

Occupational skin diseases in Czech healthcare workers from 1997 to 2009

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Abstract

Background The healthcare sector ranked in second place among economic sectors in the Czech Republic, with about 11.4 % of all occupational diseases in 2009. Skin diseases constituted about 20 % of all occupational diseases.

Objectives The aim of this study was to analyze the causes and trends in allergic and irritant-induced skin diseases in the healthcare sector.

Methods The data concerning occupational skin diseases (Chapter IV of the Czech List of Occupational Diseases, non-infectious skin illnesses) in the healthcare sector were analyzed from the Czech National Registry of Occupational Diseases from 1997 until 2009. The trends in the total counts and most frequent causes were evaluated.

Results During the past 13 years, a total of 545 skin diseases were acknowledged in healthcare workers. Allergic contact dermatitis was diagnosed in 464 (85 %), irritant contact dermatitis in 71 (13 %) and contact urticaria in 10 subjects (2 %). Ninety-five percent of the patients were females. The overall incidence in individual years varied between 1.0 and 2.9 cases per 10,000 full-time employees per year. Disinfectants were the most frequent chemical agents causing more than one third of all allergic skin diseases (38 %), followed by rubber components (32 %) and cleaning agents (10 %).

Conclusion A general downward trend of diagnosed cases of occupational skin diseases in health care workers in the Czech Republic over the past 13 years was demonstrated.

Keywords Occupational skin diseases · Contact dermatitis · Healthcare workers · Czech Republic

Introduction

Healthcare workers (HCWs) may be exposed to many contact irritants and allergens; in addition, they are obliged to wear personal protective gear, most commonly rubber gloves. A variety of specialists works in this sector, such as nurses, physicians, paramedical professionals and other HCWs. The spectrum of dermatoses includes allergic contact dermatitis (ACD), irritant contact dermatitis (ICD) and contact urticaria. The scope of exposures potentially causing occupational diseases is very broad and, besides wet work, involves rubber chemicals, disinfectants, detergents, drugs and soaps (Schnuch et al. 1998; Nettis et al. 2002; Giménez-Arnau 2006; Rietschel and Fowler 2008; Suneja and Belsito 2008). In addition, dental nurses and technicians usually work with specific dental materials, including acrylates (Alanko et al. 2004; Leggat et al. 2007).

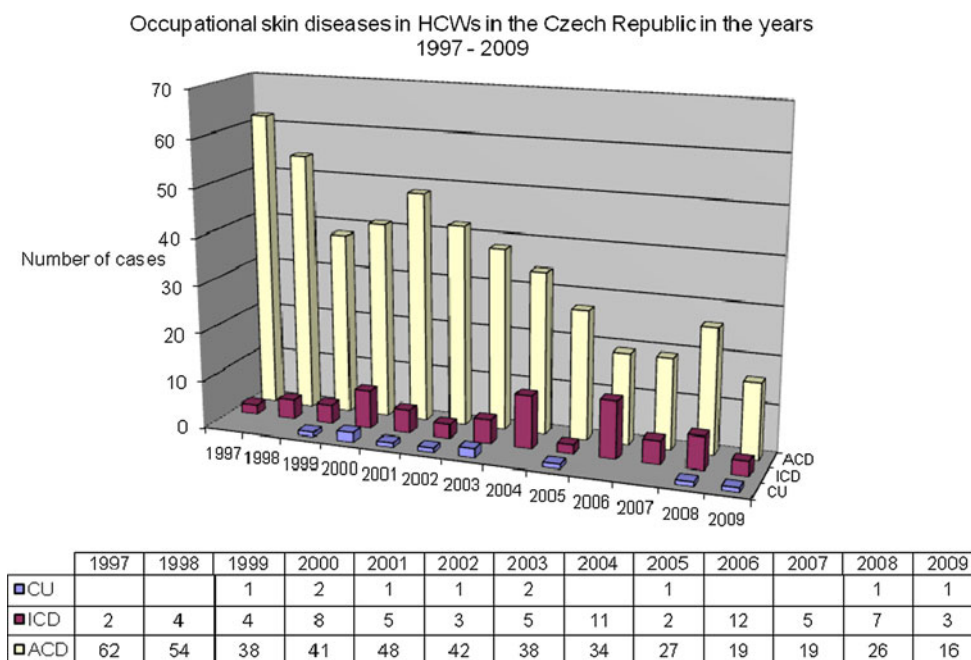
For several years, the healthcare sector has belonged to one of the most hazardous economic sectors in the Czech Republic, according to occupational diseases statistics (The National Institute of Public Health 2011). This study presents a survey of occupational non-infectious skin diseases in HCWs in the Czech Republic in the years 1997–2009.

Similarly to other European countries, the Czech Registry of Occupational Diseases provides national data based on notification of occupational illnesses (Cikrt et al. 1997;

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Fig. 1 Occupational skin diseases in healthcare workers in the Czech Republic in the years 1997–2009. *CU* contact urticaria, *ICD* irritant contact dermatitis, *ACD* allergic contact dermatitis



Diepgen and Coenraads 1999; Urban et al. 2000; Dickel et al. 2001; Diepgen 2003; Fenclová et al. 2005).

The aim of this study was to analyze the causes and trends in allergic and irritant-induced skin diseases in the healthcare sector.

Subjects and methods

Data concerning skin disorders was extracted from the National Registry of Occupational Diseases (started in 1997) in the years 1997–2009 (The National Institute of Public Health). The source of information stored in the Registry is the mandatory form “Report on Occupational Disease”, which includes the following data: age of the patient, sex, occupation, length of exposure, economic sector, diagnosis and noxious factor. The data in individual years and the most frequent causes of diseases were evaluated.

In the Czech Republic, only disorders included in the List of Occupational Diseases and fulfilling both diagnostic and exposure criteria can be acknowledged as occupational diseases. Infectious diseases of the skin are enumerated in Chapter V (Infectious Diseases). On the other hand, all skin diseases due to non-infectious factors are classified separately in Chapter IV (Disorders of the Skin). Patch testing, according to the criteria established by the International Contact Dermatitis Research Group (Wahlberg and Lindberg 2006), is performed by trained dermatologists, who determine the diagnosis of allergic or irritant-induced skin diseases. Dermatologists interpret each positive skin reaction. In the case of a positive finding, occupational

hygienists evaluate the occupational relevance after investigating the workplace of the respective patient. Finally, occupational health physicians decide on notification of the occupational disease and consequently send the data to the National Registry of Occupational Diseases.

Results

Occupational allergic and irritant-induced skin diseases reported to the Czech Registry of Occupational Diseases in HCWs accounted for 545 new cases in the years 1997–2009. During the period of investigation, a decreasing trend in the count was seen (Fig. 1); nevertheless, occupational skin diseases were still relatively common in all economic sectors. In the healthcare sector, however, the number of employees steadily displayed a slightly increasing trend, (from 223,613 in 1997 to 246,662 in 2009). Occupational skin diseases in this sector were frequent and occupied one of the three first places among occupational diseases in all economic sectors, i.e. construction industry, manufacture of motor vehicles, agriculture, manufacture of food products, mining industry, manufacture of fabricated metals products, metallurgy, etc.

Among the occupational skin diseases studied, the most frequent diagnosis was allergic contact dermatitis (ACD) with 464 (85 %) cases, while 71 (13 %) cases involved irritant contact dermatitis (ICD) and 10 cases (2 %) contact urticaria.

Interestingly, the vast majority of the patients were females (95 %, 517 subjects), mostly nurses. The mean age of our patients suffering from occupational allergic and

Table 1 The distribution of substances registered as causative agents for ACD in HCWs in the Czech Republic in the years 1997–2009

Cause	Allergic contact dermatitis % (No.)
Disinfectants	36 (168)
Rubber components	35 (161)
Cleaning agents	9 (43)
Plastics	8 (36)
Nickel	5 (21)
Pharmaceuticals	3 (16)
Chromium	1 (5)
Others	3 (14)
Total	100 (464)

Table 2 The distribution of substances registered as causative agents for ICD in HCWs in the Czech Republic in the years 1997–2009

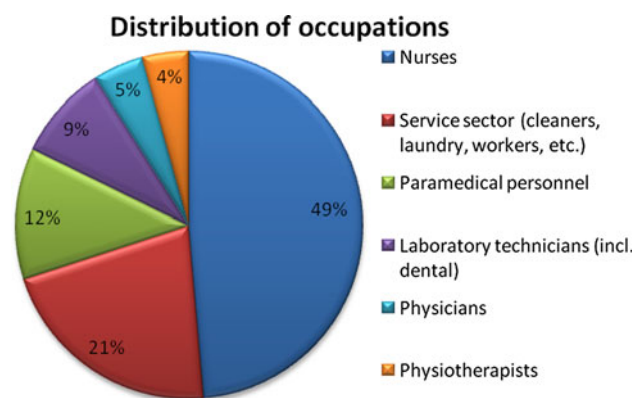
Cause	Irritant contact dermatitis % (No.)
Disinfectants	45 (32)
Cleaning agents	17 (12)
Physical factors	16 (11)
Rubber components	10 (7)
Others	10 (7)
Plastics	1 (1)
Pharmaceuticals	1 (1)
Total	100 (71)

irritant-induced skin diseases was 38 years ($SD \pm 11.8$ years); among them, 45 % (245 subjects) were at least 40 years old.

The workers in the healthcare sector developed skin symptoms after a median of 3 years performing their occupation (in the range of 21 days to 38 years). The average exposure duration was 6.2 years ($SD \pm 7.4$ years). The incidence dropped from 2.9 cases in 1997 to 1.0 cases in per 10,000 full-time employees in 2008.

The most common sensitizers and irritant factors are shown in Tables 1 and 2. Among physical mechanisms, friction was the most frequent. Natural rubber latex was responsible for all cases of contact urticaria acknowledged as an occupational disease.

Aldehydes are the most common disinfectants (biocides) causing ACD in HCWs. Sensitization to glutaraldehyde was found in 102 (18.7 %) and to formaldehyde in 38 (6.9 %) in HCWs with ACD. However, the trend in ACD due to glutaraldehyde in HCWs was constantly decreasing during the monitoring period, from 14 cases in 1997 to 3 in 2009. Formaldehyde showed the same decreasing trend (6 cases in 1997 to 1 case in 2009). As to the occupations involved, most disorders were seen in nurses, followed by

**Fig. 2** Distribution of occupations in patients with allergens and irritant-induced occupational skin diseases

employees in the service sector (e.g. cleaners, laundry workers, etc.), as can be seen in Fig. 2.

Discussion

Occupational skin diseases are common among HCWs in a number of countries (Schnuch et al. 1998; Nettis et al. 2002; Giménez-Arnau 2006; Rietchel and Fowler 2008; Suneja and Belsito 2008). The main reason is chronic exposure to a variety of chemicals and many hazardous activities (repeated hand washing, using protective gloves, exposure to disinfectants, detergents, etc.) in daily routine work. Healthcare is considered among the high-risk occupations in both Europe and the USA (Diepgen and Coenraads 1999; Dickel et al. 2001; Lushniak 2003). The situation in the Czech Republic does not substantially differ.

In spite of the leading position of HCWs in the statistics of occupational skin diseases in the Czech Republic, a downward trend in acknowledged diseases over the past 13 years was seen. This finding seems rather optimistic; however several factors should be taken into consideration. Supposedly, the total number of cases is underestimated and non-reported, especially for ICD, which may be overlooked or underestimated by HCWs themselves (Dickel et al. 2002). Symptoms in patients with ICD are usually not so troublesome and persistent, and therefore the patients, especially HCWs, are not motivated enough to undergo the full exigent investigation of the cause of their dermatitis. Secondly, for HCWs the level of discipline and compliance in investigation of their symptoms and problems may be lower, and self-treatment, underestimation of the disease and longer waits before visiting a specialist might be common.

Unfortunately, national registries appear incomplete as a result of underdiagnosing and underreporting of the

diseases. It has been determined that the incidence of occupational skin diseases in both Europe and the USA was underestimated by a factor of 10–50, the milder skin diseases not being registered at all (Diepgen and Coenraads 1999; Dickel et al. 2001; Diepgen 2003; Lushniak 2003). The situation in the Czech Republic is similar (Urban et al. 2000; Fenclová et al. 2005). The average incidence of registered occupational skin diseases in several countries in Europe and the USA lies between 5 and 19 cases per 10,000 full-time workers yearly (Diepgen and Coenraads 1999), however the incidence in this study was between 1.0 and 2.9 cases per 10,000 full-time HCWs per year, i.e. about 10 times lower.

In Germany, occupational skin diseases in 1990–1999 constituted almost 34 % of all 15) registered occupational diseases (Diepgen and Coenraads 1999), and the reported average annual incidence of occupational skin diseases in this time interval was 7.3 per 10,000 HCWs (11.2 in 1990–1992, and 5.6 between 1993 and 1999). More frequent was ICD. The highest incidence was seen in younger people (Diepgen and Coenraads 1999; Dickel et al. 2001). In Northern Bavaria, the median age of workers in the healthcare industry was 24 years, i.e. much younger as compared to our study. The median latency period in the health service sector was 3.8 years (Diepgen 2003), which is comparable with our latency period. The explanation of the higher age of our subjects might be the difference in legislation and/or criteria for diagnostics.

Occupational skin diseases in Canada reported by Holness and Mace (Holness and Mace 2001) involved more ICD (61 %) than ACD (31 %), and 27 % contact urticaria due to latex. Additionally, 11 % HCWs had both ACD related to thiuram and contact urticaria to latex.

In contrast, in the Czech Republic, occupational ACD was a more frequent skin disorder than ICD. We may hypothesise that ICD may be more easily neglected and underreported as an occupational disease. Obviously, the spectrum and the formulas of disinfectants and other chemical products used may play a role, as their irritating and allergenic potential differs.

In our study, and accordingly with many studies, the most relevant occupational allergens were disinfectants, rubber chemicals and cleaning agents (Schnuch et al. 1998; Nettis et al. 2002; Giménez-Arnau 2006; Rietschel and Fowler 2008; Suneja and Belsito 2008). Thiomersal, which is also a common occupational allergen in HCWs, is not included in the European baseline series; therefore, the HCWs in the Czech Republic are not commonly patch tested with this allergen, and the sensitivity is not known. Two groups of agents played a crucial role—disinfectants and rubber chemicals caused more than 60 % of skin diseases. In addition, disinfectants were both the most frequent contact allergen and contact irritant. Among them,

aldehydes (glutaraldehyde and formaldehyde) were in first place; other disinfectants were less frequent.

Also in Germany, significantly increased sensitization rates were revealed in the healthcare sector compared to other economic sectors (Schnuch et al. 1998). Schnuch et al. (1998) found an increase in sensitivity to thiomersal in HCWs (12.6 vs. 4.9 % in other sectors), to glutaraldehyde (9.9 vs. 2.6 %), to formaldehyde (3.6 vs. 2.1 %) and to glyoxal (4.2 vs. 1.4 %), in addition to the thiuram mix compounds (6.7 vs. 2.6 %).

Glutaraldehyde has commonly been used for cold sterilization, being introduced in 1963 (Shaffer and Belsito 2000) partly as a substitute for formaldehyde for its disinfectant properties. Unfortunately, its potential for skin sensitization considerably exceeds that of formaldehyde (Schnuch et al. 1998; Hilton et al. 1998; Shaffer and Belsito 2000; Basketter and Kimber 2001; Basketter et al. 2001; Giménez-Arnau 2006; Rietschel and Fowler 2008). In a study of Kiec-Swierczynska et al. (1998) from Poland from 1998, 12.4 % of HCWs were sensitized to glutaraldehyde. This sensitization was the highest among nurses, physicians and dental assistants (16.5, 13.5 and 33.3 %, respectively). In Germany, the reported rate of sensitization of HCWs to glutaraldehyde ranged from 1 % in 1990 to more than 4 % in 1994 (Schnuch et al. 1998). Shaffer and Belsito (2000) in a study from Kansas, USA, during the years 1994–1999 found as many as 17.6 % of HCWs tested positive to glutaraldehyde, positive reactions being more than 8× more likely in HCWs than in non-HCWs (1.9 %). Our data for HCWs (18.7 %) is similar.

In the Czech Republic from 1997 to 2009, occupational hypersensitivity to glutaraldehyde slowly decreased, probably thanks to greater awareness of the sensitizing properties of glutaraldehyde, improved personal protection and changed disinfectant formulas in the last decade.

In the general population of Poland, formaldehyde sensitivity levels were relatively high, between 2 and 2.5 %, probably due to a higher frequency of use of formaldehyde in cleaning products (Kiec-Swierczynska et al. 1998). In the Czech population in the period 1997–2002 (Machovcova et al. 2005), the sensitization to formaldehyde in the patch-tested population was even higher (4.3 %), compared to the results from Europe (Wilkinson et al. 2002). Formaldehyde as a contact allergen in the healthcare sector continues to display its importance (Schnuch et al. 1998; Shaffer and Belsito 2000; Giménez-Arnau 2006; Rietschel and Fowler 2008).

In our study, the components of protective gloves were the second most common sensitizers. Rubber chemicals are important occupation allergens, as reported above, and the recent increased use of rubber gloves is one of the most important reasons for sensitization to them, as was probably also the case in this study.

In 1994, contact allergies to thiuram mix prevailed (12.9 %) among physicians in Germany (Rustemeyer et al. 1994). In the UK, thiuram-positive patch tests were noted in 12 % of HCWs, with a peak incidence of 27 % of the HCWs patch tested in 1994 (Gibbon et al. 2001). In our study, 35 % of all patients were sensitized to some rubber chemicals; they reacted to thiuram mix, mercaptothiazole mix or the gloves themselves (data could not be stratified).

The same situation regarding sensitization to natural rubber latex was found in several countries. Recent studies in northern Europe and the USA report that 2.8–16.9 % of HCWs were allergic to latex (Valks et al. 2004; Valsecchi et al. 2000). Rather surprisingly, latex allergy was less frequent in our study (2 %). It is probably thanks to the fact that enforced utilization of latex gloves was introduced in our country a few years later than in these other countries. They were then replaced relatively early on by latex-free gloves.

A wide variety of workplace risks also exist in dental practice (Rustemeyer and Frosch 1996; Rubel and Watchorn 2000; Wallenhammar et al. 2000; Alanko et al. 2004; Leggat et al. 2007). Around 15 % of dentists admitted to having hand eczema in a Swedish survey (Wallenhammar et al. 2000). More than one fifth of dentists (22 %) reported occupational contact dermatitis in a study from Thailand (Chowanadisai et al. 2000). According to Rustemeyer and Frosch (Rustemeyer and Frosch 1996), dental technicians in Germany mostly suffered from ACD (63.6 %), primarily due to methacrylates. ICD was less common (23.6 %). Methacrylates are widely used today in dental work in fillings, for coating teeth and in prosthetics, in dental plates and dentures (Rustemeyer and Frosch 1996; Rubel and Watchorn 2000; Wallenhammar et al. 2000; Alanko et al. 2004; Leggat et al. 2007). In our study, 9 % of HCWs were specialized in dental work, and more than half of them were sensitized to acrylates.

Obviously, the awareness of the possibility of losing a job could also play an important role, especially in fully trained physicians. It may account for a high prevalence of females, in particular nurses with occupational diseases. On the other hand, the benefits for subjects with occupational diseases are rather high in the Czech Republic, where in addition to almost complete compensation of lost wages, compensation for pain and suffering and, in chronic disorders, impaired life capacity over many years are usually acknowledged.

In conclusion, the general trend of occupational skin disorders in HCWs in the past 13 years is favorable and indicates improved skin protection measures and reduced exposure to allergens in workplaces. However, the number of occupational skin disorders is still significant among Czech HCWs and, in all likelihood; an important part of ICD may be unreported from our point of view, especially

in the private sector. Given that self-employed subjects are not insured for occupational diseases, they do not appear in the statistics.

The social and financial costs of occupational skin diseases in the Czech Republic are as recurring as they are preventable. More attention should be focused on early investigation and reporting of all cases of occupational skin diseases. More importantly, it is essential to teach all HCWs the correct hand hygiene procedure and personal protection to minimize the number of irritants and allergen-induced occupational skin diseases (Radulescu et al. 2007). This should start during initial job training (nursing and medical students) and continue at regular intervals in practice.

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Conflict of interest The authors declare that they have no conflict of interest.

References

- Alanko K, Susitaival P, Jolanki R, Kanerva L (2004) Occupational skin diseases among dental nurses. *Contact Dermatitis* 50:77–82
- Basketter DA, Kimber I (2001) Predictive testing in contact allergy: facts and future. *Allergy* 56:937–943
- Basketter DA, Wright ZM, Warbrick EV, Dearman RJ, Kimber I, Ryan CA, Gerberick GF, White IR (2001) Human potency predictions for aldehydes using the local lymph node assay. *Contact Dermatitis* 45:89–94
- Chowanadisai S, Leggat PA, Kukiattrakoon B, Yamong B, Kedjarune U (2000) Occupational health problems of dentists in southern Thailand. *Int Dent* 50:36–40
- Cikrt M, Pelclova D, Markvart K, Lukas E, Kriz J (1997) Occupational and environmental medicine in Czech Republic. *Int Arch Occup Environ Health* 69:79–82
- Dickel H, Kuss O, Blesius CR, Schmidt A, Diepgen TL (2001) Occupational skin diseases in Northern Bavaria between 1990 and 1999: a population-based study. *Br J Dermatol* 145:453–462
- Dickel H, Kuss O, Schmidt A, Kretz J, Diepgen TL (2002) Importance of irritant dermatitis in occupational skin disease. *Am J Clin Dermatol* 3:283–289
- Diepgen TL (2003) Occupational skin-disease data in Europe. *Int Arch Occup Environ Health* 76:331–338
- Diepgen TL, Coenraads PJ (1999) The epidemiology of occupational contact dermatitis. *Int Arch Occup Environ Health* 72:496–506
- Fenclová Z, Urban P, Pelclová D, Lebedová J, Lukáš E (2005) Occupational diseases in health care workers in the Czech Republic. The global occupational health network. *GOHNET Newsl* 8:10–11
- Gibbon KL, McFadden JP, Rycroft RJG, Ross JS, Chinn S, White IR (2001) Changing frequency of thiuram mix allergy in healthcare workers with hand dermatitis. *Br J Dermatol* 144:347–350
- Giménez-Arnau AM (2006) Health Personnel. In: Frosch PJ, Menné T, Lepoittevin JP (eds) *Contact dermatitis*, 4th edn. Springer-Verlag, Berlin Heidelberg, pp 735–749
- Hilton J, Dearman RJ, Harvey P, Evans P, Basketter DA, Kimber I (1998) Estimation of relative skin sensitizing potency using the

- local lymph node assay: a comparison of formaldehyde with glutaraldehyde. *Am J Contact Dermatol* 9(1):29–33
- Holness DL, Mace SR (2001) Results of evaluating health care workers with prick and patch testing. *Am J Contact Dermatol* 12:88–92
- Kiec-Swierczynska M, Krecisz B, Krysiak B, Kuchowicz E, Rydzynski K (1998) Occupational allergy to aldehydes in health-care workers. Clinical observations. Experiments. *Int J Occup Med Environ Health* 11:349–358
- Leggat PA, Kedjarune U, Smith DR (2007) Occupational health problems in modern dentistry: a review. *Ind Health* 45:611–621
- Lushniak BD (2003) The importance of occupational skin diseases in the United States. *Int Arch Occup Environ Health* 76:325–330
- Machovcova A, Dastychova E, Kostalova D, Vojtechovska A, Reslova J, Smejkalova D, Vaneckova J, Vocilkova A (2005) Common contact sensitizers in the Czech Republic. Patch test results in 12,058 patients with suspected contact dermatitis. *Contact Dermatitis* 53:162–166
- Nettis E, Colanardi MC, Soccio AL, Ferrannini A, Tursi A (2002) Occupational irritant and allergic contact dermatitis among healthcare workers. *Contact Dermatitis* 46:101–107
- Radulescu M, Bock M, Bruckner T, Ellsäßer G, Fels H, Diepgen T (2007) Health education about occupational allergies and dermatoses for adolescents. *JDDG* 5:576–581
- Rietschel RL, Fowler JF Jr (2008) Medications and medical devices, and Implications for the medical community. In: Rietschel RL, Fowler JF Jr (eds) *Fisher's contact dermatitis*, 6th edn. BC Decker, Hamilton, pp 125–174
- Rubel DM, Watchorn RB (2000) Allergic contact dermatitis in dentistry. *Australas J Dermatol* 41:63–71
- Rustemeyer T, Frosch PJ (1996) Occupational skin diseases in dental laboratory technicians. (I). Clinical picture and causative factors. *Contact Dermatitis* 34:125–133
- Rustemeyer T, Pilz B, Frosch PJ (1994) Contact allergies in medical occupations. *Hautarzt* 45:834–844
- Schnuch A, Uter W, Geier J, Frosch PJ, Rustemeyer T (1998) Contact Allergies in healthcare workers. Results from the IVDK. *Acta Derm Venerol* 78:358–363
- Shaffer MP, Belsito D (2000) Allergic contact dermatitis from glutaraldehyde in health-care workers. *Contact Dermatitis* 43:150–156
- Suneja T, Belsito DV (2008) Occupational dermatoses in health care workers evaluated for suspected allergic contact dermatitis. *Contact Dermatitis* 58:285–290
- The National Institute of Public Health (2011) Occupational diseases reported in the Czech Republic 1996–2010 <http://www.szu.cz/publications-and-products/data-and-statistics>. Accessed April 13, 2011
- Urban P, Cikrt M, Hejlek A, Lukáš E, Pelclová D (2000) The Czech national registry of occupational diseases. Ten years of existence. *Cent Eur J Public Health* 8:210–212
- Valks R, Conde-Salazar L, Cuevas M (2004) Allergic contact urticaria from natural rubber latex in healthcare and non-healthcare workers. *Contact Dermatitis* 50:222–224
- Valsecchi R, Leghissa P, Cortinovis R, Cologni L, Pomesano A (2000) Contact urticaria from latex in healthcare workers. *Dermatology* 201:127–131
- Wahlberg JE, Lindberg M (2006) Patch testing. In: Frosch PJ, Menné T, Lepoittevin JP (eds) *Contact dermatitis*, 4th edn. Springer, Berlin, pp 366–390
- Wallenhammar LM, Ortengren U, Andreasson H, Barregard L, Björkner B, Karlsson S, Wrangsjö K, Meding B (2000) Contact allergy and hand eczema in Swedish dentists. *Contact Dermatitis* 43:192–199
- Wilkinson JD, Shaw S, Andersen KE, Brandao FM, Bruynzeel DP, Bruze M, Camarasa JM, Diepgen TL, Ducombs G, Frosch PJ, Goosens A, Lachappelle J-M, Lahti A, Menne T, Seidenari S, Tosti A, Wahlberg JE (2002) Monitoring levels of preservative sensitivity in Europe. *Contact Dermatitis* 46:207–210