UNIVERSITY OF CAPE TOWN

PREDICTORS OF OCCUPATIONAL SKIN DISEASE AMONG SEAFOOD PROCESSING WORKERS IN THE WESTERN CAPE

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DECLARATION

Predictors of Occupational Skin Disease among Seafood Processing Workers in the Western Cape

I, Amy Burdzik, hereby submit my dissertation for the degree of Master of Medicine (MMed) in Occupational Medicine. I declare that this is my original work (except where acknowledgements indicate otherwise) and that neither the whole work, nor any part of it, has been, is being, or is to be submitted for another degree in this or any other university. This work has not been reported or published prior to registration for the aforementioned degree.

_____ 14th April 2012

Dr Amy Burdzik

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ABSTRACT

Background: Occupational skin disease is common in seafood processing workers. While previous studies have reported an increased prevalence of symptoms (as high as 50%) and protein contact dermatitis (3-11%), the prevalence and patterns of type IV allergic contact dermatitis have not been well characterised in epidemiological studies. The aim of this study was to identify host and environmental risk factors for symptoms, clinical eczema, positive patch tests, possible and probable allergic contact dermatitis in seafood processing workers.

Methods: A cross-sectional study of 594 seafood processing workers was conducted in two seafood processing plants in the Western Cape Province of South Africa. The study used an interviewer-administered questionnaire to collect information on demographic characteristics, occupational history, work practices and skin symptoms in the preceding 12 months. A subgroup of symptomatic workers (n=120) were investigated further and compared to a group of randomly selected asymptomatic workers (n=134). Both groups underwent clinical examination by experienced dermatologists and patch testing with a battery of standard allergens (adapted British Contact Dermatitis Group Standard Series) supplemented by various seafood products and additives used in the factory. Data of skin prick tests to common aeroallergens and seafood products, and serum omega-3 fatty acid (Eicosopentaenoic acid) collected in a previously reported study were also used.

Results: The mean ages of the two groups were comparable (35-36 years), and 60% were female. The symptomatic group (reporting >2 episodes of skin problems annually) had a significantly ($p<0.05$) higher prevalence of sensitisation to fish (12%) than the asymptomatic group (4%). However, skin symptoms were not associated with clinical examination findings. The most commonly observed skin conditions were traumatic lesions (69% vs. 74%), followed by hand eczema (60% vs. 56%) and sequelae of wet work such as webspace dermatitis and paronychiae (31% vs. 39%), in the symptomatic and asymptomatic group respectively. Nickel sensitization was found in 25% of all workers tested, most being female. Chlorhexidine and carbamix sensitization were more commonly associated ($p\leq0.05$) with symptomatic workers. In multivariate logistic regression models (adjusted for age, gender, atopy, fish intake and factory) skin symptoms were strongly associated with Type I sensitisation to fish (POR = 3.50, CI: 1.23-9.92) and a family history of eczema (POR = 2.40, CI: 1.08-5.32). The wet work skin sequelae were strongly associated with "wet fish" work in the jetty and canning departments (POR = 2.09, CI: 1.03-4.25). A strong association was also observed between monthly glove changes and probable allergic contact dermatitis to rubber (POR = 4.79, CI: 1.32-17.31) and disinfectants (POR = 3.93, CI: 1.05-14.71) compared to no glove use.

Conclusion: Contact eczematous dermatitis and wet work sequelae are commonly observed in seafood processing workers. This is due to irritant exposures associated with wet work and allergens such as carbamix rubber glove additives and chlorhexidine disinfectants. There is a need for further prospective studies to evaluate the impact of different preventative measures to reduce the incidence of occupational skin disease in these workers.

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SECTION A: PROTOCOL

PREDICTORS OF OCCUPATIONAL SKIN DISEASE AMONG SEAFOOD PROCESSING WORKERS IN THE WESTERN CAPE: PROTOCOL

1. INTRODUCTION

1.1 Background

Occupational contact dermatitis is a common occupational disease. The incidence is difficult to determine as it is considered to be under-reported. However, globally it is estimated to be about 5-19 cases per 10 000 workers per year (1). The entity accounts for approximately 30% of compensable occupational disease in some countries (2), and was the fifth most commonly compensated occupational disease in South Africa in 2009 (3).

Occupational contact dermatitis is either allergic or irritant in nature. Differentiating between these conditions is difficult clinically, hence the diagnosis is supported by a positive exposure history and patch test result (1). Occupational allergic contact dermatitis is a Type IV allergic reaction resulting from exposure to an allergen in the workplace. Atopic dermatitis and atopy do not appear to be predisposing factors (2). Occupational irritant contact dermatitis occurs commonly with wet work or workplace exposure to detergents or other irritant chemicals (2). Predisposing factors include a history of atopic dermatitis (1). It has also been suggested that incidence of irritant dermatitis is inversely proportional to age and that being female may be a predisposing factor. However, this is likely to be due to the gendered distribution of work (1).

Food processing workers are at high risk of developing occupational contact dermatitis, with approximately 5 per 10 000 workers affected each year (4). Seafood workers in particular report high rates of skin symptoms (5,6). Most commonly this is an irritant dermatitis from wet work and products in fish juice (7). Fish-scales have been shown to cause irritant dermatitis (8). In addition to irritant exposures, seafood workers are exposed to high molecular weight proteins that may cause a recurrent dermatitis known as protein contact dermatitis (9). Furthermore, additives such as spices and preservatives as well as allergens in rubber gloves and metal instruments have been reported to cause allergic contact dermatitis (7).

Previous studies have reported on self-reported symptoms (5,6) and the prevalence of and risk factors for protein contact dermatitis (10). However, very little has been published about additional predictive factors for contact dermatitis in this population such as wet work, glove use, and irritant exposures as a risk factor for allergy to metals, rubbers and preservatives which are ubiquitous in the environment. This study will concentrate on allergic and irritant contact dermatitis and exposures at the workplace other than fish proteins.

1.2 Aim

The aim of this study is to determine the environmental and host factors associated with contact dermatitis (allergic and irritant) among seafood processing workers in the Western Cape Province.

1.3 Objectives

1.3.1 To describe the demographic profile of workers reporting recurrent skin symptoms compared to an asymptomatic group.

1.3.2 To determine the prevalence of the various skin conditions such as occupational contact dermatitis, protein contact dermatitis, sequelae of wet work, injuries and infections on clinical examination in the symptomatic and asymptomatic group.

1.3.3 To determine the prevalence of responses to a standard battery of patch test reagents and in-house seafood extracts in the symptomatic and asymptomatic group.

1.3.4 To correlate self-reported symptoms of recurrent skin problems with clinical examination findings as well as positive patch test results.

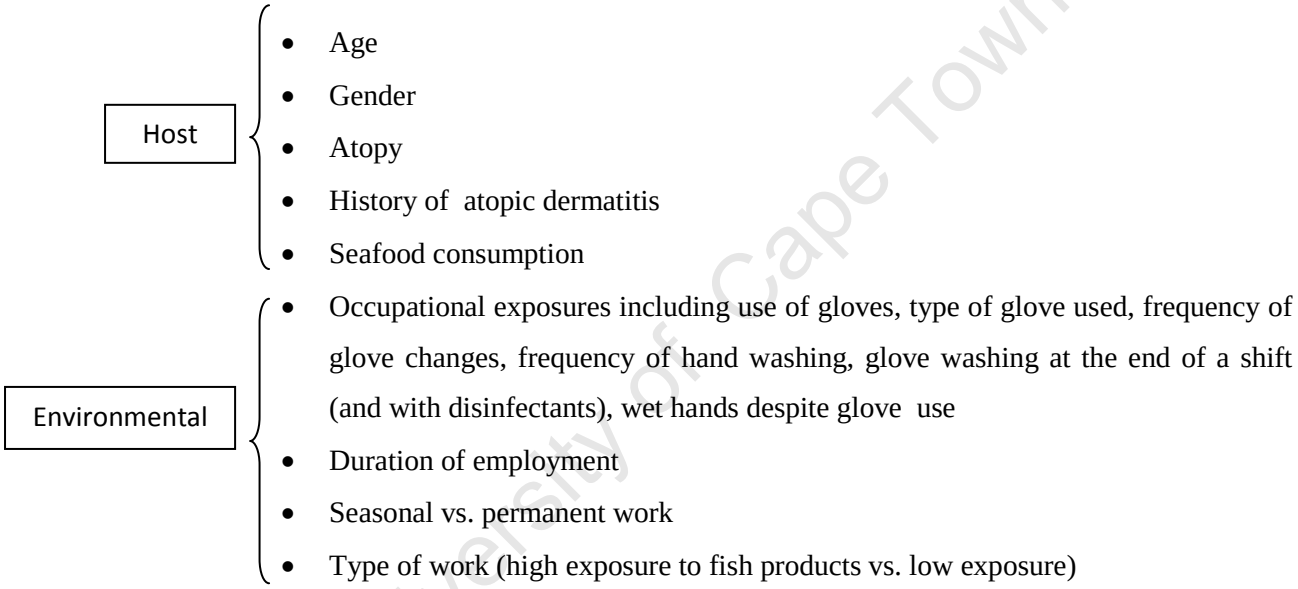
1.3.5 To identify host and environmental predictors for the following clinical endpoints:

- Recurrent skin symptoms (>2 episodes) in the past year
- Contact dermatitis on clinical examination
- Sequelae of wet work
- Positive patch test to any one of the ff:
  - metals (nickel, chromium, cobalt)
  - rubber additives (carbamix, mercaptomix, thiuram mix, mercaptobenzothiazole, 4-phenylenediamine base, IPPD)
  - disinfectants and preservatives (chlorhexidine, methyl-and methylchloro isothiasolinone (Kathon CG), formaldehyde, quaternium 15, parabens, clioquinol, imidazolidinyl urea, methyldibromo glutaronitrile and phenoxyethanol (Euxyl K400))
  - seafood (pilchard, redeye, maasbanker, mackerel, anchovy, west coast rock lobster)
- Possible contact dermatitis to any one of the ff:
  - metals (nickel, chromium, cobalt)
  - rubber additives (carbamix, mercaptomix, thiuram mix, mercaptobenzothiazole, 4-phenylenediamine base, IPPD)
  - - disinfectants and preservatives (chlorhexidine, methyl-and methylchloro isothiasolinone (Kathon CG), formaldehyde, quaternium 15, parabens, clioquinol,

imidazolidinyl urea, methyldibromo glutaronitrile and phenoxyethanol (Euxyl K400))
- seafood (pilchard, redeye, maasbanker, mackerel, anchovy, west coast rock lobster)

- Probable contact dermatitis to any one of the ff:
  - metals (nickel, chromium, cobalt)
  - rubber additives (carbamix, mercaptomix, thiuram mix, mercaptobenzothiazole, 4-phenylenediamine base, IPPD)
  - - disinfectants and preservatives (chlorhexidine, methyl-and methylchloro isothiasolinone (Kathon CG), formaldehyde, quaternium 15, parabens, clioquinol, imidazolidinyl urea, methyldibromo glutaronitrile and phenoxyethanol (Euxyl K400))
  - seafood (pilchard, redeye, maasbanker, mackerel, anchovy, west coast rock lobster)

The predictors which will be investigated are:



2. METHODS

2.1 Study Design

This is a prevalence case control study of seafood processing workers.

The data that will be used for this study are derived from a larger cross-sectional survey performed between 1999 and 2000 in two seafood processing factories in St Helena Bay on the west coast of South Africa. This large scale study investigated occupational allergy associated with rock-lobster and saltwater bony fish processing in this group of workers (11).

2.2 Population and sampling

The population chosen for the 1999 study were the employees of two seafood processing factories on the West Coast of South Africa. All 643 employees who handled rock lobster and saltwater bony fish

(pilchard, Cape anchovy, mackerel, light fish, redeye, Cape horse mackerel and lantern fish) as well as clerical staff were eligible for participation. However, 594 participated in the study.

Based on power calculations using $\alpha = 0.05$, a background prevalence of seafood allergy in adults of 0.1% (Nordic estimates) and an estimate for seafood-induced protein contact dermatitis of 3% in workers exposed to seafood, a sample size of 400 was estimated to be appropriate to investigate the original parameters of interest (11).

This sub-study will concentrate on a sub-set of patients who reported symptoms (n=120) and asymptomatic controls who were frequency matched by department (n=134).

2.3 Data collection methods

2.3.1 Questionnaire

Questionnaires were administered to 594 workers from the two seafood processing factories in the initial cross-sectional study. The questionnaire used was a version of the European Community Respiratory Health Survey, modified to include information on skin symptoms and workplace exposures, as well as seafood ingestion. It was adapted for local conditions, translated into Afrikaans and back translated into English to ensure accurate translation.

An affirmative answer to the question: "During the past 12 months have you had any skin problems that occurred 2 or more times?" designated a worker as a 'case'. They were then asked to describe skin symptoms as any of the following: itchy skin; hives; dry or scaly skin; redness of the skin; blisters or weeping skin; started within an hour of contact with a substance or food item; or other. Work-relatedness of the skin symptoms was defined as a positive response to: "Does being at work ever cause you to have skin problems?" in the questionnaire.

Possible occupational exposures were investigated in the questionnaire by questions pertaining to type of work, frequency of glove use, frequency of glove changes, types of gloves used, glove washing practices, use of disinfectants to wash gloves, hand washing frequency and whether hands were wet despite glove use.

Seafood intake was assessed by the question: "How often have you eaten (the following) seafood in the last 12 months?" followed by a list of options including, fish, crayfish or prawns, calamari, perlemoen and oysters/mussels. Occupational exposure to fish products was determined by asking about the type of work in the current factory, as well as previous work in that same factory and other factories.

2.3.2 Assessment of atopy using skin prick tests

Atopy was determined by skin prick testing (SPT) to common local aeroallergens (ALK-Abelló, A/S, Horsholm, Denmark) that included house dust mite (*Dermatophagoides Pteronyssinus*), bermuda grass (*Cynodon dactylon*), rye grass (*Lolium perenne*), cockroach (*Blatella germanica*), cat (*Felis domesticus*), dog (*Canis familiaris*), mouldmix (*Cladosporium herbarum, Alternaria alternata, Fusarium*), Aspergillus (*Aspergillus fumigatus*). A positive test was defined as a wheal read 15 minutes after testing that had a diameter (mean of two perpendicular measures) of ≥ 3mm more than the negative control. Atopic status was determined as positive if there was a positive reaction to one or more aeroallergens. Occupational sensitisation was present if the SPT was positive for any of the specially-prepared seafood allergens.

2.3.3 Clinical examination of the skin

A skin examination was performed by a dermatologist on a subgroup of the workers who reported having two episodes of skin symptoms in the past year ('cases'; n=120) as well as a 'control' group of employees (n=134), selected using stratified random sampling, the frequency matched with cases by department.

The examiner was blinded to exposure status of the workers. The examination focused mainly on the hand and forearms and noted whether workers had eczema, urticaria, finger web space dermatitis, paronychia, skin and nail trauma, or skin and nail infections at the time of the clinical examination.

2.3.4 Skin patch testing

The skin examination included patch testing with 40 commercial allergens which commonly cause dermatitis (adapted British Contact Dermatitis Group standard series) (12), as well as other extracts of allergens commonly encountered in the factories. These included fresh seafood (fishmeal, raw pilchard, cooked pilchard, canned pilchard, salted pilchard, pilchard gut, raw redeye, raw maasbanker, raw mackerel, raw west coast rock lobster) as well as tomato paste, spice oil, starch and guargum. These were prepared daily in-house from fresh or frozen products. Allergens were applied to the patient's back in aluminium Finn chambers on Scanpor tape and left in place for 2 days. Results were read after 3 days, and classified as either a negative reaction, an irritant reaction or a positive reaction of varying severity - weak positive (non-vesicular erythema, infiltration); strong positive (erythema, infiltration, papules and vesicles); and extreme positive (erythema, infiltration, bullous reaction).

2.3.5 Seafood Consumption Index – omega 3-fatty acids

Bloods were taken from participants to determine serum omega 3-fatty acid concentrations. The % µg/ml (relative composition) of eicosapentoic acid (EPA), a marine n3-polyunsaturated fatty acid, was used as a measure of regular seafood consumption.

3. DATA ANALYSIS PLAN

The dataset has already been collected and cleaned for previous analysis. Stata 10.0 (StataCorp. 2007) software will be used for all analyses. The associations between host and environmental factors, and occupational skin disease outcomes will be investigated as outlined below.

Key outcome variables will be:

a) Self-reported recurrent skin symptoms (≥ 2 episodes in the past 12 months)
b) Eczema on clinical examination, as assessed by the dermatologist
c) Sequelae of wet work on clinical examination, as assessed by the dermatologist
d) Positive patch test results to any one of the following groups of agents (as defined by the dermatologist's assessment of a weak, strong or extreme positive allergic reaction to the patch test):
   - metals (nickel, chromium and cobalt)
   - rubber additives (carbamix, mercaptomix, thiuram mix, mercaptobenzothiazole, 4-phenylenediamine base and IPPD)
   - disinfectants and preservatives (chlorhexidine, methyl-and methylchloro isothiasolinone (Kathon CG), formaldehyde, quaternium 15, parabens, clioquinol, imidazolidinyl urea, methyldibromo glutaronitrile and phenoxyethanol (Euxyl K400))
   - seafood products including pilchard, redeye, maasbanker, mackerel, anchovy and west coast rock lobster
e) Possible contact dermatitis to any one of the following groups of agents (as defined by the presence of self-reported recurrent skin symptoms (≥ 2 episodes in the past 12 months) as well as a positive patch test as described above):
   - metals
   - rubber additives
   - disinfectants and preservatives
   - seafood products
f) Probable contact dermatitis to any one of the following groups of agents (as defined by the presence of eczema on clinical examination as well as a positive patch test as described above):
   - metals
   - rubber additives
   - disinfectants and preservatives
   - seafood products

Univariate analysis will be used to summarise the distribution of each variable. Bivariate analysis will assess unadjusted associations between exposures and outcomes. Multiple logistic regression will be used to investigate associations between exposure variables (host factors, exposure status at work) and

clinical outcomes (reported skin symptoms, eczema on examination, positive patch test results, possible and probable allergic contact dermatitis). Potential confounders to be considered are age, gender, factory, atopic status and seafood intake. Exposure variables which will be tested are seasonal versus permanent work, duration of employment, high exposure work versus low exposure work, regular glove use, type of gloves used, frequency of glove changes, whether gloves are washed at the end of a shift (and with detergent), frequency of hand washing and whether hands are wet despite glove use (ineffective gloves).

4. ETHICS AND COMMUNICATION

The original study received ethical approval from the University of Cape Town Research Ethics Committee in 1999 (Reference: 109/99). This study will carry out additional analyses on a sub-set of the collected data, with no new data to be collected in this sub-study. Therefore, there is no additional risk to the individuals who participated in the original study. The research will be conducted within the guidelines provided by the Declaration of Helsinki (13).

4.1 Autonomy (consent)

Participation in the original study was voluntary and written informed consent was obtained for all tests.

4.2 Confidentiality

The study data is recorded by patient number with no identifying personal details. The researcher will not have access to the original patient records so will not be able to identify individual participants.

4.3 Beneficence

At the time of the original study, patients noted to have abnormal results were referred either to the Occupational Medicine Clinic at Groote Schuur Hospital, or to their own medical practitioners for follow-up.

Although this additional analysis may not have specific benefits for the individuals concerned, the hope is that any additional information obtained about workplace exposures which can cause harm, will ultimately lead to an improvement in working conditions for all employees in the seafood industry.

4.4 Non-maleficence

The original study was low risk to participants in that there were potentially low risks associated with performing skin prick testing, patch testing and drawing blood but participants gave informed consent, and records of the results indicate that no adverse events were reported.

The additional analysis does not require participant access, so there are no additional risks to the individual.

4.5 Reporting

This analysis is being conducted for the purposes of an MMed degree. The results will be submitted to a peer-reviewed publication on occupational skin disease, after it has been examined and comments have been taken into consideration.

4.6 Funding

Funding for the original cross-sectional study was provided by research grants from the Medical Research Council of South Africa and from NIOSH, CDC, USA (R01 Grant No F002304). There is no additional funding for this sub-study.

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SECTION B: LITERATURE REVIEW

OCCUPATIONAL DERMATITIS IN FOOD PROCESSING WORKERS AND THE SEAFOOD PROCESSING INDUSTRY – A REVIEW OF THE LITERATURE

INTRODUCTION

The review focuses on occupational contact dermatitis, including protein contact dermatitis. As the available literature about seafood processing workers is limited, the search was extended to cover food handlers more generally. Literature searches were performed on Pubmed and Medline using the key words "skin disease/dermatitis/occupational contact dermatitis", "fish/detergents/ preservatives/rubber/metals" and "seafood workers/seafood processing workers/food handlers". Abstracts were assessed for relevance of the article and the relevant full articles were obtained where possible. The search was limited to articles published in English, but there was no limit on the time at which they were published. Reference lists of the articles obtained were scanned for additional citations. Articles were appraised for validity and reliability, and limitations were assessed.

Seafood Processing Industry

Internationally, the fishing and aquaculture industries have grown in recent years, and it has been estimated that approximately 44.9 million people are employed in fishing and seafood processing worldwide (1). In South Africa, the number of workers directly employed in fishing has declined over the past decade from 30 000 people to approximately 16 854 (1). Division of labour is along gender lines with men going out to fish, and women employed in factories to perform the processing work (1,2). Reported ill-health may be related to safety risks, noise levels, cold and wet work, exposure to bio-aerosols, bacterial and parasitic infections and ergonomic risks (2). Many workers are seasonally employed with precarious employment which has been shown to increase ill health and accidents (1).

Immunological reactions to consumption of seafood are commonly reported, and there has recently been an increase in reporting of occupational immunological reactions to seafood, due to the increase in employment in the industry worldwide (3). Common Type I immune reactions include asthma and contact urticaria (3). Contact dermatitis is frequently due to an irritant reaction to the wet work, use of gloves and exposure to fish juices, but may be due to a Type IV allergy (4).

Occupational Skin Disease

Occupational skin diseases are common occupational conditions and account for a large proportion of reported occupational disease in many developed countries (5). Between 70 and 90% of occupational skin diseases are due to occupational contact dermatitis (6), with contact urticaria and other conditions making up a far smaller proportion. Incidence of occupational contact dermatitis is reported to be between 5 and 19 cases per 10 000 workers per year (5). In South Africa, occupational contact dermatitis was the 5th most commonly compensated condition in 2009 (7).

Occupational contact dermatitis is categorised as irritant or allergic in nature. Allergic contact dermatitis is a Type IV immune reaction, and is diagnosed based on a positive patch test and known exposure to a specific agent, whereas a diagnosis of irritant contact dermatitis is made on a basis of exposure to known irritants, including wet work and occlusive gloves, and a relevant temporal relationship between exposure and skin symptoms (8). Irritant dermatitis can be a diagnosis of exclusion if no patch test results are positive (5).

In general, irritant contact dermatitis is thought to occur more commonly than allergic contact dermatitis. Dickel et al reported irritant contact dermatitis in more than half of their patients with occupational skin disease, ranging from 59% of occupational skin disease in automobile workers and locksmiths and up to 76% in pastry cooks (9). In the past there was dissention with some authors reporting that allergic contact dermatitis may be more common than generally acknowledged. Kucenic and Belsito (10) argued that cases of allergic contact dermatitis are missed because of limited allergens available commercially and the time investment necessary for patch testing. However, their study, which found a prevalence of allergic contact dermatitis of 60%, was based at a tertiary referral centre, so there may have been a bias towards more severe cases of dermatitis. Recently published guidelines state that "Overall, in the general workforce, irritant occupational contact dermatitis occurs more commonly than allergic occupational contact dermatitis" (6).

A sub-category of allergic contact dermatitis which is particularly associated with the food processing industry is protein contact dermatitis (8). First described in 1976 (11), this is a condition in which individuals experience immediate symptoms on exposure to high-molecular weight proteins, such as animal and vegetable proteins. With chronic exposure, a contact dermatitis develops. Although the mechanism is not completely understood, it is thought to be an IgE-mediated reaction, and diagnostic investigations should include a skin-prick test (11) as in-vitro tests are thought to be less sensitive and are only available for a few food allergens (12).

A. OCCUPATIONAL SKIN DISEASE IN FOOD HANDLERS

Protein contact dermatitis

Several studies have considered skin conditions in food processing workers, as they are known to be a high risk group with exposures to wet work, gloves and various chemicals and proteins. A seminal study, published in 1976, described 15 food handlers who all noted that their dermatitis was aggravated by contact with fish or particular vegetables. They reported itching within 10 – 30 minutes of exposure, and some developed erythema and vesicles at the site of contact. On patch testing, they were noted to be sensitised to metals, onion and garlic. On scratch testing, 8 of 15 cases had immediate reactions to fish, whereas patch testing was negative. Therefore, the authors concluded that the symptoms were caused by an immediate hypersensitivity reaction, and surmised that large

molecular weight proteins are able to penetrate the skin. It is thought that pre-existing irritant dermatitis may impair the skin barrier sufficiently to allow this to happen (11).

A 1983 study (13) of people with contact dermatitis revealed a high proportion of food processing workers with an occupational cause (50%), and a particularly high proportion among fish factory workers (83%). The majority of the contact dermatitis was deemed to be protein contact dermatitis due to fish, meats and vegetables, as scratch tests and RASTs (radioallergosorbent tests) were positive. Mackerel was the commonest sensitiser among the fish factory workers. Similarly, in a Finnish study (14) comparing occurrence of eczema in various departments of a large factory which produced canned meats, snacks, chocolates, liquorice, chewing gum and fish (herring) products, 70% of the fish workers with eczema were thought to have an occupational cause. Overall, 23% of the workers in the fish department had occupational eczema compared to an average of 8.5% across departments. Only one worker had a positive prick test and scratch test to fish, but the majority of workers were not tested with prick and scratch tests (only 10 tests performed). Therefore, some cases of protein contact dermatitis may have been missed. In this study, it was felt that the majority of irritant dermatitis was due to brine, dressings and detergents. They also found a high prevalence of delayed sensitivity reactions to rubber chemicals.

Cronin (15) described skin conditions in 50 catering workers. Ultimately, 21 (42%) were diagnosed with irritant contact dermatitis alone, while 17 (34%) had irritant dermatitis with a food allergy and only 3 (6%) had irritant changes with a "relevant hand allergen", such as rubber or perfume mix. Type I sensitisation was most commonly related to fish, and garlic was the most common Type IV reaction, similar to Hjorth and Roed-Petersen's findings (11). Two people were sensitised to their gloves (15).

An Australian case series presented "urticarial contact dermatitis" in food handlers (16). Seafood (including fish, crustaceans and mollusks) was the most common cause of an allergic reaction on skin prick testing, but not one of the 14 cases had a positive patch test to fish. One person had a positive reaction to nickel and one to thiuram mix on patch testing, but both also had reactions to fish on the prick test. The authors concluded that prick testing was an "essential component in the investigation of contact dermatitis in food handlers".

Irritant and allergic contact dermatitis

Although the studies mentioned above have concentrated on protein contact dermatitis, in fact, irritant contact dermatitis is far more common in food processing workers, because of wet work, occlusive glove use, detergent and disinfectant exposures and contact with irritant food ingredients.

Dickel et al (9) reported irritant contact dermatitis as the cause of occupational skin disease in 63% of butchers and food processing workers, 69% of cooks and 76% of pastry cooks. Halkier-Sørensen (4)

noted irritant contact dermatitis as the cause of skin disease in 75% of workers in the seafood processing industry.

In a large-scale retrospective German study (17), data from 873 food processing industry workers were analysed. Irritant contact dermatitis and allergic contact dermatitis comprised 38.3% and 24.4% of occupational contact dermatitis respectively, whilst protein contact dermatitis was diagnosed in only 2.7% of workers. Food processing workers had a higher prevalence of nickel sulphate and thiuram contact allergy on patch testing compared to a control group of other workers undergoing patch testing. It was postulated that thiurams could be released from gloves worn by these workers due to occlusion and sweating, contributing to the higher rate of sensitisation. Food processing workers also had a nearly two-fold increase in sensitisation to formaldehyde compared to the control group, possibly because of exposure to disinfectants used to clean machinery and surfaces.

Aside from studies looking at food processing workers in particular, larger epidemiological and surveillance studies across various industries mention food processing workers as they often have above average rates of contact dermatitis. In surveillance data reported voluntarily by dermatologists and occupational physicians in the United Kingdom (18), dermatologists reported an annual incidence rate of 30.5 cases of contact dermatitis per 100 000 workers in chefs and cooks, and the most frequent causative agents were food and flour, wet work, soap, nickel and rubber. Chrome and fragrances were reported as additional causative agents in other food processing workers. There is probable over-reporting of occupational contact dermatitis in this database as doctors are encouraged to report even suspected cases. However, Nettis et al (19) reported similarly that food service workers reacted most commonly to nickel, cobalt and rubber additives on patch testing.

Metals

Further reports from the voluntary surveillance program in the United Kingdom looked at the role of nickel as an occupational allergen (20). It is difficult to ascertain the relevance of a positive patch test to nickel as sensitisation commonly occurs in the general population following ear piercing, and exposure to nickel in the food industry is difficult to quantify. In 64% of cases, nickel was not considered relevant to the skin condition, despite a positive patch test. Conversely, in 36% of cases, nickel sensitisation was thought to be relevant to the patient's occupational skin disease. Hand dermatitis and a positive patch test to nickel led the authors to assume that occupational contact was more likely. Irritant dermatitis from wet work may predispose to sensitisation. Furthermore, Shah et al (21) postulate that nickel exposure may be high in food handlers, as the fluids involved in wet work can leach nickel from utensils. Primary sensitisation may well be due to ear piercing, but secondary exposure in the workplace can lead to an allergic contact dermatitis.

Often cobalt and nickel allergy co-exist (22), particularly in women, and this may again be as a result of ear piercing and wearing of costume jewellery. Both cobalt and nickel sensitisation are associated with an increase in hand dermatitis but the mechanism is unclear (23) and dermatitis may develop in the absence of occupational exposure. Although cobalt was reported to be a frequent sensitiser by Nettis et al (19), this may have been due to co-existing nickel and cobalt allergy rather than occupational exposure. Generally, larger epidemiological studies do not report an association of cobalt allergy and food processing work (22,23). However, in the study by Rui et al (23), food workers made up only 1% of the population studied, so the numbers may have been too small to identify an association.

Rubber and rubber additives

In addition to metal exposure, workers doing wet work can be exposed to allergens in gloves. Peltonen (14) reported high rates of positive patch tests to rubber additives in seafood workers. A German contact dermatitis surveillance network (24) found that food workers had high rates of thiuram sensitisation, with a prevalence of 5% per annum. This was a similar prevalence to that found in cleaners and healthcare workers, and gave a prevalence ratio of 3.48 (CI 2.16-5.31), when compared to office workers and teachers.

In a Spanish study (25) comparing non-healthcare workers and healthcare workers – who have traditionally had a high incidence of Type I sensitisation to latex – food handlers had the same incidence of positive prick tests to latex as healthcare workers (17%), higher than other professions such as hairdressers and cleaners. Nearly 75% of patients with a positive prick test to latex had hand eczema. The authors suggest that hand eczema may predispose to sensitisation. Sommer et al (26) looked at Type IV sensitisation to natural rubber latex, even though most Type IV reactions to gloves are thought to be due to the rubber additives, such as accelerators and vulcanisers. There was a positive patch test prevalence of 1% in patients with contact dermatitis, suggesting that delayed hypersensitivity to latex does exist although at a lower prevalence than Type I sensitivity.

Table 1 lists studies which reported results of patch tests in groups of food handlers and seafood processing workers. Aside from food products, rubber additives and metals were often the cause of a positive patch test.

Table 1. Epidemiological studies and case reports of occupational contact dermatitis in food handlers and seafood processing workers reporting patch test results

Occupation	Subjects	Prevalence of contact dermatitis n (%)	Skin prick test (number positive)	Other immunological evidence	Patch test (number positive)	Other evidence
Epidemiological studies						
a) *Food handlers*						
Catering workers[15]	50	47 (94%)	11+ to foods 4 + to fish	ND	10 + to food products 1 + to herring 9 + to nickel sulphate 2 + to thiurams and carbamates	Clinical examination
Food processing factory workers[14]	541	46 (8.5%)	1 + to commercial fish antigen and herring from workplace	ND	7 of 72 + to nickel sulphate 3 of 72 +to thiurams 1 of 72 tested + to carbamix 5 of 72 +to formaldehyde 4 of 72 + to balsam of Peru 2 of 72 + to p-phenylenediamine 3 of 15 + to rubber gloves	Clinical examination
Food service workers[19]	24	16 (66.7%)	ND	ND	9 + to nickel sulphate 3 + to cobalt chloride 1 + to p-phenylenediamine 1 + to potassium dichromate 1 + to formaldehyde 1 +to IPPD	Clinical examination
Meat and fish processors[24]	436	NA*	ND	ND	22 + to thiuram mix	
Food processing occupations[17]	816	NA*	ND	ND	160 of 815 + to nickel 31 of 815 + to thiuram mix 19 of 816 + to formaldehyde	

NA=not applicable; ND=not done; RAST= Specific IgE; HRT=histamine release test
*All subjects in the study had contact dermatitis

Table 1 continued. Epidemiological studies and case reports of occupational contact dermatitis in food handlers and seafood processing workers reporting patch test results

Occupation	Subjects	Prevalence of contact dermatitis n (%)	Skin prick test (number positive)	Other immunological evidence	Patch test (number positive)	Other evidence
b) Fish processing workers						
Fish fillet and	102	14 (13.7%)	1 + to mustard alone; 6 + to fish	ND	6 + to nickel 1 + to colophony	
fish-stick producers[37]	122	29 (23.8%)	2 + to mustard and fish; 3 + to fish		1 + to fragrance mix 1 + to balsam of Peru	
Case reports and series						
Biology student handling trout[34]	1	NA	+ to cod and sardine	RAST: + to cod, sardine and oily fish HRT: + to cod	Open patch test: negative	Rub test: + to cod
Dolphinarium worker[33]	1	NA	+ for herring, anchovy, sardine, salmon, cod, tunny	RAST (herring): + HRT: + for herring, sardine, anchovy, cod, salmon, tunny	Open and closed patch tests: all negative	Rub test: + to herring, anchovy, sardine
Unknown: handling raw fish[35]	1	NA	+ for commercial fish extracts and raw extracts made in-house(cod, hake, salmon, tuna, trout)	RAST: +e for sole, hake and cod	Closed patch tests all negative	Prick-by-prick: + to raw and cooked sole, hake and cod Rub test: +to raw sole and hake.
Food handlers[15]	14	NA	10 + to seafood 5 + to vegetables and fruit 1 + to meat 1 + to grains	ND	1 + to nickel and fragrance 1 + to thiuram mix and rubber glove	

NA=not applicable; ND=not done; RAST= Specific IgE; HRT=histamine release test

B. OCCUPATIONAL SKIN DISEASE IN SEAFOOD WORKERS

Epidemiology and environmental risk factors

As noted, seafood processing workers feature prominently in the literature of dermatitis in food handlers, as they have a high prevalence of skin conditions.

Studies from South Africa (27) and Australia (28) used questionnaires to ascertain employer-reported health problems amongst workers in seafood processing plants. In Australia, there was a very low response rate of 18%, but the results were similar to those seen in South Africa. Employers in both countries reported high rates of skin problems, with skin rash accounting for 78-81% of all reported health problems associated with seafood processing. Skin symptoms were more common than rhinitis and asthma, and the authors postulated that they could be caused by wet work, as well as exposure to irritants, sensitisers such as garlic and spices, and high molecular weight proteins from fish.

A Norwegian study administered questionnaires to employees in seafood-processing plants (29). More than half of the employees reported symptoms of dry skin, itch, rash, eczema, or chapped skin and fissures in the preceding 12 months. In white fish processing, the most common self-reported causes for symptoms were contact with the fish itself, glove use and contact with fish juice.

In a prior study in Danish fish processing workers (30) 80% of workers reported skin symptoms such as itching, redness and stinging. Symptoms were predominantly located on the forearms rather than the hands. This was thought to be due to the low temperature of the fingers and palms inhibiting itch. On the other hand, Bang et al (31) found that seafood workers who felt cold reported itch and dry skin more frequently than workers who did not feel cold, and concluded that cold work might be an independent risk factor for reported skin symptoms.

A mechanism for dry skin and impaired barrier function of the skin with cold exposure was advanced by Halkier-Sørensen et al (32). Skin barrier function was disrupted in mice by treating the skin with acetone. Trans-epidermal water loss was monitored after exposure to either ice cubes or tap-water. In those mice exposed to ice, the cold exposure initially masked defective barrier function, but barrier recovery was slower, and there was a decreased return of lipids to the stratum corneum after cold exposure. This mechanism would explain chapped skin in fish workers who are exposed to wet work at cold temperatures.

As with food handlers in general, contact with high molecular weight proteins is thought to cause conditions such as contact urticaria and protein contact dermatitis. Several case reports (33-35) describe these conditions in people handling fish for work. Case series of food handlers with protein contact dermatitis note a preponderance of seafood-exposed workers (11,16). Halkier-Sørensen et al (36) performed scratch tests on 75 volunteers using low and high molecular weight compounds found

in fish juice, and found that the high molecular weight compounds were responsible for skin symptoms.

Fish products are not the only high molecular weight compounds to which seafood processing workers are exposed. Kavli & Moseng (37) reported immediate reactions to mustard among fish-stick production workers. Recently, Niewenhuizen et al (38) have characterised sensitisation to a fish parasite, *Anisakis*. Of 578 seafood processing workers, 8% had positive skin prick tests to *Anisakis*, and sensitisation to the parasite was associated with a nearly two-fold increase in skin symptoms. Seafood processing workers may also be sensitised to natural rubber latex found in gloves, as shown in other food handlers (25).

However, it is generally thought that the majority of dermatitis in the seafood processing industry is in fact irritant contact dermatitis due to wet work, occlusive glove use and the irritant properties of fish juice (4). There may be an additive effect on skin barrier function when irritants in fish and meat products are combined with detergent use. In a recent study, healthy volunteers were subjected to irritation tests with biogenic amines and various detergents. Sodium lauryl sulphate increased barrier disruption when applied with the biogenic amines (39).

A Danish study (40) showed that fish products (fish juice, fish meat, fish skin, fish juice and entrails) caused skin irritation leading to itch and erythema, and that this effect was more profound with increasing post-mortem age of the fish. Furthermore, fish scales have been shown to have an irritant effect on the skin (41). This clinical and histological study reported that scales can adhere to skin due to adhesive properties, and generate an irritant contact dermatitis. A case-report in a recreational fisherman ascribed his irritant contact dermatitis to fish skin (42).

No published studies could be found looking specifically at the prevalence of Type IV sensitisation to rubbers, metals or detergents in seafood processing workers. In France, a record review of 35 563 professional fisherman revealed allergic contact dermatitis to mercaptobenzothiazole in only three individuals (43).

Individual host risk factors

Atopy and atopic dermatitis

Atopy has been reported as a risk factor for developing occupational irritant contact dermatitis (44). However, a recent statement (6) challenges this earlier understanding as there are equal numbers of studies showing no increased risk of contact dermatitis in atopics and atopy as an independent risk factor. Atopy was associated with positive skin prick tests to fish and meat in case series investigating protein contact dermatitis (15) – of nine patients with positive prick tests to food, seven had a personal history of atopy. However, this finding was not apparent in Hjorth and Roed-Petersen's study (11) or

in Veien et al's study (13) in which half of the patients with protein contact dermatitis were atopic and half were not.

On the other hand, a history of atopic dermatitis specifically is thought to be a risk factor for occupational contact dermatitis (6). Pre-existing defects of the skin barrier play a part in the development of protein contact dermatitis in particular (45).

Gender

Women have been reported to have a higher prevalence of irritant contact dermatitis (5). However, this is thought to be related to the gendered nature of work in the seafood processing industry. In Aasmoe et al's study (29), women reported symptoms more often than men, but observation of the workplace revealed differences in the types of work performed as well as gloves worn. Therefore, it was concluded that the difference between men and women could be attributed to "different work tasks rather than [to] sex itself".

Age

It is thought that the irritancy of the skin decreases with age (5,44), and that irritant contact dermatitis, therefore occurs more commonly in younger people at the start of their careers. However, some studies have shown that this association disappears when the nature of the work performed by different age groups is taken into account (44). Current evidence is that occupational contact dermatitis can occur at any time during a person's career (6).

CONCLUSION

The seafood processing industry is an important economic sector in South Africa providing an important food source for the Southern African region. Several environmental factors predispose workers to the development of occupational skin disease. These include wet work, exposure to irritant substances, and exposure to high molecular weight proteins in the seafood such as muscle proteins. The prevalence of skin symptoms is high and is estimated to be almost 80%.

Studies in other groups of food handlers have reported increased rates of sensitisation to nickel, cobalt, thiurams and formaldehyde, but there have not been any studies that have reported on patterns of sensitisation to commonly used chemical products containing allergens such as metals and detergents in seafood processing workers in particular, and only one has reported on sensitisation to a specific rubber additive, mercaptobenzothiazole in fish handlers.

Future studies need to focus on the prevalence of patterns of Type IV sensitisation to workplace allergens in seafood processing workers as well as the prevalence and the risk factors for contact dermatitis and other occupational dermatoses in this group.

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SECTION C: JOURNAL MANUSCRIPT

PREDICTORS OF OCCUPATIONAL SKIN DISEASE AMONG SEAFOOD PROCESSING WORKERS IN THE WESTERN CAPE: A CROSS-SECTIONAL STUDY WITH PREVALENCE CASE-CONTROL ANALYSIS

ABSTRACT

Background: Occupational skin disease is common in seafood processing workers, but the patterns of type IV allergic contact dermatitis have not been well characterised in epidemiological studies.

Objectives: The aim was to identify risk factors for skin symptoms and various clinical presentations in seafood processing workers.

Methods: Demographic characteristics, occupational exposures and skin symptoms were collected through interviewer-administered questionnaires in a cross sectional study of 594 workers of two seafood processing plants. A subgroup of symptomatic (n=120) and randomly selected asymptomatic workers (n=134) were examined and patch tested with standard allergens (adapted British Contact Dermatitis Group Standard Series) and seafood products and additives used in the factories.

Results: Skin symptoms were strongly associated with Type I sensitisation to fish (POR = 3.50, CI: 1.23-9.92) and a family history of eczema (POR = 2.40, CI: 1.08-5.32). Wet work skin sequelae were strongly associated with "wet fish" work (POR = 2.09, CI: 1.03-4.25). A strong association was found between monthly glove changes and probable allergic contact dermatitis to rubber (POR = 4.79, CI: 1.32-17.31) and disinfectants (POR = 3.93, CI: 1.05-14.71) compared to no glove use.

Conclusion: Contact dermatitis and wet work sequelae are associated with irritant exposures, wet work and allergens such as carbamix rubber glove additives and chlorhexidine disinfectants in seafood processing workplaces.

Key words: seafood processing; occupational contact dermatitis; wet work; metals; rubber additives; detergents

INTRODUCTION

Occupational skin disease is highly prevalent in food handlers and seafood processing workers. More than 50% of seafood processing workers report recurrent symptoms in the preceding year (1). Previous studies have reported that a large proportion (75%) of contact dermatitis in these workers is irritant in nature and is due to wet work, exposure to detergents with frequent hand washing, and seafood products such as fish juice and fish skin (2-4). Type IV allergic contact dermatitis has been reported to chemical agents such as rubber additives (5) and biological agents such as garlic and onions (6). Protein contact dermatitis caused by high molecular weight proteins such as fish muscle accounts for between 3% and 11% of all cases of dermatitis (7).

The proportion of occupational contact dermatitis caused by Type IV allergic sensitisation to other allergens in the seafood processing environment has not been characterised in detail, but surveillance studies and case reports have shown higher than average rates of sensitisation to common allergens such as nickel, rubber additives and disinfectants in food handlers in general (8-10).

In South Africa, the seafood industry directly employs approximately 16 850 people, the majority of whom are previously disadvantaged women who perform seasonal work (11). Type I sensitisation to seafood causing upper respiratory tract symptoms and asthma has previously been investigated and reported in these workers (12). The aims of this study were (a) to describe the demographic profile of workers reporting skin symptoms compared to an asymptomatic group; (b) to determine the prevalence of various skin conditions such as irritant and allergic contact dermatitis, sequelae of wet work, traumatic lesions and infections; (c) to determine the prevalence of positive responses to a standard battery of patch test reagents and in-house seafood extracts in a group of symptomatic and asymptomatic workers; and (d) to identify host and environmental risk factors for symptoms, clinical eczema, positive patch tests, possible allergic contact dermatitis and probable allergic contact dermatitis.

MATERIALS AND METHODS

Patients

A cross-sectional study was conducted on seafood-processing workers employed in two factories in the Western Cape province of South Africa. The full methodology for the study has been described elsewhere (12). Of 594 workers who received questionnaires and underwent skin prick testing, measurement of specific IgE to latex and evaluation of seafood intake by serum Eicosopentaenoic acid levels, 120 reported recurrent skin symptoms in the past 12 months (two episodes or more). They were selected to undergo skin examination and patch testing by a dermatologist along with 134 workers who had not declared symptoms. The asymptomatic workers were selected by stratified random selection, and were frequency matched with symptomatic workers by department in the

factory. Ethics approval was obtained from the University of Cape Town Human Research Ethics Committee for both the original study (109/99) and this later analysis (121/2012).

Skin examination

Skin examination was performed by two experienced dermatologists, and concentrated particularly on the hands and forearms. The dermatologists were blinded to the exposure status of the workers. They noted hand dermatitis, sequelae of wet work such as paronychia and web space dermatitis, skin infections and traumatic lesions. Hand dermatitis was categorised as allergic contact dermatitis, irritant contact dermatitis, co-existing allergic and irritant contact dermatitis, or unclassified.

Patch testing

The workers were patch tested with 40 commercial allergens commonly known to cause dermatitis (adapted from the British Contact Dermatitis Group standard series) (13), as well as extracts of allergens commonly encountered in the factories. These included fresh seafood (fishmeal, raw pilchard, cooked pilchard, canned pilchard, salted pilchard, pilchard gut, raw redeye, raw maasbanker, raw mackerel, raw west coast rock lobster) as well as tomato paste, spice oil, starch and guargum. These were prepared daily in-house from fresh or frozen products. Allergens were applied to the individual's back in Finn chambers on Scanpor tape and left in place for 2 days. Results were read by an experienced dermatologist after 3 days, and classified as either: a negative reaction; an irritant reaction; or a positive reaction of varying severity - weak positive (non-vesicular erythema, infiltration), strong positive (erythema, infiltration, papules and vesicles), and extreme positive (erythema, infiltration, bullous reaction) based on the dermatologist's clinical opinion. For the purposes of the analysis, irritant reactions were excluded and positive reactions were grouped together.

Statistical analysis

Key outcomes of interest were recurrent skin symptoms in the preceding 12 months, eczema on clinical examination, wet work sequelae on clinical examination, positive patch tests particularly to seafood products, metals, rubber additives and disinfectants and preservatives, and variables defined as possible allergic contact dermatitis (symptoms declared and a positive patch test) and probable allergic contact dermatitis (eczema on examination and a positive patch test).

Data analysis was performed using Stata 10.0 (StataCorp. 2007). Univariate analysis was used to describe the distribution of the outcome variables as well as the host and environmental factors considered to be possible predictors. Host factors of interest were age, gender, atopy, fish intake (serum EPA), history of atopic dermatitis and family history of eczema. For categorical data, chi-square testing and Fisher's exact test were used to investigate associations. For continuous data, the t-

test and Spearman's correlation were used for normally distributed and non-parametric data respectively. Logistic regression models were initially run for each predictor individually, and then multiple regression models adjusting for age, gender, atopy, factory and seafood intake were run for the remaining host and environmental factors in a saturated model to allow for comparability of the odds ratios from different models.

RESULTS

The demographic, employment and medical characteristics of the symptomatic and asymptomatic workers are shown in Table 1.

Table 1. Demographic, employment and medical characteristics of seafood processing workers along the west coast of South Africa reporting recurrent skin symptoms in the past year compared to asymptomatic workers

Variables	Symptomatic (N=120) n (%)	Asymptomatic (N=134) n (%)
Demographic characteristics		
Age*	36 ± 11	35 ± 10
Female	73 (61)	79 (59)
Employment and exposure history		
Factory A	47 (44)	59 (56)
Factory B	73 (49)	75 (51)
Employment duration in current factory (yrs)*	10 ± 9	11 ± 9
Employment duration in current job (yrs)*	7 ± 7	8 ± 7
Employment status: Seasonal vs. permanent	74 (62)	76 (57)
Shift work: Day vs. night	64 (52)	72 (54)
Type of work		
Wet fish exposure (Jetty and canning process)	71 (59)	78 (58)
Dry fish exposure (Fishmeal manufacture and bagging)	15 (13)	22 (16)
Low exposure (Administrative and other jobs)	34 (28)	34 (25)
Regular glove usage	44 (37)	48 (36)
Wet hands despite glove usage	47 (39)	51 (38)
Hand washing > 6 times per shift	93 (78)	109 (81)
Allergy history		
Atopy (SPT)	46 (39)	54 (40)
Type I sensitisation to fish (SPT)	14 (12)	6 (4)‡‡
History of childhood eczema	12 (10)	7 (5)
Family history of eczema	23 (19)	12 (9)‡‡
Seafood intake		
Fish intake (Eicosapentaenoic acid levels – EPA (Weight % µg/ml; 20:5n-3)	2.05 ± 1.49	2.28 ± 1.43†

*mean (yrs) ± std deviation
‡‡Chi-square $p < 0.05$;† Wilcoxon's rank-sum $p<0.10$

The mean age was 35-36 years, and the majority of the workers (approximately 60%) were female in both groups. There were no significant differences between the two groups for the type of factory,

employment duration, the shift worked, employment status (permanent vs. seasonal), the type of work performed, glove usage, or hand washing frequency, suggesting that sampling of the asymptomatic group was adequate as a comparable group. Less than half of the workers reported wearing gloves at all, and only 36-37% reported regular glove use (defined as wearing gloves for more than half the time). Of those wearing gloves regularly, the majority (88%) reported wearing latex gloves (data not shown). Nearly two-fifths of workers reported that their hands were wet at the end of a shift despite glove use suggesting that their gloves were inadequate. Eighteen workers (7%) had raised IgE levels to latex and they were evenly distributed between the symptomatic and asymptomatic groups (data not shown).

There were two characteristics that were more prevalent in the symptomatic group - a Type I sensitisation to fish, diagnosed on skin prick testing (p=0.03) and a family history of eczema (p=0.02). Seafood intake, measured by serum levels of Eicosapentaenoic acid levels, was lower in the symptomatic group (p=0.08).

Of the 120 workers who reported recurrent skin symptoms in the preceding 12 months, 107 were examined clinically and underwent patch testing, along with 134 workers who did not report symptoms. Thirteen workers were not seen for logistical reasons. The prevalence of skin conditions on clinical examination is shown in Table 2. The most common skin condition observed was traumatic lesions, seen in 69% of symptomatic workers and 74% of asymptomatic workers. Hand eczema was diagnosed in 60% of symptomatic workers and 56% of asymptomatic workers. The eczema was predominantly an irritant contact dermatitis (43% and 53% of symptomatic and asymptomatic workers respectively). All of the workers found to have solely an allergic contact dermatitis clinically (n=6) had reported symptoms in the past year. In 12 individuals, allergic and irritant contact dermatitis were observed to co-exist, and the majority of these had reported symptoms in the past year (p=0.03). Sequelae of wet work such as web space dermatitis and paronychia, were found in 31-39% of workers. Skin infections were seen in 8-9% of workers, urticaria in 1% of workers, and other conditions such as Raynaud's phenomenon (1%) and psoriasis (2%) were uncommon.

Table 2: Prevalence of skin conditions on clinical examination of seafood processing workers along the west coast of South Africa reporting recurrent skin symptoms in the past year compared to asymptomatic workers

Clinical findings	Symptomatic (N=107) n (%)	Asymptomatic (N=134) n (%)
Hand Eczema	64 (60)	75 (56)
Allergic contact dermatitis	6 (6)	0 (0)†
Irritant contact dermatitis	46 (43)	71 (53)
Coexisting allergic and irritant contact dermatitis	9 (8)	3 (2)‡‡
Uncertain cause	3(2)	1(1)
Wet work sequelae	33 (31)	52 (39)
Webspace dermatitis	0 (0)	3 (2)
Paronychia	9 (8)	15 (11)
Early paronychia	25 (23)	39 (28)
Traumatic skin lesions	74 (69)	99 (74)
Minor trauma (cuts, abrasions)	52 (49)	78 (57)
Calluses	32 (30)	36 (27)
Knuckle pads	10 (9)	19 (14)
Cuticular fracturing	17 (16)	35 (26)‡
Skin infections	9 (8)	12 (9)
Warts	7 (7)	6 (4)
Skin sepsis	1 (1)	5 (4)
Nail infection (Tinea unguium)	1 (1)	1 (1)
Urticaria	1 (1)	0 (0)
Other conditions		
Psoriasis	2 (2)	0 (0)
Raynaud's phenomenon	1 (1)	0 (0)

‡ Chi-square p< 0.10; ‡‡ Chi-square p < 0.05 ; † Fisher's exact p <0.05

The patch test results are presented in Table 3. The allergens most frequently encountered in both symptomatic and asymptomatic workers were nickel sulphate, cobalt chloride and fragrance mix. A positive reaction to nickel sulphate was significantly associated with being female (p<0.001), as was a reaction to cobalt chloride (p=0.01). Nickel sulphate and cobalt chloride reactions were highly correlated (p=0.001) (data not shown). Symptomatic workers had significantly more frequent positive reactions to carbamix (found in rubber products, p=0.056); 4-phenylenediamine base (found in rubber and leather products, p=0.01) and chlorhexidine digluconate (found in disinfectants, p=0.02). Seven of the 10 workers with positive reactions to chlorhexidine digluconate worked in the "wet fish" exposure (canning and jetty) departments and 90% reported washing their hands more than 6 times per shift (data not shown).

Potassium dichromate and formaldehyde reactions were also more common in the symptomatic group, but of borderline significance (p<0.10). Positive reactions to fresh seafood products were more prevalent in the symptomatic group, but this did not reach statistical significance. Pilchard was responsible for 41% of the positive reactions to fish on patch testing. Reactions to fishmeal were more

common in the symptomatic group (p=0.08). There were very few reactions to other agents used in fish processing and canning such as tomato paste, spice oil and starch.

Table3: Outcome of patch tests for various allergen groupings among seafood processing workers along the west coast of South Africa reporting recurrent skin symptoms in the past year compared to asymptomatic workers

	Symptomatic (N=104) n (%)	Asymptomatic (N=134) n (%)
Metals	36 (35)	40 (30)
Potassium dichromate	9 (9)	3 (2)‡
Cobalt chloride	8 (8)	9 (7)
Nickel sulphate	24 (23)	35 (26)
Rubber additives	16 (15)	8 (6)‡‡
Carbamix	9 (9)	4 (3)†
Thiuram mix	0 (0)	3 (2)
Mercaptomix	1 (1)	0 (0)
IPPD	0 (0)	0(0)
Mercaptobenzothiazole	0 (0)	0 (0)
4-phenylenediamine base	7 (7)	1 (1)††
Disinfectants and preservatives	19 (18)	14 (11)‡
Chlorhexidine digluconate	8 (8)	2 (1)††
Methyl- and Methylchloroisothiazolinone (Kathon CG)	0 (0)	0 (0)
Formaldehyde	5 (5)	1 (1)†
Quaternium 15	1 (1)	0 (0)
Parabens	0 (0)	2 (1)
Clioquinol	3 (3)	7 (5)
Imidazolidinyl urea	0 (0)	0 (0)
Methyldibromo glutaronitrile and phenoxyethanol (Euxyl K400)	3 (3)	4 (3)
Thiomerosal	1 (1)	0 (0)
4 Chloro-3,5-xylenol (Dettol)	1 (1)	0 (0)
Other chemicals		
Fragrance Mix	8 (8)	9 (7)
Colophony	4 (4)	1 (1)
Balsam of Peru	4 (4)	3 (2)
Benzocaine	2 (2)	0 (0)
Budesonide	0 (0)	1 (1)
Wool alcohol	2 (2)	1 (1)
Lanolin	0 (0)	0 (0)
Epoxy resin	2 (2)	1 (1)
4-ter-Butylphenol formaldehyde resin	1 (1)	0 (0)
Turpentine peroxides	1(1)	1 (1)
Woodmix	1 (1)	0 (0)

‡ Chi-square 0.10>p>0.05; ‡‡Chi-square p<0.05; † Fisher's exact 0.10>p>0.05; ††Fisher's exact p<0.05

Table 3 (continued): Outcome of patch tests for various allergen groupings among seafood processing workers along the west coast of South Africa reporting recurrent skin symptoms in the past year compared to asymptomatic workers

	Symptomatic (N=104) n (%)	Asymptomatic (N=134) n (%)
Seafood products		
Pilchard gut	1 (1)	0 (0)
Raw pilchard	4 (4)	1 (1)
Canned pilchard	3 (3)	1 (1)
Salted pilchard	0 (0)	0 (0)
Cooked pilchard	0 (0)	1 (1)
Anchovy (raw)	2 (2)	1 (1
Redeye (raw)	1 (1)	1 (1)
Maasbanker (raw)	3 (3)	1 (1)
Mackerel (raw)	2 (2)	2 (1)
Fishmeal	3 (3)	0 (0)†
Any positive patch test to fish	6 (6)	4 (3)
West Coast Rock Lobster (raw)	1 (1)	0 (0)
Other vegetable agents		
Tomato paste	2 (2)	0 (0)
Spice oil	0 (0)	0 (0)
Starch	1 (1)	0 (0)

‡ Chi-square 0.10>p>0.05; ‡‡Chi-square p<0.05; † Fisher's exact 0.10>p>0.05; ††Fisher's exact p<0.05

A summary of the main outcome measures observed in the two groups is shown in Table 4. As noted, more than half of the population had eczema on examination and 35% had sequelae of wet work, with no difference between symptomatic and asymptomatic workers. On clinical examination, only allergic contact dermatitis was more frequent in the symptomatic group (p=0.001), and patch test results showed increased prevalence of positive patch tests to rubber additives among symptomatic workers (p=0.02). Probable contact dermatitis to metals was also significantly more common in the symptomatic group (p=0.02).

Significant host, employment and exposure factors associated with clinical presentation outcomes are shown in Table 5. Many associations were weakened after adjusting for age, gender, factory, atopy and fish intake (Table 6). Those workers reporting symptoms were nearly three times more likely to have a positive skin prick test to fish in the unadjusted model, and this increased after adjustment (POR 3.5, CI 1.23-9.92, p=0.02). Symptomatic workers also had more than a two-fold increased odds of a family history of eczema (POR 2.40, CI 1.08-5.32, p=0.03).

Eczema on clinical examination was strongly related to the factory at which people worked, with it found more commonly in Factory A, the small factory (POR 3.23, CI 1.85-5.64, p<0.001), and also associated with age, employment duration, atopy and fish intake. However, after adjusting for covariates, there were no statistically significant predictors for the eczema on clinical examination.

Table 4. Prevalence of various clinical presentation outcomes among seafood processing workers along the west coast of South Africa reporting recurrent skin symptoms in the past year compared to asymptomatic workers

Outcome variable	Symptomatic (N=107) n (%)	Asymptomatic (N=134) n (%)
Clinical examination		
Clinical eczema	64 (60)	75 (57)
Clinical allergic contact dermatitis*	15 (14)	3 (2)‡‡
Clinical irritant dermatitis*	46 (43)	71 (53)
Wet work sequelae	33 (31)	52 (39)
Positive patch tests		
Metals	36 (35)	40 (30)
Rubber additives	16 (15)	8 (6)‡‡
Disinfectants and preservatives	19 (18)	14 (11)‡
Seafood	6 (6)	4 (3)
Possible allergic contact dermatitis (symptoms + positive patch test)**		
Metals	36 (35)	N/A
Rubber additives	16 (15)	N/A
Disinfectants and preservatives	19 (18)	N/A
Seafood products	6 (6)	N/A
Probable allergic contact dermatitis (clinical eczema + positive patch test)		
Metals	23 (22)	21 (16)‡‡
Rubber additives	11 (10)	5 (4)
Disinfectants and preservatives	11 (10)	9 (7)
Seafood	3 (3)	3 (2)

*includes cases with coexisting allergic and irritant contact dermatitis

** by definition all cases of possible allergic contact dermatitis were symptomatic

‡ Chi-square $0.10>p>0.05$; ‡‡Chi-square $p<0.05$

N/A: not applicable

Table 5. Logistic regression models for significant host, employment and exposure factors (unadjusted odds ratios) associated with recurrent skin symptoms in the past year and various clinical presentation outcomes in seafood processing workers along the west coast of South Africa

Predictor variables	Symptoms (POR, CI)	Clinical examination (Prevalence odds ratio - POR, confidence interval - CI)			
		Clinical eczema	Clinical allergic contact dermatitis	Clinical irritant contact dermatitis	Wet work sequelae
Demographic characteristics					
Age	0.99 (0.97-1.01)	1.06 (1.03-1.09)††	1.02 (0.97-1.06)	1.06 (1.03-1.09)††	1.01 (0.99-1.04)
Female	1.12 (0.67-1.89)	0.79 (0.47-1.34)	-	0.59 (0.35-0.99)††	1.70 (0.98-2.97)†
Employment and exposure history					
Factory A vs. Factory B	0.79 (0.47-1.33)	3.23 (1.85-5.64)††	3.07 (1.11-8.48)††	3.79 (2.18-6.58)††	1.65 (0.97-2.82)†
Employment duration in current job	0.98 (0.94-1.02)	1.06 (1.01-1.11)††	0.93 (0.83-1.03)	1.07 (1.02-1.11)††	1.01 (0.97-1.05)
Seasonal vs. permanent work	1.05 (0.63-1.76)	0.99 (0.59-1.66)	2.04 (0.70-5.91)	0.82 (0.49-1.37)	1.61 (0.94-2.78)†
Type of work					
"Wet fish" exposure (vs. low exposure)	0.83 (0.46-1.50)	1.07 (0.59-1.92)	1.60 (0.50-5.11)	0.87 (0.49-1.57)	2.43 (1.25-4.74)††
"Dry fish" exposure (vs. low exposure)	0.68 (0.30-1.50)	2.17 (0.90-5.20)†	0.44 (0.05-4.12)	2.01 (0.85-4.74)	1.70 (0.69-4.19)
Glove usage*					
Glove usage at all	1.16 (0.70-1.92)	1.60 (0.96-2.68)†	2.87 (0.99-8.32)††	1.43 (0.86-2.37)	0.87 (0.51-1.47)
Regular glove usage	1.02 (0.60-1.74)	1.20 (0.70-2.05)	5.24 (1.80-15.24)††	1.03 (0.61-1.75)	1.40 (0.81-2.41)
Gloves inadequate (hands wet)	1.35 (0.58-3.14)	2.04 (0.82-5.04)	5.57 (1.48-20.93)††	1.41 (0.60-3.32)	1.71 (0.73-4.01)
Gloves intact (dry hands)	1.11 (0.64-1.91)	1.50 (0.87-2.60)	2.20 (0.70-6.97)	1.43 (0.83-2.46)	0.70 (0.39-1.25)
Change gloves annually	1.06 (0.44-2.52)	2.87 (1.07-7.68)††	-	3.27 (1.22-8.75)††	0.43 (0.15-1.22)
Change gloves monthly	1.27 (0.59-2.74)	2.08 (0.92-4.75) †	6.30 (1.85-21.42)††	2.38 (1.04-5.41)††	2.05 (0.94-4.47)†
Change gloves at least weekly	1.14 (0.62-2.12)	1.14 (0.62-2.11)	2.55 (0.75-8.77)	0.82 (0.44-1.52)	0.66 (0.34-1.29)
Washing gloves at the end of a shift	1.32 (0.78-2.21)	1.21 (0.72-2.04)	3.25 (1.17-8.97)††	1.01 (0.60-1.68)	1.14 (0.67-1.96)
Washing gloves with disinfectant	1.30 (0.77-2.19)	1.24 (0.73-2.10)	3.51 (1.27-9.70)††	1.02 (0.60-1.71)	1.27 (0.74-2.19)
Handwashing > 6 x per day	0.75 (0.40-1.40)	0.59 (0.31-1.13)	1.34 (0.37-4.81)	0.52 (0.27-0.99)††	1.35 (0.69-2.64)
Allergy history					
Atopy (SPT)	0.97 (0.58-1.64)	1.59 (0.93-2.70)†	0.95 (0.36-2.55)	1.27 (0.75-2.13)	0.63 (0.36-1.09)†
Type I sensitisation to fish (SPT)	2.98 (1.09-8.13)††	1.63 (0.60-4.46)	1.51 (0.32-7.11)	0.95 (0.37-2.43)	0.32 (0.90-1.12)†
History of childhood eczema	0.44 (0.17-1.15)	0.79 (0.30-2.09)	1.49 (0.19-11.87)	0.83 (0.32-2.13)	5.08 (1.14-22.52)††
Family history of eczema	2.51 (1.17-5.38)††	1.32 (0.62-2.82)	2.66 (0.88-8.05)†	0.92 (0.44-1.92)	0.77 (0.35-1.69)
Seafood intake					
Fish intake (Eicosapentaenoic acid levels – EPA (Weight % µg/ml; 20:5n-3))	0.87 (0.72-1.04)	1.28 (1.05-1.57)††	1.01 (0.73-1.40)	1.16 (0.97-1.40)	1.09 (0.91-1.30)

POR: prevalence odds ratio; CI: Confidence interval; Blank cells represent undefined odds ratios. *all compared to no glove use.
"Wet fish" exposure: jetty and canning departments; "Dry fish" exposure: fishmeal manufacturing and bagging departments; Low fish exposure: administration, boiler room, labeling, workshop, cannery pickups, cannery stores and laundry departments
† 0.10> p > 0.05; ††p < 0.05

Table 6. Multiple logistic regression models for significant host, employment and exposure factors (adjusted odds ratios) associated with recurrent skin symptoms in the past year and clinical examination findings in seafood processing workers along the west coast of South Africa

		Clinical examination (Prevalence odds ratio - POR, confidence interval - CI)			
Predictor variables	Symptoms (POR, CI)	Clinical eczema	Clinical allergic contact dermatitis	Clinical irritant contact dermatitis	Wet work sequelae
Employment and exposure history					
Employment duration in years	0.99 (0.95-1.04)	1.02 (0.96-1.07)	0.82 (0.67-0.99)††	1.03 (0.97-1.08)	1.01 (0.97-1.06)
Seasonal vs. permanent work	0.95 (0.46-1.93)	2.02 (0.93-4.42)†	0.59 (0.16-2.18)	1.88 (0.86-4.10)	1.41 (0.66-3.01)
Type of work					
"Wet fish" exposure (vs. low exposure)	0.81 (0.43-1.51)	1.03 (0.52-2.02)	1.34 (0.36-5.00)	0.93 (0.47-1.83)	2.09 (1.03-4.25)††
"Dry fish" exposure (vs. low exposure)	0.64 (0.26-1.59)	2.07 (0.74-5.80)	-	1.52 (0.56-4.17)	1.88 (0.67-5.25)
Glove usage*					
Glove usage at all	1.14 (0.67-1.92)	1.70 (0.95-3.03)†	2.52 (0.77-8.23)	1.60 (0.90-2.84)	0.73 (0.42-1.28)
Regular glove usage	1.03 (0.58-1.85)	1.42 (0.75-2.67)	3.60 (1.07-12.05)††	1.31 (0.70-2.45)	1.07 (0.58-1.98)
Inadequate gloves (wet hands)	1.47 (0.61-3.52)	2.08 (0.76-5.68)	5.88 (1.12-30.93)††	1.45 (0.56-3.75)	1.41 (0.57-3.47)
Intact gloves (dry hands)	1.06 (0.60-1.86)	1.60 (0.86-2.98)	1.96 (0.55-6.97)	1.64 (0.89-3.05)	0.59 (0.32-1.10)†
Change gloves annually	1.19 (0.46-3.09)	1.77 (0.58-5.42)	-	1.75 (0.58-5.27)	0.46 (0.15-1.43)
Change gloves monthly	1.50 (0.64-3.51)	1.42 (0.54-3.73)	1.99 (0.48-8.28)	1.67 (0.65-4.29)	1.34 (0.56-3.19)
Change gloves at least weekly	0.95 (0.48-1.90)	1.81 (0.86-3.78)	3.66 (0.75-17.85)	1.51 (0.72-3.14)	0.62 (0.29-1.32)
Wash gloves at the end of a shift	1.31 (0.74-2.33)	1.34 (0.72-2.53)	1.88 (0.61-5.78)	1.27 (0.68-2.37)	0.86 (0.47-1.58)
Wash gloves with disinfectant	1.28 (0.72-2.30)	1.54 (0.81-2.93)	2.01 (0.65-6.19)	1.45 (0.77-2.74)	1.02 (0.55-1.88)
Handwashing > 6 x per day	0.71 (0.34-1.49)	0.78 (0.34-1.79)	0.37 (0.07-1.99)	0.83 (0.37-1.89)	1.45 (0.64-3.29)
Allergy history					
Type I sensitisation to fish (SPT)	3.50 (1.23-9.92)††	1.09 (0.37-3.24)	2.69 (0.46-15.83)	0.64 (0.22-1.84)	0.34 (0.09-1.23)†
History of childhood eczema	0.41 (0.15-1.12)†	1.05 (0.36-3.08)	0.70 (0.07-6.86)	1.16 (0.40-3.40)	4.61 (1.00-21.14)††
Family history of eczema	2.40 (1.08-5.32)††	1.13 (0.49-2.63)	3.08 (0.82-11.60)†	0.90 (0.39-2.06)	0.93 (0.40-2.17)

Adjusted for age, gender, atopy, fish intake and factory. POR: prevalence odds ratio; CI: Confidence interval; Each odds ratio represents a different model. Blank cells represent undefined odds ratios. *all compared to no glove use.

"Wet fish" exposure: jetty and canning departments; "Dry fish" exposure: fishmeal manufacturing and bagging departments; Low fish exposure: administration, boiler room, labeling, workshop, cannery pickups, cannery stores and laundry departments

† $0.10 > p > 0.05$; †† $p < 0.05$

Allergic contact dermatitis on clinical examination was diagnosed only in females. Even after adjusting for covariates it was significantly associated with regular glove usage (POR 3.60; CI 1.07-12.05, p=0.04) and having wet hands despite the use of gloves (POR 5.88, CI 1.12-30.93, p=0.04). A family history of eczema was three times more likely than in workers without allergic contact dermatitis, but this was of borderline statistical significance (POR 3.08, CI 0.82-11.60, p=0.096). There were no statistically significant predictors of irritant contact dermatitis after adjusting for gender, age, factory, atopy and fish intake.

Workers in departments with "wet fish" exposure (fish canning and jetty) were twice as likely to have web space dermatitis or paronychia on examination (POR 2.09, CI 1.03-4.25, p=0.04) compared to those with minimal contact with fish such as workers in the packing department, boiler room, administration, workshop, stores and laundry. Workers with wet work sequelae also had more than four times the odds of a history of childhood eczema (POR 4.61, CI 1.00-21.14, p=0.05). Having gloves that were intact at the end of a shift, thus resulting in dry hands, was protective against developing wet work sequelae (POR 0.59, CI 0.32-1.10, p=0.095), and this was of borderline significance.

Predictive factors for positive patch tests are shown in Table 7. In the unadjusted models, workers at Factory A (the small factory) appeared to have lower odds of a positive patch test to fish (POR 0.15, CI 0. 0.18-1.18, p=0.07) (data not shown). After adjusting for covariates there were no statistically significant predictors of a positive patch test to fish.

Female workers were five times more likely to have a positive patch test to metals compared to males (POR 4.96, CI 2.54-9.72, p<0.001), and in unadjusted models, workers with positive patch tests to metals were more than twice as likely to be seasonal workers (POR 2.62, CI 1.45-4.72, p=0.001) and to wash their gloves with disinfectant at the end of a shift (POR 2.06, CI 1.17-3.59, p=0.01). Workers with positive patch tests to metals were also three times more likely to wash their hands in excess of six times per shift (POR 3.45, CI 1.47-8.10, p=0.004) (data not shown). In the final multivariate adjusted models there were no statistically significant predictors of a positive patch test to metals.

In unadjusted models, none of the employment or host factors were significant predictors of a positive patch test to rubber additives. However, after adjusting for covariates, seasonal workers were four times more likely to have a positive patch test to rubber additives compared to permanent workers (POR 4.47, CI 1.24-16.17, p=0.02) and wash their hands more than 6 times in a day (POR 4.29, CI 0.87-21.20, p=0.07). Furthermore, changing gloves at least weekly resulted in a 74% decrease in the likelihood of a positive rubber patch test (POR 0.26, CI 0.05-1.29, p= 0.099), whereas monthly glove changes nearly tripled the odds of a positive test (POR 2.80, 0.90-8.70, p=0.07). There were no statistically significant predictors of a positive patch test to disinfectants and preservatives after adjusting for covariates.

Table 7. Multiple logistic regression models for significant host, employment and exposure factors (adjusted odds ratios) associated with positive patch tests in seafood processing workers along the west coast of South Africa

Predictor variables	Positive patch tests (Prevalence odds ratio - POR, confidence interval - CI)			
	Fish	Metals	Rubber additives	Disinfectants and preservatives
Employment and exposure history				
Employment duration in current job	0.98 (0.87-1.10)	1.03 (0.98-1.09)	0.99 (0.92-1.06)	0.97 (0.91-1.03)
Seasonal vs. permanent work	1.26 (0.23-7.00)	0.91 (0.40-2.06)	4.47 (1.24-16.17)††	0.71 (0.26-1.99)
Type of work				
"Wet fish" exposure (vs. low exposure)	1.09 (0.22-5.43)	1.01 (0.50-2.05)	0.57 (0.21-1.58)	0.67 (0.28-1.61)
"Dry fish" exposure (vs. low exposure)	1.47 (0.20-10.78)	0.93 (0.27-3.18)	1.30 (0.34-5.04)	0.62 (0.19-2.01)
Glove usage*				
Glove usage at all	1.90 (0.48-7.45)	1.14 (0.63-2.06)	0.86 (0.36-2.05)	1.31 (0.60-2.82)
Regular glove usage	0.84 (0.19-3.78)	1.00 (0.53-1.89)	1.15 (0.44-2.99)	1.60 (0.67-3.78)
Inadequate gloves(wet hands)	1.21 (0.12-12.05)	1.03 (0.38-2.80)	1.58 (0.45-5.48)	2.25 (0.74-6.87)
Intact gloves (dry hands)	2.18 (0.51-9.32)	1.16 (0.62-2.19)	0.68 (0.25-1.82)	1.07 (0.46-2.50)
Change gloves annually	1.43 (0.11-18.88)	1.24 (0.34-4.57)	0.67 (0.12-3.71)	1.34 (0.42-4.30)
Change gloves monthly	5.69 (0.78-41.29)†	1.18 (0.45-3.07)	2.80 (0.90-8.70)†	1.79 (0.58-5.56)
Change gloves at least weekly	1.36 (0.25-7.32)	1.09 (0.52-2.27)	0.26 (0.05-1.29)†	0.98 (0.32-3.02)
Wash gloves at the end of a shift	4.05 (0.90-18.27)†	1.21 (0.64-2.25)	1.41 (0.55-3.60)	1.04 (0.45-2.43)
Wash gloves with disinfectant	4.19 (0.92-19.05)†	1.31 (0.70-2.46)	1.60 (0.61-4.16	1.04 (0.43-2.50)
Handwashing > 6 x per day	0.66 (0.10-4.19)	1.93 (0.72-5.21)	4.29 (0.87-21.2)†	0.94 (0.35-2.50)
Allergy history				
Type I sensitisation to fish (SPT)	-	1.10 (0.35-3.45)	0.90 (0.19-4.36)	0.94 (0.19-4.67)
History of childhood eczema	-	1.08 (0.34-3.43)	1.15 (0.24-5.63)	1.50 (0.30-7.49)
Family history of eczema	0.66 (0.08-5.74)	1.43 (0.60-3.44)	1.73 (0.57-5.24)	0.99 (0.31-3.20)

Adjusted for age, gender, atopy, fish intake and factory. POR: prevalence odds ratio; CI: Confidence interval; Each odds ratio represents a different model. Blank cells represent undefined odds ratios. *all compared to no glove use.

"Wet fish" exposure: jetty and canning departments; "Dry fish" exposure: fishmeal manufacturing and bagging departments; Low fish exposure: administration, boiler room, labeling, workshop, cannery pickups, cannery stores and laundry departments

† $0.10 > p > 0.05$; †† $p < 0.05$

Predictors for possible and probable contact dermatitis are shown in Tables 8 and 9. For the outcome variables possible and probable allergic contact dermatitis to fish, there were no statistically significant predictor variables in either unadjusted or adjusted models. For possible and probable contact dermatitis to metals, being female significantly increased the odds of the outcome (POR 2.63, CI 1.14-6.06, p=0.02 and POR 3.63, CI 1.61-8.22, p=0.002, respectively). Hand washing more than 6 times in a day was associated with both possible and probable allergic contact dermatitis to metals in unadjusted models, but remained marginally significant only in possible contact dermatitis in the adjusted models (POR 3.94, CI 0.82-18.86, p=0.09).

For probable contact dermatitis to metals, using gloves doubled the odds of disease in the adjusted model (POR 2.04, CI 1.00-4.17, p=0.049) as did washing gloves with disinfectant at the end of a shift (POR 2.06 CI 0.99-4.30, p=0.053).

In models for possible and probable contact dermatitis to rubber additives the only significant predictor in both unadjusted and adjusted models was changing gloves monthly in comparison to not wearing gloves at all. Workers with possible contact dermatitis to rubber additives had a five-fold increased likelihood of monthly glove changes (POR 5.20, CI 1.35-20.04, p=0.02) and those with probable contact dermatitis had a similarly raised odds of monthly glove change of 4.79 (CI 1.32-17.31, p=0.02).

There were no significant predictors of possible allergic contact dermatitis to disinfectants and preservatives. In workers with probable contact dermatitis to detergents and preservatives, age and factory were significant predictors in the unadjusted models. In the adjusted model, the only statistically significant predictor was monthly glove changing which resulted in a nearly four-fold increased risk of the outcome (POR 3.93, CI 1.02-14.71, p=0.04). Wet hands at the end of a shift were nearly four times as common in people with probable allergic contact dermatitis to disinfectants and preservatives but this was of borderline significance (POR 3.86, CI 0.93-16.00, p=0.06).

Table 8.Multiple logistic regression models for significant host, employment and exposure factors (adjusted odds ratios) associated with possible allergic contact dermatitis in seafood processing workers along the west coast of South Africa

Predictor variables	Possible allergic contact dermatitis to: (Prevalence odds ratio - POR, confidence interval - CI)			
	Fish	Metals	Rubber additives	Disinfectants and preservatives
Employment and exposure history				
Employment duration in current job	0.99 (0.86-1.13)	1.02 (0.95-1.09)	1.02 (0.95-1.09)	1.00 (0.93-1.08)
Seasonal vs. permanent work	5.86 (0.60-57.63)	0.71 (0.27-1.90)	2.28 (0.67-7.81)	0.41 (0.14-1.19)†
Type of work				
"Wet fish" exposure (vs. low exposure)	1.07 (0.14-8.00)	0.90 (0.38-2.13)	0.73 (0.21-2.49)	0.46 (0.17-1.27)
"Dry fish" exposure (vs. low exposure)	0.89 (0.06-12.52)	0.84 (0.18-3.82)	1.03 (0.20-5.29)	-
Glove usage*				
Glove usage at all	2.08 (0.35-12.46)	0.89 (0.43-1.84)	1.45 (0.51-4.08)	0.83 (0.32-2.16)
Regular glove usage	0.90 (0.14-5.64)	0.95 (0.44-2.06)	1.63 (0.56-4.73)	1.04 (0.38-2.80)
Inadequate gloves(wet hands)	-	0.72 (0.19-2.73)	2.55 (0.58-11.21)	0.91 (0.18-4.60)
Intact gloves (dry hands)	2.85 (0.45-18.04)	0.93 (0.43-2.01)	1.18 (0.38-3.72)	0.81 (0.29-2.26)
Change gloves annually	2.10 (0.10-42.67)	0.81 (0.15-4.43)	1.58 (0.24-10.39)	0.29 (0.03-2.62)
Change gloves monthly	5.62 (0.38-83.28)	1.31 (0.42-4.11)	5.20 (1.35-20.04)††	1.76 (0.46-6.75)
Change gloves at least weekly	1.53 (0.18-13.11)	0.75 (0.30-1.88)	0.25 (0.03-2.28)	0.80 (0.21-2.99)
Wash gloves at the end of a shift	5.02 (0.71-35.31)	1.02 (0.48-2.20)	2.20 (0.78-6.24)	0.84 (0.31-2.26)
Wash gloves with disinfectant	5.02 (0.71-35.31)	1.09 (0.51-2.37)	2.42 (0.85-6.90)†	0.94 (0.35-2.53)
Handwashing > 6 x per day	0.92 (0.08-10.66)	3.94 (0.82-18.86)†	-	1.33 (0.38-4.68)
Allergy history				
Type I sensitisation to fish (SPT)	-	2.40 (0.76-7.59)	1.21 (0.24-6.10)	0.77 (0.91-6.57)
History of childhood eczema	-	0.88 (0.23-3.38)	0.80 (0.16-4.12)	1.65 (0.19-14.05)
Family history of eczema	1.03 (0.11-9.72)	2.03 (0.78-5.31)	1.23 (0.31-4.86)	1.90 (0.55-6.53)

Adjusted for age, gender, atopy, fish intake and factory. POR: prevalence odds ratio; CI: Confidence interval; Each odds ratio represents a different model. Blank cells represent undefined odds ratios. *all compared to no glove use.
"Wet fish" exposure: jetty and canning departments; "Dry fish" exposure: fishmeal manufacturing and bagging departments; Low fish exposure: administration, boiler room, labeling, workshop, cannery pickups, cannery stores and laundry departments
† $0.10 > p > 0.05$; †† $p < 0.05$

Table 9. Multiple logistic regression models for significant host, employment and exposure factors (adjusted odds ratios) associated with probable allergic contact dermatitis in seafood processing workers along the west coast of South Africa

Predictor variables	Probable allergic contact dermatitis to: (Prevalence odds ratio - POR, confidence interval - CI)			
	Fish	Metals	Rubber additives	Disinfectants and preservatives
Employment and exposure history				
Employment duration in current job	1.01 (0.89-1.14)	1.06 (0.99-1.13)	1.00 (0.93-1.08)	0.96 (0.89-1.03)
Seasonal vs. permanent work	1.63 (0.19-13.96)	0.78 (0.31-1.99)	2.82 (0.62-12.83)	0.87 (0.23-3.25)
Type of work				
"Wet fish" exposure (vs. low exposure)	1.96 (0.17-23.18)	1.40 (0.59-3.32)	0.68 (0.20-2.35)	0.71 (0.23-2.17)
"Dry fish" exposure (vs. low exposure)	5.18 (0.34-78.16)	1.62 (0.37-7.10)	0.83 (0.15-4.53)	0.53 (0.13-2.24)
Glove usage*				
Glove usage at all	2.78 (0.44-17.56)	2.04 (1.00-4.17)††	1.36 (0.47-3.93)	2.35 (0.85-6.48)†
Regular glove usage	0.98 (0.14-6.64)	1.91 (0.92-3.97)†	1.78 (0.55-5.78)	2.17 (0.69-6.79)
Inadequate gloves(wet hands)	2.53 (0.18-36.14)	2.13 (0.69-6.55)	1.25 (0.23-6.92)	3.86 (0.93-16.00)†
Intact gloves (dry hands)	2.89 (0.40-20.82)	2.92 (0.96-4.26)†	1.39 (0.45-4.33)	2.00 (0.67-5.93)
Change gloves annually	2.91 (0.15-56.34)	2.73 (0.64-11.72)	1.06 (0.16-6.82)	2.10 (0.55-8.04)
Change gloves monthly	5.41 (0.36-81.30)	1.54 (0.51-4.68)	4.79 (1.32-17.31)††	3.93 (1.05-14.71)††
Change gloves at least weekly	2.06 (0.20-20.96)	2.15 (0.90-5.16)	-	1.15 (0.19-6.99)
Wash gloves at the end of a shift	6.86 (0.86-54.59)†	1.89 (0.92-3.89)†	2.34 (0.73-7.47)	1.43 (0.49-4.17)
Wash gloves with disinfectant	7.16 (0.90-57.23)†	2.06 (0.99-4.30)††	2.97 (0.88-10.00)†	1.98 (0.64-6.11)
Handwashing > 6 x per day	0.94 (0.08-11.16)	1.40 (0.45-4.39)	3.25 (0.59-18.00)	1.57 (0.46-5.30)
Allergy history				
Type I sensitisation to fish (SPT)	-	1.25 (0.37-4.18)	0.47 (0.05-4.10)	1.21 (0.22-6.69)
History of childhood eczema	-	0.78 (0.23-2.68)	-	3.18 (0.34-29.81)
Family history of eczema	-	1.06 (0.40-2.84)	2.45 (0.68-8.77)	1.94 (0.55-6.76)

Adjusted for age, gender, atopy, fish intake and factory. POR: prevalence odds ratio; CI: Confidence interval; Each odds ratio represents a different model. Blank cells represent undefined odds ratios. *all compared to no glove use.

"Wet fish" exposure: jetty and canning departments; "Dry fish" exposure: fishmeal manufacturing and bagging departments; Low fish exposure: administration, boiler room, labeling, workshop, cannery pickups, cannery stores and laundry departments

† $0.10 > p > 0.05$; †† $p < 0.05$

DISCUSSION

In the original study of South African seafood processing workers 120 of 594 workers (20%) reported recurrent skin symptoms (12). This symptom prevalence is lower than that reported in studies in Norway (1) and Denmark (14) in which more than 50% and 80% of workers respectively had reported symptoms, but higher than the prevalence of 5% reported by employers in South Africa (15) and Australia (16) in postal surveys, which suggests under-reporting of skin conditions by employers. The reported symptoms were not correlated with any findings on clinical examination of our subjects, as equal numbers of symptomatic and asymptomatic workers had abnormal skin examinations. This raises the possibility that the use of self-reported skin symptoms on their own as a marker for skin disease may not be appropriate nor particularly sensitive for early skin problems, and that certain skin changes e.g. web space dermatitis and irritant contact dermatitis may be culturally acceptable to workers and therefore assumed to be not worthy of reporting. However, patients with allergic contact dermatitis on examination all fell into the symptomatic group implying that these workers had more severe skin conditions. This would be anticipated, particularly if they were exposed to the relevant allergen in the workplace.

The clinical examination by qualified dermatologists found hand eczema in more than half of the workers. As self-reported symptoms were not related to clinical findings this probably adequately represents the overall prevalence of eczema in the workers. It is substantially higher than that reported by Peltonen et al (8) but similar to the prevalence reported by Cronin (6) and Bauer et al (9). The vast majority of dermatitis was irritant contact dermatitis. This is in keeping with findings by Halkier-Sorensen that 75% of contact dermatitis in seafood workers is irritant (3). Allergic contact dermatitis was diagnosed in only 7% of the workers which is similar to the 6% of patients with irritant changes and a "relevant hand allergen" reported by Cronin (6). Traumatic hand lesions were the most common skin finding. This is not surprising given the low rate of regular glove use (36-37%) and the nature of the work.

Patch testing revealed 23-26% sensitization to nickel, which was strongly associated with female gender. This is consistent with other reports which give a prevalence of nickel sensitisation of approximately 30% in women (17). Type IV sensitisation to rubber additives was more common in the symptomatic group ($p=0.02$), suggesting that at least some of the skin symptoms reported may be related to glove use. The most prevalent rubber allergen was carbamix, which yielded a positive patch test in 3-9% of the population under current study. In the past the most frequent reactions reported among various working populations, but particularly health care workers were to thiuram mix (18). However, thiuram sensitisation has been declining in recent years due to the changing make-up of gloves (19), with carbamix reactions currently on the rise (18). Our findings are possibly related to the type of glove used in the factories involved in the study. Patch tests for latex were not performed but

IgE levels were measured. Eighteen workers (7%) had Type I sensitisation to latex. This is approximately half the prevalence measured by Valks et al (20). There was however no relationship to wearing latex gloves. This low prevalence may also be a result of the healthy worker effect.

The high rates of chlorhexidine digluconate sensitivity in the "wet fish" exposure departments of jetty and canning are probably related to frequent hand washing and use of disinfectants to wash gloves. Since formaldehyde is used during the fishmeal manufacturing process, it was anticipated that the majority of the positive reactions to formaldehyde would be in workers from that department who are predominantly male. However, the reactions were evenly split between fishmeal manufacturing workers and "low exposure" workers. Interestingly there were no reactions to formaldehyde in the jetty and canning workers. This does suggest that working with formaldehyde in the fishmeal department may increase the chance of a positive reaction, compared to working in the jetty and canning departments. Some of the employees in the "low exposure" departments, such as the workshop, may be exposed to formaldehyde during maintenance procedures providing an alternative explanation for the positive reactions observed.

In this study there were very few positive patch tests to fish in that only 10 employees (4%) reacted to fish products, compared to 20 (8%) who had positive skin prick tests to fish. Those who had Type I sensitisation to fish were more likely to report skin symptoms. This is in accordance with previous studies which reported lower prevalence of positive patch tests than Type I reactions to fish products. Freeman and Rosen (21) reported no positive patch tests to fish, and in Hjorth and Roed-Petersen's seminal study (22), there were only 4 positive patch tests to fish (accounting for 27% of the study population) whereas there were 8 positive scratch tests. This confirms our understanding that a large portion of contact dermatitis in seafood workers is probably caused by a Type I reaction to high molecular weight proteins, so-called protein contact dermatitis, rather than a Type IV reaction to haptens (23).

Personal risk factors which appeared to be related to more than one of the clinical outcomes were atopy, age and gender. There has been some debate whether atopy per se increases the risk of occupational contact dermatitis, and recent guidelines report that no conclusions can be drawn at this stage as studies of equal quality have returned contradictory findings (24). In the current study, atopy was associated with an increased risk of some outcomes (eczema on examination, possible contact dermatitis to rubber) but appeared to have a protective effect in other outcomes (wet work sequelae, positive patch test to detergents). These contradictory findings imply that atopy may not be related to contact dermatitis in this population. As noted, gender was strongly associated with positive patch tests to metals which was driven predominantly by positive nickel patch tests also observed more commonly in women. For other clinical outcomes, gender appeared to be less relevant. Age had only a very slight influence on the risk for various clinical outcomes. These findings are concordant with

the current view that any apparent relationship between age or gender and occupational contact dermatitis is more likely to be due to the nature of the work performed by women and older workers rather than by inherent differences in skin susceptibility (25,26).

The type of factory in which workers were employed was a significant determinant in a number of regression models. This factory effect may be the result of differing size and resources available at the factories to mitigate occupational dermal exposures, resulting in significantly different exposure levels to fish products and different patterns of use of personal protective equipment.

There were very few exposure factors that were consistently relevant across the different outcome measures. Wet work sequelae such as paronychia were significantly associated with work in the jetty and canning departments. This was expected as this had been defined as work with "wet fish". Surprisingly, regular hand washing more than 6 times during a shift was not associated with irritant contact dermatitis nor with wet work sequelae on examination. This may be due to the question not being sensitive enough as more recent studies have defined wet work as having wet hands or wearing occlusive gloves for more than 2 hours per shift and hand washing more than 20 times in a shift (27). Regular glove use was, however, strongly associated with allergic contact dermatitis on clinical examination. As this was a cross-sectional study it is not possible to determine temporality, so this may reflect increased use of gloves by workers with allergic contact dermatitis in order to prevent exacerbations of their skin condition. Monthly glove changes appeared to be associated with positive patch tests to rubber and probable contact dermatitis to rubber additives and disinfectants. Workers who changed their gloves at least weekly had similar odds of a positive patch test to rubbers compared to workers not wearing gloves at all, whereas workers who changed gloves only monthly had a 4-5 fold increased odds of probable contact dermatitis. This indicates that wearing no gloves at all may be better for workers than wearing the same pair of gloves for an extended period, as gloves may tear or degrade allowing close contact of irritants and allergens with the skin. Uter et al (28) report that regular glove washing may decrease the number of rubber accelerators in the glove, making them hypo-allergenic. However, in our study, there was no decrease in clinical findings of eczema despite glove washing at the end of a shift.

While this study was able to demonstrate associations between potential risk factors and some of the clinical endpoints of interest, it was unable to do so for other outcomes. This could be attributed to the small study population and the relatively low prevalence of allergic contact dermatitis and positive patch tests observed, which may have resulted in lack of statistical power to demonstrate potential associations. There may also potentially have been some selection bias since half the study population was selected based on a declaration of skin symptoms in the past year, which was not correlated with most clinical outcomes of interest. Since categorisation of eczema was reliant on clinical judgment, there is also the possibility of potential misclassification of disease outcomes, especially how weak

allergic reactions may have been differentiated from irritant reactions. The outcome variables "possible allergic contact dermatitis" and "probable allergic contact dermatitis" likely overestimate the true numbers of allergic contact dermatitis in this population, since the relevance of the current positive patch test was not determined in each individual. Therefore, some of the positive patch test results may reflect previous rather than current exposure. On the other hand, some delayed positive patch test reactions may have been missed as they were read only until 3 days after application and previous studies have shown that up to 8% of positive reactions may be observed at a later time point (29). It is also possible that the choice of the control group may also not have been the most appropriate since the prevalence of irritant dermatitis was unexpectedly similar to the symptomatic group. Furthermore, the cross-sectional nature of this study rendered it difficult to determine the temporal relationships between behavioral patterns of glove usage and the presence of dermatitis observed by the investigators. It is well known that glove usage can either cause or protect against occupational dermatoses as their efficacy is highly dependent on the nature of the working environments, the associated exposures and individual practices (30).

In conclusion this study has demonstrated that seafood workers reporting recurrent skin symptoms are more likely to have Type I sensitisation to fish and a family history of eczema when compared to asymptomatic workers. Workers handling wet fish in the jetty and canning departments are more likely to have paronychia and webspace dermatitis than workers without direct fish exposure. Monthly glove changes may result in workers wearing gloves which are no longer intact. This may mean that irritant products and allergens are occluded next to the skin, and increase the risk of occupational contact dermatitis. Future studies should evaluate suitable preventive strategies to minimise occupational skin disease in these workers.

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SECTION D: APPENDICES

APPENDIX A: INFORMATION AND CONSENT FORM FROM ORIGINAL STUDY IN SEAFOOD PROCESSING WORKERS

UCT OCCUPATIONAL SEAFOOD ALLERGY STUDY IN

SOUTH AFRICA - 2001

ENGLISH CONSENT FORM

1. **Title of research project**
   Occupational allergy associated with rock-lobster and saltwater bony-fish processing in South Africa.

2. **Purpose of the research**
   The University of Cape Town is conducting this important study of the allergic effects of seafood. This study is going to be done by researchers who are independent of the company. We will be studying a group of workers who have been involved with seafood processing as well as a group of workers who have not worked with seafood. By comparing these two groups we hope to understand whether working with seafood causes allergic problems.

3. **Description of the research project**
   If you agree to participate you will be asked to complete the following tests during working time:

   Phase 1: All workers will have these tests

   a) **Complete a questionnaire**

   A member of our study team will interview you in privacy to complete the questionnaire. You will be asked questions about any breathing or chest problems; current and previous employment history; eating or working with seafood; and the use of cigarettes.

   b) **Skin tests**

   Skin tests would be done to see whether you are allergic to any of the seafoods or any other substance that commonly causes allergy in the Western Cape. A nurse will place a drop of liquid containing each type of seafood and the other substances on your forearm and then use a lancet to scratch the skin in that area.

   c) **Blood test**

   You will also be asked to undergo a blood test to check for allergies to seafood.

   d) **Breathing tests**

   You will be asked to blow several times into a machine which measures how well your lungs are working. You will be asked to repeat the breathing test after you first

breathe in a small amount of a chemical substance (methacholine). This test helps us find out if you may have a breathing problem like asthma. You may be asked to breathe in this substance and then blow into the machine several times.

Phase II: If you have a skin problem, you will be asked to come back another day so that we can do other tests

a) **Medical examination of your skin**

This examination would be conducted by a doctor to look for any skin rashes. She will examine the skin of the hands, forearms and face only.

b) **Patch testing**

You may be asked to have a skin patch test to help figure out the cause of any skin problems. We will use chemical substances that are commonly used in everyday life in addition to samples of seafoods. The solutions will be placed on your back using special strips of paper very similar to plaster. You will be asked to keep it on for 3 days. You will then come back to the nurse to have the tests read and the strips will be removed.

4. **Confidentiality of information collected**
Your name will not appear in any reports on this study. The records of skin tests, blood tests, questionnaires and breathing tests will be kept completely confidential and will be seen only by members of the study team.

5. **Risks and discomforts of the research**

a) From the blood tests. You will feel a single needle stick when the blood is taken. Sometimes a small bruise may occur from the needle stick, but this is minor and will heal quickly. The total amount of blood taken is quite small and your body will quickly replace it.

b) From the questionnaire and breathing tests. There are no risks from completing the questionnaire and the initial breathing test. Part of the breathing test uses a chemical substance that can cause headache, cough, chest tightness, hoarse voice or a sore throat for a short time in some people. This can be treated immediately with a different medication, which you breathe in. You will only be given the chemical substance if your simple breathing test is normal. This greatly reduces the chance of having a serious problem.

c) From the skin tests. Itchiness can occur in some instances. Very rarely severe allergic reactions to skin tests or patch tests (difficulty breathing or feeling faint and collapsing) may occur in people that are highly allergic to seafood. You will be asked questions before receiving the tests to help make sure you are not at any risk for such a problem. In addition, you will be at the factory, where nurses will be available to check you for any possible problems, for several hours after the test and have medications on hand to treat any such reaction. A doctor is also located nearby ready to help if necessary.

6. **Expected benefits to you and to others**

You will be given a written copy of all your test results along with an explanation of what they mean, unless you tell us that you do not wish to receive this. You may

wish to show these to your doctor if you are having any problems. These tests will help determine if you have an allergy to seafood or other substances used in the skin tests. What we learn from this study will help to protect you, and those working with seafood in South Africa and other parts of the world. We will learn how best to monitor worker's health and how to reduce workers' exposure to seafood substances.

7. **Costs to you resulting from participation in the study**

The study is offered at no cost to you. In the event a problem is discovered and you wish to be seen by a doctor for it, we can recommend to you who to see. However, the study cannot pay for these additional medical visits or treatments.

8. **Contact person**.

You may contact one of the following persons for answers to further questions about the research, your rights, or any injury you may feel is related to the study.

University of Cape Town Researcher: Dr. Mohamed Jeebhay, Telephone No. (021) 406-6309

Plant Nurse: Sr. Cecelia Blaauw, Telephone No.: (022) 736-1100

9. **Consent of the participant**

I have read the information given above, or it has been read to me. I understand the meaning of this information, Dr./Mr./Ms.

_____

has offered to answer any questions concerning the study. By signing this form, I hereby consent to participate in the study. I also understand that I am free to withdraw from the study at any time without penalty.

10. **Documentation of the consent**

One copy of this signed document will be kept together with our research records for this study. A copy of the information sheet about the study will be given to you to keep.

_____ _____
Printed name of participant Signature, Mark, or Thumb Print

_____ _____
Interviewer's name (Print) Signature

DATE: _____

APPENDIX B: ENGLISH QUESTIONNAIRE FROM ORIGINAL STUDY IN SEAFOOD PROCESSING WORKERS

UCT OCCUPATIONAL SEAFOOD ALLERGY STUDY

IN SOUTH AFRICA - 2001

ENGLISH QUESTIONNAIRE

Card 1

RECORD NO: _____ □□□1-3

A. IDENTIFICATION DATA

1. Surname _____

2. First name/s _____

3. Address _____

_____

_____

4. Work number _____ □□□□□□4-9

5. Date of birth Day ____ Month ____ Year 19 ___ □□□□□□10-15

6. Gender Male _____ (1) □16
Female _____ (2)

7. Home language English ____ (1) □17
Afrikaans ____ (2)
Xhosa ____ (3)
Other ____ (4)

8. Interviewer's initials _____ □18

9. Date of interview Day ____ Month ____ Year 20 ____ □□□□□□19-24

10. Factory_____ □25

11. Shift Day ____ (1) □26
Night ____ (2)

B. HEALTH

I am going to ask you some questions about your health. At first these will be mostly about your breathing. Wherever possible, I would like you to answer 'YES' or 'NO'.

Circle (O) appropriate responses.

Wheeze and tightness in the chest

1. Have you had wheezing or whistling in your chest at any time in the last ***12 months***?
YES (1) NO (2) □27

If YES, go on to Question 1.1
If NO, skip to Question 2

1.1 Have you been short of breath when the wheezing noise was present?
YES (1) NO (2) □28

1.2 Have you had this wheezing or whistling when you ***did not*** have a cold or flu?
YES (1) NO (2) □29

2. Have you been woken up with a feeling of tightness in your chest at any time in the last ***12 months?***
YES (1) NO (2) □30

Shortness of breath

3. Have you had an attack of shortness of breath that came on during the daytime when you were at rest at any time in the last ***12 months?***
YES (1) NO (2) □31

4. Have you had an attack of shortness of breath that came on following running or exercise at any time in the last ***12 months?***
YES (1) NO (2) □32

5. Have you been woken by an attack of shortness of breath at any time in the last ***12 months?***
YES (1) NO (2) □33

Cough and phlegm from the chest

6. Have you been woken by an attack of coughing at any time in the last ***12 months?***
YES (1) NO (2) □34

7. Do you ***usually*** cough first thing in the morning?
YES (1) NO (2) □35

8. Do you ***usually*** cough during the rest of the day, or at night?
YES (1) NO (2) □36

If YES, go on to Question 8.1
If NO, skip to Question 9

8.1 Do you cough like this on most days/nights for as much as three or more months in each of the last two years?

YES (1) NO (2) □37

9. Do you usually bring up any phlegm from your chest first thing in the morning?

YES (1) NO (2) □38

10. Do you usually bring up any phlegm from your chest during the day, or at night?

YES (1) NO (2) □39

If YES, go on to Question 10.1
If NO, skip to Question 11

10.1 Do you bring up phlegm like this on most days/nights for as much as three or more months in each of the last two years?

YES (1) NO (2) □40

Breathing

11. Do you ever have trouble with your breathing?

YES (1) NO (2) □41

If YES, go on to Question 11.1
If NO, skip to Question 12

11.1 Do you have this trouble: □42

Give all options at once
Insert a cross (X) next to one answer only

a) continuously so that your breathing is never quite right? ____
b) repeatedly, but it goes away completely between the times when it troubles you? ____
c) only rarely? ____

12. Are you disabled from walking by a condition ***other than*** heart or lung disease?

YES (1) NO (2) □43

If YES, state the condition _____
and go on to Question 13
If NO, go to Question 12.1

12.1 Are you troubled by shortness of breath when hurrying on level ground or walking up a slight hill?

YES (1) NO (2) □44

If YES, go on to Question 12.1.1
If NO, skip to Question 13

12.1.1 Do you get short of breath walking with other people of your own age on level ground?

YES (1) NO (2) □45

If YES, go on to Question 12.1.1.1
If NO, skip to Question 13

12.1.1.1 Do you have to stop for breath when walking at your own pace on level ground?

YES (1) NO (2) □46

Asthma

13. Have you ever had asthma?

YES (1) NO (2) □47

If YES, go on to Question 13.1
If NO, skip to Question 13.8

13.1 ***If yes***, was this confirmed by a doctor?

YES (1) NO (2) □48

13.2 How old were you when you were told you have asthma? □49

Give all options at once
Insert a cross (X) next to one answer only

a) Only before you were 17 years old ____
b) Only at the age of 17 years or older ____
c) Both ____

The following references to "attack" of asthma refers to episodes of wheezing, shortness of breath, chest tightness or cough attributed to asthma

13.3.1 How old were you when you had your first **attack** of asthma?

_____ years old □□50-51

13.3.2 How old were you when you had your most recent **attack** of asthma?

_____ years old □□52-53

13.4.1-6 Which months of the year do you usually have attacks of asthma?

13.4.1 January/February	YES (1)	NO (2)	□54
13.4.2 March/April	YES (1)	NO (2)	□55
13.4.3 May/June	YES (1)	NO (2)	□56
13.4.4 July/August	YES (1)	NO (2)	□57
13.4.5 September/October	YES (1)	NO (2)	□58
13.4.6 November/December	YES (1)	NO (2)	□59

13.5 Have you had an attack of asthma in the last ***12 months?***

YES (1) NO (2) □60

If YES, go on to Question 13.5.1
If NO, skip to Question 13.6

13.5.1 How often have you had an attack of asthma in the last ***12 months?*** □61

Give all options at once
Insert a cross (X) next to one answer only

a) Every day ____
b) More than 2 times a week ____

c) More than 1 time per month ____
d) 3 to 12 times in the whole year ____
e) 1 to 2 times in the whole year ____

13.6 Are your chest symptoms caused by, or made worse by any of the following:

Answer all questions			
13.6.1 Contact with animals/pets	YES (1)	NO (2)	□62
13.6.2 Grass or flowers	YES (1)	NO (2)	□63
13.6.3 Heavy exercise	YES (1)	NO (2)	□64
13.6.4 Breathing cold air	YES (1)	NO (2)	□65
13.6.5 Dusts or sprays at work	YES (1)	NO (2)	□66
13.6.6 Tobacco smoke	YES (1)	NO (2)	□67
13.6.7 Change in the weather	YES (1)	NO (2)	□68

13.7 Do your chest symptoms seem better or worse when you are away from work (for example, on weekends, off-shift and vacations)? □69

Give all options at once
Insert a cross (X) next to one answer only

a) Stay the same ____
b) Get better ____
c) Get worse ____

13.8 Does being at work ever make your chest tight or wheezy?

YES (1) NO (2) □70

If YES, go on to Question 13.8.1
If NO, skip to Question 13.9

13.8.1 When did you first notice having problems with chest tightness or wheeze at work?

Date: Month ____ Year ___ □□□□71-74

13.8.2 Is there anything that you work with that causes you to have these chest symptoms?

YES (1) NO (2) □75

If YES, go on to Question 13.8.3
If NO, skip to Question 13.9

13.8.3 What do you think is causing these symptoms?

_____ □76

13.9 Have you ever had to change or leave your work area, either temporarily or permanently, in this factory or any other factory because of any chest symptoms?

Card 2

YES (1) NO (2) □1

If YES, go on to Question 13.9.1
If NO, skip to Question 13.10

13.9.1 What type of job were you doing when this happened?

_____ □□2-3

13.9.2 Was this a job in this factory?
YES (1) NO (2) □4

If YES, go on to Question 13.9.2.1
If NO, skip to Question 13.10

13.9.2.1 What department did you move to?
_____ □□5-6

13.9.2.2 What job did you do there?
_____ □□7-8

13.9.2.3 Did your symptoms improve when you changed jobs?
YES (1) NO (2) □9

13.10 Have you ever worked in a job or jobs that exposed you to vapours, gas, dust or fumes?
YES (1) NO (2) □10

If YES, go on to Question 13.10.1. List the jobs beginning with the most recent
If NO, skip to Question 13.11

13.10.1 What was or is this job? _____ □□11-12
(if current job write 'current job')
13.10.2 Before that? _____ □□13-14
13.10.3 Before that? _____ □□15-16

13.11 Has there ever been an instance when you inhaled a large amount of vapours, gas, dust or fumes in any of these jobs that resulted in you developing a tight chest, wheeze or cough?
YES (1) NO (2) □17

If YES, go on to Question 13.11.1.
If NO, skip to Question 13.12

13.11.1 What was or is this job? _____ □□18-19
(if current job write 'current job')

13.12 Are you using any medicines, including inhalers/pumps, nebulizers, syrups or tablets, for asthma or breathing problems?
YES (1) NO (2) □20

If YES, go on to Question 13.12.1, showing examples of each
If NO, skip to question 13.13

13.12.1 Which medicines? _____ □21
_____ □22
_____ □23

13.12.2 Do you take these medicines every day even when you do not have any trouble breathing?
YES (1) NO (2) □24

13.13 Have you ever been treated for any of the following:

Answer all questions

13.13.1 Repeated chest infections as a child YES (1) NO (2) UNK (3) □25
13.13.2 Tuberculosis (TB) YES (1) NO (2) UNK (3) □26
13.13.3 Chronic bronchitis YES (1) NO (2) UNK (3) □27

Nose and eye symptoms

14. Have you ever had any nose or eye problems or allergies such as hay fever?
YES (1) NO (2) □28

14.1 How old were you when you ***first*** noticed these symptoms?
_____ years old □□29-30

If YES, go on to Question 14.2 Answer all questions
If NO, skip to Question 14.4

14.2 During the past ***12 months*** have you had two or more episodes of:

14.2.1 sneezy, itchy or runny nose when you did not have a cold or flu? YES (1) NO (2) □31
14.2.2 red, itchy or watery eyes YES (1) NO (2) □32
14.2.3 Do you usually have the nose or eye symptoms at any particular time of the year? YES (1) NO (2) □33

14.2.3.1 If YES, which is the ***worst*** season? □34

Give all options at once
Insert a cross (X) next to one answer only

a) Winter ____
b) Spring ____
c) Summer ____
d) Autumn ____

If YES to any of the above, go on to Question 14.3
If NO, skip to Question 14.4

14.3 Do your nose or eye symptoms seem better or worse when you are away from work (for example, on weekends, off-shift and vacations)? □35

Give all options at once
Insert a cross (X) next to one answer only

a) Stay the same ____
b) Get better ____
c) Get worse ____

14.4 Does being at work ever cause you to have sneezy/itchy/runny nose or red/itchy/watery eyes? YES (1) NO (2) □36

If YES to any one of the above, go on to Question 14.4.1
If NO, skip to Question 14.6

14.4.1 Since when have you been having these symptoms at work?
Date: Month ____ Year ____ □□□□37-40

14.4.2 Is there anything that you work with that causes you to have these symptoms?

YES (1) NO (2) □41

If YES, go on to Question 14.4.3
If NO, skip to Question 14.5

14.4.3 What do you think is causing these symptoms?

_____ □42

14.5 Are you using any medicines, including nose sprays, drops, tablets or injections, for your nose or eye symptoms at present? YES (1) NO (2) □43

If YES, go on to Question 14.5.1
If NO, go on to Question 14.6

Present a chart with different samples of allergy medicines (N.B. a worker might show you his/her medicines).

14.5.1 Which medicines? _____ □44

_____ □45

14.6 Did you have hay fever (itchy or watery eyes/nose) as a child?

YES (1) NO (2) □46

Skin symptoms

15. Have you ever had any kind of skin problem either at home or at work?

YES (1) NO (2) □47

If YES, go on to Question 15.1
If NO, skip to Question 15.4.4

15.1 How old were you when you ***first*** noticed this skin problem?

_____ years old □□48-49

15.2 During the past ***12 months*** have you had any skin problems that occurred 2 or more times?

YES (1) NO (2) □50

If ***Yes,*** which of the following problems did you have?

Go through each option in the table below and circle the appropriate response.

	Forearms Hands	**Face / Neck**	**Legs Knees**	**Whole Body**
15.2.1 itchy or scratchy skin	Yes/No □51	Yes/No □52	Yes/No □53	Yes/No □54
15.2.2 hives (“bommels”)	Yes/No □55	Yes/No □56	Yes/No □57	Yes/No □58
15.2.3 dry, scaly skin	Yes/No □59	Yes/No □60	Yes/No □61	Yes/No □62
	Forearms	**Face / Neck**	**Legs**	**Whole Body**

	Hands		**Knees**	
15.2.4 redness of the skin	Yes/No □63	Yes/No □64	Yes/No □65	Yes/No □66
15.2.5 blisters or weeping skin	Yes/No □67	Yes/No □68	Yes/No □69	Yes/No □70
15.2.6 burning skin	Yes/No □71	Yes/No □72	Yes/No □73	Yes/No □74
15.2.7 started within an hour of contact with a substance or food item	Yes/No □75	Yes/No □76	Yes/No □77	Yes/No □78
15.2.8 Other? Specify: _____	Yes/No □1 Card 3	Yes/No □2	Yes/No □3	Yes/No □4

If YES, to any of the above go on to Question 15.3
If NO, skip to Question 15.4

15.3 Do your skin problems seem better or worse when you are away from work (for example, on weekends, off-shift and vacations)? □5

Give all options at once
Insert a cross (X) next to one answer only

a) Stay the same ____
b) Get better ____
c) Get worse ____

15.4 Does being at work ever cause you to have skin problems?
YES (1) NO (2) □6

If YES, go on to Question 15.4.1
If NO, skip to Question 15.4.4

15.4.1 Since when have you been having these skin problems at work?
Date: Month ____ Year ___ □□□□7-10

15.4.2 Is there anything that you work with that makes these skin problems worse?
YES (1) NO (2) □11

If YES, go on to Question 15.4.3
If NO, skip to Question 15.4.4

15.4.3 What do you think is causing these skin problems?
_____ □12

15.4.4 Have you ever cut or injured your fingers or hands while working with the seafood?
YES (1) NO (2) □13

15.4.5 Do you wear gloves while working?
YES (1) NO (2) □14

If YES, go on to Question 15.4.5.1

If NO, skip to Question 15.5

15.4.5.1 How often do you wear these gloves while working? □15

Give all options at once
Insert a cross (X) next to one answer only

a) most of the time ____
b) less than half the time ____
c) occasionally ____

15.4.5.2 How often do you change these gloves? □16

Give all options at once
Insert a cross (X) next to one answer only

a) daily ____
b) weekly ____
c) monthly ____
c) yearly ____

15.4.5.3 Which type of glove are you using most of the time while working?

Ask workers to choose from the selection and place the number in the space provided below

Glove used: _____
□17

15.4.5.4? Do you use any other gloves while working? YES (1) NO (2) □18

If yes, which ones? (choose from the same selection)

a) _____
□19

b) _____
□20

15.4.5.5 Are your gloves washed at the end of each shift?

YES (1) NO (2) □21

15.4.5.6 Are your gloves washed with a disinfectant on a regular basis (almost every day)?

YES (1) NO (2) □22

15.4.5.7 Are your hands still wet even though you use gloves while working?

YES (1) NO (2) □23

15.5 How many times do you wash your hands in the course of a day? □24

Give all options at once
Insert a cross (X) next to one answer only

0 _____
1 time _____
2-3 times _____
4-5 times _____
6 or more _____

15.6 Are you using any medicines, including any creams or ointments, for your skin problems at present?

YES (1) NO (2) □25

If YES, go on to Question 15.6.1
If NO, skip to next question 15.7

15.6.1 Which medicines? _____ □26
_____ □27

15.7 Did you have eczema as a child? YES (1) NO (2) □28

Other allergic conditions

16. Are you allergic to insect stings or bites? YES (1) NO (2) □29

If YES, go on to Question 16.1
If NO, skip to Question 17

16.1.1-3 What kind of reactions do you have?
16.1.1 Breathing difficulty, feeling faint, fever? YES (1) NO (2) □30
16.1.2 Redness, itching or swelling at the sting site YES (1) NO (2) □31
16.1.3 Other: _____
□32

17. Have you ever had any difficulty with your breathing after taking medications or injections that you did not have before?

YES (1) NO (2) □33

If YES, go on to Question 17.1
If NO, skip to 18.1

17.1 Which medicines? _____
□34

18.1-6 When you are near animals (such as cats, dogs or horses), near feathers (including pillows, quilts or duvets), near grass and flowers, or in a dusty part of the house, do you ***ever***

18.1 Start to cough? YES (1) NO (2) □35
18.2 Start to wheeze? YES (1) NO (2) □36
18.3 Get a tight chest? YES (1) NO (2) □37
18.4 Start to feel short of breath? YES (1) NO (2) □38
18.5 Get a runny/stuffy nose or sneeze? YES (1) NO (2) □39
18.6 Get itchy or watery eyes? YES (1) NO (2) □40
18.7 Get itchy skin/rash? YES (1) NO (2) □41

19. Have you ever had an illness or trouble caused by eating a particular type of food/fruit or drinking a particular juice/drink?

YES (1) NO (2) □42

If YES, go on to Question 19.1
If NO, skip to 20

19.1 What type of food/drink was this?

_____

_____

19.1.1-6 Did this illness or trouble include:

19.1.1 Itchy skin or rash	YES (1)	NO (2)	□43
19.1.2 Diarrhoea or vomiting	YES (1)	NO (2)	□44
19.1.3 Runny or stuffy nose	YES (1)	NO (2)	□45
19.1.4 Severe headaches	YES (1)	NO (2)	□46
19.1.5 Breathlessness/tight chest/wheeze	YES (1)	NO (2)	□47
19.1.6 Other: _____			□48
19.2 Was the food canned or preserved?	YES (1)	NO (2)	□49
19.3 Do you experience these problems when you drink fizzy drinks also?	YES (1)	NO (2)	□50

20. Are you allergic to seafood such as fish, crabs, prawns, lobster, mussels?

YES (1) NO (2) □51

If YES, go on to Question 20.1
If NO, skip to next Section C on **FAMILY HISTORY**

20.1.1-9 What kind of reactions do you have?

20.1.1 hives/itchy wheals	YES (1)	NO (2)	□52
20.1.2 eczema	YES (1)	NO (2)	□53
20.1.3 nausea/vomiting/stomach pain/ diarrhoea	YES (1)	NO (2)	□54
20.1.4 wheezing/tight chest/ difficulty breathing	YES (1)	NO (2)	□55
20.1.5 itching of tongue/lips	YES (1)	NO (2)	□56
20.1.6 swelling/itching of throat	YES (1)	NO (2)	□57
20.1.7 dizziness/collapse	YES (1)	NO (2)	□58
20.1.8 fever/general weakness/joint pains	YES (1)	NO (2)	□59
20.1.9 Other: _____			□60

20.2 When do you experience these reactions?

20.2.1 After eating seafood	YES (1)	NO (2)	□61
20.2.2 After touching seafood	YES (1)	NO (2)	□62
20.2.3 After smelling seafood	YES (1)	NO (2)	□63

20.3 Which seafood do you suspect are causing the symptoms?

20.3.1 Hake	YES (1)	NO (2)	□64
20.3.2 Snoek	YES (1)	NO (2)	□65
20.3.3 Mackerel	YES (1)	NO (2)	□66
20.3.4 Anchovy	YES (1)	NO (2)	□67
20.3.5 Sardines (pilchard)	YES (1)	NO (2)	□68
20.3.6 Red eye	YES (1)	NO (2)	□69
20.3.7 Mussels	YES (1)	NO (2)	□70
20.3.8 Perlemoen	YES (1)	NO (2)	□71
20.3.9 Crayfish	YES (1)	NO (2)	□72
20.3.10 Prawns	YES (1)	NO (2)	□73
20.3.11 Haarders (bokkom)	YES (1)	NO (2)	□74
20.3.12 Other _____			□75

20.4 When did you first experience these reactions?

20.4.1 Before working in the seafood industry	YES (1)	NO (2)	□76

20.4.2 After beginning work in the seafood industry YES (1) NO (2) □77

20.5 Have you ever experienced any of these reactions during or after working or handling seafood?

See list of reactions under question 20.1 if a reminder is needed

Card 4

YES (1) NO (2) □1

If YES, go on to Question 20.5.1
If NO, skip to next Section C on **FAMILY HISTORY**

20.5.1 What were you busy doing? _____ □2

20.5.2 Where were you handling/working with the seafood?

20.5.2.1 at work YES (1) NO (2) □3

20.5.2.2 at home YES (1) NO (2) □4

20.5.2.3 recreational activities (fishing, diving)
YES (1) NO (2) □5

20.5.2.4 Other? Specify _____ □6

20.5.3 What reaction/s did you experience?
_____ □7

20.5.4 What seafood/s were you working with?
_____ □8

20.5.5 When did the reaction occur?: □9

Give all options at once
Insert a cross (X) next to one answer only

a) within 1hour ____
b) within 1 to 3 days ____
c) after 3 days ____

C. FAMILY HISTORY

1. Do/did any members of your family (blood relatives) ever have any kind of allergies?

Do not include relatives by marriage If family history is completely unknown (subject is adopted, etc.), mark UNK and do not complete table. Move to next section

YES (1) NO (2) UNK (3) □10

If YES, complete table below. Insert a cross (X) in the appropriate block for each option.

Type of Allergy	**NO ONE** in family	**YES**, present in the family			**DO NOT KNOW**	
		Parent	Brother /sister	Child		
1.1 Hay fever	1	2	3	4	5	11
1.2 Eczema	1	2	3	4	5	12
1.3 Asthma	1	2	3	4	5	13
1.4 Seafood Allergy	1	2	3	4	5	14
1.5 Other allergy _____ _____	1	2	3	4	5	15

D. SMOKING HISTORY

1. Have you **ever smoked** tobacco (cigarettes or pipe) for as long as a year?

'YES' means at least 20 packs of cigarettes or 360 grams of tobacco in a lifetime or at least one cigarette per day for one year

YES (1) NO (2) □16

If YES, go on to Question 1.1
If NO, skip to Question 2

1.1 How old were you when you started smoking?
_____ years old □□17-18

1.2 Do you **now** smoke?

'YES' means smoking tobacco in the last month or more

YES (1) NO (2) □19

If YES, go on to Question 1.2.1
If NO, skip to Question 1.3.1

1.2.1-2. How much do you **now** smoke on average?

1.2.1 Number of cigarettes per day_____ □□20-21
1.2.2 Pipe tobacco in grams/week_____ □□□22-24

Show different packets of tobacco for pipe smokers

1.3. Have you stopped smoking completely?
YES (1) NO (2) □25

If YES, go on to Question 1.3.1
If NO, skip to Question 1.4

1.3.1. How old were you when you stopped smoking completely?
_____ years old □□26-27

1.3.1.1 How many years in total did you smoke cigarettes? (Do not include the years you stopped before you started again)
_____ years □□28-29

1.3.2.1-2 ***On average*** of the entire time you smoked, how much did you smoke?
1.3.2.1 Number of cigarettes per day _____ □□30-31

1.3.2.2 Pipe tobacco in grams/week _____ □□□32-34

1.4 Do you or did you inhale the smoke?
YES (1) NO (2) □35

2. Have you been regularly exposed to tobacco smoke from other people smoking cigarettes or pipe in the last 12 months?

'Regularly' means on most days or nights

YES (1) NO (2) □36

E. DIETARY HISTORY – SEAFOOD INTAKE

This section is on eating seafood.

1. How often have you eaten the following seafood in the last 12 months?

Go through each seafood option and insert a cross (X) in the block for each option

Type of seafood	**Never**	**Less than once a month**	**Once or more than once a month**	
1. Fish: fried, cooked canned or dried (e.g. Haarders (bokkom), snoek, tuna, mackerel etc.)	1	2	3	37
2. Crayfish or prawns	1	2	3	38
3. Calamari	1	2	3	39
4. Perlemoen	1	2	3	40

5. Oyster/Mussels	1	2	3	41
6. Other: _____ _____	1	2	3	42

2. Have you changed your diet or avoided certain seafood because they do not agree with you when you eat them?

YES (1) NO (2) □43

If YES, go on to Question 2.1
If NO, skip to next Section F on **WORK HISTORY**

2.1 What seafoods have you avoided?

_____ □□44-45
_____ □□46-47

F. WORK HISTORY IN SEAFOOD PROCESSING

I am going to ask you about your present work

Use company record of work history, if available, to prompt worker's memory

1. How long have you been working at this factory?

_____ years □□48-49
_____ months □□50-51

Present job

2. How long have you been working in your current job?

_____ years □□52-53
_____ months □□54-55

3. In which department are you currently working? □□56-57

_____

3.1 What is your job in this department? □□58-59

Job Title _____

get a short description of the job

_____

_____

3.2 Do you ever do other jobs during your shift on a regular basis (almost every day)?

YES (1) NO (2) □60

If Yes, which jobs? _____ □61

_____ □62

3.3 Are you currently a seasonal, permanent or casual worker? □63

Give all options at once
Insert a cross (X) next to one answer only

a) Seasonal _____
b) Permanent _____
c) Casual _____

3.4 How much dust or mist/spray/steam would you say that this job produces: □64

Give all options at once
Insert a cross (X) next to one answer only

a) None _____
b) A little _____
c) An average amount _____
d) A lot _____

3.4.1 How far do you work from the source of the dust or mist/spray/steam? □65

Mention all options at once
Insert a cross (X) next to one answer only

a) Right next to the source _____
b) About 1-2 metres away _____
c) More than 2 metres away _____
d) Does not apply _____

3.5 Do you use any personal protective equipment on a **regular basis** (almost every day) while doing your job?

YES (1) NO (2) □66

If NO, skip to Question 4
If YES, continue with Question 3.5.1

3.5.1 Which of the following personal protective equipment do you use on a **regular** basis (almost every day)?

3.5.1.1 Goggles:	YES (1)	NO (2)	□67
3.5.1.2 Gloves:	YES (1)	NO (2)	□68
3.5.1.3 Mask:	YES (1)	NO (2)	□69
3.5.1.4 Aprons:	YES (1)	NO (2)	□70
3.5.1.5 Other:	_____		□71

If NO to all of the previous questions, skip to Question 4
If YES to any one of the above questions, continue with Question 3.5.2

3.5.2 How long have you been wearing the personal protective equipment on a **regular** basis (almost every day) while working?

3.5.2.1 Goggles:	_____ yrs	□□72-73
3.5.2.2 Gloves:	_____ yrs	□□74-75
3.5.2.3 Mask:	_____ yrs	□□76-77
3.5.2.4 Other:	_____ yrs	□□78-79

Previous jobs in present factory

4. Before doing this job at this factory, did you do a different job here? Card 5

YES (1) NO (2) □1

If NO, skip to question 5
If YES, continue with question 4.1

4.1 What other jobs did you do here?

Start with the first job and work forward, getting a one-line description of each job. If **casual** worker, denote each period of employment as a separate job. For continuous years of seasonal work consider as one job (provided no broken years service)

Job 1

4.1.1 Department _____ □□2-3
4.1.2 Job Title _____ □□4-5

get a short description of the job

_____

4.1.3 Seasonal/permanent/casual: _____ □6

4.1.4. How long did you work in this job? _____ years □□7-8
_____ months □□9-10

4.1.5 How much dust or mist/spray/steam would you say that this job produced: □11

Give all options at once
Insert a cross (X) next to one answer only

a) None _____
b) A little _____
c) An average amount _____
d) A lot _____

4.1.6 Which of the following personal protective equipment did you use on a regular (almost every day) basis while working?

4.1.6.1 Goggles:	YES (1)	NO (2)	□12
4.1.6.2 Gloves:	YES (1)	NO (2)	□13
4.1.6.3 Mask:	YES (1)	NO (2)	□14

Job 2

4.2.1 Department _____ □□15-16
4.2.2 Job Title _____ □□17-18

get a short description of the job

_____

4.2.3 Seasonal/permanent/casual: _____ □19

4.2.4. How long did you work in this job? _____ years □□20-21

_____ months □□22-23

4.2.5 How much dust or mist/spray/steam would you say that this job produced: □24

Give all options at once
Insert a cross (X) next to one answer only

a) None _____
b) A little _____
c) An average amount _____
d) A lot _____

4.2.6 Which of the following personal protective equipment did you use on a **regular** (almost every day) basis while working?

4.2.6.1 Goggles:	YES (1)	NO (2)	□25
4.2.6.2 Gloves:	YES (1)	NO (2)	□26
4.2.6.3 Mask:	YES (1)	NO (2)	□27

Job 3

4.3.1 Department _____ □□28-29
4.3.2 Job Title _____ □□30-31

get a short description of the job

_____

4.3.3 Seasonal/permanent/casual: _____ □32

4.3.4. How long did you work in this job? _____ years □□33-34

_____ months □□35-36

4.3.5 How much dust or mist/spray/steam would you say that this job produced: □37

Give all options at once
Insert a cross (X) next to one answer only

a) None _____
b) A little _____
c) An average amount _____
d) A lot _____

4.3.6 Which of the following personal protective equipment did you use on a **regular** (almost every day) basis while working?

4.3.6.1 Goggles:	YES (1)	NO (2)	□38
4.3.6.2 Gloves:	YES (1)	NO (2)	□39
4.3.6.3 Mask:	YES (1)	NO (2)	□40

Job 4

4.4.1 Department _____ □□41-42
4.4.2 Job Title _____ □□43-44

get a short description of the job

_____

4.4.3 Seasonal/permanent/casual: _____ □45

4.4.4. How long did you work in this job? _____ years □□46-47

_____ months □□48-49

4.4.5 How much dust or mist/spray/steam would you say that this job produced: □50

Give all options at once
Insert a cross (X) next to one answer only

a) None _____
b) A little _____
c) An average amount _____
d) A lot _____

4.4.6 Which of the following personal protective equipment did you use on a **regular** (almost every day) basis while working?

4.4.6.1 Goggles:	YES (1)	NO (2)	□51
4.4.6.2 Gloves:	YES (1)	NO (2)	□52
4.4.6.3 Mask:	YES (1)	NO (2)	□53

Reminder: Please do a general check to determine if the total number of years in each job adds up to the total number of years in this factory. Refer to company records if available.

Previous work in other seafood factories

5. Have you worked in any **other** seafood processing factories in the past two years?

YES (1) NO (2) □54

If NO, skip to question 6
If YES, continue with question 5.1

5.1 Why did you change jobs? □55

_____

_____

5.2 What is the total amount of time you have worked in seafood processing factories ever since you started working?

Years_____ Months _____ □□□□56-59

Previous work experience

6. Name all the previous factories that you have worked in, when not working in this factory or before coming to work in this factory:

Start with the most recent job and work backwards (including all other seafood processing factories and jobs done during the off-season)

Name of Company	**What did the company make?**	**Job Title (what did you do?)**	**Date start (Year)**	**Date stop (Year)**	**Total (yrs)**		
						60	61

THANK YOU FOR ANSWERING THE QUESTIONNAIRE

APPENDIX C: CONSENT FOR PATCH TESTING FROM ORIGINAL STUDY IN SEAFOOD PROCESSING WORKERS

UCT OCCUPATIONAL SEAFOOD ALLERGY STUDY IN SOUTH AFRICA – 2001

INFORMED CONSENT FOR SKIN PATCH TEST AND PRETEST QUESTIONS

Card 1

Record Number ☐☐☐ 1-3

Work number ☐☐☐☐☐☐ 4-9

Date ☐☐☐☐☐☐ 10-15

DAY MONTH YEAR

Screening Question

Are you taking steroid pills such as prednisone etc? YES (1) NO (2) ☐ 16

If the answer is YES, explain to the patient that the patch test will not be done.

We will be testing you with chemicals that are commonly found at home or at work, including the seafood processed by the factory. The purpose of this test is to identify those chemicals or seafood that you are allergic to or that may cause irritation to your skin. Once we know what you may be allergic to, we will advise you how to cope with the problem and how to avoid these chemicals or seafood. The skin patch test is not meant to be harmful to you but your skin problem can become worse during the test. We will be available to advise and assist you should this happen.

Any personal information obtained during the testing will remain confidential and will not be shared with anyone at your workplace.

Should you say "NO" to participating in this study, your work will not be affected in any way and it will not influence the nature of the treatment you may require.

While the test is being done or while you are being asked to keep the patch strips on your back, you are free to stop participating if you experience any difficulty or inconvenience.

_____ _____

Printed name of participant Signature, Mark, or Thumb Print

_____ _____

Witness's name (Print) Signature

APPENDIX D: PATCH TEST PRE-TEST INSTRUCTION FORM FROM ORIGINALSTUDY IN SEAFOOD PROCESSING WORKERS

UCT OCCUPATIONAL SEAFOOD ALLERGY STUDY IN SOUTH AFRICA – 2001

SKIN PATCH TEST PRE-TEST INSTRUCTION FORM

Study record number: _____

Name:

_____

Work number: _____

You are invited to come to the UCT Occupational Seafood Allergy Research study offices at the _____ for a skin patch test.

1. The patch test is done by putting chemicals that often cause skin problems on to your back using special patch strips.
2. After 48 hours (2 full days) we will ask you to remove these patch strips.
3. We will examine your back one day after the patch strips are removed.
4. Please do not allow your back to get wet while the patch strip is on your back.
5. Please do not scratch your back while the patch strip is on your back.
6. Any personal information obtained during this testing will be kept confidential and will not be shared with anyone at your workplace.
7. If you have any questions or concerns after the skin patch test strip is placed on your back contact Dr. Asmah Johar or Dr. Gail Todd at Groote Schuur Hospital in Cape Town at (021) 404-3376.

YOUR VISIT / APPOINTMENT is on:

Day	**Date**	**Time**	
_____	_____	_____	**Appointment for Patch Test**
_____	_____	_____	**Remove Patch at Home**
_____	_____	_____	**Return to Read Patch Test Results**

APPENDIX E: SKIN EXAMINATION DATA COLLECTION SHEET FROM ORIGINAL STUDY IN SEAFOOD PROCESSING WORKERS

OCCUPATIONAL SEAFOOD ALLERGY STUDY IN SOUTH AFRICA – 2001

SKIN EXAMINATION DATA COLLECTION SHEET

Card 1

Record Number: _____ 1-3

Factory: _____ 4

Name: _____

Work number: _____ 5-10

Date: _____ 11-16

DAY MONTH YEAR

FINAL IMPRESSION OF CLINICAL EXAMINATION

Please circle the relevant number if condition present

1. Hand eczema □17

1.1 a) Acute b) Chronic c) Acute on Chronic □18

1.2 a) Irritant b) Allergic c) Both d) Uncertain □19

2. Contact urticaria □20

2.1 Hands / forearm □21

2.2 Face / neck □22

2.3 Legs / knees □23

2.4 Generalised □24

3. Wet work sequelae □25

3.1 Paronychia □26

3.2 Early paronychia □27

3.3 Web space dermatitis □28

4. Trauma □29

4.1 Cuticular fracturing 2^{o} to minor trauma □30

4.2 Minor trauma (cuts, abrasions, lacerations) □31

4.3 Knuckle pads □32

4.4 Calluses □33

5. Infective □34

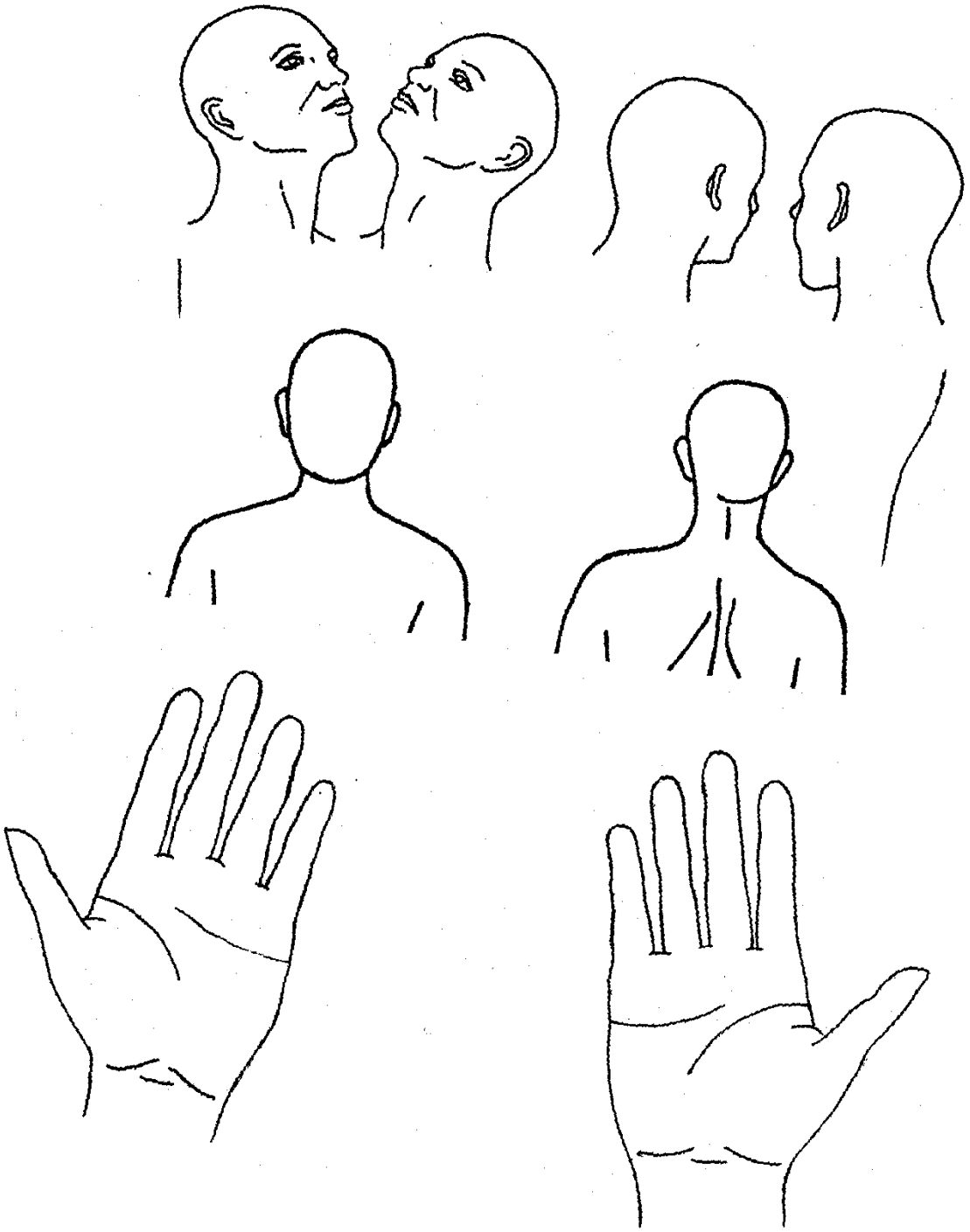
5.1 Warts □35
5.2 Infection of nails – Pseudomonas □36
5.3 Tinea unguium □37
5.4 Skin sepsis □38

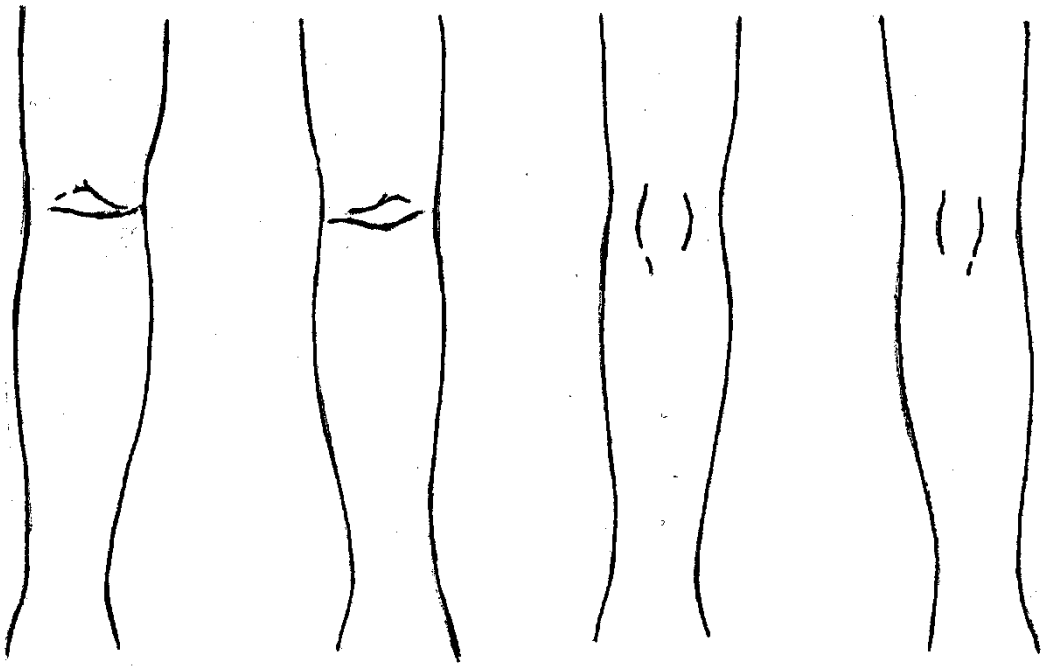
6. Other

6.1 Psoriasis □39
6.2 Raynaud's □40
6.3 Other: _____ □41

CLINICAL DIAGNOSES SCHEDULE

1.	Paronychia: Swelling of nail fold Loss if cuticle Dystrophic nail Erythema	**9.**	Irritant exposure: Thickened hyperkeratotic skin Increased skin markings Dryness Increased pigmentation
2.	Early paronychia: Mild swelling of nail folds Fractured / torn cuticles	**10.**	Minor trauma: Cuts/abrasions/lacerations Hyperkeratoses of finger tips with fissures Nail damage (split nails or onycholysis)
3.	Eczema: Erythema Vesicles	**11.**	Knuckle pads: Papules, plaques of thickened skin
4.	Cuticular fracturing 2^{o} to minor trauma	**12.**	Skin sepsis
5.	Warts	**13.**	Raynaud's
6.	Infection of nails - *Pseudomonas*	**14.**	Web space dermatitis (irritant and candida)
7.	Tinea unguium	**15.**	Calluses
8.	Psoriasis	**16.**	Others





VENTRAL DORSUM

APPENDIX F: PATCH TEST RESULTS DATA COLLECTION SHEET FROM ORIGINAL STUDY IN SEAFOOD PROCESSING WORKERS

OCCUPATIONAL SEAFOOD ALLERGY STUDY IN SOUTH AFRICA – 2001

SKIN PATCH TEST DATA COLLECTION SHEET

Card 1

Record Number: _____ 1-3

Factory: _____ 4

Name: _____

Work number: _____ 5-10

Date: _____ 11-16

DAY MONTH YEAR

No.	LIST OF COMPOUNDS	Reading at 72hrs	Allergic (1) IR (2)	
1	Potassium dichromate			17
2	4-phenylenediamine base			18
3	Thiuram mix			19
4	Neomycin sulphate			20
5	Cobalt chloride			21
6	Benzocaine			22
7	Nickel sulphate			23
8	Clioquinol(Chinoform,Vioform)			24
9	Colophony			25
10	Paraben mix			26
11	N-isopropyl-N-phenyl-4-Phenylenediamine (IPPD)			27
12	Wool alcohol			28
13	Mercapto mix			29
14	Epoxy resin			30
15	Balsam of Peru			31
16	4-tert-Butylphenol formaldehyde resin			32
17	Carbamix			33
18	Formaldehyde			34
19	Fragrance mix			35
20	Ethylene diamine HCL			36
21	Quaternium 15 (Dowicil 200)			37
22	4-Chloro-3-cresol (PCMC)			38
23	Imidazolidinylurea (Germall 115)			39
24	Turpentine peroxides			40
25	Napthyl mix			41
26	4-Chloro-3,5-xylenol (PCMX)(Dettol)			42

27	Lanolin			43
28	Thiomerosal			44
29	Propylene glycol			45
30	Chlorhexidine digluconate			46
31	Cl+Me-isothiazolinone(Kathon CG)			47
32	Mercaptobenzothiazole(MBT)			48

No.	LIST OF COMPOUNDS	Reading at 72hrs	Allergic (1) IR (2)	
33	Sesquiterpene lactone mix			49
34	Cetyl stearyl alcohol			50
35	Methyldibromo glutaronitrile and phenoxyethanol (Euxyl K400)			51
36	Musk mix			52
37	Toluenesulphonamide Formaldehyde resin			53
38	Taraxacum officinale (dandelion)			54
39	Woodmix(pie/spruce/birch/teak)			55
40	Tixocortol-21-pivalate			56
41	Budesonide			57

No.	SEAFOOD AND ASSOCIATED AGENTS	72hrs	Allergic (1) IR (2)	
42	Fishmeal			58
43	Pilchard (gut)			59
44	Pilchard (salted)			60
45	Pilchard (canned)			61
46	Pilchard (raw)			62
47	Pilchard (cooked)			63
48	Redeye (raw)			64
49	Anchovy (raw)			65
50	Maasbanker (raw)			66
51	Mackerel (raw)			67
52	West Coast Rock Lobster (raw)			68
53	Tomato paste			69
54	Spice oil			70
55	Stysel (starch)			71
56	Guargum			72
57	Pepper			73

1. General comment: (e.g. reason test not done/ stopped, other reactions) 74

_____

75

2. FIELDWORKER INITIALS: _____

CODING SYSTEM FOR SKIN PRICK TEST READING AT 72 HRS

?	Doubtful
+	Weakly positive (nonvesicular) erythema, infiltrated
++	Strongly positive (vesicular)
+++	Extremely positive (bullous)
-	Negative
IR	Irritant Reaction

APPENDIX G: EXTRA TABLES

Table 1. Logistic regression models for significant host, employment and exposure factors (unadjusted odds ratios) associated with positive patch tests in seafood processing workers along the west coast of South Africa

Predictor variables	Positive patch tests (Prevalence odds ratio - POR, confidence interval - CI)			
	Fish	Metals	Rubber additives	Disinfectants and Preservatives
Demographic characteristics				
Age	1.00 (0.94-1.06)	0.96 (0.93-0.99) ††	1.01 (0.97-1.05)	1.03 (0.99-1.06)
Female	0.65 (0.18-2.32)	4.96 (2.54-9.72)††	0.92 (0.39-2.17)	0.50 (0.24-1.05)†
Employment and exposure history				
Factory A vs. Factory B	0.15 (0.18-1.18)†	0.69(0.39-1.21)	1.21 (0.52-2.83)	1.38 (0.66-2.89)
Employment duration in current job	0.98 (0.89-1.09)	0.98 (0.94-1.02)	1.00 (0.95-1.07)	1.00 (0.95-1.06)
Seasonal vs. permanent work	0.74 (0.21-2.63)	2.62 (1.45-4.72) ††	1.94 (0.77-4.87)	0.50 (0.24-1.06) †
Type of work				
"Wet fish" exposure (vs. low exposure)	0.80 (0.19-3.46)	1.38 (0.74-2.59)	0.63 (0.24-1.67)	0.56 (0.24-1.27)
"Dry fish" exposure (vs. low exposure)	1.24 (0.20-7.76)	0.37 (0.13-1.09)†	1.17 (0.35-3.88)	0.90 (0.31-2.64)
Glove usage*				
Glove usage at all	1.58 (0.43-5.75)	1.33 (0.77-2.29)	0.86 (0.37-2.01)	1.28 (0.61-2.69)
Regular glove usage	0.75 (0.19-2.97)	1.58 (0.90-2.77)	1.07 (0.45-2.55)	1.18 (0.55-2.50)
Inadequate gloves (wet hands)	1.17 (0.13-10.92)	1.09 (0.43-2.74)	1.51 (0.45-5.07)	2.12 (0.73-6.12)
Intact gloves (dry hands)	1.70 (0.44-6.52)	1.40 (0.78-2.50)	0.69 (0.26-1.81)	1.07 (0.48-2.42)
Change gloves annually	1.22 (0.13-11.39)	0.47 (0.15-1.46)	0.72 (0.15-3.42)	2.23 (0.77-6.78)
Change gloves monthly	1.89 (0.33-10.78)	1.40 (0.62-3.16)	2.24 (0.81-6.16)	1.57 (0.55-4.43)
Change gloves at least weekly	1.57 (0.34-7.24)	1.81 (0.94-3.46)	0.29 (0.06-1.34)	0.80 (0.29-2.18)
Washing gloves at the end of a shift	2.34 (0.64-8.53)	1.84 (1.06 – 3.20) ††	1.31 (0.56-3.06)	0.84 (0.39-1.80)
Washing gloves with disinfectant	2.52 (0.69-9.20)	2.06 (1.17-3.59) ††	1.42 (0.61-3.31)	0.78 (0.36-1.70)
Handwashing > 6 x per day	1.04 (0.21-5.05)	3.45 (1.47-8.10) ††	3.10 (0.70-13.64)	0.54 (0.24-1.23)
Allergy history				
Atopy (SPT)	1.00 (0.28-3.66)	0.97 (0.56-1.70)	1.58 (0.68-3.68)	0.43 (0.19-1.01) †
Type I sensitisation to fish (SPT)	-	0.81 (0.28-2.35)	1.13 (0.24-5.21)	0.76 (0.17-3.48)
History of childhood eczema	-	1.34 (0.47-3.88)	0.95 (0.21-4.38)	1.40 (0.31-6.38)
Family history of eczema	0.73 (0.09 – 5.97)	1.43 (0.66-3.13)	1.89 (0.65-5.50)	0.90 (0.29-2.77)
Seafood intake				
Fish intake (Eicosapentaenoic acid levels – EPA (Weight % µg/ml; 20:5n-3))	0.98 (0.63-1.52)	0.79 (0.64-0.99) ††	1.04 (0.79-1.37)	0.89 (0.68-1.18)

POR: prevalence odds ratio; CI: Confidence interval; Blank cells represent undefined odds ratios. *all compared to no glove use.

"Wet fish" exposure: jetty and canning departments; "Dry fish" exposure: fishmeal manufacturing and bagging departments; Low fish exposure: administration, boiler room, labeling, workshop, cannery pickups, cannery stores and laundry departments

† 0.10> p > 0.05; ††p < 0.05

Table 2. Logistic regression models for significant host, employment and exposure factors (unadjusted odds ratios) associated with possible allergic contact dermatitis (symptoms and a positive patch test) in seafood processing workers along the west coast of South Africa

	Possible allergic contact dermatitis related to: (Prevalence odds ratio - POR, confidence interval - CI)			
Predictor variables	Fish	Metals	Rubber additives	Disinfectants and preservatives
Demographic characteristics				
Age	1.03 (0.95-1.10)	0.99 (0.96-1.03)	1.01 (0.96-1.06)	1.01 (0.97-1.06)
Female	0.65 (0.13-3.31)	2.63 (1.14-6.06)††	0.84 (0.30-2.34)	0.90 (0.35-2.33)
Employment and exposure history				
Factory A vs. Factory B	-	0.66 (0.32-1.40)	1.45 (0.52-3.99)	1.03 (0.40-2.66)
Employment duration in current job	1.01 (0.89-1.13)	0.99 (0.94-1.05)	0.99 (0.92-1.08)	1.01 (0.95-1.08)
Seasonal vs. permanent work	1.51 (0.27-8.39)	1.38 (0.66-2.88)	1.70 (0.57-5.05)	0.41 (0.15-1.07)†
Type of work				
"Wet fish" exposure (vs. low exposure)	0.71 (0.12-4.33)	1.11 (0.49-2.49)	0.74 (0.23-2.37)	0.38 (0.15-1.01)†
"Dry fish" exposure (vs. low exposure)	0.91 (0.08-10.44)	0.51 (0.13-1.98)	1.11 (0.25-4.93)	-
Glove usage*				
Glove usage at all	2.09 (0.37-11.61)	1.03 (0.51-2.09)	1.34 (0.48-3.73)	0.92 (0.36-2.34)
Regular glove usage	0.88 (0.16-4.92)	1.31 (0.64-2.72)	1.41 (0.51-3.93)	1.04 (0.39-2.74)
Inadequate gloves (wet hands)	-	0.75 (0.20-2.77)	2.14 (0.52-8.91)	0.93 (0.19-4.54)
Intact gloves (dry hands)	2.70 (0.48-15.05)	1.11 (0.53-2.34)	1.13 (0.37-3.49)	0.91 (0.33-2.49)
Change gloves annually	2.5 (0.22-28.69)	0.50 (0.11-2.32)	1.43 (0.28-7.32)	0.47 (0.06-3.82)
Change gloves monthly	1.88 (0.16-21.34)	1.28 (0.46-3.55)	3.65 (1.14-11.74)††	1.54 (0.45-5.28)
Change gloves at least weekly	2.03 (0.28-14.80)	1.13 (0.49-2.63)	0.27 (0.03-2.28)	0.79 (0.24-2.62)
Washing gloves at the end of a shift	3.05 (0.55-17.01)	1.39 (0.69-2.85)	2.00 (0.72-5.57)	0.86 (0.32-2.26)
Washing gloves with disinfectant	3.28 (0.59-18.28)	1.52 (0.74-3.10)	2.16 (0.76-6.01)	0.92 (0.35-2.43)
Handwashing > 6 x per day	1.32 (0.15-11.54)	5.20 (1.20-22.43)††	-	0.98 (0.31-3.09)
Allergy history				
Atopy (SPT)	0.74 (0.13-4.15)	1.24 (0.61-2.53)	2.67 (0.94-7.62)†	0.51 (0.18-1.47)
Type I sensitisation to fish (SPT)	-	2.19 (0.74-6.51)	1.74 (0.36-8.29)	0.63 (0.08-4.97)
History of childhood eczema	-	0.93 (0.26-3.37)	0.57 (0.12-2.73)	1.59 (0.20-12.59)
Family history of eczema	1.26 (0.14-11.16)	2.13 (0.87-5.21)†	1.49 (0.40-5.55)	1.77 (0.55-5.69)
Seafood intake				
Fish intake (Eicosapentaenoic acid levels – EPA (Weight % µg/ml; 20:5n-3))	0.67 (0.29-1.57)	0.84 (0.64-1.12)	1.05 (0.75-1.46)	0.72(0.46-1.13)

POR: prevalence odds ratio; CI: Confidence interval; Blank cells represent undefined odds ratios. *all compared to no glove use.

"Wet fish" exposure: jetty and canning departments; "Dry fish" exposure: fishmeal manufacturing and bagging departments; Low fish exposure: administration, boiler room, labeling, workshop, cannery pickups, cannery stores and laundry departments

† $0.10 > p > 0.05$; †† $p < 0.05$

Table 3. Logistic regression models for significant host, employment and exposure factors (unadjusted odds ratios) associated with probable allergic contact dermatitis (eczema on clinical examination and a positive patch test) in seafood processing workers along the west coast of South Africa

Predictor variables	Probable allergic contact dermatitis related to: (Prevalence odds ratio - POR, confidence interval - CI)			
	Fish	Metals	Rubber additives	Disinfectants and Preservatives
Demographic characteristics				
Age	1.03 (0.96-1.11)	0.99 (0.96-1.02)	1.04 (1.00-1.09)†	1.04 (1.00-1.09)††
Female	0.65 (0.13-3.31)	3.63 (1.61-8.22)††	0.84 (0.30-2.34)	0.41 (0.16-1.04)†
Employment and exposure history				
Factory A vs. Factory B	0.27 (0.03-2.39)	0.97 (0.50-1.89)	2.50 (0.88-7.12)†	3.66 (1.36-9.90)††
Employment duration in current job	1.01 (0.90-1.13)	1.01 (0.97-1.06)	1.04 (0.97-1.10)	1.01 (0.94-1.08)
Seasonal vs. permanent work	0.75 (0.15-3.75)	1.77 (0.88-3.53)	1.26 (0.44-3.59)	0.47 (0.18-1.19)
Type of work				
"Wet fish" exposure (vs. low exposure)	1.43 (0.15-14.05)	1.82 (0.81-4.08)	0.75 (0.23-2.37)	0.58 (0.21-1.64)
"Dry fish" exposure (vs. low exposure)	3.82 (0.33-43.69)	0.79 (0.23-2.78)	1.11 (0.25-4.93)	1.05 (0.29-3.87)
Glove usage*				
Glove usage at all	2.09 (0.37-11.61)	2.30 (1.16-4.55)††	1.34 (0.48-3.73)	2.01 (0.77-5.24)
Regular glove usage	0.88 (0.16-4.92)	2.55 (1.31-4.96) ††	1.41 (0.51-3.93)	1.20 (0.47-3.06)
Inadequate gloves (wet hands)	2.40 (0.21 -27.50)	2.14 (0.74-6.18)	1.37 (0.27-7.00)	2.99 (0.81-11.07)
Intact gloves (dry hands)	2.00 (0.33-12.22)	2.34 (1.14-4.80) ††	1.34 (0.45-3.95)	1.76 (0.63-4.92)
Change gloves annually	2.50 (0.22-28.69)	1.36 (0.41-4.50)	1.43 (0.28-7.32)	4.11 (1.19-14.22)††
Change gloves monthly	1.88 (0.16-21.33)	2.28 (0.87-5.97)†	4.42 (1.43-13.70)††	3.65 (1.14-11.74)††
Change gloves at least weekly	2.03 (0.28-14.80)	2.76 (1.27-6.00)††	-	0.56 (0.11-2.77)
Washing gloves at the end of a shift	3.05 (0.55-17.01)	2.56 (1.31-5.00) ††	2.00 (0.72-5.57)	0.99 (0.39-2.52)
Washing gloves with disinfectant	3.28 (0.59-18.28)	2.80 (1.44-5.47) ††	2.16 (0.78-6.01)	1.07 (0.42-2.72)
Handwashing > 6 x per day	1.32 (0.15-11.54)	2.31 (0.86-6.21) †	1.90 (0.42-8.64)	0.58 (0.21-1.60)
Allergy history				
Atopy (SPT)	3.09 (0.55-17.20)	1.47 (0.76-2.84)	2.02 (0.73-5.64)	0.79 (0.30-2.06)
Type I sensitisation to fish (SPT)	-	1.21 (0.38-3.83)	0.76 (0.10-6.11)	1.33 (0.28-6.20)
History of childhood eczema	-	0.82 (0.26-2.62)	-	1.68 (0.21-13.32)
Family history of eczema	-	1.28 (0.52-3.17)	2.24 (0.68-7.42)	1.65 (0.51-5.27)
Seafood intake				
Fish intake (Eicosapentaenoic acid levels – EPA (Weight % µg/ml; 20:5n-3))	1.19 (0.75-1.88)	0.87 (0.67-1.12)	1.18 (0.88-1.59)	0.95 (0.68-1.32)

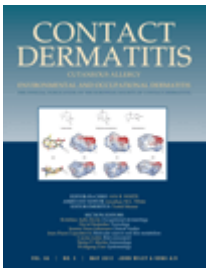
POR: prevalence odds ratio; CI: Confidence interval; Blank cells represent undefined odds ratios. *all compared to no glove use.

"Wet fish" exposure: jetty and canning departments; "Dry fish" exposure: fishmeal manufacturing and bagging departments; Low fish exposure: administration, boiler room, labeling, workshop, cannery pickups, cannery stores and laundry departments

† $0.10 > p > 0.05$; †† $p < 0.05$

APPENDIX H: GUIDELINES FOR AUTHORS FOR CHOSEN JOURNAL (CONTACT DERMATITIS)

Contact Dermatitis



Edited By: Ian R. White

Impact Factor: 3.672

ISI Journal Citation Reports © Ranking: 2010: 4/21 (Allergy); 8/54 (Dermatology)

Online ISSN: 1600-0536

Original papers and review articles should, in most cases, not exceed 8 printed pages (approx. 700 words per printed page). Additional pages must be paid for by the authors at a current rate of GBP140 per page (does not apply to review articles).

Contact Dermatitis accepts original articles, review articles, 'Contact Points' and letters to the editor.

MANUSCRIPTS

For all submissions:

Title page containing:

(1) Concise informative title;

(2) Name(s) of author(s). Family names should be underlined;

(3) Name of department(s)/institution(s) to which the work is attributed;

(4) Name and address of author for correspondence about the manuscript; an email address must be provided;

(5) Disclosures: failure to disclose potential conflicts of interests will result in rejection of the manuscript.

a. Statement of all funding that supported the work must be clearly indicated;

b. All conflicts of interests must be given [Each author is responsible for disclosing all financial and personal relationships that might be perceived by others as biasing their work. Authors MUST state whether potential conflicts exist or not. This will be recorded in the publication];

(6) Author contributions.

a. Each author should have participated sufficiently to take public responsibility for appropriate portions of the work and each author's contributions clearly stated. All other individuals should be named in the Acknowledgements (see below);

(7) If the title exceeds 40 characters (letters and spaces) a running head of no more than 40 characters.

For original and review articles:

Summary and key words - The summary should not exceed 200 words. **Original articles** should have a structured abstract, comprising the five headings:

1. Background,
2. Objectives,
3. Patients/Materials/Methods,
4. Results,
5. Conclusions.

Below the abstract, provide 3-8 **key words** or phrases.

Introduction - Present the background briefly, but do not review the subject extensively. Give only pertinent references. State the specific questions you want to answer.

Patients and Methods/Materials and Methods - Describe selection of patients or experimental animals, including controls. Do not use patients' names or hospital numbers.

Identify patch test materials (supplier, dilution, vehicle), chambers used, application period and days of readings (use D2, D4 not 48, 96hrs etc).

Identify methods, apparatus (manufacturer's name and address) and procedures in sufficient detail to allow other workers to reproduce the results. Provide references and brief descriptions of methods that have been published. When using new methods, evaluate their advantages and limitations.

Identify drugs, chemicals and consumer products (including cosmetics unless a specific reason for non-disclosure is given) including generic name, dosage and route(s) of administration.

Indicate whether the procedures were approved by a properly constituted Ethics Committee in your country, or in accordance with the Helsinki Declaration of 1975, and later revisions. Drug trials must be logged on a public register.

Results - Present results in logical sequence in tables and illustrations. In the text, explain, emphasise or summarise the most important observations. Units of measurement must be expressed in accordance with the Système International d'Unités (SI Units).

When appropriate, data should be statistically evaluated and the appropriateness of the statistical methodology explained. Rates should include confidence intervals. Authors are encouraged to seek advice from a statistician.

Discussion - Do not repeat in detail data given in the Results section. Emphasise the new and important aspects of the study. Relate the observations to other relevant studies. On the basis of your findings (and those of others), discuss possible implications/conclusions. When stating a new hypothesis, clearly identify it as such.

Acknowledgements - Acknowledge only persons who have made substantive contributions to the study. Authors are responsible for obtaining written permission from everyone acknowledged by name because readers may infer their endorsement of the data and conclusions.

Tables - Tables should be numbered consecutively with Arabic numerals. Type each table on a separate sheet, with titles and footnotes making them self-explanatory.

Figures (illustrations, chemical structures and photographs) - should clarify the text and their numbers be kept to a minimum. Details must be sufficient to retain their clarity after reduction of size. Colour illustrations will be accepted free of charge.

Chemical structures should be produced with a chemical structure drawing program (e.g., ChemSketch) and conform to the American Chemical Society settings.

Photographs - When there is any chance that a person may be identified from a picture, legend or other accompanying text, Contact Dermatitis requires the individual's signed consent to publication. Editors may choose to publish the photograph on the front page of the journal. Pictures with black bands across the eyes are discouraged.

Legends - Figure legends should allow interpretation of the figures without reference to the main text; they should appear according to their order of appearance in the text.

References - Number references consecutively in the order in which they are first mentioned in the text. Identify references in text, tables and legends by Arabic numerals (in parentheses). All authors cited, and only these, must be listed at the end of the paper. References should follow the following style examples:

1. Giwercman C, Lerbaek A, Bisgaard H, Menné T. Classification of atopic hand eczema and the filaggrin mutations. Contact Dermatitis 2008: 59: 257-260.
2. Agner T, Menné T. Individual predisposition to irritant and allergic contact dermatitis. In: Contact Dermatitis, 4th edition, Frosch P J, Menné T, Lepottevin J-P Eds): Berlin Heidelberg, Springer-Verlag, 2006: 127-134.
3. European Commission, Scientific Committee on Consumer Products. Opinion on Oak moss /Tree moss (sensitisaton only), 2008. Available at: http://ec.europa.eu/health/ph_risk/committees/04_sccp/docs/sccp_o_131.pdf (last accessed 01 December 2008).

Ensure that accents are included on names (e.g. Søsted H. Menné T. not Sosted H. Menne T.

Other Requirements

Abbreviations and symbols - All units must be metric.

Unfamiliar abbreviations must be defined when first used.

Avoid acronyms and excessive use of unnecessary abbreviations (e.g., atopic dermatitis not AD, hand eczema not HE, allergic contact dermatitis not ACD).

Do not use Roman numerals in the text.

In decimal fractions a decimal point, and not a comma, must be used. The minus sign is shown as --.

Use a space between digits to separate thousands (e.g. million: 1 000 000)

Nomenclature - All units must be defined.

Units of measurement must be SI Units.

Chemical names and botanical extracts should be INCI, if available (http://ec.europa.eu/enterprise/cosmetics/html/cosm_inci_index.htm), and in preference to other common names; CAS numbers should be provided, if appropriate (e.g., 2-bromo-2-nitropropane-1,3-diol (bronopol; CAS 52-51-7)) (http://ec.europa.eu/enterprise/cosmetics/inci/inci_2006.pdf).

For drugs, the International Non-proprietary Name (INN) should be used (http://www.who.int/medicines/services/inn/en/).

Publication

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APPENDIX I: ETHICS APPROVAL FROM THE UNIVERSITY OF CAPE TOWN HUMAN RESEARCH ETHICS COMMITTEE

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences
Human Research Ethics Committee
Room E52-24 Groote Schuur Hospital Old Main Building
Observatory 7925
Ms S Ariefdien - Tel: [021]4066492 • Fax: [021]4066411
email: sumayah.ariefdien@uct.ac.za

16 March 2012

HREC REF: 121/2012

Dr A Burdzik,
Occupational Medicine
Department of Public Health & Family Medicine
4th Floor
Falmouth Building

CC. Prof M Jeebhay

Dear Dr Burdzik,

PROJECT TITLE: PREDICTORS OF OCCUPATIONAL SKIN DISEASE IN SEAFOOD PROCESSING WORKERS IN THE WESTERN CAPE: A CROSS-SECTIONAL STUDY WITH CASE-CONTROL ANALYSIS

Thank you for submitting your new study to the Faculty of Health Sciences Human Research Ethics Committee

It is a pleasure to inform you that the Ethics Committee has formally approved the above-mentioned study.

Approval is granted until 28 March 2013

Please submit an annual progress report (FHS016) if the research continues beyond the expiry date. Please submit a brief summary of findings if you complete the study within the approval period so that we can close our file (FHS010).

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the HREC. REF in all your correspondence.

Yours sincerely

PROFESSOR MARC BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS

Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Convention on Harmonisation Good Clinical Practice (ICH GCP) and Declaration of Helsinki guidelines.

The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.