

## INVESTIGATIVE REPORT

# Cost-of-illness Analysis of Patients with Chronic Hand Eczema in Routine Care in Germany: Focus on the Impact of Occupational Disease

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**Chronic hand eczema places a heavy burden on patients, often affecting their ability to work. This paper compares the cost-of-illness and treatment approaches for patients with refractory chronic hand eczema, in relation to whether the disease was occupational or unrelated to work factors. Data from 2 surveys, comprising 310 patients with chronic hand eczema insured by German statutory health insurance (SHI) (including work-impaired patients, work-unaffected patients and non-working patients) and known work-related chronic hand eczema insured by occupational health insurance (OHI). Annual healthcare costs of managing work-impaired patients (SHI) and patients with work-related chronic hand eczema (OHI) were €3,164 and €3,309, respectively, approximately double the costs of managing non-working and work-unaffected (SHI) patients. This analysis shows that the costs associated with chronic hand eczema are affected by the correlation of chronic hand eczema with work, with costs being higher for occupational patients with chronic hand eczema. Key words: chronic hand eczema; refractory; costs; work-status; health insurance; sick-leave; occupational contact dermatitis.**

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Chronic hand eczema (CHE) has a high impact on the affected individual and places a heavy burden on society (1, 2). The disease typically follows a remitting and relapsing course and can be difficult to manage (3, 4). In addition to high levels of morbidity, CHE is associated with high rates of sick leave, exclusion from the labour market and loss of earnings (4–9). A study involving 10 European dermatology departments found that more than 50% of all cases of hand eczema were reported to be work-related CHE (10). To date, no studies have compared the costs of managing CHE *per se* with those of managing work-

related CHE, although it might be expected that the costs of disease due to loss of productivity (i.e. the indirect costs of CHE) in addition to the healthcare costs would differ depending on whether the disease was occupational or unrelated to work factors.

A recent economic survey of practices and clinics in Germany assessed the annual direct and indirect costs per patient of managing CHE that is refractory to treatments with potent topical steroids (6). The study found that costs increased with the clinical severity of CHE and according to treatment stage. All patients in that study were covered by German statutory health insurance system (SHI; *Gesetzliche Krankenversicherung*), the basic health insurance covering 90% of the German population. Most employees are additionally insured through occupational health insurance (OHI; *Berufsgenossenschaften*), which applies if diseases or injuries are work-related. OHI reimburses the cost of treatment that is applied upon the request of the treating physician, but only if OHI accepts the disease as work-related.

The aim of this paper is to analyse and compare the cost-of-illness for CHE in relation to whether the disease is occupational or unrelated to work factors, by using cost data from the SHI cost-of-illness study (as reported by Augustin et al. in 2011 (6)) with additional cost-data for German OHI patients with work-related CHE.

## METHODS

### *Design and settings*

This analysis presents data from 2 virtually identical cross-sectional data-surveys that collected patient-level data relating to CHE and its management. The surveys were conducted in 2008 at 24 dermatology practices and clinics across Germany (SHI-insured patients – the first survey) (6) and 2 specialized centres (Heidelberg and Osnabrück) linked with the OHI system (the second survey).

### *Patients*

The methods of recruitment and data collection for SHI patients have been described in detail elsewhere (6). Patients were recruited from OHI centres using the same inclusion and exclusion criteria as those defined by Augustin et al. (6), except that all patients recruited from OHI centres, by definition, had CHE that was considered to be related to work or occupational exposures

and their treatment costs were reimbursed by OHI. Otherwise, all patients included in the 2 surveys were adult outpatients with CHE refractory to treatment with potent topical steroids.

Regarding the impact of the disease on patients' ability to work, the SHI data did not describe a homogeneous group of patients, and were therefore split into 3 distinct groups depending on the impact of CHE on work. Specifically, the patient data were grouped as follows (Fig. 1):

- Non-working patients (SHI-1): SHI patients not working (excluding those who lost their job due to CHE).
- Work-unaffected patients (SHI-2): SHI patients in work for whom work is not affected by CHE.
- Work-impaired patients (SHI-3): SHI patients in work for whom work is affected by CHE (i.e. disease causes days off work or with job loss/change due to CHE). In such patients, CHE might be caused by work, although (at the time of the study) the relationship was not confirmed by OHI.
- Work-diseased patients (OHI): OHI patients, i.e. subjects with known work-related CHE and in whom the correlation between CHE and work has been confirmed by the occupational health insurer.

The non-working patients (SHI-1) and work-unaffected patients (SHI-2) have CHE that is likely to be unrelated to work. In the work-impaired patients (SHI-3) and work-diseased patients (OHI) CHE is impacting their work productivity, whilst for the latter group it is known that the disease is work-related (as indicated by the insurance status).

Data collection instruments

In brief, patient demographic and clinical data, together with information on sick-leave and changes in employment conditions, and resource-utilization data, were collected from patients and physicians. The severity of clinical disease was determined by Modified Total Lesion Symptom Score (mTLSS) and Physician's Global Assessment (PGA) (categories: clear, almost clear, mild, moderate, severe), both according to Ruzicka et al. (11), and a photographic guide (clear, almost clear, moderate, severe and very severe) according to Coenraads et al. (12), a validated photographic guide to assess the severity in a standardized way. The latter 2 CHE severity measures have 5 categories, but differ slightly with respect to the categories' labels. For the photographic guide, clinical severity was assessed on the day of evaluation, and worst and mean status for the

previous 12 months was determined by the physician based on the information provided by the patient.

The impact of CHE on health-related quality of life (QoL) was assessed using the Dermatology Life Quality Index (DLQI) (a 10-item disease-specific questionnaire) (13) and the Skindex-29 (a multi-dimensional 29-item questionnaire on dermatology-specific QoL with 3 dimensions: "Symptoms", "Emotions" and "Functioning") (14, 15).

Resource use and costs

As detailed by Augustin et al. (6), all treatments relevant to CHE were documented. For the analysis, CHE treatment stages were defined using criteria developed for German treatment guidelines, as follows (16): treatment stage I: only topical treatments or any treatment; treatment stage II: topical treatments plus phototherapy (e.g. psoralen plus ultraviolet A; PUVA); treatment stage III: oral treatments applied, and treatment stage IV: patients with hospitalization episodes. Patients were assigned to the highest-attained treatment stage recorded. Hence, it is possible, but not required, that a patient in stage III is treated with UV therapy and/or topical treatments.

Costs were evaluated from the societal perspective and assessed the utilization of all resources relevant to the disease (direct costs) and the indirect costs of disease resulting from sickness absences. Standard insurance-specific tariffs (SHI and OHI) were applied. Direct costs evaluated were: ambulant honoraria (including diagnostics), emollients, drug expenses, UV therapy, hospital treatment (inpatients and day care), and patients' out-of-pocket expenses.

Statistics

Data analysis was performed using STATA SE version 11 (Statacorp LP, College Station, TX, USA). All parameters (demographics, degree of severity, use of resources, costs) were analysed descriptively. Data are presented for the totals and for the 4 groups by work impact of CHE (3 different SHI groups and the fourth group from the OHI survey). Comparisons between groups were conducted for continuous variables with analysis of variance (ANOVA) or Kruskal-Wallis test and for categorical variables with  $\chi^2$  test or Fisher's exact test.

Two logistic regression analyses were performed to identify patient-related factors associated with CHE treatment choices based on the data from all patients. The first model analysis factors

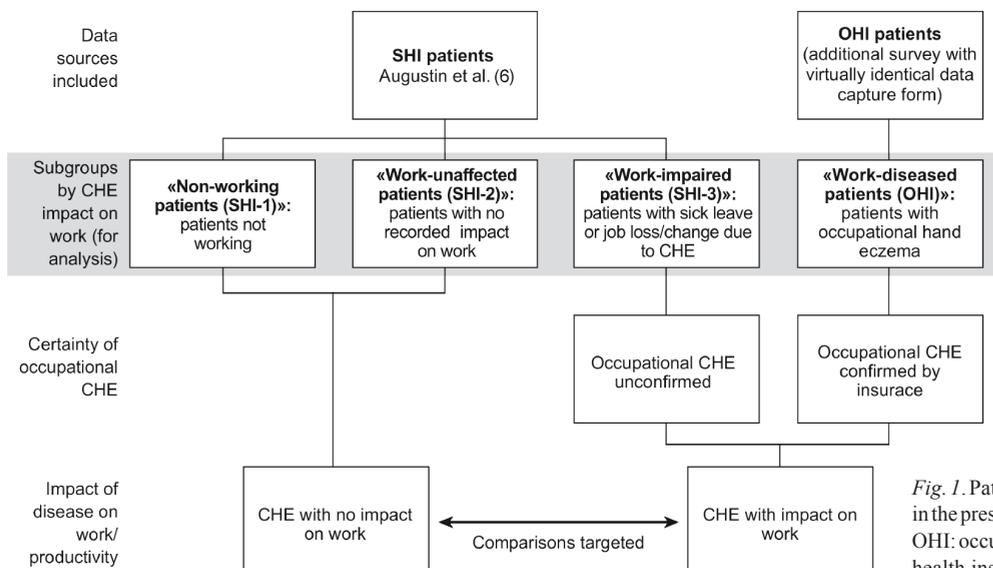


Fig. 1. Patients with chronic hand eczema included in the present analysis. CHE: chronic hand eczema; OHI: occupational health insurance; SHI: statutory health insurance; CI: confidence interval.

were associated with the use of additional non-topical therapies (i.e. treatment stage II, III, or IV) vs. topical treatments only; the second with hospitalization (treatment stage IV) vs. no hospitalization. The following explanatory variables were included: age, gender, time since diagnosis (years), hand cleared since diagnosis, clinical severity in the past 12 months (based on photographic guide), CHE impact on work life (i.e. work-impaired patients (SHI-3) and work-diseased patients (OHI)) and Skindex-29 subscales.

## RESULTS

### Patient demographics and clinical characteristics

The analysis involved 310 patients with refractory CHE, comprising 223 patients from the statutory health system (SHI group) and 87 from the occupational health insurance system (OHI group). Within the statutory health insurance sample (SHI), 72 patients were non-working, 105 patients were work-unaffected and 46 patients were work-impaired. All 87 patients in the occupational health system (OHI) were work-diseased, as indicated by their insurance status (Fig. 1).

The mean age of the patients was 45.7 years and approximately 50% were female. In the SHI group, 33.9% of working patients reported taking sick leave in the past 12 months, with a mean duration of 21.3 days, while in the OHI group, 62.7% of working patients reported taking sick leave, with a mean duration of 47.2 days. It was found that 2.3% of SHI patients reported losing their job and 2.3% changed jobs, compared with 1.5% reporting job loss and 5.9% changing jobs in the OHI group.

In terms of clinical severity, approximately 50% of patients had had severe disease episodes in the previous 12 months (as assessed by photographic guide) (Fig. S1a; available from: [http://www.medicaljournals.se/](http://www.medicaljournals.se/acta/content/?doi=10.2340/00015555-1565)

[acta/content/?doi=10.2340/00015555-1565](http://www.medicaljournals.se/acta/content/?doi=10.2340/00015555-1565)). Among the 4 groups, the health of the 46 patients with work-impaired status (SHI) was most affected according to mTLSS, DLQI and Skindex-29 (Table I, Fig. S1b). The mean duration of disease was found to be 5.5 years (OHI), 7.0 years (SHI-2), 7.9 years (SHI-3) and 13.3 years (SHI-1).

### Resource use consumption and costs

Virtually all patients received topical treatments (92.5% of patients used emollients, 77.6% topical steroids, 13.9% calcineurin inhibitors and 15.3% other treatments). Approximately every third patient received UV therapies.

The treatment stage of patients varied according to the impact of CHE on work (Fig. 2). Non-working and work-unaffected SHI patients received broadly similar treatments, with most patients (approximately 70%) receiving topical treatments only (i.e. treatment stage I). However, patients from the third SHI group who had CHE affecting their ability to work (i.e. SHI-3) were managed differently: only 39% of patients received topical treatments alone, whilst 47.7% received UV therapies, 42.5% oral therapies and 26% hospital care. Therefore, management of work-impaired patients (SHI-3) was broadly similar to the management of work-diseased patients (OHI), i.e. 39–49% of patients received non-topical treatments alone and approximately every fourth patient in these 2 groups had been hospitalized.

The mean annual direct and indirect costs per patient in the SHI system were €1,742 and €386, respectively, and, for the OHI system, €3,309 and €3,422, respectively (Table SI; available from: <http://www.medicaljournals.se/acta/content/?doi=10.2340/00015555-1565>).

Table I. Patient characteristics

Patient characteristics	Total n = 310	Non-working patients (SHI-1) n = 720	Work-unaffected patients (SHI-2) n = 105	Work-impaired patients (SHI-3) n = 46	Work-diseased patients (OHI) n = 87	p-value
Gender, % female	53.5	61.1	60.0	39.1	47.1	0.03*
Age, years, mean	45.7	55.4	41.2	40.4	45.8	0.00*
Work status, % working	73.5	0.0	100.0	91.1	93.1	0.00*
Time since diagnosis, years, mean	8.2	13.3	7.0	7.9	5.5	0.00*
Cleared hands since diagnosis, %	53.3	55.7	56.0	54.3	47.7	0.67
Extent of hands affected (dorsal and palmar), %						
Left hand	25.6	24.3	24.7	30.9	24.9	0.32
Right hand	25.9	24.2	24.4	32.5	25.6	0.14
mTLSS (0–21) <sup>a</sup> , mean	8.5	8.3	8.8	10.1	7.7	0.01*
DLQI (0–80) <sup>b</sup>	7.0	6.1	5.6	10.1	7.7	0.00*
DLQI ≥ 11 (0–80) <sup>b,c</sup> , %	23.5	22.2	15.2	37.0	27.6	0.02*
Skindex-29 (0–100) <sup>d</sup> , mean						
Total	37.5	35.9	33.2	46.9	39.1	0.00*
Symptoms	49.0	48.8	45.4	54.4	50.7	0.05*
Emotions	41.7	39.5	37.9	50.7	43.3	0.01*
Functioning	27.2	25.5	22.3	38.7	28.8	0.00*

\*Significant at  $p < 0.05$ .

<sup>a</sup>Scale from 0=no to 21=maximum severity. <sup>b</sup>Scale from 0=no impairment to 30=maximum impairment. <sup>c</sup>According to Hongbo et al. (19), DLQI scores of ≥ 11 indicate a very large or extremely large effect on the patient's life. <sup>d</sup>Scale from 0=no impairment to 100=maximum impairment. mTLSS: Modified Total Lesion Symptom Score; DLQI: Dermatology Life Quality Index; OHI: occupational health insurance; SHI: statutory health insurance.

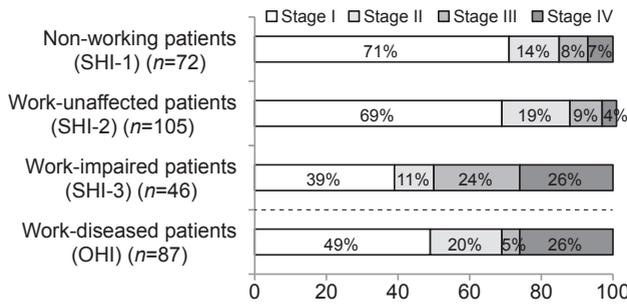


Fig. 2. Treatment stage of patients according to impact of chronic hand eczema (CHE) on work. Stage I: only topical treatments; Stage II: topical treatments plus phototherapy (e.g. psoralen plus ultraviolet A; PUVA); Stage III: oral treatments applied; Stage IV: patients with hospital stays/inpatient treatment. OHI: occupational health insurance; SHI: statutory health insurance.

Overall, both direct and indirect costs contributed to the higher OHI costs (€6,731 vs. €2,218 (SHI)). The OHI costs remained higher than SHI costs after recalculation and adjustment of direct costs according to the SHI tariff (results not presented).

The mean direct costs (healthcare costs) of managing patients in the non-working and work-unaffected (SHI-1 and SHI-2) groups were €1,271 and €1,442, respectively, compared with €3,164 and €3,309 for patients in the work-impaired group (SHI-3) and work-diseased group (OHI), respectively (Fig. 3). Although it is also evident that a considerable fraction of non-working and work-unaffected (SHI-1 and SHI-2) patients have higher direct costs (18–25% with €2,000–€5,000 cost per year; Fig. 4).

Naturally, only those patients with CHE affecting work or with work-related disease incurred productivity loss (indirect costs) due to CHE and these were means of €1,872 and €3,422 in the work-impaired group (SHI-3) and work-diseased group (OHI), respectively.

*Factors associated with chronic hand eczema treatments*

Based on the cohort of all patients, the significant variables associated with additional non-topical treatments

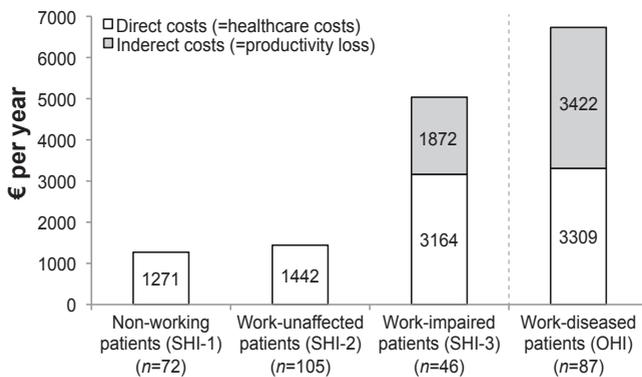


Fig. 3. Yearly per-patient costs of chronic hand eczema (CHE) according to impact of CHE on work (according to insurance-specific tariffs). OHI: occupational health insurance; SHI: statutory health insurance.

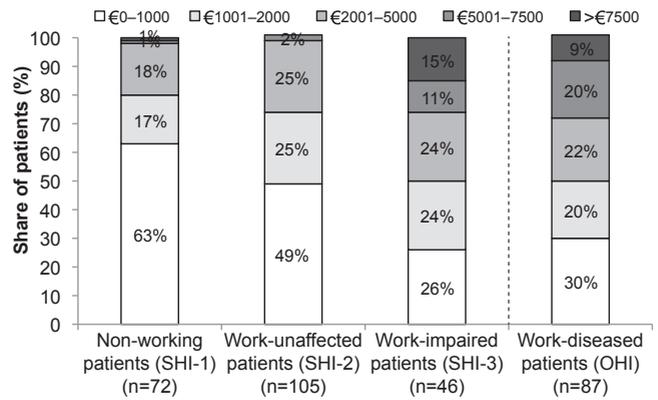


Fig. 4. Distribution of annual direct per patient cost according to impact of chronic hand eczema on work. OHI: occupational health insurance; SHI: statutory health insurance.

(treatment stages II, III and IV) are: clinical severity, Skindex-29 functioning subscale, and whether CHE has an impact on work life (Table II), i.e. patients with a higher severity of CHE (based on photographic guide and Skindex-29 functioning subscale) and those in whom CHE impacts on work are more likely to receive additional non-topical therapies. Similarly, clinical severity and cases in which CHE impacts on work life are associated with hospital care (treatment stage IV). For a patient with CHE impacting on work (compared with the remaining patients), the odds of being hospitalized are 5.5 times higher, after controlling for disease severity and other factors. Skindex-29 subscales, particularly the emotional aspect, appear to have a limited impact on treatment choices. However, the Skindex-29 subscales detail the health/patient status, as described at an assessment visit, and it is unclear whether these levels of impairment were also observed at the times and visits when treatment decisions were made. Furthermore, these analyses show that factors such as time since diagnosis, clearing of hands since diagnosis, age or gender do not have any significant influence on treatment choices. Even when other factors, such as disease duration or clinical severity, are considered, the impact of “having CHE with work impact” on treatment choices is confirmed.

DISCUSSION

CHE exacts a considerable clinical burden and is associated with high rates of sick leave, loss of earnings and, for some patients, requires a change of job or exclusion from the workforce (4–9, 16). This is the first study to investigate the relationship between costs of illness and whether CHE is occupational or unrelated to work, based on 2 different surveys. In this study, all patients covered by OHI had work-related CHE by definition, while those covered by SHI included patients who had CHE not related to, or caused by their work. We aimed to understand the impact of CHE affecting

Table II. Factors associated with treatment choices based on logistic regression analysis

	Patient receives additional non-topical treatment (treatment stages II, III and IV) <i>n</i> = 281		Patient receives hospital care for CHE (treatment stage IV) <i>n</i> = 281	
	Odds ratio (95% CI)	<i>p</i> -value	Odds ratio (95% CI)	<i>p</i> -value
Age	1.00 (0.98–1.02)	0.80	0.99 (0.96–1.03)	0.75
Gender				
Male	1		1	
Female	0.83 (0.49–1.43)	0.51	1.41 (0.64–3.12)	0.40
Time since diagnosis, years	0.99 (0.96–1.01)	0.33	1.02 (0.99–1.06)	0.20
Hands cleared since diagnosis				
No	1		1	
Yes	1.14 (0.66–1.96)	0.64	1.03 (0.46–2.29)	0.94
Clinical severity in past 12 months <sup>a</sup>	1.44 (1.06–1.98)	0.02*	2.11 (1.31–3.39)	0.00*
CHE impact on work life				
No	1		1	
Yes <sup>b</sup>	1.84 (1.09–3.13)	0.02*	5.51 (2.31–13.11)	0.00*
Skindex-29				
Symptoms	1.00 (0.99–1.02)	0.79	0.98 (0.95–1.00)	0.08
Emotions	0.99 (0.97–1.01)	0.37	1.01 (0.98–1.04)	0.63
Functioning	1.03 (1.00–1.05)	0.02*	1.00 (0.97–1.04)	0.78

<sup>a</sup>1: almost clear to 4: very severe. <sup>b</sup>Includes work-impaired patients (SHI) and work-diseased patients (OHI).

\*Significant at *p* < 0.05.

CHE: chronic hand eczema; OHI: occupational health insurance; CI: confidence interval.

work by assessing treatment and cost data according to whether patients from the SHI group were “non-working” patients, “work-unaffected” patients (i.e. in work but their attendance at work was not affected by CHE) or were “work-impaired” patients (i.e. in work and experiencing days of work lost due to CHE). This allowed us to show that the impact of CHE on work has a considerable influence on the treatment provided to patients. The SHI “work-impaired” group of patients (SHI-3) was found to be very similar to the “work-diseased” group of patients (OHI) in terms of treatments used and with regards to the mean direct costs of management.

The direct treatment costs of managing “work-impaired” (SHI-3) and “work-diseased” (OHI) patients were similar, at over €3,000 per year – twice as high as the direct treatment costs of “non-working” or “work-unaffected” SHI patients. Interestingly, the QoL differences, as measured by DLQI and Skindex-29 are not similarly pronounced among the 4 groups, although the lowest quality of life is observed in “work-impaired” (SHI-3) patients.

The limitation of the present study is that it reflects the German situation<sup>1</sup>.

The recent multicentre German study to determine the cost-of-illness in patients with CHE in routine care (6) showed that CHE costs are correlated with disease severity. The analysis presented here adds a further important cost driver – CHE caused-by and impacting-on work function. Understanding the cost impact of CHE requires careful consideration of all cost drivers. Another recent study in Germany evaluated the societal costs of OHI patients in the year prior to CHE patients entering a tertiary rehabilitation programme (18). The

societal cost per OHI patient was €8,799, a figure that is even higher than the OHI costs reported in the present study (€6,731). The higher costs were driven by longer absences from work.

Taking these factors together, it can be seen that CHE is associated with a high economic burden, particularly when it affects patients’ work function. This study, and other recent German cost analyses (6), emphasize that the costs associated with CHE are affected not only by disease severity but also by the relationship of CHE to work (causal and/or affecting work performance). Addressing the economic burden posed by CHE will require improved strategies for the prevention and treatment of refractory CHE in both SHI and OHI settings.

<sup>1</sup>According to § 9 of the 7<sup>th</sup> book of the German Social Code (SGB VII), occupational diseases are those diseases which the German government, through statutory ordinance, and with the agreement of the Federal Council, define as a disease that a worker develops as a result of his or her insured work activity (17). In Germany, statutory worker’s compensation (OHI: *Berufsgenossenschaften*) has served since 1885 to insure workers against work-related risks that are related directly to their occupation and is 1 of 5 mandatory insurances within the German social security system (SHI, *Gesetzliche Krankenversicherung*, is another:). Statutory worker’s compensation bodies are subject to public law, and are not intended merely to provide compensation in the event of occupational diseases, but also to prevent their occurrence. This includes preventive measures and treatment. It is stated in the German Ordinance on Occupational Diseases (*Berufskrankheiten-Verordnung*) that: “If there is a risk to the insured person of contracting occupational disease or of its recurrence or worsening, worker’s compensation insurance providers must act against the risk with all appropriate means. If the hazard cannot be eliminated, worker’s compensation must try to ensure that the insured party can discontinue the harmful occupation. The involvement of medical occupational health and safety authorities must be ensured.” Different regulations in other countries may lead to different results with respect to economic burden of disease.

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