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OCCUPATIONAL HEALTH**

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# **ANNUAL SURVEILLANCE REPORT**

## **OCCUPATIONAL ALLERGIES**

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# Table of Contents

<b>GLOSSARY</b>	<b>3</b>
<b>EXECUTIVE SUMMARY</b>	<b>4</b>
<b>BACKGROUND</b>	<b>5</b>
<b>METHODS</b>	<b>7</b>
<b>RESULTS</b>	<b>9</b>
<b>1. Respiratory Allergens</b>	<b>9</b>
1.1 Sociodemographic characteristics	9
1.2. Respiratory allergy screening	11
<b>2. Skin allergens</b>	<b>12</b>
2.1 Sociodemographic characteristics	12
2.2 Occupational profile of referrals	13
2.3 Diagnosis of all referred patients	14
2.4 Allergy screening diagnosis	14
2.5 Patch test results of common series tested	16
2.6 Primary site affected by allergy	17
2.7 Workplace relatedness	18
<b>CONCLUSIONS</b>	<b>19</b>
<b>LIMITATIONS</b>	<b>19</b>
<b>REFERENCES</b>	<b>20</b>

## Glossary

<b>Allergens</b>	A substance capable of triggering a response that starts in the human immune system and results in sensitisation or an allergic reaction.
<b>Atopic patients</b>	Patients that tested positive to three or more tests in the aeroallergens panel.
<b>Contact dermatitis</b>	A reactive eczematous skin inflammation that occurs after direct contact with a substance (chemical, biological or physical agent/s). Symptoms include itching, erythema, blisters, exudation, papules and flaking.
<b>Allergic contact dermatitis (ACD)</b>	An immune response on a localised region of the skin due to contact with an allergen to which an individual is sensitised.
<b>Irritant contact dermatitis (ICD)</b>	A contact dermatitis, which occurs when an irritant substance has caused damage to the skin (tissue).
<b>ESS</b>	European Standard Series
<b>IgE</b>	Immunoglobulin E
<b>Industry</b>	The industry where the patients came from were grouped into categories according to the Standard Industrial Classification of all economic activities (7th Edition).
<b>Job</b>	The activity that the patient does while on duty.
<b>NIOH</b>	National Institute for Occupational Health
<b>N-O</b>	Non-occupational
<b>Occupational allergy</b>	Occupational allergies such as asthma, rhinitis, conjunctivitis, urticaria and contact dermatitis is the result of exposure to allergens or chemicals while “on the job”.
<b>ORA</b>	Occupational respiratory allergy
<b>OAU</b>	Occupational Allergy Unit
<b>Panel</b>	A set of allergens used to test for skin allergies in specific exposure situations. The European standard series is a set of the most common allergens associated with allergic contact dermatitis. Other exposure-specific series include hairdressing, cosmetic, metalworking oil series, shoe, rubber, epoxy resin, and dental series.
<b>Patient</b>	All workers or persons referred internally or externally to the NIOH for respiratory allergy testing.
<b>SPT</b>	A skin prick test, also called a scratch test, checks for immediate allergic reactions to allergens and is usually done on the forearm.
<b>Type of sample</b>	Blood, serum or bulk sample (samples from the workplace that is suspected as the causative agent).

## Executive Summary

In 2021, patients from various industries visited the occupational allergy clinic at the NIOH. One hundred and seventy-two patients attended the respiratory allergy clinic and sixty-three attended for skin allergies at the NIOH in 2021. Data were obtained from patient records and entered into Microsoft Office Access before importing to STATA SE version 16 for analyses. Summary measures have been presented in this report.

Patch tests were used to test for possible contact allergies. Testing was conducted using different batteries of commercial allergens (patch test series) and substances from the patient's workplace. Of the 63 patients who visited the occupational skin allergy clinic at the NIOH, 39 patients were tested for skin allergies. Of these patients, 44% were diagnosed with allergic contact dermatitis, 10% were diagnosed with both allergic and irritant contact dermatitis, and 24% were diagnosed with irritant contact dermatitis only.

Respiratory allergies were diagnosed using the skin prick tests (SPT). The main industry that referred patients was precious metal research and development (80%), followed by mining and quarrying (10.5%), as well as manufacturing activities (5%). The highest proportion of tests requested was platinum only (44%), followed by platinum and nickel (37%) and aeroallergens (14.5%). For the patch testing, the most common test series performed was for the European Standard Series (ESS) with 62% of all patients tested, followed by the cosmetic series (4.8%). A large proportion (73%) of those tested were allergic to at least one of the substances tested in the ESS series. The top allergens identified were nickel, Formaldehyde, colophonium, methylisothiazolinone / Methylchloroisothiazolinone, and potassium dichromate, among both referred groups. Half (51%) of the patients seen at the clinic reported atopy.

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 and health sector showed 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.

## Background

Industrialisation in general causes a significant increase in occupational allergies. Occupational allergies can lead to serious health problems and hence are compensable under the South African Compensation for Occupational Injuries and Disease Act of 1993 (Act 130, 1993). In certain industries where allergens are prominent, pre-employment screening is essential for preventing allergies resulting from workplace exposure. This pre-employment screening is particularly important for atopic individuals with a genetic predisposition to developing allergies. Numerous studies have described the strong association between atopic individuals and their likelihood of developing allergies due to exposure at work (Tarlo et al, 1991; Tschopp et al, 1998).

Occupational allergens are substances used or handled in the work environment that can trigger an immune response, resulting in sensitisation or an allergic reaction. These agents are diverse and, in many instances, are complex and as such, proving the causation of disease can be challenging. In addition, only a few occupational allergens are commercially available; and biological allergens may differ by species and region and may not be relevant to South Africa or specific provinces.

The Occupational Allergy Unit (OAU) of the Immunology & Microbiology Section at the National Institute for Occupational Health (NIOH) conducts occupational allergy testing. The OAU has been maintaining a database of occupational allergies since 2005. The information in this database is paramount for understanding occupational allergy tests and surveillance of occupational allergies in South Africa. The database is used to identify specific allergens and industries, which can inform preventative measures to reduce exposure in the workplace. Furthermore, the data in the database is an important resource for research purposes.

Occupational skin diseases (OSD) are among the most common types of occupational diseases in the workplace. Worldwide it is recognised 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 that persists after exposure removal. Therefore, the services provided by the occupational skin disease clinic at the Immunology & Microbiology Section, NIOH, are essential and relevant to reducing occupational exposure to allergens.

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. metalworking oil, epoxy, cosmetic, dental, hairdressing, nail series etc.) enhance the detections 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 to look at trends in OSD in the 'referral area', which includes Johannesburg and the surrounding areas Mpumalanga, Limpopo, Free State and Northwest. This is an important process since the extent and type of OSD occurring in South Africa or the industries in which these occur is not well understood. The OSD clinic database, which the British Contact Dermatitis group donated, was started in 2005 and there are 1154 patient records captured in the database. The database was created in Access and has many linked tables which record 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. Tables for the various patch test series allow for the comprehensive recording of the patch test results. The data can be exported into several statistical programs for analysis.

The data presented in this report summarises the data obtained in 2021, of patients presenting with suspecting occupational skin allergies at the occupational skin clinic. This report can be accessed at: <http://niohweb.nhls.ac.za/>

## Methods

The 2021 data presented here were obtained from patients referred to the occupational allergy clinic at the NIOH with suspected occupational skin diseases and respiratory allergies. Patients are referred to the NIOH from areas in and around Gauteng, Rustenburg, Mpumalanga, Limpopo and the Free State. Referred are by occupational health practitioners, dermatologists, company health and safety representatives & wellness programs and public hospital clinics. This included patients who came for follow-up, further testing, requests from insurance companies, or for completion of documents for the Compensation Commission.

### Patch test

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. Patch testing is important as identification of a causative allergen will necessitate avoidance of that substance without resulting in work loss. The consultant dermatologist saw referrals from companies and patch tests were conducted by competent technical staff of the Immunology & Microbiology section.

A patch test is conducted by placing allergens along with negative and positive controls on a sticky strip, then placed on the patient's back for 2 days when they return to the clinic to read the patch tests and record the results. The most common patch test series that was tested in 2021 at the OSD clinic 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 applied to more specifically test for allergens associated with different 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 sometimes wear rubber gloves and rubber.

### Respiratory allergies

Skin prick tests (SPT) were used to test for respiratory allergies. The SPT involves applying allergen solutions onto the patient's forearm and introducing these into the skin by pricking the patient's skin. The SPT is desirable since results are available within 15 minutes. In patients with potentially life-threatening anaphylactic shock reactions and those on medication which cannot be stopped, SPT is not recommended. For such cases, the ImmunoCAP-specific IgE test is considered to identify the

specific IgE against the suspected allergen. IgE test results are not presented in this surveillance report.

The OAU specialises in testing non-commercial allergens. This function is valuable since some allergens are specific to certain occupational sectors found in a few countries or regions (e.g. certain metal allergies such as potassium dichromate). Laboratory preparation of allergens ensures that the cause of rare or less common allergies can be identified. The laboratory maintains an extensive occupational allergen bank, and a list of allergens can be made available upon request.

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

Data from clinic 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.

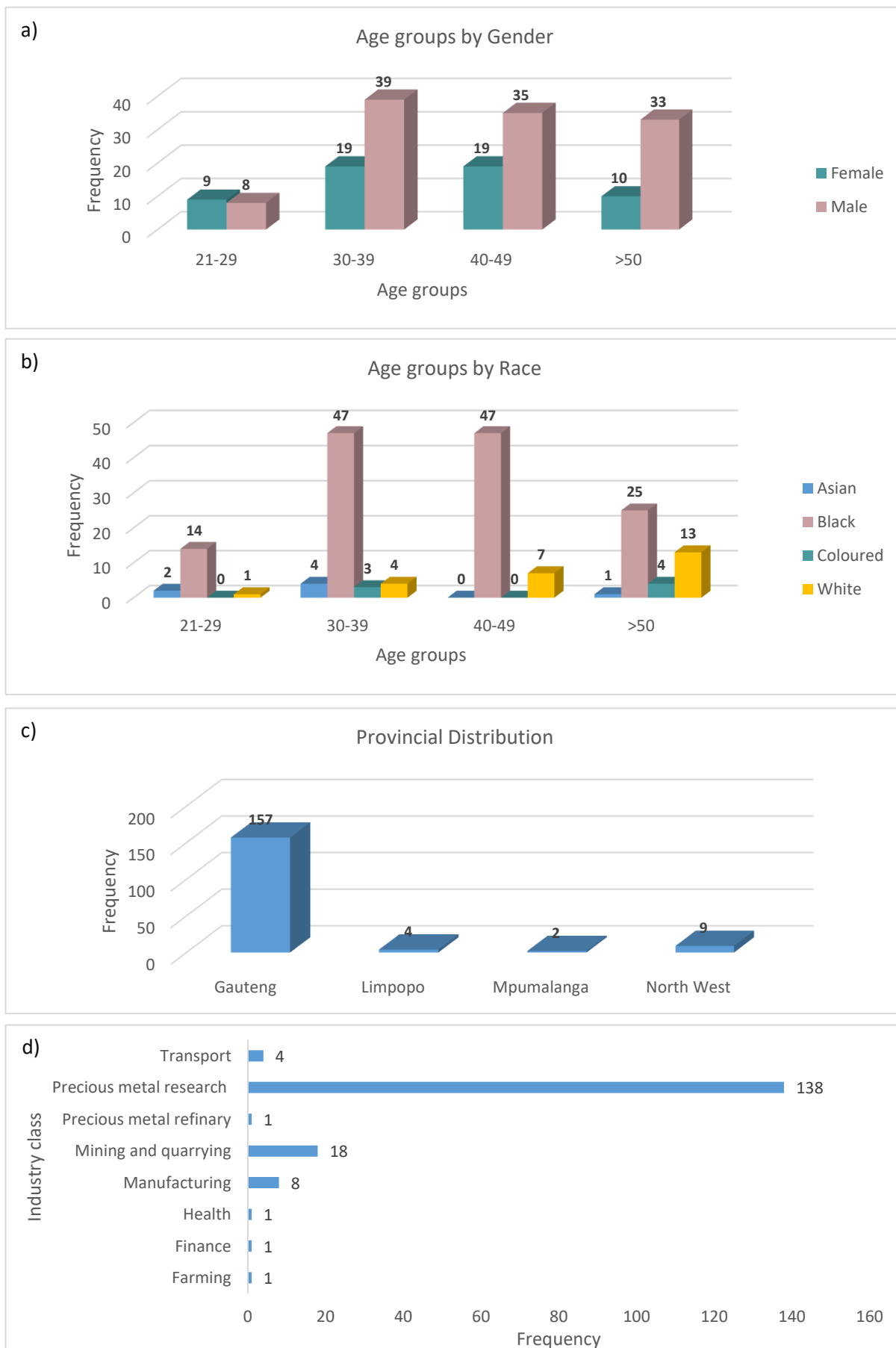


## Results

### 1. Respiratory Allergens

#### 1.1 Sociodemographic characteristics

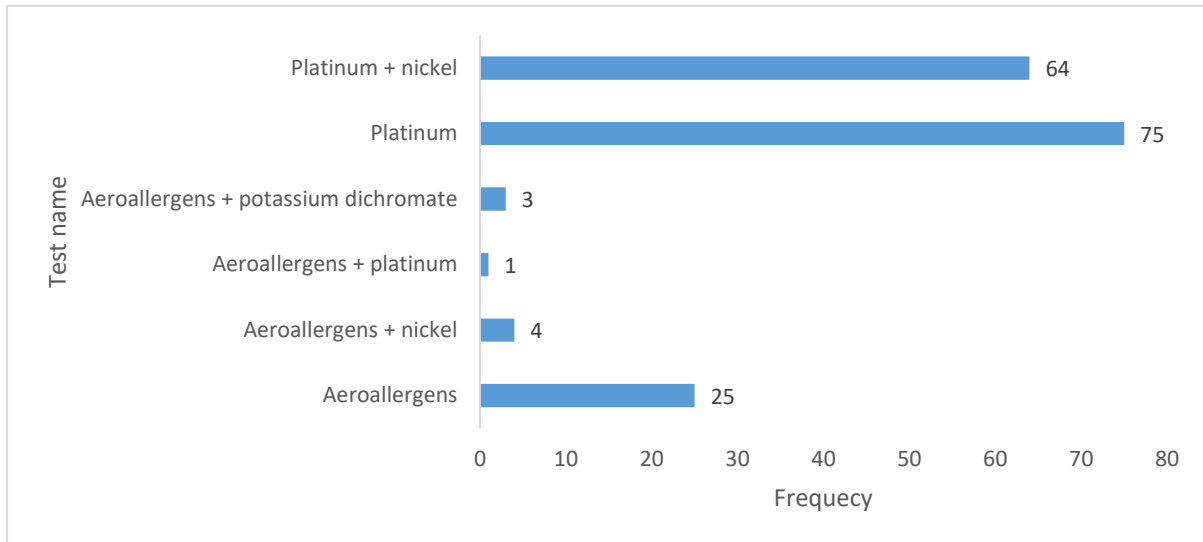
In total, 172 patients attended the respiratory allergy clinic at the NIOH in 2021. The mean age of patients attending the respiratory clinic was 42 years, ranging from 22 to 71 years. A larger proportion of patients, 34%, in the age group 30-39 years, presented for respiratory allergy testing. Approximately 67.0% of patients were male (Figure 1a). The patients were predominantly Black African (77%), followed by White patients (15%) (Figure 1b). The main industry that referred patients was research and experimental development (80%), followed by mining and quarrying (10%), as well as repair of fabricated metal products activities (2%). Other industrial categories included: scientific research and development, manufacturing, health, finance, farming as well as transport services (Figure 1d).



**Figure 1 (a-d):** Sociodemographic characteristics of patients seen at the OA clinic, NIOH.

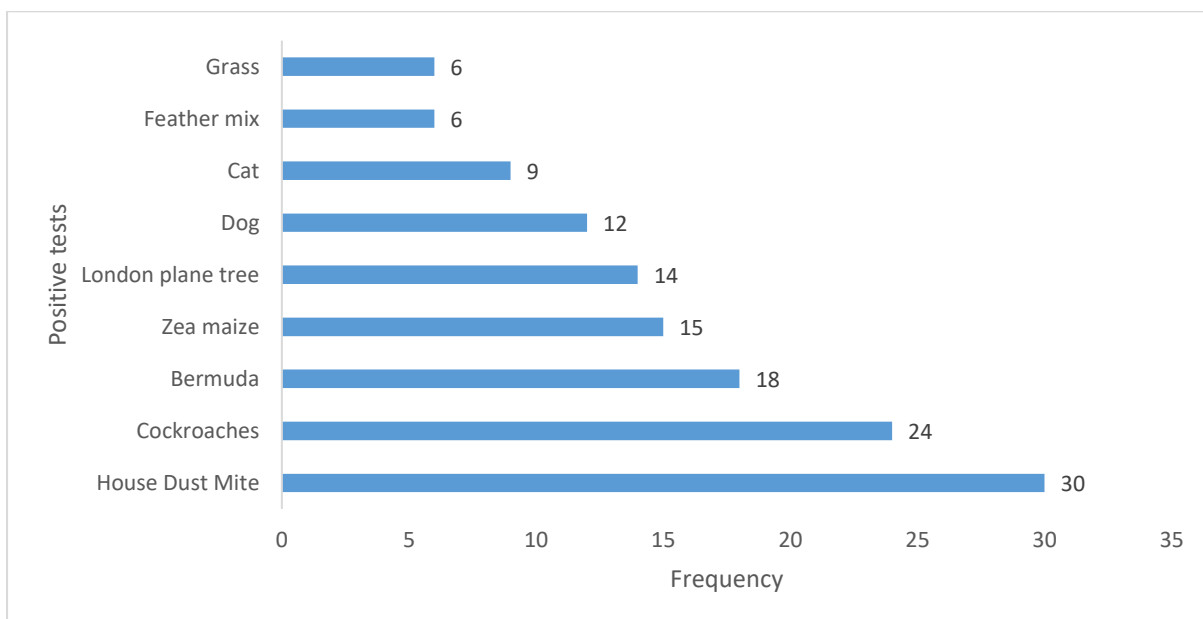
## 1.2. Respiratory allergy screening

Among the highest proportion of tests requested were platinum (44%), followed by platinum and nickel (37%) and by aeroallergens (14.5%) (Figure 2).



**Figure 2:** Frequency of positive respiratory allergy tests requested.

Among the aeroallergens in Figure 3, approximately 24% tested positive for cockroaches, 30% House Dust Mite (*D. pteronyssinus*), 14% for London plane tree, 18% for Bermuda grass, 15% for zea maize, 6% for feather mix and grass respectively. Cat and dog contributed 9% and 12%, respectively.

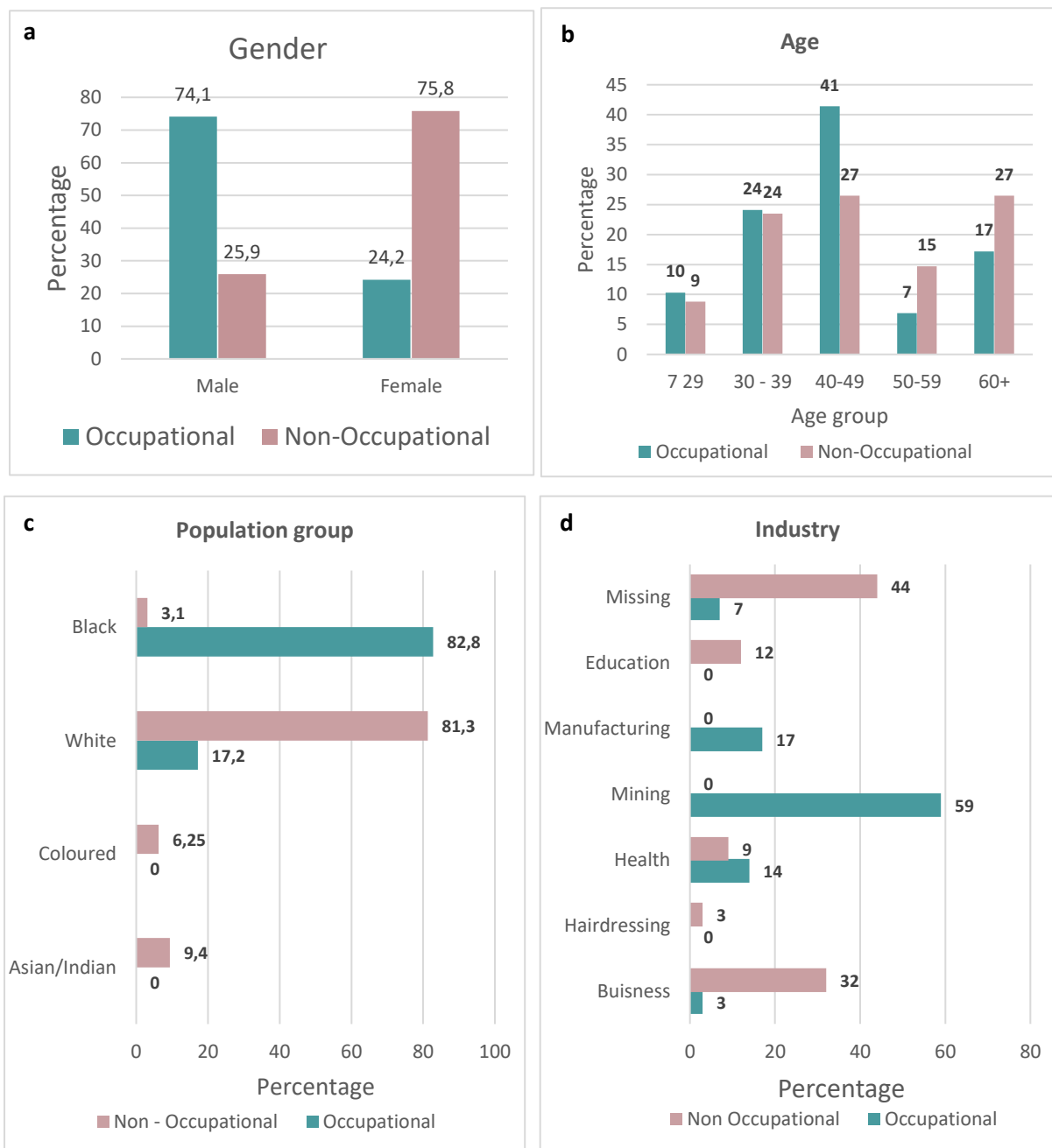


**Figure 3:** Percentage of positives for the various aeroallergens tests

## 2. Skin allergens

### 2.1 Sociodemographic characteristics

Of the 63 patients that presented at the Occupational Skin Diseases Clinic, just under half (29) were referred to as occupational cases. The total patient group ranged in age from 9 -76 years. The mean age of patients attending the OSDC was 46 years; the occupational referrals ranged from 25-74 years, the N-O ranged from 16 to 88 years of age (Figure 4b). Approximately 74% of the occupational patients were male, while 78% of the N-O were female. Most patients referred from workplaces were Black, while the majority of those referred by dermatologists (N-O) were White (Figure 4c).



**Figure 4 (a-d):** Sociodemographic characteristics of patients seen at the OA clinic, NIOH.

## 2.2 Occupational profile of referrals

Mining operator was the most common occupational category of all the occupational referrals to the clinic, followed by machine tool operators & a variety of occupations, including manager, lab technician, and nurse among others (Figure 5).

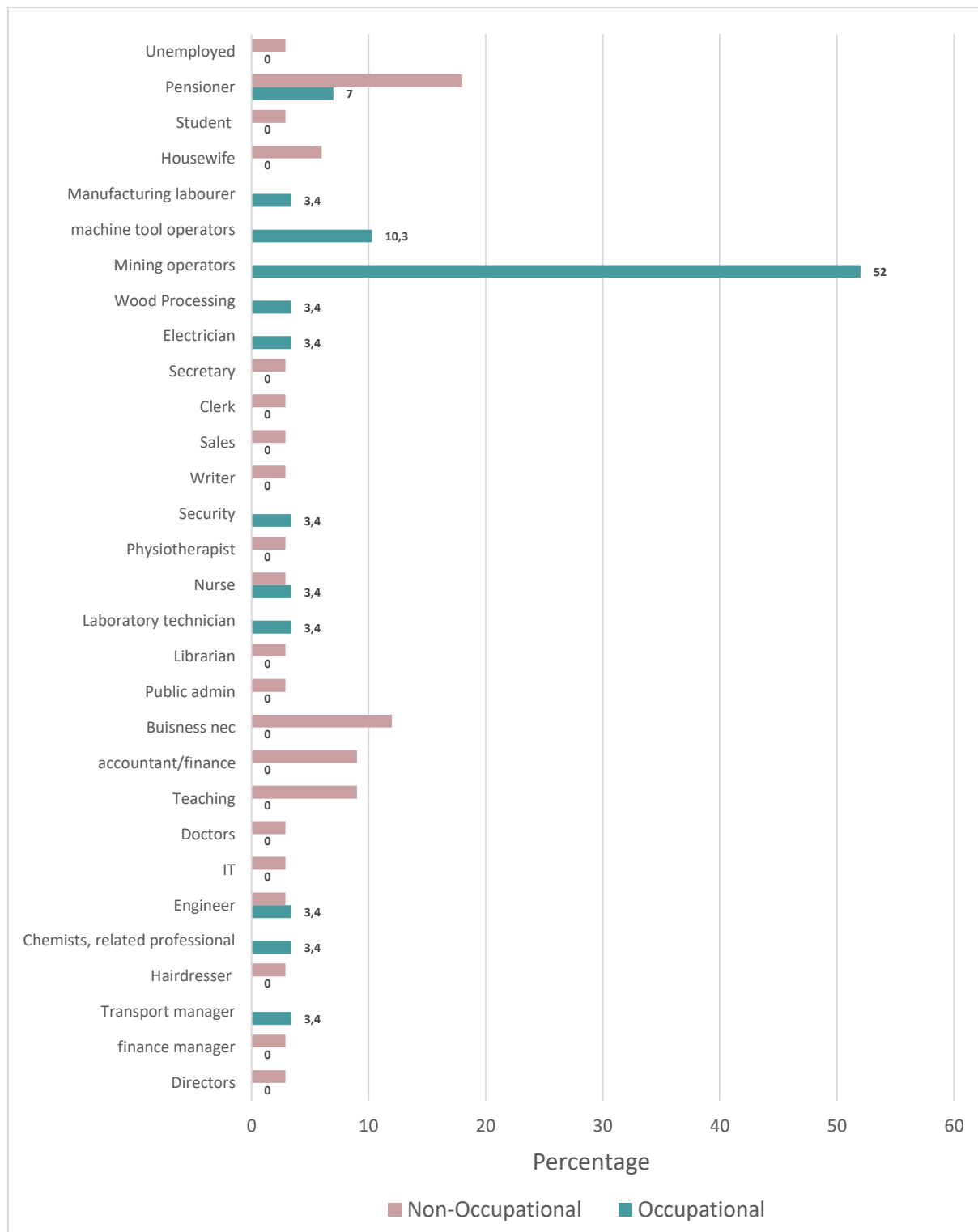
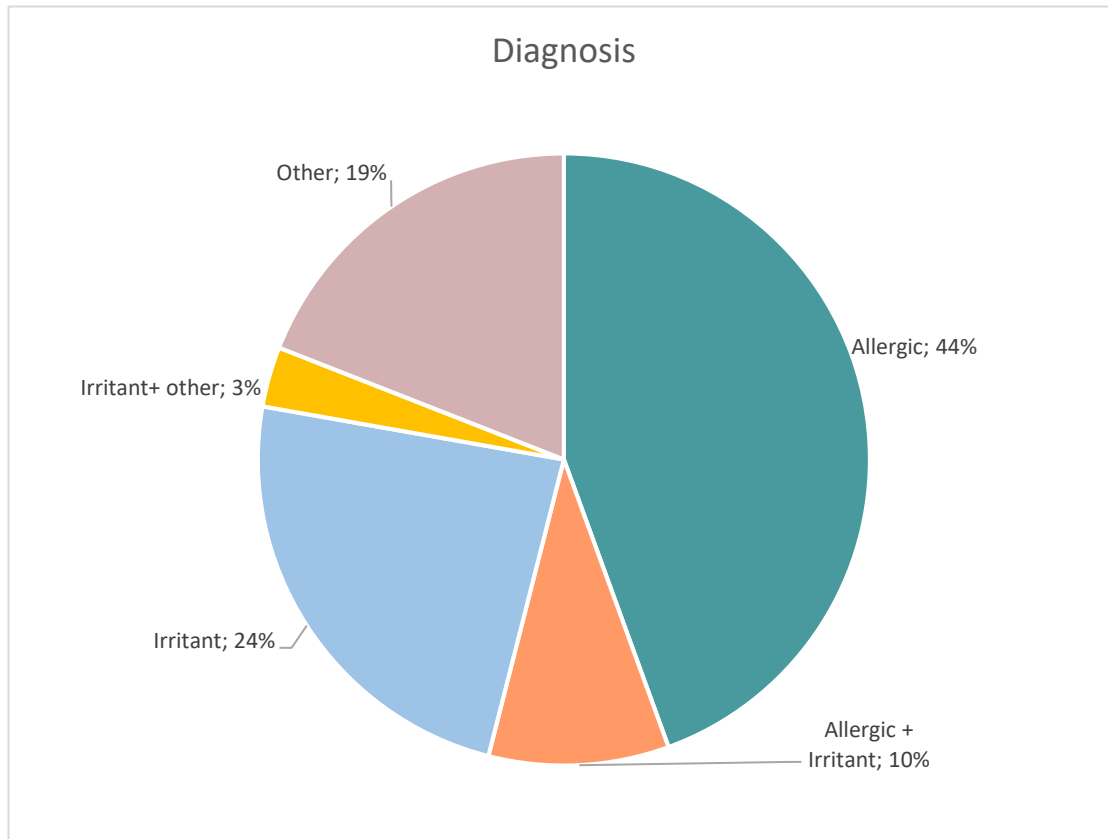


Figure 5: Patient referrals by occupation.

### 2.3 Diagnosis of all referred patients

Contact dermatitis (including allergic, irritant and a combination of both reactions) was diagnosed in the largest group of referrals (78%) (Figure 6). Followed by 'other' (19%), which included atopic dermatitis, keratoderma and acne folliculitis, among others (Figure 6).



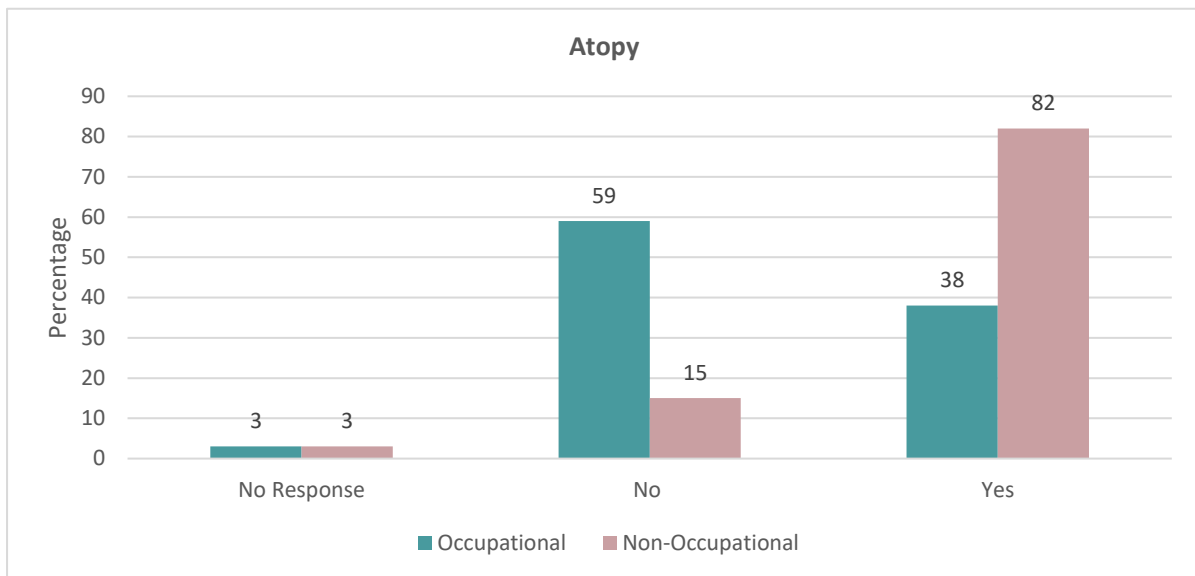
**Figure 6:** Percentage of all patients' main diagnosis.

### 2.4 Allergy screening diagnosis

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

#### 2.4.1. Atopy

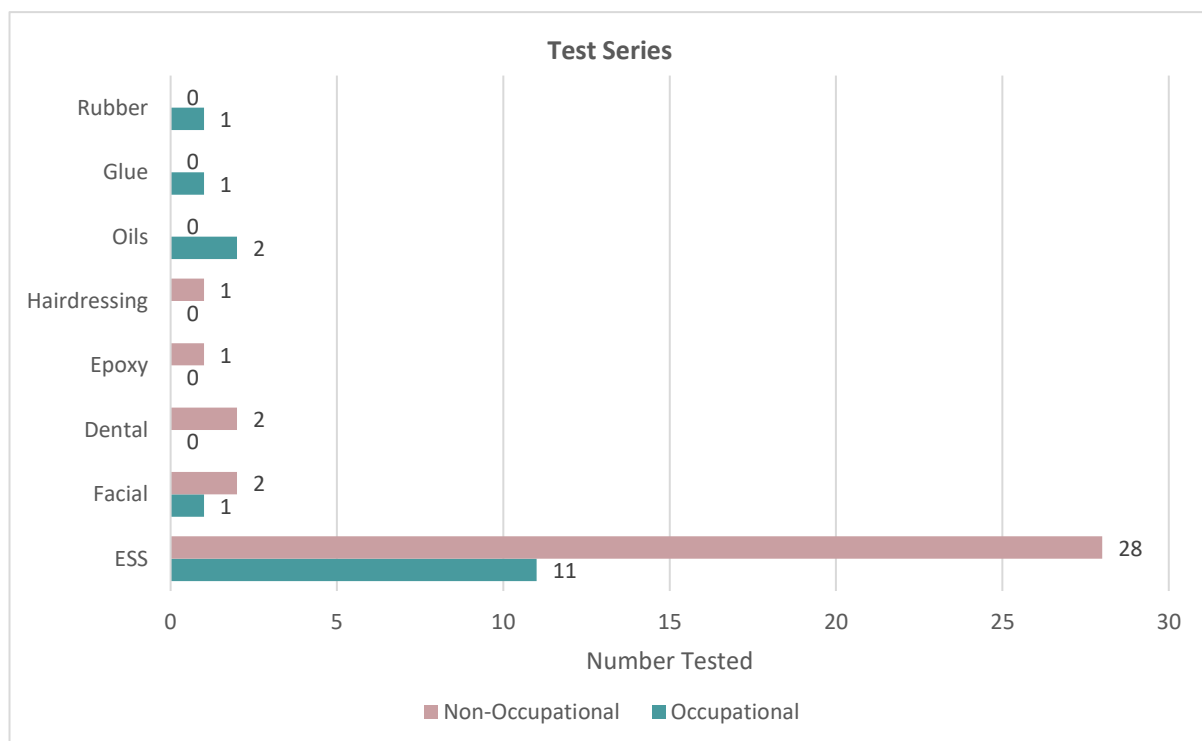
Atopy was more prevalent among the N-O patients (82%) than the occupational patients (38%) in Figure 7. The atopic individuals were predominantly pensioners (13%), followed by miners (10%) and business associates (8%).



**Figure 7:** Percentage of patients reporting atopy.

#### 2.4.2 Allergy test series performed

The most common series tested in the occupational referrals (other than the ESS) was the oils series, while in the N-O group the facial and dental series were most commonly tested (Figure 8).



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

**Figure 8:** Number of allergy test series requested by patient group

## 2.5 Patch test results of common series tested

### 2.5.1 European standard series

The test series each consist of several allergens and 73% of those patients tested with the ESS were positive for at least one allergen in the test series. Of all patients tested with the ESS - nickel, Formaldehyde, colophonium (rosin, adhesives, paint, varnish, inks and [plasticisers), methylisothiazolinone / Methylchloroisothiazolinone (preservatives in personal care products and coolants in the workplace), and potassium dichromate (found in the leather tanning and chemical construction industries) were common allergens detected among both groups. While a few allergens were found only in occupational referrals and others only in non-occupational referrals (Table 1).

**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	2	18.2	2	7.1
Thiuram	1	12.5	2	8
Cobalt chloride	1	9	0	0
Epoxy resin	0	0	1	4.1
Formaldehyde	2	22.2	5	20.8
Colophonium	2	22.2	2	8.3
Balsam of Peru	0	0	1	4.1
Isopropyl-phenyl-paraphenylene diamine	0	0	1	4.5
Neomycin 20%				
Paraben mix	1	11	0	0
Fragrance mix	0	0	1	4.1
Nickel sulphate	4	36.4	9	33.3
Methylchloroisothiazolinone/ Methylisothiazolinone (MCI/MI)	2	22.2	2	8.3
Methyldibromo glutaronitrile	2	22.2	1	4.5
RelDispBluMx	0	0	1	4
Lyril	0	0	1	4.3
Methylisothiazolinone †	1		1	
Copper sulphate†	1		0	
Propolis†	0		1	

\*n is the number of people with a positive reaction \*\* 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.

†miscellaneous substances tested in a few patients.



### 2.5.2 Rubber Series

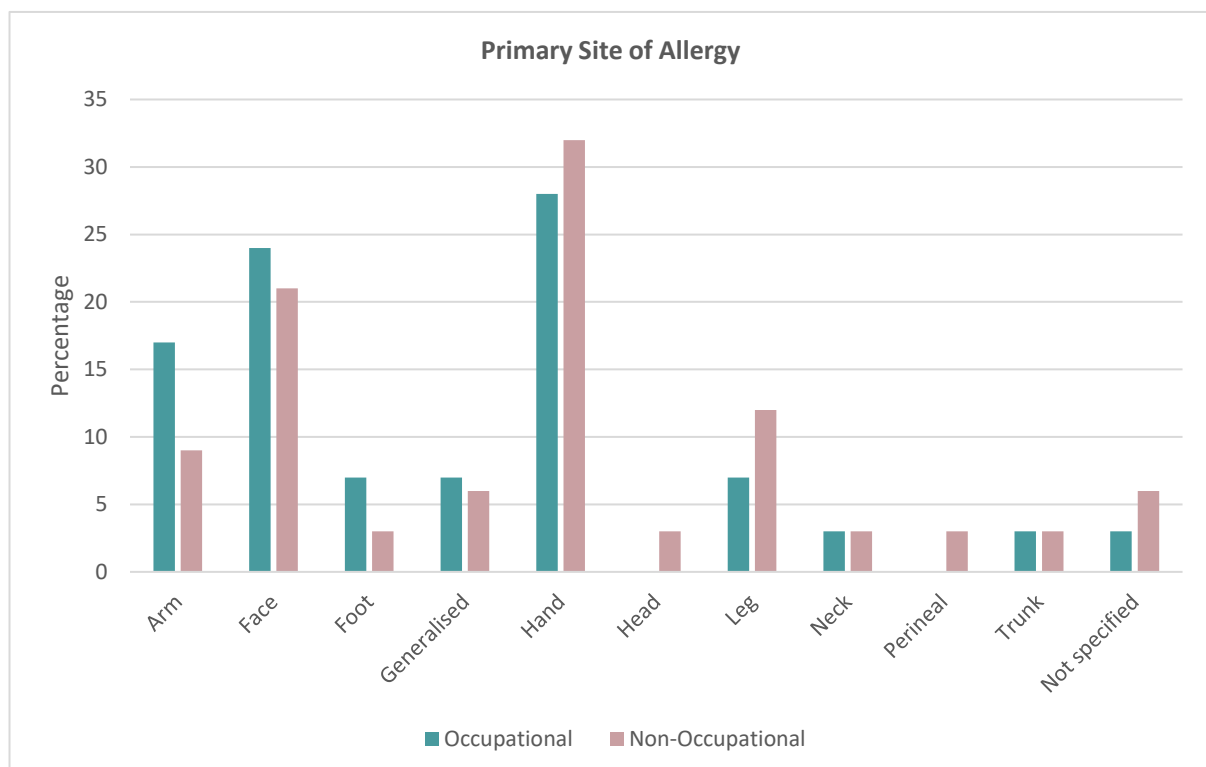
Only one occupational referral patient was tested with the 25 allergens of the rubber series and was positive for Tetraethylthiuram disulphide, which is used as an accelerator and activator in the processing of rubber. It is found in shoes as well as adhesives, condoms, gloves, personal care products and tires and tubes, and it is also found in fungicides and medication to treat alcoholism.

### 2.5.3 Other Series

Facial, Dental, Hairdressing, Oils, Epoxy, and Glue Series were only tested on a few people each, and none of these patients tested positive, i.e. were not sensitised to any of the substances in these series.

## 2.6 Primary site affected by allergy

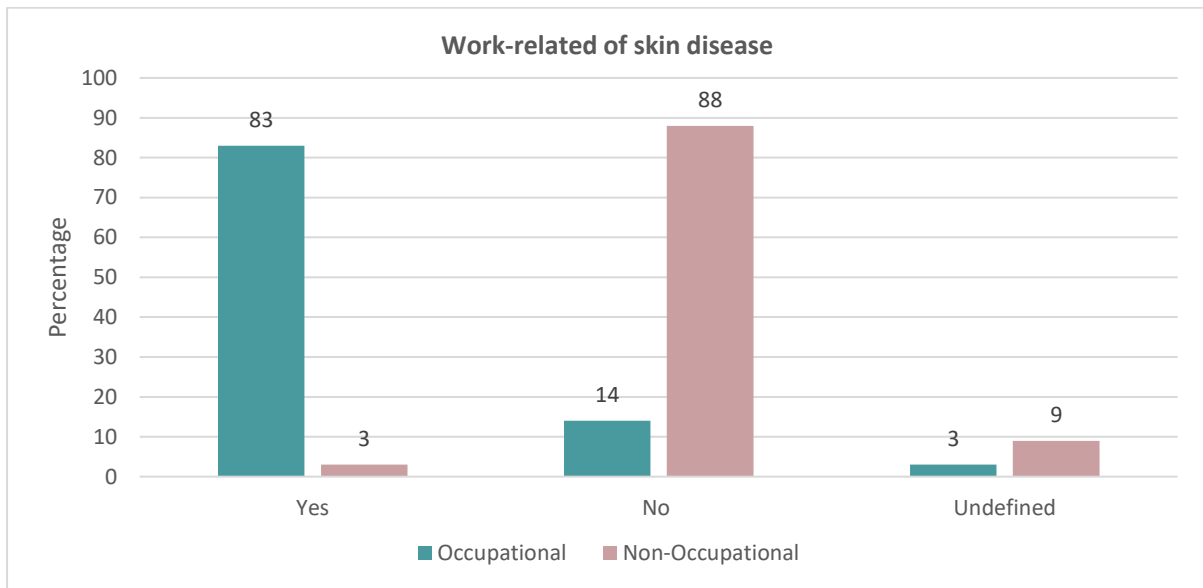
The primary allergy site corresponds with the expected exposures, with both presenting with facial and hand allergies, while occupational referrals presented with facial, arm and hands as their primary sites of allergy (Figure 9).



**Figure 9:** Percentage of patients and primary site of allergy.

## 2.7 Workplace relatedness

The skin diseases were considered workplace-related if they occurred at work or improved when away from work and recurring when returning. Also if there are exposures to possible causative agents in the workplace. Eighty-three per cent of the occupational referrals were diagnosed with an occupational or work-related skin disease, while 3% of the N-O referrals had occupational allergies (Figure 10).



**Figure 10:** Percentage of work-relatedness of skin disease by patient type.

## Conclusions

Occupational skin allergies and irritant reactions form an important part of Occupational Health. Surveillance of these diseases is essential as it helps identify putative agents and manage the risk of developing workplace allergies. This information can inform employers and raise awareness among workers.

Testing of respiratory allergies was conducted for a battery of common aeroallergens and non-commercial allergens. The majority of patients were in the 31-40 and 40-49 year age group; 60% were female and from precious metal research. The highest proportion of tests requested was the platinum (44%) and the platinum and nickel test (37%), followed by aeroallergens (14.5%). Approximately 63% of patients tested positive for aeroallergens. The top three aeroallergens were house dust mites (30% positive of all tested), Cockroaches (24%) and Bermuda grass (18%).

Patch testing for skin allergies was conducted mainly with the European Standard Series (ESS), where the majority of patients were also 30 to 49; however, there were a higher proportion of > 50-year-old patients in the referral group compared to the worker group. The gender distribution was contrary among workers and referrals - 74% of males were workers and 78% of females were referrals. The majority of worker patients were from the mining and quarrying sector. Referral patients included 32% from the business sector. Contact dermatitis (including allergic, irritant and a combination of both reactions) was diagnosed in the largest group of referrals (78%). Of all patients tested with the ESS - nickel, Formaldehyde, colophonium, methylisothiazolinone / Methylchloroisothiazolinone, and potassium dichromate were common allergens detected among both groups.

In 2021, the majority of patients were from precious metal research, manufacturing, mining and business, highlighting the need for more research and implementation of control measures in these industries. Since the COVID-19 pandemic there has been a decline in the number of referrals for allergy tests. Nonetheless, continued efforts must be invested to strengthen the allergy surveillance programme across South African industries to provide a comprehensive picture; however, additional data is needed from other allergy treatment centres throughout the country.

## Limitations

The 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 skin allergies (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. The exact nature of the job within an industry is not known for some participants. The province of employment is unavailable. These and other relevant information will be added to the minimum data set for future surveillance.

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