




REVIEW ARTICLE

Incidence of occupational contact dermatitis in healthcare workers: a systematic review

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Abstract

Healthcare workers (HCWs) can be considered at an increased risk of developing occupational contact dermatitis (OCD) due to repetitive hand washing with soaps and disinfectants and extended use of gloves for many hours during the day. The aim of this study was to summarize the incidence of OCD in HCWs. We searched the databases PubMed/MEDLINE (1980-present), EMBASE (1980-present) and Cochrane Library (1992-present) through May 2020 using the search term 'incidence of contact dermatitis in HCWs' according to Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. Overall, 16 studies (six cohorts; 10 register-based) with follow-up periods between 1987 and 2013 fulfilled the inclusion criteria. The incidence of OCD reported in studies using registers of occupational diseases ranged from 0.6 to 6.7 per 10 000 person-years. The cohort studies reported incidence from 15.9 to 780.0 per 10 000 person-years; the incidence was higher in studies which included apprentice nurses. A higher incidence was also observed amongst dental practitioners, particularly dental technicians and nurses, compared to other HCWs. Studies reporting incidence data are very scarce and results differed by study design, type of contact dermatitis and investigated HCWs. Our study highlighted the dearth of high-quality data on the incidence of OCD and the possible underestimation of disease burden. Prospective cohort studies with harmonized designs, especially exposure assessment and outcome ascertainment, are required to provide more accurate, valid and recent estimates of the incidence of OCD. A high incidence amongst specific occupational groups suggests the need to undertake intervention studies with a focus on prevention, particularly during pandemics such as COVID-19.

Received: 4 August 2020; Accepted: 11 December 2020

Conflict of interest

None.

Funding source

None.

Introduction

Contact dermatitis is one of the most common work-related diseases in developed countries^{1,2}, and occupational contact dermatitis (OCD) has a negative impact on workers' quality of life and ability to do their job.³ Healthcare workers (HCWs) can be considered at an increased risk of developing OCD due to the repetitive hand washing with soaps and disinfectants and extended use of gloves for many hours during the day.^{4,5} Numerous cross-sectional studies have shown that OCD is common in

HCWs; however, epidemiological data on the incidence of irritant (ICD) and allergic contact dermatitis (ACD) are lacking. Longitudinal study designs provide important incidence data on the onset of new cases in a defined time frame and the temporal associations with occupational exposures and risk factors. Moreover, studies that evaluate the incidence of diseases are important because they delineate the temporal trend of OCD in an occupational group, verify differences with other occupational groups or evaluate the effectiveness of interventions.

The aim of this study was to summarize incidence data on OCD in HCWs.

Materials and methods

We searched the databases MEDLINE via PubMed (1980-present), EMBASE (1980-present) and Cochrane Library (1992-present) through May 2020 using the search term 'incidence of contact dermatitis in HCWs' according to Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. The detailed research is reported in Appendix S1 (Supporting Information). Manual search in reference list of papers was included while conference reports were not considered for paucity of detailed data available.

Titles and abstract review were performed independently by two researchers and articles were excluded if there was no evidence of incidence data on contact dermatitis. Studies published online, in-print and in-press from all years written in any language were considered. Participants Exposure Comparison Outcome Time approach was used to define the objectives of the review.

Inclusion criteria

All peer-review journal articles that evaluated the incidence of OCD in HCWs were considered potentially eligible. Cohort studies, insurance claim registered-based studies and studies that calculated incidence considered new patients observed in a fixed period were included in the review. Studies in which were impossible the calculation of incidence of OCD in HCWs were excluded from the analysis.

Quality assessment

Quality assessment was performed by use of the Newcastle-Ottawa Scale, in which studies were scored on eight items regarding representativeness of the study population, comparability in different outcome groups (sex and age groups) and ascertainment of exposure or outcome of interest.⁶

Full-text articles were reviewed and the following data were extracted: number of workers and patients involved or person-years, analysed period, incidence of cases on 10 000 occupied workers (95% confidence intervals, CI) in HCWs, nurses, dental practitioners, dentists, medical doctors and apprentices.

Incidence data, when not available, were obtained considering new cases of OCD/population at risk in the considered time-frame.

Results

The literature search yielded 221 references, of which 180 were excluded during title and abstract screening. Of the 43 full-text reviewed, 16 studies (six cohorts; 10 register-based) met inclusion criteria with follow-up periods between 1987 and 2013. Reasons for exclusion are reported in the PRISMA flow diagram (Figure 1).

Table 1 summarizes the results. In general, there are very few studies reporting incidence data. We found only six cohort

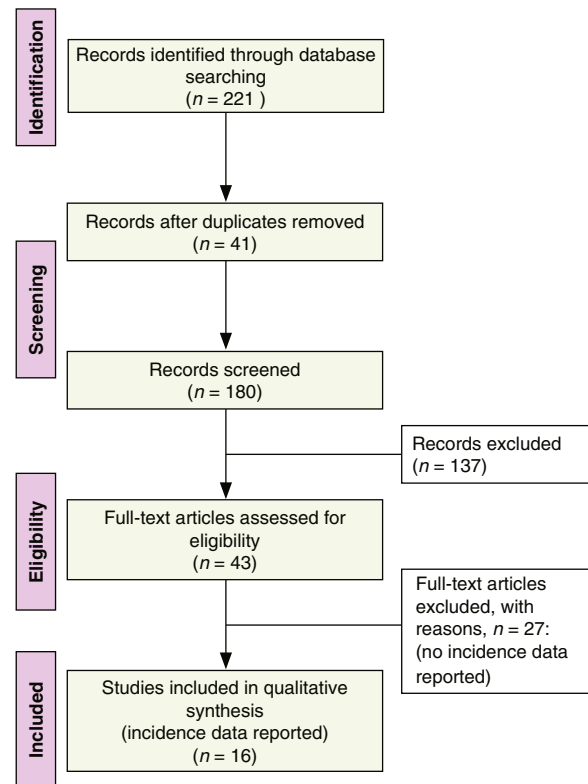


Figure 1 PRISMA flow chart showing the flow of studies through each phase of the review process.

studies, three in the Netherlands, two in Italy and one in Germany. Smit *et al.*⁷ in 1987–1989 reported an incidence rate of 65 cases of OCD for 10 000 workers-months (850 for 10 000 workers-years) in nurses and in 1990–1992⁸ an incidence rate of 1450 cases for 10 000 person-years in apprentice nurses. Schmid *et al.*⁹ in Germany reported an incidence rate of 11.5% in apprentice nurses during the first year of follow-up. Visser *et al.*¹⁰ reported an incidence rate of 3670 cases for 10 000 workers-years in the first year of traineeship. Larese *et al.*¹¹ in Italy analysing only glove-related OCD in 2000–2009 found an incidence rate of 23.9 and 25.0 cases per 10 000 workers/year for ICD and ACD, respectively, and analysing all OCD in 2004–2013 an incidence rate of 45 cases for 10 000 workers/year.¹² OCD incidence was higher for nurses (61.4 cases per 10 000 workers/year) and lower for medical doctors (15.9 cases for 10 000 workers/year).¹²

Other studies calculated the incidence of OCD using registers of occupational diseases, finding values ranging between 1.0 to 13.8 cases per 10 000 workers/year considering different countries and occupations, higher for dentists (11 cases per 10 000/year) and dental technicians (13.8 cases per 10 000/year) with a declining trend in years considered.^{13–16}

Table 1 Characteristics of studies reviewed on incidence of occupational contact dermatitis in healthcare workers (HCWs)

| Authors, publication year, country, (reference) | Follow-up period | Number of participants (N) or Person-years (p-y) | Incidence of OCD cases per 10 000 person-years (p-y) | HCW population |
|---|--|--|--|--|
| Cohort studies | | | | |
| Smit & Coenraads, 1993, The Netherlands (7) | 1987–1989 | N = 298 | 780 originally expressed per 1000 person-months | Nurses |
| Smit <i>et al.</i> , 1994, The Netherlands (8) | 1990–1992 | N = 111 | 1450 originally expressed per 100 p-y | Apprentice nurses |
| Schmid <i>et al.</i> , 2005, Germany (9) | 2000–2003 | N = 104 | 1150 originally expressed as % | Apprentices nurses 1st year of traineeship |
| Visser <i>et al.</i> , 2013, The Netherlands (10) | 2008–2011 | N = 445 | 3670 1370 originally expressed per 100 p-y | Apprentices nurses 1st year of traineeship 2nd and 3rd year of traineeship |
| Larese Filon <i>et al.</i> , 2014, Italy (11) | 2000–2009 | 9.660 p-y | 23.9 ICD25 ACD*Only gloves-related CD | HCW |
| Larese Filon <i>et al.</i> , 2017, Italy (12) | 2004–2013 | 25.202 p-y | 45 Overall 19 ICD 22 ACD 61.4 overall 15.9 overall | HCWs Nurses Medical doctors |
| Register-based studies | | | | |
| Authors, publication year, country, (reference) | Register and follow-up period | Number of OCD cases (N) | Incidence of OCD cases per 10 000 person- years (p-y) | HCW population |
| Diepgen & Coenraads, 1999, Germany (13) | Register of occupational skin diseases in Northern Bavaria 1990–1993 | NR (N = 2567 all occupations) | 11 12 | HCWs Dentists |
| Dickel <i>et al.</i> 2001, Germany (14) | Register of occupational skin diseases in Northern Bavaria 1990–1999 | N = 607 | Overall 10.8 7.3 1990–1992 13.8 11.2 1993–1999 9.5 5.6 | Dental technicians HCWs Dental technicians HCWs Dental technicians HCWs |
| Larese <i>et al.</i> , 2003, Italy (15) | Regional (Pordenone) register of occupational diseases 1995–2000 | N = 29 | 10.8 | HCWs |
| Machovcova <i>et al.</i> , 2013 Czech Republic (16) | Czech National Registry of Occupational Diseases 1997– | N = 545 | 1997 2.9 2008 1.0 | HCWs |
| Other study design/data sources | | | | |
| Authors, publication year, country, (reference) | Data source and follow-up period | Number of OCD cases (N) or Person-years (p-y) | Incidence of OCD cases | HCW population |
| Rustemeyer <i>et al.</i> , 1994, Germany, (17) | Insurance institution | NR | 11 per 10.000 workers | Dentists |
| Meyer <i>et al.</i> , 2000, United Kingdom (18) | Network reporting work-related diseases 1994–1996 | N = 60 N = 57 N = 601 N = 102 | 3.86 2.76 1.92 1.16 per 10 000 p-y | Dental practitioners Dental nurses Nurses Medical practitioners |
| Horwitz <i>et al.</i> , 2002, USA, (19) | Workers' compensation claims due to latex related OCD 1987–1998 | N = 65 | 0.58 per 10 000 workers | HCWs |

Table 1 Continued

| Other study design/data sources | | | | |
|---|--|---|---|--|
| Authors, publication year, country, (reference) | Data source and follow-up period | Number of OCD cases (N) or Person-years (p-y) | Incidence of OCD cases | HCW population |
| United Kingdom (20) | Network reporting work-related diseases 2002–2005 | N = 3145 | 1.15 per 10 000 workers | HCWs |
| Cahill <i>et al.</i> , 2016 Australia (21) | Archive of patients from a Dermatology Clinic 1993–2010 | N = 459 | 2.1 Overall 1.1 ICD 0.5 ACD per 10,000 p-y | HCWs |
| Schwensen <i>et al.</i> , 2013 Denmark (22) | Patients with severe OSD from a Dermatology Clinic 2003–2010 | N = 112 N = 23 N = 28 N = 10 | 1 (M); 3.4 (F) 4.5 (M); 6.7 (F) 0 (M); 17.8 (F) 10.6 (M); 13.7 (F) per 10 000 p-y | Nurses Medical doctors Dental assistants Dentists |

ACD, allergic contact dermatitis; F, females; HCWs, healthcare workers; ICD, irritant contact dermatitis; M, males; NR, not reported.

The majority of studies calculated the incidence considering HCWs that underwent patch test in cases series, obtaining values ranging from 1 to 17.8 cases per 10 000 workers/year in nurses and dental assistants, respectively.^{17–22}

Discussion

Our study is the first, to the best of our knowledge, which analyses the incidence of OCD in HCWs. The literature is very limited on incidence data of OCD in the working population, and despite the important numbers of OCD in HCWs cohort studies such estimates are only available in six studies.^{7–12} Cohort studies are the strongest observational design to evaluate the incidence of diseases as exposed workers are monitored in a prospective or retrospective manner and incidence data obtained are more precise compared to other methods (compensation data, patients' reports) in which reported cases are generally underestimated.^{13–22} The registries (e.g. those of the insurance systems) notify only more severe OCD or cases who underwent a patch test by a specialist. This is the reason why the estimates of incidence are higher in cohort studies (45 cases per 10 000 workers/year in Italy) compared with studies based on registries. Prospective studies performed on the population of apprentices^{8–10} showed an incidence of OCD more than 100 times higher during apprenticeship compared to cohorts of HCWs. This difference is probably due to the 'healthy worker effect', with selection of susceptible persons during training. In fact, the highest incidence was found in the 1st year of traineeship.^{9–10} Incidence was originally expressed per 100 person-years, and simple extrapolation to 10 000 person-years could also influence comparison with results of other methodologically similar studies. Analysed studies indicated incidence differences between various healthcare occupations, with higher OCD incidences in dental practitioners, particularly dental technicians and nurses,

compared to other HCWs.^{14–18} Higher OCD incidences in females have been previously observed, in particular for working categories such as hairdressers, cooks, butchers, beauticians and bakers.²² Even if female sex can be considered a recognized risk factor for contact dermatitis,²³ we cannot confirm a significantly higher incidence rate in female HCWs compared to male subjects according to the review we performed, as there was a lack of sex-specific incidence rates available from the included studies. Moreover, it should be noted that most of the HCW cohorts followed in the prospective and retrospective studies we examined have a composition of the sample including women with a percentage usually around 70% and up to 90%^{10–12}; it could be difficult to appreciate a significantly increased incidence rate in females compared to males in samples predominantly composed of females. Looking at the three cohort studies considering not-apprentices HCW (for whom the higher incidence rates compared to other groups can be explained with specific reasons, as discussed above) it can be said that higher incidence rates were found in working populations as nurses^{7,12}, where a predominant female composition of the sample can be expected, compared to studies evaluating HCW overall¹¹ or other specific HCW groups, as medical doctors¹², where female subjects represent the majority of the sample, but with a more balanced proportion compared to males. Nevertheless, it should be considered that the differences between occupational groups within HCW could also be related to specific factors typical of the working activity, such as the higher exposure to detergents and disinfectants in nurses compared to physicians.

The incidence rates of OCD in HCWs were higher than those reported in cohort studies on construction workers²⁴ in which the incidence was 21.4 cases per 10 000 person-years, and lower than data reported for mechanics²⁵ (9.2 cases per 100 person-years). In general, the incidence of OCD in HCWs was lower

than other professional categories such as hairdressers, beauticians and bakers.²² Also, in one large compensation claims study²⁶, the incidence of OCD in HCWs was lower than in other occupational groups, but the high number of HCWs contributed significantly to the total burden of OCD.

Our study demonstrated the need to encourage cohort studies to collect more accurate and reliable estimates on the incidence of occupational diseases and to undertake intervention studies with a focus on prevention. HCWs incidence of OCD is very high in apprentices and lower in experienced workers, but their contribution to the overall burden of occupational diseases is on the top of the lists, due to the high number of exposed workers. Our study highlights the need for improved early and proactive prevention in this occupational group, starting during the first year of traineeship.

Moreover, it is important to conduct intervention studies in working places to prevent occupational skin diseases.

In conclusion, our study highlights the need for better prevention of OCD in HCWs and more cohort studies in large occupationally exposed populations from a wide range of settings to have a better estimation of the burden of OCD. On this topic, the harmonization of occupational cohorts promoted by OMEGA-NET consortium (COST-ACTION CA16216) will permit to obtain more precise data in the future. The burden of OCD has become particularly important during the current COVID-19 pandemic when HCW have been required to wear personal protective equipment for extended periods of time, which increases the risk of OCD.

Acknowledgement

This publication is based upon work from COST Action CA16216, supported by COST (European Cooperation in Science and Technology).

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Supporting information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Terms adopted for the literature search.