Rīga Stradiņš University
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Eczema in Association with Occupational Exposure and Hygiene Practices among Hospital Workers

RESEARCH PAPER

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ABSTRACT

Background. Eczema, or dermatitis, is a group of inflammatory skin conditions which can have a significant negative impact on the quality of life as well as work performance. Healthcare workers may be especially susceptible to developing such skin conditions, as the infection control measures of the work in hospitals include frequent hand sanitization, washing, and prolonged glove wearing, which are all factors probable to cause eczema. Implementation of appropriate measures to prevent the development of eczema is essential to maintain quality of life, work performance, and ensure that there is no early exit from the profession.

Aim. The aim of this research paper is to investigate the association between hygiene practices and eczema among healthcare professionals, identifying common risk factors and preventive approaches.

Method. A written, structured literature review where existing research and analyses were used to discuss occupational eczema in association with different hygiene practices, as well as possible risk factors and prevention methods.

Results. The review found that healthcare workers have a higher risk of developing occupational eczema, especially hand eczema. This is largely attributable to cumulative wet-work exposure interacting with individual susceptibility and work environment. In particular, frequent soap-and-water handwashing and longer daily duration of occlusive glove wear are strongly associated with higher rates of hand eczema, whereas alcohol-based hand sanitizer is generally better tolerated. Departments with more rigorous hygiene regimens consistently bear the greatest eczema burden, reflecting their higher exposure levels. Personal risk factors (such as female gender, atopy, or filaggrin gene variants) modify how strongly a given exposure leads to disease. The consequences of occupational hand eczema are not only dermatological – it also reduces quality of life, increases sick leave usage, and can influence career decisions. Key approaches include favoring alcohol-based hand rubs over soap when possible, providing ready access to emollient moisturizers (and education on their proper use), and general staff education about hand skin care.

Conclusions. Occupational hand eczema among healthcare workers is predictable and preventable. The highest burdens occur where wet-work exposure is intense, individual susceptibility is present, and environmental factors are unfavorable; adjusting hygiene protocols and improving skin protection can markedly reduce disease incidence without compromising patient safety.

KOPSAVILKUMS

Aktualitāte. Ekzēma jeb dermatīts ir iekaisuma ādas slimību grupa, kas var būtiski negatīvi ietekmēt dzīves kvalitāti un darba sniegumu. Veselības aprūpes darbinieki var būt īpaši uzņēmīgi pret šādu ādas slimību attīstību, jo infekciju kontroles pasākumi slimnīcās ietver biežu roku dezinfekciju, mazgāšanu un ilgstošu cimdu nēsāšanu – tie visi ir faktori, kas var veicināt ekzēmas rašanos. Atbilstošu profilakses pasākumu ieviešana ir būtiska, lai saglabātu dzīves kvalitāti, darba spējas un novērstu priekšlaicīgu aiziešanu no profesijas.

Mērķis. Šī pētījuma mērķis ir izpētīt saistību starp higiēnas praksēm un ekzēmu veselības aprūpes profesionāļu vidū, identificējot biežākos riska faktorus un profilakses pieejas. **Metode.** Rakstiska, strukturēts literatūras apskats, kurā izmantoti esošie pētījumi un analīzes, lai apspriestu ar profesiju saistīto ekzēmu saistībā ar dažādām higiēnas praksēm, kā arī iespējamos riska faktorus un profilakses metodes.

Rezultāti. Pārskats atklāja, ka veselības aprūpes darbiniekiem ir lielāks risks saslimt ar profesionālo ekzēmu, īpaši roku ekzēmu. Tas lielā mērā ir saistīts ar kumulatīvu mitrā darba iedarbību, kas mijiedarbojas ar individuālo uzņēmību un darba vidi. Īpaši bieža roku mazgāšana ar ziepēm un ūdeni, kā arī ilgstoša okluzīvo cimdu lietošana dienas laikā ir cieši saistītas ar augstākiem roku ekzēmas rādītājiem, kamēr spirta bāzes roku dezinfekcijas līdzekļi parasti ir labāk panesami. Nodaļās ar stingrākiem higiēnas režīmiem konsekventi novērojams lielāks ekzēmas slogs, kas atspoguļo augstāku ekspozīcijas līmeni. Personīgie riska faktori (piemēram, sieviešu dzimums, atopija vai filagrīna gēna varianti) ietekmē to, cik stipri konkrēta ekspozīcija izraisa slimību. Profesionālās roku ekzēmas sekas nav tikai dermatoloģiskas – tā samazina dzīves kvalitāti, palielina darba nespējas lapu skaitu un var ietekmēt karjeras lēmumus. Galvenās profilakses pieejas ietver spirta bāzes dezinfekcijas līdzekļu izmantošanu ziepju vietā, kad tas iespējams, nodrošinot vieglu piekļuvi mitrinošiem līdzekļiem (un izglītojot par to pareizu lietošanu), kā arī vispārēju personāla izglītošanu par roku ādas kopšanu.

Secinājumi. Profesionālā roku ekzēma veselības aprūpes darbinieku vidū ir paredzama un novēršama. Lielākais slogs rodas gadījumos, kad mitrā darba iedarbība ir intensīva, pastāv individuāla uzņēmība un nelabvēlīgi vides faktori; higiēnas protokolu pielāgošana un ādas aizsardzības uzlabošana var būtiski samazināt slimības izplatību, neapdraudot pacientu drošību.

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LIST OF ABBREVIATIONS

- ACD – Allergic Contact Dermatitis
- COVID-19 – Coronavirus Disease 2019
- HCW – Healthcare Worker(s)
- ICD – Irritant Contact Dermatitis
- MDPI – Multidisciplinary Digital Publishing Institute
- NIH – National Institutes of Health
- OCD – Occupational Contact Dermatitis
- QOLHEQ – Quality of Life in Hand Eczema Questionnaire
- RSU – Rīga Stradiņš University
- SDS – Sodium Dodecyl Sulfate (also known as Sodium Lauryl Sulfate)
- TEWL – Transepidermal Water Loss
- WHO – World Health Organization

INTRODUCTION

Eczema encompasses a group of inflammatory skin conditions, with atopic dermatitis being the most common subtype. Among healthcare professionals, occupational allergic contact dermatitis and irritant contact dermatitis are particularly significant, as they are often triggered by workplace exposures. Occupational skin disease is recognized as the second most common cause of occupational illness [1], with substantial prevalence worldwide. For example, in the United Kingdom approximately 16,000 new cases are reported annually [1], while in the United States estimates from 2010 indicated around 850,000 cases of work-related dermatitis [1]. These conditions carry notable consequences, accounting for an estimated 25% of all lost workdays [1]. Irritant contact dermatitis alone accounts for roughly 80% of occupational hand dermatitis cases [2]. By contrast, in the general population, the prevalence of hand eczema is considerably lower – ranging from 0.4% to 4% [2]. Clinically, occupational dermatitis presents with symptoms such as erythema, scaling, lichenification, hyperkeratosis, fissuring, vesicles, and sensations of pain, burning, or itching [2]. Healthcare workers are particularly vulnerable due to their frequent engagement in so-called “wet work,” which includes regular contact with liquids, prolonged glove use (exceeding two hours daily), and hand washing or disinfection more than 20 times per day [2]. Healthcare workers are subject to strict regulations regarding infection control measures, which include frequent hand sanitization, washing, as well as prolonged glove wearing. The development of occupational eczema can have significant consequences for healthcare systems, employers, and affected individuals. These include direct medical costs, disability compensation, work absences, and in severe cases, early departure from the profession. The impact on mental well-being can also be considerable, compounding the personal and professional burden.

While occupational dermatitis has been widely studied, research specifically examining the contribution of individual hygiene practices to eczema onset and severity remains limited. Existing studies often group eczema with other skin disorders, overlook the cumulative effect of multiple hygiene behaviors, or report inconsistent findings regarding whether soap-and-water washing or alcohol-based sanitizers cause greater harm. This lack of targeted evidence hinders the development of effective prevention strategies.

Aim of the study. The aim of this research work is to investigate the association between hygiene practices and eczema among healthcare professionals, identifying common risk factors and preventive approaches.

The guiding **research question** is: What is the association between occupational hygiene practices and the occurrence of eczema among healthcare professionals?

Tasks of the study were:

1. To investigate literature data on the association between different hygiene practices and eczema among healthcare professionals;
2. To investigate and outline literature data on risk factors and preventive approaches.

Hypothesis. This literature review is guided by the hypothesis that frequent occupational hygiene practices, such as repeated handwashing, the use of alcohol-based sanitizers, and prolonged glove wearing, contribute to an increased risk of eczema among healthcare professionals. It is further hypothesized that the severity and persistence of eczema are influenced by individual factors, including genetic predisposition and duration of employment in healthcare. Preventive strategies, such as regular use of emollients, adjustments in hygiene protocols, and staff education on skin protection, are expected to mitigate the negative impact of occupational hygiene practices on skin health. Firstly, the topic will be discussed regarding existing articles about the association between hygiene practices and eczema among healthcare professionals. Then, literature regarding risk factors and preventative approaches will be analyzed.

METHODS AND MATERIALS

Literature research. This study is a structured literature review. The Riga Stradins University library online databases have been used for literature research. From the section e-journals, Clinical Key has been used. From the section free access databases, PubMed has been used. From the section evidence-based medicine databases, UpToDate has been used. Amboss has been used as well. Online sources not present in the Riga Stradins University online library have been used as well, including Google Scholar and the National Library of Medicine (NIH). Also, the multidisciplinary digital publishing institute (MDPI) has been used, as well as the Indian Journal of Dermatology and the website of the U.S. Bureau of Labor Statistics. To search in the databases, the following terms and/or words have been used: occupational hand dermatitis, eczema, dermatitis, hand eczema/dermatitis, contact dermatitis, occupational skin disease, occupational dermatitis, hygiene practices, hand washing, hand hygiene, alcohol-based

sanitizer, soap and water, prolonged glove use, healthcare workers, healthcare professionals, nurses, physicians, medical staff. Inclusion criteria for literature selection were primarily English-language sources, with a focus on recent (mostly last 10–15 years) publications.

RESULTS

1. OVERVIEW OF ECZEMA IN HEALTHCARE PROFESSIONALS

In this section, the prevalence of eczema in different healthcare professions will be analyzed, as well as how eczema occurrence compares to other possible skin diseases in the occupational field.

1.1. Prevalence in different healthcare professions and settings

Only a limited number of studies report incidence data for occupational contact dermatitis (OCD) among healthcare workers, with most originating from Europe. Reported rates vary widely depending on profession and training level. For example, cohort studies in apprentice nurses have found incidence rates ranging from 1,150 to 3,670 cases per 10,000 worker-years, corresponding to approximately 11–37% developing OCD within the first year of follow-up [3]. Among practicing nurses, lower but still considerable rates are observed – one Italian study reported around 61 cases per 10,000 worker-years (about 0.6%) in nurses . In comparison, physicians experience markedly lower rates, on the order of 15–20 cases per 10,000 worker-years (approximately 0.15–0.2% annually) [3]. Overall, nurses consistently represent the most affected professional group, especially early in their careers [3]. This is likely explained by nurses' higher exposure to "wet work" (frequent hand washing, disinfectants, and occlusive gloves) compared to physicians. Demographic factors such as the predominance of women in nursing may also contribute, given that female sex is an established risk factor for hand eczema [3].

Prevalence studies, however, are more widely available. In Denmark, one cross-sectional survey found the one-year prevalence of hand eczema in healthcare workers to be 21%, which is double the prevalence in the background population [4]. The point prevalence was 12%, and the lifetime prevalence 35% [4]. Another review noted that healthcare workers

generally show a one-year prevalence around 20%, substantially higher than the 14.5% lifetime prevalence in the general population [5].

In a more global context, in a cross-sectional study in Ethiopia, it was found that the 12-month prevalence among healthcare workers was 31.5%, with hand involvement reported by 22% of participants [1]. In Malaysa, during the COVID-19 pandemic, healthcare workers presented with a 1-year prevalence of occupational hand eczema of 42.3%, and a point prevalence of 16.5% [6]. These data points complement the European data, affirming the global similarities in the prevalence of occupational hand eczema.

In general, these data underscore that healthcare workers, especially nurses and early-career staff, face a significantly increased burden of hand eczema. Physicians and administrative staff, with lower exposure to wet work and disinfectants, tend to experience reduced rates. These differences among professions are also influenced by gender distribution, as nursing remains a predominantly female occupation, which has been established as a risk factor for eczema.

1.2. Occupational relevance compared to other skin diseases

Occupational skin diseases, particularly hand dermatitis, are among the most frequently reported work-related health conditions. In 2020, the U.S. Bureau of Labor Statistics recorded an incidence of 1.8 per 10.000 full-time equivalent workers for occupational skin diseases, which places them as the second most common nonfatal occupational illness, overtaken only by respiratory conditions [7]

Contact eczema represents about 90% of dermatoses, with most cases being the irritant type [8]. Other skin dermatoses, such as contact urticaria to latex, are also significant among healthcare workers, with a high global prevalence of 10 to 17% [8].

A cross-sectional study in Portugal investigated occupational dermatoses among healthcare workers in a hospital center and found that out of healthcare workers who have an occupational dermatosis diagnosis, 54.84% had irritant contact dermatitis, 27.42% a latex allergy, 9.65% allergic contact dermatitis, and 8.06% had contact dermatitis plus a latex allergy [8].

A Brazilian study found that occupational skin diseases constitute 60% of occupational diseases in industrialized settings [9].

Another study in Greece investigated the prevalence rates of different dermatoses among different professional settings, finding eczema had the highest prevalence, especially among individuals engaged in wet work, such as cooks and hairdressers [10]. Other skin diseases such as acne, chemical burns and malignant tumors did also occur, but with significantly lower prevalence rates compared to contact eczema [10]. For instance, the prevalence rate of contact eczema in hairdressers was 30%, while farmers had a prevalence of 5.5% to develop malignant tumors, and industrial workers of 13.3% for chemical burns [10].

These figures highlight that occupational skin diseases, especially hand eczema, represent a substantial burden and make up a significant part of occupational disorders.

2. PATHOGENESIS AND MECHANISMS RELEVANT TO OCCUPATIONAL ECZEMA

To better understand the effects of hygiene practices, it is useful to mention the general physiology of the skin barrier and its function.

2.1. Skin barrier structure and function

The main skin barrier function lies in the stratum corneum. The stratum corneum is composed of vertical stacks of anucleate corneocytes, which are packed with keratin filaments [11]. The keratin filaments are embedded in a matrix of filaggrin breakdown products, ceramides, cholesterol and fatty acids, which is the so-called extracellular lipid matrix (Figure 1) [11].

These two components of the stratum corneum complete different functions. The corneocytes provide mechanical reinforcement, maintain hydration, protect underlying mitotically active cells from UV damage, and regulate cytokine-mediated initiation of inflammation [11]. The extracellular lipid matrix creates the brick-and-mortar structure of the

stratum corneum, regulates permeability, has antimicrobial peptide activity, initiates corneocyte desquamation, excludes toxins, and also allows for selective chemical absorption [11].

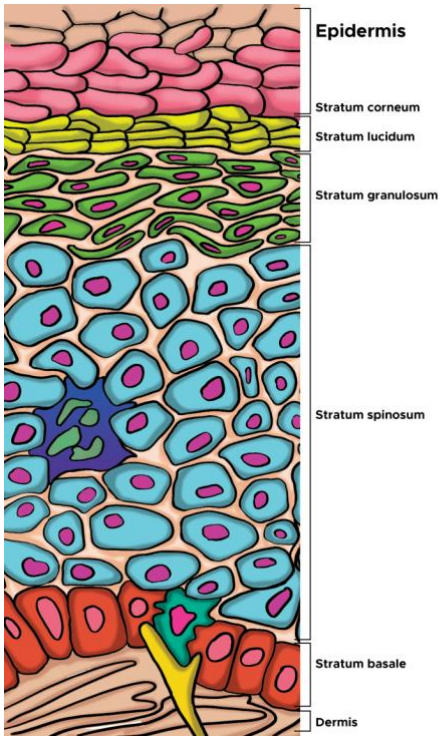

Figure 1. Diagram of the skin barrier. Murphrey MB, Miao JH, Zito PM. Histology, Stratum Corneum. [Updated 2022 Nov 14]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK513299/

Another important aspect is the skin's pH. It is also known as the acid mantle, and by being acidic in nature, it acts as a barrier against pathogenic bacteria [14]. Other functions include maintaining the natural microflora and optimizing the functions of the lipid barrier by ensuring proper enzyme function [14].

The resident microbes have a symbiotic relationship with the skin. They are supplied with the correct biotope, benefit from an acidic pH, as well as from minerals in the form of sweat, lipid as sebum, and protein as dead skin cells [14]. In turn, they strengthen the first-line defense of the skin by producing fatty acids, which prevent colonization of the skin by harmful microbes [14]. The acidic pH also regulates the homeostasis of the corneum, by regulating proteases – if the pH becomes too high, there is an over-activation of the proteases, resulting in an excessive breakdown of corneodesmosomes, which hold the corneocytes together [14].

All of these components make up the protective aspects of the skin barrier. In turn, a damaged or altered stratum corneum will result in an increased transepidermal water loss, increased permeability, reduced water retention, and altered lipid composition, as well as decreased protection from external pathogens [11].

2.2. Effects of repeated exposure to irritants (soap, alcohol, gloves, disinfectants)

Occupational hand eczema encompasses both irritant contact dermatitis (ICD) and allergic contact dermatitis (ACD), which are triggered by workplace exposures.

The mechanism behind ICD is the direct cytotoxic effects of chemical or physical irritants on the viable cellular components and non-viable barrier of the skin, which triggers the innate immune response, initiating pro-inflammatory signaling cascades, ultimately resulting in dermatitis [12].

In general, ICD develops when then sum of all irritations exceeds the repair capacity of the skin, meaning that the skin is unable to repair itself before new irritation is introduced [18]. The main causative pathogenic effect for the development of symptoms in ICD is the direct damage to the skin barrier, and a certain minimum of exposure to an irritant is necessary [18].

On the other hand, ACD occurs due to an adaptive immune mechanism and is a type IV delayed-type hypersensitivity reaction [12]. It does not require a certain minimum of exposure, as allergic reactions are not dose dependent [18]. The sensitization phase is initiated by small allergenic molecules (haptens) binding epidermal proteins, triggering the innate immune response and activation of skin dendritic cells [12]. These dendritic cells engulf the hapten-protein complex, travel to the lymph node, and present the protein complex to the T cells, therefore sensitizing them to the allergen [12]. Now, upon re-exposure to the allergen, the so-called elicitation phase occurs, which is a robust inflammatory reaction in the skin and manifests as eczema [12].

Frequent hand washing with soap and water removes natural moisturizing factors and disrupts the stratum corneum, resulting in increased transepidermal water loss, reduced skin hydration, and compromise of the protective barrier. All these factors combined increase the underlying eczema risk [13]. Additionally, it was found in in vitro and in vivo studies that surfactant-rich soaps alter the skin's pH and deplete lipids, causing dryness, irritation, and barrier impairment [14]. This occurs due to the action of the surfactant, also depicted in the diagram below (Figure 2).

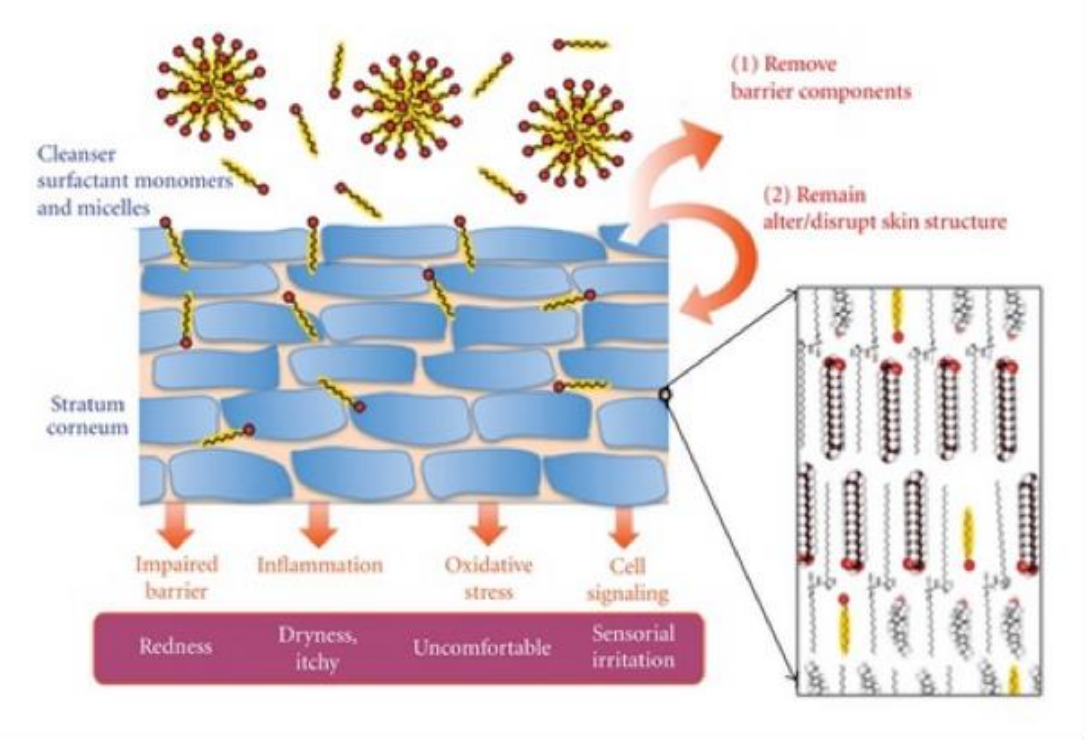

Figure 2 Effects of surfactants on the skin barrier. Walters, Russel M., Mao, Guangru, Gunn, Euen T., Hornby, Sidney, Cleansing Formulations That Respect Skin Barrier Integrity, Dermatology Research and Practice, 2012, 495917, 9 pages, 2012. https://doi.org/10.1155/2012/495917

The surfactant in the soap binds to proteins of the stratum corneum, causing transient swelling and hyperhydration during the washing process [14].Then, evaporation of the water occurs due to the reduction of the swelling in the proteins [14]. Additionally, it has been found that during this process, the surfactants as well as other cleaning agents, are able to penetrate the deeper layers and induce biochemical responses such as itching [14].

In general, the surfactants binding to the skin's proteins diminishes their ability to bind with water and retain it, effectively dehydrating the skin [14]. This lack of hydration impairs the flexibility and protective function of the stratum corneum, leading to scaling, dryness, and cracking [14].

Alcohol-based disinfectants, in contrast, do not contain surfactants [14]. A study found that alcohol-based solutions or gels (70% ethanol) did not affect skin moisture or elasticity during short-term testing [15]. However, repeated use can damage the skin by denaturing and dissolving lipids in the suprabasal epidermis [15]. In vitro studies also show alcohol can alter keratinocyte metabolism, induce inflammatory cytokine release, and increase enzymatic activity [15]. Overall, short-term use does not significantly reduce skin hydration, but long-term

exposure may alter skin characteristics, partly due to mechanical irritation from rubbing and product composition [15].

The usage of gloves is also a factor influencing the development of eczema. The occlusive gloves cause hyperhydration of the skin of the hands, which results in maceration [16]. These macerations allow for deeper penetration into the skin by soaps and alcohol-based sanitizers, resulting in eczema [16].

Additionally, numerous studies among healthcare workers show that the frequent usage of latex gloves correlates with higher rates of eczema due to the irritating effects of proteins in the latex or from residual chemicals in the glove material, causing allergic contact eczema or immediate hypersensitivity reactions [17].

Altogether, repeated exposure to irritants disrupts the skin's protective barrier and promotes eczema development. The strongest impact arises from frequent use of surfactant-containing soaps, while alcohol-based disinfectants are less irritating in the short term but can still be harmful with prolonged use. The use of occlusive gloves amplifies the damaging effects of both, along with having irritating effects by themselves.

3. CLINICAL PICTURE IN THE OCCUPATIONAL CONTEXT

3.1. Acute vs. chronic presentation

Occupational skin diseases can affect all parts of the body, but most commonly, the hands are affected due to exposure to wet work and possible irritants [18]. Therefore, the main focus is on the manifestations in the hands.

As mentioned in the section above, the two kinds of hand eczema are classified as irritant contact dermatitis and allergic contact dermatitis [12]. According to The European Society of Contact Dermatitis Guideline Development Group, hand eczema can be classified as chronic if it persists for more than 3 months, or when the condition reoccurs at least twice within the 12 months [21].

For irritant contact dermatitis, the acute form presents with edema, vesicles, erythema, bullae and oozing [19]. Additionally, the irritant substances can get easily caught in the web spaces of the fingers [19]. These areas may be the first to manifest with symptoms [19].

In chronic irritant contact dermatitis, one can observe more chronic processes affecting the skin, such as lichenification, fissuring, and hyperkeratosis [19].

Another factor impacting the clinical picture of irritant contact dermatitis is the intensity of the irritant. The repeated exposure to a mild irritant, such as soap and water, can produce erythema, chapped skin, dryness and fissuring [19]. In general, variably intense pruritus and pain are accompanying symptoms for both acute and chronic forms [19].

For allergic contact dermatitis, there is no absolute visual distinction from irritant contact dermatitis, meaning that the acute and chronic forms manifest similarly [18]. However, one difference which may aid in distinguishing between irritant and allergic contact dermatitis is that the allergic dermatitis usually is well demarcated in the area of contact with the allergen, and tends to evoke a more intense pruritus [19]. Nonetheless, regarding their presentation in the acute and chronic forms, no major distinctions can be made [18].

In general, it can be said that hand dermatitis can occur in acute forms as erythema, scale/crust, erosions, vesicles, and bullae with variable edema, as well as chronically as persistent redness, scaling, lichenification, fissures, and erosions, along with variably intense pruritus and pain in all stages.

3.2. Symptom impact on work performance and quality of life

In order to assess the possible impact of the symptoms arising from the development of eczema on the general quality of life, it can be useful to use resources such as standardized questionnaires.

One study conducted in Denmark made use of The Quality Of Life in Hand Eczema Questionnaire (QOLHEQ) in order to assess the impact of hand eczema on the quality of life in the general public [20]. General questions of the questionnaire included how they felt their health is overall, how many sick leaves they had to take for any reason, how their sleep is, and whether they experience pruritus [20]. These answers were compared to those in the general population not suffering from hand eczema.

It was found that individuals affected by hand eczema reported poorer feelings of overall health and had taken more sick leaves for any reason [20]. It was also found that one of the factors most strongly associated with moderate to very strong impaired quality of life was occupational hand eczema [20].

Another study conducted in the US found that quality of life, along with work productivity and activity impairment, were significantly worse for patients with chronic hand dermatitis, also finding a 25% cost increase in total medical costs attributable to chronic hand eczema [22].

These results show the impact which hand eczema can have on the overall quality of life, health, and work.

Additionally, hand eczema is associated with social embarrassment due to its visible location and can therefore result in social isolation due to the avoidance of social situations. This can result in anxiety and depression [22].

Other associations found with hand eczema are sleep disturbances and a financial burden due to direct treatment costs, an indirect loss due to working capacity reduction, sick leave, and possibly job loss [23].

The damaged skin barrier may also cause new sensitization to allergens in affected persons who are also afflicted with atopy [23]. Another issue is the increased colonization of pathogenic microorganisms on the hands, which is favored by hand eczema, therefore also increasing the risk of possible transmission of these microorganisms [23]. All of these factors may influence the life quality, as well as the work performance.

In a Danish study of large proportions including 2.274 healthcare workers, it was found that hand eczema had a clear impact on work performance and decision making regarding the career future. Around 8% reported having to take sick leave due to the condition, with the biggest impact being made on assistant nurses, who made up 15% of that group [4].

The occupational relevance was further proved by the commonly reported improvements during weekends or longer times off, with 25% reporting improvement after weekends, 35% after a week off, and 27% after longer periods [4].

Regarding the career choices, around 3% of healthcare workers decided to change jobs due to the implications of hand eczema, 15% considered changing jobs, and 6% reported altering work tasks [4].

Furthermore, 12% of cases were reported to the national occupational disease registry, especially in severe forms.

Regarding the severity of the hand eczema, most cases were mild to moderate, however around 11% were classified as severe or very severe, which has been consistently linked in prior studies with reduced quality of life [4].

Taken together, these findings demonstrate that hand eczema not only causes physical discomfort, but also significantly compromises healthcare workers' quality of life, work performance, and career stability. The occupational relevance of hand eczema is underscored by the improvement seen in the time off work, and the number of workers considering changing careers due to the impact of hand eczema.

4. ASSOCIATION BETWEEN HYGIENE PRACTICES AND ECZEMA

It is necessary for healthcare professionals to follow strict infection-control protocols, which involve frequent handwashing with soap and water, regular use of alcohol-based sanitizer and prolonged glove wearing. These measures are put in place for the patients and the employee's safety. The possible relationship between the different hygiene behaviors and the development of eczema will be explored in this section.

4.1. Handwashing frequency and water temperature

A study conducted in 2022 explored how different water temperatures may affect the skin barrier in healthcare workers [24]. It was done by applying both cold (11 degrees Celsius) and hot (around 41 degrees Celsius) water to the volar surface of the forearm for 10 minutes [24]. In the results, it was noted that hot water produced a significantly larger increase in transepidermal water loss, along with substantial erythema and reduced stratum corneum hydration [24]. Cold water also had a negative impact on the skin barrier parameters; however, it was recognized to be to a much lesser extent [24].

As discussed in the previous sections, barrier reduction plays a major role in the development of hand eczema. Therefore, the findings of this study support the idea that water temperature is a key modifiable factor in handwashing, where frequent washing with hot water can exacerbate barrier disruption, while washing with cold or lukewarm water can help mitigate some of the negative effects.

Handwashing with soap and water has also been shown to have a negative impact on the skin barrier, directly correlating to the frequency of handwashing.

A cross-sectional study examining the hand hygiene habits and prevalence of hand eczema during the COVID-19 pandemic found that washing the hands more than 10 times per day increased the risk of development of hand eczema by 1.55 times, as compared to those who washed their hands fewer times [25].

Similar results were found in a study conducted in the United States [26]. According to this study, there’s a significant association between the frequency of handwashing and the development of irritant hand dermatitis, finding that those who wash their hands more than 10 times per day are 55% more likely to experience the occurrence of irritant hand dermatitis [26]. The study further states that for one unit increase in frequency of hand-washing per day, the incidence rate of irritant hand dermatitis increases by 4% [26].

In general, the described studies show that factors such as water temperature and hand-washing frequency strongly influence the possible development of hand eczema. Hand-washing frequency of more than 10 times per day significantly increases the risk of development of hand eczema compared to someone washing less than 10 times a day, and adjusting the water temperature to milder degrees may mitigate the negative effects.

4.2. Alcohol-based sanitizer use

Alcohol-based sanitizer use is generally reported by healthcare workers as causing more irritation to the skin; however, this is thought to be rather attributed to the burning sensation which occurs when applying alcohol-based sanitizer to previously macerated hands [27].

According to a systematic review and meta-analysis synthesizing twelve studies, there has been no statistically significant association between the use of alcohol-based sanitizer and the risk of development of hand eczema [27].

In the direct comparison of alcohol-based sanitizer users versus non-users, it was found that the pooled risk ratio was 0.98, which shows no significant difference, meaning that users were basically at the same risk as non-users [27]. As for the usage of alcohol-based sanitizers more than 10 times daily compared to less than 10 times daily, the pooled risk ratio was 1.06, which shows a slightly higher risk with very frequent use, but also not statistically relevant [27]. For the comparison between disinfecting the hands more than 20 times daily compared to less than 20 times daily, the pooled risk ratio was 1.05, again showing no significant increase in the risk of development of hand eczema [27]. There was also no statistically significant risk of hand eczema found with use of alcohol hand disinfectant more than nine times within four hours versus less than nine times in the same timeframe [27].

dditionally, the laboratory-based evidence within the review supports the clinical findings, since alcohol-based sanitizers generally cause less transepidermal water loss, erythema, and skin dryness [27].

A prospective cohort study of 795 healthcare workers found that the usage of alcohol-based sanitisers on wet skin was associated with a higher 1-year prevalence of hand eczema at follow-up [28].

Overall, the evidence mentioned above suggests that the frequent usage of alcohol-based sanitizers is less harmful to the skin barrier and causes no major increase of the risk of development of hand eczema. However, adapting the usage of alcohol-based sanitizers so that

they are not used on wet skin can be beneficial to reduce the 1-year prevalence of development of hand eczema.

4.3. Glove use (material, duration, occlusion effects)

Wet work is defined as activities where workers have to immerse their hands in liquids for more than at least 2 hours per shift, wear waterproof or occlusive gloves for at least two hours, or wash their hands more than 20 times per shift [29].

Glove use is an integral part of occupational hygiene in the healthcare field, and their usage commonly exceeds 2 hours per shift, as well as being used along with other hygiene measures such as handwashing and alcohol-based sanitizer use.

The glove usage in the healthcare field during the COVID-19 period was especially high, and studies during that time have found that wearing occlusive gloves daily for around 3 hours correlates with a higher risk of hand eczema development [29].

In a cross-sectional survey of more than 5.000 Swedish healthcare workers, the relationship between daily glove wearing and the development of hand eczema was investigated [30]. Daily glove wear was categorized by time as below 1 hour of wearing, 1 to 3 hours of wearing, and above 3 hours [30]. It was shown that there is a dose-dependent association between the duration of glove wearing and the subsequent development of hand eczema, specifically, wearing gloves for more than 3 hours per day was associated with the disease [30].

The authors also reported a higher 1-year prevalence of the development of hand eczema among healthcare workers directly caring for COVID-19 patients versus others, consistent with elevated glove and hygiene exposures in that group [30]. There was no correlation found between the number of pair changes and the risk of eczema development, once again underscoring that the main mechanism of action lies within the cumulative duration of the glove usage [30].

Regarding the material of the gloves, it was found in a multi-hospital healthcare worker survey that the most commonly implicated material in the development of hand eczema is natural rubber latex [31]. This may be due to the rubber accelerators used in these gloves [31]. 45.51% reported symptoms beginning after latex glove use, and another 20.51% reported symptoms after all glove types available at work [31]. A small amount of healthcare workers of 3.21% reported symptoms after pre-powdered glove usage [31].

Taken together, current evidence indicates that the glove-eczema relationship is driven more by the duration of wearing of the occlusive gloves and co-existing hygiene measures, rather than by the number of glove changes.

In periods of intensified use, such as the COVID-19 period, it has been illustrated that glove usage above 3 hours per day shows a consistent association with hand eczema prevalence, while material allergens increase the risk of developing symptoms via sensitization pathways.

5. RISK FACTORS

Occupational, personal, and environmental factors may influence the development of occupational eczema. Outlining these factors clarifies why identical routines affect workers differently.

5.1. Occupational factors (exposure time, department type, hygiene frequency)

As mentioned in previous sections, the exposure time to irritants such as soap, water, and the wearing of occlusive gloves is associated with hand eczema, specifically washing the hands with soap and water more than 10 times per day [25], and wearing occlusive gloves for more than 3 hours per shift [30]. Due to these reasons, hospital departments where especially high hygiene measures are needed for infection control are the most affected by hand eczema. This trend has also been shown during the COVID-19 period, where increased hygiene measures were applied and a subsequent increase in hand eczema has been noted [33].

In a cross-sectional study conducted among nurses in a Japanese teaching hospital, it was found that working in a surgical department was associated with hand eczema [32]. The prevalence of development of hand eczema was at 48% in the surgical unit and at 6% in the psychiatry unit [32].

Generally, it can be concluded that departments, such as surgical departments, where hygiene measures such as washing of the hands and wearing occlusive gloves are implemented at a higher frequency, have the highest rate of hand eczema when compared to other units where hand hygiene is less of a factor, such as psychiatric wards.

5.2. Personal factors (genetic predisposition, atopy, skin sensitivity)

Personal factors such as age, gender, and atopy may have an influence on the development of occupational eczema.

Age. Generally, the skin's reactivity to irritants is highest in infants and tends to decrease with age. The reactivity to irritants is lower among individuals above 65 years of age than in those below 30 years of age [2]. Therefore, younger individuals have a higher risk of having a skin reaction to an irritant.

Gender. Population data consistently show clear sex differences, with women reporting roughly double the one-year prevalence of hand eczema compared with men [34].

In Sweden, a general population study has been conducted, finding that the 1-year prevalence was 20.3% in women and 10% in men [34]. It is theorized that this prevalence in women is not necessarily due to genuine sex differences in susceptibility, but rather due to a higher exposure to wet-work, since it is still common that women complete more housework, meaning they are exposed at work and then also at home [2]. Additionally, as it has been established, the individuals mainly affected by occupational eczema are nurses, which is still predominantly female field of work, meaning that women are over-represented in wet-work roles, which may contribute to the higher observed prevalence [2].

Atopy and family history. It has been shown in multiple population-based datasets that personal atopy, such as asthma, allergic rhinitis and atopic dermatitis, as well as parental allergy, are independent risk factors in the development of eczema [34, 35].

Atopy is the familial or personal tendency to produce higher amounts of immunoglobulin E (IgE) antibodies [36]. These antibodies are produced in response to typically low doses of common environmental allergens, usually proteins, and lead to the development of typical clinical symptoms such as asthma, rhinoconjunctivitis, or eczema [36].

In a national Finnish survey, it was found that the presence of any of the atopic diseases increases the probability of developing hand eczema, parental allergy further elevates the risk, and the female gender as well as obesity were found to be additional contributors [35]. On the other hand, it was also shown that physical activity proved to be of protective association, suggesting that both immune-barrier traits as well as lifestyle shape susceptibility to developing hand eczema [35].

Complementary Swedish cohort data add on to these results, similarly identifying atopic history as a predictor of both prevalence and incidence of hand eczema in the community [34]. Additionally, since individuals with atopic dermatitis have a chronically impaired barrier function, they exhibit an increased susceptibility to irritants [2].

A population-based study of patients with occupational skin disease has found that 64% of the participants with irritant contact eczema either reported a personal or family history of atopic dermatitis or had typical and/or minor signs of atopic dermatitis [2].

Mechanistically, these findings align with the concept that baseline barrier fragility and type-2 hypersensitivity reactions amplify the effects of everyday irritants such as soap, water, and occlusion, meaning that the same amount of exposure can result in a greater clinical impact in atopic individuals or those with allergic family backgrounds [35].

Genetic predisposition (filaggrin and barrier genes). Genetic predisposition, such as atopy, which was mentioned above, plays an important role in the development of eczema. In this context, it is important to mention filaggrin and barrier genes. These genes play a central role in the development of hand eczema under routine hygiene practices in some individuals, due to causing a genetically weakened epidermal barrier, most prominently due to filaggrin loss-of-function variants [37]. The filaggrin gene codes for the filaggrin protein, which is essential for stratum corneum integrity [37]. Its breakdown products include natural moisturizing factor, which aids in water-binding, pH buffering, and corneocyte adhesion; if the function of the filaggrin gene is reduced, it results in lower levels of natural moisturizing factor, resulting in a drier, more permeable and irritation-prone skin surface [38].

It has been shown in a recent prospective early-life cohort that filaggrin loss-of-function variants are not only associated with atopic dermatitis phenotypes, but also with barrier impairment, including higher transepidermal water loss in both lesional and non-lesional skin, meaning that both visibly healthy-seeming as well as visibly damaged skin lose more water due to an intrinsically weaker barrier structure [37]. This aids in the explanation of why the same exposure dose of soap cycles or occlusion time produces larger biophysical impairments, such as increased transepidermal water loss and slower recovery in individuals who are filaggrin-deficient compared to others who are not [37].

This should be viewed in a real-life context relating to wet work. In a two-part prospective study of apprentice nurses, the relationship between filaggrin loss-of-function genes and the risk of development of hand eczema was examined [38]. In this study, an increased risk of hand eczema from loss-of-function mutation alone could not be proved; however, it was found that participants who had both filaggrin loss-of-function mutations and atopic dermatitis constituted the highest-risk group during traineeships, which involved frequent handwashing and gloving [38]. This demonstrates that the presence of loss-of-function mutations amplifies the disease risk, particularly in the presence of atopic inflammation and high exposure [38].

Body site. Exposure of irritants to different body sites can have different effects, due to the differences in thickness of the stratum corneum, as well as differing barrier functions [2]. Independent of exposure, the hand is physiologically high-risk [40].

Workplace measurements show that the palmar transepidermal water loss is around 60 g/m2/h, while the dorsal transepidermal water loss is around 29 g/m2/h [40]. This means that there is a substantially greater baseline water flux through the palmar stratum corneum and therefore a lower margin of safety against irritants where contact is most intense, since mainly the hands are involved in wet work [40]. Also, the finger webs are usually affected first, since irritant substances can get trapped there more easily [2].

Generally speaking, the face, dorsum of the hands, and finger webs are more prone to irritation from chemical substances due to their thinner stratum corneum than the palms, soles, or the back would be [2].

5.3. Environmental factors (humidity, temperature, seasonality)

Another possible influence on how certain irritants interact with the skin are environmental factors such as humidity, temperature, and seasonality.

Humidity. Relative humidity is a measure of the actual amount of water vapor in the air compared to the total amount of vapor that can exist in the air at its current temperature. Lower relative humidity dries the stratum corneum, raises transepidermal water loss, and shifts the barrier metrics to be more permeable [41]. On the other hand, higher relative humidity tends to reduce transepidermal water loss [41].

When examining this in a real-life context, it has been found that the prolonged exposure to very low relative humidity, which is typical for heated winter air, is repeatedly linked with xerosis, or extremely dry skin, and contact eczema in occupants and workers [42]. This shows that humidity is an important modulator of barrier health during the colder seasons [42].

At a population level, climatic epidemiology suggests that low indoor and outdoor humidity is associated with higher eczema prevalence, which further supports the idea that environmental dryness increases the baseline vulnerability to irritants of those who are subjected to it [43].

Temperature. As mentioned in previous sections, water temperature has an impact on the transepidermal water loss and barrier structure [24]. Especially, hot water has been found to be associated with a higher transepidermal water loss and decreased barrier structure [24].

Regarding the skin and ambient temperature, it has been found that if there is increased skin or surrounding temperature, it leads to an elevation of transepidermal water loss, while a higher relative humidity would mitigate these negative effects [41]. This again reinforces why warm, dry microclimates, such as heated indoor air, can potentiate irritant effects on the hands and allow for deeper penetration of irritants, such as sodium lauryl sulfate, a surfactant which is contained in many detergents [41, 2].

Seasonality. According to a study which followed healthcare professionals over six months in the United States Midwest, winter season and frequent handwashing were each associated with irritant hand eczema [44]. Workers showing a stronger reaction to detergents upon patch-testing were also more likely to manifest eczema during follow-up – an exposure-season-susceptibility pattern consistent with climate-amplified irritants [44].

Speaking in broader terms, climatic studies argue that dry and cold periods raise the eczema burden compared with humid and warm periods, once again implicating that humidity and temperature can potentiate effects of everyday irritant exposures [43].

Taking all this together, it has been shown across studies that hand eczema emerges from the combination of exposure, susceptibility, and setting.

On the occupational side, greater dose and frequency of wet-work show a pattern of dose-response, with the highest burdens in departments where there is special emphasis on hygiene behaviors, such as surgical departments.

Personal factors such as gender, younger working age, atopy and barrier-gene variation also influence whether and to what degree eczema develops.

Also, body sites are affected differently due to structural differences, resulting in a more severe impact at the same dosage, especially on the dorsum of the hands as well as the finger webs.

Finally, different temperatures, humidity, and seasons can influence the skin's transepidermal water loss and barrier function. Generally speaking, higher humidity and mild temperatures are favorable factors for the integrity of the skin.

6. PREVENTIVE STRATEGIES AND MANAGEMENT APPROACHES

In order to prevent and manage occupational hand eczema effectively, it is useful to combine exposure control, skin care, and targeted clinical management, with several strategies being outlined by different studies and guidelines.

According to the WHO guidelines on hand hygiene in health care, the hands should, if they are not visibly soiled, rather be cleaned with alcohol-based sanitizers instead of soap and water in order to reduce the cumulative irritant exposure [44]. Here, it is crucial not to wash the hands immediately before or after alcohol-based sanitizer application and to let the hands dry completely before donning gloves, since residual moisture plus occlusion may increase the skins sensitivity and trigger a reaction [45].

A cluster randomized trial among healthcare professionals showed that a program providing accessible emollients plus feedback and education significantly improved skin condition and reduced the occurrence of contact eczema compared to usual care, supporting the accessibility to skin-care interventions combined with education in wet-work settings [46].

This was also found in a large, randomized study conducted among nurses, where a behavior-change package containing online training, prompts, moisturizer provision, as well as eczema surveillance lowered the prevalence of hand eczema and was cost-effective, indicating once again that education as well as system support can shift the daily habits of personal hygiene practices enough to change outcomes [47].

It is also relevant to evaluate whether it is more useful to use emollients, moisturizers, or barrier cremes. Barrier cremes form a film on the skin, which is more occluding than an emollient, which also causes some protective film formation, but to a lesser extent. A comprehensive systematic review concluded that regularly using emollients is plausibly beneficial, whereas evidence for barrier cremes remains inconsistent; therefore, education and emollient availability should be prioritized, while barrier cremes should be used more selectively [48].

Regarding the glove use, for healthcare workers with allergic contact eczema to rubber accelerators, switching to documented accelerator-free nitrile (or other non-accelerator options) is a key control measure [49]. The diagnosis should be confirmed by patch testing to specific accelerators in order to guide material selection and to avoid recurrent flares [49].

In order to summarize the points made about preventive strategies and management approaches, it can be said that it is useful to get the basics right, meaning to first apply alcohol-based sanitizer, completely dry hands before donning gloves, have ready access to emollients with proper explanation on how to use them, as well as focused education and surveillance, along with material substitutions and patch-test-guided glove choices for allergic cases.

CONCLUSIONS

- Frequent soap-and-water handwashing and prolonged glove use show a strong dose-dependent relationship with the development of hand eczema in healthcare workers.
- Regular use of alcohol-based hand sanitizers is generally less irritating to the skin barrier than repeated washing. Evidence indicates that alcohol-based hand rubs do not significantly increase eczema risk, provided they are used properly (e.g. not on wet or already irritated skin).
- High-exposure departments (such as surgical units or intensive care, and situations like the COVID-19 pandemic) experience the greatest burden of occupational hand eczema. Increased hygiene demands in these settings correlate with higher prevalence of dermatitis, underlining the need for targeted preventive measures in these areas.
- Individual susceptibility greatly influences outcomes: women (due to combined occupational and domestic exposures) and individuals with atopic background or filaggrin gene variants have a lower threshold for developing eczema. Genetic and atopic predispositions, as well as personal factors like age and lifestyle, modulate the risk.
- Occupational hand eczema leads to tangible consequences: reduced quality of life, increased sick leave, consideration of career change in severe cases, and added medical costs. Many affected workers report psychosocial impacts such as embarrassment, stress, and sleep disturbance, highlighting that this is not a trivial issue but one that can affect overall well-being and job performance.

PRACTICAL RECOMMENDATIONS

- Prefer alcohol-based hand rubs over soap-and-water washing when appropriate (i.e. when hands are not visibly soiled).
- Avoid “double cleansing” – do not wash hands immediately before or after using an alcohol-based sanitizer. Also, always allow hands to dry completely before putting on gloves.
- Moisturize regularly: Use a fragrance-free, hospital-approved emollient cream on hands frequently (e.g. after washing or at least before breaks and after shifts). Ensure that

moisturizing lotions or creams are easily accessible at sinks and workstations . Healthcare facilities should provide approved hand creams and encourage staff to use them.

- Educational programs: Implement training for healthcare workers on skin protection. Topics should include recognizing early signs of hand eczema, proper hand hygiene techniques that minimize skin damage, and the correct use of moisturizers. Consider instituting a skin surveillance program or periodic skin checks so that any issues are caught early and managed.
- Optimize glove use: Use gloves thoughtfully to minimize skin stress. If a healthcare worker develops an allergic reaction to standard gloves (e.g. latex or rubber accelerators), provide accelerator-free nitrile or other hypoallergenic gloves and ensure they are readily available .
- Adjust work protocols if possible: In departments with extremely high hygiene demands, consider measures like scheduling brief respite periods for hand recovery (e.g. alternating tasks so one person isn't constantly washing or scrubbing). Provide warm (not hot) water for hand washing to lessen barrier disruption.
- Seek medical advice early: Encourage staff to report persistent skin irritation or rash on their hands to occupational health or a dermatologist.

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Declaration

I, Marlene Schulze, hereby certify that this research paper on the topic

„ Ekzēma saistībā ar arodekspozīcijas un higiēnas praksi slimnīcu darbinieku vidū ”

(title of the research paper in Latvian)

„Eczema in Association With Occupational Exposure and Hygiene Practices among Hospital Workers ”

(title of the research paper in English)

is my own independent research. All other sources of data, definitions and quotations in my research paper are referenced accordingly. The text of this research paper has never been submitted in any way to any other National Examination Board for evaluation in its entirety or parts and has never been published in its entirety.

_____ /Marlene Schulze
(student's signature) (name, surname)

29.09.2025