

Ascertainment of hand dermatitis using a symptom-based questionnaire; applicability in an industrial population

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In this study, the applicability of a symptom-based questionnaire on hand dermatitis was assessed in a population of rubber workers. The questionnaire was previously validated in a study among nurses. 224 subjects employed in 9 different companies completed a questionnaire on skin complaints. Subsequently, 202 workers attended the physical examination of the skin by a dermatologist. The ascertainment of skin complaints according to the questionnaire was compared to the medical evaluation. The 2 different diagnostic tools used for assessing dermatitis resulted in dissimilar estimates of the prevalence of active hand dermatitis, ranging from 6.9% to 38.1% of all workers. Using the medical evaluation as 'gold standard' we observed a moderate sensitivity and specificity (respectively 71.4%; 95% CI: 47.7–95.1 and 76.1%; 95% CI: 70.0 – 82.2), a low positive predictive value (18.2%; 95% CI: 8.0 –28.4) and a high negative predictive value (97.3%; 95% CI: 94.7 –99.9) for the classification based on the self-administered questionnaire. When evaluated against 'first symptoms of dermatitis' the sensitivity decreased, while the specificity remained almost the same. The deviant findings between the present and the original validation study of the same questionnaire among nurses hamper its applicability in populations with different occupations. Therefore, if questionnaires are to be used, validity studies have to be carried out to evaluate differences in perception of skin diseases between different (occupational) populations.

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Skin diseases such as contact dermatitis are common occupational illnesses and are estimated to account for 9–35% of all occupational diseases (1–4). However, because these estimates are based on several different diagnostic methods, such as medical records, questionnaires and physical examinations, it is difficult to draw comparisons between occupational groups and the general population. It is generally believed that the use of medical records leads to an underestimation of the prevalence of contact dermatitis, as only relatively few people with skin complaints seek medical assistance (5). Other studies have used medical evaluations by trained physicians. However, the use of such a labor-intensive diagnostic tool in large epidemiological studies is often not feasible. As a conse-

quence, questionnaires are most often used as a diagnostic tool for estimating the prevalence of skin diseases or as a primary screening method.

Their validity, however, has been addressed in only a few studies, in which questionnaire-based diagnoses of hand dermatitis were compared to an objective assessment of hand dermatitis by trained physicians (5–9).

The results of these validation studies range from high specificity (100%) and lower sensitivity (60%) to a high sensitivity (100%) but lower specificity (64%) (5, 7).

In this study a symptom-based questionnaire on hand dermatitis, previously validated among nurses, and a physical examination were used to identify skin diseases in a population of rubber

workers. The aim of the study was to assess the applicability of such a symptom-based questionnaire in an industrial population.

Materials and Methods

Study population

The study was conducted from January 1997 through July 1997 among 225 subjects employed in the rubber manufacturing industry in The Netherlands. Subjects were part of a large exposure survey in the rubber manufacturing industry investigating the relative contribution of dermal exposure to the total genotoxic dose. Subjects were employed in 9 companies and were selected on the basis of their production function (10). Subjects were asked to complete a self-administered medical questionnaire prior to the exposure survey (Monday). 224 (99.6%) Subjects successfully completed the questionnaire; of these, 202 (90.2%) workers attended the medical evaluation at the end of the week (Friday).

Hand dermatitis

Hand dermatitis was assessed using a symptom-based questionnaire and a medical evaluation. Questions concerning hand dermatitis were adapted from a validated questionnaire developed by Smit et al. (5). In total, 4 different criteria were used for the diagnosis of hand dermatitis on the basis of the questionnaire.

Hand dermatitis was defined as a positive answer to at least 1 of the following: Have you had one of these symptoms at your hands or fingers in the past 12 months: (a) 'red swollen hands or fingers', (b) 'red hands or fingers and fissures', (c) 'vesicles on the hands or at the sides of the fingers', (d) 'scaling hands or fingers with fissures', (e) 'itching hands or fingers with fissures'. Moreover, sub-

jects had to give a positive answer to either of these 2 questions: did one or more of these symptoms last for more than three weeks? did one or more of these symptoms occur more than once? (Criteria I). A more lenient additional classification based on 1 or more symptoms but without the requirement of long-lasting or recurrent symptoms (Criteria II) and a more stringent classification based on the occurrence of 2 or more symptoms with the addition of long-lasting or recurrent symptoms were also used (Criteria III). The question do you have a skin disease at this moment? was used to estimate the point prevalence of current skin diseases (Criteria IV).

The medical evaluation of current skin conditions was conducted by 2 dermatologists. Objective skin symptoms were used for the classification: 'Active hand dermatitis' ('major' dermatitis), and 'the first symptoms of dermatitis' ('minor' dermatitis).

'Major' dermatitis was defined as: erythema, papules, vesicles and fissures, comprising a clear eczematous picture. 'Minor' dermatitis was exhibited as erythema, slight chapping and scaling of the skin (6,11). No distinction was made between irritant and allergic dermatitis, as morphologic characteristics of these skin disorders are similar. Neither the dermatologist nor the worker was informed about the results of the questionnaire on hand dermatitis prior to the medical evaluation.

Data analysis

The questionnaire's applicability was studied by computing its sensitivity (% of individuals with the disease, who are classified as having the disease), specificity (% of individuals without the disease who are classified as not having the disease), positive predictive value (PPV) (% of subjects with a positive test who have the disease) and negative

Table 1. Prevalence of hand dermatitis as estimated by a symptom-based questionnaire and medical evaluation (95% confidence interval between parenthesis)

Criteria	Type of diagnosis of hand dermatitis	Prevalence		
		<i>n</i>	% ^{c)}	(95% CI)
	Questionnaire			
I	One or more symptoms and recurrent or lasted more than 3 weeks ^{a)}	55	27.2	(21.1–33.3)
II	One or more symptoms ^{a)}	77	38.1	(31.4–44.8)
III	Two or more symptoms and recurrent or lasted more than 3 weeks ^{a)}	30	14.9	(10.0–19.8)
IV	Complaints at time of survey ^{b)}	35	17.3	(12.0–22.5)
	Medical evaluation			
	'Major' Dermatitis	14	6.9	(3.4–10.4)
	'Minor' Dermatitis	56	27.7	(21.5–33.9)

^{a)} Period prevalence (last 12 months).

^{b)} Point prevalence.

^{c)} *n*=202 subjects.

Table 2. Validity statistics of self-reported hand dermatitis compared to physical examination of hand dermatitis (95% confidence intervals between parentheses)

Criteria	'Major' dermatitis		'Minor' dermatitis		Dermatitis ^{c)}	
	(%)	(95% CI)	(%)	(95% CI)	(%)	(95% CI)
I	Symptom-based diagnosis: ≥ 1 symptoms and recurrent or lasted more than 3 weeks					
sensitivity	71.4	(47.7–95.1)	39.3	(26.5–52.1)	45.7	(34.0–57.4)
specificity	76.1	(70.0–82.2)	82.6	(76.1–89.1)	82.6	(76.1–89.1)
PPV ^{a)}	18.2	(8.0–28.4)	48.9	(34.3–63.5)	58.2	(45.2–71.2)
NPV ^{b)}	97.3	(94.7–99.9)	76.2	(69.2–83.2)	74.1	(67.0–81.2)
II	Symptom-based diagnosis: ≥ 1 symptoms					
sensitivity	85.7	(67.4–100)	57.1	(44.1–70.1)	62.9	(51.6–74.2)
specificity	65.4	(58.6–72.2)	75.0	(67.6–82.4)	75.0	(67.6–82.4)
PPV ^{a)}	15.6	(7.5–23.7)	49.2	(37.0–61.4)	57.1	(46.0–68.2)
NPV ^{b)}	98.4	(96.2–100)	80.5	(73.5–87.5)	79.2	(72.1–86.3)
III	Symptom-based diagnosis: ≥ 2 symptoms and recurrent or lasted more than 3 weeks					
sensitivity	28.6	(4.9–52.3)	21.4	(10.7–32.1)	22.9	(13.1–32.7)
specificity	86.2	(81.3–91.1)	89.4	(84.1–94.7)	89.4	(84.1–94.7)
PPV ^{a)}	13.3	(1.1–25.5)	46.2	(27.0–65.4)	53.3	(35.4–71.1)
NPV ^{b)}	94.2	(90.7–97.7)	72.8	(65.9–79.7)	68.6	(61.7–75.5)
IV	Skin complaints at time of medical evaluation					
sensitivity	57.1	(31.2–83.0)	12.5	(3.8–21.2)	21.4	(11.8–31.0)
specificity	85.6	(80.6–90.6)	84.8	(78.7–90.9)	84.8	(78.7–90.9)
PPV ^{a)}	22.9	(9.0–36.8)	25.9	(9.4–42.4)	42.9	(26.5–59.3)
NPV ^{b)}	96.4	(93.6–99.2)	69.6	(62.5–76.7)	67.1	(60.0–74.2)

a) Positive predictive value.

b) Negative predictive value.

c) Summation of 'major' and 'minor' dermatitis.

predictive value (NPV) (% of subjects with a negative test who do not have the disease). The medical diagnosis served as 'gold standard' in these calculations. For the statistical procedures regarding 'minor' dermatitis, subjects with 'major' dermatitis were excluded from the analysis. 95% confidence intervals were calculated assuming prevalence and validity statistics as a proportion (p) drawn from a normal distribution ($p \pm 1.96 \sqrt{p(1-p)/n}$).

Results

The prevalence of hand dermatitis as estimated by the symptom-based questionnaire and medical evaluation is presented in Table 1.

The different classifications and diagnostic tools resulted in dissimilar estimates of the prevalence of hand dermatitis. The prevalence of workers with hand dermatitis based on the symptom-based questionnaire ranged from 14.9 % to 38.1% depending on the criteria used. 35 subjects (17.3%) had skin complaints at the time of the survey. Although 70 subjects (34.6%) were diagnosed with skin diseases of some kind, only 14 cases (6.9%) of 'major' hand dermatitis were identified according to the medical evaluation.

Both sensitivity and specificity for 'major' hand dermatitis were moderate (respectively 71.4% and 76.1%), the positive predictive value was low (18.2%) and the negative predictive value high

(97.3%) (Table 2). Estimates of these statistics for 'minor' dermatitis resulted in a considerable decrease in sensitivity (39.3%) while the specificity remained almost unaffected (82.6%). Application of the more lenient classification (Criteria II) of hand dermatitis based on the symptom-based questionnaire resulted in a higher sensitivity for 'major' and 'minor' dermatitis, respectively 85.7% and 57.1%. However, the specificity decreased slightly. For the more stringent categorization (Criteria III) the opposite was observed, as the sensitivity decreased and the specificity increased. Remarkably, the sensitivity for 'major' and 'minor' dermatitis both dropped when only skin complaints at time of the study were considered, although the specificity improved slightly.

Discussion

Validation of the questionnaire revealed an overall moderate sensitivity and specificity, indicating moderate agreement. Overestimation of the prevalence of 'major' hand dermatitis based on the questionnaire was clearly illustrated by the very low positive predictive value (18.2%; 95% CI: 8.0–28.4). More stringent criteria for identifying dermatitis applied at the medical evaluation probably resulted in the observed difference. Hence, when less severe skin diseases like 'minor' dermatitis were included, the positive predictive value in-

creased, indicating that self-reported complaints were related to these skin diseases. Overestimation of the prevalence could also have been influenced by the different time frame the medical evaluation and questionnaire covered, respectively a point prevalence vs. a 12-month period prevalence. However, the validity calculated for reported complaints at the time of the study was even poorer than for the criteria based on self-reported symptoms, indicating that the different time frames reflected are probably not the most important factors for the observed difference.

Although overreporting of hand dermatitis was apparent in this study, only a moderate sensitivity was observed, indicating that a number of workers (29%) did not report pronounced symptoms of hand dermatitis as confirmed by the medical examination. In a validation study of the same questionnaire among nurses, a high sensitivity (100%) and negative predictive value (100%) was observed, while the specificity (64%) and positive predictive value (38%) were relatively low (5). The difference in sensitivity found between these 2 validation studies can likely be explained by a different perception of skin diseases. Susitaival et al. (7) validated their questionnaire in a population sample of Finnish farmers and found also a low sensitivity, probably indicating that workers with a more physical workload have got used to having skin diseases. Although medical evaluations by trained physicians were used as a 'gold standard' in all of these validity studies, the observed differences could have been influenced by inter-expert variability. However, among dermatologists a clear consensus on the morphological signs of hand dermatitis is present.

Questionnaires are not only used for estimating the prevalence of skin diseases but also as a primary screening method. The high negative predictive value (97.3%; 95% CI: 94.7–99.9) found for 'major' hand dermatitis in this study suggests that the questionnaire could be used as a diagnostic tool for primary screening. However, due to the low prevalence of hand dermatitis (6.9%), the NPV is severely influenced by the large proportion of healthy subjects. Hence, if the questionnaire had been used for this purpose, 29% of the cases of hand dermatitis would still have remained undetected. The more lenient classification without the requirement of long-lasting or recurrent symptoms is to be preferred in this case, as the sensitivity was considerably higher. Therefore, workers reporting even the mildest symptoms of possible hand dermatitis should be included in medical screening. However, none of the classifications used resulted in a good diagnostic tool for estimating the prevalence of hand dermatitis, as the over-

all sensitivity and specificity remained moderate for all criteria used.

The 'true' prevalence (6.9%; 95% CI: 3.4–10.4) of 'major' hand dermatitis, as assessed by the dermatologists in this study, was similar to findings in previously reported studies in the rubber manufacturing industry using the same methodology (13, 14). Reported prevalences of hand dermatitis in the general population are nevertheless similar (2–10%) (15–20). However, these estimates are mainly based on information gathered from questionnaires and are therefore likely an overestimation of the true prevalence. The apparent differences between the several diagnostic tools for identifying hand dermatitis complicate comparisons of prevalences between occupational groups and the general population.

Furthermore, it was concluded that the applicability of a questionnaire for identifying skin diseases, and in particular hand dermatitis, is limited, as large differences were found in validity when applying a standardized questionnaire to different populations. Moreover, if questionnaires are to be used, validity studies must be carried out to evaluate perception of skin diseases in specific occupational populations or subgroups of the general population.

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