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## CLINICAL REPORT

# Disability Pensions due to Skin Diseases: A Cohort Study in Swedish Construction Workers

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**Disability pensions due to skin diseases in Swedish male construction workers were studied by linking data from pension registers and an occupational health service. Incidence rates of disability pensions for cement workers, painters and plumbers were compared with 2 control groups. A total of 623 disability pensions were granted during 4 decades of follow-up. The main diagnoses were eczema (36%) and psoriasis (49%). Pensions were mostly granted in the age range 55–64 years. Among painters, cement workers and plumbers the incidence rates for disability pensions were 33.3, 24.5 and 20.4 cases/100,000 person-years, respectively, compared with 13.7 and 9.2 cases/100,000 person-years in control groups. Relative risks were highest for eczema, and were notable for psoriasis. Attributable fractions for eczema were 90% in cement workers and painters and 75% in plumbers compared with control groups. Attributable fractions for psoriasis in the occupational groups studied were in the range 54–67%. In conclusion, eczema and psoriasis have a high impact on loss of work ability, as reflected by disability pensions. Key words: attributable fraction; eczema; exposure; prevention; psoriasis; work ability.**

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Despite the fact that skin diseases have a wide range of impacts on working capacity, there have been few studies of disability pension (DP) due to skin diseases (1–3). DP is the final step taken in protracted and severe cases of skin disease in which medical treatment and rehabilitation have been unsuccessful.

Construction work is largely manual and entails mechanical wear and exposure to contact allergens, skin irritants and wet-work. These factors can initiate and/or aggravate skin diseases. Working in the construction industry often also requires dexterity and manual strength; abilities that are often markedly impaired when dermatoses involve the palms and fingers. Long periods of sick-leave and DPs are documented consequences of some skin diseases, e.g. eczema and psoriasis (2–5).

Occupational groups well-known for hazardous skin exposure are concrete workers and bricklayers working with cement, painters and plumbers. Until the 1980s in Sweden cement contained skin-sensitizing chromates, and paints were based on solvents that were harmful to the skin and nervous system. During the 1980s preventive measures were introduced on a national level in Sweden to reduce these harmful skin exposures; iron (II) sulphate was added to cement to convert chromates to a less sensitizing form, while solvent-based paints were, to a large extent, replaced by water-based paints (6, 7).

The granting of DPs is related not only to the severity of medical ailments and specific working conditions, but also to the structure of the pension system. A DP in Sweden requires that the person has a chronic disease that permanently decreases his or her ability to work. Before the early 1990s other factors were also taken into account, e.g. the labour market in the person's home area could be included in the evaluation if the person was over 60 years of age (8).

The main aim of the current study was to examine work incapacity, as manifested in DPs due to skin disease. Cohorts of construction workers were followed for a period of 4 decades. A further aim was to evaluate whether known changes in occupational skin exposure to noxious agents corresponded to a change in the subsequent risk of DP.

## SUBJECTS AND METHODS

The design is a cohort study. The study was approved by the Regional Ethics Review Board (2011-367-32M). Study participants gave their informed consent according to the principles of the Declaration of Helsinki.

Persons working in the construction industry in Sweden were affiliated to a nationwide occupational health service (Bygghälsan) from the late 1960s until early 1993. These workers were offered free health examinations on a regular basis, and it is estimated that approximately 80% of those invited participated at least once (Anders Englund, personal communication). Data from the health examinations carried out from 1971 are computerized. The resulting register contains information about occupation, age and findings from health controls performed in a total of 389,132 persons.

The rate of DP awards was found through a linkage with registers available from the National Insurance Office (Försäkringskassan). The register contains up to 2 diagnoses for the DP and dates. The occurrence of DPs due to eczema (International Classification of Diseases, Ninth edition (ICD-9): 690, 692; ICD-10: L23, L24, L25, L30), psoriasis (ICD-9: 696; ICD-10:

Table I. Numbers and mean year of birth for the occupational groups of male Swedish construction workers

Occupational group	n	Year of birth, mean
Cement workers	39,575	1942
Concrete workers	29,887	1941
Bricklayers	9,688	1943
Painters	23,129	1948
Plumbers	23,885	1947
Control group 1	99,284	1949
Woodworkers	64,196	1948
Electricians	35,088	1952
Control group 2	39,213	1941
Foremen	28,262	1942
Office workers	10,951	1940

L40), atopic dermatitis (ICD-9: 691; ICD-10: L20) and other skin diseases are recorded, with more than one diagnosis per individual being possible (Table SI<sup>1</sup>). The ICD registers do not specify the location of eczema and psoriasis.

The Swedish national social insurance scheme includes all Swedes and can provide one-quarter, one-half, three-quarters or a full pension. In the present study DP was defined as the first time a person was granted a DP, irrespective of the extent of DP ( $\geq 1/4$ ) or if the skin disease diagnosis was considered as the primary or secondary cause of the award. In cases in which the labour market was deemed relevant to the award of a DP the register reflected this, and such cases were excluded from the analysis.

Data for the individuals in the cohort were extracted from the year of their first examination to the year of death, emigration, year of DP award, age 65 years or to 31 December 2010. The first year of health examination was 1971. Person-years were calculated and stratified by decade (1971–1979, etc.) and age (20–39, 40–54, 55–64 years).

There were too few female concrete workers, bricklayers, painters and plumbers to allow analysis (women usually had administrative jobs), and so woman were excluded from the study ( $n=553$ ). Other exclusion criteria were: persons born before 1916 ( $n=23,354$ ), and persons examined before the age of 15 years or after the age of 65 years ( $n=1,779$ ).

The national occupational health service classified jobs into 22 groups in the mid-1970s. Our analyses included only workers with heavy exposure to cement (concrete workers and bricklayers), painters and plumbers. Two control groups were defined: Control group 1 consists of woodworkers and electricians; Control group 2 consists of foremen and office workers. Workers in Control group 1 have a similar socioeconomic status to concrete workers, bricklayers, painters and plumbers. Their work tasks are also manual, but the skin exposure is different and includes less wet-work and contact with chemicals. Control group 2 consists of persons with low occupational skin exposure. Office workers, who comprise the minor part of Control group 2, may have different socioeconomic status. In total, the cohort included 225,086 individuals; descriptive data are shown in Table I. Additional data concerning the number of DPs due to all skin diseases, eczema and psoriasis, person-years, age, and time-periods are given in Table SII<sup>1</sup>.

Incidence rates (IRs) were adjusted for age (40–54, 55–64 years) and time-period (1971–1979, 1980–1989, 1990–1999, 2000–2010), and standardized according to the distribution of person-years in Control group 1. Negative binomial

Table II. Skin disease diagnoses in 623 cases of disability pension in occupational groups of male construction workers in relation to age. An individual may have more than one skin disease diagnosis

Occupational group	Skin disease	Age (years)			
		20–39	40–54	55–64	20–64
Cement workers ( $n=39,575$ )	All skin diseases	1	35	137	173
	Eczema	0	13	74	87
	Psoriasis	0	19	49	68
Painters ( $n=23,129$ )	All skin diseases	3	35	78	116
	Eczema	0	8	42	50
	Psoriasis	1	23	28	52
Plumbers ( $n=23,885$ )	All skin diseases	1	18	59	78
	Eczema	0	2	18	20
	Psoriasis	1	14	28	43
Control group 1 <sup>a</sup> ( $n=99,284$ )	All skin diseases	5	51	137	193
	Eczema	1	12	45	58
	Psoriasis	3	33	66	102
Control group 2 <sup>b</sup> ( $n=39,213$ )	All skin diseases	1	17	56	74
	Eczema	0	0	13	13
	Psoriasis	0	9	34	43

<sup>a</sup>Woodworkers and electricians. <sup>b</sup>Foremen and office workers.

regression analysis was adjusted for age and time-periods, as Poisson regression analysis indicated over- or under-dispersion for some subgroups; SAS<sup>®</sup> (COUNTREG procedure) was used in the calculations.

Attributable fractions (AFs) were calculated from the age-adjusted IRs ( $(IR_{exp} - IR_{ref})/IR_{exp}$ ), and included only those individuals aged 40 years and over, as the award of DPs due to skin disorders was very rare among workers under the age of 40 years.

## RESULTS

There were a total of 623 cases of DP due to skin diseases. Eczema (227 cases, 36%) and psoriasis (303 cases, 49%) constituted the majority of the diagnoses. For all skin diseases, in particular eczema, the majority of cases were in the age group 55–64 years (Table II). For psoriasis most cases were also in the age group 55–64 years, but one out of 3 cases was in the age group 40–54 years. For atopic dermatitis, 28 DPs were found, with 18 individuals in the oldest age group. Additional skin diseases causing DPs included approximately 30 diagnoses, e.g. urticaria, prurigo, erythematous diseases and hypertrophic disorders (Table SI<sup>1</sup>).

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Table III. Adjusted<sup>a</sup> incidence rates (IR per 100,000 person-years) for disability pension due to all skin diseases, eczema and psoriasis according to occupational group

Occupational group	All skin diseases		Eczema		Psoriasis	
	IR	Cases, n	IR	Cases, n	IR	Cases, n
Cement workers	24.5 (20.4–28.6) <sup>b</sup>	172	10.7 (8.2–13.3)	87	10.9 (8.0–13.8)	68
Painters	33.3 (27.1–39.5)	113	14.4 (10.3–18.3)	50	15.3 (11.0–19.4)	51
Plumbers	20.4 (15.7–25.0)	77	4.9 (2.7–7.2)	20	11.5 (8.0–15.1)	42
Control group 1 <sup>c</sup>	13.7 (11.8–15.7)	188	4.2 (3.1–5.2)	57	7.2 (5.8–8.6)	99
Control group 2 <sup>d</sup>	9.2 (6.8–11.6)	73	1.2 (0.6–1.9)	13	5.0 (3.3–6.7)	43

<sup>a</sup>Adjusted according to age (40–54 and 55–64 years and decade). <sup>b</sup>95% confidence intervals. <sup>c</sup>Woodworkers and electricians. <sup>d</sup>Foremen and office workers.

Table IV. Relative risks and 95% confidence intervals for disability pension due to all skin diseases, eczema and psoriasis, adjusting for age (40–54, 55–64 years) and decade, in the occupational groups compared with the 2 control groups

Occupational group	All skin diseases		Eczema		Psoriasis	
	Control group 1 <sup>a</sup>	Control group 2 <sup>b</sup>	Control group 1 <sup>a</sup>	Control group 2 <sup>b</sup>	Control group 1 <sup>a</sup>	Control group 2 <sup>b</sup>
Cement workers	1.7 (1.2–2.5)	3.0 (2.0–4.4)	2.5 (1.8–3.6)	7.8 (4.3–14.0)	1.5 (1.1–2.0)	2.1 (1.4–3.2)
Painters	2.6 (1.8–3.7)	4.1 (3.1–5.6)	3.4 (2.4–5.0)	11.1 (6.0–20.4)	2.1 (1.5–3.0)	3.2 (2.0–5.1)
Plumbers	1.5 (1.0–2.1)	1.6 (1.6–3.8)	1.2 (0.72–2.0)	3.8 (1.9–7.6)	1.5 (1.1–2.2)	2.3 (1.4–4.0)

<sup>a</sup>Woodworkers and electricians. <sup>b</sup>Foremen and office workers.

Incidence rates (IR) for having a DP due to skin diseases were highest among painters (33.3 cases per 100,000 person-years), followed by cement workers (24.5 cases per 100,000 person-years) and plumbers (20.4 cases per 100,000 person-years) (Table III). For painters and cement workers the IRs were of the same magnitude for eczema and psoriasis, but for plumbers and the 2 control groups the IRs were higher for psoriasis than for eczema. The workers in Control group 1 generally had a higher IR than office workers and foremen (Control group 2).

Relative risks (RR) for DPs due to the skin diseases in cement workers, painters and plumbers in comparison with the 2 control groups are shown in Table IV. The highest RRs for eczema and psoriasis were found for painters. The RRs were highest for eczema, but were also high for psoriasis in all the occupational cohorts studied.

Time trends for the IRs for DPs due to eczema and psoriasis are shown in Fig. 1. For both diagnoses there was a falling trend during the two last studied decades. The highest IRs due to both eczema and psoriasis were

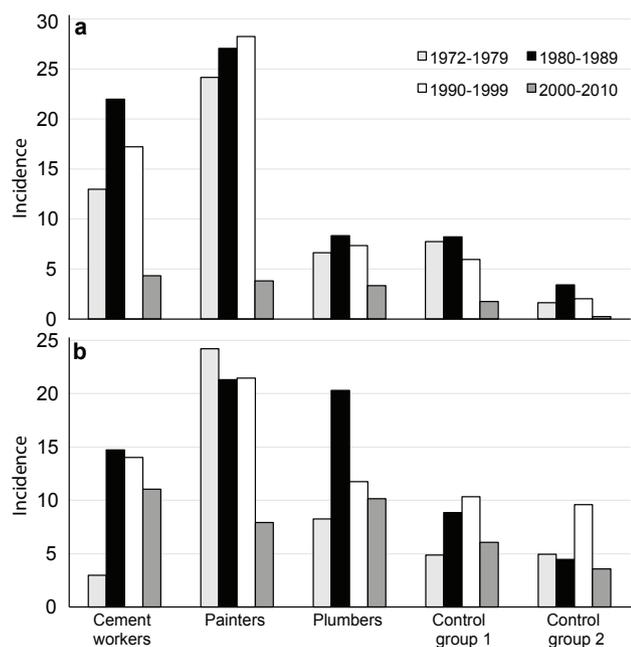


Fig. 1. Incidence of disability pension per 100,000 person-years and time-period for the occupational cohorts, age 40–65 years. (a) DP due to eczema. (b) DP due to psoriasis.

found in painters during the first 3 decades, decreasing markedly thereafter. There was a similar, but less pronounced, pattern for cement workers.

The AFs for DPs are shown in Table V. For eczema the AFs were high, both in workers exposed to cement and in painters,

compared with those working in less exposed jobs (Control group 1), but the AF was much lower in plumbers. The AFs were notably higher when the comparison was made with less-exposed workers (Control group 2). The AFs were considerably lower for psoriasis.

## DISCUSSION

This large cohort study of Swedish construction workers, with a long follow-up, shows that there is an increased risk of DPs due to work-related skin diseases in specific occupational groups. The findings also indicate that dermatoses, including eczema, psoriasis and a large number of other skin diseases, can be an obstacle in construction work. In some cases severe problems reduce the ability to continue working in the current occupation, or indeed to undertake any paid employment altogether.

Construction workers in Sweden (e.g. painters, cement workers, plumbers, woodworkers and electricians) either learn their trade as apprentices or at preparatory schools over a period of 2–3 years. They usually stay in their chosen trades as these tend to be well paid compared with other manual jobs. The DPs mostly occurred in rather old age groups; therefore these workers had been exposed in their trades for many years. A worker who develops allergic eczema at a young age may be retrained for another job rather than being granted a DP.

In concordance with previous findings, the present study shows that the risk of a DP increases with age, both in exposed workers and in controls (8, 9). Painters and cement workers had the highest IRs for DPs due to both eczema and psoriasis, but the RR was higher for eczema (Tables III and IV). This finding corresponds

Table V. Attributable fractions (AFs) for disability pension due to all skin diseases, eczema and psoriasis in the occupational groups of construction workers. (For calculations, see Methods)

Occupational group	All skin diseases		Eczema		Psoriasis	
	Control group 1 <sup>a</sup> , %	Control group 2 <sup>b</sup> , %	Control group 1 <sup>a</sup> , %	Control group 2 <sup>b</sup> , %	Control group 1 <sup>a</sup> , %	Control group 2 <sup>b</sup> , %
Cement workers	44	62	61	90	34	54
Painters	59	72	71	90	53	67
Plumbers	33	55	14	75	37	57

<sup>a</sup>Woodworkers and electricians. <sup>b</sup>Foremen and office workers.

well with the fact that eczema is influenced more by skin exposure than is psoriasis.

Psoriasis was included in the analyses since it has been shown to be a common cause of DP for skin disease in previous studies (2). Psoriasis constitutes a minor, but well-documented, group of occupational dermatoses, and prevalences of 1.2–5.6% have been reported in various clinical study populations (10, 11). Interestingly, in our study we found comparable IRs for psoriasis and eczema in cement workers and painters, which indicates that psoriasis also has a negative impact on work ability. The IR due to psoriasis in plumbers was nearly twice the rate due to eczema and was also more prominent at younger ages (Tables II and III). Psoriasis is currently viewed as a systemic disorder with skin symptoms, potential joint involvement and comorbidities (11). Occupational skin symptoms related to psoriasis are localized mainly on the hands. Psoriatic lesions may be triggered by wet-work, contact with irritants, friction and mechanical stress, known as the Koebner phenomenon (12). Joint involvement in psoriatic arthritis and comorbidities between psoriasis and cardiovascular diseases and metabolic syndrome may contribute to impaired working capacity at younger ages.

A high risk of disabling eczema in cement workers was expected due to their contact with sensitizing chromium in skin-irritating alkaline cement. There was a successive reduction in eczema cases after the 1980s among cement workers, a development that coincided with the addition of iron (II) sulphate to cement. In Sweden this change was introduced in the early 1980s, with legislation in 1989 (13). Since 2005 European Union legislation (EU directive 2003/53/EC) has restricted the marketing and use of cement containing > 2 ppm of hexavalent chromate (14). Chromate allergy often appears late in the occupational career, which may explain a delayed effect of the reduced exposure. A corresponding decrease in chromate allergy has been observed in several countries, e.g. Denmark, Finland, Germany and the UK (15–19).

The high risk and time trend for DPs awarded due to eczema in painters may relate to solvent exposure. Replacement of solvent-based paints with water-based paints is probably a major cause of the diminishing incidence. Historically, painters were exposed to turpentine, which carried a high risk of allergic contact dermatitis and neurotoxic effects. During the 1950s turpentine was gradually replaced by non-sensitizing, but still neurotoxic, organic solvents (20), and in the mid-1980s there was a change to less irritating water-based paints (7). However, exposure to the biocides that are now added to water-based paints, e.g. isothiazolinone preservatives, has created a new risk for allergic eczema. Furthermore, the use of sensitizing synthetic resins, i.e. epoxy-resin compounds, constitutes new risks of contact allergy (21, 22). However, the possible effects of these new risks were not observed in the present study of DPs.

For plumbers, mechanical wear, wet-work, handling a diversity of metals and plastics, rubber and sealing compounds as well as soldering may all impose a risk of dermatitis (23). Since the 1960s the use of resins and glues in the trade has increased, while the use of lead, for example, has decreased. The pipe re-lining methods introduced in the 1970s implied exposure to uncured plastic components, which adds to the risk of contact allergy (24, 25).

In a separate analysis all manual workers in the cohort with a specified job title were compared with Control group 2. The RR of DP was 2.4 for all skin diseases (95% CI 1.5–3.7), 5.5 for eczema (95% CI 2.9–10.3) and 2.0 for psoriasis (95% CI 1.3–3.2); lower RRs than were found for cement workers and painters.

The sensitizing chemicals (e.g. biocides and epoxy resins) introduced relatively recently in construction work constitute well-documented risk factors for allergic skin reactions (17). In our study, however, no increased risk was observed in terms of DPs, which may be attributed in part to the limited length of the exposure period and follow-up time. An alternative explanation could be more restricted granting of DPs during the last decade. Even in this large cohort, which was followed over a long time, the study will only have limited power to detect the potency of recent risks.

The present study used DPs to assess health effects from skin exposure in the construction industry. DP is a serious outcome, meaning that the skin disease in these cases has been severe and chronic and caused substantial harm to the individuals concerned. DPs also comprise a great cost to society by imposing a burden on the welfare system and causing the loss from the workforce of skilled workers at too early an age. DPs can be found through registers, which makes studies cost-efficient. In contrast, a study based on health examinations for cases of similar severity would be almost unfeasible as it would mean screening 100,000 workers over several decades. A more or less restrictive policy in the social welfare system to grant DPs may explain a decrease or increase over time, but this would not bias the comparison between occupational groups over different time-periods.

This large cohort study included observations made over 4 decades. The “exposure” was determined through the job title at the health control, while the workers were employed in the construction industry. As many as 225,086 individuals are included. The possibility of linking the pension register from the National Insurance Office with data from an occupational health service was the methodological basis for the present study. Throughout the period under consideration all Swedish construction workers were affiliated to this health service; a large proportion participated in health controls and was included in our cohort. Thus, this cohort includes workers from a variety of companies in the construction industry. The possibility of including 2 control groups with different

amounts of skin exposure was an advantage. The fact that the changes in occupational exposure over time were on a national level is a distinct advantage. One limitation of our study is that DP was due to one or, in some cases, two diagnoses, which makes it difficult to draw definitive conclusions. It is difficult to quantitatively evaluate the importance of single factors for the timing of the decrease in incidences of DP awards. Typically, a person is on sick-leave part-time or full-time, and there may be attempts to try other jobs before a DP is granted. It is therefore to be expected that a decrease in IR is gradual rather than very rapid at the time of the change in exposure. The decrease in the number of DPs due to skin disease during the 2000s (Fig. 1) may, to a certain extent, be an effect of more restrictive granting of DPs, and thus not entirely reflect a decrease in the occurrence or severity of these diseases. It should be noted that more efficient medical therapies have also been introduced.

As we have included partial DPs, the occurrence of other chronic diseases (e.g. musculoskeletal disorders) may increase the incidence of DP awards; in such cases skin diseases may form a contributory, rather than the main, cause. We used 2 control groups in the study. Control group 1 has more occupational skin exposure than Control group 2. The difference between the control groups may not be entirely dependent on differences in skin exposure, but rather may depend on a higher risk of DPs stemming from other causes in Control group 1.

In conclusion, construction workers have an increased risk of DPs due to skin diseases. Workers exposed to cement, painters and plumbers run a higher risk of DP due to eczema and to psoriasis in relation to controls. A reduction in DP rates corresponding in time to reduced exposure to sensitizing chromate and solvents indicates the value of preventive measures.

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## REFERENCES

- Menné T, Bachmann E. Permanent disability from skin diseases. *Dermatosen* 1979; 27: 37–42.
- Ibler KS, Jemec GBE. Permanent disability pension due to skin diseases in Denmark 2003–2008. *Acta Dermatovenerol Croat* 2011; 19: 161–164.
- Mattila K, Leino M, Mustonen, Koulu L, Tuominen R. Influence of psoriasis on work. *Eur J Dermatol* 2013; 23: 208–211.
- Meding B, Wrangsjö K, Järvholm B. Fifteen-year follow-up of hand eczema: persistence and consequences. *Br J Dermatol* 2005; 152: 975–980.
- Mälkönen T, Alanko K, Jolanki R, Luukkonen R, Aalto-Korte K, Lauerma A, et al. Long-term follow-up study of occupational hand eczema. *Br J Dermatol* 2010; 163: 999–1006.
- Fregert S, Gruvberger B, Sandahl E. Reduction of chromate in cement by iron sulfate. *Contact Dermatitis* 1979; 5: 39–42.
- Fischer T, Bohlin S, Edling C, Rystedt I, Wieslander G. Skin disease and contact sensitivity in house painters using water-based paints, glues and putties. *Contact Dermatitis* 1995; 32: 39–45.
- Järvholm B, Stattin M, Robroek SJW, Janlert U, Karlsson B, Burdorf A. Heavy work and disability pension – a long term follow-up of Swedish construction workers. *Scand J Work Environ Health* 2014; 40: 335–342.
- Brenner H, Ahern W. Sickness absence and early retirement on health grounds in the construction industry in Ireland. *Occup Environ Med* 2000; 57: 615–620.
- Moroni P, Cazzaniga R, Pierini F, Panella V, Zerboni R. Occupational contact psoriasis. *Dermatosen* 1988; 36: 163–164.
- Mahler V, Diepgen T, Skudlik C, Becker D, Dickel H, Fartasch M, et al. Psoriasis predisposition and occupational triggering factors in the appraisal of occupational medical expertise. *JDDG, Journal der Deutschen Dermatologischen Gesellschaft* 2014; 12: 519–529.
- Skudlik C, John S-M. Psoriasis and work. In: Rustemeyer T, Elsner P, John SM, Maibach HI, editors. *Kanerva's occupational dermatology*. Berlin: Springer-Verlag, 2012: p. 349–352.
- The Swedish Chemicals Agency's Regulation on chromium in cement (KIFS 1989:2).
- European Commission. Directive 2003/53/EC of the European Parliament and of the Council of 18 June 2003 amending for the 26th time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (nonylphenol, nonylphenol ethoxylate and cement). *Official Journal of the European Union* 2003; 178/24–178/28.
- Avnstorp C. Risk factors for cement eczema. *Contact Dermatitis* 1991; 25: 81–88.
- Zachariae COC, Agner T, Menné T. Chromium allergy in consecutive patients in a country where ferrous sulfate has been added to cement since 1981. *Contact Dermatitis* 1996; 35: 83–85.
- Roto P, Sainio H, Reunala T, Laippala P. Addition of ferrous sulfate to cement and risk of chromium dermatitis among construction workers. *Contact Dermatitis* 1996; 34: 43–50.
- Geier J, Krautheim A, Uter W, Lessmann H, Schnuch A. Occupational contact allergy in the building trade in Germany: influence of preventive measures and changing exposure. *Int Arch Occup Environ Health* 2011; 84: 403–411.
- Stocks SJ, McNamee R, Turner S, Carder M, Agius RM. Has European Union legislation to reduce exposure to chromate in cement been effective in reducing the incidence of allergic contact dermatitis attributed to chromate in the UK? *Occup Environ Med* 2012; 69: 150–152.
- Dick F. Solvent neurotoxicity. *Occup Environ Med* 2006; 63: 221–226.
- Estlander T, Jolanki R. Painters, laquerers, and varnishers. In: Rustemeyer T, Elsner P, John SM, Maibach HI, editors. *Kanerva's occupational dermatology*. Berlin: Springer-Verlag, 2012: p. 1601–1604.
- Mose AP, Lundov MD, Zachariae C, Menné T, Veien NK, Laurberg G et al. Occupational contact dermatitis in painters – an analysis of patch test data from the Danish Contact Dermatitis Group. *Contact Dermatitis* 2012; 67: 293–297.
- Hillen U. Plumbers and pipe fitters. In: Rustemeyer T, Elsner P, John SM, Maibach HI, editors. *Kanerva's occupational dermatology*. Berlin: Springer-Verlag, 2012: p. 1653–1654.
- Fillenham G, Lidén C, Anveden Berglind I. Skin exposure to epoxy in the pipe relining trade – an observational study. *Contact Dermatitis* 2012; 67: 66–72.
- Anveden Berglind I, Lind M-L, Lidén C. Epoxy pipe relining – an emerging contact allergy risk for workers. *Contact Dermatitis* 2012; 67: 59–65.