Prevalence and risk factors of work-related contact dermatitis symptoms among healthcare cleaners during the COVID-19 pandemic in Northwest Ethiopia: a multicentre cross-sectional survey

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ABSTRACT

Objective This study was aimed to explore the prevalence and risk factors of work-related contact dermatitis (WRCD) symptoms among cleaners working in healthcare institutions in Gondar city, Northwest Ethiopia, during the COVID-19 pandemic.

Design A multicentre cross-sectional study was conducted from September to October 2021. An interviewer-administered standardised Nordic Occupational Skin Questionnaire, V.2002 (NOSQ-2002) was used to assess WRCD. The collected data were entered into EpiData V.4.6 and analysed using Stata V.14 software. The association between dependent and independent variables was computed with a binary logistic regression. The association was determined using an adjusted OR (AOR) with a 95% CI at a p value of <0.05.

Setting The study was conducted in Gondar city healthcare institutions, Northwestern Ethiopia.

Participants A total of 409 cleaners participated in this study.

Outcome measures The primary outcome is the prevalence of WRCD symptoms, which was measured using the NOSQ-2002.

Results The response rate was 95.6%. The majority, 302 (73.8%), of the study participants were female. The mean age (±SD) was 31 (±7.87) years old. The overall prevalence of self-reported WRCD during the last 12 months was 213 (52.1%) (95% CI (47.1% to 57.0%)). The highest symptoms reported were skin redness, 51.6% (n=110), and the most affected skin body sites were hands (hand dermatitis), 74.2% (n=158). Hand washing frequency more than 20 times per day (AOR=1.73, 95% CI (1.03 to 2.92)), personal history of eczema (AOR=1.46, 95% CI (1.01 to 2.42)) and lack of training on skin hazards (AOR=2.06, 95% CI (1.16 to 3.63)) were factors influencing the occurrence of WRCD.

Conclusions This study revealed the prevalence of WRCD is common during the COVID-19 pandemic. Adjusting hand washing frequency per day, educating people with atopy about the avoidance of exposure to skin irritants and providing training on skin hazards were recommended to minimise the condition.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study is the first of its kind in exploring the magnitude and factors influencing work-related contact dermatitis among healthcare cleaners in Ethiopia.

⇒ Using the validated Nordic Occupational Skin Questionnaire, which is a standardised and effective tool for measuring self-reported skin disorders.

⇒ One limitation of our study is that a cause-and-effect relationship between variables cannot be established due to the cross-sectional study design.

⇒ Our study may also be limited by recall bias due to its reliance on self-reported data from participants.

⇒ Furthermore, due to a feasibility issue, the finding was not supported by clinical diagnoses such as patch testing, which helps to identify workplace irritants and allergic contact dermatitis.

BACKGROUND

The WHO declared the COVID-19 pandemic, on 11 March 2020.3 Because of the fast spread of the contagion, different preventive measures, including social distancing, wearing masks, wearing disposable gloves and frequent hand washing using soap or alcohol-based disinfectants, have been introduced to prevent the disease, particularly among frontline workers such as employees working in healthcare facilities.2 While these precautions are advised to prevent COVID-19 transmission, they may potentially have detrimental effects on the skin.3 Following the WHO’s recommendations, frequent hand washing with soap and water for 40–60s has emerged as the most important activity during the COVID-19 pandemic.3 However, these precautionary measures may disrupt the normal flora of the skin and the natural protective flora of the skin.
skin barrier, resulting in a variety of skin diseases, most commonly irritant and allergic contact dermatitis.5

Work-related contact dermatitis (WRCD) is defined as any skin disorder resulting from contact with an exogenous substance in the workplace that subsequently induces an allergic or irritant response.6 CD is the most common occupational-induced skin disease, accounts for 95% of all work-related skin diseases.7 The most commonly recorded CD symptoms are redness, swelling, itching, flaking or cracking, blisters and weeping sores of the skin.8 The nasal bridge, cheeks, wrists and forehead were the most frequently affected skin sites by CD.9 However, hands are the body site more involved in work-related CD.10 11 A study from Denmark reported that 42.4% of participants had experienced contact dermatitis during the COVID-19 pandemic, which was more noticeable during frequent hand washing with soap.12 A study in China reported a 74.5% prevalence of contact dermatitis in hands during COVID-19 pandemic, which was more noticeable during frequent hand washing with soap.12 A study in China reported a 74.5% prevalence of contact dermatitis in hands during COVID-19 among employees working in healthcare facilities, indicating that the COVID-19 pandemic is associated with skin disorders.13 According to a study conducted in Saudi Arabia,14 the skin’s dryness (92.9%), itching (50%) and redness (46.4%) were the most commonly reported contact dermatitis symptoms during the COVID-19 pandemic and 93.5% of the skin sites were impacted at the hand. As per a study conducted in Turkey, hand washing during the COVID-19 pandemic has increased the risk of contact dermatitis by 3.57 times.15 Another scientific report confirmed that hand hygiene measures resulted in a 100% increase in skin disorders when hygiene routines were performed more than 10 times/day.16

Globally, WRCD continues to exert a significant occupational disease burden.17 Exposure to contact dermatitis is influenced by climate, occupation, cultural habits and regulations.18 CD affects workers of all ages in a variety of work settings, with a slight female preponderance.19 It has a significant impact on workers’ quality of life, functional capacity, social relationships and health service utilisation.20 21 22 As well, it accounts for 25% of all lost workdays21 and can even lead to job loss or change of employment.22 Ultimately, this can produce significant individual and societal economic losses.24

Cleaning service is a type of wet work, where more than 50% of the work is carried out in damp hand conditions, which makes cleaners ideal candidates to develop WRCD.23 24 Cleaning work may result in physical skin damage due to frequent contact with water, soaps, detergents, latex, alcohol, chemicals such as acids and bases, or other technical products that can irritate the skin in contact.25 Cleaners working in healthcare facilities are more prone to developing WRCD because of exposure to various cleaning substance ingredients in their working environment.26 As well, this group of workers has a low level of education regarding prevention and control methods for environmental and occupational determinants.25 Moreover, because many cleaning services are run under informal conditions, employees in the sector are exempt from national labour and other regulations, making them more vulnerable to a variety of occupational and environmental hazards that can lead to serious injuries, illness and death.29 Furthermore, healthcare cleaners are primarily advised to implement COVID-19 precautions measures such as frequent hand washing, which may adversely affect skin eruption.2 However, there is insufficient data on the prevalence and risk factors for WRCD among workers in the cleaning industry globally. Therefore, the current study aimed to explore the prevalence and risk factors of WRCD symptoms among cleaners working in healthcare institutions in Gondar city, Northwest Ethiopia, during the COVID-19 pandemic.

**METHODS AND MATERIALS**

**Study design, period and setting**

An institution-based cross-sectional study was conducted from September to October 2021. The study was carried out in Gondar city public and private health institutions. The city is located in the Northwest of Ethiopia, which is 740 km far from Addis Ababa, the capital city of Ethiopia. The city has 12 subcity administrations with a population of over 300,000. In the city, there are eight public health centres, 47 private health institutions and one comprehensive specialised hospital. These health facilities provide preventive, curative, inpatient and ambulatory services, treatment of common psychiatric disorders, dental services and others for 15,000–25,000 people in rural areas, and around 40,000 people in urban areas.30

**Study populations**

All cleaners working in both public and private healthcare institutions in Gondar city were the source population. The study population consisted of all cleaners who worked in all healthcare institutions in Gondar during the study period. Participants who had at least 1 year of working experience and who were available throughout data collection were included, while cleaners who had a critical illness, known pregnant women, maternity leave or sabbatical leave were excluded from the study.

**Sample size determination and sampling procedure**

The sample size was calculated by using a single population proportion formula,31 by considering the following statistical assumptions: confidence level of 95%, proportion=50% (no previous study in the study area), margin of error of 5% and using the following single proportion formula: $n = \frac{(Z_{\alpha/2})^2 \left[ \frac{p(1-p)}{d^2} \right]}{0.5}$, where $n$=initial sample size, $Z=1.96$, the corresponding Z-score for the 95% CI, proportion $(p)=50\%$, d=margin of error=5%, then $n = (1.96)^2 \left[ \frac{0.5(1-0.5)}{0.05^2} \right] = 384$. After considering 10% non-response rate, the final sample size was 422. However, the whole population had taken for the study due to being small population size of the cleaners. During study period, there were about 428 healthcare cleaners working in all health institutions of Gondar city (both public and private healthcare institutions).
Variable measurement and definition of terms

WRCD symptoms
A non-infectious disease either allergic or irritant contact dermatitis caused aggravated or exacerbated by work place exposures. The symptoms of contact dermatitis include redness, burning, blisters, itching, dry skin, fissures, aching or pain, and crusting of the skin that experienced in any part of the body site during the past 12 months.22 33

Healthcare cleaners
Ward attendants (those responsible for cleaning the interior wards) or grounds labourer (those responsible for cleaning the exterior grounds).

Training on skin hazards
Educational actions for credentials by employees on risk factors accountable for contact dermatitis related to work, repetitive hand washing, infection control, sharps, use of appropriate personal protective equipment (PPE) when cleaning, information on chemical products and hazards, safe handling of cleaning chemicals, skin irritants, use of moisturisers or barrier creams and use of alcohol-based hand rubs in the past 12 months.22 33

Perceived job satisfaction
A total score of at least 32 on the general job satisfaction scale.34

Perceived job stress
A score of at least 21 on the workplace stress scale.35

Data collection tools and procedures
Data were collected through a previously validated self-reporting survey questionnaire.32 36 The questionnaire was divided into three main categories, with the first section focusing on sociodemographic items such as age, sex, educational status, marital status, monthly income and working experience. The second section focused on health behaviour-related issues such as utilisation of PPE, types of PPE used and reasons for not using PPE. The number of hand washes during a usual working day during the COVID-19 pandemic, as well as the time spent on each hand wash, was measured. Moreover, a number of hands disinfected with alcohol in a typical working day during the COVID-19 pandemic were included. Also, either changing or not changing work clothes after work, exchanges of clothes with other family members and the presence of a self-reported allergic disease (atopic dermatitis (yes or no), asthma (yes or no) or a personal history of eczema such as allergic rhinitis or hay fever (yes or no)) were incorporated in the health behaviour-related issues item.

The third part of the questionnaire contains detailed information about work environment-related characteristics such as the working unit/room, working hours per day, information on workplace health and safety, source of information about workplace health and safety, training regarding skin hazards, the availability of periodic medical examinations, the presence of different types of hand washing facilities in the working area, perceived job satisfaction, and job stress. We used the 10-item generic job satisfaction scale questionnaire to measure cleaners’ perceived job satisfaction.34 The scale comprised 10 questions ranging from 1 to 5 for each item and ranged from very dissatisfied, dissatisfied, neutral, satisfied and very satisfied, according to their occurrences, respectively, in the month before the survey. The scale had 10 items with a rating of 1 to 5, and the responses ranged from very dissatisfied, dissatisfied, neutral, satisfied and very satisfied, and then summing up all 10 items. The scale produced a single ranking, with high scores indicating higher job satisfaction and vice versa. The perceived job-related stress of the participants was collected using an 8-item workplace stress scale questionnaire.35 The scale comprised 8 questions ranging from 1 to 5 for each item and ranged from never, rarely, sometimes, often and very often, according to their occurrences respectively, in the month before the survey. The 8-item workplace stress scores are obtained by reversing scores on 3 positive items, for example, 5=1, 4=2, 3=3, etc, and then summing up all 8 items. Items 6, 7 and 8 are positive items. The scale produced a single ranking, with high scores indicating higher stress levels and vice versa. The instruments used in the current study have been employed in previous studies conducted in the country’s context.37–40

The final section focused on specific WRCD symptoms that are known to be indicative of this disease,41 which were assessed by the standardised Nordic Occupational Skin Questionnaire V.2002 (NOSQ-2002).42 Briefly, the symptoms of contact dermatitis included redness, burning, blisters, itching, dry skin, fissures, aching or pain, and crusting of the skin in any part of the body site. To ascertain if a WRCD event occurred over time, we specifically asked cleaners if any of their symptoms had occurred in the past 12 months.

Data quality assurance
To ensure the quality of the data collected, we gave much emphasis to the appropriate design of data collection tools. The questionnaire was first developed in English and translated into the local language Amharic and back to English by language experts and professionals to ensure consistency. Second, we hired two data collectors and one supervisor with prior experience and knowledge of the task. The data collectors and supervisor took 2 days of training and orientation before the actual data collection on issues relating to the clarity of the questions, objectives of the study, confidentiality of information, informed consent, as well as the training covers the roles and responsibilities maintained by both the data collectors and supervisor during the data collection process. The principal investigator supervised both data collectors and supervisors. Third, we conducted a pretest 1 week before the actual data collection period on 5% (21) of the sample size in the Debark Hospital, nearby Gondar city, which helped us test the validity and consistency of the instrument used. Based on the findings from the
pretest analysis, we modified some words and misinterpretations, minimised the number of questions and made corrections to some other ambiguities. Problems faced during the data collection process were solved by discussion on the spot with the principal investigator, supervisor and data collectors.

**Data management and statistical analysis**

Data were coded, labelled, verified, categorised and entered into EpiData V4.6 software. We used Stata V.14 to analyse the entered data and computed frequencies, percentages, means and the SD to present the findings. Prior to doing bivariable and multivariable binary logistic regression analyses, the variables’ normality, outliers and multicollinearity were examined. A variance inflation factor was used to test the multicollinearity assumption, and all variables displayed values of less than five. As a result, we found no evidence of multicollinearity. The reliability of the questionnaire items was also tested (Cronbach’s alpha) for each of the independent variables (>0.75), and it was 0.89 for the outcome variable, so the questionnaire was tolerable for its consistency. A binary logistic regression analysis was performed separately for each independent variable to explore the associations with each dependent variable. The independent variables that were significant at <0.2 p values in the bivariable logistic regression analysis were exported to the multivariable logistic regression model to control the potential effects of confounders. Variables were dropped into the multivariable logistic regression model with a forward variable selection method. We checked the goodness of fit model using Hosmer and Lemeshow and found the assumption satisfied (p value>0.05). A cut-off<0.05 p value was set to evaluate the significance and OR with a 95% CI to establish the strength of associations in the multivariable logistic regression model.

**Patient and public involvement**

Healthcare cleaners participated in this investigation by contributing useful information. However, they have never been involved in the study design, protocol, data collection tools, reporting or dissemination of the findings. The findings will be shared with the Gondar city administration health office as well as published in an open access journal.

**RESULTS**

**Sociodemographic characteristics of the study participants**

A total of 409 healthcare cleaners took part in the study, yielding a response rate of 95.6%. The majority, 302 (73.8%), of the study participants were female. The mean (±SD) age of the respondents was 31 (±7.87) years. The majority, 226 (55.3%) of the study participants, indicated that they were married. In terms of educational status, the majority, 226 (55.3%) of the study participants, indicated that they were married. In terms of educational status, 226 (55.3%) of the study participants had a personal health certificate. The median monthly salary for the cleaners was 1600 Ethiopian Birr (ETB), with 178 cleaners (43.6%) earning less than or equal to 1500 ETB (table 1).

**Health behaviour-related characteristics of the study participants**

In a high proportion, 240 (58.7%) of the respondents did not read the available safety guidelines or manual at their workplace. Overall, 118 (28.9%) of the cleaners did not wear PPE. The most common reasons pointed out for not wearing PPE among participants were lack of PPE 51 (12.5%), lack of comfort 27 (6.6%) and lack of fit 22 (5.4%), while 18 (4.4%) of respondents supposed they did not need it to do their job safely. The majority of respondents did increase their frequency of hand hygiene practices during the COVID-19 pandemic. Consequently, 131 (32%) of respondents washed their hands less than or equal to 10 times per day, whereas 180 (44%) of respondents washed their hands more than 20 times per day. Of the participants, 214 (52.3%) of them reported that they did not change out their working clothes following work, but one-fifth (20.3%) of the participants reported they had a personal history of eczema (table 2).

**Table 1** Sociodemographic characteristics of cleaners working in healthcare institutions in Gondar city, Northwest Ethiopia, 2021 (N=409)

| Variables                  | n    | %    |
|----------------------------|------|------|
| Sex                        |      |      |
| Female                     | 302  | 73.8 |
| Male                       | 107  | 26.2 |
| Age in years               |      |      |
| 20–29                      | 210  | 51.3 |
| 30–39                      | 126  | 30.8 |
| ≥40                        | 73   | 17.8 |
| Marital status             |      |      |
| Married                    | 226  | 55.3 |
| Single                     | 125  | 30.6 |
| Divorced                   | 40   | 9.8  |
| Widowed                    | 18   | 4.4  |
| Educational status         |      |      |
| Cannot read and write      | 35   | 8.6  |
| Primary school             | 187  | 45.7 |
| Secondary school and above | 187  | 45.7 |
| Monthly salary (ETB)       |      |      |
| 700–1000                   | 26   | 6.4  |
| 1001–1500                  | 152  | 37.2 |
| >1500                      | 231  | 56.5 |
| Work experience            |      |      |
| <5 years                   | 278  | 68.0 |
| ≥5 years                   | 131  | 32.0 |

ETB, Ethiopian Birr.
Regarding their source of information, 104 (25.2%) of the respondents reported that they had information on workplace health and safety. The majority of the participants, 283 (69.2%) reported that they had information on workplace health and safety, training of skin hazards and job satisfaction were the variables correlated to contact dermatitis in the bivariable logistic regression analysis. However, after controlling for confounding variables in the multivariable binary logistic regression analysis, hand-washing frequency per day, personal history of eczema and training of skin hazards remained significant factors determining the occurrences of WRCD. WRCD was presented to be 1.73 times more common among cleaning professionals who washed their hands more than 20 times per day compared with counterparts who cleaned their hands 10 or fewer times per day (AOR=1.73, 95% CI (1.03 to 2.92)) at a p value of 0.039. The occurrence of contact dermatitis was also significantly influenced by a prior personal eczema history. Cleaning staff with a personal history of eczema were 1.46 times more likely to develop WRCD than those without such a history (AOR=1.46, 95% CI (1.01 to 2.42)) at a p value of 0.047. Moreover, a lack of training about skin hazards and job satisfaction remained significant factors in determining the occurrences of WRCD.

Prevalence of WRCD symptoms
The prevalence of self-reported WRCD symptoms among Gondar city healthcare institution cleaners during the last 12 months was 213 (52.1%) (95% CI (47.1 to 57.0)). A significantly higher prevalence of contact dermatitis was found among female cleaners compared with male cleaners (40.8% vs 11.3%), respectively (X²=4.80; p=0.029). Skin redness 26.9% (n=110), burning sensations 19.8% (n=81), blisters 19.6% (n=80) and itching 17.1% (n=70) were among the most frequently reported symptoms of skin disorders, as stated in figure 1. The most frequently affected skin body sites by contact dermatitis were the hands (hand dermatitis) 38.6% (n=158), arms 23.5% (n=96) and faces 19.3% (n=79), respectively (figure 2).

Factors determining the occurrence of WRCD symptoms
Associations between variables (dependents and independent variables) were established using a binary logistic regression OR (95% CI) model. Sex, frequency of hand washing and hand sanitising, personal history of eczema, periodic medical examination, information on workplace health and safety, training of skin hazards and job satisfaction were the variables correlated to contact dermatitis in the bivariable binary logistic regression analysis. However, after controlling for confounding variables in the multivariable binary logistic regression analysis, hand-washing frequency per day, personal history of eczema and training of skin hazards remained significant factors determining the occurrences of WRCD.

Workplace environment-related characteristics of the study participants
The majority of the participants, 283 (69.2%) reported that they had information on workplace health and safety. Regarding their source of information, 104 (25.2%) of them got it from their coworkers, 68 (16.6%) from websites or the internet, 42 (10.3%) from posters or notices at work, 39 (9.5%) from meetings at work and 30 (7.3%) from other sources (television, radio, published papers). The majority, 345 (84.3%) of the participants, claimed that they had not been trained on skin hazards. In terms of the presence of a hand washing facility in the workplace, 187 (45.7%) of the cleaners were employed in a facility with soap and water, 131 (32%) of them were employed in one with water only and 91 (22.2%) of them were employed in a workplace without a facility at all. Regarding psychosocial traits, 267 (65.3%) of respondents reported being dissatisfied with their current job and 240 (58.7%) of them reported feeling stressed at work (table 3).

Table 2  Showing health behaviour-related characteristics of respondents in Gondar city, Northwest Ethiopia, 2021 (N=409)

| Variables                                                                 |   n  | %    |
|---------------------------------------------------------------------------|------|------|
| Do you use available safety guidelines/manual at workplace?              | 169  | 41.3 |
| No                                                                       | 240  | 58.7 |
| Do you use personal protective equipment (PPE)?                          |      |      |
| Yes                                                                      | 291  | 71.1 |
| No                                                                       | 118  | 28.9 |
| What types of PPE do you use?                                            |      |      |
| Face mask                                                                | 127  | 31.1 |
| Rubber/latex gloves                                                      | 79   | 19.3 |
| Body wear                                                                | 46   | 12.2 |
| All                                                                      | 39   | 9.5  |
| Reasons of not using PPE                                                 |      |      |
| Lack PPE/not available                                                   | 51   | 12.5 |
| Lack of comfort                                                          | 27   | 6.6  |
| Lack of fit                                                              | 22   | 5.4  |
| Not needed                                                               | 18   | 4.4  |
| How many times do you wash your hands during a usual working day         |      |      |
| ≤10 times per day                                                        | 131  | 32.0 |
| 11–20 times per day                                                      | 98   | 24.0 |
| > 20 times per day                                                       | 180  | 44.0 |
| How much time do you spend on each hand washing during the COVID-19      |      |      |
| pandemic?                                                                |      |      |
| <40s                                                                     | 67   | 16.4 |
| 40–50s                                                                   | 293  | 71.6 |
| >50s                                                                     | 49   | 12.0 |
| How many times do you use disinfecting alcohol for hands in a usual      |      |      |
| working day during the COVID-19 pandemic?                                |      |      |
| 0–5 times per day                                                        | 96   | 23.5 |
| 6–10 times per day                                                       | 84   | 20.5 |
| 11–20 times per day                                                      | 127  | 31.0 |
| > 20 times per day                                                       | 102  | 25.0 |
| Do you change working cloth after work?                                  |      |      |
| Yes                                                                      | 195  | 47.7 |
| No                                                                       | 214  | 52.3 |
| Do you exchange of clothes to the other family member?                   |      |      |
| Yes                                                                      | 95   | 23.2 |
| No                                                                       | 314  | 76.8 |
| Do you have any personal history of eczema?                              |      |      |
| Yes                                                                      | 83   | 20.3 |
| No                                                                       | 326  | 79.7 |

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times higher chance of acquiring WRCD than those who had (AOR=2.06, 95% CI (1.16 to 3.63)) at a p value of 0.013, as shown in table 4.

DISCUSSION
A limited number of studies have been published in the medical literature addressing the prevalence of WRCD in healthcare cleaners around the world. This scant information is typically sourced from specialised workplace settings, such as healthcare facilities. Cleaning workers are a group of individuals who have frequent contact with water and chemical products, presenting a high risk for the development of WRCD. Therefore, we aimed to measure the prevalence of WRCD and associated factors among cleaners working in healthcare facilities in Gondar city, Northwest Ethiopia. Accordingly, 213 (52.1%) cases of WRCD were reported among the sampled cleaners, implying that nearly one out of every two cleaners had WRCD. Our survey also indicated that, washing hands more than 20 times per day, having a personal history of eczema and lacking training about skin hazards were independent variables that showed association with WRCD. This is likely explained as we collected the data during the COVID-19 epidemic, and cleaners in health facilities were considered one of the

Table 3  Work environment-related characteristics of cleaners working in healthcare institutions in Gondar city, Northwest Ethiopia, 2021 (N=409)

| Variables                                      | n  | %   |
|------------------------------------------------|----|-----|
| Working unit/room                              |    |     |
| Wards                                          | 190| 46.5|
| Laboratory/diagnostic                          | 91 | 22.2|
| Emergency                                      | 71 | 17.4|
| Toilet                                         | 57 | 13.9|
| Working hours per day                          |    |     |
| ≤8 hours                                       | 329| 80.4|
| >8 hours                                       | 80 | 19.6|
| Do you have any information on workplace health and safety? |    |     |
| Yes                                            | 283| 69.2|
| No                                             | 126| 30.8|
| Source of workplace health and safety information |    |     |
| Coworkers                                      | 104| 25.2|
| Website/internet                               | 68 | 16.6|
| Poster/notice at work                          | 42 | 10.3|
| Meeting at work                                | 39 | 9.5 |
| Others*                                        | 30 | 7.3 |
| Have you ever taken any training regarding skin hazards? |    |     |
| Yes                                            | 64 | 15.7|
| No                                             | 345| 84.3|
| Periodic medical examination available         |    |     |
| Yes                                            | 247| 60.4|
| No                                             | 162| 39.6|
| Hand washing facility in the working area       |    |     |
| No facility                                     | 91 | 22.2|
| Facility with water                             | 131| 32.0|
| Facility with water and soap                    | 187| 45.7|
| Does your skin changes improve when you are away from your normal work (eg, on weekends or for longer periods)? |    |     |
| Yes                                            | 302| 73.8|
| No                                             | 107| 26.2|
| Perceived job satisfaction                      |    |     |
| Satisfied                                      | 142| 34.7|
| Dissatisfied                                   | 267| 65.3|
| Perceived job stress                            |    |     |
| Stressed                                       | 240| 58.7|
| Not stressed                                   | 169| 41.3|

*Television, radio, published papers.
front-line workers for COVID-19 prevention, so they were expected to use COVID-19 personal prevention measures as recommended by the WHO, such as face masks, hand washing, disinfectants and other products that may affect the proportion of current WRCD among study populations. In this study, a very low percentage (19.3%) of workers used gloves. This could be because the number of COVID-19 cases in developing countries such as Ethiopia is rapidly increasing during the pandemic, and they are using the available gloves under conditions of limited resources.

Our finding was lower compared with previous studies in Poland (59%) and the UK (86%). Our result was, however, higher than studies conducted in Turkey (21.6%), Germany (30%), Indonesia (10.6%) and New Zealand (14.8%). This variation could be explained by differences in study period, measurement tool used (testing vs self-report), the study population’s knowledge differences about the variable of interest, the labour inspection system, the skin protection supply at work, exposure to materials (products) used for cleaning purposes and disinfectants and existing health systems in different countries regarding WRCD prevention and control among cleaners in healthcare facilities. The differences might also be due to the differences in workplace illness reporting cultures and data collection methods used. As well, the prevalence of WRCD has not been well defined between countries, partly because of differences in definitions, diagnostic criteria and occupational health and safety practices in the workplace.

In response to the fear of a COVID-19 pandemic, an increasing daily frequency of hand washing was

### Table 4  Bivariable and multivariable analysis on associated factors of work-related contact dermatitis symptoms among cleaners in a healthcare institution in Gondar city, Northwest Ethiopia, 2021 (N=409)

| Variables                                      | Contact dermatitis |
|------------------------------------------------|--------------------|
|                                                | Yes, n (%)         | No, n (%)         | COR with 95% CI | AOR with 95% CI | P value |
| Sex                                            |                    |                   |                |                |        |
| Male                                           | 46 (43.0)          | 61 (47.0)         | 1              | 1              |        |
| Female                                         | 167 (55.3)         | 135 (44.7)        | 1.64 (1.05 to 2.56) | 1.37 (0.82 to 2.31) | 0.230 |
| Hand washing frequency per day                 |                    |                   |                |                |        |
| ≤10 times per day                              | 58 (44.3)          | 73 (55.7)         | 1              | 1              |        |
| 11–20 times per day                            | 46 (46.9)          | 52 (53.1)         | 1.11 (0.66 to 1.88) | 1.07 (0.60 to 1.92) | 0.807 |
| >20 times per day                              | 109 (60.6)         | 71 (39.4)         | 1.93 (1.22 to 3.05) | 1.73 (1.03 to 2.92)* | 0.039 |
| Hand sanitising frequency per day              |                    |                   |                |                |        |
| 0–5 times per day                              | 55 (57.3)          | 41 (42.7)         | 1              | 1              |        |
| 6–10 times per day                             | 44 (52.4)          | 40 (47.6)         | 0.82 (0.46 to 1.48) | 0.95 (0.51 to 1.76) | 0.866 |
| 11–20 times per day                            | 64 (50.4)          | 63 (49.6)         | 0.76 (0.44 to 1.29) | 0.82 (0.47 to 1.44) | 0.493 |
| >20 times per day                              | 50 (49.0)          | 52 (51.0)         | 0.72 (0.41 to 1.26) | 0.75 (0.42 to 1.34) | 0.326 |
| Personal history of eczema                     |                    |                   |                |                |        |
| Yes                                            | 50 (60.2)          | 33 (39.8)         | 1.52 (0.93 to 2.47) | 1.46 (1.01 to 2.42)* | 0.047 |
| No                                             | 163 (50.0)         | 163 (50.0)        | 1              | 1              |        |
| Periodic medical examination                   |                    |                   |                |                |        |
| Yes                                            | 137 (55.5)         | 110 (44.5)        | 1              | 1              |        |
| No                                             | 76 (46.9)          | 86 (53.1)         | 0.70 (0.48 to 1.06) | 0.66 (0.43 to 1.00) | 0.051 |
| Information on workplace health and safety     |                    |                   |                |                |        |
| Yes                                            | 156 (55.1)         | 127 (44.9)        | 1              | 1              |        |
| No                                             | 57 (45.2)          | 69 (54.8)         | 0.67 (0.44 to 1.03) | 0.71 (0.46 to 1.11) | 0.129 |
| Training regarding skin hazards                |                    |                   |                |                |        |
| Yes                                            | 26 (40.6)          | 38 (59.4)         | 1              | 1              |        |
| No                                             | 187 (54.2)         | 158 (45.8)        | 1.73 (1.01 to 2.97) | 2.06 (1.16 to 3.63)* | 0.013 |
| Job satisfaction                               |                    |                   |                |                |        |
| Satisfied                                      | 66 (46.5)          | 76 (53.5)         | 1              | 1              |        |
| Dissatisfied                                   | 147 (55.1)         | 120 (44.9)        | 1.41 (0.94 to 2.12) | 1.46 (0.95 to 2.25) | 0.083 |

*Significant at p value<0.05 in multivariable logistic regression analysis, Hosmer and Lemeshow test p value=0.5212.

1, reference category; AOR, adjusted OR; COR, crude OR.
documented in both Healthcare Workers (HCW) and non-Healthcare Workers (HCW) populations. The findings from our analysis indicated that the probability of developing WRCD increased with daily hand washing frequency. This result was supported by existing literature. This could be due to the fact that frequent hygienisation of hands generates various changes in skin texture, ranging from the development of cutaneous xerosis (dryness of the skin) up to long-lasting contact dermatitis. When diligent hand hygiene practices are implemented, workers are exposed to excessive amounts of water contact and left in a wet work environment, which causes extensive swelling of the stratum corneum (the skin’s outer layer) and disruption of the ultrastructure of intercellular lipids and increases skin permeability and sensitivity to physical or chemical irritants.

In addition, when measures for frequent hand hygiene are implemented, there might be repeated use of soaps, surfactants, detergents or solvents. These substances used for domestic cleaning are weak irritants and are usually very well tolerated. Nevertheless, repeated exposure to these substances can lead to chronic cumulative contact dermatitis and a history of atopic dermatitis or allergic contact dermatitis. One possible explanation is that people with a history of eczema have an immune system that over-reacts to even minor allergens or irritants. This over-reaction might irritate the skin and make dermatitis more likely. A similar finding was made in Northern China, where having a history of eczema increases the likelihood of occupationally induced hand contact dermatitis by five times. This was due to the fact that skin with eczema or atopy is more likely to become inflamed and that the healing or restoration of the skin takes longer time.

It is also a result of the respondent’s immune system being compromised by eczema or atopic dermatitis, which disrupts the skin’s physiological defences. This made someone with atopic skin/eczema more likely to develop WRCD. This occurred because the skin became more susceptible to irritation by lowering the irritation threshold in a person with an eczema history. Moreover, contact dermatitis is T-cell mediated inflammation of the skin caused by repeated skin exposure to haptens in a sensitised individual. As a reference, the Interleukin 4/Th2 pathway increases an individual’s susceptibility to eliciting a response to environmental triggers.

The other important contributing factor to WRCD was a lack of training on skin hazards. There is little evidence to support the hypothesis that workers’ training on skin hazards influences the incidence of WRCD. Similar results were reported in other studies. The potential explanation for our finding is due to the fact that training on skin hazards interventions have been shown to be effective for improving prevention practices and reducing the occurrences of WRCD. It is commonly understood that training in workplace health and safety; such as skin hazards, will increase employees’ knowledge and awareness of ways to prevent and control the risks and hazards associated with adverse health conditions, as this generally boosts early recognition and notification of the conditions. Furthermore, the provision of safety training at the earliest possible period of employment could enhance workplace safety norms and procedures. Investigations also revealed that workplace health and safety training encouraged workers to identify and disclose health concerns as soon as possible.

This study was undertaken among cleaners employed in healthcare facilities who are more prone to developing WRCD due to exposure to various cleaning solution constituents in their working environment. There are only a few published studies in the scientific literature that examine the prevalence and risk factors of work-related dermatitis among cleaning workers. This study would likely add a significant amount of evidence to the scant existing literature on the prevalence and causes of WRCD. There are certain limitations to this study. The study was based on participants’ self-reported data. In self-reported research, there is a risk of recall bias. Participants’ responses may also be susceptible to social desirability bias, which leads them to give answers that are socially acceptable. To decrease social desirability, however, precautions were taken by making sure that only study participants were present during data collection and that data confidentiality was upheld. Besides, the finding was not supported by clinical diagnoses, such as patch testing, which helps identify work-related irritants and allergic contact dermatitis. However, we made use of the validated NOSQ, which is a standardised tool for measuring self-reported prevalence of skin dermatitis. Furthermore, since this research was a cross-sectional study, it might be difficult to draw conclusions about the temporal relationship between WRCD and factors contributing to its occurrence.

CONCLUSION

WRCD is a common work-related skin problem that is underdiagnosed in the global healthcare facility cleaner.
population. This study revealed that nearly one in two cleaners had WRCD due to their work in healthcare facilities during the COVID-19 pandemic, indicating a significant prevalence of the work-related skin problem. Washing hands more than 20 times per day, a personal history of eczema, and a lack of training about skin hazards were important factors in the occurrence of WRCD. Thus, this study suggests that the epidemiology of WRCD should be regularly updated to identify the most recent risk factors for the incidence of dermatitis so that successful treatments and preventive measures can be implemented. Hand washing frequency per day may be optimised as a preventative measure to reduce the risk of contact dermatitis. Applying moisturising skin care products after hand cleansing is an essential step in keeping the skin hydrated and preventing further abnormal skin reactions. Provision of training on skin hazards for healthcare cleaners and the provision of education for people with atopy about the avoidance of exposure to skin irritants are the most important recommendations for the prevention of dermatological-related disorders.

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