



**NATIONAL INSTITUTE FOR
OCCUPATIONAL HEALTH**

Division of the National Health Laboratory Service

REPORT NO.: IM011/20-21

2019

ANNUAL SURVEILLANCE REPORT

OCCUPATIONAL SKIN ALLERGIES

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Table of Contents

Glossary	3
1. Executive summary	4
2. Background	5
3. Methods	6
4. Results	7
4.1. Sociodemographic characteristics	7
4.2. Occupational profiles of referrals	8
4.3. Diagnosis of referred patients	9
4.4. Allergy screening diagnosis	9
4.4.1. Atopy	10
4.4.2. Allergy test series preformed	10
4.4.2.1. Patch test results of common series tested	11
4.4.2.1.1. European standard series	11
4.4.2.1.2. Cosmetic series	12
4.4.2.1.3. Rubber series	12
4.4.2.1.4. Miscellaneous Tests	13
4.5. Primary Site affected by allergy	13
4.6. Work relatedness	14
5. Conclusion	15
6. Limitations	15

Glossary

Allergens	A substance capable of triggering a response that starts in the human immune system and results in sensitisation or an allergic reaction
Atopic patients	Patients that tested positive to three or more tests in the aeroallergens panel
Contact dermatitis	A reactive eczematous inflammation of the skin, which occurs after direct contact with a substance (chemical, biological or physical agent/s). Symptoms include itching, erythema, blisters, exudation, papules and flaking.
Allergic contact dermatitis (ACD)	An immune response on a localized region of the skin, due to contact with an allergen to which an individual is sensitized
Irritant contact dermatitis (ICD)	A contact dermatitis, which occurs when an irritant substance has caused damage to the skin (tissue)
ESS	European Standard Series
Industry	The industry where the patients worked at time of exposure were grouped into categories according to the Standard Industrial Classification of all economic activities (7th Edition)
Job	The activity that the patient does while on duty
NIOH	National Institute for Occupational Health
Occupational allergy	A condition resulting from exposure to allergens or chemicals while “on the job” such as contact dermatitis, urticaria, asthma, rhinitis, conjunctivitis
OAU	Occupational Allergy Unit
N-O	Non-occupational
OSDC	Occupational Skin Disease Clinic
Panel	A set of allergens used to test for skin allergies depending on the exposure. The European standard series is a set of the most common allergens that are associated with allergic contact dermatitis. Other exposure-specific series include: hairdressing, cosmetic, metalworking oil series, shoe, rubber, epoxy resin, dental series
Patient	All workers or persons referred (internal or external) to the NIOH for skin allergy testing
Type of sample	Substance from the workplace that is suspected as the causative agent

1. Executive Summary

In 2019, 89 patients from various industries, and non-occupational (N-O) patients visited the occupational skin allergy clinic at the NIOH. A total of 80 patients were tested for skin allergies. Of these patients, 29% were diagnosed with allergic contact dermatitis, 8% were diagnosed with both allergic and irritant contact dermatitis and 30% were diagnosed with irritant contact dermatitis only. The remainder were a mix of other diagnoses such as 4.5% contact urticaria and 9% endogenous reactions.

Patch tests were used to test for possible contact allergies. Testing was conducted using a battery of commercial allergens (patch test series), as well as substances from the patient's workplace. Data were obtained from patient records and entered into Microsoft Office Access. The data was imported into STATA SE version 16 for analyses, post-cleaning and removal of duplicates. Summary measures have been presented in this report.

The majority of patients were in the 50+ age group. However, there were a higher proportion of < 29 year-old patients in the N-O group compared to the occupational group. The sex distribution was different among workers and non-occupational with 67% males in the worker group and 57% female in the N-O group. The main industries that referred patients was the mining industry (30%), followed by manufacturing (26%), health (16%) and business (18%). The N-O patients were from pensioners (23%) business (28%), health (13%) and students (15%).

The most common test series performed was for the European Standard Series (ESS) with 66% of all patients tested followed by the cosmetic series (25%). The top allergens identified were nickel, methylisothiazolinone, Balsam of Peru, cobalt chloride and Fragrance mix II, among both groups whereas potassium dichromate and epoxy resin were common among the OC group and MCI/MI and fragrance mix I were common among the N-O. Almost half (42%) of patients reported atopy.

The atopic individuals were predominantly N-O (57%) worked mostly in business (26%), followed by health (19%) and manufacturing (12%).

Although there are limitations to the data such as the lack of generalisability, it should be noted that even for the N-O, the manufacturing industry followed by the health sector had the highest proportion of patients with symptoms and positive allergy tests. Further investigation is required to assess the working environment and provide appropriate preventive controls.

2. Background

Occupational skin diseases (OSD) are among the most common type of occupational diseases which occur in the workplace. Worldwide it is known that these conditions are under-recognised, under-diagnosed, under-reported and under-compensated. Early diagnosis of OSD is crucial, as prolonged exposure is more likely to lead to intractable dermatitis which persists after removal from exposure. Therefore, a need for an OSD diagnostic service in South Africa was identified and an occupational skin disease clinic was initiated at the Immunology & Microbiology Section, NIOH.

As approximately 80-90% of OSD patients present with contact dermatitis (CD), which can be either irritant (ICD) or allergic (ACD) in nature, patch testing is done to differentiate between the two forms. This is important since ICD & ACD have different management requirements. Patch tests with commercially available allergen series, either the European standard series (general most common allergens that cause allergic contact dermatitis) or different exposure-specific series (e.g. cosmetic, dental, hairdressing, nail series etc.) enhance the detection of sensitisation to specific allergens. The Immunology & Microbiology Section hold an extensive allergen bank and a list of the allergens can be made available on request. From the clinic, permission is obtained from the patients to capture their information into a comprehensive database in order to look at trends in OSD. This is an important process since little is known about the extent and type of OSD which occur in South Africa and the industries in which these occur. The OSDC database, which was donated by the British Contact Dermatitis group, was started in 2005 and there are 1045 patient records captured into the database. The database records the patients' demographics, the occupation and industry in which they work; their atopic status; the part of the body which is affected and the type of skin disease.

This report can be accessed at: <http://niohweb.nhls.ac.za/>

3. Methods

The data presented in this report summarises the data of patients presenting with suspected occupational skin diseases/allergies at the occupational skin clinic in 2019. Patients are referred by occupational health practitioners, dermatologists, company health and safety representatives & wellness programs and from public hospital clinics.

Patients are referred to the NIOH from areas in and around Gauteng as well as North West (Rustenburg), Mpumalanga, Limpopo and the Free State. This includes patients who came for follow-up, for further testing or for requests from insurance, or for completion of documents for the Compensation Commission.

Although contact dermatitis can occasionally be classified as allergic or irritant by a physical examination, this is not always the case, often an irritant dermatitis is identified by negative patch testing. For this reason, patch testing is important; also for identifying a causative allergen, in the case of allergic contact dermatitis in order to avoid the offending substance and possible job loss. Atopic patients were defined as those who had a history of childhood eczema &/or had a family history of atopy and/or tested positive to three or more allergens in the aeroallergens panel by skin prick test.

Referrals from companies were seen by the consultant dermatologist and patch tests were conducted by staff of the Immunology & Microbiology Section who are deemed competent to perform the test. A patch test is conducted by placing the allergens, including a negative control on a patch test unit having 10 chambers. These strips are placed on the patient's back for 2 days. They then return to the clinic for reading of the results. The most common patch test series tested in 2019 at the OSDC was the European standard series. This is a good starting point as it includes the most common allergens which cause contact dermatitis. However, several other series were also used for testing depending on the awareness of the occupational exposures. The cosmetic series is important not only for testing for reactions to self-care products but also for testing beauticians that work with cosmetics all the time. The rubber series is critical for healthcare workers who commonly wear rubber gloves but also for factory workers or miners who wear rubber gloves, rubber boots or rubber containing respirators as well.

Data from the OSDC files were entered into an Access database, which was then imported into STATA SE version 16 for data analysis. Summary measures consisting of means, medians and interquartile ranges for all continuous or discrete study variables were documented. Frequencies (numbers and percentages) were produced for categorical data.

4. Results

Of the 89 patients that presented at the OSDC, two thirds were referred as occupational cases. The total patient group ranged in age from 7 - 83 years.

4.1 Sociodemographic characteristics

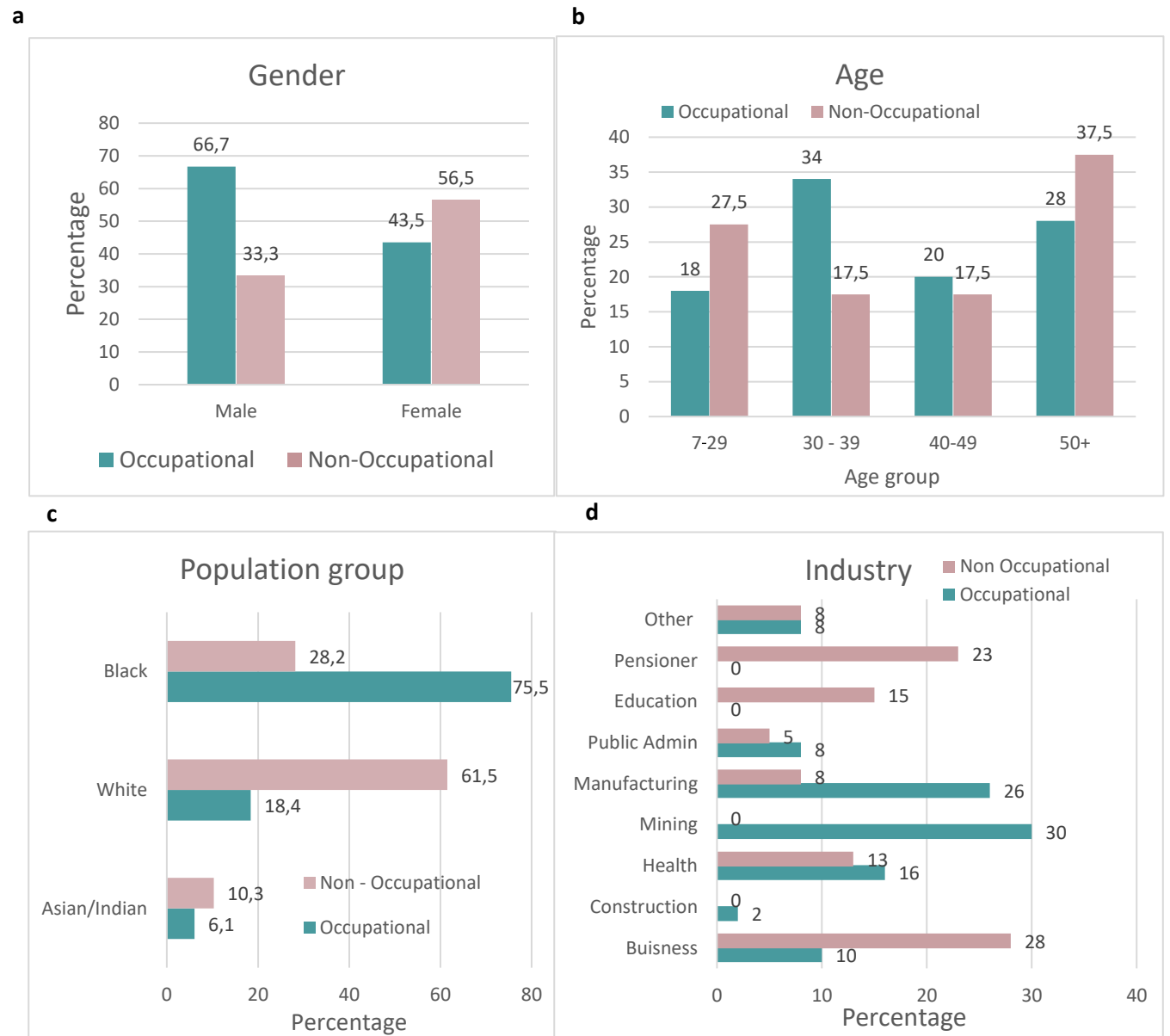


Figure 1 a-d Socio-demographics

The mean age of patients, attending the OSDC was 42 years; while all of the occupational referrals were of working age, the N-O ranged from 7 to 83 years of age. Approximately 67% of the occupational patients were male, while 57% of the N-O were female. The majority of patients referred from workplaces were Black, while the majority of those referred by dermatologists (N-O) were White (Fig1c).

4.2 Occupational profile of referrals

The main industry that referred patients was the mining industry (30%), followed by manufacturing (26%) and Health (16%). The N-O patients came from pensioners (23%), business (28%), health (13%) and students (15%) (Fig1d).

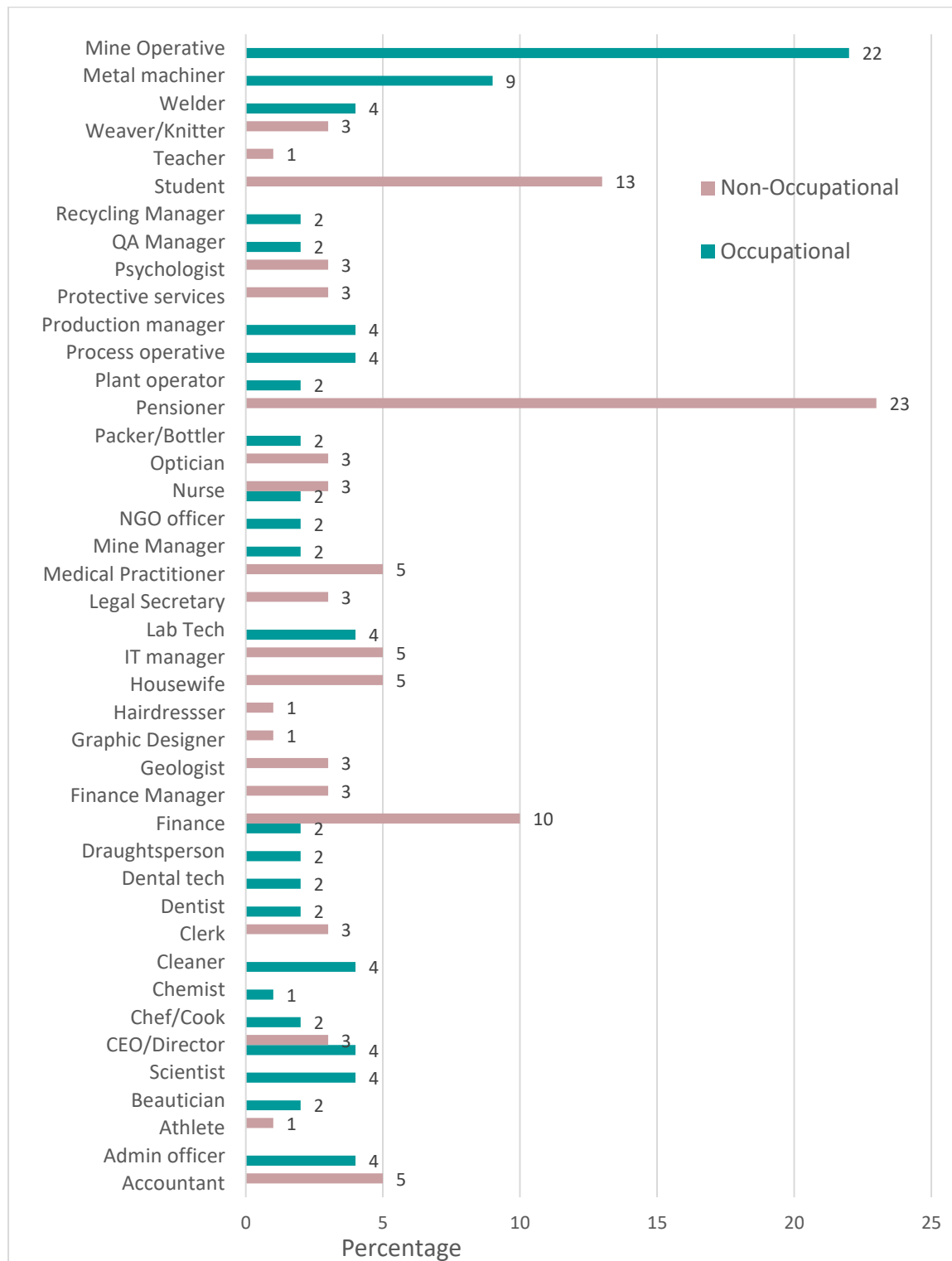


Figure 2. Occupations by referral type

Mining operator was the most common occupational category of all the occupational referrals to the clinic, followed by metal machiners & a variety of occupations including production managers, directors, scientists, cleaners among others. & admin staff (figure 2).

4.3 Diagnosis of referred patients

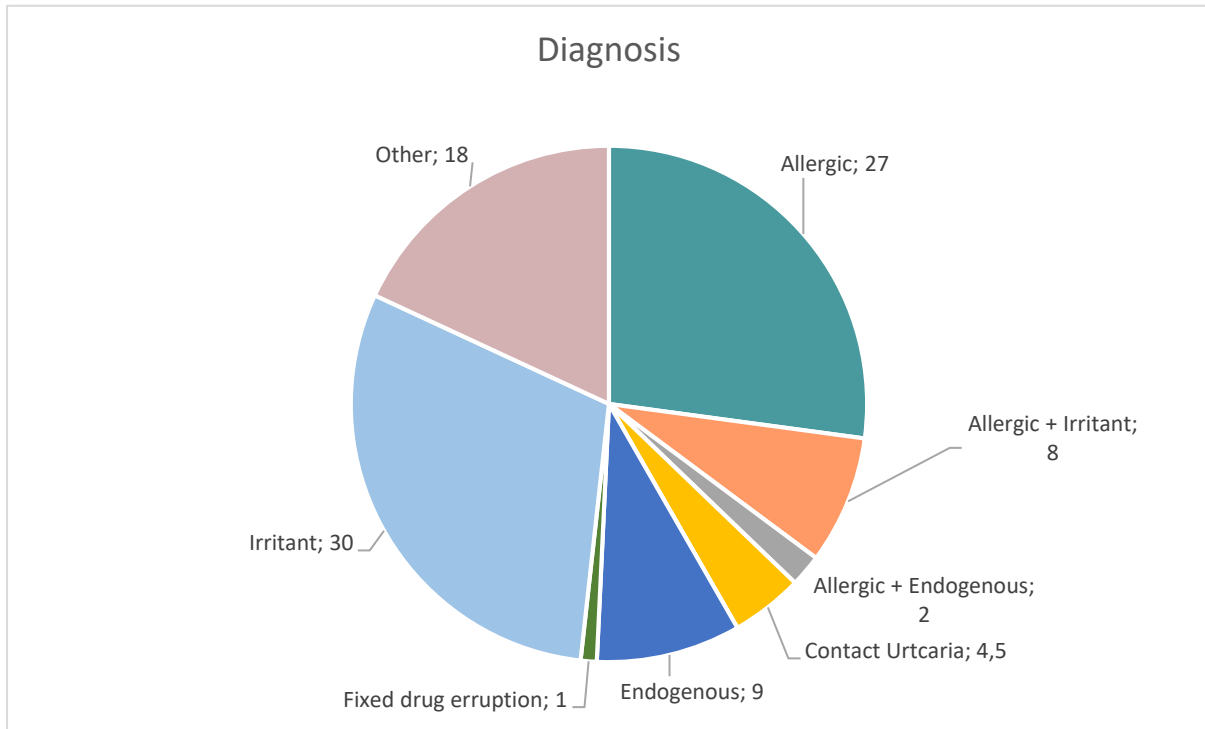


Figure 3. Percentage of all patients' main diagnosis.

Contact dermatitis (including allergic, irritant and a combination of both reactions) was diagnosed in the largest group of referrals (67%) (Fig3). Followed by 'other' (18%), which included multiple chemical sensitivity, among others (Fig3).

4.4 Allergy screening diagnosis

The patients that attend the OSDC are seen by a dermatologist who diagnosis the type of OSD and if they are considered to have contact dermatitis, they are screened for possible allergic reactions by patch testing.

4.4.1. Atopy

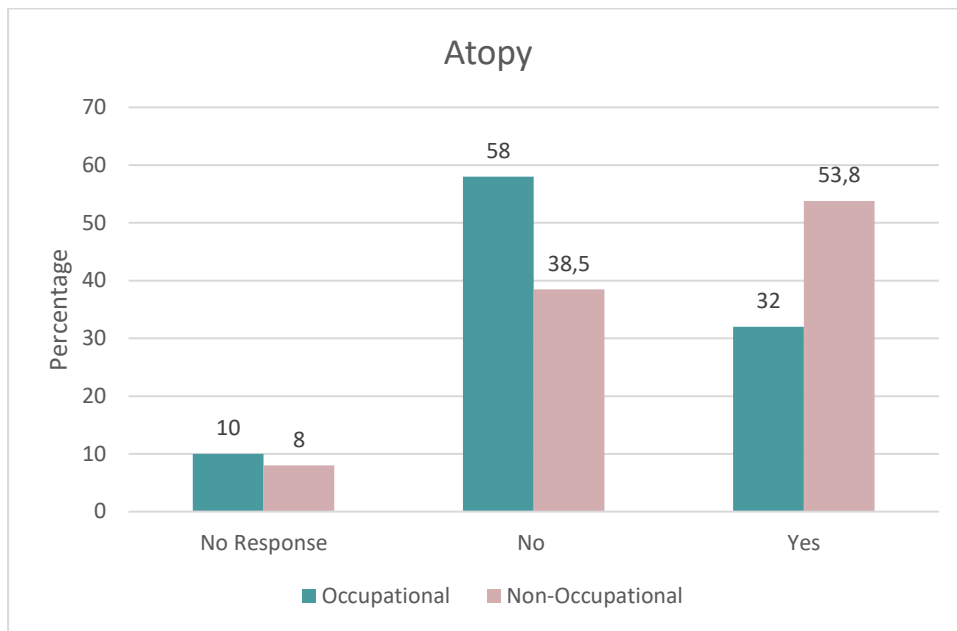
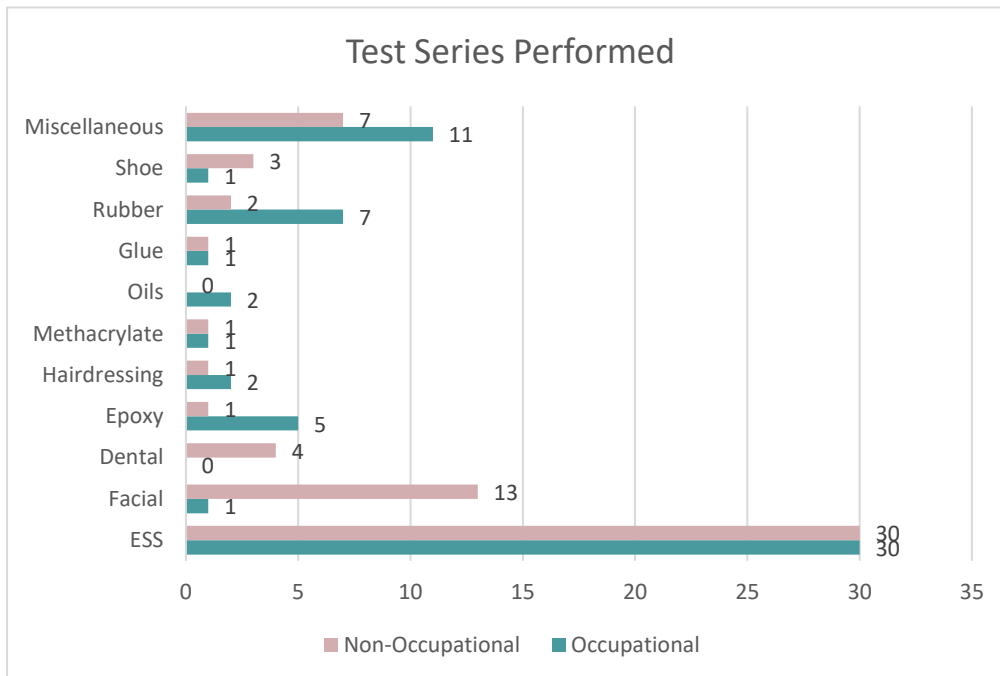


Figure 4 Percentage of patients reporting atopy.

Atopy was more prevalent among the N-O patients (54%) than the occupational patients (32%) in Fig4.

4.4.2 Allergy test series preformed



*Miscellaneous consisted of specific tests such as metals or other allergens which do not form a series

Figure 5 Number of allergy test series requested by patient group

The most common series tested in the occupational referrals (other than the ESS) include the rubber and the epoxy series while in the N_O the cosmetic series was most commonly tested. Miscellaneous other substances were tested in both groups (figure 5).

4.4.2.1 Patch test results of common series tested

4.4.2.1.1 European standard series

The test series each consist of a number of allergens, 49% of those patients tested with the ESS were positive to at least one allergen in the test series.

Table 1 Number and percentage of patients testing positive for allergens in the ESS

Allergen Tested	OC (n* positive)	OC%**	N-O (n positive)	N-O%**
Potassium dichromate	4	16.0	3	13.6
Thiuram	1	5.0	1	4.8
Paraphenylene diamine	0	0	2	11.8
Cobalt chloride	5	20.8	1	7.7
Formaldehyde	2	8.3	4	20.0
Colophonium	2	8.3	2	10.0
Balsam of Peru	1	4.1	0	0.0
Isopropyl phenyl phenylenediamine	1	6.6	0	0.0
Wool alcohol	1	4.5	1	4.5
Mercapto mix	1	4.5	0	0.0
Epoxy resin	0	0.0	1	6.2
PTBP formaldehyde	0	0.0	1	5.5
Fragrance mix I	0	0.0	5	20.8
Nickel sulphate	6	22.2	9	36.0
Methylchloroisothiazolinone/ Methylisothiazolinone (MCI/MI)	2	8.3	3	17.6
Methylisothiazolinone	3	12.5	4	17.4
Tixocortol pivalate	0	0.0	1	10.0
Textile dye mix	0	0.0	2	14.2
Lyrar	0	0.0	3	13.6
Fragrance mix II	1	4.2	3	12.5

*n is the number of positives ** percentage is calculated by dividing the number of positives by the total number tested with each substance, the number tested varies depending on exposures thus the percentages vary.

Of all patients tested with the ESS - nickel, methylisothiazolinone, and Potassium dichromate were common allergens detected among both groups whereas cobalt chloride is common among the OC group and Formaldehyde and fragrance mix I and II were common among the N-O. (Table 1)

4.4.2.1.2 Cosmetic series

Fourteen patients were tested with the cosmetic series and the positive reactions were:

Table 2 Positive reactions detected to allergens in the cosmetic series.

Positive reactions to allergens in Cosmetic series	No of positives
Tea-tree oil	1
Turpentine	1
Hydroabietyl alcohol	1
Drometrizole	1
p-Chloro-m- Cresol	1
2 Bromo 2 nitropropane-1,3 diol	1

A total of 31% of patients tested (all N-O) reacted to at least one allergen from the cosmetic series and one of the patients tested positive to 2 allergens (Table 2). Although these allergens were detected in N-O cases, they can also be of importance in an occupational setting. Turpentine is found in sealing wax, deodorizers, paints and self-care products; tea-tree oil used as a remedy for various skin and nail conditions and also present in household cleaning products and hydroabietyl alcohol is used in adhesives, mascara, inks, sealants and as a plasticizer in plastics. Drometrizole is a UV-adsorber used in cosmetics, dental materials, dyes etc. while p-chloro-m-cresol is a fungicide found in creams, protein shampoos, cooling fluids etc.

4.4.2.1.3 Rubber Series

A total of 9 OC patients were tested with the 25 allergens forming the rubber series and one patient was positive for N-Isopropyl-N-phenyl-4-phenylenediamine is used to protect rubber from oxidation and flex-cracking. It is found in gloves, shoes as well as some lubricating oils and greases.

4.4.2.1.4 Miscellaneous Tests

Positive reactions to allergens in Cosmetic series	OC No of positives	N-O no of positives
Bisphenol	1	0
Everysun suntan lotion	0	1
Goldsodium thiosulphate	0	1
Potassium dicyanoaurate	0	1
Sodium tetrachloropalladate II hydrate	0	1

Eighteen patients were tested with ‘miscellaneous’ substances which are either not part of a series (metals) or were brought in by the patient. Four patients tested positive to the substances below.

Table 3 Positive reaction detected to ‘miscellaneous’ substances.

Bisphenol is used to make hard plastic items. Goldsodium thiosulphate and potassium dicyanoaurate are common sensitizers found in gold plated jewelry, dentistry, intracoronary stents, as well as gold electrodes and optical equipment. Sensitization to these gold salts does not necessarily imply that the patient is sensitive to pure gold, only to these salts. Sodium tetrachloropalladate II hydrate is a palladium salt it is used in many alloys, it is used in dentistry and as a catalyst in chemical synthesis. (Table 3)

4.5 Primary site affected by allergy



Figure 6 Percentage of patients and primary site of allergy.

The primary allergy site corresponds with the expected exposures, with N-O presenting with facial allergies and thus being tested for cosmetic products, while occupational referrals presented with hands as their primary site of allergy (Figure 6).

4.6 Workplace relatedness

The skin diseases were considered to be workplace related if they occurred while at work, with an improvement when away from work and a recurrence when returning to work. Also if there are exposures to possible causative agents in the workplace. Sixty-eight percent of the occupational referrals were diagnosed as having an occupational or work-related skin disease. While only 3 % of the N-O referrals had occupational allergies. (Figure 7)

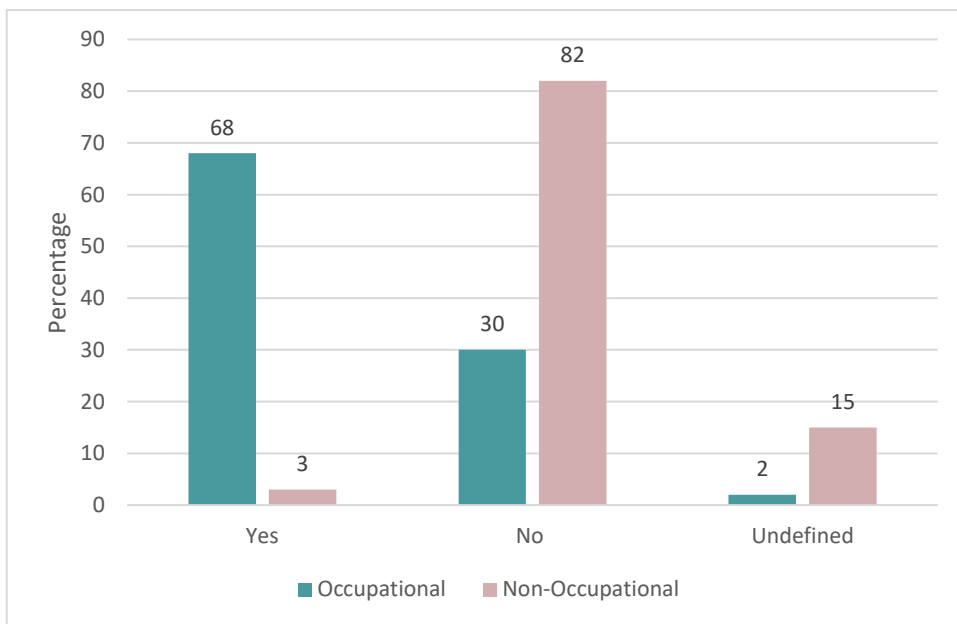


Figure 7 Percentage of work related allergies by patient type

5 Conclusions

Occupational allergic and irritant contact dermatitis, are an important cause of occupational diseases and Occupational Health Surveillance of these diseases is an essential component of an occupational health surveillance programme, which helps with control and planning. Awareness is needed amongst workers and management of the risk of developing workplace contact dermatitis.

In 2019, a significant percentage of workers had work-related allergies and the majority of patients were from the mining, business and health sectors, highlighting the need for more research and implementation of control measures in these industries. Strengthening the skin surveillance programme in these industries and in South Africa could provide a more comprehensive picture, but for this to occur, additional data is needed from other allergy treatment centres throughout the country.

6 Limitations

Majority of the patients are from Gauteng due to the location of the clinic in Johannesburg, Gauteng. Thus, these results cannot be generalised. Other centres assessing occupational skin diseases (public and private) need to provide data to develop a comprehensive occupational skin surveillance system. There is missing data/information in the current data collection tool.