

Long-term effectiveness of secondary prevention in geriatric nurses with occupational hand eczema: the challenge of a controlled study design

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Summary

Background. The high prevalence of occupational dermatoses indicates the need for effective and sustainable prevention strategies.

Objectives. To evaluate the long-term effectiveness of secondary prevention in geriatric nurses.

Patients/Methods. One hundred and two geriatric nurses with occupational hand eczema participated in an interdisciplinary prevention programme [intervention group (IG)]. Members of the control group (CG) ($n = 107$) were medically treated by local dermatologists. Six years after intervention (T2), data on job continuation, skin lesions and skin protection behaviour were obtained by standardized questionnaires and compared with baseline values (T0) and data from a 3-month follow-up (T1).

Results. At T2, 65.3% of the IG and 56.8% of the CG still worked as geriatric nurses; 6.9% of the IG and 13.6% of the CG had given up work because of occupational hand eczema. The skin status improved in both cohorts. The data indicated a lower frequency of skin lesions and morphological signs in the IG, for example vesicles (IG, 12.8%; CG, 40.0%; $\chi^2 = 7.00$, degrees of freedom = 1, $p = 0.008$).

Conclusions. The results indicate long-term effects regarding job continuation and disease severity, although few results showed statistical significance. It is outlined that controlled long-term studies aiming at proving the general effectiveness of secondary prevention are no longer feasible in Germany, as the statutory accident insurance has led to a legal entitlement of all patients affected by occupational hand eczema to immediate preventive intervention.

Key words: hand eczema; intervention; occupational; prevention; geriatric nurses; follow-up.

Cases of suspected 'severe or recurrent skin diseases' form the largest proportion of occupational diseases in the statistics of the German employers' liability insurance associations (1). These skin diseases predominantly appear as occupational hand eczema in employees of

so-called 'high-risk professions' characterized by a high level of skin exposure (e.g. hairdressers, healthcare workers, and metal-surface processors) (2, 3). Thus, effective primary, secondary and tertiary prevention strategies are needed to reduce the prevalence, to detect occupational hand eczema in the initial stages of the disease, and to successfully treat severe dermatoses. In recent years, the management of occupational skin diseases has significantly improved in Germany, as a result of optimized structures of patient care (4–9).

Geriatric nurses are well known to be at risk of developing occupational hand eczema. A recent study

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showed a point prevalence of 18% (10). Typical sources of skin exposure in nursing activities are the frequent use of occlusive gloves and repetitive contact with subtoxic irritants (e.g. water, soap, and detergents) (11, 12).

Concerning secondary prevention, outpatient interdisciplinary programmes comprising both educational and dermatological intervention have been consecutively developed and implemented at the University of Osnabrück since 1994. These programmes are aimed at enabling the participants to remain in work despite their skin lesions, and at positively influencing disease management and individual skin protection behaviour (13–18). Controlled evaluation studies are usually regarded as the methodological 'gold standard', and have thus been carried out in order to determine the effectiveness of programmes for hairdressers and geriatric nurses. As compared with controls who had access to medical treatment only, there was evidence for short-term effects: both the risk of job loss because of occupational hand eczema and the severity of hand eczema significantly decreased after participation (13, 15, 17, 18).

However, besides short-term studies, long-term follow-up studies are required for the evaluation of prevention programmes. So far, controlled study designs for the investigation of long-term effects have exclusively focused on job continuation in hairdressers (13). Thus, the aim of this study was to examine the sustainability of this prevention approach in geriatric nurses.

Patients and Methods

Cohorts

Between November 2000 and August 2002, a total of 102 geriatric nurses consecutively took part in the intervention. Patients of the intervention group (IG) were referred to the prevention programme by the Institution for Statutory Accident Insurance in the Health and Welfare Services (Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege). Inclusion criteria were the presence of an occupational skin disease that had been reported by a dermatologist, and voluntary participation in order to include intrinsically motivated participants. The geriatric nurses of the unsupervised control group (CG) ($n = 107$) met the same inclusion criteria, but were only medically treated by their local dermatologists, without participating in the intervention. Allocation to the IG and CG took place according to postal code. Urban and rural regions were equally represented in both cohorts (15, 17).

The IG ($n = 102$) and CG ($n = 107$) mostly comprised female patients (IG, 92.2%; CG, 94.4%) with mean ages

of 39.7 years (IG) and 39.1 years (CG), respectively. Most geriatric nurses of both cohorts worked in nursing homes (IG, 69.6%; CG, 63.6%); the remaining nurses were employed in the field of outpatient care. At baseline, no statistically significant differences were found between the IG and CG regarding sex, age, education, institution (inpatient versus outpatient care), amount of working time (full time versus part time), or years of working experience (15, 17).

Intervention

Over a period of 6 months, the IG took part in an interdisciplinary prevention programme comprising four visits to the study centre in Osnabrück (Germany) and involving both dermatological and health educational interventions. The programme was aimed at enabling its participants to remain in their jobs without severe skin lesions and to improve the individual skin protection behaviour. The geriatric nurses were individually counselled by health educators regarding the choice, use and disposal of protective gloves, as well as the correct application of skin care products (one-on-one counselling). Additionally, they attended a 1-day skin protection course in groups of 8–10 persons. Central themes were the anatomy of normal and disordered skin barriers, the pathogenesis of irritant and allergic contact dermatitis, and the performance of effective skin protection. The patients underwent three to four dermatological consultations, including an examination of the skin, diagnosis, and discussion of therapy strategies. Furthermore, each geriatric nurse was offered a visit of workplace by a health educator on a voluntary basis in order to inform and to train the other staff members regarding skin protection as well and to facilitate the implementation of skin protection measures at work (structural prevention). At the end of the 6-month study period, a 'refresher seminar' was conducted, in which experiences gained during every day at work were shared, problems concerning the implementation of skin protection measures were identified, and solutions were offered (15, 17). Further descriptions of this and comparable secondary prevention programmes have been published elsewhere (13–21).

Study design

Long-term effectiveness was evaluated by applying a prospective controlled study design. Standardized questionnaires were used to obtain data for the IG and CG before intervention (T0, baseline measurement), at a first follow-up (T1, 3 months after intervention), and

at a second follow-up (T2, 6 years after intervention). For data protection reasons, questionnaires were sent to the controls by the Institution for Statutory Accident Insurance in the Health and Welfare Services. The questionnaires consisted of items focusing on the success criteria of job continuation, the presence, severity and morphological signs of hand eczema (skin dryness, erythema, scaling, vesicles, oozing, and fissures), and skin protection behaviour. In cases of initial non-response, questionnaires were resent to the IG and CG once.

Some participants of the IG and CG were free of occupational hand eczema at baseline (T0), as a result of continuing therapy by the local dermatologist or sick leave prior to the intervention. As the controls did not undergo a dermatological examination at the study centre, no medical information (e.g. regarding diagnoses, allergies, and atopic diathesis) could be obtained for this cohort. The study was approved by the local ethics committee.

Data analysis

Data were analysed cross-sectionally by comparing the IG and CG, and longitudinally by comparing data of the matched cohorts at T0, T1, and T2. PASW[®] STATISTICS 18 (SPSS Inc., Chicago, IL, USA) for Windows[™] was used for data analysis. Chi-square and Fisher's exact test were applied for calculation of significances of contingency tables and for carrying out drop-out analyses. McNemar's test was performed on dichotomous dependent variables of matched cohorts. The Mann–Whitney *U*-test and Wilcoxon's test were used for analysis of differences between independent and dependent samples, respectively. For all tests, a significance level of 0.05 was chosen.

Results

Response rates and drop-outs

Response rates of 80.4% (*n* = 82) and 79.4% (*n* = 81) were obtained from the IG at T1 and T2, respectively, as opposed to 72.9% (*n* = 78) and 58.9% (*n* = 63) in the CG.

Drop-out analyses did not reveal significant differences between responders and non-responders.

Between T0 and T2, measures of secondary (outpatient) and tertiary (inpatient) prevention were integrated into the regular supply of patient care by most insurers. For methodical reasons, two independent groups, differing only in whether outpatient intervention was received, were required. Nine data records (8.8%) of the IG, belonging to geriatric nurses who had participated in an inpatient prevention measure, were thus excluded at T2 (Table 1). In this way, changes in the success criteria could more confidently be ascribed to the outpatient programme under evaluation, and outcome parameters were not biased by a more intensive preventive programme such as inpatient rehabilitation (tertiary prevention) (22). As shown in Table 1, 19 controls (17.8%) subsequently attended either an inpatient or outpatient prevention programme between T1 and T2, and consequently had to be excluded from further analyses. According to drop-out analyses, in the drop-outs from neither the IG nor the CG could a systematic selection be detected in terms of the presence and severity of occupational hand eczema or morphological signs, with the exception of 'erythema': at T0, 'erythema' was significantly more frequent in those 9 patients (8.8%) of the IG who subsequently took part in an inpatient rehabilitation programme [$\chi^2 = 4.88$, degrees of freedom (d.f.) = 1, $p = 0.035$].

Remaining in work

As shown in Figure 1, 96.3% (*n* = 79) of the IG and 85.9% (*n* = 67) of the CG were still working as geriatric nurses at T1. None of the IG but 6 controls (7.7%) gave up work because of occupational hand eczema. At T2, 65.3% (*n* = 47) of the IG and 56.8% (*n* = 25) of the CG were still employed as geriatric nurses; 6.9% (*n* = 5) of the IG related job loss to occupational hand eczema, as opposed to 13.6% (*n* = 6) of the CG. 'Other reasons' for job change were retirement, motherhood, and other diseases (e.g. slipped disc). For performance of Fisher's exact test, the percentages of those who had given up work for

Table 1. Study cohorts and drop-outs at T0, T1, and T2

	Intervention group, <i>n</i> = 102 (%)				Control group, <i>n</i> = 107 (%)		
	T0	T1	T2		T0	T1	T2
Non-response	0 (0)	20 (19.6)	21 (20.6)	Non-response	0 (0)	29 (27.1)	44 (41.1)
Participation in inpatient programme	0 (0)	0 (0)	9 (8.8)	Participation in inpatient or outpatient programme	0 (0)	0 (0)	19 (17.8)
Study cohort	102 (100)	82 (80.4)	72 (70.6)	Study cohort	107 (100)	78 (72.9)	44 (41.1)

T0, baseline measurement before intervention; T1, 3 months after intervention; T2, 6 years after intervention.

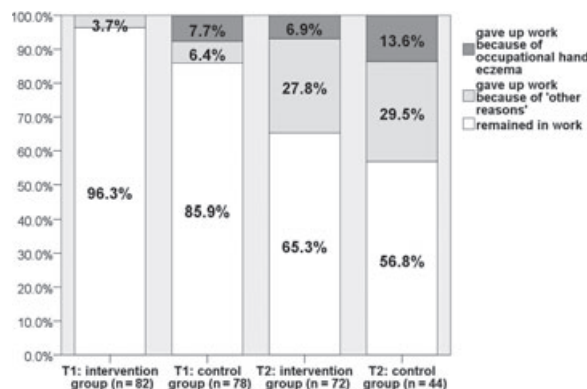


Fig. 1. Job continuation in the intervention group and the control group at T1 (3 months after intervention) and T2 (6 years after intervention).

'other reasons' were assumed to be approximately the same in the IG and CG. When those who had remained in work and those who had given up work because of occupational hand eczema were cross-sectionally compared, there was a significant difference between IG and CG at T1 ($\chi^2 = 6.76$, d.f. = 1, $p = 0.011$) but not at T2 ($\chi^2 = 1.60$, d.f. = 1, $p = 0.315$).

Wulfhorst et al. (13) published the results of a similar controlled intervention study, following the same interdisciplinary prevention approach, in hairdressers. They showed a significant difference between participants and controls 5 years after participation: 58.7% ($n = 101$) of the hairdresser IG had remained in work, as opposed to only 29.1% ($n = 16$) of the CG ($\chi^2 = 15.43$, d.f. = 2, $p = 0.000$); 12.2% of the IG ($n = 21$) and 27.3% of the CG ($n = 15$) gave up work because of occupational hand eczema. Although there was no difference between the intervention groups of both studies (hairdressers and geriatric nurses) ($\chi^2 = 1.71$, d.f. = 2, $p = 0.425$) in terms of job continuation, the results for the controls varied significantly ($\chi^2 = 7.98$, d.f. = 2, $p = 0.019$), as many hairdressers of the CG had changed their occupation (Fig. 2).

Presence of skin lesions

Among the participants, 32.4% of the IG ($n = 33$) and 31.8% of the CG ($n = 34$) reported skin diseases before working as geriatric nurses ($\chi^2 = 0.01$, d.f. = 1, $p = 0.929$). At baseline, skin lesions were equally frequent in both cohorts (IG, 88.2%, $n = 90$; CG, 89.7%, $n = 96$) ($\chi^2 = 0.12$, d.f. = 1, $p = 0.732$). Improvements in occupational hand eczema at T1 and T2 might also have resulted from a job change leading to reduced skin exposure. Thus, only data records of geriatric nurses

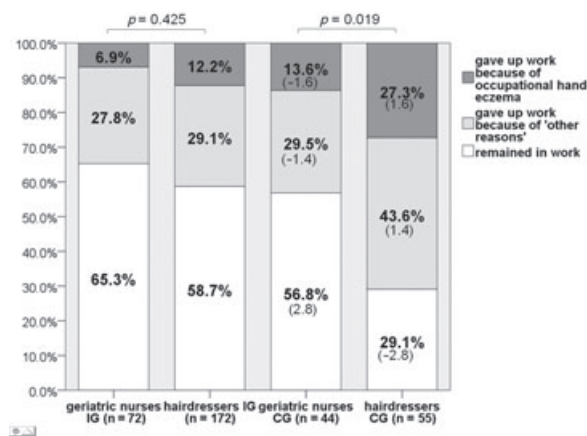


Fig. 2. Job continuation in the intervention group (IG) and the control group (CG) of geriatric nurses (6 years after intervention) and hairdressers (5 years after intervention) (in parentheses: significant differences are combined with their adjusted residuals, chi-square test).

remaining in their original profession were used for further analyses. This reduction in the study cohort did not cause systematic selection and bias of data.

At T1, there were statistically significantly more patients in the IG reporting being free of skin lesions (46.8%, $n = 37$) than in the CG (16.4%, $n = 11$) ($\chi^2 = 14.78$, d.f. = 1, $p = 0.000$). At T2, 38.3% ($n = 18$) of the IG and 28.0% ($n = 7$) of the CG reported complete clearance of hand eczema ($\chi^2 = 0.76$, d.f. = 1, $p = 0.382$); 57.4% ($n = 27$) of the IG stated that they had observed skin lesions 'never' or 'seldom' in the interval since T0, as compared with 32.0% of the CG ($n = 8$) and 60.0% ($n = 15$) of the controls, and 38.3% ($n = 18$) of the IG characterized the frequency of skin lesions as 'occasionally to frequently'.

Morphological signs of skin lesions

Concerning the morphological signs of occupational hand eczema, the percentage of geriatric nurses reporting 'vesicles' was significantly lower in the IG at T2 ($\chi^2 = 7.00$, d.f. = 1, $p = 0.008$) (Table 2). On cross-sectional comparison, there were no further significant differences in the remaining parameters.

In the longitudinal comparison of T0 and T2, the frequency of skin lesions (IG, $p = 0.002$) and the frequencies of four of six morphological signs (skin dryness, $p < 0.001$; vesicles, $p = 0.012$; oozing, $p = 0.021$; fissures, $p < 0.001$) significantly decreased in the IG, whereas the frequencies of only two morphological signs (scaling, $p = 0.039$; fissures, $p = 0.039$) decreased in the CG.

Table 2. Cross-sectional analysis of changes in the prevalence of skin lesions and morphological signs at T0 (baseline) and T2 (6 years after intervention) in patients still working as geriatric nurses at T2 (intervention group (IG), n = 47; control group (CG), n = 25)

	T0			T2		
	IG (%)	CG (%)	p-value	IG (%)	CG (%)	p-value
Skin lesions	89.4	88.0	1.000 ^a ($\chi^2 = 0.03$, d.f. = 1)	61.7	72.0	0.382 ^b ($\chi^2 = 0.76$, d.f. = 1)
Skin dryness	78.7	60.0	0.091 ^b ($\chi^2 = 2.85$, d.f. = 1)	40.4	56.0	0.207 ^b ($\chi^2 = 1.59$, d.f. = 1)
Erythema	46.8	60.0	0.286 ^b ($\chi^2 = 1.14$, d.f. = 1)	38.3	36.0	0.848 ^b ($\chi^2 = 0.04$, d.f. = 1)
Scaling	34.0	44.0	0.406 ^b ($\chi^2 = 0.69$, d.f. = 1)	21.3	16.0	0.758 ^a ($\chi^2 = 0.29$, d.f. = 1)
Vesicles	31.9	52.0	0.096 ^b ($\chi^2 = 2.77$, d.f. = 1)	12.8	40.0	0.008 ^b ($\chi^2 = 7.00$, d.f. = 1)
Oozing	19.1	32.0	0.222 ^b ($\chi^2 = 1.49$, d.f. = 1)	2.1	12.0	0.117 ^a ($\chi^2 = 3.03$, d.f. = 1)
Fissures	68.1	48.0	0.096 ^b ($\chi^2 = 2.77$, d.f. = 1)	21.3	20.0	0.899 ^b ($\chi^2 = 0.02$, d.f. = 1)

d.f., degrees of freedom.

^aFisher's exact test.^bChi-square test.

Severity of skin lesions

For analysis of changes in disease severity, skin lesions were divided into two types: 'severe' skin lesions, characterized by fissures, oozing, and/or vesicles; and 'mild' skin lesions, characterized by the absence of these symptoms but skin dryness, erythema, and/or scaling. This classification has previously been applied in a comparable evaluation study in hairdressers (21). At T0, severe skin lesions were dominant in both cohorts (IG, 78.7%; CG, 72.0%) ($p = 0.555$, $z = -0.59$), whereas these percentages decreased at T2 (IG, 27.7%; CG, 52.0%) ($p = 0.097$, $z = -1.66$). At T2, 34.0% (n = 16) and 38.3% (n = 18) of the IG had mild or no skin lesions, respectively, as compared with 20.0% (n = 5) and 28.0% (n = 25) of the CG. Longitudinal changes in terms of disease severity were statistically significant in the IG only (IG, $p < 0.001$, $z = -4.32$; CG, $p = 0.090$, $z = -1.70$).

Skin protection behaviour and disease management

In the comparison of T0 and T2, medians of 'daily duration of wearing gloves' and 'daily water contact' did not change in either the IG or the CG. At T2, there were statistically significant differences in the frequency of 'washing hands with skin cleanser' (IG, 5.5; CG, 10) ($p = 0.022$, $z = -2.28$) and 'washing hands with clear water' (IG, 5; CG, 10) ($p = 0.002$, $z = -3.13$). This was caused not only by a decrease in this behaviour in the IG but also by an increase in the CG. There was no sustainable increase regarding the frequency of use of skin care products.

In the IG, 72.3% (n = 34) reported that the recommended protective gloves were still available at T2. At T2, 54.4% (n = 25) of the IG 'always' or at least 'sometimes' used additional cotton glove liners when wearing occlusive protective gloves, as opposed to 33.3% (n = 8) of the CG. The first follow-up at T1 showed an

overall more frequent use of cotton glove liners in both the IG (81.8%, n = 63) and CG (62.1%, n = 41).

Among the participants, 76.6% (n = 36) of the IG and 72.0% (n = 18) of the CG experienced no or only minor inconvenience resulting from skin protection during everyday life, but strong or very strong limitations were associated with a skin disease (IG, 51.0%, n = 24; CG, 44.0%, n = 11). Almost all IG participants stated that they were able to cope better with their skin disease after intervention (91.5%, n = 43); 97.9% (n = 46) would recommend it to other geriatric nurses affected by occupational hand eczema.

Discussion

At T2, we found a higher number of geriatric nurses who had given up work because of occupational hand eczema in the CG than in the IG, although these results were not statistically significant. Skin lesions had improved in both cohorts when assessed by self-reported questionnaire (both cohorts were under continuous treatment by their local dermatologists). Altogether, the data indicated a better skin status in the IG at T2. However, only 'vesicles' proved to be significantly less frequent in the IG in cross-sectional analyses. Data on skin protection allowed us to draw careful conclusions only with regard to long-term effects.

Wulfhorst et al. (13) achieved response rates of 80.0% (IG, n = 172) and 64.7% (CG, n = 55) in their long-term follow-up in hairdressers. Therefore, the response rates of the present study (IG, 79.4%, n = 81; CG, 58.9%, n = 63) may be considered satisfactory. Higher rates in the IG are explicable by their closer relationship to the study centre.

At T2, the CG contained almost twice as many geriatric nurses who had given up work because of occupational hand eczema (13.6%, n = 6) as the IG (6.9%, n = 5). In contrast to T1 (15, 17) and Wulfhorst

et al. (13), these differences did not prove to be statistically significant. More geriatric nurses of the IG and CG remained in work in the long-term follow-up than was the case for the hairdressers (13). The mean age at baseline, which was higher in geriatric nurses (IG, 39.7 years; CG, 39.1 years) than in hairdressers (IG, 27.6 years; CG, 26.3 years), might partially explain these differences. Younger employees might be more willing to change their profession in cases of occupational hand eczema, because of better employment prospects after occupational retraining (22). Furthermore, allergic contact dermatitis was found in many hairdressers at baseline (IG, 57.3%, $n = 59$; CG, 37.3%, $n = 31$) (13), whereas it was diagnosed in only 6 geriatric nurses (5.9%) of the IG. Studies have revealed the prognosis of occupational allergic contact dermatitis to be poorer than the prognosis of irritant contact dermatitis (23, 24). The ability to cope with allergic contact dermatitis might have improved in hairdressers of the IG, as a result of a health educational intervention (e.g. regarding the correct use and disposal of protective gloves), as opposed to controls without intervention.

As most epidemiological studies indicate, hand eczema is characterized by a chronic and relapsing course, so that permanent clearing of occupational hand eczema is to be expected in only a minority of patients (23, 25). This explains why hand eczema is still prevalent in 61.7% ($n = 29$) of the IG and 72.0% ($n = 18$) of the CG. Dermatological examinations, which are often regarded as the 'gold standard', were unfortunately not feasible in the present study, forcing the researchers to rely on participants' self-assessment of occupational hand eczema. In previous epidemiological validation studies, the self-diagnosis of hand eczema usually led to an underestimation of the true prevalence, because of low sensitivity (0.53–0.73) and high specificity (0.93–1.00) (26–31). In contrast, a study by Svensson et al. (32), which was partially conducted in patients who had already been diagnosed with hand eczema, indicated high sensitivity and an overestimation of the prevalence of hand eczema (sensitivity, 0.94; specificity, 0.29). Cvetkovski et al. (33) found the patient's rating of disease severity of occupational hand eczema to be more severe than the dermatologist's rating. Both studies suggest increased sensitivity regarding the perception of skin diseases in patients with previous medical diagnosis and treatment. Consequently, we assume that the use of self-reporting in this study has not led to a large underestimation of the prevalence, as can be observed in epidemiological cohorts.

The results for skin protection behaviour allow for only vague conclusions regarding long-term effects. Anveden

and Meding (34) compared observed and self-assessed skin exposure in geriatric care, and found a tendency for overestimation. The ambiguous results of our study regarding skin protection might be attributable to the method of data collection: participants were asked to estimate the daily frequency of exposure, instead of choosing from predefined multiple-choice answers, as in the study of Anveden and Meding. It would also be advisable for future studies to obtain more detailed information, for example the use of hand disinfection instead of hand washing. As recommended by Ramsing and Agner (35), the geriatric nurses were advised to use additional cotton glove liners in order to reduce glove occlusion. Although the results of the present study show that IG participants were more likely to use cotton glove liners, the data indicated a less frequent use both in the CG and in the IG as compared with T1. This might indicate a need for additional 'refresher seminars' (e.g. conducted a few years later), which would provide an opportunity to refresh patients' memory regarding adequate skin protection and to further improve the sustainability of the intervention.

A randomized, controlled study is usually considered to be the 'gold standard'. Except for Wulfhorst et al. (13), evaluation studies focusing on this secondary prevention approach usually apply an uncontrolled, longitudinal pre/post-test design and/or have follow-up periods ranging from several months to 1 year (14–17, 36, 37). The controlled design of the present study made it necessary to compare geriatric nurses of the IG with controls without intervention, and to exclude patients with previous participation in inpatient dermatological rehabilitation (22). This reduction in sample size is predominantly attributable to the improved management of occupational hand eczema in Germany in recent years: immediate secondary prevention programmes are now generally offered to all wet work employees suffering from occupational hand eczema by various German employers' liability insurance associations.

Since January 2006, the updated 'dermatologist's procedure' (Hautarztverfahren) has obliged German dermatologists to immediately inform the statutory employers' liability insurance body in cases of suspected occupational hand eczema. Complementarily, the insurers apply a hierarchical multistep intervention procedure (Stufenverfahren Haut) that provides rapid help for insureds affected by occupational hand eczema (6, 7, 9, 39). Subsequent measures are adjusted to the individual level of disease severity, ranging from outpatient dermatological therapy and skin protection seminars in cases of milder forms of occupational hand eczema (secondary prevention) (13, 15–17) to interdisciplinary

inpatient rehabilitation (tertiary prevention) for severe dermatoses (4, 6–9, 22). As insurants are entitled to these programmes by law, it was difficult, for structural, legal and ethical reasons, to maintain an appropriate control group, as these programmes have been increasingly offered to all insurants. This reflects the 'challenge of controlled study designs', which affects the evaluation of both secondary and tertiary prevention (6). These structural improvements were made between T0 and T2 of this study, in contrast to the intervention evaluated by Wulfhorst et al. (13), which was conducted between 1994 and 1997. Those cohorts were not yet influenced by these structural changes.

The uncontrolled pre/post-test study remains as feasible design for future research, having already been applied in recent studies (14, 36, 37). Although this implies a limitation from a methodical point of view, it constitutes an important improvement for patients suffering

from occupational hand eczema. Future controlled studies might aim at improving existing programmes by defining a 'modified' programme as intervention and the 'standard' programme as control.

Drop-outs in both cohorts, self-assessment of skin lesions and the lack of medical information about the controls (e.g. diagnoses and atopic diathesis) are limitations of our study. However, the long follow-up period of this survey and the controlled study design are of great value for evaluation research and quality management.

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