

## ORIGINAL ARTICLE

**Contact dermatitis in car repair workers**

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**Abstract**

**Background** Occupational contact dermatitis (OCD) is a common skin disorder with a poor prognosis.

**Objectives** The objectives of this study were to (1) estimate the prevalence of CD among car repair workers, (2) study some risk factors associated with CD, and (3) conduct an intervention skin care education program.

**Subjects and methods** A cross-sectional study was conducted in 87 car repair workers with regular and direct exposure to chemicals at the industrial zone in Zagazig City, Egypt and 76 unexposed assembly booksellers. All workers were subjected to a questionnaire and clinical examination, and those who were diagnosed clinically as CD were patch tested. Intervention study with a skin care education program was carried out on 47 car repair workers. Re-evaluation of the intervention group after 5 months was done.

**Results** The total prevalence of CD among car repair workers (18.4%) was significantly higher compared with their controls (3.9%), with the highest prevalence among car mechanics (24.1%) and painters (20.7%); 16.1% of them reported recurrent dermatitis in the last 12 months. Nickel accounted for most positive patch test reactions (33.3%). A significant association was noticed between the prevalence of CD and age, smoking, atopic background and duration of work. After the intervention study, a significantly higher knowledge level about CD was reported.

**Conclusion** The most important risk factors for OCD among the car repair workers are atopic background and long duration of work. Skin care education program is an important tool for prevention of CD and control of exposure to substances hazardous to the skin.

**Introduction**

Occupational contact dermatitis (OCD) constitutes up to 30% of all occupational diseases, for which compensation is payable.<sup>1</sup> It is one of the leading causes of occupational morbidity and absenteeism and has become an intolerable cause of missed workdays and even loss of occupation.<sup>2</sup>

OCD is a pathological condition where there is a pattern of inflammatory response of the skin that occurs as a result of contact with external factors (allergens, irritants)

present in an occupational setting and can be influenced by a combination of exposure characteristics [exposure to wet work, friction, handling of chemicals and working practices (exogenous factors)] as well as individual susceptibility (endogenous factors) and its severity depends on the type and intensity of exposure.<sup>3-5</sup>

There are two types of CD: irritant (ICD) and allergic (ACD). ICD is the most common type<sup>6</sup> and occurs after exposure to an agent or agents causing early impairment and then cumulative damage to the stratum corneum.

ACD is a manifestation of a type IV hypersensitivity reaction which develops at the site of skin contact with the allergen and may spread to previously unexposed sites.<sup>7,8</sup>

High-risk occupations as mechanics, car painters and vehicle maintenance men are exposed to irritant chemicals as organic solvents, various oils and allergens as rubber, nickel and metal-working fluids capable of causing irritant and allergic contact dermatitis.<sup>9–11</sup>

Epidemiologic studies investigating the risk of occupational skin disease have been performed in car factories, but little have been done on car repair workers especially car tinkers and car mechanics.

Thus, this study was planned to (1) determine the prevalence of CD among car repair workers, (2) study some risk factors associated with CD and (3) conduct an intervention skin care education program to control this problem and evaluate its impact on knowledge, attitude, symptoms and signs of CD among car repair workers.

## Methodology

### Study design

This study conducted from September 2006 until August 2007 in car repair shops at the industrial zone in Zagazig City, Egypt. It was performed in two stages:

- 1 A comparative cross-sectional study on dermatitis was conducted in a sample of 87 car repair workers and 76 booksellers.
- 2 Intervention study, in which an intervention group of 47 car repair workers was exposed to a skin care education program.

### Sample size

The size of the study sample was 87, calculated using Epi-info program version 6.1,<sup>12</sup> with a total number of 137 car repair workers working in 60 car repair shops as estimated by the City Council, 70% power of the study, 95% confidence interval and 15.3% prevalence of work-related hand eczema (HE) in the car industry as estimated from a previous study.<sup>13</sup>

### Study workers selection

- 1 Car repair workers (exposed group): a total number of 87 male car repair workers composed of 29 car tinkers, 29 car mechanics and 29 car painters, with regular and direct exposure to chemicals, were collected at random and included in this study.
- 2 Non-exposed group: 76 male booksellers who worked at the book shops in Zagazig City and had no history of occupational exposure to chemical agents were

selected randomly and were compared with the exposed group as regards age, educational level, smoking habit and duration of work.

All participants gave informed consent.

### Questionnaire

All the exposed (87) and non-exposed (76) workers were personally interviewed at their work shops using a questionnaire prepared from Nordic Occupational Skin Questionnaire.<sup>14</sup> The questionnaire enquired about demographics, education and work history, working habits, handling of chemicals, protective measures, skin symptoms and their connection to the work, exacerbating factors, and consequences of symptoms, skin symptoms during the past 12 months, childhood eczema, asthma/hay fever, etc.

Those workers with a history of previous other jobs, or other activities outside work in which they exposed to any chemicals were excluded from the study.

### Clinical examination

All workers who had reported or denied skin problems in a questionnaire were followed up with a dermatological examination. Examination was conducted over a 2-week period for signs of CD as erythema, scaling, papules, vesicles and fissures, including their sites.

Only subjects who verified CD at the examination were patch tested.

### Diagnosis of OCD

Evidence to support the diagnosis of occupational dermatitis depends on the following well-recognized indicators:

- Occupational contact with an agent known to cause similar skin changes in other individuals.
- The occurrence of similar dermatitis in fellow workers within the same occupation.
- A time relationship between exposure and dermatitis.
- Type and site of lesions consistent with occupational exposure.
- Similarity to other post-exposure episodes of dermatitis followed by an improvement and resolution after removal. This is also assessed by a detailed exposure history and clinical examination by a dermatologist corroborated by patch test results.

### Patch testing

As morphologic characteristics of ACD and ICD are similar;<sup>15</sup> only application of diagnostic patch tests could have ruled out with certainty the presence of ACD.

## Patch testing procedure

Ten out of 16 exposed workers who were clinically diagnosed as CD and fulfil the inclusion criteria (5 car mechanics, 4 car painters and one car tinker) were prone to the standard patch test (TRUE test, Mekos Laborations A/S, Hillerød, Denmark) by a dermatologist, after controlling of the disease clinically for at least 2 weeks following the acute phase.

Exclusion criteria were systemic or local corticosteroid or immunosuppressive treatment, immunocompromised disease, florid eczema or UV exposure in the tested area.

The test consists of two panels (I and II) each one containing 12 allergens in a prearranged sequence. The panels were applied simultaneously on the left and the right side of the upper back, a 5-cm-wide area of skin on either side of the midline. Patches were removed at 48 h, and readings were made at 49 and 72–96 h following the initial application.<sup>16</sup> All readings were performed by the same investigator according to the system suggested by the International Contact Dermatitis Research Group in 1970.<sup>17</sup> Readings were classified as negative, allergic, doubtful and irritant. Presumed allergic reactions were graded as + (erythema, infiltration and possible papules), ++ (erythema, infiltration, papules and vesicles) or +++ (erythema, infiltration and coalescent vesicles). A reaction was interpreted as doubtful when only long-lasting erythema without infiltration was present or when an erythematous infiltrated reaction covered 50% or less of the test area. Irritant reactions defined as weak, macular erythema without infiltration or as a follicular pattern restricted to the area covered by the chamber.

In the presence of clinical manifestations, ACD required a positive patch test and a history of exposure to the allergen to be diagnosed. In addition, ICD was used for cases with clinical manifestations, negative or irritant patch test reactions, a history of exposure to irritants and periods of eczema related in time to such exposure.

## Intervention study

It included 47 car repair workers who agreed to participate in this study including those who clinically diagnosed as CD. They were exposed to a skin care education program which is a series of practical instructions about skin care for a period of 5 months. It is an integrated part of an educational program. It includes:

- A. Health education: through face to face approach including data about
  1. Effects of skin contact with chemicals especially dermatitis (definition, risk factors, clinical picture, complications and treatment).

2. Importance of personal cleanliness in the prevention of dermatitis

3. The proper use of personal protective equipments will minimize contact with harmful agents.

B. Skin care provision: included supplementation of gloves, barrier cream and paper towel provision.

C. Treatment of cases: by a dermatological consultant.

Re-evaluation of the intervention group after 5 months as regards knowledge, attitude and symptoms was done by using the same starting questionnaire and underwent clinical examination of their hands to assess the intervention program effect.

## Data management and analysis

The collected data were computerized and statistically analysed using Statistical Package for Special Sciences (SPSS) program for Windows (version 9.0).<sup>18</sup> The qualitative data were evaluated using chi-squared ( $\chi^2$ ) and Fisher exact test and Mc Nemar's test for paired analysis when appropriate. Odds ratios (ORs) and their 95% confidence intervals (95% CI) for the risk factors of hand or forearm dermatitis were calculated in both univariate and logistic regression analysis. The significance level was considered at  $P$ -value  $< 0.05$ .

## Results

Exposed and non-exposed workers were comparable with regard to age, educational background, smoking habits, childhood eczema, family history of atopy and duration of work. The self-reported prevalence of HE among car repair workers (32.2%) was significantly higher when compared with booksellers (11.8%); 16.1% of exposed workers reported recurrent dermatitis in the last 12 months (Table 1).

Thirty-nine (44.8%) of exposed workers reported dry skin on their hands without dermatitis compared with 27 (35.5%) of booksellers. Twenty-five per cent of exposed workers who reported history of childhood eczema also reported HE. Fifty-four per cent of HE in the past 12 months was reported to be work related. Most (84%) of those who reported work-related HE reported that it improved during times off work. Fifty-nine (67.8%) car workers wash their hands with gasoline or benzene but nobody in the study was wearing protective gloves or using barrier creams or emollients, except few workers wear protective aprons.

The prevalence of CD as diagnosed by a dermatologist was high in all occupational groups. It ranged from 10.3% among car tinkers to 20.7% among car painters and 24.1% among car mechanics. The lowest prevalence (3.9%) was found among booksellers (Table 2).

| Characteristics                    |                      | Car repair workers<br>(N = 87) | Control group<br>(N = 76) |
|------------------------------------|----------------------|--------------------------------|---------------------------|
| Age (years)                        | ( $\bar{X} \pm SD$ ) | 33.7 $\pm$ 11.2                | 32.8 $\pm$ 6.7            |
| Education:                         |                      |                                |                           |
| – Illiterate:                      | n (%)                | 7 (8.1%)                       | 2 (2.6%)                  |
| – Read & write                     | n (%)                | 29 (33.3%)                     | 11 (14.5%)                |
| – Primary school                   | n (%)                | 43 (49.4%)                     | 47 (61.8%)                |
| – Secondary school                 | n (%)                | 8 (9.2%)                       | 16 (21.1%)                |
| Smokers                            | n (%)                | 38 (43.7%)                     | 30 (39.5%)                |
| History of childhood eczema        | n (%)                | 9 (10.3%)                      | 7 (9.2%)                  |
| Family history of atopy            | n (%)                | 11 (12.6%)                     | 8 (10.5%)                 |
| HE in the last 12 months           | n (%)                | 28 (32.2%)                     | 9 (11.8%)*                |
| Recurrent HE in the last 12 months | n (%)                | 14 (16.1%)                     | 2 (2.6%)**                |
| Duration of work (years)           | ( $\bar{X} \pm SD$ ) | 15.1 $\pm$ 9.6                 | 13.3 $\pm$ 9.3            |

\* $P < 0.01$  \*\* $P < 0.001$ .**Table 1** Demographic and occupational characteristics of the studied groups**Table 2** Prevalence of contact dermatitis among the studied workers.

| Studied workers    | Total | Prevalence of CD |                     |
|--------------------|-------|------------------|---------------------|
|                    |       | n (%)            | OR (95% CI)         |
| Booksellers        | 76    | 3 (3.9%)         | 1.0                 |
| Car repair workers | 87    | 16 (18.4%)       | 5.48 (1.46–30.35)*  |
| Car tinkers        | 29    | 3 (10.3%)        | 2.81 (0.35–22.06)   |
| Car mechanics      | 29    | 7 (24.1%)        | 7.74 (1.57–49.07)** |
| Car painters       | 29    | 6 (20.7%)        | 6.35 (1.21–41.43)*  |

\* $P < 0.01$  \*\* $P < 0.001$ .

Statistically significant differences were observed in the percentage of clinical findings (symptoms and signs) between exposed and non-exposed workers ( $P < 0.05$ ). Five (5.7%) exposed workers had other skin diseases (tinea and psoriasis). The most commonly affected areas with CD were the fingers, webs and hands in 13 (86.7%) car repair workers and 1 (33.3%) bookseller, the wrist and forearm in 5 (33.3%) car workers and other sites (under the shoulder, popliteal and cubital fossae) in 2 (13.3%) car workers and 2 (66.6%) booksellers.

The majority of car repair workers with CD (60.0%) were ICD, while 4 workers (40.0%) had positive patch test reactions (ACD; Table 3).

The number of positive reactions ( $n = 9$ ) exceeded the number of positive car workers ( $n = 4$ ) because three workers had more than one positive reaction. One patient had one positive reaction, 1 had two positive reactions and 2 had three positive reactions. Nickel sulphate accounted for most positive patch test reactions (3 of 9) followed by colophony (2 of 9), epoxy resin (2 of 9),

**Table 3** Distribution of CD cases according to results of patch test among car repair workers

| Patch test results |       | ACD       | ICD        |
|--------------------|-------|-----------|------------|
| Car tinkers        | n (%) | 0 (00.0%) | 1 (100.0%) |
| Car mechanics      | n (%) | 2 (40%)   | 3 (60%)    |
| Car painters       | n (%) | 2 (50%)   | 2 (50%)    |
| Car repair workers | n (%) | 4 (40%)   | 6 (60%)    |

potassium dichromate (1 of 9), and *p*-phenylenediamine (1 of 9) in both car mechanics and painters. The only car tinker CD case who patch tested was found to have irritant reaction to nickel sulphate. Five of the cases had negative reactions and were diagnosed as ICD to other substances exposed to them during their work and they were not included in the standard test.

The most important procedures and things at the workplace that start and worsen HE were hammering in car tinkers (100.0%), friction with repaired parts, tar and engine oils in car mechanics (85.7%), and sanding of painting parts (83.3%) and cementing the car body with pastes (masking; 50.0%) in car painters, respectively. While other aggravating factors at the workplace like wetness, frequent washing the hands with water, soaps or with solvents and friction of the hands with anything were also from the important things that worsen dermatitis in car mechanics (57.1%) and car painters (66.7%), respectively.

A significant association was found between the prevalence HE and young age ( $\leq 30$  years), smoking, history of childhood eczema and family history of atopy and long duration of work (Table 4).

**Table 4** Univariate analysis of some demographic characteristics, work factors and frequency of CD among exposed workers

|                                 |       | Car repair workers |                     |                    |
|---------------------------------|-------|--------------------|---------------------|--------------------|
| Characteristics                 |       | with CD (N = 16)   | without CD (N = 71) | OR (95% CI)        |
| <b>Age (year)</b>               |       |                    |                     |                    |
| ≤ 30                            | n (%) | 12 (27.9)          | 31 (72.1)           | 3.87 (1.02–15.9)*  |
| > 30                            | n (%) | 4 (9.1)            | 40 (90.9)           | 1.0                |
| <b>Smoking</b>                  |       |                    |                     |                    |
| Non smokers                     | n (%) | 5 (10.2)           | 44 (89.8)           | 1.0                |
| Smokers                         | n (%) | 11 (28.9)          | 27 (71.1)           | 3.59 (1.0–13.5)*   |
| <b>HE in childhood</b>          |       |                    |                     |                    |
| Negative                        | n (%) | 11 (14.1)          | 67 (85.9)           | 1.0                |
| Positive                        | n (%) | 5 (55.5)           | 4 (44.5)            | 7.61 (1.46–41.6)** |
| <b>Family history of atopy</b>  |       |                    |                     |                    |
| Negative                        | n (%) | 11 (14.5)          | 65 (85.5)           | 1.0                |
| Positive                        | n (%) | 5 (45.5)           | 6 (54.5)            | 4.92 (1.06–23.04)* |
| <b>Duration of work (years)</b> |       |                    |                     |                    |
| ≤ 10                            | n (%) | 5 (10.0)           | 45 (90.0)           | 1.0                |
| > 10                            | n (%) | 11 (29.7)          | 26 (70.3)           | 3.81 (1.06–15.35)* |

\* $P < 0.05$  \*\* $P < 0.01$ .**Table 5** Logistic regression analysis for the risk factors associated of OCD

| Risk factors                       | OR (95% CI)      |
|------------------------------------|------------------|
| Occupation                         |                  |
| – Non-exposed worker (booksellers) | 1.0              |
| – Exposed workers                  |                  |
| Car tinkers                        | 1.7 (0.8–3.4)    |
| Car mechanics                      | 4.4 (1.5–18.6)   |
| Car painters                       | 2.1 (1.3–20.7)   |
| Atopy                              |                  |
| – No HE in childhood               | 1.0              |
| – HE in childhood                  | 5.7 (1.18–28.4)  |
| – No family history of atopy       | 1.0              |
| – Family history of atopy          | 2.7 (1.5–4.7)    |
| Duration of work                   |                  |
| ≤ 10                               | 1.0              |
| > 10                               | 2.38 (1.02–5.56) |

Significant predictors of OCD were presented only.

Table 5 shows the logistic regression analysis of risk factors associated with HE. Type of occupation (mechanics and painters), childhood eczema, family history of atopy and the long duration of work were the most significant risk factors.

Table 6 revealed a significantly higher knowledge level regarding CD definition, causes, risk factors and prevention among car repair workers after the intervention study.

After the intervention program, there was a significant reduction ( $P < 0.05$ ) in symptoms and signs of CD and a significant decrease ( $P < 0.01$ ) in the number of workers who complained from recurrent dermatitis. In addition,

there was a significant change in the attitude and behaviour of the workers ( $P < 0.001$ ).

## Discussion

Car repair workers are at risk of developing skin morbidity including occupational dermatoses because of their exposure to skin irritants.<sup>19</sup> Car mechanics are usually exposed to fuels, solvents, various oils, greases and skin-cleansing agents.<sup>20</sup> In car shops, high exposures to organic solvents have been recorded particularly during spray painting operations.<sup>11</sup> Epoxy resins was also reported to cause OCD in car repair workers.<sup>21</sup> In this type of work, it is also possible to develop contact allergy to substances such as metals, rubber, preservatives and other additives.<sup>20</sup>

Mechanics and mahinists differ in the spectrum of occupational exposures. Machinists have a high risk for dermatosis as they expose in the metal industry to water-soluble metal-working fluids containing both irritant and sensitizing ingredients.<sup>22,23</sup>

In the present study, the self-reported prevalence of HE (32.2%) among car repair workers as well as the prevalence as diagnosed by a dermatologist (18.4%), was significantly higher when compared to booksellers (11.8% and 3.9%, respectively). This occupation is generally considered as high-risk occupation for HE with exposure to both contact irritants and allergens.

The 1-year prevalence of HE among car repair workers in this study was higher than in car mechanics in a previous study<sup>24</sup> and was lower than what was reported in another study.<sup>25</sup>

**Table 6** Changes in knowledge about CD among car repair workers after the intervention study

| Knowledge and attitude          | Car repair workers                       |                                         | P-value |
|---------------------------------|------------------------------------------|-----------------------------------------|---------|
|                                 | Before intervention<br>(N = 47)<br>n (%) | After intervention<br>(N = 47)<br>n (%) |         |
| <b>Knowledge:</b>               |                                          |                                         |         |
| <b>Definition &amp; Causes:</b> |                                          |                                         | < 0.001 |
| Adequate                        | 22 (46.8)                                | 46 (97.9)                               |         |
| Inadequate                      | 25 (53.2)                                | 1 (2.1)                                 |         |
| <b>– Symptoms:</b>              |                                          |                                         | < 0.01  |
| Adequate                        | 35 (74.5)                                | 44 (93.6)                               |         |
| Inadequate                      | 12 (25.5)                                | 3 (6.4)                                 |         |
| <b>– Risk factors:</b>          |                                          |                                         | < 0.001 |
| Adequate                        | 20 (42.6)                                | 41 (87.2)                               |         |
| Inadequate                      | 27 (57.4)                                | 6 (12.8)                                |         |
| <b>– Prevention:</b>            |                                          |                                         | < 0.001 |
| Adequate                        | 26 (55.3)                                | 44 (93.6)                               |         |
| Inadequate                      | 21 (44.7)                                | 3 (6.4)                                 |         |

Knowledge score: correct answer = 2, incorrect = 1, don't know = 0. Total score is computed and knowledge is scored as, adequate (equal and more than median as cut off), inadequate (less than median).

Whereas, prevalence as diagnosed by a dermatologist was higher in this study than in other cross-sectional study among auto-repair workers.<sup>26</sup> The different prevalence rates of HE related to differences in methodology, identification of persons with CD and disease definition.

In this study, current dermatitis was clinically reported by a dermatologist less frequently than what was found in the questionnaire. These results are in agreement with a previous study among the car mechanics.<sup>20</sup> In contrast, the self-reported prevalence of HE among car mechanics in another study was lower than that clinically reported.<sup>24</sup> This means that self-reported 1-year prevalence of HE considerably underestimates the true prevalence. HE is not easy for laymen to diagnose themselves. Also in some cases, false-positive answers were usually caused by confusion with other skin diseases such as psoriasis. Thus, self-reported point prevalence of HE can be validated if a dermatologist examine the subjects.

The prevalence of CD symptoms and signs in this study was significantly higher among car repair workers when compared to booksellers. About 16.1% (constituted 87.5% of CD cases) complained from recurrent dermatitis in the last 12 months. Many subjects reported that their symptoms improved during times off work, and these were often regarded as being work related. However, not all symptoms reported as work related improved during absence from work. This could reflect the tendency of hand dermatitis to become chronic.

The vast majority of the occupational dermatosis cases are HE.<sup>23</sup> In the present study, also in addition, dermatitis

in the other sites of body than in the hands in connection with work was asked. Dermatitis in the other sites may be due to exposure to the non-volatile fractions of paints during the spray painting process.<sup>27</sup>

In this study, the majority of car repair workers had ICD (60%). This finding is corroborated by the study of Kristensen<sup>28</sup> who reported that most of cases of HE in the automobile manufacturing industry were of irritant contact type. In 40% of our car repair workers, contact allergy was demonstrated. The positive test reactions were to substances in the standard series. It is however very likely that the substances in the standard series did not fully cover the exposure of the tested persons. Subjects with a positive patch test reaction to one or more tested contact allergens were considered to have contact sensitization.<sup>29</sup> Testing to more allergens increases accuracy of the diagnosis of ACD.<sup>8</sup>

In this study, nickel sulphate accounted for most positive patch test reactions. One explanation for the high prevalence of nickel allergy was the common use of nickel-plated tools. The use of nickel-plated tools should be avoided in this kind of work where skin exposure to irritants promotes sensitization. Several of the allergens in the standard series can be found in the work environment of car workers (e.g. colophony, epoxy resin, chromium, rubber, cobalt and probably *p*-phenylenediamine and ethylenediamine). Allergies to other different allergens in test panels were not common, as the prevalence of sensitivity to an individual allergen depends not only on the intrinsic allergenicity of the compound but also on the

level of allergen exposure to the workers, which may vary from one workplace to other. Moreover, the number of car workers patch tested was small as we depend on the clinically diagnosed cases at the time of the study only and not on the history of previously affected cases.

In agreement with our results, Meding *et al.*<sup>20</sup> reported positive patch test reactions in 33% of car mechanics series. The most frequent reactions were to thimerosal, nickel and colophony. In addition, Slodownik *et al.*<sup>2</sup> reported that of 102 CD cases in maintenance and clerical workers, 60 had ICD and 42 had ACD, of which 33 (78.6%) were maintenance workers, mainly mechanics.

In this study, a significant association was noticed between the prevalence of CD and younger car repair workers aged  $\leq 30$  years, smoking, atopic background and work for more than 10 years. Montnemery *et al.*<sup>30</sup> found that age was inversely related to the 1-year prevalence of HE, and the highest value was detected among those aged 20–29 years.

In contrast to our study, two studies<sup>26,31</sup> among automobile repair workers reported that increasing worker age was one of the risk factors which significantly associated with CD. It was reported that increased prevalence of OCD was associated with work experience of 10–14 years.<sup>25,26</sup>

In our study, a high prevalence of smoking with CD was observed. The influence of smoking on cell-mediated immunity is still obscure. In addition, some studies<sup>26,31</sup> found a significant association between OCD and smoking in auto repair workers and automobile production machine operators. Further investigations into the possible mechanisms of this connection are required.

Atopic disposition is the best known endogenous factor plays an important role in the aetiology of CD.<sup>32</sup> In our study, an atopic background is found up to 31.3% in workers with CD. Those workers had a significant high risk to develop CD more than those without past history of atopy.

Consistent with our results, a previous study<sup>2</sup> showed a significant difference in the atopic background between maintenance workers mainly mechanics and clerical workers with ACD:39% and 22.2%, respectively. Another study<sup>26</sup> reported that OCD was significantly associated with positive family history of atopy. In contrast to our study, other studies<sup>20,33</sup> reported insignificant correlation between HE and childhood eczema in car mechanics and in the general population.

Finally, logistic regression analysis of factors affecting frequency of CD among car repair workers revealed that the type of occupation, atopy and duration of work are the most important risk factors for development of CD.

The risk of CD in car repair workers was about fourfold compared with that in the controls. Atopic constitution, especially atopic dermatitis, is a known factor in the

development of HE.<sup>33</sup> Also in this study, the car workers with atopic dermatitis or HE in childhood and/or a family history of atopy had a higher risk of CD. The frequency of CD was high also in subjects with duration of work more than 10 years. This is explained by the fact that the longer duration of work the higher level of exposure to affecting agents.

Mechanical exposures friction, pressure and sharp objects, frequent washing of the hands are other factors aggravating OCD. It is important to note that excessive hand washing with cleansers or detergents can dry out and damage the skin and to know that washing with more easily available solvents, mineral oils or industrial detergents, all of which can be harmful to the skin. Dermal exposure to organic solvents can defat the skin and thereby increase the uptake of these solvents by the body.<sup>21</sup> In addition, friction against the skin (e.g. from operating grinding machines and other equipment) can abrade or scrape away the skin. This can diminish the protective action of skin against allergens.<sup>34</sup>

Koch<sup>35</sup> emphasized that the critical factors in the management of OCD are recognition of clinical features, knowledge of allergens and irritants present in different occupational fields, knowledge of suitable protection.

This study demonstrates the importance of worker education as a tool for primary prevention of CD. Evaluation after the 5 months of intervention study revealed a significantly higher knowledge level about CD causes, risk factors, prevention, change in the attitude and behaviour regarding safe work practice, skin care and use of protective gloves compared to before the intervention. In addition, the prevalence of most skin symptoms reported by the workers and the clinically evaluated signs after the intervention study were significantly reduced than before it.

A previous study<sup>36</sup> also reported a significant, higher information level, change in behaviour and less skin signs as evaluated clinically in the intervention group compared with the control group but in contrast to our study, they found no significant difference for self reported skin problems.

The introduction of skin protection programs in workplaces is an important element in the prevention of OCD. This program was reported to change behaviour and decrease skin symptoms in wet occupations.<sup>37,38</sup> It is important that there is no change in the number and nature of hazardous materials handled before, during and after the program. It would not be expected to see a dramatic drop in the number of cases over the intervention period studied because this is a needed improvement in hazard data dissemination during the study period.

Educational efforts should promote awareness and identify work activities that would expose workers to allergens and irritants. Job training should also teach

recognition of early signs and symptoms of contact dermatitis, proper use of protective clothing and barrier creams as well as personal and environmental hygiene.<sup>39</sup>

## Conclusion

Car repair workers are at high risk to OCD attributed to exposure to various chemicals at work. Atopic background and long duration of work are found to be the highest risk factors for CD. Intervention development research is an essential prerequisite of any study that attempts to determine whether specific interventions prevent work related injury and illness or not. The skin care education program is an important tool for primary prevention of CD and control of exposure to substances hazardous to the skin.

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