

OCCUPATIONAL DERMATOSES AMONGST HEALTH CARE WORKERS IN INDIAN SCENARIO

Dermatology

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ABSTRACT

Background: Healthcare workers (HCW) may be exposed to many contact irritants and allergens. The use of personal protective equipment (PPE) has increased due to COVID-19 pandemic. Herein we evaluated 78 HCW with suspected OD. **Aims and Objectives:** To study clinical profile of occupational dermatoses and to assess the impact on the quality of life (QOL) (Dermatology life quality index/DLQI) of HCW. **Materials and Methods:** This was cross sectional study conducted between 2020 to 2022 included 78 HCW with OD. Patch test was done using Indian standard series, supplemental allergens, and AS IS substances wherever clinically indicated. **Results:** The majority of healthcare workers were nursing officers, accounting for 33 (42.3%), followed by doctors, who constituted 30 (38.5%). A significant portion of these professionals, 50 (64%), were engaged in COVID-19 care settings, including both ICU and non-ICU environments. Irritant contact dermatitis (ICD) was found in 46 cases (58.97%), while allergic contact dermatitis (ACD) was identified in 8 cases (10.25%). The remaining cases included mask acne, pressure indentations/erythema, frictional blisters, contact urticaria, contact leukoderma, and Koebnerization of psoriasis. Among the 54 patients who underwent patch testing, 16 were found to be sensitive to various allergens such as fragrance mix and chlorocresol. OD had a mild to moderate impact on the quality of life for most of these healthcare workers. **Discussion:** HCWs exposed to many irritants and allergens such as gloves, sanitizers, PPE, disinfectants, chemicals(laboratory). In present study contact dermatitis (CD), frictional dermatoses (FD) were commonly observed. Gloves, sanitizers, mask were most frequently observed contactants. **Conclusion:** Occupational dermatoses were increased recently due to PPE use. OD had small to large impact on QOL. The importance of understanding OD should be highlighted among dermatologists and HCW.

KEYWORDS

Contact dermatitis, Health care workers, Personal protective equipment, Hand eczema, occupational dermatoses

INTRODUCTION

Occupational skin diseases (OSD) are one of the most serious emerging risks associated with chemical exposure and extensive use. As skin is the largest organ of the body and exposed to various chemicals, physical and biological risk factors during work. Healthcare Worker (HCW) is any person, working in a healthcare entity who has the potential for exposure to patients, residents, or consumers of the healthcare entity and/or to infectious materials, including body substances, contaminated medical supplies and equipment, contaminated environmental surfaces, or contaminated air. HCW may be exposed to many contact irritants and allergens. Furthermore, as a result of COVID-19 pandemic, the use of personal protective equipment (PPE) has gained prominence.¹ PPE are protective gears designed to protect the HCW by minimizing the exposure to a biological agent. Components of PPE are goggles, face shield, mask, gloves, coverall/gowns (with or without aprons), head cover and shoe cover. Certain components of PPE, such as glasses, masks, and protective clothing, as well as wet work involving rubber chemicals, disinfectants, detergents, drugs, and soaps, may impair skin integrity.² These factors results in spectrum of dermatoses includes ACD, ICD and contact urticaria(CU), FD, pressure injuries(PI) as well as exacerbations of underlying endogenous diseases including atopic dermatitis (AD), dyshidrotic eczema, acne and psoriasis.^{2,3} For some patients, dermatitis can be multifactorial, as endogenous disease may coexist and be exacerbated by exogenous disease.⁴ A paucity of literature exists regarding the epidemiology, clinical profile, quality of life (QOL) and causative agents of OD in HCWs amongst the Indian population.

Aims and Objective

- 1) To study clinical profile of occupational dermatoses amongst health care workers.
- 2) To determine the impact of occupational dermatoses on the quality of life (Dermatology life quality index/DLQI) of health care workers.

METHODS

Design

This was cross sectional descriptive study. Comprehensive research summary was generated by analysis of data. Quantitative research enabled to find out the frequency of various OD and its relation to usage of suspected contact allergens in terms of frequency, number of hours in HCW.

Participants

This study included all HCW clinically diagnosed with occupational dermatoses, (it is any pathological condition of the skin for which work related exposure can be shown to be a major direct or contributory factor like contact dermatitis, contact urticaria, goggle and mask dermatitis/pressure dermatosis, facial acne, sweat dermatitis) in tertiary care centre in north India. we evaluated seventy-eight HCW who met inclusion criteria.

Data Collection

The pre-designed proforma was used for the history and examination. All HCW with occupational dermatoses were included. An informed written consent was taken from all the patients. Demographic parameters and detailed history were recorded. The impact of the occupational dermatoses on quality of life was assessed using the DLQI scale. A detailed mucocutaneous examinations were done and the morphology and distribution of the lesions was recorded. Patch testing was done in 54 patients using Indian standard series (ISS) and supplemental allergens (manufactured by systopic laboratory India) and "as is" product in appropriate dilution as clinically indicated. In suspected gloves allergy, glove was cut in pieces of size 2 cm x 2 cm with the inside and outside part of the glove applied separately and scanpor tape was used to secure the material to the back. In case of suspected CD to sanitizer, sanitizer was put on fin chamber covered with absorbent paper. Patch test readings were taken at 48 hours and 96 hours. Interpretation of Patch test was done as per International Contact Dermatitis Research Group (IGDRG) criteria.

Statistical Analysis

Data entered into a Microsoft Excel spread sheet & results analysed using Statistical Package for Social Sciences SPSS 27. The presentation of the Categorical variables was done in the form of number and percentage (%). Quantitative variables like age, DLQI were expressed as mean and standard deviation. Qualitative data like were presented in percentage, proportions and graphs. Chi-square (χ^2) test was used to compare categorical data. For statistical significance, p value of less than 0.05 was considered statistically significant.

RESULTS

A total 78 HCW were included, consisting of doctors, nursing officers, lab technician, cleaning staff and nursing orderly (Table 1). The majority of participants were female nursing officers, in the age range of 21–30 years, with male to female ratio was 2:3. Most of HCWs were working in covid care services. Among them, thirty (38.5%) HCW were working in ICU and twenty (25.6%) HCW were working in non-ICU setting. The remaining twenty (35.9%) HCW were working in non-covid health care services.

The gloves, sanitizers, and N95 masks were commonly identified as suspected irritants, followed by PPE kits, Betadine, and head caps in some HCWs (Supplemental image). Most patients had used powdered gloves for more than 8 hours ($P < 0.004$). Nineteen HCWs reported using sanitizers more than five times a day (Table 2). Hands and faces were the most frequently affected areas (Figures 1-2). The majority of HCWs experienced erythematous papules (Figure 1), scaling, xerosis, and pressure marks, with urticaria and friction blisters also observed (Figure 2c).

A total of 54 patients who provided consent underwent patch testing. Among them, 38 patients (70.38%) tested negative, whereas 16 patients (29.62%) tested positive (Supplemental Table). Among 78 HCWs with OD, irritant contact dermatitis, frictional dermatoses were observed in 46 (58.97%) and 20 (25.6%) respectively (Table 3). ACD was seen in 8 (10.24%) HCWs. The remaining patients exhibited contact urticaria, Koebnerization of psoriasis on the face, or contact leukoderma (Table 3). Of the 20 patients with frictional dermatoses, mask acne, pressure indentation at the nasal bridge (Figure 2a-b), post-inflammatory hyperpigmentation, and frictional blisters from N95 masks were most commonly noted (Figure 2c-d). Quality of Life (QOL) was assessed using standard questionnaires. Among the 78 HCWs, 28 (35.9%) experienced a small effect, 32 (41%) a moderate effect, and 14 (17.9%) a very large effect on their QOL. Three (3.8%) patients reported a severe impact on their QOL (Figure 3).

DISCUSSION

Healthcare workers (HCWs) are exposed to numerous irritants and allergens, including gloves, sanitizers, PPE, disinfectants, and laboratory chemicals. This study evaluated 78 HCWs with occupational dermatoses. Most patients (61.5%) were aged between 21 and 30 years, with a male-to-female ratio of 2:3. These findings are consistent with other studies, which also report a higher prevalence of occupational dermatoses among females compared to males.⁵⁻⁸ The majority of HCW in the study were nursing officers (42.3%), followed by doctors (38.5%). These findings are consistent with other studies, which have also reported that 23-43% of nursing officers are commonly affected by OD.^{5,7,9}

Out of seventy-eight HCW with OD, fifty (64%) were employed in COVID-19 healthcare settings. This suggests that working in COVID-19 services may have increased the risk of OD, possibly due to heightened use of PPE and frequent hand hygiene practices. Additionally, 28 HCW (36%) working in non-COVID settings also developed skin problems, indicating that adherence to COVID-19 protocols might still impact skin health even in non-COVID environments.

In the present study, gloves were identified as the most common contactant, affecting 39.74% of HCWs, followed by sanitizers at 29.92% and masks at 25.64% (Supplementary Figure). Mushtaq et al. similarly found gloves to be the most common contactant, affecting 47.52% of participants, followed by sanitizers at 38.61%, masks at 20.79%, and full-body suits at 6.93%.¹⁰ These findings align with previous studies, which have identified PPE, sanitizers, and goggles, with gloves also frequently implicated as common contactants.¹¹⁻¹³ However, alcohol-based disinfectants, soap, frequent hand hygiene measures, and gloves were commonly identified as contactants associated with OD among HCW.^{5,14} This variation in observations could be attributed to the increased use of sanitizers, gloves, and

masks, reflecting changes in attitudes and practices among HCW in response to the post-COVID pandemic environment.

Hands ($n=52$, 66%) were the most common affected site followed by face ($n=21$, 26%). Among them dorsum of hand (41%) was involved in gloves related dermatoses (Figure 1a-d) compared to palms (33%) and web space (41%) as in CD to sanitizer (Figure 1e-f). However, hands (22-84%) were reported to be the most commonly affected sites in most of the studies in HCW.^{10,15,16} The preferential involvement of web space and palmar creases could be because of accumulation of the irritants and allergens.¹⁷

Among the 31 HCW with gloves related dermatoses most of them had used powdered double gloves for more than 8 hours/ day ($p < 0.004$) (Table 2). These observations were similar to previous study,¹⁸ where as 88% patients had sanitizer related dermatoses. They had used sanitizer more than 5 times per day. These findings were consistent with a recent study, by Solanki et al, observed using hand sanitizer more than 8 times per day was a significant causative factor in hand-related dermatitis.¹⁶

We observed a distinctive pattern in patients with hand eczema related to CD from gloves and sanitizers. Specifically, patients with CD from gloves typically exhibited erythematous papules and plaques on the dorsum of the hands, often with a sharp cutoff at the wrist. These findings are consistent with previous studies, which have reported similar presentations in patients with CD due to gloves.^{9,17} Patients with CD from sanitizers commonly exhibited xerosis and scaly lesions on the palms and in the web spaces of the hands. These findings are consistent with observations reported in previous studies.¹⁹ These clinical findings reinforce the results of previous studies.

The face was affected in 21 (26%) HCW. Among them, 20 experienced mask-related dermatoses. The most common issues were mask acne (15 cases, 19.23%), followed by pressure injuries (11.54%), erosion, post-inflammatory hyperpigmentation (10.26%), and pressure erosion at the nasal bridge, particularly in those using N95 masks with metallic nasal bridges. One patient developed severe frictional blisters, erosion, and pressure marks at the site of contact with the N95 mask, significantly impacting their quality of life (Figure 2). This led to take leave from work. Most of the patients ($n=18$, 88%) had used mask more than 8 hours per day, while two patients ($n=2$, 12%) had used mask less than 8 hours per day (Table 2). Most of the workers (13, 65%) used N95 masks with metallic nasal bridges, which could explain the nasal bridge erythema observed in five HCW. According to Lan et al., HCW using masks for more than 6 hours faced a significant risk of skin damage.²⁰ However, we did not observe a statistically significant difference concerning the number of hours of mask use, though it did contribute significantly to the development of mask-related dermatoses. Notably, patients using double masks (80%)—comprising N95 and surgical masks—were at a higher risk of developing mask-related dermatoses compared to those using a single mask (20%). This difference was statistically significant ($p < 0.001$).

As per previous study mechanical pressure of mask due to prolonged use and perspiration can all lead to various types of cutaneous lesions such as indentations of the face, acne mechanica, skin tears, PIH, ulceration, crusting, erythema, and infection.^{21,22} These findings were comparable to recent studies, with acne was observed in 11-37% of cases.^{11,16} Similarly blisters, erosions, pressure injuries (PI) and ulcers were reported in HCW using mask, protective goggles due to constant pressure.^{11,19} Three patients had presented with PIH. Among them one patient also had differential pigmentary changes i.e, skin covered under mask lighter compared to the rest of the face. Foo et al, noticed pigmentation in 8 patients with mask use, at nasal bridge, cheeks, and chin.¹² In recent studies among HCW managing COVID-19 patients experienced N-95 mask-related pressure sores on the nasal bridge.^{20,23} similarly we observed PI at nasal bridge, could be due to use of N 95 mask with metallic nasal bridge for more than 8 hours per day.

In present study most of the HCW 46 (58.97%) had ICD, among them ICD to gloves and sanitizer was present in 26 (33.33%), 20 (25.64%) patients respectively. Frictional dermatoses (FD) were observed in 20 (25.64%) patients. Eight (10.25%) patients had ACD. These observations were similar to study conducted by Singh et al where most common dermatoses were ICD (39.5%) followed by friction dermatitis (25.5%).¹¹ According to study conducted by Franca et al, ICD was present in 34 (54.84%), ACD in 6 (9.65%) cases, these observation were consistent with present study findings.⁵ In present

study CD was most commonly due to increased sanitizer, gloves use along with increased frequent hand washing. Hence ICD was most commonly observed OD in HCW followed by FD and ACD.

One patient developed contact leukoderma from latex gloves. A similar case was reported by Lahouel et al., where contact leukoderma occurred in a patient with allergic contact dermatitis (ACD) to thiuram.²⁴ In two patients, contact urticaria was observed following exposure to PPE kits during COVID-19 duties. Similar findings were reported in a study where two patients developed wheals after being exposed to PPE.²⁵ One patient experienced Koebnerization of psoriasis. Exacerbations of endogenous dermatoses, including atopic dermatitis, psoriasis, and acne, have been reported previously.^{16,19,26}

Patch testing was conducted in 54 patients, with 16 (29.62%) testing positive. Among these, seven patients tested positive for thiomersal. This positivity is likely related to past exposure to thiomersal, which is used in various vaccine preparations and dental amalgams. Schnuch et al. observed that sensitization to thiomersal is significantly more common among healthcare workers due to its presence in these applications.^{27,28} Three female patients tested positive for nickel. The incidence of contact allergy to nickel among healthcare workers has increased from 9.4% to 26.2% over the past decade.²⁹ In our study, nickel allergy in one case was likely due to past exposure to artificial jewellery. Additionally, one patient tested positive for Fragrance Mix. Contact allergy to Fragrance Mix has been reported in 8% to 12% of healthcare workers investigated for eczema.³⁰ Fragrance mix was also present in alcohol based sanitizers.¹⁷ According to Hamnerius et al., CD due to fragrances was more common among healthcare workers with contact allergy to rubber additives used in gloves.³⁰ Three patients tested positive for para-phenylenediamine (PPD). All of them had hand eczema, with powdered gloves suspected as the causative agent, despite no prior history of hair dye application. Isopropylphenyl p-phenylenediamine (IPPD), a related compound, is used as an antioxidant in the manufacturing process of rubber.^{17,31} IPPD can cross-react with PPD.³² Estlander et al. also found that isopropylphenyl p-phenylenediamine (IPPD) was positive in patients with suspected glove allergy.³³ This could be a possible reason for the positive reaction to para-phenylenediamine (PPD) in the present study.

Two of our patients tested positive for a paraben mix in patch testing, and both had CD related to sanitizers. Paraben mix is commonly used as a preservative in various products, including antiseptic solutions, lignocaine preparations, and topical therapeutic agents.¹⁹ Sensitivity to parabens in our study is likely related to sanitizer use. Additionally, imidazolinylurea tested positive in one patient who was suspected of having hand eczema due to gloves or antiseptic hand rubs. Formaldehyde and formaldehyde-releasing preservatives, which are widely used in products such as disposable gowns and personal protective equipment, were also identified in the context of this study.³⁴ One patient exhibited ACD to chlorocresol. This sensitivity is significant because chlorocresol is commonly used as an antiseptic agent in various creams, lotions, and soaps. Typically, individuals with ACD to chlorocresol have a history of using topical medications that contain this preservative.³⁵

Two patients tested positive for triclosan, cetrimide who had CD to powdered gloves. These are used as an antibacterial agent and preservative, especially in shampoos, soaps, and deodorants. Its primary use is probably in disinfectant hand cleaners for HCW, and for household use.³⁶ Few reports with cetrimide allergy were seen after exposure to antiseptic solution containing the cetrimide.^{37,38} We identified two cases of ACD to neomycin sulfate on day 5 of patch testing. This reaction might be attributed to previous exposure to neomycin sulfate, a widely used topical antibiotic. Prystowsky and colleagues have reported that the prevalence of neomycin patch test sensitivity in the general population is approximately 1%.³⁹

Among the 78 HCW with OD, 28 (35.9%) experienced a small effect on their quality of life, 32 (41%) experienced a moderate effect, and 14 (17.9%) faced a very large effect (Figure 3). For 35% of HCWs, their skin condition had a small impact on their quality of life, while the remainder experienced moderate to severe impacts. Three patients (3.8%) had their quality of life very severely affected, to the extent that they took leave from work. Only one patient reported that their current skin condition did not affect their quality of life. Occupational dermatitis is known to significantly impact health-related quality of life and contribute to work loss.⁴⁰ We observed that most healthcare workers with OD experienced a small to moderate impact on their

quality of life, which aligns with the findings reported by Daye et al.⁹

LIMITATIONS

Worldwide, thiurams, diphenylguanidine, and carbamates are recognized as the most common rubber contact allergens.^{30,33,41} We were unable to test allergens such as diphenylguanidine and carba mix due to the non-availability of these antigens. Additionally, we could not test all 78 patients because some did not provide consent.

CONCLUSION AND RECOMMENDATIONS

Occupational dermatoses among HCW have been on the rise, largely due to increased use of gloves, sanitizers, PPE, and frequent hand hygiene practices in both COVID-19 and non-COVID settings. HCWs working in COVID-19 environments, particularly those in ICU, are at a higher risk of developing occupational dermatoses. Gloves were the most common contactants, followed by sanitizers and masks. The use of double masks and prolonged use of gloves were significantly associated with occupational dermatoses.

Patients with CD from sanitizers commonly presented with scaling and xerosis on the palms and in the web spaces of the hands. In contrast, those with CD from gloves often exhibited erythematous papules, plaques on the dorsum of the hands, and a sharp cutoff at the wrist.

The Dermatology Life Quality Index (DLQI) was significantly impacted in patients with occupational dermatoses. To address these issues, patch testing should be promoted for patients with PPE-related facial dermatoses to identify hidden allergens. Extensive chemical analyses of gloves, masks, and sanitizers should be conducted to detect any concealed allergens. HCWs with ACD should be counselled on avoiding allergens, and regular training programs on awareness and preventive measures should be emphasized to improve the quality of life for HCWs.



Figure 1: (a, b) Erythematous papules on dorsum of hand and wrist (c) with sharp cut off in patient with contact dermatitis (CD) to gloves. Xerosis, scaling and secondary Ichthyosis were seen in patient with CD to gloves (d). Xerosis, scales at palms, web space in patient with CD to sanitizers. Notably these patients had accentuation of scales at web spaces (e, f).

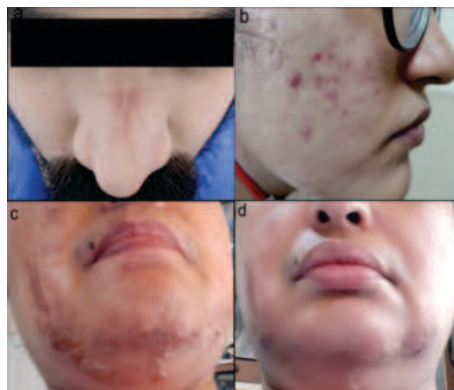


Figure 2: (a) Pressure erythema, indentation due to N 95 mask with metallic nose bridge. (b) Mask acne at cheek in patient with N 95 mask use. (c) Pressure indentation, blisters in patients with N 95 mask use for more than 8 hours/day. (d) After a 7-day leave from work, the patient experienced significant improvement, with the resolution of erythema, erosion, and blisters.

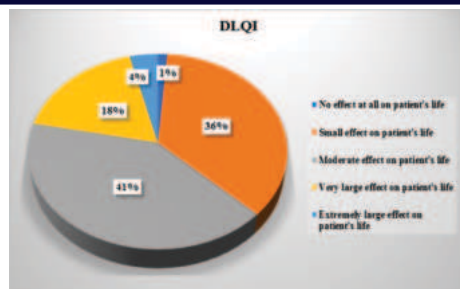


Figure 3: Graph shows effect of occupational dermatoses on quality of life of health care workers.

Table 1: Occupation and Working Area in HCW (n=78)

Parameters	No. of patients	Percentage (%)
Occupation		
Nursing officer	33	42.3
Doctor	30	38.5
Cleaning staff	7	9.0
Technician (lab/ OT)	4	5.1
Nursing orderly	4	5.1
Total	78	100%
Working area		
Covid		
NON -ICU	20	25.6
ICU	30	38.5
Non-COVID	28	35.9
Total	78	100%

Table 2: Pattern of Usage of Suspected Agents (*HCW used more than two types of masks)

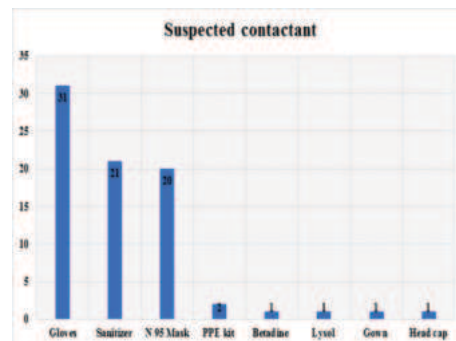
S No	Parameters	No	Percentage	P value (X ²)
Gloves (n=31, 39.74%)				
A	One pair	19	61.29	
	Double pair gloves	12	38.70	0.72
B	Surgical	29	93.54	
	Non-surgical	2	6.46	0.72
C	Powdered gloves	29	93.54	
	Powered and non-powdered	1	3.22	
	Non-powdered gloves	1	3.22	0.61
D	> 8 hours /day	20	64.50	
	< 8hours/ day	11	35.50	0.004
Sanitizers (n=21, 29.92%)				
E	Sanitizer with fragrance	7	33.33	
	Without fragrance	14	66.66	
	Total	21	100%	0.48
F	> 5 times /day	16	76	
	< 5 times /day	5	24	
	Total	21	100%	0.48%
Mask use				
A	Single mask	4	20	
	Double mask	16	80	0.001
Types of masks used*				
B	N 95 mask	20	100 %	
	surgical mask	14	70	
	K 95 mask	1	5	
	Cloth mask	1	5	0.073
Mask with or without metal fix				
C	With nose metal fix	13	65	
	without nose metal fixation	7	35	0.5
Duration				
D	>8 hours	18	88.5	
	<8 hours	2	11.5	
	Total	20	100 %	0.73

Table 3: Clinical Profile in Health Care Workers (n=78)

Final diagnoses (n)		Contactants	No of patients	Percentage (%)
Irritant contact dermatitis (46)		Gloves /sanitizer	46	
Allergic contact dermatitis (8)	PPD	Gloves	2	2.56
	Paraben mix	Sanitizer	2	2.56
	PPD + Cetrimide	Gloves	1	1.28
	Fragrance mix	Sanitizer	1	1.28
	Imidazolidinyl urea	Sanitizer	1	1.28
	Chlorocresol	Sanitizer	1	1.28
Frictional dermatoses (20)	Mask acne	Mask (N 95 mask)	13	16.66
	Pressure indentation/ pressure dermatitis nasal bridge	Mask (N 95 mask metallic nasal fixators)	3	3.84
	Post inflammatory hyperpigmentation	Mask (N 95 mask/surgical mask)	3	3.84
	Frictional blisters at cheek	Mask (N 95 mask)	1	1.28
Contact urticaria		PPE kit, gown	2	2.56
Koebnerization of psoriasis over face		Mask (N 95 mask / surgical /cloth mask)	1	1.28
Contact leukoderma		Gloves	1	1.28
Total			78	100 %

Supplementary Table: Patch test finding (n=16)

Clinical diagnosis	Patch test finding	No of patients	Percentage (%)	Relevance
CD to gloves	PPD	2	3.7	Probable To gloves
	Neomycin Sulphate, Triclosan	1	1.85	Past
	Thiomersal, Neomycin Sulphate	1	1.85	Past
	PPD, cetrimide	1	1.85	Possible to gloves
CD to sanitizer	Fragrance Mix	1	1.85	Probable to sanitizer
	Chlorocresol	1	1.85	Probable to sanitizer
	Imidazolidinyl urea	1	1.85	Possible to sanitizer/ mask
	Paraben Mix, Thiomersal	1	1.85	Possible to sanitizer
	Paraben Mix, Thiomersal, Nickel Sulphate	1	1.85	Possible to sanitizer
CD to gloves / sanitizer	Thiomersal	4	7.40	Past
	Nickel Sulphate	2	3.7	Past



Supplementary Image

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