

ORIGINAL ARTICLE

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Occupational contact dermatitis in Triveneto: Analysis of patch test data of the North Eastern Italian Database from 1996 to 2016

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ABSTRACT

Background: Occupational contact dermatitis (OCD) is frequent in the workplace.

Objectives: To provide recent data on the epidemiology of OCD in Italy.

Methods: This multicenter retrospective study, conducted from 1996 to 2016, included patients with suspected allergic contact dermatitis (ACD) patch tested in the departments comprising the North-East Italy Contact Dermatitis Group.

Results: We studied 18 859 workers with a diagnosis of contact dermatitis (CD), of which 10.4% were recognized as being of professional origin. OCD declined from 1996 to 2011–2013 and increased in 2014–2016. The overall prevalence of both CD and OCD was higher in women compared to men, but the share of OCD of the total CD was greater for men compared to women. A history of atopic dermatitis was less frequent in workers with OCD than in non-OCD patients (5.8% vs 8.6%). Hairdressers were the youngest working category (27.1 ± 11.7 years). Hands were the primary site of involvement in patients with OCD (76.6%). The five highest risk occupations for OCD were hairdressers, cooks, metalworkers, chemical industry workers, and construction workers.

Conclusions: OCDs have a relevant impact in our region, mainly for five job categories, and the increase in the last 3 years suggests the need to improve preventive measures.

KEYWORDS

gender, occupational contact dermatitis, patch test, prevalence, time, trend

1 | INTRODUCTION

Occupational contact dermatitis (OCD) is an inflammatory disease related to workplace exposure.¹ It represents the majority of occupational skin diseases (OSDs), accounting for 70% to 95% of all reported cases in Western European countries and is classified, depending on the etiology, into irritant contact dermatitis (ICD) and allergic contact dermatitis (ACD).^{2–5} It usually develops on areas of direct skin contact, with hands as the primary site of involvement in 80% of the cases,^{3–6}

followed by wrists, arms, and face.⁷ Workers are often affected at the beginning of their career and the prognosis is commonly very poor.^{8–10} Nearly 80% of total OCDs in Germany occurs in only seven occupational groups: hairdressers, metal workers, healthcare workers, food industry workers, construction workers, cleaners, and painters.¹⁰ Even if OSD ranks among the five most frequently notified and recognized occupational diseases in Europe,¹¹ the true frequency of OCD has not been well defined, partly because of difference in definitions, diagnostic criteria, data collection methods, reporting systems, degree

of industrialization, and limited surveillance data.^{4,7} The incidence rates reported so far underestimate the actual frequency of the phenomenon due to underdiagnosis and underreporting.^{5,6,8,10,12} The most reliable studies provided a range of estimates of 11 to 86 cases/100000 workers per year, depending on the country.⁵⁻⁷

Italian epidemiological data on OCD are scarce. Although several studies have focused on the identification of the main causative agents in relation to different occupational job categories, general demographic and clinical features of patients affected by OCD are not well characterized. The only available data date back to a multicenter study carried out by GIRDCA (Gruppo Italiano Ricerca Dermatiti da Contatto e Ambientali), over the period 1984–1993, showing a prevalence of 29% on the total patients affected by contact dermatitis (CD).^{13,14} Not counting occupational skin cancers, the most current data, reported by INAIL, the Italian national insurance authorities for the workplace injury, show only 399 (249 male; 150 female) notified cases of occupational dermatoses in 2017, approximately 0.7% of total notified professional diseases, with a decreasing trend from 1996 to 2017.^{15,16} The aim of our study was to investigate the characteristics of OCD in our region from 1996 to 2016, to identify the occupations more involved, and to analyze the time trend in patients who underwent patch tests.

2 | METHODS

2.1 | Patients

The North-Eastern Italian Database has been already described in several publications.¹⁷⁻²² From 1996 to 2016, a total of 27 381 patients (age >15 years) with symptoms and/or signs of suspected ACD consulted one of the eight departments of dermatology or occupational medicine comprising the North-East Italy Contact Dermatitis Group (NEICDG): Trieste, Padua (three clinics), Pordenone, Rovigo, Trento, and Bolzano. The departments of Rovigo, Trento, and Bolzano participated only from 1998 to 2004. All patients were patch tested after receiving a thorough clinical examination and completing a standardized questionnaire aimed at collecting information about individual characteristics, occupational history, and a personal or family history of atopy (atopic eczema, asthma, and/or allergic rhino-conjunctivitis).²³ The diagnosis of ACD was made if there was at least a positive patch test reaction to a substance for which the intensity, duration, and site of exposure could explain the dermatitis. The diagnosis of irritant contact dermatitis (ICD) was assigned when ACD could be excluded by negative patch results. The relationship between occupational exposure and CD was documented as “yes” (occupational), “no” (non-occupational), or “unknown.” For the purpose of this study, patients without a valid occupation, such as unemployed, retired and housewives, and patients with CD considered to be of unknown origin by physicians were excluded from the analysis.

All patients were assigned to occupational categories and aggregated into larger job groups (eg, nurses, physicians, and others hospital workers were grouped into the category of the “healthcare workers”).

Similarly, specific body sites were aggregated into larger categories (eg, fingers, palms, and dorsa of hands were included into “hands”). The occupational exposure was evaluated by considering the patient's job at the time of consultation, as sensitization, often acquired during a short period of exposure, was supposed to have occurred during the current occupation. Sex and age differences were taken into account to minimize confounding factors, as described below.

2.2 | Patch test

Finn Chambers on Scanpor tape (Epitest, Tuusula, Finland) and a selection of haptens from FIRMA (Firenze, Italy) were used to perform patch tests on patients with the European baseline series.²⁴ Patches were applied on the upper back and removed after 48 hours, that is, on day 2 (D2). The sites were examined upon removal and on D3 or D4 according to International Contact Dermatitis Research Group guidelines.²⁵ Reactions of grades +, ++, and +++ in the second reading were considered to be positive. Doubtful reactions were considered negative.

2.3 | Statistical analysis

Data analysis was performed with the software STATA version 14.0 (Stata, College Station, Texas). Categorical data were cross-tabulated into $k \times k$ contingency tables, and compared by use of the chi-square test. The associations between OCD and occupations were analyzed by multivariate logistic regression analysis controlling for sex and age, with clerks as reference category. Trend of prevalence of OCD by year groups was investigated by using the Cuzick test for trend and multivariate logistic regression considering the first 3 years as reference category and adjusting for age and sex. Differences in age classes were investigated using univariate regression analysis adjusting for calendar years. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated from the coefficients and the standard errors of logistic regression output, respectively. Differences in the distribution of age among selected occupational categories were analyzed with the Kruskal-Wallis test. Patients with missing data for the variables “atopic dermatitis” (AD) and “body sites” were retained in the data set. A P -value <.05 was established as the limit for statistical significance.

3 | RESULTS

The North-Eastern Italian Database included 27 381 patients with symptoms and/or signs of suspected ACD patch tested between 1996 and 2016. After the exclusion of subjects not working ($n = 7887$), and those with CD considered of doubtful professional origin by physicians ($n = 635$), we included data of 18 859 patients belonging to various job categories and with a diagnosis of CD, of which 10.4% were recognized as being of occupational origin. The

study population included 12 081 women (64.1%) and 6778 men (35.9%) and general characteristics are shown in Table 1.

Patients with OCD were younger than patients with non-OCD (odds ratio [OR] 0.76; 95% confidence interval [CI] 0.68–0.83) with a mean age of 35.2 ± 11.6 years vs 36.8 ± 13.9 years, respectively. The overall prevalence of both CD and OCD was higher in women compared to men, but the proportion of OCD among the total CD was greater for men compared to women (OR 1.22; 95% CI 1.11–1.35). A history of AD was less common in OCD than in non-OCD (OR 0.65; 95% CI 0.54–0.81). Regarding the sites of occurrence, OCD was strongly associated with hand dermatitis (OR 5.79; 95% CI 5.17–6.48), whereas leg and face dermatitis was associated with non-OCD. ACD represented the main diagnosis in both occupational and non-OCD, but it was statistically more frequent in the occupational group (OR 1.14; 95% CI 1.04–1.26).

The characteristics of patients with OCD by sex category are shown in Table 2. Women were significantly younger than men (mean age 33.8 ± 11.0 vs 37.2 ± 12.1). No difference in the prevalence of AD was detected, whereas ACD was more frequent in women (OR 1.68; 95% CI 1.39–2.01). The analysis of dermatitis distribution by site showed a higher prevalence of face dermatitis among women (OR 1.64; 95% CI 1.15–2.35), whereas hand and leg localizations were slightly, but not significantly, less prevalent in women than in men.

When considering the distribution of OCD cases by age group and sex (Table 3), women were more prevalent in age classes 15–25 years (OR 1.47; 95% CI 1.18–1.86) and 26–35 years (OR 1.18; 95% CI 0.99–1.43), however, only reaching statistical significance in the youngest age group. Throughout the age classes 36–45, 46–55, and 56–65 years, women became progressively less frequent than men, with a significant difference between sexes among the age classes 46–55 and 56–65 years (OR 0.75; 95% CI 0.59–0.97 and OR 0.37; 95% CI 0.24–0.57, respectively).

Data regarding the temporal trend of OCD between 1996 and 2016, considering cases distribution by 3-year periods are shown in Table 4. Data from Padua clinics were not available for the year 2012. Results from the logistic regression analysis, conducted with 1996–1998 as the reference period, highlighted a significant reduction of the number of the cases of OCD for the 1999–2001, 2002–2004, 2005–2007, 2008–2010, and 2011–2013 3-year periods, whereas for the 2014–2016 period, there was an increase in OCD, albeit not significant (OR 1.14; 95% CI 0.96–1.35).

The prevalence of OCD in occupational categories is represented in Table 5 and Figure 1. Approximately 60% of all cases of OCD occurred in only five occupational groups. OCD was most common in hairdressers, barbers, and beauticians (44.1%), followed by cooks (27.8%), metalworkers (25.5%), chemical industry workers (22.4%), and construction workers (21.2%). Multivariate logistic analysis, adjusted for age and sex, with clerks as the reference occupational group, found a statistically stronger association for OCD for almost all occupational groups, except for teachers and the category “others” (including occupations with ill-defined exposure).

The 10 most frequent occupational groups with the higher proportion of OCDs and their specific characteristics are shown in Table 6. The largest number of patients worked as healthcare workers, accounting for 22.9% of all OCD diagnosed. Among those with OCD, women were more represented among healthcare workers, domestic and restaurant workers, hairdressers, textile workers, cleaners and farmers and fishermen category while men were more represented among construction workers, metalworkers, and chemical industry workers. An equal frequency of men and women was observed in the category of woodcraftsmen and similar. The age distribution differed significantly between the occupational groups considered (Kruskal-Wallis test; $P < .0001$). The post hoc analysis shows that hairdressers had, on average, the youngest age among those in the other

TABLE 1 Characteristics of the studied population

	Total (N = 18 859)	OCD (N = 1962)	Non-OCD (N = 16 897)		
Mean age $\pm$ SD (years)	36.7 ± 13.7	35.2 ± 11.6	36.8 ± 13.9	$P < .001$	
	N. (%)	N. (%)	N. (%)	OR	95%CI
Males	6778 (35.9)	789 (40.2)	5989 (35.4)	1.22	1.11–1.35
Females	12 081 (64.1)	1173 (59.8)	10 908 (64.6)	0.81	0.74–0.90
AD	1294 (8.3)	107 (5.8)	1187 (8.6)	0.65	0.54–0.81
Hand localization	6466 (40.8)	1429 (76.6)	5037 (36.1)	5.79	5.17–6.48
Leg localization	1067 (6.7)	49 (2.6)	1018 (7.3)	0.35	0.26–0.46
Face localization	3092 (19.5)	161 (8.6)	2931 (21.0)	0.35	0.31–0.42
ICD	8210 (43.5)	796 (40.6)	7414 (43.9)	0.87	0.79–0.96
ACD	10 649 (56.5)	1166 (59.4)	9483 (56.1)	1.14	1.04–1.26
Age ≥ 40 years	7432 (39.4)	659 (33.6)	6773 (40.1)	0.76	0.68–0.83

Note: Statistically significant results are in bold. Missing data: AD (n = 3218); sites of occurrence (n = 3036).

Abbreviations: ACD, allergic contact dermatitis; AD, atopic dermatitis; CI, confidence interval; ICD, irritant contact dermatitis; non-OCD, non-occupational contact dermatitis; OCD, occupational contact dermatitis; OR, odds ratio; SD, standard deviation.

	Females (N = 1173)	Males (N = 789)		
Mean age $\pm$ SD (years)	33.8 $\pm$ 11.0	37.2 $\pm$ 12.1	$P < .001$	
	n (%)	n (%)	OR	95%CI
AD	64 (5.8)	43 (5.8)	1.01	0.67–1.50
Hand localization	846 (75.7)	583 (77.8)	0.89	0.71–1.11
Leg localization	23 (2.1)	26 (3.5)	0.58	0.33–1.03
Face localization	116 (10.4)	45 (6.0)	1.64	1.15–2.35
ICD	417 (35.5)	379 (48.0)	0.60	0.50–0.62
ACD	756 (64.5)	410 (52.0)	1.68	1.39–2.01
Age $\geq$ 40 years	351 (29.9)	308 (39.0)	0.67	0.55–0.81

TABLE 2 Characteristics of population with occupational contact dermatitis

Note: Statistically significant results are in bold. Missing data: AD (n = 124); sites of occurrence (n = 96).

Abbreviations: ACD, allergic contact dermatitis; AD, atopic dermatitis; CI, confidence interval; ICD, irritant contact dermatitis; OR, odds ratio; SD, standard deviation.

Age (years)	Total (N = 1962) n (%)	Females (N = 1173) n (%)	Males (N = 789) n (%)	OR	95%CI
15–25	460 (23.4)	307 (26.2)	153 (19.4)	1.47	1.18–1.86
26–35	631 (32.2)	394 (33.6)	237 (30.0)	1.18	0.99–1.43
36–45	457 (23.3)	266 (22.7)	191 (24.2)	0.92	0.74–1.14
46–55	307 (15.6)	166 (14.2)	141 (17.9)	0.75	0.59–0.97
56–65	98 (5.0)	36 (3.1)	62 (7.9)	0.37	0.24–0.57
>65	9 (0.5)	4 (0.3)	5 (0.6)	0.53	0.14–2.00

TABLE 3 Distribution of cases with occupational contact dermatitis by age group and sex

Note: Statistically significant results are in bold.

Abbreviations: CI, confidence interval; OR, odds ratio.

TABLE 4 Prevalence of occupational contact dermatitis in the study population across 1996–2016, by 3-year period and sex

Years	Females (N = 12 081)		Males (N = 6778)		Total (N = 18 859)			
	F _{tot}	OCD (N = 1173) n (%)	M _{tot}	OCD (N = 789) n (%)	N _{tot}	OCD (N = 1962) n (%)	OR	95%CI
1996–1998	1642	234 (14.3)	987	156 (15.8)	2629	390 (14.8)	1	—
1999–2001	3298	341 (10.3)	1904	217 (11.4)	5202	558 (10.7)	0.69	0.60–0.79
2002–2004	1574	183 (11.6)	968	109 (11.3)	2542	292 (11.5)	0.75	0.63–0.88
2005–2007	1935	114 (5.9)	1077	89 (8.3)	3012	203 (6.7)	0.41	0.35–0.50
2008–2010	1808	110 (6.1)	896	70 (7.8)	2704	180 (6.7)	0.41	0.34–0.50
2011–2013 ^a	797	44 (5.5)	445	42 (9.4)	1242	86 (6.9)	0.43	0.33–0.55
2014–2016	1027	147 (14.3)	501	106 (21.2)	1528	253 (16.6)	1.14	0.96–1.35

Note: Statistically significant results are in bold.

Abbreviations: CI, confidence interval; OR, odds ratios.

^aData from Trieste and Padua clinics not available for the year 2012. ORs and 95% CIs were evaluated for OCD with logistic regression analysis, with 1996–1998 as reference period.

occupational groups. Farmers and fishermen were significantly older than other categories, except for construction workers.

Even though the construction worker category had a slightly higher proportion of ICD and a lower proportion of AD compared with other occupational groups, no significant differences were

detected in the analysis. The proportions of hand and face dermatitis showed significant differences between categories (chi-square test; $P < .0001$). Hand dermatitis prevailed in all occupational groups; face dermatitis was particularly common in chemical industry workers (20.0%), and farmers and fishermen (18.6%).

TABLE 5 Prevalence of occupational contact dermatitis and non-occupational contact dermatitis in occupational groups

Occupational groups	Total (N = 18 859) N.	Non-OCD (N = 16 897) N. (%)	OCD (N = 1962) N. (%)	OR	95%CI
Clerks	6640	6491 (97.8)	149 (2.2)	1	-
Healthcare workers	2665	2215 (83.1)	450 (16.9)	9.5	7.8–11.5
Domestic and restaurant workers	1349	1106 (82.0)	243 (18.0)	10.1	8.2–12.5
Metalworkers	1243	927 (74.6)	316 (25.4)	15.2	12.3–18.8
Construction workers	758	597 (78.8)	161 (21.2)	11.7	8.4–16.4
Textile workers	565	462 (81.8)	103 (18.2)	10.2	7.8–13.3
Delivery workers	414	381 (92.0)	33 (8.0)	4.1	2.8–6.1
Cleaners	396	340 (85.9)	56 (14.1)	7.9	5.6–11.1
Woodcraftsmen and similar	367	295 (80.4)	72 (19.6)	10.9	8.0–14.8
Hairdressers, barbers and beauticians	324	181 (55.9)	143 (44.1)	34.3	26.1–45.2
Drivers	248	226 (91.1)	22 (8.9)	4.4	2.8–7.1
Farmers and fishermen	232	187 (80.6)	45 (19.4)	11.5	8.0–16.7
Chemical industry workers	219	170 (77.6)	49 (22.4)	12.8	8.9–18.3
Shop assistants	217	202 (93.1)	15 (6.9)	3.5	2.0–6.1
Technicians	92	75 (81.5)	17 (18.5)	11.4	6.6–19.8
Service workers	86	71 (82.6)	15 (17.4)	10.3	5.8–18.4
Paper workers	71	61 (85.9)	10 (14.1)	7.4	3.7–14.8
Teachers	31	30 (96.8)	1 (3.2)	1.8	0.2–13.2
Cooks	18	13 (72.2)	5 (27.8)	18.4	6.4–52.5
Others	2924	2867 (98.1)	57 (1.9)	0.95	0.7–1.3

Note: Others" includes occupations without well-defined exposure. The ORs and 95% CIs were evaluated for OCD with multivariate logistic analysis adjusted for age and sex, with clerks as reference category. Statistically significant results are in bold.

Abbreviations: CI, confidence interval; non-OCD, non-occupational contact dermatitis; OCD, occupational contact dermatitis; OR, odds ratio.

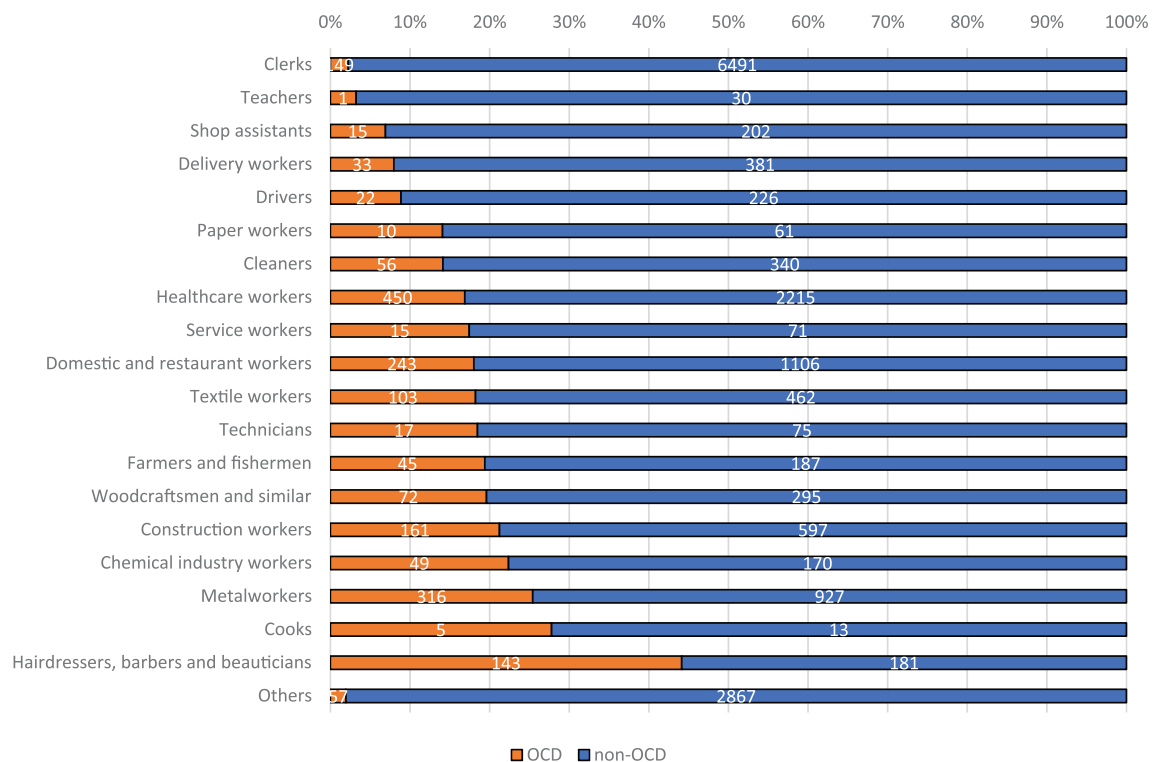
**FIGURE 1** Occupational contact dermatitis prevalence in different job categories

TABLE 6 Demographic data of the 10 most frequent occupational groups with the higher proportion of occupational contact dermatitis

	Total OCD	Healthcare workers	Metal workers	Domestic and restaurant workers	Construction workers	Hairdressers, barbers and beauticians
Cases, n (%)	1962 (100)	450 (22.9)	316 (16.1)	243 (12.4)	161 (8.2)	143 (7.3)
Mean age ± SD (years)	35.2 ± 11.6	35.9 ± 10.0	36.0 ± 11.2	32.9 ± 10.8	39.9 ± 13.2	27.1 ± 11.7*
Sex, n (%)						
Females	1173 (59.8)	361 (80.2)	101 (32.0)	178 (73.3)	0 (0.0)	130 (90.9)
Males	789 (40.2)	89 (19.8)	215 (68.0)	65 (26.7)	161 (100.0)	13 (9.1)
AD, n (%)	107 (5.8)	25 (6.1)	16 (5.3)	15 (6.7)	3 (2.0)	8 (6.4)
Sites, n (%)						
Hand dermatitis	1429 (76.6)	356 (84.4)	227 (75.2)	197 (84.5)	117 (75.5)	112 (80.6)
Leg dermatitis	49 (2.6)	6 (1.4)	7 (2.3)	7 (3.0)	6 (3.9)	3 (2.2)
Face dermatitis	161 (8.6)	19 (4.5)	33 (10.9)	11 (4.7)	8 (5.2)	12 (8.6)
Diagnosis, n (%)						
ICD	796 (40.6)	170 (37.8)	135 (42.7)	95 (39.1)	75 (46.6)	54 (37.8)
ACD	1166 (59.4)	280 (62.2)	181 (57.3)	148 (60.9)	86 (53.4)	89 (62.2)
	Textile workers	Woodcraftsmen and similar	Cleaners	Chemical industry workers	Farmers and fishermen	
Cases, n (%)	103 (5.2)	72 (3.7)	56 (2.9)	49 (2.5)	45 (2.3)	
Mean age ± SD (years)	34.4 ± 11.3	33.9 ± 9.9	32.3 ± 12.5	34.3 ± 10.9	41.6 ± 12.3	
Sex, n (%)						
Females	74 (71.8)	36 (50.0)	56 (100.0)	20 (40.8)	25 (55.6)	
Males	29 (28.2)	36 (50.0)	0 (0.0)	29 (59.2)	20 (44.4)	
AD, n (%)	6 (5.9)	3 (4.2)	2 (3.8)	2 (4.3)	2 (4.5)	
Sites, n (%)						
Hand dermatitis	61 (62.2)	50 (72.4)	33 (64.7)	31 (68.9)	33 (76.7)	
Leg dermatitis	5 (5.1)	1 (1.4)	2 (3.9)	1 (2.2)	0 (0.0)	
Face dermatitis	11 (11.2)	9 (13.0)	6 (11.7)	9 (20.0)	8 (18.6)	
Diagnosis, n (%)						
ICD	39 (37.9)	30 (41.7)	24 (42.9)	18 (36.7)	18 (40.0)	
ACD	64 (62.1)	42 (58.3)	32 (57.1)	31 (63.3)	27 (60.0)	

Note: Missing data: AD (n = 109); sites of occurrence (n = 81).

Abbreviations: ACD, allergic contact dermatitis; AD, atopic dermatitis; ICD, irritant contact dermatitis; OCD, occupational contact dermatitis; SD, standard deviation.

* $P < .001$ (Kruskal-Wallis test).

4 | DISCUSSION

Our study included 18 859 patients working in various jobs and with a diagnosis of CD, in 10.4% recognized as occupational. This prevalence is lower than that found by GIRDCA in its multicentric Italian study conducted from 1984 to 1993 (29%).¹⁴ Although these data are not perfectly comparable due to a different definition of professional categories (Sertoli et al considered housewives as an occupational group), our finding is compatible with a plausible improvement in working conditions and prevention over the years. Furthermore, it would also be in accordance with a declining trend in the INAIL notified cases of OSD, from 2500 cases reported in 1994 to 399 in 2017

(from 7.3% to 0.7% of all notified occupational diseases, respectively).^{13,15,16}

However, it is important to note that in Italy, underreporting of occupational cases is an important issue. There are several explanations for this: Skin diseases are considered mild diseases and workers do not receive money compensation for these; dermatologists do not want to spend a lot of time to fill in the forms; workers do not want to attend an occupational medical center to do the report because they will receive no, or very few, benefits. In the European context, our population seems to be less affected by OCD, and although an increase in prevalence has been observed during the last 3-year period (Table 4), we are below the European mean of 24% reported

by ESSCA (European Surveillance System on Contact Allergy) for the period 2002–2010.⁹

Women comprised 64.1% of the patients and were predominant in both the OCD and non-OCD groups. This proportion, consistent with previous studies,^{26–29} may indicate that women were more often affected by contact dermatitis than men. There is a clinical notion that women are more skin-reactive than men, and it has been observed that AD shows a female preponderance in adulthood,^{26,30} the latter perhaps related to an exacerbation of Th2 inflammation supported by estradiol and other female sex hormones.³¹ Moreover, female skin is thinner due to lower testosterone levels,^{32,33} and there is a lower epidermal cellular density, and lower collagen content in female skin at all ages, compared with men.^{34,35} In animal studies, female skin is more permeable to some organic compounds (eg, benzoic acid, cortisone, urea, and trichloroethylene).^{33,36} On the other hand, some authors suggest that the higher prevalence of contact dermatitis among women could be explained by different environmental exposures, domestically as well occupationally, and not by a genuine difference in skin susceptibility between the genders.^{29,37}

Comparing occupational and non-occupational groups, men had a proportionally higher frequency of OCD than women (11.6% vs 9.7%, OR 1.22; 95% CI 1.11–1.45). This may be due in part to differences between the sexes in the amount of skin exposure to allergens in occupational and non-occupational environments. Women were probably exposed to allergens and/or irritants more than men, especially in non-occupational settings. Nickel sensitization, the most frequent contact allergy, is seen more frequently in women because they have a greater exposure to nickel through jewelry, especially earrings.³⁸ Women are more exposed than men to a whole range of haptens in cosmetics, and they continue to deal more often than men with home and children's care, with a consequently greater domestic exposure to both allergens and irritants.²⁹ Moreover, relying on literature findings,³⁹ it could be argued that women are more likely to adhere to preventive work procedures and this may contributed to lowering the risk for women of incurring an OCD.

There is a general consensus that AD is the most important personal risk factor for the development of CD,^{10,29,40–42} due to an impaired epidermal barrier function, even in uninvolved skin.⁴³ This is well documented in particular for ICD, whereas the role of AD in ACD is still being discussed.^{43,44} In our study population, we find an overall prevalence of AD of 8.3%. The frequency is quite low when compared to previous findings reporting AD as a cofactor of contact dermatitis in 20–40% of the cases.^{9,10} This interesting result, in accordance with some studies, showed a lower prevalence of adult AD in south and south-east Europe than in northern and western countries.^{26,45,46} This, in turn, could be related to a low prevalence of filaggrin loss-of-function mutations in these populations, but evidence in the literature is scarce.^{47,48} In our study there was a statistically lower frequency of AD in individuals with OCD than in those without OCD (5.8% vs. 8.6%, OR 0.65; 95% CI 0.54–0.81). Our findings, together with the data on the prevalence of OCD in each occupational group (Table 5 and Table 6), may indicate the presence of a “healthy worker effect” among patients with OCD. In other words, subjects with a history of

AD would not start or would leave jobs at greater risk for the development of CD. Schwensen et al, in their case-control studies on CD among hairdressers and blue-collar workers, came to a similar conclusion when discussing the lower prevalence of AD in these occupational groups.^{49,50}

Regarding the diagnosis, we find that ACD is predominant in our population (56.5% vs 43.5%) with a slightly higher proportion, as compared to ICD, among individuals with OCD (OR 1.14; 95%CI 1.04–1.26). Generally, ICD is the most common type of CD reported in literature, accounting for 60–80% of all CD, while ACD accounts for the remaining 20–40%,^{6,41,51} but the proportion may vary widely across studies, depending on the occupations that prevail and the hazards to which people are exposed, the centers that report cases, and differences in the diagnostic criteria.^{4,5,52,53} In comparison, a previous Italian study from Sertoli et al found that ACD clearly predominates over ICD (64.4% vs 34.6%, respectively).¹⁴ Our result may be explained by taking into account the influence of different factors. First of all, the centers that collected the cases are predominantly dermatological clinics. This may have led to the selection of the most serious cases of contact dermatitis, which are notoriously the allergic type, considering that mild or transient diseases are more likely to be managed within primary care.^{4,5} Moreover, in our study, all the patients were patch tested, thereby minimizing the possibility of overdiagnosing ICD, reported by some authors as related to differences in defining the disease and making the diagnosis.^{53–55} Another factor that could be taken into consideration is the low frequency of AD in the Italian adult population.^{26,45} The lower prevalence of ICD found in the OCD group (0.87; 95% CI 0.79–0.96) is consistent with the different frequency of AD in the two groups. In the comparison between genders, women are predominant both in ICD and in ACD but proportionally more often diagnosed with occupational ACD than men. These are results that rarely appear in the literature. The available studies confirm that women have a higher share of occupational ACD than men, while, regarding occupational ICD, it is not possible to define a clear predominance.^{56,57}

As expected, we find that OCD affects people at a significantly younger age than non-OCD (mean age 35.2 ± 11.6 vs. 36.8 ± 13.9 years, $P < .0001$),^{9,10} whereas age above 40 seems to be protective for the development of OCD. This is probably because generally OCD develops after a short period of exposure; therefore it is more common to find it at the beginning of the career or soon thereafter.² In addition, we can assume that young workers are more likely to change jobs; as a consequence they could be exposed to a wider variety of irritants and allergens.

Consistent with literature data,^{27,37,53,57} among OCD patients, women were significantly younger than men. It is possible that a higher exposure, domestically as well occupationally, influenced an early onset of dermatitis in women. As already highlighted in several studies, even in our population, hairdressers were the youngest working category among those at high risk for OCD (mean age 27.1 ± 11.7 years). Probably the high amount of wet work and the exposure to strong sensitizers, especially during apprenticeship,

results in an early onset of occupational dermatitis in this occupation.^{49,51,58}

Regarding the sites of occurrence, in agreement with previous studies,^{3,8,51,59} we observed that OCD had a much higher proportion of hand involvement than non-OCD (76.6% vs. 36.1%, OR 5.79; 95% CI 5.17–6.48), whereas leg and face dermatitis was rare. Among persons with OCD there were no significant differences regarding hand and leg localization between genders, whereas women had a significantly higher frequency of face dermatitis than men. We do not know if the use of cosmetics may have retained allergens increasing their sensitization effects; however, it is well known that the use of detergents can influence skin absorption of some chemicals.⁶⁰

In the occupational groups analyzed in Table 6, although the hand was the predominant anatomical site in all categories, we observed a considerably higher proportion of face dermatitis in chemical industry workers and farmers. We suppose that this may be related to a certain proportion of cases caused by airborne allergens or irritants, especially among chemical industry workers.⁶¹ In addition, in farmers, due to the intrinsic characteristics of the job, the face is often directly exposed to plants or chemicals. Besides, the concomitant exposure to sunlight, typical of this category, can determine the onset of phytophotodermatitis.^{62,63}

Nearly 70% of all OCDs occurred in only five occupational groups: healthcare workers, metalworkers, domestic and restaurant workers, hairdressers, barbers, and beauticians. Considerable sex differences were observed in most of the industrial activities. In particular, cleaners, hairdressers, barbers and beauticians, and healthcare workers were confirmed as occupational categories with a highly female dominance, whereas construction workers were a strictly male category.^{9,51,57,64,65}

In the multivariate logistic analysis, we find a statistically higher association for OCD for almost all occupational groups. Hairdressers, barbers, and beauticians represented the occupation with the highest risk (OR 34.3; 95% CI 26.1–45.2), followed by cooks, metalworkers, chemical industry workers, and construction workers. These results are widely reflected in the literature.^{8,9,37,57} Healthcare workers, often reported as a high-risk category,^{8,9} ranked at an intermediate level in our analysis. It should be considered that healthcare workers are an occupational macro-category, the composition of which may vary across studies. Our result is more consistent with that of Schwensen et al in their study of 1000 cases of severe OCD, who reported a relative lower incidence for nurses and nursing assistants than in other occupations.⁵⁷ In our opinion, healthcare is an occupational sector where, in the last years, prevention strategies have spread more than in other industrial activities, and where peoples' awareness of prevention is greater and prevention better accepted.

Regarding temporal trends of OCD in European countries, a recent study, taking into account the period 2000–2012, found a significant decline in incidence of physician-reported and of recognized claims for OCD in most of the countries considered. In Norway OCD increased while in France and in The Netherlands did not have a significant trend.⁶⁶ In our study, data on the prevalence of OCD, gathered in 3-year periods, showed an initial decrease from 14.8%

(1996–1999) to 6.7% (2005–2007 and 2008–2010) and a new increase to 16.6% in the last 3-year period. This trend cannot be explained easily, even if various factors are considered such as the effectiveness of prevention, the influence of the economy on the employment rate, and/or the diffusion of less protective contractual forms. However, looking at the last 3-year period, it seems that OCD is still a problem to be addressed even if, as compared with less recent Italian data,¹⁴ a decrease has been observed.

Our study has some limitations. The large sample size derives from patients attending health services for suspected CD; consequently, the results may be affected from selection bias. The choice to define the diagnosis of ACD or ICD relying only on patch test results and not on the clinical features may have led to possible misclassifications.

The decision of merging smaller groups into larger ones, to improve the statistical power of our analysis, may have led to some loss of information, even though we retained occupational categories previously reported in the literature to have higher prevalence of OCD than the average. Unemployed people were excluded from the analysis, causing a possible underestimation of some cases, but as the occupational history was collected by dermatologists or occupational physicians, the role of previous occupation was taken into account. To avoid the misclassification of OCD we trained occupational physicians and dermatologist to collect the data since the start of the study. Another possible limitation of the study is related to its multicenter design, which may have affected the consistency of our data, although all participants accepted the use of a standardized protocol and were trained.

5 | CONCLUSIONS

Our study showed that contact dermatitis predominantly affects women, even though men had a higher probability to have OCD. During the study period, OCD was diagnosed in 10.4% of the patients tested. They were characterized by younger age, hand as the predominant localization, and a lower frequency of AD, the latter indicating a possible “healthy worker effect.” ACD represented the main diagnosis in our population, with higher frequency in OCD than non-OCD and, within OCD category, among women than men.

ACKNOWLEDGEMENTS

We thank all member departments of the North-East Italy Contact Dermatitis Group (NEICDG): Dermatological Unit, S. Chiara Hospital, Trento, Italy; Dermatological Unit, Hospital of Rovigo, Italy; Dermatological Unit, S. Martino Hospital, Belluno, Italy; and Dermatological Unit, Azienda sanitaria dell'Alto Adige, Bolzano Italy.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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How to cite this article: Santarossa M, Mauro M, Belloni Fortina A, Corradin MT, Larese Filon F. Occupational contact dermatitis in Triveneto: Analysis of patch test data of the North Eastern Italian Database from 1996 to 2016. *Contact Dermatitis*. 2020;1–10. <https://doi.org/10.1111/cod.13512>