

Spoilt for choice – evaluation of two different scoring systems for early hand eczema in teledermatological examinations

THOMAS BAUMEISTER, WOBBEKE WEISTENHÖFER, HANS DREXLER AND BIRGITTA KÜTTING

Institute and Outpatient Clinic of Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Schillerstr 25/29, D-91054 Erlangen, Germany

Background: Besides improving working conditions and using personal protective equipment, early detection is most important in managing work-related hand eczema. Implementing regular teledermatological skin screenings could be helpful, but none of the published hand eczema-scores has hitherto been used in teledermatology.

Objective: Testing and comparing two validated scores [Osnabrück hand eczema severity index (OHSI); hand eczema severity index (HECSI)] for their suitability in an occupational telemedical screening.

Patients/Materials/Methods: One hundred and twenty photographic records of the hands of 30 male wet workers were examined twice with each score. Results were tested for reproducibility, intra-observer reliability and inter-score-correlation.

Results: Examination time, mean score values, and score ranges reached did not differ significantly. The inter-score-correlation was moderate (correlation coefficients: 0.651 for first examination; 0.642 for second examination). In the qualitative assessment, the HECSI showed a better overall agreement between results of first and second examinations.

Conclusions: Both scores are suitable for assessing the skin condition in a teledermatological setting. The comparability is limited to qualitative assessment, as the strictly objective OHSI measures the extent of hand eczema and the finer graduated HECSI measures the intensity of hand eczema, adding a subjective component. For assessing minimal skin changes, a scoring system that reduces subjective elements while at the same time it offers a differentiated grading is advisable.

Key words: hand eczema, HECSI; occupational screenings; OHSI; scoring systems; teledermatology.
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Hand eczema is one of the most common skin diseases. It often has a chronically relapsing course with a poor prognosis, resulting in a high social and economic impact for the individual and society (1). If mild cases are also included, the 1-year prevalence of hand eczema is estimated to be 7–12% in the general population (2,3). For approximately one-third of the patients, the disease starts before the age of 20 and is often occupationally related (4). In the case of occupational hand eczema, the most efficient management is improvement of working conditions,

i.e. the elimination of wet work, irritants, or possible allergens and the use of personal protective equipment. However, although the implementation of preventive strategies for occupational skin diseases is generally good, the acceptance and compliance concerning the use of protective equipment is often low (5), as long as employees do not feel personally concerned. It has been shown that personal protective measures are employed especially by those reporting hand eczema in their medical history (5). For preventing chronic occupational hand

eczema with serious socioeconomic consequences (e.g. sick leave, loss of work), raising the awareness of the individuals concerned by regular skin screenings at workplace seems to be important. It has been shown that it is possible to detect early signs of hand eczema by means of teledermatology (6) and that in order to organize a more flexible, timely, and cost-effective preventative routine, a telemedical approach is conceivable. A teledermatological store-and-forward routine (7) that allows periodic screenings as well as spontaneous documentation of acute and temporary skin lesions could probably serve this purpose and keep costs as well as time at a minimum. Additionally, the workflow is considerably less hindered by a telemedical screening compared to a complete skin examination at the workplace. Furthermore, examination of the skin can be performed independently without delay by one or more physicians with specialized dermatological knowledge (6,8).

To reach viable results in teledermatological examinations, the accurate assessment of the severity of hand eczema or its preliminary stages is essential for quantifying the baseline clinical disease burden and for documentation of the effectiveness of a treatment (9). An abundance of different scoring systems have been used for quantifying hand eczema, but only a few of these have been validated until now (10). No scoring system has gained general acceptance so far (11), and none of the published scoring systems has, to our knowledge, been used in teledermatology.

Four physician-rated scores have recently been validated and tested for their inter-observer reliability: the hand eczema severity index (HECSI) (11), the photographic guide (12), the Manuscore (13) and the Osnabrück hand eczema severity index (OHSI) (9,14). However, except for the HECSI, intra-observer reliability was never determined (10). All of these scores were developed for the diagnosis and treatment of distinct hand eczema and were, therefore, consistently validated by using them on diseased subjects. However, their validity and usability in a teledermatological screening of workers suffering mainly from slight eczema remains to be proven. As none of the existing scoring systems can be regarded as the 'gold standard' we decided to compare two validated scoring systems, e.g. HECSI and OHSI for their suitability in teledermatological settings. Both scores show a high agreement in inter-observer variability (Inter-class correlation coefficient: 0.82 versus 0.8) (10) and bear the closest resemblance among the four validated scores.

Therefore, this study was aimed at comparing the OHSI and the HECSI for the assessment of early hand eczema and at evaluating their suitability in occupational screenings via a telemedical approach.

Advantages and disadvantages of both scoring systems for application in telemedical occupational screenings are evaluated and critically discussed, especially concerning the assessment of minimal skin changes that occur in initial hand eczema.

Material and Methods

Study population

From a digital photographic database of the hands of 1355 metal workers, we randomly chose photographic records of both hands (back and palm) of 30 male participants (a total of 120 photographs). The 1355 metal workers were aged between 17 and 64 years (median: 42; mean: 40.8) and employed in 19 factories, mainly of small or medium size, all situated in Germany. They were recruited during a 6-month period in winter 2006/2007 at which time they had to be fit for work and exposed to cutting fluids as surrogate for wet work (5).

All participants gave their informed written consent to participate in a standardized interview, a dermatological examination of their hands and having digital photographs taken of the backs and palms of their hands. The study design was approved by the ethics committee of the University of Erlangen-Nuremberg.

Preparation of photographic material

Each photographic record contained two photographs of each hand, showing both the dorsal and the palmar aspects. The photographs had been taken against a green, non-reflecting background, with a tripod-mounted, commercially available Olympus® sp-350 camera (resolution 8.0 mega pixels), and showed a four-figure identification code number as the only distinguishing feature, as rings, bracelets, or watches had been removed. After duplicating each photographic record, the resulting 60 sets of photographs (a total of 240 photographs) were randomly mixed and then numbered consecutively from 1 to 60. After entering the identification code into a decoding list, the code was removed from the picture.

The scores and statistic procedures

As appears from the publications concerning the scores, in both scoring systems the hands of the participants are sectioned and the skin condition of the participant is assessed by giving point values for the extent and intensity of characteristic morphological signs in these sections (11,14). However, the mathematical model in OHSI and HECSI varies distinctly.

The OHSI employs six morphological signs (erythema, scaling, papules, vesicles, infiltration, and

fissures). The hands are subdivided into eight areas, namely the two palmar areas, the backs of both hands, and the dorsal and palmar aspects of the fingers of each hand. The extent is assessed by the area of the skin of the hands affected by one or more of the morphological characteristics, and a 1/8 scoring system is used for the affected areas on both hands combined (14). The score points are primarily given for the extent of a single skin lesion in each defined area separately. After that, the score points for all areas are added up and divided through eight. The cut-off point for severe hand eczema is greater than 7, the total score value can range from 0 to 18 points (9). Contrary to HECSI, the intensity is not taken into consideration.

The HECSI scoring system grades the intensity of erythema, induration, papules, vesicles, fissuring, scaling, and oedema for five areas on each hand [fingertips, fingers (except the tips), palms, back of hands, and wrists] on a scale from 0 to 3, meaning that score values are given for the intensity of single lesions in a defined area and are then added up. The extent of affected skin on each area is measured with a score from 0 to 4. The intensity and extent are multiplied and the total score value can range from 0 to 360 points (11).

Because of these differences, we chose to evaluate the scores at first separately with regards to the total score values and their percentage of the reachable maximum score values, i.e. 360 with HECSI and 18 with OHSI. The scores were then checked for qualitative reproducibility of the results and the percentage of qualitative reproducibility of both scores was compared. As the severity of disease is measured by extent in one score (OHSI) and 'intensity' in the other (HECSI), this factor of measuring had to be left out of the comparison. However, the advantages and disadvantages of both proceedings are discussed.

The statistic evaluation was done with SPSS® (SPSS Inc.; Chicago, IL, USA) version 16.0. As a result of our fit-for-work study population, a normal distribution of the results was not to be expected; therefore, we used Spearman's rank correlation coefficient for assessment of the correlation of the test results and the intra-score-correlation. For evaluation of the qualitative reproducibility, we used either parametric or non-parametric tests as appropriate. Coefficient values were interpreted as follows: <0.2 very poor agreement; 0.2–0.5 poor agreement; 0.5–0.7 moderate agreement; 0.7–0.9 high agreement; >0.9 very high agreement.

Examination procedure

As both scores are known for a high inter-observer agreement and in order to avoid inter-observer bias,

the evaluation of the 60 sets of photographs was to be performed by one single examining physician who had been thoroughly trained earlier. The training consisted of an introduction into both scoring systems. The similarities and differences between HECSI and OHSI were explained by an occupational dermatologist. The characteristic morphological changes of hand eczema were shown by digital photographs. Then three photographic cases of mild to moderate hand eczema were assessed using both scores and discussed in the training session.

First, the photographs of each file were examined by using the HECSI score. In order to preserve observational quality, only 10 sets of photographs were evaluated per day, so that each subject's hands were examined twice within 6 days. After a period of 1 week the procedure was repeated, this time using the OHSI score as evaluation tool. In order to keep an unbiased view on the skin condition, the examiner got no further information about the participants (i.e. age, working conditions, skin conditions, past dermatological disorders).

Results

The minimal time span needed for an examination was 47 seconds with the OHSI; the maximal time for an examination was 6 min with the HECSI. With both scores, the second examination took less time than the first, significantly so with OHSI ($P = 0.009$). Table 1 shows the mean duration of the examinations performed with each score. The test durations showed a moderate to good correlation with the amount of score values given. The time needed for each examination with HECSI and OHSI was not significantly different for both scores; it averaged less than 3 min.

Evaluating the mean score values and score ranges that were reached in both examinations with each scoring system (Table 2), we found no significant difference in the averages of total score sum and the mean values given for single lesions

Table 1. Mean duration of examinations 1 and 2 performed with either HECSI or OHSI

Test – duration	Examination 1		Examination 2		Δ 1–2	
	HECSI	OHSI	HECSI	OHSI	HECSI	OHSI
Seconds (mean)	162	170	149	145	13	25
Seconds (median)	149	174	152	139.5		
Range (seconds)	48–304	70–276	68–244	47–252	80	1
Correlation with point values	0.723	0.726	0.565	0.664		

Table 2. Comparison of score values reached with HECSI or OHSI respectively, differentiated for single morphological changes

Examination	HECSI		OHSI	
	1	2	1	2
Total score				
Mean	6.9	7.03	1.19	1.15
Median	6	6	1.125	1.12
Range	0–17	0–28	0–3.63	0–3.25
Percentage of maximum	4.7	7.8	20.2	18.1
Erythema				
Mean	1.7	1.63	3.4	3.0
Median	2	1.5	3	3
Range	0–4	0–6	0–12	0–11
Percentage of maximum	26.7	40	50	45.8
Scaling				
Mean	2.43	2.77	5.43	5.20
Median	2.5	3	4	3
Range	0–8	0–7	0–20	0–18
Percentage of maximum	53.3	46.6	83.3	75
Vesicles				
Mean	0.47	0.43	0.53	0.40
Median	0	0	0	0
Range	0–6	0–2	0–6	0–4
Percentage of maximum	40	13.3	25	16.6
Fissures				
Mean	0.47	0.27	0.4	0.17
Median	0	0	0	0
Range	0–2	0–2	0–3	0–3
Percentage of maximum	13.3	13.3	12.5	12.5
	Oedema ^a	Oedema ^a	Papules ^b	Papules ^b
Mean	0.06	0	0	0
Median	0	0	0	0
Range	0–2	0	0	0
Percentage of maximum	13.3	0	0	0
Infiltration				
Mean	0.6	0.03	0	0.07
Median	0	0	0	0
Range	0–1	0–1	0	0–2
Percentage of maximum score reached	6.7	6.7	0	8.3

Percentage of maximum, maximum value as percentage of highest reachable score value.

^aOnly assessed in HECSI score.

^bPapules and infiltration assessed as one lesion in the HECSI, but two distinct lesions in the OHSI.

(e.g. erythema, papules, vesicles, fissures, scaling, infiltration, and oedema) in both examinations using either HECSI or OHSI. As the examination was performed by one examiner only, the result of the correlation could be rated as intra-observer variability as well. As can be seen in Table 3, the correlation between the results of first and second examinations proved slightly better for the OHSI-assessment. In the OHSI-results, there was a high

correlation in the results for total score, erythema, vesicles and scaling, whereas a high correlation of HECSI-results could be found only with regard to vesicles.

With both scoring systems, there was an overall tendency to give fewer points in the second examination.

As range and maximal reachable score values of both scores are very different from each other (HECSI 0–360 versus OHSI 0–18), a distinct difference in the results was to be expected. We compensated for this difference by calculating the percentage share of the point values reached with regard to the maximum score. The difference between the score ranges of HECSI (Δ 11) and OHSI (Δ 0.38) and the percentage share are shown in Table 3. For the most frequently detected lesions, namely erythema, scaling, and vesicles, we could detect a smaller range of variation in the OHSI while the maximum values of the OHSI lay closer to the possible maximum score.

Correlating the total score values obtained with either HECSI or OHSI, the level of inter-score-correlation was only moderate (correlation

Table 3. Comparison between results of examinations 1 and 2 for HECSI and OHSI

Examination	HECSI	OHSI
Total score		
Correlation coefficient	0.572**	0.845**
Δ of range 1–2	11	0.38
Δ 1–2 as percentage of maximum	3.1	2.1
Erythema		
Correlation coefficient	0.664**	0.851**
Δ of range 1–2	2	1
Δ 1–2 as percentage of maximum	0.56	5.6
Scaling		
Correlation coefficient	0.690**	0.860**
Δ of range 1–2	1	2
Δ 1–2 as percentage of maximum	0.56	11.1
Vesicles		
Correlation coefficient	0.832**	0.759**
Δ of range 1–2	4	2
Δ 1–2 as percentage of maximum	22.2	11.1
Fissures		
Correlation coefficient	0.640**	0.398*
Δ of range 1–2	0	0
Δ 1–2 as percentage of maximum	0	0
	Oedema ^a	Papules ^b
Δ of range 1–2	2	0
Δ 1–2 as percentage of maximum	0.56	0
Infiltration		
Δ of range 1–2	0	2
Δ 1–2 as percentage of maximum	0	11.1

^aOnly assessed in HECSI score.

^bPapules and infiltration assessed as one lesion in the HECSI, but two distinct lesions in the OHSI.

*Significant on a 0.05 level.

**Significant on a 0.001 level.

Table 4. Congruence between examinations 1 and 2 using either HECSI or OHSI

	HECSI			OHSI		
	First examination	Second examination	Percentage overlap	First examination	Second examination	Percentage overlap
Erythema	21	24	87.5	25	25	84
Scaling	26	27	96.2	26	26	100
Vesicles	8	6	75	6	4	66.6
Infiltration	2	1	50	0	1	0
Fissures	11	7	63.64	6	3	33.3
Oedema	1	0	0	Not assessed	Not assessed	0
Papules	Not assessed	Not assessed		0	0	0

coefficient of 0.651 for the first examination; 0.642 for the second examination).

To determine if the correlation level was influenced by the frequency of detection of the single lesions, the numbers of participants on which single lesions had been detected were compared. The lesions were detected with varying frequency with both scoring systems during the two examinations. The OHSI-results, however, seemed to be more consistent in the assessment of erythema and scaling. This proved to be correct with regard to the detection of scaling, when we assessed the percentage of overlap, but it did not do so in the case of erythema. However, the differences lay within a 5% margin.

With regard to consistency in the detection of vesicles, infiltration, and fissures, the HECSI seemed to show a larger overlap between the two examinations. For further details, see Table 4.

The correspondence varied remarkably in both scores depending on the area assessed and with the frequency of detection of a particular lesion. Using either HECSI or OHSI the best agreement between the two examinations was obtained in the assessment of the palmar skin condition while being remarkably lower in the digital region. Tables 5 and 6 show the agreement between the two examinations differentiated for each score.

In order to compare the results, we calculated the percentage of reproducibility. Each of the six lesions assessed in both scores can appear either in five (HECSI) or eight (OHSI) areas, resulting in 30 areas for the HECSI and 48 for the OHSI. Analysing the correspondence between the defined areas and the

detection of single lesions, we got a proportion of 26.6% (HECSI) and 14.6% (OHSI) of areas with high to very high correspondence. The proportion of areas with moderate agreement was 20% for the HECSI and 10.4% for the OHSI.

Taken together, this leads to a proportion of 46.6% of moderate to high reproducibility in the qualitative assessment with the HECSI score and only 27.1% with the OHSI.

Discussion

Screening tests at the workplace should meet several requirements: (i) inexpensive, (ii) easy and fast to perform, (iii) non-invasive, causing minimal discomfort in the tested persons and finally, (iv) highly valid and reproducible. The first three aspects can be confirmed for teledermatological screenings.

To simulate a teledermatological examination aimed at the prevention of occupational hand eczema and to determine a suitable assessment tool for this purpose, we assessed digital images of the hands of fit-for-work male wet workers with two validated scoring systems [HECSI(11) and OHSI(14)] which have been recently used in studies comprising large study samples. The HECSI was used in two studies concerning distinct hand eczema comprising samples with 416 and 799 participants (13,15), respectively, whereas the OHSI was used in a large German cohort study of 1375 geriatric nurses for assessing the prevalence of hand eczema and relevant risk factors (16).

Table 5. Qualitative assessment of the HECSI score – correlation of morphological pattern and location between both examinations

HECSI	Erythema	Scaling	Vesicles	Infiltration	Fissures	Oedema
Fingertips	0.550*	0.336	0.877**	X	0.169	X
Fingers (without tips)	0.530*	0.659**	0.614**	1**	0.905**	X
Palms	0.709**	0.818**	0.802**	X	0.557**	X
Back of hands	0.433*	0.533*	X	X	X	X
Wrist	1*	1*	X	X	X	X

X, no lesions of this quality were seen in one or both examinations.

*Significant on a 0.05 level.

**Significant on a 0.001 level.

Table 6. Qualitative assessment of the OHSI score – correlation of morphological pattern and location between both examinations

OHSI	Erythema	Scaling	Vesicles	Infiltration	Fissures	Papules
Right hand						
Fingers dorsal	0.467*	0.472	0.356	X	X	X
Fingers palmar	1**	0.665**	0.695**	X	X	X
Back of hands	0.731**	0.493	X	X	X	X
Palm	0.760**	0.866**	X	X	X	X
Left hand						
Fingers dorsal	0.816**	0.055	1**	X	0.464	X
Fingers palmar	0.239	0.550*	0.05	X	0.695	X
Back of hands	0.605**	0.451*	X	X	X	X
Palm	0.712**	0.929**	X	X	X	

X, no lesions of this quality were seen in one or both examinations.

*Significant on a 0.05 level.

**Significant on a 0.001 level.

Using a simulated teledermatological store-and-forward setting (6) enabled us to assess the intra-observer variability. In a clinical setting, this is only possible by having one patient examined at least two times by the same person with as much time as possible between examinations. This poses a logistical problem in the case of temporary skin alterations as they often occur in early occupational hand eczema.

We showed that in a teledermatological setting, similar to the one used in our study, the amount of time for a preventive dermatological screening is minimal; the longest examination in our setting took about 6 min. There was no significant difference in the amount of time necessary to perform an examination with either score. Probably because of a learning effect, the second examination took less time with both scoring systems.

As none of the participants in our study group suffered from severe hand eczema, it was to be expected that an examination performed with assessment tools developed for patients with manifest hand eczema would yield low score values. The ranges of the scores are distinctly different: in the OHSI a maximum score of only 18 points is reachable and the possibilities of measuring minimal differences seem to be limited, whereas the 20-fold higher score sum of the HECSI allows mirroring minimal changes in a patient's skin condition. An advantage on the side of the HECSI could therefore be expected in the assessment of workers showing only minimal skin lesions.

However, the first clinical signs of hand eczema (e.g. scaling, erythema and vesicles) were detected fairly consistently with both scoring systems. Looking at one score at a time with regard to consistency between the first and the second examination, there seems, on first sight, to be advantages in the use of the OHSI. The intra-observer reliability was moderate in case of the HECSI, thereby corresponding with the original study by Held et al. (11). In case

of the OHSI (14), the original publication contained no information concerning the intra-observer reliability; in our study it was high. The frequency of detection was identical in both OHSI-examinations for erythema and scaling, whereas in the HECSI-examinations the results varied. The OHSI seemed to have an advantage here, whereas regarding the other lesions (fissures, infiltration) the results were also slightly different.

When we assessed the overlap, however, the advantage seemed to shift towards the HECSI, which now showed larger overlaps in all criteria except scaling. The percentage should not be overestimated in the case of rarely diagnosed lesions such as infiltration because it might distort and overweigh the importance of single lesions while being highly informative for frequently occurring lesions such as erythema. When we tested both scores for reproducibility of the results, the HECSI showed a higher agreement between first and second examinations with regard to the kind of lesion detected in a defined area.

The further comparison of the scores was limited because of the different mathematical modelling of each score. The OHSI measures the extent of single lesions as a proportion of a defined area, whereas the HECSI measures the estimated severity of single lesions and multiplies it with an extent-related factor independent of a special lesion. Comparing these two factors would mean comparing a potentially measurable area with a subjective assessment.

Assessing the severity of a disease by measuring the affected area might be very useful in the monitoring of an acute skin disease with a monomorphous appearance, where the success of a therapeutic regime is measured by the amount of affected skin in comparison to healthy skin. In case of assessment of hand eczema, however, this might be a disadvantage, as in the course of a disease the affected area can remain the same, for instance, if the disease is limited to the interdigital or palmar

area of the hands, while the disease burden can change significantly. Also, the quality of lesions can change from primary lesions such as erythema and vesicle to secondary lesions such as scaling without changing the size of the affected area. An additional limiting factor for the comparability of both scores is the fact that the lesions assessed were partly different: oedema was only assessed in the HECSI and papules were assessed only in the OHSI. The results could, therefore, not be compared.

Conclusions

- (1) The teledermatological store-and-forward principle can be used to validate scoring systems for hand eczema.
- (2) Telemedicine offers an alternative approach in occupational screenings: it saves time, avoids bias caused by environmental conditions, and does not disrupt work.
- (3) Both HECSI and OHSI seem to be suitable tools for the assessment of a person's skin condition in a teledermatological setting.
- (4) Comparison of OHSI and HECSI is limited to qualitative assessment, as the OHSI employs almost exclusively objective criteria, while the HECSI involves subjective estimate of severity.
- (5) As the OHSI measures the severity of disease only by the area of affected skin, it might be less able to measure the intensity of hand eczema.
- (6) For assessing minimal skin changes, the HECSI has the advantage of measuring on a more differentiated scale and so be able to register minimal changes better than the OHSI.
- (7) The development of a scoring system that reduces subjective elements to a minimum, while at the same time offers a differentiated grading, might be advisable.

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Address:

Dr. med. Thomas Baumeister
Institute and Outpatient Clinic of Occupational,
Social and Environmental Medicine
University of Erlangen – Nuremberg
Schillerstr. 25/29
D-91054 Erlangen Germany
Tel: 0049 9131/852 69 77
Fax: 0049 9131/852 61 11
e-mail: Thomas.Baumeister@ipasum.med.uni-erlangen.de