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Occupational Contact Dermatitis Risk Factors on Healthcare Workers Isolation Ward During the COVID-19 Pandemic

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ABSTRACT

Background: After a history of exposure to the suspected material and a thorough physical examination, the diagnosis of occupational contact dermatitis (OCD) is commonly suspected. During the initial consultation, essential information involving the above is frequently neglected. **Purpose:** To evaluate the clinical manifestations of OCD cases in health workers and analyze the factors that influence OCD cases in health workers at the isolation ward of Dr. Soetomo Surabaya Hospital during the COVID-19 pandemic. **Methods:** The sample selection was done through purposive sampling. Accessible population that met the inclusion criteria and did not have exclusion criteria were included as research samples. The target population was healthcare workers in the Special Isolation Ward of Dr. Soetomo Hospital Surabaya. The accessible population was healthcare workers who performed hand hygiene activities and used Personal Protective Equipment (PPE) in the Special Isolation Ward of Dr. Soetomo Hospital Surabaya. The research subjects were healthcare workers who worked in the Special Isolation Ward. **Result:** The research results showed a strong and significant correlation between atopic history and the occurrence of contact dermatitis due to poor skin barrier function and decreased tolerance. The study also found that there was no significant correlation between atopic history and the severity level of OCD. There was a significant difference in transepidermal water loss (TEWL) values in the lesion and non-lesion areas, both on the palmar and dorsal aspects of the hand. Moisturizer is an important component in managing hand dermatitis as it can repair and maintain the skin's protective barrier. **Conclusion:** There is a strong and significant correlation between atopic history and the occurrence of contact dermatitis due to poor skin barrier function and decreased tolerance. An individual's atopic history can increase the severity of their OCD.

Keywords: *occupational contact dermatitis, health worker, COVID-19, PPE, human & health.*

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BACKGROUND

Contact dermatitis is characterized by an irritation and redness of the skin caused by irritants or external allergens, followed by spongiosis or intercellular edema of the epidermis.[1] According to the Canadian Center for Occupational Health (CCOHS), Occupational Contact Dermatitis (hereinafter OCD) is a skin infection due to work-related activities. OCD skin inflammation can be caused by allergens or irritants that come into direct contact with the skin, notably originating from the workplace. The use of hand sanitizers, frequent hand washing, and the wear of personal protective equipment (PPE), which consists of masks, goggles, a face shield, hazmat, closed shoes, and shoe covers, are recommended due to the pandemic of Coronavirus Disease 2019 (COVID-19) to prevent transmission to health workers who treat patients with COVID-19 infection. In fact, the employment of

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personal protective equipment (PPE) was found to be the source of various skin healt issues that are experienced by health workers who work as the frontline in the prevention of COVID-19 infection.[2]. Nevertheless, no epidemiological data on OCD in health workers due to the use of PPE and an evaluation of the quality of life of health workers who experienced OCD due to the use of PPE during the COVID-19 pandemic in Surabaya are available at the moment.

According to epidemiological studies conducted in Australia in 2012, contact dermatitis accounts for 79-95% of all occupational skin diseases, with 44% being irritant contact dermatitis (ICD) and 32.7% being allergic contact dermatitis (ACD).[3] Furthermore, it is estimated that the incidence of OCD is 0.5–1.9 cases per 1000 workers per year.[4] Epidemiological data from previous research conducted in China in 2020 showed the prevalence of skin damage in health workers related to preventive measures against COVID-19 infection through the use of PPE was reported to be 97.0% (526 out of 542), and the most frequently affected location were the bridge of the nose (83.1%), cheeks (78.7%), hands (74.5%), and forehead (57.2%). Another study in Wuhan with 1000 surveys conducted on health workers who had to wear PPE reported having an adverse skin reaction during the COVID-19 pandemic, with the three most frequently affected areas being the hands (84.6%), cheeks (75.4%), and the bridge of the nose (71.8%).[5] Contact dermatitis is responsible for 70-90% of all occupational skin infections, and it can have a negative impact on one's quality of life. Contact dermatitis on healthcare workers' hands is prevalent, and it can lead to poor quality of life, work absenteeism, and even unemployment. To raise awareness and comprehension of contact dermatitis, hospital health personnel must be educated.

Long-term utilization PPE by healthcare professionals will raise the risk of OCD. In addition, different levels of physical, chemical, and biological exposure at work might worsen the condition of contact dermatitis in the workplace and increase the risk of OCD in healthcare professionals..

The diagnosis of OCD can generally be suspected following a thorough physical examination and a history of exposure to the suspected material. During the initial session, crucial information is frequently overlooked. In order to correctly identify and diagnose OCD, Mathias presented seven objective criteria. If there are 4 of the 7 criteria, then it can be concluded that dermatitis may come from work.[6]

Skin health issues caused by OCD can have a negative impact on the quality of life of health workers and their families. The consequences for relatives or other family members might be widespread, especially when it comes to raising children. The indirect effects of quality of life on nuclear family members can have major consequences for their emotional, physiological, social, and financial well-being.[7]

This study seeks to investigate the clinical manifestations of OCD cases in healthcare workers, as well as the factors that influence OCD cases in healthcare workers, along with the quality of life and work productivity related to OCD in healthcare workers, especially in the isolation ward at Dr. Soetomo Surabaya Hospital during the COVID-19 pandemic. This research has been reviewed and approved by the Ethics Committee at Dr. Soetomo General Academic Hospital Surabaya (1821/KEPK/II/2020).

METHODS

Purposive sampling was used to determine the sample, which consisted of an accessible population that matched the inclusion requirements and had no exclusion criteria. The target population consists of healthcare professionals working in the isolation ward at Dr. Soetomo Surabaya Hospital. The accessible population is health workers who carry out hand hygiene activities and use PPE at the isolation ward of Dr. Soetomo Surabaya Hospital.

Samples was collected from the entire population that met the inclusion criteria such as Have been and or are conducting health service activities in special isolation ward using PPE and disinfection in the last 2 months; Able to use google form media; Have or are experiencing complaints or symptoms of irritant contact dermatitis (ICD) or allergic contact dermatitis (ACD) while working at special isolation ward using PPE and disinfection in the last 2 months; and Meet 4 of the 7 Mathias criteria and the results of the questionnaire for skin disorders according to work. Likewise, this study excluding samples that met the exclusion criteria such as Refusing to participate in research; Do not fill out the google form until it is finished; and Not following the research flow until it is completed. In this study, a total of 30 patients were obtained as the sample size according to the inclusion criteria.

This research includes Occupational Contact Dermatitis (OCD) as Dependent variable. Meanwhile, independent variable was ingredients contained in PPE or hand sanitizer, TEWL levels, gender, age, atopic history, length of work, length of exposure, complaints, clinical manifestations, patch test results, and quality of life.

Health workers filled out data and questionnaires with google forms, interviews using the Mathias criteria questionnaire, the Indonesian version of the

Nordic Occupational Skin Questionnaire 2002 (NOSQ-2002 LONG), and the Indonesian version of the Dermatology Life Quality Index (DLQI) questionnaire to determine whether occupational skin diseases are related to OCD, to obtain characteristics of the study population (demographic data, employment history, history of skin diseases, as well as current skin diseases, hand washing activities / using hand sanitizers, and the use of PPE), as well as to assess the level of quality of life of individual research subjects.

IKHD values indicate the effect on patients: no, little, mild, severe, or extremely. Data collected using questionnaires, clinical photos, TEWL, and patch tests. Results interpreted by Courage & Khazaka Electronics Gmbh, Germany. Skin condition is classified as very healthy, healthy, normal, limit, or critical.

The instruments used to collect data in this study were using questionnaires, clinical photos, TEWL examinations, and patch test examinations.

Likewise, the data analysis technique used in this study was descriptive statistics with percentages.

On the basis of inclusion and exclusion criteria, research preparation began with the subject data to be collected. After which, prepare the research infrastructure and facilities. After that, testing and validation of the intended instrument. Thereafter, Research and Data Collection Implementation Next, write up the data collector on the data collection procedure and the researcher's interpretation of the examination results. The prospective subject of the study subsequently completed the questionnaire. The data gathered from the physical examination and supporting examination were then entered into the data collector's guide questionnaire. Following that, Descriptive data retrieval and analysis data processing using SPSS software 25.0.0 for Windows, 2017 (Armonk, NY: IBM Corp).

RESULT

The study included 30 patients who met the inclusion criteria. For each patient, the researchers collected detailed information on several factors, including the types of personal protective equipment used, the patient's atopic history, the incidence of occupational contact dermatitis with prolonged wear of personal protective equipment while working, and the palmar transepidermal water loss (TEWL) examination results. These factors were carefully documented and analyzed as part of the study's methodology.

Table 1. Types of personal protective equipment in cases of Occupational Contact Dermatitis in the isolation ward of Dr. Soetomo Surabaya Hospital during the COVID-19 pandemic

Type of PPE	Factors that cause	Total (%)
Hand gloves	thiuram-mix, carba-mix, ercapto-mix	11 (35%)
Hand hygiene	alcohol, perfume	9 (28%)
Oppo tape	biaxially oriented polypropylene dan water base acrylic adhesive, resins	8 (25%)
N95 mask	polyurethane dan polypropylene	3 (9%)
Goggles	plastic polycarbonate	1 (3%)
	Total	32 (100%)

[S]One response may have more than one component that causes occupational contact dermatitis.

Based on Table 1 above, it can be seen that there are several types of PPE that cause Occupational Contact Dermatitis (OCD) cases, namely gloves as many as 11 respondents (35%), hand hygiene activities as many as 9 respondents (28%), the use of oppo tape to glue hazmat suits as many as 8 respondents (25%), N95 masks as many as 3 respondents (9%), and goggles as many as 1 respondent (3%).

Referring to Table 2, the Chi-Square test revealed that the value of p = 0.002 (0.05) indicates a strong and significant relationship between the presence of an atopic history and the incidence of OCD. Five respondents (16%) had a history of atopic asthma and atopic dermatitis; two respondents (6%) had a history of atopic dermatitis; two respondents (6%) had a history of asthma, atopic dermatitis, and allergic rhinitis; and one respondent (3%) had a history of allergic rhinitis; atopic dermatitis known from an early age. In addition, 8 (26%) respondents had a family history of atopic dermatitis; 6 (20%) respondents had a family history of asthma and atopic dermatitis; 5 (16%) respondents had a family history of allergic rhinitis and atopic dermatitis; and 1 (3%) had a family history of asthma, atopic dermatitis, and allergic rhinitis.

Table 2. Atopic history and types of atopic patients and their families in the isolation ward of Dr. Soetomo Surabaya Hospital during the COVID-19 pandemic

Variable		N	%	P
Patients' History	asthma, atopic dermatitis	5	16	0,002
	atopic dermatitis	2	6	
	asthma, atopic dermatitis, allergic rhinitis	2	6	
	allergic rhinitis, atopic dermatitis	1	3	
Family's History	atopic dermatitis	8	26	
	asthma, atopic dermatitis	6	20	
	allergic rhinitis, atopic dermatitis	5	16	
	asthma, atopic dermatitis, allergic rhinitis	1	3	
	Total	30	96	

Table 3. Incidence of Occupational Contact Dermatitis with Prolonged Wear of Personal Protective Equipment While Working in the isolation ward of Dr. Soetomo Surabaya Hospital during the COVID-19 pandemic

Type of PPE	Duration of Use	N	%
Hand gloves	1-3 hours	6	20
	3-6 hours	11	36
N95 Mask	1-3 hours	1	3
	3-6 hours	2	6
Goggles	1-3 hours	1	3
	3-6 hours	1	3
Oppo tape	1-3 hours	5	16
	3-6 hours	7	23
Hand hygiene	5-10 times per day	7	23
	20-30 times per day	10	33
Total		51	143

Based on Table 3 above, it shows the exposure material that causes skin damage and the duration of PPE use. The use of gloves for 3-6 hours caused more skin damage in 11 respondents (36%). Hand hygiene activities 20 – 30 times a day in 10 respondents (33%). The use of oppo tape as a hazmat adhesive for 3-6 hours more skin damage occurred by 7 respondents (23%). N95 mask for 3-6 there was skin damage as many as 2 respondents (6%). Using goggles for 3-6 hours there is as many as 1 respondent (3%). The standard operating procedures of the special isolation ward at Dr. Soetomo Regional General Hospital in Surabaya govern the division of time and length of work of working respondents. Respondents had a length of contact that ranged from 1 hour per day to 6 hours per day. The more inpatients in special isolation ward the longer they get exposured.

The results of the palmar TEWL examination can be identified by the table above. The results of the TEWL measurement using the Tewameter 300® on the palms or palmar showed the mean value of TEWL in the palmar area of the lesion was 63,98 and in the palmar area of the non-lesion was 16,87. The results of the paired t-test showed that there was a difference between the TEWL value of the palmar area of the lesion and the palmar area of the non-lesion area with a sig value of 0.012 (< 0.05). This test revealed that there was a significant difference between the TEWL of the palmar area with a lesion and the TEWL of the palmar non-lesion area.

Table 4. The results of palmar Transepidermal Water Loss Measurement in the isolation ward of Dr. Soetomo Surabaya Hospital during the COVID-19 pandemic

Variable	TEWL in the non-lesion area	TEWL in lesion area	Sig
Mean	16,87	63,98	0,012
Standard Deviation	39,22	86,10	
Minimum	7,60	42,50	
Maximum	25,12	69,27	

Table 5. Measurement Results of transepidermal water loss in the dorsum of the hand in the isolation ward of Dr. Soetomo Surabaya Hospital during the COVID-19 pandemic

Variable	Dorsum of the hand Non-Lesion Area TEWL	Dorsum of the hand Lesion Area TEWL	Sig
Mean	17,41	22,61	0,022
Standard Deviation	41,32	8,72	
Minimum	9,14	17,97	
Maximum	24,23	49,43	

The results of the dorsum of the hand TEWL examination can be identified by the table above. The results of the TEWL measurement on the back of the hand (dorsum manus) showed the mean value of TEWL in the lesion area was 22,61, while in the non-lesional area it was 17,41. The results of the paired t-test showed that there was a difference between the TEWL value of the dorsum of the hand in the non-lesion area and the TEWL value of the dorsum manus in the lesion area with a sig value of 0.022 (<0.05). This test revealed a significant difference between the TEWL value of the dorsum of the hand in the lesion area and the TEWL value of the dorsum of the hand in the non-lesional area.

Based on the Table 5, it shows that the number of respondents with who experienced a light to moderate effect on the quality of life was 26 woman with a percentage of 96.7%, and those who experienced an influence on the quality of life were severe to extreme influential as many as 1 person with a percentage of 3,3%. Meanwhile, man respondents who experienced a light to moderate effect on the quality of life were 2 people with a percentage of 67%, and those who experienced a severe to extreme influence on the quality of life only 1 person with a percentage of 33%. Hence, it can be seen that there are differences in the quality of life of men and women with OCD where women's quality of life is more easily affected. In statistical tests, the relationship between Gender and Quality of Life was obtained with chi square in significant results, which is p 0,049 (< 0.05).

Table 6. Relationship between Gender and Quality of Life in the isolation ward of Dr. Soetomo Surabaya Hospital during the COVID-19 pandemic

	Quality of Life						
Variable	Light – Moderate Effect		Severe – Extreme Effect		Total		p
Gender	N	%	N	%	N	%	0,049
Woman	26	96,7%	1	3,3%	27	100	
Man	2	67%	1	33%	3	100	
Total	28	94%	2	6%	30	100	

Table 7. Relationship between Quality of Life and Work Productivity in the isolation ward of Dr. Soetomo Surabaya Hospital during the COVID-19 pandemic

	Quality of Life						
Variable	Light – Moderate Effect		Severe – Extreme Effect		Total		p
Productivity	N	%	N	%	N	%	0,001
Low	2	50%	2	50%	4	100	
High	26	100%	0	0%	26	100	
Total	28	94%	2	6%	30	100	

Based on the Table 6, the number of respondents with low productivity levels who experience a mild to moderate effect on the quality of life are as many as 2 (50%) :, and those who experience a severe to extreme influence on the quality of life are as many as 2 (50%). Meanwhile, respondents with a high level of productivity who experienced a mild to moderate effect on the quality of life were 26 (100%) respondents, and there were no respondents who experienced a severe to extreme influence on the quality of life which is as many as 0 people (0%), and this result was generated from a total sample of 30 respondents. The statistical test found a significant relationship between work productivity and quality of life with a p value of 0.000

(< 0.05). Therefore, it can be seen that productivity has a relationship with the quality of life of OCD patients.

DISCUSSION

The results of the study in Table 1 reveal that there are several types of PPE that cause Occupational Contact Dermatitis (OCD) cases, namely gloves for as many as 11 respondents (35%), hand hygiene activities for as many as 9 respondents (28%), the use of oppo tape to glue hazmat suits for as many as 8 respondents (25%), N95 masks for as many as 3 respondents (9%), and goggles for as many as 1 respondent (3%). Two respondents were able to have more than one ingredient that causes occupational contact dermatitis.

Chemicals added during the process of making latex gloves can cause abnormalities in the skin. The ingredients in latex gloves that can cause allergies include chemical antigens [8]. The slow hypersensitivity type reaction (type IV), resulting in allergic contact dermatitis. Symptoms usually develop within 24-48 hours of exposure of skin membranes or mucosa to latex in sensitive people. The main allergens are residual accelerators and antioxidants left over from the original manufacturing process. Langerhans cells process antigens and carry them to the T cells of the skin. Some objects can cause sensitization. Type IV hypersensitivity is more common in atopic individuals. Dermatitis can predispose the patient to further sensitization or infection.[9]

Latex glove powder comes from corn flour or talcum powder. Powder on gloves that are not absorbed in latex protein has the potential to cause irritant contact dermatitis because the entry of glove powder into the body can interfere with physiological functions [10]. Irritant contact dermatitis may be a local reaction to glove powder. Skin irritation associated with glove powder is mainly related to its potential abrasive effect. All of these can cause dry, cracked, and itchy skin on the back of the hand under the glove. This reaction usually occurs within a few minutes to several hours after contact with the gloves. Symptoms are limited to the site of glove contact and include redness, cracking, blisters, dryness, peeling, and cracking [9]. Although latex gloves provide good protection against infectious agents, they have also been associated with allergic reactions and irritation [10].

Health workers have jobs that increase the risk of occupational skin diseases caused by latex gloves due to their use and continuous contact with latex gloves. Contact dermatitis, either allergic or irritant, is the most common skin disease that occurs in the field, and its incidence is estimated to reach 80% of all cases of occupational diseases reported [11].

Prevention of Occupational Contact Dermatitis (OCD) in cases of hand dermatitis can be done, according to the WHO by recommending that hand washing using an alcohol-based hand sanitizer or hand rub be carried out for 20 to 30 seconds. Some materials that can be used include alcohol, chlorhexidine, chlorocilenol, hexachlorophene, iodine and iodophors, quaternary ammonium compounds, triclosan, and [9]others. The way to wash your hands is also the same, using six steps. Alcohol interacts with the virus's target envelope to kill it (virusicidal). The effectiveness of hand sanitizers during this pandemic is proven by a systematic study; nine out of 10 cross-sectional studies (case control) prove a decrease in nosocomial and community transmission [12].

Hand dermatitis continues to increase during the COVID-19 pandemic. The most significant increase in cases was found among medical personnel. Research conducted in the United States on medical personnel proves that medical personnel who work 36 to 40 hours per week experience the highest incidence of dermatitis (76.11%). Prior to the pandemic, it was noted that medical personnel experienced hand dermatitis due to wearing occlusive gloves for more than 5 hours per day. Women suffer more often than men (27.5% vs 10.4%). Based on these data, when a pandemic occurs, there is an increase in hand washing from 5-10 times per day to 10-20 times per day. The results showed that before COVID-19, the frequency of washing hands was 10-20 times per day, and during COVID-19, it was 20-30 times per day. In terms of hand washing, it was noted that as many as 76.6% of medical workers who washed their hands more than 10 times a day experienced skin damage. A total of 27 doctors out of 31 doctors experienced skin disorders, and 35 nurses out of 65 nurses also experienced skin disorders during the pandemic [13]

Hand dermatitis today often occurs due to hand hygiene practices to prevent infection. Part of hand hygiene usually consists of water, surfactants, drying elements, and disinfectants. Each component has an effect on the epidermal barrier. The role of water, for example, is to eliminate free amino acids, which are components of natural moisturizing factors: and have a role in maintaining hydration through plasticization and desquamation of the stratum corneum. After contact with water, the skin becomes more alkaline, while a good level of acidity is needed for the skin to carry out several functions, including protective functions. Exposure to soap or cleansers and water causes significant structural and functional changes. In the epidermis, there is hyperproliferation, structural damage, a reduced ability to bind water, inadequate hydration, and desquamation. After chronic surfactant

exposure, there is an increase in stratum corneum turnover. Neurosensory irritation of the skin is caused by abnormalities in the stratum corneum due to an increased immune response, an accelerated nerve response, and an increase in epidermal growth factor, causing discomfort, itching, stinging, and burning. [14]

Patients with hand dermatitis initially experience dry, reddish, and itchy hands. According to research conducted by Guertler et al, the most common symptoms among health personnel are dry skin (83.2%), erythema (38.6%), and itching (28.9%). In the study, approximately 90.4% of medical workers reported several complaints. The distribution of lesions in hand dermatitis is often distinctive. In irritating contact dermatitis, palmar manus and distal dorsum digiti are most typically affected. If dermatitis is predominant on the dorsum of the manus, digits, interdigital space, and wrist, then allergic contact dermatitis is the most likely cause. Vesicles, pustules, or crusts most frequently develop on palmar and digiti in atopic dermatitis. Nevertheless, dishidrotic dermatitis of the hands is suspected if the lesion appears as oval and numerous blisters on the palmar and extends to the dorsum of the manus[15].

It is known that there are currently two types of hand hygiene, namely, using running water and soap and using hand sanitizer. Running water appears to have an effect in the form of increasing pH changes until the pH becomes neutral. An increase in neutral pH causes an increase in proteases, leading to disruption of the function and integrity of the skin barrier. While soap is a product that contains synthetic detergents and is used as a tool for washing or cleaning, alkaline soap is able to remove debris, including normal flora, causing dry and irritated hands [13].

The use of moisturizers is one method for reducing symptoms and preventing the progression of hand dermatitis. This is commonly neglected due to a lack of knowledge regarding skincare. According to research conducted by Guertler et al., the average amount of moisturizing cream used during the COVID-19 pandemic has increased significantly. After the pandemic, the average number of times a day that moisturizers were used increased to between one and two times each day. But still, the average use of hand moisturizers remains low. According with the consensus in China about the protection of mucosa and skin during the pandemic, emphasizing the use of emollients containing hyaluronic acid, seramides, vitamin E, or other skin-improving ingredients is performed each time after washing hands whenever possible.[16]

Health workers frequently use oppo tape to glue hazmat clothes to ensure that there is no opening for outside air to enter the hazmat clothes or gowns of medical personnel. When used, this adhesive is frequently applied to the hands or face. Oppo tape materials that are often found can cause allergies, namely resins, turpentine, and adhesives, such as acrylate and methacrylate. The types of allergies that commonly arise due to the use of plasters are irritant contact dermatitis and allergic contact dermatitis. In a study involving 37 people who were tested on ordinary adhesives and hypoallergenic adhesives, the results showed that 17 people (45%) showed allergic symptoms on the skin surface, while only 4 people (10%) were sensitive to hypoallergenic adhesives. As a preventive alternative to the use of adhesives, you can use hypoallergenic polyacrylate adhesives to reduce the incidence of allergies that may arise.[17]

The wearing of masks has two purposes: the first is to control the source of the virus by preventing infected users from spreading the virus to others, and the second is to act as a preventative measure by protecting uninfected users from being exposed to the virus.[18] Masks are a form of personal protective equipment that are worn to protect against the transmission of respiratory diseases caused by droplets, body fluids, and airborne pathogens[19]. The recommended masks consist of three types of masks, namely medical masks, cloth masks, and N95 masks [20]. The Centers for Disease Control and Prevention (CDC) recommends that everyone wear a cloth mask in public because the majority of asymptomatic COVID-19 patients can still spread the virus (CDC, 2020). Healthcare professionals treating COVID-19 patients in areas exposed to high aerosol concentrations, such as COVID-19 intensive and semi-intensive care units, are advised to wear N95 masks. Medical masks are essential for all health care personnel and anyone entering a health care facility.[18]

Based on experimental research by Navarro-Trivino and Ruiz-Villaverde in Spain, it is stated that the incidence of occupational skin diseases in healthcare workers is 12.75%. The incidence of skin disorders on the face is 25.7% with the most cases, namely acne [21]. Hua et al.'s cross-over research on the relationship between the use of personal protective equipment (PPE) and skin disorders in healthcare workers during the pandemic said 526 out of 542 healthcare workers (97%) had skin disorders [22]. Other studies on the use of N95 masks continuously stated that the reactions that often appeared on the skin due to the use of masks were acne (59.6%), itching on the face (51.4%), and rashes on the face (35.8%). [23]

The use of masks can cause several effects on the skin, such as physical trauma to the skin, acne, contact

dermatitis, urticaria, and aggravating previous skin diseases. [24,25] [16] The most common skin disorders are erythema, papules, squara, fissures, erosions, ulcers, vesicles, and wheals [24]. Clinical symptoms that are usually felt are dry skin, numbness, itching, and burning. The most frequently affected parts of the skin are the nose and cheeks. Complaints of contact dermatitis can be reduced and prevented by taking preventive measures in the form of wearing moisturizers on areas of the face that are often exposed to it with mask material. [26]

Wearing goggles can cause skin diseases such as urticaria or contact dermatitis due to contact and suppression while wearing it. A study showed that more than 1/3 of health workers complained of breakouts, itchy faces, and even dermatitis due to the use of goggles. The use of goggles by health workers can cause itching that arises from the wearing of personal protective equipment, which is closely related to contact dermatitis. Until now, research on skin reactions related to the use of goggles has been very limited. The ingredients in goggles are still unknown; it is unknown which ingredients can cause allergies. The use of moisturizers on the skin's surface before using goggles, as well as avoiding overly tight use, can help to prevent and reduce the incidence of allergies caused by goggles.[27]

A history of atopic dermatitis increases the probability of developing contact dermatitis due to poor skin barrier function and decreased tolerance. According to a study by Visser et al., individuals with a history of atopic filagrin mutations have abnormalities in the skin barrier that make it easier for irritants or allergens to penetrate the deeper layers of the skin, causing irritation or impairment to the skin with repeated exposure.[28] Sularsito and Juanda discovered similar results, stating that people with a history of atopic dermatitis are more susceptible to contact dermatitis than people who do not have a history of atopic.[29]

A person's history of being atopic can increase the severity of their OCD. Based on clinical and diagnostic experience, it is known that contact with allergens or irritants can trigger OCD. Sensitization in OCD will affect the skin manifestations that occur. Skin with a damaged barrier can facilitate allergens followed by a specific IgE response. This sensitization process is related to the severity of the disease.[30] Nonetheless, in this study, it was found that all respondents affected by OCD whose severity had been assessed had no effect on their atopic history. This finding is in line with previous research.[31] Due to the fact that the chemicals that workers are exposed to are allergens or irritants, there are chemicals that can directly cause irritation to the skin without eliciting an immune response.[31] The probability between workers who have a history of atopy and those who do not have a history of atopy is the same for chemicals that are irritants and allergens. Thus, history of atopy is not an important factor in the severity of OCD.

The following moisturizers can be used to maintain and restore the skin barrier: occlusive (petrolatum and beeswax), which work as a physical barrier to reduce TEWL and retain water content in the stratum corneum: and humectants (urea and glycerin), which are hydrophilic compounds that can attract water from two sources, namely from the dermis to the epidermis and from the external environment when it is moist. Emollients (ceramides and free fatty acids), are lipids and oils that add to the lipid membrane of the skin barrier; rejuvenator proteins (keratin and collagen), are Low-molecular-weight proteins that can add to the skin barrier protein that is lost when washing hands.

Moisturizer is one of the most significant material in the management of hand dermatitis, because almost all hand dermatitis experience skin barrier disruption. Initial management of hand dermatitis usually aims to control inflammation, then proceed to repair and maintain the skin barrier. In most cases, management begins with symptomatic therapy, followed by daily skin care management, including the use of moisturizers.[32]

Based on the results of the study in the table 3, the results of the palmar TEWL examination can be seen. The Tewameter 300® was used to measure TEWL on the palms or palmar, and the findings showed that the mean value of TEWL in the palmar area of the lesion was 63.98 and in the non-lesion area was 16.87. The paired t-test results revealed a difference with a sig value of 0.012 (<0.05) between the TEWL values of the lesion and the non-lesional area on the palmar area. The results of this test showed that there was a significant difference between the TEWL value of the lesion area and the TEWL of the non-lesional area.

Based on the results of the study in the Table 4, it can be seen the results of the TEWL examination of the dorsum manus. The results of the TEWL measurement on the back of the hand (dorsum manus) showed the mean value of TEWL in the dorsum manus lesion area was 22.61 and on the dorsum manus non-lesion area was 17.41. The results of the paired t-test showed that there was a difference between the TEWL value of the dorsum manus in the lesion area and the dorsum manus in the non-lesion area with a sig value of 0.022 (< 0.05). The results of this test showed that there was a significant difference between the TEWL value of the

lesion area and the TEWL of the non-lesional area.

The paired t-test showed that there was a significant difference between the TEWL value of the lesion area and the TEWL value of the non-lesional area. The results of this study indicate that the value of TEWL in both the lesioned and non-lesioned reas has increased compared to the normal value of TEWL in normal patients, which indicates that in patients with contact dermatitis there has been disruption of the skin barrier. Based on the literature, this also proves the inside-outside hypothesis that the defenses of the skin without lesions in contact dermatitis patients have been damaged, and the damage will increase in the skin with lesions.[33,34] Other literature states that reduced amounts of ceramides have been reported in the epidermis, both in the skin of patients with contact dermatitis with lesions and those without. In patients with non-skin contact dermatitis, dryness of the skin and impaired function of the stratum corneum barrier also occur, which are characterized by increased water loss through the epidermis.[35] Research conducted by Suhiro et al. in Japan also concluded that there was an increase in TEWL values in patients with contact dermatitis compared to normal patients.[36] Another study conducted by Kim et al. in North Korea found a twofold increase in TEWL in non-lesional skin; and a fourfold increase in TEWL in lesional skin, compared with normal controls.[34] In patients with contact dermatitis, non-skin lesions also have dry skin and impaired skin barrier function, which is characterized by increased water loss through the epidermis.

Based on the DLQI questionnaire, the quality of life index in dermatology (henceforth IKHD) can be analyzed in six parts as follows: symptoms and feelings, daily activities, leisure time, work and school, personal relationships, and medication. The assessment for each question in the questionnaire is as follows: extreme effect with a score of 3, severe effect with value of 2, little effect with a value of 1, no effect at all with a value of 0, irrelevant with a value of 0, while if there is a question not answered it have a value of 0, and on question number 7 if answered yes in “hinder work or study” have a score of 3. IKHD is assessed by adding up all the scores for each question, with a maximum score of 30 and a minimum of 0. The higher the score, the more it impacts the quality of life. IKHD can also be expressed as a percentage of the maximum value of 30.

According to the study's results in the Table 6, 26 female (96.7%) experienced a mild to moderate effect on their quality of life, while 1 person (3.3%) experienced a severe to extreme effect on their quality of life. Meanwhile, among male respondents who experienced a mild to moderate effect on the quality of life, there were 2 people (67%), and only 1 person (33%), who experienced a severe to extreme effect on the quality of life. The results of this study show that there are differences in the quality of life of men and women with OCD: andthat women's quality of life is more easily affected.

The number of OCD patients in this study was found to be higher among women, whose quality of life was easily affected. This findings similar to that of previous research. Higher stress levels are often found in women; this is one of the factors that trigger the disease and can cause more severe symptoms. Psychological stress is a factor that can affect all homeostatic systems, causing the immune system to be suppressed.[37] One of the organs that can be disturbed due to psychological stress is the skin, which is the largest organ in the human body.[38] The skin will react by activating multiple pathways when psychological stress triggered by noxious stimuli or stressors is delivered to the skin’s organs, creating peptides at the local level that weaken the skin's immune response. This process can worsen the condition of a person's skin diseases, one of which is dermatitis.

Based on the results of the study in the Table 7, it shows that the number of respondents with low productivity levels who experience a mild to moderate effect on the quality of life is as high as two (50%) respondents, and there were two (50%) respondents who experience a severe to extreme effect on the quality of life. While respondents with a high level of productivity who experienced a mild to moderate effect on the quality of life were 26 (100%) respondents, there were no respondents who experienced a severe to extreme influence on the quality of life (0%); these results were generated by a total sample of 30 respondents. The statistical test found a significant relationship between quality of life and work productivity with a p value of 0.000 (<0.05). So it can be seen that productivity has a relationship with the quality of life of OCD patients, which is in line with previous research.[39] In this study, OCD patients with mild-to-moderate effect on quality of life had high productivity, while OCD patients with low-moderate and extreme influential quality of life had low productivity. This is in line with the statement made by Rosyiana and Pramuningtyas that the impact of OCD, either directly or indirectly, can affect the treatment needed and is associated with the loss of work time and reduced quality of life, so that it can reduce patient productivity.[40]

Skin health problems caused by OCD can affect the quality of life of healthcare workers and their families. The effects can be serious for relatives or

other family members, especially when it comes to raising children. The secondary effects of quality of life on nuclear family members can have a serious impact on the emotional, health, social, and financial aspects of their lives. The impact of OCD on workers is enormous and can occur chronically as long as exposures persist in the workplace. OCD either directly or indirectly can have an impact on the necessary treatment and reduced income of workers, associated with the loss of working time and reducing the quality of life, so that it affects the productivity of workers.[41]

Dermatitis is a skin problem that has a psychological effect on patients and can cause significant disturbances to the quality of life. Patients often feel that they have received a negative stigma, along with a bad self-image, and feel inferior.[42] According to the International Labor Organization (ILO), contact dermatitis accounts for 80% of occupational skin diseases. In fact, prior to the pandemic, the reported prevalence of occupational contact dermatitis in Indonesia was 29%. It was recorded that, of 526 healthcare workers, 74.5% of them reported experiencing hand skin damage due to increased infection prevention. During the COVID-19 pandemic, 97% of healthcare workers experienced skin damage due to the increased use of hand disinfection, including all infection prevention.[43]

The percentage of occupational dermatitis among all occupational diseases occupies the highest portion at around 50-60%. In addition to the high prevalence, the site of occupational dermatitis is usually found on the arms, hands, and fingers. Because this causes the patient a great deal of disturbance when he is working, it has a detrimental impact on the patient's overall productivity, and as a result, the disease requires special treatment. Based on data in Sweden, occupational skin diseases account for around 50% of all registered workers' diseases. It is estimated that between 20 and25 percent of reported cases of occupational skin disease result in lost work time between 10 and 12 working days. The economic cost of occupational skin diseases in America is about $222 million to $1 billion over a year.[44]

The incidence of OCD increases with increasing frequency and duration of exposure to PPE and hand hygiene activities. The test results revealed a substantial difference between the TEWL value of the lesion area and the TEWL value of the non-lesional area in the palmar region of the dorsum manus, indicating that the skin barrier is compromised in OCD patients. There are disparities in the quality of life between men and women with OCD, with the quality of life of women being more easily affected. The results of the analysis indicate that productivity is associated with OCD patients' quality of life. The majority of OCD patients' patch test findings were positive for 1% thiuram-mix allergen, 100% lanolin, and 3% benzophenone.

Based on the aforementioned findings, it is recommended to apply a moisturizer containing ceramides to the face and hands before wearing PPE and after washing hands with disinfectant soap. Avoid using alcohol-based hand sanitizers. Avoid using gloves made from latex and powder by using nitrile gloves (latex and powder free). Reduce the duration of time to use PPE, especially healthcare workers with a history of Occupational Contact Dermatitis (OCD).

In sum, our study provides compelling evidence to support the association between atopic history and the incidence of occupational contact dermatitis (OCD) in healthcare workers who are exposed to various substances and wear personal protective equipment (PPE) while working in special isolation ward. The Chi-Square tests revealed a strong and significant relationship between atopic history and the incidence of OCD. Our findings also suggest that certain substances and PPE can lead to skin damage, as evidenced by the significant differences in TEWL values between lesion and non-lesion areas on the palms and dorsum of the hands.

Our study underscores the importance of implementing measures to protect the skin of healthcare workers, particularly those with an atopic history. These measures could include providing appropriate PPE that minimizes skin exposure to harmful substances, such as gloves and gowns made of non-irritating materials, and using emollients to maintain skin hydration and barrier function. In addition, regular skin assessments and education on proper skin care practices should be implemented to identify and prevent skin damage in healthcare workers.

Based on the aforementioned findings, it is recommended to apply a moisturizer containing ceramides to the face and hands before wearing PPE and after washing hands with disinfectant soap. Avoid using alcohol-based hand sanitizers. Avoid using gloves made from latex and powder by using nitrile gloves (latex and powder free). Reduce the duration of time to use PPE, especially healthcare workers with a history of Occupational Contact Dermatitis (OCD).

The implementation of this evaluation research has been effectively pursued in order to generate data consistent with the research objectives. Yet, there are still obstacles and limitations in this study's implementation, especially the weakness of the questionnaire-based research data collected from each

respondent. If the respondent does not answer honestly or does not comprehend the statement item's meaning, the resulting data will be less accurate. The pharmacy has been unable to deliver patch test reagent ingredients derived directly from PPE materials. This study was limited to a single hospital, hence the outcomes obtained were limited to health care workers in a special Covid-19 isolation ward at Dr. Soetomo Regional General Hospital in Surabaya who diagnosed OCD.

Health facilities can provide healthcare workers with hand sanitizers without alcohol content, and latex and powder-free gloves.

Further research can be conducted by utilizing other hospitals as research sites and a larger sample size, thereby enhancing the research data on how healthcare professionals with Occupational Contact Dermatitis (OCD) feel in multiple hospitals. It is hoped that by doing this, study results will be supported and more relevant and comprehensive recommendations for improvement will be obtained.

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