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**HAND DERMATITIS AMONGST HEALTH CARE WORKERS  
DURING COVID-19 PANDEMIC**

**LITERATURE REVIEW**

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## ABSTRACT

**Background.** Hand dermatitis is an inflammatory condition which affect the skin of the hands, often resulting from repetitive exposure to cleaning agents and other irritants, such as, soaps, water, mechanical friction from hand gloves. During the pandemic of COVID-19, intensified infection control practices led to more prolonged and frequent hygiene on hands. Studies reported that the average number daily disinfections among healthcare workers rose from 8-10 before the pandemic to over 20 during COVID-19 (Guertler et al., 2020; Lan et al., 2020). Consequently, the prevalence of hand dermatitis among healthcare workers also rose sharply, reaching up to 74% in some hospitals compared to 20-30% before the pandemic (Lin et al., 2020; Kiely et al., 2021).

**Aim.** The aim of this paper was to examine how occupational, hygiene-related, and personal factors contributed to hand dermatitis development during COVID-19 pandemic amongst healthcare workers.

**Materials and Methods.** A narrative literature review was conducted using Google Scholar, and analyzed 30 peer-reviewed articles published between 2020 and 2024. The selected studies included cross-sectional surveys, systematic reviews, and observational studies focusing on the prevalence, risk factors, and preventive strategies related to occupational hand dermatitis in healthcare settings.

**Results.** Across the reviewed literature, hand dermatitis was highly prevalent among healthcare workers during the pandemic, with rates ranging from 13% to over 50% worldwide. Frequent hand washing, exposure to alcohol-based sanitizers, and prolonged gloves usage were the main contributing factors, often aggravated by atopic skin. These symptoms were reported to affect workers' comfort, their capacity to maintain hygiene compliance, and even their quality of life.

**Conclusion.** These findings highlighted the importance for an improved preventive measures and institutional support to help maintain healthcare workers' skin health while upholding infection control standards. Proactively addressing occupational skin diseases can help ensure both adherence to hygienic procedures and employees' well-being in future public health emergencies.

**Keywords:** Hand dermatitis; Healthcare workers; COVID-19; Occupational skin diseases; Hand hygiene.

## KOPSAVILKUMS

**Ievads.** Roku dermatīts ir iekaisīga ādas slimība, kas ietekmē roku ādu un bieži attīstās atkārtotas saskares rezultātā ar mazgāšanas līdzekļiem un citiem kairinātājiem, piemēram, ziepēm, ūdeni un mehānisku berzi no cimdiem. COVID-19 pandēmijas laikā pastiprināta infekciju kontroles prakse izraisīja biežāku un ilgāku roku higiēnas veikšanu. Pētījumi liecina, ka veselības aprūpes darbinieku vidū roku dezinfekcijas reižu skaits pieauga no vidēji 8-10 reizēm pirms pandēmijas līdz vairāk nekā 20 reizēm dienā COVID-19 laikā. Rezultātā roku dermatīta izplatība veselības aprūpes darbinieku vidū būtiski palielinājās, sasniedzot līdz pat 74% dažās slimnīcās salīdzinājumā ar 20-30% pirms pandēmijas.

**Mērķis.** Šī darba mērķis bija izpētīt, kā aroda, ar higiēnu saistītie un personīgie faktori veicināja roku dermatīta attīstību COVID-19 pandēmijas laikā veselības aprūpes darbinieku vidū.

**Materiāli un metodes.** Tika veikts naratīvs literatūras pārskats, analizējot 30 recenzētus rakstus no Google Scholar, kas publicēti laika posmā no 2020. līdz 2024. gadam. Tika izvēlēti pētījumi, kuros bija analizēta roku dermatīta izplatība, riska faktori un preventīvie pasākumi veselības aprūpes iestādēs.

**Rezultāti.** Analizētajā literatūrā tika konstatēta augsta roku dermatīta izplatība veselības aprūpes darbinieku vidū pandēmijas laikā, ar rādītājiem, kas dažādās valstīs svārstījās no 13% līdz vairāk nekā 50%. Bieža roku mazgāšana, alkoholu saturošu dezinfekcijas līdzekļu lietošana un ilgstoša cimdu valkāšana bija galvenie riska faktori, ko bieži pastiprināja atopiskās ādas īpatnības. Tika uzsvērts, ka simptomi ietekmēja darbinieku komfortu, spēju ievērot higiēnas prasības un dzīves kvalitāti.

**Secinājumi.** Šie atklājumi uzsver nepieciešamību uzlabot preventīvos pasākumus un iestāžu atbalstu, lai palīdzētu saglabāt veselības aprūpes darbinieku ādas veselību, vienlaikus ievērojot infekciju kontroles standartus. Savlaicīga profesionālo ādas slimību novēršana var veicināt gan higiēnas noteikumu ievērošanu, gan darbinieku labklājību nākotnes sabiedrības veselības ārkārtas situācijās.

**Atslēgvārdi:** roku dermatīts; veselības aprūpes darbinieki; COVID-19; arodslimības; roku higiēna.

## **LIST OF ABBREVIATIONS**

ACD – Allergic Contact Dermatitis  
AHDs – Alcohol-based hand disinfectants  
CDC – Centres for Disease Control and Prevention  
COVID-19 – Coronavirus Disease 2019  
DLQI – Dermatology Life Quality Index  
HCWs – Healthcare Workers  
HECSI – Hand Eczema Severity Index  
ICD – Irritant Contact Dermatitis  
OCD – Occupational Contact Dermatitis  
OSD – Occupational Skin Disorders  
QoL – Quality of Life  
WHO – World Health Organization

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## INTRODUCTION

Occupational skin disorders are one of the most prevalent work-related health issues in industrialized cultures. Contact dermatitis being the most commonly reported subtype. It classifies into two types which are irritant contact dermatitis and allergic contact dermatitis. Distinguishing between the two types is challenging, which is why diagnosis is typically made by excluding ACD with the help of allergy patch test. It was reported that between 6,7% and 10,6% of people globally had lost their jobs due to hand dermatitis, with the occupations at risk being in healthcare, agriculture, construction, hairdressing, as well mechanics and machinists. OCD came with significant impact on work productivity and employee costs, where affected personnels would need extended leave from their jobs, relocation, and adjustments to procedures at work. OCD may cause limitations in the social and home activities, further can contribute to negative psychological impacts. Anxiety, depression, low self-esteem, and social disengagement are examples of detrimental psychological effects. According to studies, psychological anguish associated with occupational contact dermatitis affects as many as 50% of people with the illness. (AlEdani G.C., 2024)

The emergency of the COVID-19 pandemic dramatically altered hygiene practices, particularly for healthcare workers, managing patient care on the frontlines. Healthcare workers dealing with COVID-19 included a great amount of wet work, which could be the use of alcoholic hand sanitisers both before and after patient care, or for visible dirty hands with water and soap. It was anticipated the use of disposable gloves when in contact with bodily fluids. Exposure of wet work was considered as a major risk factor the development and occurrence of hand eczema. Although there are limited studies, there was been reported skin damage especially hand eczema that has been caused by exposure to wet work among HCWs. (Mewati S.K., 2024)

Another risk factor was the use of alcohol-based sanitizers for the hand being more than 60% of alcohol concentration. About 66,1% of health workers wash hands with the frequency more than 10 times a day and only 22,1% of health workers uses hand moisturizers after. Although hand sanitizers that is alcohol-based have bactericidal effects that could kill normal skin flora, as well being important for the maintenance of skin's defenses. Alcohol-based hand sanitizers can denature structural proteins like keratin in the outer skin layer, alter intercellular lipids, which can lead to the development of dermatitis. (Rianto T.A., 2024)

Numerous studies showed that the usage of gloves could lead to frequent cases of irritant contact dermatitis, allergic contact dermatitis, and contact urticaria. HCWs were required to utilize medical gloves for long periods of time to protect themselves when being around patients with COVID-19. Furthermore, this led to increased number of reported hand dermatitis cases related to usage of gloves among HCWs, which became an importance in reviewing the issue. (Gunasegaran, 2024, Hamnerius P.B., 2021, Larese Filon P. et al., 2023)

**The aim** of the thesis was to analyse hand dermatitis amongst healthcare workers during COVID-19. Following **tasks** were set to reach the aim. Firstly, to examine how occupational, hygiene-related, and personal factors contributed to hand dermatitis development during COVID-19 pandemic amongst healthcare workers. Furthermore, the dermatological consequences from intensified routines of hand hygiene were examined. And finally, to summarise how these consequences were addressed in workplace and what are potential preventative strategies in similar conditions.

**Research question:** During the COVID-19 pandemic, what occupational, personal, and hygiene-related factors led to hand dermatitis among healthcare workers, and how were these impacts handled by workplace conditions and preventive measures?

**Materials and methods.** A qualitative, thematic synthesis method was utilized to interpret and organize the data, examining how hygienic routines that were pandemic-driven could contribute to the skin damages, and how these also were addressed in different healthcare environments. A total of 30 full-text, and peer-reviewed articles were chosen using Google Scholar as the search engine. This review is limited to publications between 2020-2024 years-period, including articles that explored hand eczema or occupational skin damage during the COVID-19 pandemic periods in healthcare settings. In addition, articles that were not published in the English language were excluded.

Each study was read in full volume, summarized, and categorized into one or several thematic areas of hand dermatitis: prevalence and burden, personal predisposition factors, occupational risk factors and workplace conditions, chemical and product-related triggers, consequences of hand dermatitis, prevention and management. Articles that did not include healthcare workers,

were published before COVID-19 period, or not addressing dermatological issues that were hand-related were excluded.

The following **key words** were used in the search: hand dermatitis, hand eczema, healthcare workers, COVID-19, occupational skin disorders, skin damage, gloves, hand hygiene, personal risk factors, hand disinfectants, concomitant disorders, prevention, occupational exposure.



## 1. LITERATURE REVIEW

### 1.1 Definition

Term “dermatitis” is often used with qualifiers, like for instance “contact dermatitis”, which describes several different disorders of the skin. An inflammation of the skin involving the skin layers epidermis and superficial dermis is often referred to as “dermatitis” or “eczema”. When the term “eczema” is used alone it usually refers to atopic dermatitis or “atopic eczema”. The term “eczematous” as well involves some crusting, scaling, or oozing of serous, as opposed to mere erythema. (Ahmed Z.H. et. al., 2021)

When it comes to see it in an occupational settings, e.g. in healthcare workers, the most prevalent form of skin condition is irritant contact dermatitis. It arises from repeated exposure to disinfectants, soaps, water as well as mechanical friction from hand gloves. *Stratum corneum*, the skin’s primary barrier, became compromised with repetition of occlusion and cleansing, that led to inflammation, furthermore, higher susceptibility to pathogens and allergens. (Chaudhari K.P. et. al., 2023)

The World Health Organization and Centres for Disease Control and Prevention provided guidelines that recommended sanitation or handwashing multiple times within a workday. In this context, exposure of aggressive hand hygiene control was noted in healthcare workers more than in the pre-pandemic periods. It is vital to understand the dermatological consequences that may come from this. Not only would the occupational skin disease affect the individual’s health and comfort, but it could also reduce the compliance of protocols of hand hygiene, unconsciously even increase the infection risk. Therefore, this issue is both of occupational and public health concern. (Bhatt P.K., 2024)

## **1.2 Prevalence of hand dermatitis during the COVID-19 pandemic**

COVID-19, an infectious disease that was a cause from severe acute respiratory syndrome called coronavirus 2 (SARS-CoV-2 virus). A cross-sectional study, Mewati et al. made a survey involving healthcare workers (n=390) in India, assessing the prevalence of hand dermatitis during COVID-19 pandemic. It resulted in an increase in dermatological issues among healthcare workers, with the most emerging occupational skin condition being hand dermatitis. The review showed that 26,2% (n=102/390) had features of hand dermatitis. (Mewati S.K., 2024)

In another cross-sectional study conducted by Chaudhari et al. involving 200 healthcare workers in India, a prevalence of hand eczema, with the inclusion of new onset as well as exacerbation of pre-existing conditions was 47% . (Chaudhari K.P. et. al., 2023)

Erdem et al. made a clinical evaluation of healthcare workers (n=89) in COVID-19 units in Turkey, resulting in 50.5% with signs of hand eczema confirmed by dermatological examination. The prevalence aligned with self-reported data from other research studies, strengthened diagnostics by incorporating objective assessments. The authors noted, that most of the cases classified as mild, presented with dermatologic symptoms including dryness, scaling, and erythema. This reinforces the widespread of dermatologic impact of hand hygiene practices during the pandemic-era in clinical settings. (Erdem A.C., 2020)

In a study conducted by Symanzik et al. reports of 5.8% prevalence of hand eczema among German healthcare workers during the pandemic. The authors used Osnabrueck Hand Eczema Severity Index (OHSI) to dermatologically assess the condition. It clinically confirmed that rate was slightly higher than the self-reported rates (4.6%) in the same cohort, which emphasized the value of clinical evaluation objectively. (Symanzik B. S. et. al., 2022)

Celik et al. constructed a study in Turkey, which mentioned a dramatically increased symptoms of hand eczema during the COVID-19 pandemic among healthcare workers. The prevalence raised from 39.5% pre-pandemic to 79.3% during the pandemic, which were based on self-reported symptoms. This remarkable increase demonstrates the impact of intense hygiene protocols effect on skin health, especially observed among physicians and nurses with high workloads exposure. Although the study also assessed working hours, no statistically

association was found between weekly or daily workload and hand eczema prevalence. (Celik O., 2020)

In a survey among of 5.094 healthcare workers in nine hospitals in Sweden reported a one-year prevalence of hand eczema was 29.0%. Although, were reported lower rates in other regions, the prevalence demonstrated that the development of hand eczema remained an actual occupational concern. This is true even in countries with advanced occupational health systems and with access to preventive measures. The Scandinavian data, strengthens the global perspective on hand eczema prevalence during COVID-19 pandemic. (Hamnerius P.B., 2021)

Reinholz et al. described a significant increase in the prevalence of hand eczema among healthcare workers in a dermatology department in Germany, showing an increase from 12.5% pre-pandemic to 39.5% during the COVID-19 pandemic. This potential spike was attributed to intensified hand hygiene routines, especially the increased usage of soap and disinfectants. The review highlights how infection control measures during pandemic-era had a measureable impact in European clinical settings. (Reinholz M.C. et al., 2021)

AlEdani et al. via a systematic review of 11 research papers related to occupational contact dermatitis during COVID-19 infection, had summarized and reported increased incidences in Asia, Europe, and the Middle-East. Which further showed that it was a global trend and not only isolated to one country or hospital, leading to the true prevalence being even higher. In countries like Sweden, Germany, Denmark, Finland, UK, Singapore, Australia and USA, the prevalence of contact dermatitis was remarkably high, reaching 90-95%, and was most commonly associated with OSD. The particularly high rates in these countries were explained by the presence of mandatory reporting systems and well-established national registries (e.g., in Germany, Finland, and Denmark), which capture more cases compared to countries with voluntary reporting systems such as the UK and Australia. (AlEdani G.C., 2024)

Bhatt et al. emphasized the importance of measuring prevalence within healthcare systems, as it can substantially influence clinical performance. Among the HCWs who experienced hand dermatitis, were difficulties to wash, sanitize hands, and wear gloves, as it would be irritated and painful to do. Leading to feeling of discomfort during their work and a reduction in continuing compliance in their hygiene. (Bhatt P.K., 2024)

Larese Filon P. et al. managed a systemic review by analysing the incidence of occupational contact dermatitis among healthcare workers, from 16 research studies, where data was collected from 1987 to 2013. It further reported rates of incidence ranging from 0.6 to 780 per 10,000 person-year, with more increased rates among dental professionals and nursing trainees. The review highlighted differences in methodology among cohort and register-based studies, and an underestimation of burden of the disease in already existing data. It therefore emphasized the importance for standardized, ongoing observation in both pandemic and non-pandemic periods. (Larese Filon P. et al., 2023)

### **1.3 Occupational Risk Factors**

Frequent handwashing in clinical settings has led to increased exposure to wet work, which has been identified as a significant external risk factor for the development of hand eczema. The repeated use of water, detergents, and soaps depletes the lipid layer of the epidermis, compromising the skin's natural barrier. This breakdown facilitates irritation and increases the risk of occupational skin conditions such as hand eczema. The intensified hygiene protocols introduced during the COVID-19 pandemic further exacerbated this issue, making it a growing concern for HCWs worldwide. Bhatt et al. showed that hand washing more than 10 times a day at the workplace was associated with a statistically significant increase in occurrence of hand eczema. (Bhatt P.K., 2024)

A study in India shows that from the participants that developed hand eczema many were practicing intense use of hand washing and sanitizers. Similar findings reported from a study done in China which defined frequent hand washing as more than 10 times a day, as well as wearing medical devices for more than 6 hours among healthcare workers. The findings showed a higher risk of skin damage in corresponding areas compared to those who were doing it less times. (Lan J. et al., 2024). In the Mewati et al. study, the use of hand sanitizers for more than 20 times a day showed a significant association with hand eczema, and the same study also noted a similar association with hand washing frequency exceeding 10 times daily. The use of gloves for extended duration was said to lead to skin maceration, because of the increased occlusion, sweating, and heat. During the pandemic, wearing gloves for more than one hour had a significant statistically association with hand eczema. It was explained by healthcare workers following combined intensive hand washing and use of hand sanitizers would further advance manifestation of hand eczema. (Mewati S.K., 2024)

Schütte et al. managed a systemic review and also meta-analysis of 29 studies containing over 846,000 participants to find key work-related risk factors and personal-related risk factors for occupational contact dermatitis. Authors confirmed that frequent wet work exposure 1.56 times increased the risk of irritant contact dermatitis (OR=1.56, 95% CI=1.21-2.01). While with the presence of pre-existing atopic dermatitis increased even more (OR=2.44, 95% CI=1.89-3.15). These findings were supported statistically, which reinforced previous reports observed, and it underlines the importance to evaluate both personal medical history and occupational exposures among HCWs at high risk. (Krajewski M.S., 2021)

Celik et al. created a study in Turkey, where the authors evaluated both occupational and environmental contributors to the development of hand eczema. Healthcare workers frequently performing handwashing, prolonged usage of gloves, and an with increased exposure to disinfectants were said to be associated with a higher burden of symptoms. In spite of the availability of preventive measures, some workers have reported regular usage of skin moisturizers, which can suggest a gap in the middle of awareness and protective behaviour. In addition, the study found that the prevalence of hand eczema increased from 39.5% before the pandemic to 79.3% during the pandemic, based on self-reported symptoms, highlighting the impact of intensified hygiene protocols on skin health. (Celik O., 2020)

Rianto et al. examined HCWs in Indonesia and connected some of the risk factors to the high prevalence of CD were due to, changes in the habit of hand washing with a frequency of more than 10 times per day and with the duration of more than 2 minutes. Another risk factor was the use of alcohol-based sanitizers for the hand being more than 60% of alcohol concentration. About 66,1% of HCWs wash hands with similar frequency and only 22,1% of health workers used hand moisturizers after. Hand sanitizers that is alcohol-based have bactericidal effects that could kill normal skin flora, being important for the maintenance of the skin's defenses. The study showed, excessive use causing damages protein structure localised in the outer layer of skin, which can lead to the development of dermatitis. The risk would further be exacerbated by daily use of gloves and having history of skin condition, such as eczema or allergic rhinitis. Study shows that more than 75% of HCWs that uses hand sanitizers more than 10 times a day of reported skin symptoms, such as irritation, which showed a correlation between the disrupted skin barrier and hygiene protocol intensity. (Rianto T.A., 2024)

Hamnerius et al. discovered dose-dependent associations across hand eczema and daily soap usage exceeding 20 times and glove usage more than three hours in the same cohort. Alcohol-based hand disinfectants (AHDs) were not associated with hand eczema after adjustments done multivariated. However, AHD formulations done temporary that was produced during emergency shortages were frequently more reported by workers with hand eczema. These findings emphasized not only the intensity of the exposure but also variability of product formulation as important factors. (Hamnerius P.B., 2021)

Abdi et al. managed a study involving 142 hospital workers in Iran. Authors found that handwashing more than 10 times a day together with the usage of liquid soap contributed with a significant association with higher risk of development of hand dermatitis ( $p=0.017$  and  $p=0.047$ , respectively). It showed highest prevalence of symptoms among professions such as laboratory staff and nurses, which reflected variations in the intensity of exposure. Liquid soap identification as a independent risk factor adds detail to the understanding of how occupational exposures can be related to disruption of the skin barrier. (Shahmohammadi R.A. -A., 2022)

Guertler et al. compared hand eczema onset among healthcare workers in a non-COVID surgical department and COVID-19 intensive care unit in Germany. Despite the differences when it comes to patient exposure, it was reported in both groups increased rates of skin symptoms. Including dryness, itching, and erythema, indicated an extension of occupational risk beyond frontline COVID-19 units. Their findings concluded that hygiene practices that are intensified together with prolonged usage of gloves across all clinical settings contributed significantly to the risk of hand dermatitis. (Guertler M.S., 2020)

Lan et al. established key occupational exposures that contributed to the development of hand eczema among healthcare workers in Taiwan. Including prolonged glove use for more than 6 hours per day and frequently washing hands for more than 10 times per day were associated with an increased odds ratio of eczema of (OR:2,17) and (OR:1,92) respectively. The review also established to find that nurses were most affected group, which reflected the intensity of exposure of care roles being frontline. (Lan K.B., 2021)

## 1.4 Personal Predisposing Factors

Individual susceptibility was said to play a key role in development of hand dermatitis. Mewati et al. discovered that certain healthcare workers have been more predisposed due to history of underlying dermatological conditions. This showed a statistically significant association between having history of atopic dermatitis and hand eczema occurrence during the COVID-19 pandemic in India. The study further highlighted that a prior history of atopic diathesis was a significant risk factor for new episodes of hand eczema (OR=2.04, 95% CI=1.08-3.83). Female healthcare workers demonstrated a slightly higher prevalence (29.6%) compared to males (22.5%), and nursing staff (27.9%) were somewhat more affected than physicians (23.9%). (Mewati S.K., 2024)

AlEdani et al. confirmed similar interpretation, which made it not an unique finding, as it identified that individuals having pre-existing atopic skin condition being more vulnerable to occupation related dermatitis. Emphasizing that sensitivity of skin played a significantly role in increasing the severity and risk of developing hand eczema among healthcare workers. (AlEdani G.C., 2024)

Ahmed et al. constructed a review detailed of genetic contributors to hand eczema, stating the role of filaggrin (FLG) mutations in skin barrier impairment function and increasing susceptibility among non-atopic individuals. Other genes implicated including TNF-alpha polymorphisms, LCE gene deletions, SPINK5, and IL-1A variations. In addition, it was emphasized that smoking and psychological stress could potentially be modifiable risk factors that could contribute to the onset and persistence of the disease. (Ahmed Z.H. et. Al., 2021)

Celik et al. identified significant associations between eczema risk and personal predisposition in Turkey. Having history of atopy among healthcare workers had 1,7 times higher risk of developing hand eczema, it also mentioned that female workers had markedly higher risk. Highlighting the importance of gender-related and genetic susceptibility in occupational hand dermatitis. (Celik O., 2020). Consistent with the previous studies, Symanzik et al. confirms that atopic skin condition significantly increases the risk of new onset hand eczema development among healthcare workers (p=0.009). (Symanzik B. S. et. al., 2022)

Chaudhari et al. noted that 26 from 200 participants reported aggravation of hand eczema in India. The most common aggravator for the development of hand dermatitis among healthcare workers during the COVID-19 pandemic was psychological stress that might have contributed to the development of exacerbations of hand eczema. (Chaudhari K.P. et. al., 2023)

Individuals with preexisting history of sensitive skin or atopic dermatitis were especially at risk during intensified hand hygiene protocol periods, such as the COVID-19 pandemic. The study emphasized that preventive strategies to individual skin needs should be adapted rather than being applied the same to all healthcare workers. For more effective long-term management of occupational skin health, recognising and addressing the individual risk factors was important. (Carvalhais T.S., 2024)

Alhalwani et al. in the cross-sectional study in Saudi Arabia at National Guard Institute found that participants being female and also participants aged 31-40 years had significantly higher rates of dermatological symptoms. Even if the study included both healthcare workers and non-clinical workers, the demographic trends had aligned with more broad discovery of susceptibility of to hand dermatitis being gender-related and age-related. The study further reinforced previous observations that skin responses to sanitizers usage individually can vary based on lifestyle and biological factors, which would make certain groups more susceptible during high-exposure periods, such as the pandemic. (Alhalwani, 2023)

### **1.5 Chemical and Product-Related Triggers**

Additionally, to the mechanical factors being trigger for the development of dermatitis, it was said that chemical exposures included in certain hygiene products could have contributed significantly to worsening or developing hand dermatitis during COVID-19 pandemic among healthcare workers. Rianto et al. identified that alcohol-based hand sanitizers was a primary source for causing irritation. Specific allergens such as propylene glycol, isopropyl alcohol, as well as added fragrances was said to increase the risk of development of contact dermatitis. (Rianto T.A., 2024)

Bhatt et al. further showed that applying repeatedly alcohol-based hand sanitizers, especially those that contained fragranced or other harsh ingredients, could lead to increased damage of the skin among healthcare workers in the United States. Further explained that while hand



sanitizers are essential factor for infection control, the frequent usage without any skin protection accompanied could lead to impaired skin barrier. Highlighting as well that certain alcohols and fragrances were known as irritants, especially if they were used on already compromised or dry skin. Therefore the study underscores the importance of carefully selecting hand sanitizers with minimal irritant or allergic responses. (Bhatt P.K., 2024)

Sawada et al. made a study in Japan that expands the list of chemical agents that appeared problematic by highlighting disinfectants containing additional irritants such as benzalkonium chloride and sodium hypochlorite. Mentioned substances that often was detected in cleaning solutions were related with enhanced inflammatory responses, further weakening the barrier of the skin. (Sawada Y., 2023)

Other studies similarly mentioned that prolonged exposure to hand sanitizers including alcohol could contribute to disruption of the skin barrier, which led to worsening of preexisting dermatological conditions, such as eczema. It highlights the cumulative effect of chemical exposure being repeated in clinical facilities, particularly if not balancing it with skin care measures. (Chaudhari K.P. et. al., 2023, AlEdani G.C., 2024)

Taken together, choosing skin friendly product are not only essential for individuals comfort, but also for keeping the skin barrier function intact. Prevention methods, therefore, should both address the composition of disinfection products and it's frequency of usage in healthcare settings.

## **1.6 Workplace Conditions and Hygiene Demands**

Demands of workplace hygiene during the COVID-19 pandemic shaped significantly the patterns of exposure that was contributing to the development of hand dermatitis among healthcare workers. Mewati et al. observed during the pandemic the requirements that healthcare workers performed, including hand hygiene more than 20 times a day. It meant both the use of alcohol-based sanitizers and handwashing done mostly within short intervals. It also highlighted the usage of gloves for more than 3 hours per shift also took part in the development of skin irritation. Conditions were operated by strict infection control protocols that were performed across COVID-dedicated hospital settings in India. (Mewati S.K., 2024)

Chaudhari et al. reported that healthcare workers in India wears gloves for extended periods from typically 4 to 8 hours every shift. The prolonged occlusion combined with glove removal and reapplications has shown to be a significant aggravating factor for hand dermatitis. It further mentions that the demanding nature of shifts during the pandemic left crucial time for preventative skin care routines, which also could have contributed in worsening skin conditions. (Chaudhari K.P. et. al., 2023)

AlEdani et al. emphasized the intensified pandemic-related hygiene worldwide among healthcare systems. The protocols consisted of mandatory and frequent usage of gloves and sanitizers, sometimes without parallel skin protection measures. Author mentions also that the healthcare workers were under a lot of pressure with compliance to those standards, often when skin symptoms emerged. It suggested that there was a lack of adequate dermatological safeguards during the pandemic. (AlEdani G.C., 2024)

From another broader perspective on occupational health, Carvalhais et al. had framed overexposure to hand sanitizers and disinfectants as a hazard rather than being an individual issue. Further argued that demands of excessive hygiene were implemented in institutional protocols, having little skin health considerations. Pointing also out that the absence of a structured hygiene programs in the workplaces including skin care as an important component. (Carvalhais T.S., 2024)

### **1.7 Consequences of Hand Dermatitis on Healthcare Workers**

Hand dermatitis among healthcare workers led to consequences that extended beyond physical discomfort. It often had affected worker's performance, as well as practice in hygiene and overall, their well-being. Mewati et al. describes chain of symptoms that affected healthcare workers with hand eczema in India, such as dryness, itching, redness, and scaling. With the symptoms it further caused discomfort while performing work activities, especially when frequent involving the usage of gloves and hand hygiene. It emphasized that by skin barrier damage it could also increase the susceptibility to develop secondary infections. Participants with more severe cases also required treatment or hygienic routine changes. (Mewati S.K., 2024)

Chaudhari et al. reported that not only did hand dermatitis affect the healthcare workers physically but also caused psychological distress. Visible eczema on the hands also contributed to workers feeling anxious, not to mention also socially discomfort in clinical settings. The compliance to regular hand hygiene was also affected in participants that had pain and irritated skin. For some workers had time off from clinical work due to the severity of symptoms. (Chaudhari K.P. et. al., 2023)

Celik et al. revealed that the development of hand eczema not only affected the participant's physical comfort but also their psychological well-being and their performance at work. Symptoms that could interfere with their daily tasks included pain, itching and breakdown of the skin. It further lead to reported social withdrawal, emotional distress, and decreased quality of life. Some responders also raised concerns about altering of hand hygiene behaviour caused by increase infection risk. (Celik O., 2020)

For objectively assessing the disease burden, Erdem et al. included the Hand Eczema Severity Index (HECSI), which scored dermatologic symptoms such as desquamation, erythema, and fissures. Even if most of the cases were scored as mild, the structured scoring allowed a standardized documentation of the severity. By this methodological approach, it added a new dimension to the literature, as most studies had more subjective reports. Including future research with severity scales could aid in more policy planning and targeted interventions. (Erdem A.C., 2020)

Graham et al. provided evidence that were measures objectively, involving persistent damage of the skin barrier among healthcare workers in United States of America, more precisely those with atopic dermatitis. By measuring transepidermal water loss (TEWL) both before and after hygiene protocols. Even though the usage of emollients, the TEWL levels remained increased, which was said to be suggested that standard practices of moisturizing may not be enough to restore fully the integrity of the skin. This highlights the potential for chronic skin dysfunction and raises an importance of the need for recovery strategies and prevention being more targeted for vulnerable healthcare workers. (Graham Y.V., 2021)

Bhatt et al. in a study from United States of America concluded, that healthcare workers being exposed to frequent usage to hand sanitizers often felt burning, persistent dryness, and peeling of the skin. This often created a lot of discomfort among workers, that lead to them being less

compliant to consistent hand disinfection, more specifically during long shifts. The study further mentioned that there is a clear need for intervention being done early for the prevention of long-term complications. (Bhatt P.K., 2024)

Duygu et al. had conducted multicenter survey involving 11 hospitals in Turkey with 958 healthcare workers in the ICU. It revealed that particular proportion of the participants experiencing hand-related dermatological symptoms. Those symptoms were dryness, itching, and redness from prolonged usage of gloves and also frequently hygienic practices. The symptoms did not only cause physical discomfort but it also lead to affected staff having reduced performance on the job. It was reported higher rates of skin problems by nurses than physicians, which highlighted vulnerability which was role-based. This study underscored how interference of daily clinical protocols could be affected by occupational skin conditions, particularly in intense periods like COVID-19 pandemic. (Roy I.S., 2022)

Other similar studies emphasized how hand dermatitis caused reduction of participant's quality of life and clinical performance interferences, more specifically in participants with chronic symptoms. Further the review noted that during the pandemic, repeated exposure to irritants could cause long-term skin conditions. These studies stress the importance of dermatological follow-up and recovery being included in occupational health programs. (AlEdani G.C., 2024, Carvalhais T.S., 2024)

## **1.8 Prevention and Management Strategies**

To reduce the burden of hand dermatitis, it was essential with effective management and preventive strategies among healthcare workers, especially in periods where hygiene demands was increased. Rianto et al. showed that allergens' avoidance in hand sanitizers, for example, propylene glycol and fragrances, help to prevent development of contact dermatitis. Recommendations on the use of alcohol-based hand sanitizers were that those should contain at least 60% of alcohol. Further on that, the hand sanitizers should not contain any surfactants, fragrances, dyes or preservatives, such as methylisothiazolinone, that can contribute in causing allergies and symptoms such as dry and itchy or peeling skin. As well as encouraging to apply emollients frequently. The review also mentions the importance of education to healthcare workers on selecting products and taking care of the skin. In clinical settings, actions on an

individual level were presented as important factor to decrease irritation of the skin. (Rianto T.A., 2024)

Bhatt et al. (2024) argued that preventing hand dermatitis requires not only proper hand hygiene but also the use of sanitizer formulations that are gentle on the skin. Especially in the setting of high-frequency disinfection, it was important to include the usage of moisturizers in hygienic protocols routinely. However, their findings were largely suggestive rather than conclusive, as the study primarily highlighted associations rather than establishing direct causal links between specific preventive measures and reduced dermatitis incidence. Also mentions that the lack of institutional guidance in the pandemic period left several healthcare workers being not properly protected. It, therefore, highlights the importance to provide preventive measures which are both structured and evidence based in clinical settings. (Bhatt P.K., 2024)

To address hand dermatitis, Carvalhais et al. called for systemic interventions in the workplace. It was suggested that in programs for healthcare hygiene protocols should be included an easy access to products for the skin and practical training for prevention of dermatitis. The prevention needed to be proactive and integrated in routines of infection control and not implemented as an afterthought. The authors of this review recommended to have long-term strategies to promote occupational health flexibility and skin recovery. (Carvalhais T.S., 2024)

Chaudhari et al. mentioned that many of the measures for prevention were related to hand dermatitis symptoms being improved. Preventions included switching to non-powdered gloves from powdered gloves, decreasing time of glove usage, and the usage of corticosteroid moisturisers and creams that were prescribed. The authors did not specify an exact recommended duration for the use of topical corticosteroids or preventive routines; however, they emphasized the importance of consistent and individualized application based on the severity of symptoms and workplace exposure. The authors also clarified that corticosteroid creams were recommended only for healthcare workers already affected by hand dermatitis, not as a universal preventive measure. The study further reinforced the importance to have a tailored strategies for prevention both meeting the needs of the individual skin and workplace conditions. Further recommended to incorporate the maintenance of hand hygiene into the medical curriculum for indian healthcare workers. (Chaudhari K.P. et. al., 2023)

Celik et al. recommended some preventive strategies, including usage of alcohol-based hand disinfectants rather than soap when feasible, consistent application of skin moisturizers, and seeking dermatological consultations for persistent skin symptoms. They highlighted the importance interventions to raise awareness and enhance compliance by practicing skin care. Authors also suggested to ensure early management by including teledermatology into occupational health care programs. (Celik O., 2020)

Keng et al. divided the prevention strategies into three levels, which were individual, occupational, and long-term systemic in Singapore. Individual level of prevention included that healthcare workers being recommended to use emollients, make sure to have proper fitting of personal protective equipments, and have scheduled breaks which can decrease buildup of friction and moisture. Occupational level included that hospitals could plan shorter shifts of using personal protective equipments, supply hygienic products that are gently for the skin, and have proper education programs for skin care. Lastly, long-term strategies involved investing in teledermatology, having inclusive designs of personal protective equipments, and develop a policy incorporating skin protection for preparedness for future pandemics. (Keng G.T., 2021)

Additionally to the mentioned broader efforts on prevention, Sawada et al. recommended strategies individualized for healthcare workers in Japan having persistent symptoms of the skin. Including patch test to clarify specific allergen triggers, the use of disinfections with low-irritancy, and applying consistently emollients that are fragrance-free. In this way, targeted measures aids to create prevention to a persons sensitivities and increase skin recovery long-term. (Sawada Y., 2023)

Loi et al. constructed a quality improvement project in Singapore General Hospital during the COVID-19 pandemic, with contribution of workplace interventions to help recovery of irritant hand dermatitis between healthcare workers. It included exchanging current ABHR with less harmful formulations, by altering mild cleansers, temporary modifications of work, and latex gloves switched to nitrile gloves. Two months after, participants showed average of 80% of improvement in skin conditions. The results highlights the necessity systemic workplace changes together with individual strategies of hand care. (Loi C.C., 2022)

Ahmed et al. provided prevention recommendations, involving the usage of pre-exposure barrier creams, selecting carefully types of gloves (semi-permeable, rip-up, and hypoallergenic

gloves), and also emollient care for post-exposure like humectants and lipids. The authors also emphasized the need of adjustments of product formulation, and recommend alcohol-based hand disinfectants with addition of moisturizers like glycerin, to minimize irritation of the skin while efficacy maintenance. They also highlight education on correct technique on hand hygiene as a cornerstone of prevention among healthcare workers. (Ahmed Z.H. et. Al., 2021)

Rundle et al. recommended hand sanitizers which were alcohol-based with addition of moisturizers as preferred option, contributing to reduction of skin irritation during COVID-19 pandemic. They highlighted synthetic, fragrance-free detergents with moisturizers, and to avoid hot water to minimize disruption of the skin barrier. Recommendations on gloves included nitrile or neoprene type of gloves and the usage of barrier creams and nighttime emollient routines for HCW with persistent dermatitis. (Rundle P.M., 2020)

Symanzik et al. guided a controlled intervention trial involving online-based health education combined with free provision of products for skin care for healthcare workers. The intervention group over 6 months experienced no new cases of hand eczema, while 8.8% of the control group developed new cases of hand eczema. This demonstrated a significant preventive effect ( $p < 0.001$ ). This study highlighted the effectiveness of merging education with measures protecting the barrier as a preventive strategy on a institutional level. (Symanzik B. S. et. al., 2022)

Jindal R. and Pandhi D. (2020) tailored a detailed guidelines on prevention supported by Indian Association of Dermatologists. It includes the usage of soaps that were fragrance-free, moisturizing after washing the hands, and to avoid unnecessary handwashing after the usage of alcohol-based hand sanitizers. Further emphasized that there should be an application of emollients while the skin is still damp, so it can maximize protection and absorption. Nonetheless, it was recommended to use sanitizers that contained glycerol and also wearing glove liners of cotton beneath medical gloves to decrease irritation and friction. (Jindal P., 2020)

Abdi et al. study among 142 hospital workers in Iran suggested many preventive measures, such as routinely usage of formaldehyde-free soap, regular check-ups by dermatologists for the healthcare workers, and unnecessary avoidance of irritant exposures such as hot water. The author brought an importance that early identification and systematic monitoring occupational

skin could prevent symptom progression during periods of intensified hygiene. (Shahmohammadi R.A. -A., 2022)

Erdem et al. also highlighted shortcomings in management and prevention, which reports only 40.9% from the participants utilised regularly moisturizers, and fewer added corticosteroids as care for skin irritations. Although high exposure to irritants, alor of healthcare workers did not seek for dermatological care, which suggests for gaps in both institutional support and awareness. It called for stronger emphasis on accessible treatment options and proactive skin protection. The observations done echoes earlier findings and made an importance of ongoing needs for structured hand care protocols. (Erdem A.C., 2020)

Despite the range of preventive strategies and treatment options currently available being wide, Ahmed et al. highlighted the significant evidence gaps remaining, particularly including newer systemic treatments such as biologics (e.g., duplilumab) and JAK inhibitors (e.g., baricitinib, upadacitinib). The review stressed the importance for well-modulated interventional studies to measure the long-term outcomes and management optimizations for healthcare workers with chronic or severe hand dermatitis. (Ahmed Z.H. et. Al., 2021)



## CONCLUSIONS

This thesis investigated the methods in which hand dermatitis among healthcare professionals during COVID-19 pandemic was influenced by personal, occupational, and hygiene-related factors. Across the 27 articles, a similar pattern emerged: skin damage increased significantly as **hand hygiene methods**, such as frequent washing, usage of alcohol-based disinfectants, and prolonged usage of gloves. The most reported condition was irritant contact dermatitis, which often exacerbated by individual predisposition factors such as pre-existing skin sensitivity or atopic history. Other personal factors reported included female sex, younger age, and a prior history of atopic diathesis, whereas regular use of emollients and adequate dermatological education were shown to minimize risk.

Workplace conditions, such as **wet work** exposure, **lack of employees**, and **usage of disinfectants** that are known to cause irritation. Numerous studies highlighted how hand dermatitis affected on the comfort, well-being, and possibly also compliance with infection control protocols. While several studies assessed the long-term efficacy of various **preventive measures** that were proposed, ranging from gently hand rubs to dermatological education and barrier creams. Practical recommendations from the reviewed studies include; (1) regular application of emollient creams after hand washing, (2) limiting the continuous use of gloves to less than one hour whenever possible, and (3) substituting harsh disinfectants with milder, skin-friendly alternatives. Numerous studies lacked longitudinal follow-up, and still sparse institutional-level interventions.

Hand dermatitis turned up as a widespread occupational health consequence of pandemic period hygienic demands. It affected workers globally in frontline, across healthcare settings both low- and high-resourced. The findings of this thesis underlined the importance of protecting skin health of those delivering care simultaneously to continue to prioritize infection control in healthcare systems. To support healthcare professionals and stop long-term dermatological harm in pandemic that can appear in the future, more robust institutional research, education, and regulations are required. Importantly, studies emphasized that the prevalence of hand dermatitis remains high among healthcare workers even outside pandemic situations, underlining its relevance as a persistent occupational health issue.

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