.0)	70 (34.8)	
High education	27 (33.7)	114 (56.7)	
Country of birth			
Born or raised in Denmark	6 (7.5)	157/200 (78.5)	<0.001
Born or raised outside of Denmark	74 (92.5)	43/200 (21.5)	
Years of work experience within profession			
<1 year	5 (6.3)	15 (7.5)	0.666
1–5 years	25 (31.2)	50 (24.9)	
5–10 years	17 (21.2)	40 (19.9)	
>10 years	33 (41.3)	96 (47.7)	
Type of employment			
Permanent	70/79 (88.6)	147 (73.1)	0.005
Temporary	9/79 (11.4)	54 (26.9)	
Previous work with high risk of HE			
Yes	16/79 (20.3)	67 (33.3)	0.031
No	63/79 (79.7)	134 (66.7)	

Statistical differences were estimated with the χ^2 test or Fisher's exact test. HE: hand eczema. Significant p-values are shown in **bold**.

Table II. Self-reported history and self-evaluated knowledge of hand eczema (HE)

Variable	Cleaners N = 80 n (%)	Healthcare workers N = 201 n (%)	p-value
Have you ever had HE?			
Yes	29 (36.3)	50 (24.9)	0.031
No	51 (63.7)	141 (70.1)	
Don't know	0 (0.0)	10 (5.0)	
Participants with self-reported HE:			
Receiving treatment for HE before			
Yes	17/29 (58.6)	36/50 (72.0)	0.223
No	12/29 (41.4)	14/50 (28.0)	
Receiving information regarding HE from a physician before			
Yes	12/29 (41.4)	30/49 (61.2)	0.089
No	17/29 (58.6)	19/49 (38.8)	
Self-evaluated knowledge of HE from a scale of 0–10*			
Low	44 (55.0)	107/199 (53.8)	0.663
Intermediate	30 (37.5)	82/199 (41.2)	
High	6 (7.5)	10/199 (5.0)	
HE in family or near social circle			
Yes	11 (13.8)	55/200 (27.5)	0.010
No	66 (82.5)	128/200 (64.0)	
Don't know	3 (3.7)	17/200 (8.5)	
Attended a work-related HE prevention programme			
Yes	8 (10.0)	20 (10.0)	0.990
No	72 (90.0)	181 (90.0)	

Statistical differences were estimated with the χ^2 test or Fisher's exact test. Significant p-values are shown in **bold**.
 *Low self-evaluated knowledge: 0–4. Intermediate self-evaluated knowledge: 5–8. High self-evaluated knowledge: 9–10.

ISCED educational levels were summarized into 3 groups: low education (levels 0–2), medium education (levels 3–4) and high education (levels 5–8). The proportion of the participants recognizing HE was summarized as a percentage (Table III). In order to investigate whether the participants overestimated or underestimated the severity of HE, the incorrect answers for all the degrees of severity were divided into 2 groups: overestimating of the severity (those selecting a higher HE severity) and underestimating of the severity (those selecting a lower HE severity) (Table IV).

To evaluate whether sex, age, educational level, country of birth, type of profession and years of work experience within a profession influenced the level of ability to recognize HE, a binominal logistic regression was performed by dichotomizing the total score of recognized HE into: high level of recognition (4/4 photographs of HE recognized) and low level of recognition (0/4–3/4 photographs of HE recognized) (Table V). The results were presented using odds ratios (OR) at a 95% confidence interval (95% CI). Differences were defined as statistically significant at $p < 0.05$.

RESULTS

A total of 350 eligible individuals were invited to participate in the study, with 281 eventually participating.

Table III. Hand eczema (HE) recognition (yes or no)

	Cleaners N = 80 n (%)	Healthcare workers N = 201 n (%)	p-value
Mild HE			
Yes, there is HE in the photograph	33 (41.2)	116 (57.7)	0.013
No, there is not HE in the photograph	47 (58.8)	85 (42.3)	
Moderate HE			
Yes, there is HE in the photograph	65 (81.2)	185 (92.0)	0.009
No, there is not HE in the photograph	15 (18.8)	16 (8.0)	
Severe HE			
Yes, there is HE in the photograph	68 (85.0)	190 (94.5)	0.009
No, there is not HE in the photograph	12 (15.0)	11 (5.5)	
Very severe HE			
Yes, there is HE in the photograph	66 (82.5)	195 (97.0)	<0.001
No, there is not HE in the photograph	14 (17.5)	6 (3.0)	

Statistical differences were estimated with the χ^2 test or Fisher's exact test. Significant p-values are shown in **bold**.

Three cleaners and 2 HCW were excluded due to insufficient Danish skills, resulting in a participation rate of 81.4% (Table SV). The study population included cleaners ($n = 80$), auxiliary nurses and their locum tenens ($n = 120$), nurses ($n = 18$), surgeons ($n = 47$) and doctors of internal medicine ($n = 16$). No significant differences regarding the level of recognition of HE were found between medical doctors and nurses and auxiliary nurses and they were therefore merged into a single group (HCW) for further analyses (Table SIII). Sex distribution was 29.5% ($n = 83$) males and 70.5% ($n = 198$) females. Educational levels are listed in Table I.

A statistically significant difference regarding country of birth was found between cleaners and HCW. Of the cleaners 92.5% reported being born or raised outside of Denmark, while the proportion of HCW was 21.5% ($p = < 0.001$) (Table I).

History of hand eczema

Cleaners had a statistically significantly higher lifetime prevalence of self-reported HE compared with HCW (36.3% vs 24.9%) ($p = 0.031$) (Table II). The majority (90.0%) of both the cleaners and the HCW had not attended a work-related HE prevention programme prior to their participation in this study. No difference was found regarding self-evaluated knowledge of HE, and the majority of cleaners and HCW (55.0% and 53.8%) considered themselves to have a low degree of knowledge of HE (Table II). A sub-analysis among both groups

Table IV. Ability of cleaners and healthcare workers' (HCW) to assess hand eczema (HE) severity in clinical photographs representing mild, moderate, severe and very severe HE

Degree of HE in photographs	Profession	Underestimation of severity	Correct severity	Overestimation of severity	p-value
Mild	Cleaners $n = 33$ (%)	No lower degree of disease severity than mild HE was offered	29 (87.9)	4 (12.1)	0.657
	HCW $n = 116$ (%)		105 (90.5)	11 (9.5)	
Moderate	Cleaners $n = 65$ (%)	27 (41.6)	22 (33.8)	16 (24.6)	0.377
	HCW $n = 185$ (%)	84 (45.4)	70 (37.8)	31 (16.8)	
Severe	Cleaners $n = 68$ (%)	23 (33.8)	26 (38.2)	19 (28.0)	<0.001
	HCW $n = 190$ (%)	105 (55.3)	64 (33.7)	21 (11.0)	
Very severe	Cleaners $n = 66$ (%)	26 (39.4)	40 (60.6)	No higher degree of disease severity than very severe HE was offered	<0.001
	HCW $n = 195$ (%)	127 (65.1)	68 (34.9)		

Statistical differences were estimated with the χ^2 test or Fisher's exact test. Significant p-values are shown in **bold**.

Table V. Multivariate analysis comparing high level of recognition with low level of recognition of hand eczema

	N=281		Crude OR		Adjusted ^a OR	
High level of recognition outcome	High level of recognition N = 134	Low level of recognition N = 147	OR (95% CI)	p-value	OR (95% CI)	p-value
Sex						
Male (reference)	36	47	1		1	
Female	98	100	1.28 (0.76–2.14)	0.349	1.28 (0.74–2.22)	0.383
Age						
18–34 years old	39/131	32/143	1.41 (0.79–2.50)	0.242	1.36 (0.67–2.76)	0.404
35–54 years old (ref.)	64/131	74/143	1		1	
≥55 years old	28/131	37/143	0.88 (0.48–1.59)	0.660	0.82 (0.43–1.54)	0.536
Educational level						
High (ref.)	68	73	1		1	
Medium	40	46	0.93 (0.55–1.60)	0.802	0.95 (0.53–1.69)	0.853
Low	26	28	1.00 (0.53–1.87)	0.992	1.52 (0.72–3.21)	0.270
Profession ^b						
Cleaners (ref.)	31	49	1		1	
Healthcare workers	103	98	1.66 (0.98–2.82)	0.060	2.17 (1.01–4.68)	0.048
Country of birth						
Born or raised in Denmark (ref.)	81	82/146	1		1	
Born or raised outside of Denmark	53	64/146	0.84 (0.52–1.35)	0.468	1.25 (0.64–2.43)	0.517
Years of work experience within profession						
<1 year	13	7	1.91 (0.69–5.31)	0.217	1.85 (0.65–5.29)	0.251
1–5 years (ref.)	37	38	1		1	
5–10 years	26	31	0.86 (0.43–1.72)	0.672	1.02 (0.48–2.18)	0.962
>10 years	58	71	0.84 (0.47–1.48)	0.546	1.10 (0.53–2.29)	0.798

High level of recognition: 4/4 photographs of HE recognized. Low level of recognition: 0/4–3/4 photographs of HE recognized. Binominal logistic regression analysis with ORs for cleaners and HCW with a high level of recognition compared with cleaners and HCW with a low level of recognition. Significant *p*-values and odds ratio are shown in **bold**.
95% CI: 95% confidence interval; OR: odds ratio; ref.: reference; HE: hand eczema; HCW: healthcare worker.
^aAdjusted for sex, age, educational level, country of birth, type of profession and years of work experience within profession. ^bIn the group of HCW 51.2% were categorized as having a high level of recognition and 48.8% as having a low level of recognition. In the group of cleaners 38.7% were categorized as having a high level of recognition and 61.3% as having a low level of recognition.

found that a history of HE did not affect the degree of self-evaluated knowledge. Among participants with a history of HE compared with those without a history of HE, there was a higher proportion of atopic dermatitis (25.6% vs 7.3%, *p*<0.001) and contact allergy (20.3% vs 6.3%, *p*<0.001). HE occurred more commonly in the age group 18–34 years (39.4%) compared with the other age groups (26.1% among the group 35–54 years and 20.0% among the group >55 years). However this difference was not significant (*p*=0.069).

Ability to recognize hand eczema

The cleaners' recognition of HE in photographs was statistically significantly lower compared with HCW, regardless of severity (Table III).
Level of recognition of HE was divided into low and high level. A low level of recognition was found in 61.3% of the cleaners and 48.8% of the HCW, with a nearly significant difference (*p*=0.060). When adjusting for sex, age, educational level, country of birth and years of work experience within profession, HCW were statistically significantly more likely to have a high level of recognition of HE compared with cleaners (adjusted OR 2.17 (95% CI 1.01–4.68)) (*p*=0.048) (Table V). A sub-analysis among cleaners and HCW found that having a history of HE or atopic dermatitis did not affect the level of ability to recognize HE. 41.6% of cleaners and 45.4% of HCW underestimated the disease severity of moderate HE (Table IV). A statistically significantly higher proportion of HCW underestimated the disease

severity of severe and very severe HE compared with cleaners (*p*=<0.001) (Table IV).

DISCUSSION

It appears to be difficult for cleaners and HCW to recognize HE in clinical photographs, especially when it comes to mild disease. In general, cleaners performed significantly less well than HCW, and it is speculated that this may be due to differences in education and knowledge of HE. Recognizing and acknowledging the presence of mild symptoms of HE is an important first step in management of the disease, i.e. the timely use of preventive measures and appropriate treatment to obviate the evolution of more chronic lesions (12). The study suggests that working cleaners and HCW may consider mild symptoms as a normal condition potentially resulting in neglect of skin symptoms and consequences of HE.
As mentioned, prevention of HE may depend partly on the recognition of symptoms and partly on knowledge of the disease. The level of recognition of mild HE was, however, poor for both of the studied groups. Notably, the participants with self-reported HE were not better at recognizing HE in clinical photographs than those without self-reported HE.
The low ability to recognize HE in clinical photographs brings focus to the reliability of self-reported HE in general, and underestimation of HE may be present, as emphasized by previous studies (17, 18, 27). Regarding the assessment of severity of HE, the majority of clea-

ners and HCW underestimated the severity of moderate HE, and HCW statistically significantly underestimated the disease severity of severe and very severe HE compared with cleaners. The underestimation of the severe symptoms among HCW may reflect a higher threshold regarding disease severity, but may also reflect a higher level of attachment to their profession (6). The threshold may be taken to represent the coping capacity of the individual and the psychological, social and economic resources of the respondent may therefore influence the results. The underestimation of disease severities among HCW in the study may lead to a delay in seeking medical attention, and may affect the accuracy of self-reported HE, thereby aggravating the problem.

The majority of the cleaners in this study were immigrants in Denmark and had a low level of education, which may have influenced both their employment possibilities and their knowledge of HE (28). In Denmark, a larger proportion of female non-western immigrants (15.1%) is employed in cleaning and other operational services compared with ethnic Danish women (4.2%) (29). It is speculated, that having fewer employment possibilities may promote the acceptance of skin symptoms as a part of the job. Notably, 41% of cleaners and 28% of HCW with self-reported HE did not receive treatment for HE, and an even larger proportion of both groups did not receive information regarding HE from a physician. It may indicate that self-treatment is occurring (30), and that more focus on patient and staff education is needed. A nearly statistically significant trend of HE more often affecting younger employees (18–34 years) was found in the study, which corresponds to findings of other studies (3, 31, 32). It is possible that those remaining in the work field have less severe and more tolerable symptoms.

In the current study the majority of cleaners and HCW reported having a low degree of knowledge of HE. Somewhat surprisingly, HCW did not report a higher self-evaluated knowledge of HE compared with cleaners, despite the fact that more than 30% of the HCW in the study were medical doctors. Only 10% of the study population had attended a HE work-related prevention programme, and, together with the low self-reported knowledge of HE, this accentuates the need for greater focus on prevention of HE in cleaners and HCW. A "road map" has been suggested for such an initiative. A nationwide skin protection programme was implemented in hairdressing vocational schools in Denmark in 2011 and has been shown to reduce the risk of HE (33). The absence of similar programmes for other high-risk professions emphasize that HE is still a neglected disease (34).

Study limitations

The study has some limitations that may influence the results. Firstly, a potential language barrier may complicate understanding the questions regarding HE and lead to incorrect answers. However, the procedures

were explained with an impression of understanding and in the multivariate logistic regression, the current study adjusted for country of birth, since a proportion of those born or raised outside of Denmark may have a first language other than Danish.

Secondly, the guide to CHE (22) contained photographs of exclusively Caucasian hands. However, other skin types may be represented in the study population. HE appears differently on various skin types; especially, redness is not seen to the same extent on darker skin types. A guide with photographs of all skin types does not yet exist. In addition, the guide is originally validated for assessing disease severity in patients with known HE, but has not been validated for patients to recognize the presence of HE.

Thirdly, presenting all 16 photographs from the guide when investigating the ability to recognize HE would have been ideal. However, to accommodate the time constraints of the participants, the investigators limited the number of photographs presented, which ensured an adequate sample size of the study and minimized the cognitive load on the participants. Participants were blinded with regard to the exact number of photographs, thus unable to predict/expect any given number of photographs. Participants were informed that the topic of interview regarded HE exclusively and were asked whether they observed HE in the photographs, thus emphasizing the focus on HE in order to reduce possible bias due to expecting photographs with no visible lesions. Some received a short explanation of HE in order to not exclude participants who lacked basic knowledge of the disease. However, this may have improved recognition, potentially weakening the study's findings. The study identified challenges in recognizing HE in photographs, but the overall ability to recognize the disease may depend on an individual's knowledge and the capacity to integrate objective signs with subjective symptoms, such as itching, which are not represented in photographs.

Finally, the participating cleaners and HCW were invited to participate by the management, which may have caused selection bias.

Conclusion

This study indicates that only a minority of cleaners identify HE correctly in clinical photographs, and the difficulty is particularly pronounced in mild disease, which is unfortunately also when preventative efforts would be expected to have the greatest impact. HCW are marginally better than cleaners at recognizing mild HE; however, they only achieved 57.7% correct answers in this category. In all other categories HCW were better than cleaners at recognizing HE. More focus on, and awareness of, HE is needed in these high-risk professions. The true prevalence of HE is expected to be higher than reported, which may be due to underestimation of symptoms and signs.

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The study relied on anonymous participation and was questionnaire- and interview-based. According to Danish legislation, acceptance by the regional ethics committee is not required for questionnaire and interview studies. This was confirmed by Research Ethics Committee, Region Zealand (case number EMN-2023-03558). The followed procedures were in accordance with the current Declaration of Helsinki (2013).

Informed consent was obtained from all individual participants included in the study.

Conflicts of interest: GBEJ reported receiving grants from AbbVie, LEO Foundation, Afyx, InflaRx, Janssen-Cilag, Novartis, UCB, CSL Behring, Regeneron, Sanofi, Boehringer Ingelheim, Union Therapeutics, and Toosonix and personal fees from Coloplast, Chemocentryx, LEO Pharma, Incyte, Kymera, and VielaBio. KSJ has been part of advisory boards and received personal fees from Astra Zeneca, Leo Pharma; Sanofi Genzyme, and Eli Lilly. GBEJ and KSJ declare that none of the mentioned conflicts of interest influenced the work reported in this paper. The remaining authors have no conflicts of interest to declare.

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