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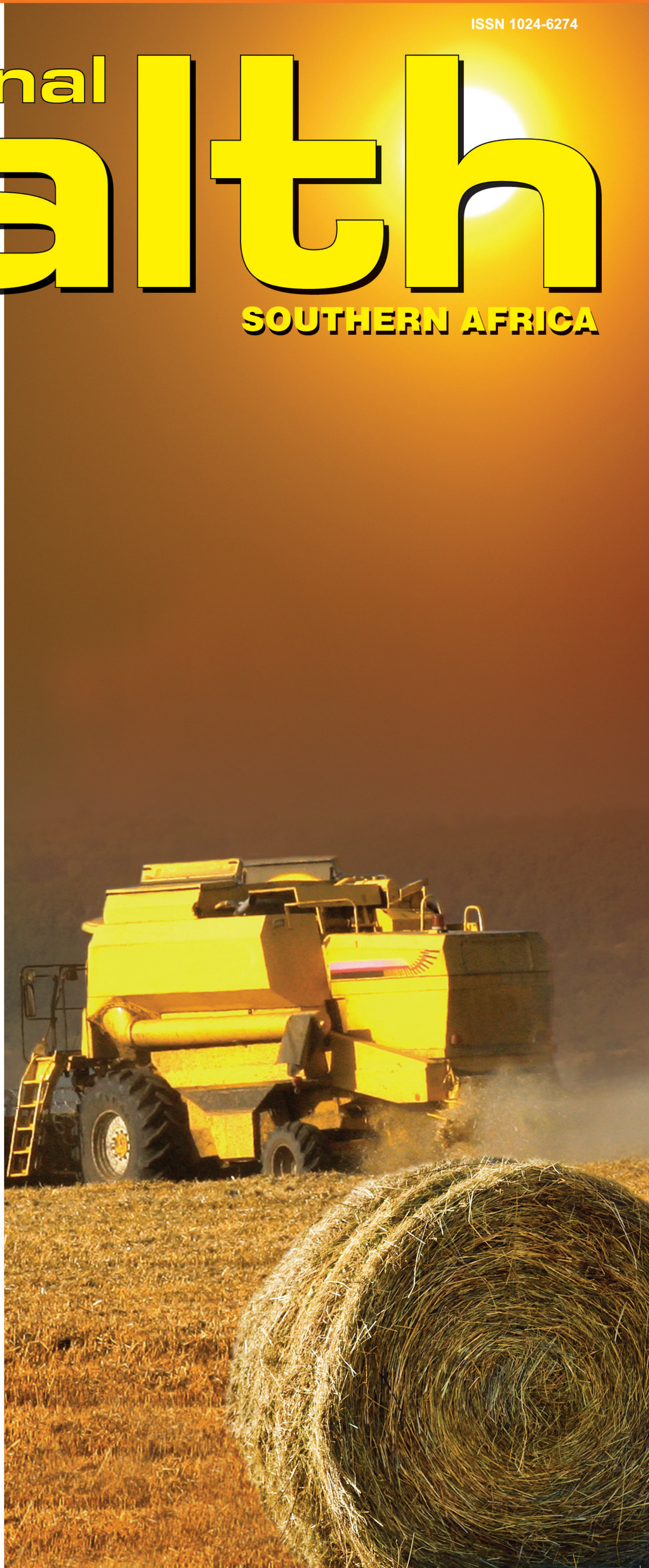

Occupational allergy and asthma in the seafood industry – emerging issues

Silica exposure in South African farming

Seasonal trends in potential sunburn risk among outdoor workers in South Africa using monitored ambient solar UV radiation levels

Workers' compensation, minimum wages, and moral hazard scope: stylized considerations on a South African case

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This journal is on the list of Approved South African Journals, and authors qualify for a subsidy for their affiliated tertiary institutions.

From the Editor . . .

Linda Grainger, Editor

In this the last issue for the year, four interesting and informative articles dealing with a variety of topics are featured. Although we had called for papers on our planned subtheme of infections in the occupational context, none were received. Instead, we have rescheduled it for May/June 2012. Please check the call for papers below, and send us your articles.

The growing global consumption of seafood has given rise to an increasing incidence of seafood-related allergies amongst workers involved in seafood processing. In an article based upon his inaugural address, Jeebhay provides an overview of occupational allergies and asthma in these workers. He describes the changing nature of the fishing and seafood processing industry in the midst of ecological degradation and globalisation, and gives insights into the allergens that have been identified and other pathophysiological mechanisms that have been implicated in airway inflammation. He also explains how more refined exposure assessment studies have enabled detailed characterisation of allergen exposure response relationships.

The second paper, by Swanepoel and Rees, presents the results of a novel research project to investigate silica exposure in South African farming. Surprisingly little information exists on exposure to respirable silica in the agricultural industry, so given the large number of workers involved in farming and potentially exposed this is an important study. It summarises recent data from a comprehensive exposure assessment on three farms and discusses occupational health implications and research needs.

In the third paper, Wright and Ncongwane address the issue of sunburn risk among outdoor workers in South Africa. This is the first published research study that we are aware of that has estimated national potential sunburn risk among outdoor workers using monitored ambient solar UV radiation levels. Since many workers are engaged in outdoor work, it has wide relevance and is an important line of enquiry. It also highlights the need for exposure standards and increasing awareness of the need for sun-protective practices.

Garzarelli, Keeton, Schöer and Sitoe present an interesting study from the perspective of workers' compensation, which highlights how for some South African sectors the simultaneous provision of a minimum wage and a permanent disablement coverage increases moral hazard scope. Their arguments are sure to stimulate thought and debate.

I had the pleasure of attending Mohamed Jeebhay's inaugural address earlier this year. His appointment as a full professor in the School of Public Health and Family Medicine, Faculty of Health Sciences, University of Cape Town, was the culmination of many years of hard work and a passion for protecting the health of workers. He is currently Associate Director of Occupational Health in the Centre for Occupational and Environmental Health Research (a unit within the school), leading the research programmes related to workplace allergens and asthma and is also active in developing occupational and environmental health training and research capacity in southern Africa, through various programmes supported by the Fogarty International Centre through the University of Michigan (USA). He, along with other colleagues drawn from a variety of disciplines, is also involved in the large postgraduate programme offered by the department.

I would like to thank all our readers and contributors for their support over the past year. Without you, there would be no journal! May you and your loved ones have a restful and peaceful break so that you can return to work, refreshed and energised for 2012.

Pictured from left: Professor Marian Jacobs (Dean of the Faculty of Health Sciences), Professor Mohamed Jeebhay, Professor Thandabantu Nhlapo (Deputy Vice-Chancellor of UCT), Professor Leslie London (Director of the School of Public Health and Family Medicine)

Call for papers for 2012

We are particularly keen to publish papers that present effective interventions relating to the disciplines of occupational hygiene, medicine and nursing. In addition to publishing papers on any relevant topic, we have planned subthemes for five issues as shown below. Please ensure that we receive your submissions no later than the dates indicated alongside the topic.

Issue	Theme	Submission date
March/April 2012	Shift work	16 January 2012
May/June 2012	Infections and occupational health	29 March 2012
July/August 2012	Ethics and occupational health	27 May 2012
September/October 2012	Reproductive health and occupational health	14 July 2012
November/December 2012	Chronic diseases and occupational health	13 September 2012

We therefore invite you to submit original research, review, case study, or back to basics papers for consideration for publication. The authors' guidelines are available on the website, www.occhealth.co.za. All papers are peer-reviewed before publication. Should you be interested in submitting a paper, please indicate this by e-mailing the Editor at grainger@telkomsa.net. Please provide some basic details about what you envisage would be included in the paper.

Occupational allergy and asthma in the seafood industry – emerging issues

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ABSTRACT

Increased demand for seafood and its functional by-products has been associated with a concomitant rise in fishing and aquaculture activities. This increased consumption and processing of seafood is associated with more frequent allergic health problems among seafood processors. This overview of occupational allergies and asthma in seafood exposed workers illustrates the changing nature of the fishing and seafood processing industry in the midst of ecological degradation and globalisation. It provides detailed insights into the major and minor allergens that have been identified and other pathophysiological mechanisms that have been implicated in airway inflammation. More refined exposure assessment studies in recent times have enabled detailed characterisation of allergen exposure response relationships, which confirm the increased risk associated with elevated allergen exposures. Directions for future research and preventive strategies are outlined.

Key words: occupational allergy, seafood industry, rhinitis, asthma, dermatitis

INTRODUCTION

Worldwide, food allergies and anaphylaxis are increasing at a faster rate than any other allergic disorder, affecting up to 13% of adults and 12% of children.[1] The World Allergy Organization (WAO) estimates that allergic diseases affect at least 30–40% of the world's population, and are increasingly affecting young people and those in the developing world as the diseases reach their plateau in the industrialised world.[2] Most allergic reactions to foods can be attributed to a few food groups including seafood, which form important sources of protein for populations from developing countries.

In industrialised countries, increased demand and consumption for seafood and its functional by-products has been associated with a concomitant rise in fishing and aquaculture activities. Aside from the potential depletion of marine stocks resulting from these activities, recent studies suggest that this increased consumption and processing of seafood has resulted in more frequent reports of allergic health problems among consumers as well as processors of seafood.[3] This overview provides an update on the state of knowledge and understanding of occupational allergies and asthma in seafood exposed workers with a particular focus on the changing nature of the fishing and seafood processing industry, insights into the pathophysiological mechanisms that underlie the disease and the allergens implicated. It also identifies the risk factors that could be earmarked for preventive strategies. Emerging issues and directions for future research are outlined.

A MEDLINE search was undertaken for studies on occupational seafood allergy during the period 2000-2010 following a similar review published in 2001.[3]

FISHING AND THE SEAFOOD PROCESSING INDUSTRY

Recent data from the Food and Agriculture Organization indicates that in 2008, fishery capture and aquaculture production activities produced 142 million tonnes of fish.[4] While fish capture remained around 90 million tonnes since 2001, aquaculture production has continued to increase at an average annual growth rate of 6% p.a. Aquaculture currently constitutes just under 50% of the total global fish supply. It is estimated that 80% of seafood harvests are used for direct human consumption and the remainder for non-food sources such as fishmeal and fish oil (Figure 1).

With this increase in harvesting in the last three decades, employment in the primary fisheries sector has grown faster than the world's population and employment in traditional agriculture. The number of fishers and fish farmers has been growing at an average rate of around 4% per year.[4] In 2008, this sector provided direct employment and revenue for 45 million people worldwide, 98% of whom are from developing countries, especially from the Asian continent. While developing countries increase their share of fishery exports with increasing globalisation, the number of fishers in industrialised countries has declined primarily due to ageing of the workforce.

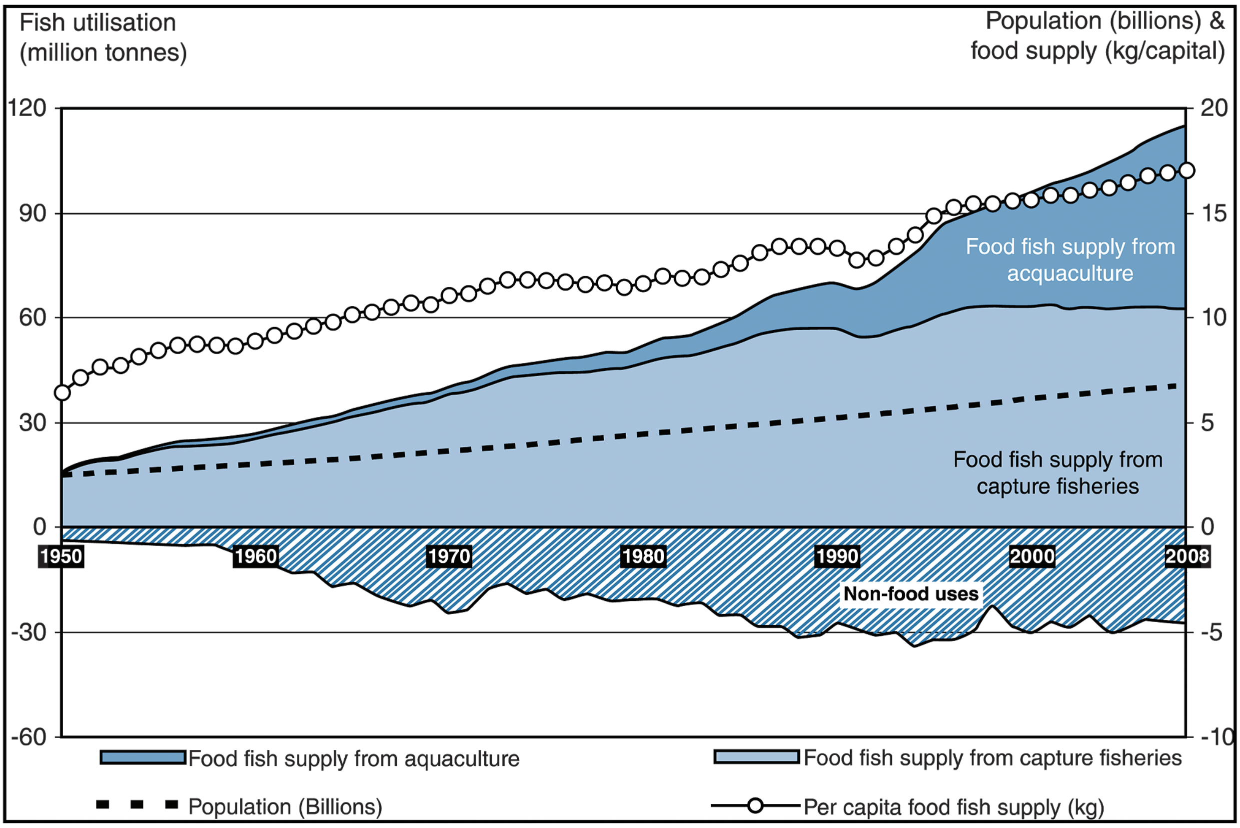

Figure 1. World fish utilisation and supply[4]

The International Labour Organization (ILO) estimates that approximately 50% of the fishing population work aboard fishing trawlers, 30% in aquaculture production (marine and freshwater), and 20% work inland as capture fishers or in other land-based activities such as processing.[5] A characteristic feature of employment in the fishing industry is the seasonal nature of the work due to seasonal weather variations and the migratory nature of marine species. As a result, the number of full-time fishers has declined while the number of part-time fishers has grown quite rapidly in Asian countries. In many countries, labour in the fishing industry is divided along gender lines with men almost exclusively involved in harvesting and some processing of the seafood at sea and women doing most of the processing ashore and some inland capture.[6]

THE SEAFOOD MATRIX

The three most important seafood groupings of marine species frequently consumed and processed are Arthropods, Molluscs, and Pisces (sub-phylum Chordata).

It is estimated that in most developing countries at least 70–80% of seafood is eaten fresh.[7] However, based on trends over the last decade in China, this proportion of fresh seafood eaten is on the decline towards trends seen in industrialised countries as the marine seafood stocks are decreasing and aquaculture and processing activities take

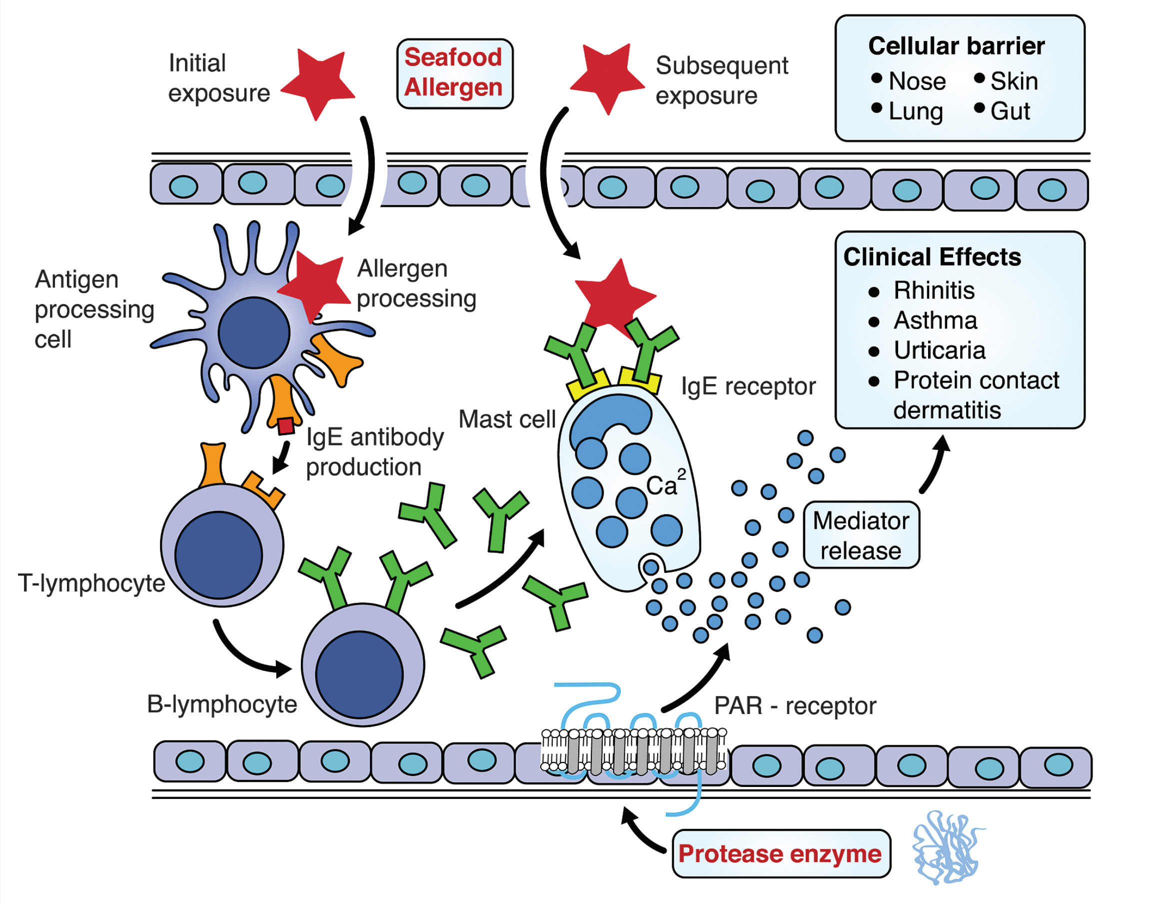

Figure 2. Mechanisms of allergic and non-allergic inflammation in seafood exposed individuals (Modified and adapted)[14]

hold. The processed aquatic products are mainly filleted frozen products, as well as dried, salted, canned products, surimi products, additives and fishmeal.

Studies in crab processing plants demonstrate that the aerosols generated in these factories contain mainly crab exoskeleton containing chitin, meat primarily muscle protein, gills and kanimiso/internal organs.[3] Fish juice produced in fish filleting and canning plants has various biogenic amines, degradation compounds associated with postmortem changes, digestive enzymes, skin slime/mucin, collagen and fish muscle proteins.

Aside from the actual seafood, various non-seafood contaminants and additives have been detected in the seafood matrix. These include parasites (*Anisakis simplex*), protochordates (*Hoya* or sea-squirt), red soft-coral, algae (dinoflagellates – *Hematodinium*), bacteria (Vibrio), viruses (hepatitis A), marine or bacterial toxins (saxitoxins, scombroid toxin, histamine, endotoxin), gases produced

Table 1. Seafood and associated agents causing occupational allergy and asthma in seafood workers

Phylum	Class	Family species (common name)
Arthropoda	Crustacea	Crabs, lobsters, prawns, shrimp, scampi, shrimpmeal
Mollusca	Gastropoda	Abalone
	Bivalvia	Clams, oysters, mussels, scallops
	Cephalopoda	Cuttlefish (and bone), octopus, squid
Pisces (sub-phylum Chordata)	Osteichthyes (bony fish)	Salmon, plaice, tuna, hake, cod, herring, pilchard, anchovy, trout, swordfish, sole, pomfret, yellowfin, turbot, fishmeal (flour)
	Chondrichthyes (cartilaginous fish)	Shark (cartilage)
Other agents		Hoya (Sea-squirt), Anisakis, Red soft coral, Daphnia, Marine sponge, Algae

by anaerobic decomposition of fish (hydrogen sulphide), polyphosphates, nitrosamines and residues of drugs used in aquaculture (e.g. antibiotics or hormones), chemical additives (sulphites), spices (mustard, paprika, flour additives, garlic), and hidden ingredients (casein) in canned or processed fish products.[3]

PATHOPHYSIOLOGICAL MECHANISMS

Aside from the ingestion route commonly encountered in the domestic setting, seafood also finds its way into the human body through inhalation and skin contact in domestic and recreational settings and is the main route of exposure in workplace settings. Adverse reactions have been reported in all these exposure contexts in individuals consuming, handling and processing seafood.

The adverse reactions associated with seafood could be a toxic or non-toxic individual reaction that may be due to an allergy or intolerance to an additive or contaminant of seafood.[8] In seafood exposed individuals, both allergic and irritant reactions have been observed. The allergy is commonly mediated by specific IgE antibodies in response to a seafood allergen or associated agent present in the seafood matrix (Figure 2). There is also evidence that seafood digestive enzymes such as trypsin can activate protease activated receptor-2 on epithelial cells of the airways and cause airway inflammation through the expression of IL-8 in in-vitro models.[9]

HEALTH EFFECTS ASSOCIATED WITH SEAFOOD

Seafood allergy was first reported in 1937 by Arent de Besche in a fisherman who developed allergic symptoms and asthma when handling codfish.[10] Various seafood species, from all three major seafood groupings, have subsequently been reported to cause occupational allergy and asthma (Table 1).[3,11]

Rhinitis

Various epidemiological studies and case reports indicate that ocular-nasal symptoms and allergic rhinitis occur commonly in seafood exposed workers. Frequently, this is the first indicator that there is underlying allergic disease. A large proportion of individuals with occupational asthma also report co-existing occupational rhinitis.[12] The prevalence of occupational rhinitis associated with fish and seafood proteins is reported to be between 5–24%.[13] However, the true incidence of occupational rhinitis in this setting has yet to be characterised.

Asthma

Epidemiological studies indicate that the prevalence of occupational asthma is between 2 and 36%.[11] These differences in prevalence are partly due to varying definitions of occupational asthma used; the allergenic potential of the seafood proteins of the species implicated; and the type of work process causing excessive exposure such as steam, organic dust, air blowing and water jets. What is notable, however, is that various studies show that occupational asthma is more commonly associated with shellfish (4–36%) than with bony fish (2–8%).[11] Rhinitis, conjunctivitis and less frequently urticaria, are often associated and may precede the development of chest symptoms. There have also been isolated case reports of workers with work-related asthma symptoms who subsequently developed ingestion-related allergic symptoms.[3]

> "... inhalation of seafood muscle proteins and digestive enzymes such as trypsin can cause respiratory allergy or inflammation."

The natural history of occupational asthma is outlined in Figure 3, commencing from entry into the workplace as a healthy individual, and passing on to the allergic sensitisation phase with the development of specific IgE antibodies following inhalation to the seafood allergen, followed by the rhinitis phase and finally the development of occupational asthma with continued exposure. The latency period between the onset of exposure and the onset of asthma symptoms is highly variable, however a large proportion of workers develop asthma within the first 2 years of exposure. If the asthma is detected early, it could be "cured" since the mainstay of management is interrupting the progression of the disease through avoidance of exposure to the offending allergen.[12]

Dermatoses

Allergic dermatoses to seafood, in contrast to respiratory allergy, have been studied to a lesser extent. The major skin manifestations associated with seafood are contact urticaria and eczematous contact dermatitis of various types. Contact urticaria is associated with direct contact with raw seafood proteins. At least 75% of eczematous dermatitis in the fish processing industry is of an irritant nature commonly due to contact with water and fish products (fish juice, slime, skin, fillet).[3] Contact with the proteinacious material such as seafood also causes a chronic recurrent dermatitis commonly known as protein contact dermatitis (PCD).[16] However, biochemical sensitisers (e.g. garlic, onion, spices) added to seafood can also cause a delayed allergic contact dermatitis.[3] Various reports have indicated that these dermatological outcomes can also co-exist in affected individuals.

In the seafood industry, the reported prevalence of occupational protein contact dermatitis (PCD) is between 3–11%.[3] Protein contact dermatitis (PCD) initially manifests as itchy, erythematous and vesicular lesions. PCD usually goes on to present as a chronic eczema with episodic acute exacerbations a few minutes after repeated contact with the offending allergen.[16] The development of immediate contact reactions usually requires repeated skin contact although prior sensitisation through ingestion or inhalation and subsequent dermal contact can also result in PCD. Predominantly affected areas are the volar aspect of the forearm and dorsum of the hands. In the more severe form, local skin contact with seafood may result in generalised urticaria and/or systemic symptoms (angioedema, wheezing). The diagnosis can be made by means of skin prick tests since patch tests with the responsible allergen are usually negative. Occasionally, specific IgE antibodies can be detected in the sera.

RISK FACTORS FOR OCCUPATIONAL ALLERGY AND ASTHMA ASSOCIATED WITH SEAFOOD

Various studies show that the aetiology and development of allergic disease is due to an interaction between genetic, environmental and host factors giving rise to different allergic disease phenotypes. The seafood industry provides an ideal context to analyse both upstream and downstream risk factors for occupational allergy and asthma associated with seafood.

(a) Environmental factors

Working populations with seafood contact

Occupational exposure to seafood allergens occurs mainly

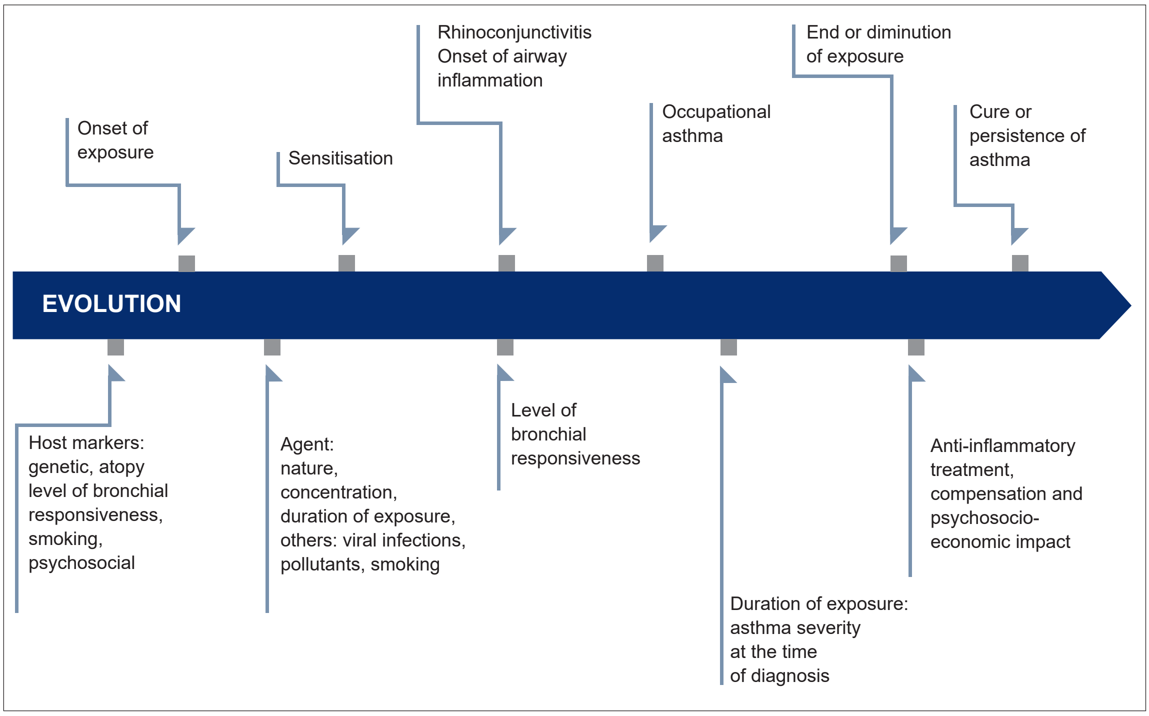

Figure 3. Natural history of occupational asthma, risk factors for disease onset and progression

(Reproduced with permission from Jean-Luc Malo)[15]

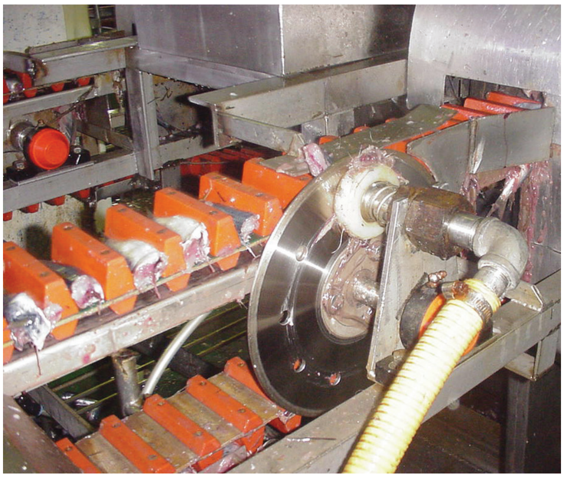

Figure 4a. Pilchard heading

Figure 4b. Salmon degutting

Figure 4c. Crab scrubbing

Figure 4d. Lobster cleaning and washing

in the food and fishing industry. Seafood processing plants in particular vary in technology levels, with some of the smaller workplaces relying entirely on manual handling of the seafood and larger companies using modern highly automated processes. There is great variation in processing procedures and preservation techniques for the different types of seafood including filleting, freezing, drying, cooking, smoking and high pressure techniques.[17] Workers are involved in either manual or automated processing of crabs, prawns, mussels, fish, and fishmeal in factories. Other occupations associated with exposure to seafood include harvesting activities (fishermen, aquaculture, oyster shuckers, fishmongers, truck drivers, maintenance), food preparation activities (restaurant chefs and waiters), laboratory and pharmaceutical technicians and researchers, pet food production and value added (shell grinders, jewellery polishers).[3,11]

Work processes generating seafood aerosols

Studies among fish processors demonstrate that common work processes causing bioaerosol production include butchering or grinding; degilling, “cracking” and boiling of crabs; cleaning and brushing of crab; “tailing” of lobster; “blowing” of prawn meat through shells; washing or scrubbing of shellfish; degutting, heading, and cooking/boiling of fish; mincing of seafood; and cleaning of the processing line or storage tanks with high pressured water hoses (Figures 4a–d).[3] Processes that generate dry aerosol particulates such as prawn blowing operations using compressed air and fishmeal loading/bagging appear to generate higher levels of particulate than wet processes (prawn blowing with water jets). It is these aerosolised wet or dry particulates produced from seafood during processing operations that are inhaled by workers.

Environmental exposure assessments in seafood processing plants demonstrate a wide range of airborne concentrations of aerosols from the lower limits of assay detection to as high as 11 mg/m^3 for total inhalable particulates, 6 mg/m^3 for protein and 75 µg/m^3 for allergen levels (Table 2).[11] Particulates and allergens reach very high levels during dusty fishmeal operations and crab processing aboard vessels at sea since processing occurs in very confined spaces with poor ventilation systems. Recent studies also suggest that particle concentrations are higher in factories with old seafood processing machines. Aerodynamic studies of these particles in crab processing environments indicate that at least 30% of airborne particulates are <5 µm and almost 100% are <1 µm in herring fish filleting environments.[3,18] This suggests that most of these particles are capable of being inhaled and reaching the small airways.

Food processing techniques

Aerosols and particulates produced in the seafood processing industry are not inert but are biologically active. There is increasing evidence that food processing techniques such as heating, freezing and high pressures have the ability to change the nature, dose and allergenicity of food.[19] During processing, the seafood is concentrated into major allergen source compartments from muscle, visceral contents, skin slime/mucin or collagen.[3] The allergenic potential of these proteins is dependent on the seafood type, with crustacean proteins being more allergenic than fish proteins. In addition, other by-products such as protease enzymes from the gut, chitin from shellfish, and endotoxin from gram negative bacteria, also promote airway inflammation when present in high concentrations. Furthermore, it has been shown that storage conditions may also influence the allergenicity of seafood extracts by influencing the relative distribution of various IgE reactive proteins.[20] Fish kept on ice for several days showed additional high molecular weight allergens and higher IgE binding capacity than fresh fish. Codfish stored for several days (at 4°C) displays a much higher IgE reactivity than very fresh fish. These changes may be attributed to the natural development of components such as formaldehyde in fish tissue, which might affect the allergenicity of some proteins.[20] This is confirmed by recent studies suggesting that processing raw crustaceans or fish may be less sensitising than the cooked seafood.[11,21]

Seafood allergens in aerosols

Molecular characterisation studies show that aerosolised seafood proteins are primarily high molecular weight proteins.[8,20] Immunological studies of serum obtained from crab processing workers with occupational asthma identified the major allergen in shellfish responsible for inhalant-related seafood allergy to be tropomyosin, a 34–39 kDa muscle protein, which is important for muscle contraction.[22,23] This is the same allergen that has been identified in patients with ingestion-related allergy. Another minor inhaled seafood allergen, arginine kinase (40 kDa) has also been recently identified.[24] Studies among fish processing workers also suggest that a highly cross-reactive allergenic isoform of pilchard parvalbumin, the major allergen causing ingestion-related seafood allergy, is also one of the allergens responsible for the symptoms observed in workers.[25] Parvalbumin is a 12 kDa calcium binding protein also involved in muscle contraction. In contrast to ingestion sensitised patients, who recognise mainly the monomer, occupationally sensitised workers appear to recognise higher molecular weight proteins, including parvalbumin dimers and oligomers. Furthermore, another novel allergen (36 kDa), identified as fish glyceraldehyde-3-phosphate dehydrogenase has also been characterised. [26]

Cross-reactivity of pan-allergens is an important mechanism that may result in allergic reactions in individuals. Tropomyosin is a pan-allergen because it is a highly conserved protein among crustacean species. Individuals, allergic to one seafood type such as crab, who have cross-reactive allergies can experience similar symptoms as a result of a common allergen found in a range of other sources such as crustaceans (shrimp, lobster) as well as molluscs

Table 2. A summary of various exposure assessment studies of seafood processing workers on land and aboard vessels reported in the literature

Seafood category	Particle fraction measured	Particulate conc. (mg/m^3) range	Protein conc. (mg/m^3) range	Allergen (µg/m^3) range
Crustaceans				
- crabs (snow, Tanner, common, King)	total inhalable	0.001-0.680	0.001-6.400	0.001-5.061
- crabs (snow)*	total inhalable	ND	ND	0.079-21.093
- prawns	total inhalable	0.100-3.300	ND	ND
- shrimp	total inhalable	ND	ND	1.500-6.260
- rock lobster	thoracic	LOD-0.661	LOD-0.002	ND
- scampi	total inhalable	ND	ND	0.047-1.042
Finfish				
- salmon	respirable	0.040-3.570	ND	0.100-1.00
- pollock	total inhalable	0.004	ND	ND
- whiff megrim/hake	total inhalable	ND	ND	0.002-0.025
- pilchard	thoracic	LOD-2.954	LOD-0.006	0.010-0.898
- cod	total inhalable	ND	ND	3.800-5.100
- salmon	total inhalable	ND	ND	LOD-1.600
- herring	total inhalable	ND	ND	0.300-1.900
- fishmeal (anchovy)	thoracic	LOD-11.293	LOD-0.004	0.069-75.748
- shark cartilage**	respirable	0.920 - 5.140	ND	ND
	total inhalable	26.400 - 44.700	ND	ND

Reproduced with permission from Jeebhay and Cartier[11]

ND: Not done, LOD: Limit of detection

* processing aboard vessels; ** non-food-handling environment

(snails), insects (cockroach), roundworms (*Anisakis*) and house dust mites.[8] While there appears to be very little or no cross-reactivity between shellfish and bony fish, again there exists a high degree of cross-reactivity between fish species, due to the presence of parvalbumin and similarly between crustaceans due to the presence of tropomyosin.[8,25]

Exposure-response relationships

There is increasing evidence that the risks of sensitisation and occupational asthma are increased with higher exposures of seafood aerosols. Gaddie et al. reported that a substantial proportion of prawn processors experienced relief of allergic symptoms including asthma when compressed-air jets were replaced by cold-water jets for prawn meat extrusion, the wet weight of material filtered in the air decreasing from 1,8–3,3 mg/m^3 to 0,1–0,3 mg/m^3.[27] Similarly, Douglas et al. reported that adding an exhaust ventilation over gutting machines in a salmon processing facility reduced respirable aerosol levels from a mean of 3,14 mg/m^3 to <0,01 mg/m^3.[28] As a result no new cases of occupational asthma occurred over 24 months versus a prevalence of 8% over an 18 month period prior to this. Recently, Gautrin et al. showed that cumulative exposure to snow crab allergens is positively associated with occupational asthma and allergy in a dose-response manner. [29] Studies among pilchard and anchovy fish processors have also found that workers with work-related asthma symptoms had a twofold increased risk of being exposed to pilchard-antigen concentrations >30 ng/m^3 at the time of onset of their symptoms.[30] Similar positive relationships for incident work-related asthma symptoms and increasing concentrations as well as cumulative exposures have also been observed.[31] This risk is further modified in atopic individuals, who demonstrate a higher risk.

Workplace organisation factors mediating exposure to seafood

Recent studies also suggest that industrial change (linked to ecological degradation and globalisation) and associated ecological and global shifts in production interact with rurality, migrancy, seasonality, gendered and racialised divisions of labour, as well as shortcomings in occupational health and safety interventions to mediate hazardous exposures and worker vulnerability.[32] All these factors have the potential to contribute to substantial long-term negative physical health, economic hardship and poor quality of life of the affected workers and their families due to the potential under-diagnosis, under-reporting and under-compensation of workers with occupational allergy and asthma.

(b) Host factors

Atopy

Atopy among seafood processors is the most important host factor associated with the development of allergic sensitisation and asthma to seafood allergens from crabs, prawns, cuttlefish, pilchard and anchovy. Studies among food handlers and caterers have shown an association between atopy and urticaria and protein contact dermatitis induced by crustaceans.[3,11]

Smoking

Smoking has been associated with an increased risk of developing sensitisation to prawns, crab and fish (pilchard, anchovy and salmon).[3,11] It is also a risk factor for developing occupational asthma in salmon and crab processing workers. Various reasons have been postulated including disruption of the natural epithelial barrier of the respiratory tract facilitating allergen entry or smoking acting as an adjuvant enhancing the allergenicity of the inhaled allergen.[33]

> "Atopy is associated with an increased risk of sensitisation to various seafood."

Upper airway disease – occupational rhinitis

Many studies show that occupational rhinitis and occupational asthma frequently occur as co-morbid conditions. Rhinoconjunctivitis may precede or coincide with the onset of occupational asthma. The presence of rhinitis has been associated with an increased risk of developing occupational asthma to a number of proteins including seafood. Studies also show that the risk of developing occupational asthma is highest in the year after the onset of occupational rhinitis.[14]

Pre-existing skin disease

Skin integrity constitutes an important risk factor for the development of urticaria and protein contact dermatitis.[3] Skin integrity and physiological factors (such as temperature below 19°C) also seem to be important in determining the location of skin symptoms (urticaria) and recovery of skin barrier function among workers handling fish.[17]

PREVENTION

Legislation, policies and exposure standards

Currently, workplace exposure standards do not exist for seafood allergen exposures. However, these can only be developed and enforced once sampling methods and standardised assays for quantifying these allergens become widely available. Aside from country-specific legislative provisions to promote a healthy and safe working environment on land, the ILO Convention on Fishing will also contribute towards improving occupational health and safety conditions at sea and to ensure social protection for these vulnerable groups of workers.[34]

Workplace interventions and control measures

Exposure control measures by eliminating exposure or worker relocation are key to reducing the risk of occupational allergy and asthma among workers in the seafood industry. Identifying departments and activities with high aerosol exposure such as fishmeal bagging, gutting machines, cleaning and brushing crabs, and compressed-air jets should lead to the introduction of improved local exhaust ventilation systems and change in work processes to reduce aerosol exposures.[35] Preliminary studies suggest that processing (cleaning and brushing) raw crab before it is cooked may help reduce the risk of sensitisation, however further studies are needed to confirm this.[11]

Medical surveillance of workers

Regular medical surveillance of exposed workers employed particularly in high-risk seafood industries such as crab and prawn processing is another strategy that can be used to reduce the incidence of occupational allergy and asthma and long-term disability. Abbreviated questionnaires may allow early detection of allergic symptoms, which could be investigated further using skin prick tests or allergens specific IgE if available. Prior to work withdrawal, proper evaluation should be conducted to confirm the diagnosis of occupational allergy or asthma. Affected individuals should be transferred to a low allergen exposure environment, while measures are undertaken to reduce allergen exposures in high-risk work processes. Surveillance of workers is also important as it may point to early presentation of allergies to previously unknown allergens that may be newly introduced into the work process before the product is released for broader domestic consumption.[3,11]

Although studies have shown that atopic individuals are at higher risk of developing occupational asthma, there is no way of predicting which individuals will become symptomatic. As a result there is general consensus that there is no place for pre-screening and exclusion from employment of atopic individuals since studies show that almost 40% of workers are atopic and a residual risk for asthma exists even in non-atopic individuals that are exposed.[36] However, what is recommended is advising and counselling atopic apprentices to choose jobs that do not subject themselves to seafood allergens during the course of their work.

Increased worker awareness and training

Workers who are allergic to seafood and workers in high-risk working environments with exposure to seafood need to be educated on the health risks associated with handling seafood containing products.

Immunotherapy modalities

While immunotherapy remains a theoretical possibility, it is still in the experimental stage as it has not yet been studied in seafood exposed working populations.[26]

CONCLUSIONS

This review has identified some emerging areas and developing trends in relation to occupational allergy and asthma in the seafood industry. These relate to industrial change (linked to ecological degradation and globalisation) and associated global shifts in production that form the basis for continued and increased exposure to vulnerable populations. More detailed insights have emerged into the allergens causing work-related fish and shellfish allergy and asthma, indicating that while the major allergens (parvalbumin and tropomyosin) causing occupational asthma appear to be similar to the allergens causing ingestion-related allergy, there are other allergens that are also implicated. In-vitro studies have also identified serine proteases that cause airway inflammation by upregulating the IL-8 receptor, which may be contributing to the work-related symptoms observed in workers. More advanced laboratory-based techniques have paved the way for detailed exposure characterisation studies of seafood allergen and other contaminants present in seafood aerosols. Evidence from exposure-response relationships emphasise control strategies directed towards reduction of exposures as being the mainstay of prevention.

Areas for future research

- Detailed exposure assessment studies are required using standardised immunoassays for specific seafood allergens and non-immunologically-based approaches (for proteases, sulphites, toxins) to investigate single and mixed exposures.
- Establishing health surveillance programmes for high-risk exposure groups:
  - detailed epidemiological studies of workers aboard vessels;
  - establishing dose-response relationships in order to establish the utility of exposure threshold limits for minimising exposure to seafood allergens; and
  - investigating the interaction of exposures with host factors in modifying the asthmatic response.
- Investigating the relevance of raw versus cooked seafood for inhalant respiratory allergy.
- Identification and characterisation of other major or minor seafood allergens causing inhalant respiratory allergy and asthma.
- Evaluating effective intervention packages (exposure controls / best practice) in seafood processing environments aboard vessels and ashore.

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LESSONS LEARNED

- Seafood processing techniques causes aerosolisation of allergens which are more likely to be inhaled by exposed workers.
- Industrial food processing techniques change the nature, dose and allergenicity of seafood.
- Occupational allergy and asthma due to crustaceans is more prevalent than due to bony fish.
- Atopy, smoking and rhinitis are risk factors for inhalant reactions associated with exposure to seafood.
- Reducing airborne exposures can decrease the risk of developing allergy and asthma associated with seafood.

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Silica exposure in South African farming

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ABSTRACT

Objectives: **Little information exists on exposure to respirable silica in the agricultural industry. This paper summarises recent data from a comprehensive exposure assessment on three South African farms and discusses occupational health implications and research needs.**

Methods: **A total of 298 respirable dust and respirable quartz measurements were collected from three farms with sandy, sandy loam and clay soil, using standard international measurement and analytical methods.**

Results: **Silica exposure above generally used OELs occurred on all three farms with the highest individual concentration measured on the sandy soil farm (626 μg.m^{-3}). Of the measurements on the sandy soil, sandy loam soil and clay soil farm respectively 57%, 59% and 81% exceeded the ACGIH TLV of 25 μg.m^{-3}. On the sandy soil and sandy loam soil farms respectively, 12% and 13% of respirable quartz concentrations exceeded 100 μg.m^{-3}.**

Conclusion: **There may be significant potential for over-exposure to respirable quartz in farming and even clay soil farming may pose a risk. Given the large numbers of potentially exposed farm workers and the seriousness of silica-associated diseases, dust-related occupational health interventions should be considered.**

Key words: Silica, farming, agriculture, exposure, dust control

INTRODUCTION

Diseases associated with silica exposure include silicosis, a fibrotic nodular disease of the lung parenchyma, pulmonary tuberculosis (PTB), lung cancer, chronic obstructive pulmonary disease (COPD) and autoimmune and renal diseases.[1] Silica exposure is an important public health issue particularly in settings of high TB and HIV rates. The mineral has contributed to serious epidemics of TB in southern Africa[2] and other low and middle-income regions of the world because of the increased risk of PTB in silica-exposed workers.[3] It is well known that HIV infection increases the incidence of TB and the risk of TB in individuals with both HIV and silicosis is larger than the sum of each factor.[4]

Most studies of silica exposure and silica-associated disease have focused on the historically known "dusty trades", such as mining and quarrying, construction and sandblasting, foundries, ceramics and other industries where silica is used as a raw material or abrasive.[5] Although farming is mentioned as an industry associated with silica exposure,[1] it is still not known to what extent silica exposure is a risk in this industry. Farming may be of particular concern because of the large numbers employed, the possible high background TB and HIV rates and the generally poorer access to health services than urban residents. In many African countries, farming provides a livelihood for more than 70% of the population. South Africa also has a large agricultural labour force and is a significant employer relative to other industries. During 2004-2009 agriculture employment in South Africa ranged from 679 000 - 859 000 with an average of 765 833.[6] Migrant labour and poor socio-economic circumstances are common in farming, consequently there may be high HIV infection and TB rates amongst farm workers.[7] Limited data on TB and HIV rates specifically amongst farm workers in South Africa are available, but the Food and Agriculture Organization reported that AIDS has killed around 7 million agricultural workers since 1985 in the 25 hardest-hit countries in Africa and could kill 16 million more before 2020.[8] Thus, up to 25% of the agricultural labour force could be lost in countries of sub-Saharan Africa by 2020 unless effective interventions are implemented.

SILICA EXPOSURE AND SILICOSIS IN FARMING

Studies on occupational exposure to silica in farming are limited, but have recently been reviewed.[9] Despite the paucity of data, respirable silica concentrations exceeding generally accepted OELs have been demonstrated in farming internationally.[11-13]

In grape crop harvesters, 50% of the personal exposure to silica measurements exceeded the ACGIH TLV of 25 μg/m^3 (range 7-105 μg/m^3).[11] Some remarkably high silica levels were measured on seven different farms in three eastern North Carolina counties (Pitt, Lenoir and Wayne).[12] Although the exposures determined from 37 personal respirable dust breathing-zone samples from 27 farm workers were relatively low on the majority of the farms (overall mean of 1300 ±2900 μg/m^3), somewhat surprisingly, the highest level of time weighted average (TWA) respirable silica measured was 3910 $\mu g/m^3$ during sweet potato transplanting (overall mean concentration of 700 ± 1600 $\mu g/m^3$). Personal exposure to inorganic and organic dusts during manual harvesting of California citrus and table grapes showed geometric means (GMs) of respirable dust exposures of 1.14 mg/m^3 for citrus harvest and 0.23 mg/m^3 for table grape operations.[13] However, the GMs of respirable silica exposures were 80 $\mu g/m^3$ for citrus harvest and 20 $\mu g/m^3$ for table grape operations.

Some determinants of silica exposure in farming have been identified and exposure may vary substantially as farming most commonly occurs outdoors. An important determinant may be the soil type as sandy and sandy loam soils (i.e. soil of clay and sand with admixture of decayed vegetable matter) have been reported to contain higher levels of silica in the respirable fraction in parts of eastern North Carolina compared with other North Carolina regions.[12,14,15]

The body of literature on silica-associated diseases in farming is small[16-21] and has been reviewed recently.[9] Silicosis has been convincingly diagnosed in agricultural workers,[17,20] but very rarely and in the main there is little evidence that pneumoconiosis occurs to any extent in the industry. Studies of other silica-associated diseases have not been published. The small number of studies and generally poor access to health services that would link diseases to workplace exposures may partly explain the paucity of reports of silica-associated diseases in farm workers.

Although the literature on occupational exposure to silica in farming is scant, some studies convincingly demonstrated that over-exposure to silica can occur in farming and that respirable dust does not necessarily act as a good surrogate for silica exposure. In view of the relatively high silica concentrations reported in the few studies conducted internationally, the lack of South African studies, the large number of people possibly exposed, and the expected high HIV and TB rates which make silica exposure a potentially serious concern, we conducted a comprehensive exposure assessment of respirable dust and silica on three South African farms. This paper briefly reviews silica exposure in farming, presents recent data showing that there is a potential for over-exposure to silica in South African farming and discusses some occupational health implications for South Africa. The South African exposure data are drawn from two articles[9,10] and from unpublished analyses to estimate annual cumulative silica exposure; the occupational health implications have not been published previously.

SILICA EXPOSURE ON THREE SOUTH AFRICAN FARMS

Methods

Personal respirable dust and silica measurements were done on three South African farms known to have sandy, sandy loam and clay soils[10] using the Health and Safety Executive (HSE) Methods for the Determination of Hazardous Substances (MDHS) 14/3 method and MDHS 101. The farms were visited nine times over 36 months, amounting to a total of 27 days of sampling and 298 measurements. The major tasks undertaken on the three farms over the annual farming cycle were identified in conjunction with the farmers. They have been listed in a previous publication[9] and were selected to be representative of potentially dusty jobs performed on the sandy, sandy loam and clay soil farms. Respirable dust and silica measurements were done during the summer and winter seasons and were collected over a period of approximately 8 hours (mean = 460 minutes, range = 360-520 minutes). Throughout the study, no engineering dust controls were observed on any of the implements and no formal respiratory protective equipment (RPE) was used by the farm workers, although they may occasionally use some type of personal protection (e.g. a bandana or scarf covering the nose and mouth) during very dusty activities. All the tractor drivers measured during the study used "open-cabbed" tractors.

"... it is still not known to what extent silica exposure is a risk in this industry."

Table 1. Eight-hour TWA respirable dust concentrations (mg.m^{-3}) on a sandy, a sandy loam and a clay soil South African farm

Farm	n	AM	GM	GSD	Range	
Sandy soil farm	138	0.68	0.3	3.2	0.02	6.49
Sandy loam soil farm	77	0.46	0.2	2.9	0.03	3.39
Clay soil farm	83	0.73	0.5	2.5	0.06	3.97
Total	298	0.64	0.3	3.0	0.02	6.49

GM – geometric mean; GSD – geometric standard deviation; AM – arithmetic mean; TWA – time weighted average.

Adapted from Swanepoel et al., 2011 with kind permission from RightsLink[10]

Ethics

Informed consent was obtained from all study participants and confidentiality was respected regarding farms, farmers and farm workers. All results of the exposure assessment were communicated to farmers and farm workers. Ethics approval was obtained from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand (clearance number M070252).

RESULTS

Table 1 shows eight-hour TWA respirable dust exposures for the three farms. The highest individual respirable dust concentration (6.49 mg.m^{-3}) was measured on the sandy soil farm, during wheat planting operations. As expected, respirable dust concentrations differed across the three farms (Kruskal-Wallis test; p = 0.0006). The median respirable dust concentrations of the sandy soil and sandy loam soil farms did not differ significantly (Wilcoxon test; p = 0.2), but the median concentrations of respirable dust on the sandy soil and sandy loam soil farms were significantly lower than that of the clay soil farm (Wilcoxon test; p = 0.002 and p = 0.001 respectively).

Eight-hour TWA respirable silica concentrations for the farms are shown in Table 2. Large proportions (41%) of the silica measurements were below the Limit of Detection (LOD) of 22 µg reported by the analytical laboratory with the clay soil farm being the main contributor (64%). Consequently, values below the LOD were estimated using multiple imputation[22] and these are presented in Table 2 for proportions above occupational exposure limits. The sandy and sandy loam soil farms were very similar with respect to the distribution of the concentrations; although, the sandy soil farm had the highest concentration measured (626 µg.m^{-3}). Respirable silica concentrations exceeded all three occupational exposure reference limits: 100 µg.m^{-3} (South African Occupational Exposure Limit [OEL]); 50 µg.m^{-3} (National Institute for Occupational Safety and Health [NIOSH] Recommended Exposure Limit [REL]) and 25 µg.m^{-3} (American Conference of Governmental Industrial Hygienists [ACGIH] Threshold Limit Value [TLV]) for silica. For the sandy, sandy loam and clay soil farm, 12%, 13% and 0% of the silica measurements respectively exceeded the South African OEL of 100 µg.m^{-3}, and substantial proportions of the measurements exceeded the lower standards of the NIOSH-REL and the ACGIH TLV-TWA.

Although the proportions of measurements above the 100 µg.m^{-3} level were not significantly different for the sandy and sandy loam soil farms, both were significantly larger than the clay soil farm (prop test, all p-values <0.001). Surprisingly, the clay soil farm had a larger proportion of measurements above the 25 µg.m^{-3} level than the other two farms, but the sandy soil farm had the largest proportion of measurements above the 50 µg.m^{-3} level (prop.test; all p values <0.003).

Typically, the annual cycle of farming activities for each farm worker is varied with episodic dusty seasonal tasks (e.g. soil preparation) interspersed with periods of relatively low dust exposure (e.g. mending fences and equipment maintenance). Annual cumulative silica exposure may therefore be poorly described by respirable silica levels found during particular dusty tasks, which may be of short duration. An index of the annual cumulative respirable silica exposure can be estimated for a typical farm worker by summing the exposure for all tasks done by duration in days of the task (i.e. [task 1 average exposure x days] + [task 2 average

Table 2. Eight-hour TWA respirable quartz concentrations (μg.m^{-3}) on a sandy, sandy loam and clay soil South African farm

Farm	n	%<LOD	AM	GM	GSD	Range	%≥100*	%≥50†	%≥25‡	%quartz Median
Sandy soil farm	138	35	53.2	31.7	2.7	<LOD - 626	12	30	57	14.3
Sandy loam soil farm	77	27	46.85	31.6	2.3	<LOD - 413	13	22	59	14.0
Clay soil farm	83	64	33.8	31.1	1.4	<LOD - 98	0	9	81	13.7
Total	298	41	46.0	31.5	2.3	<LOD - 626	9	22	64	14.0

%<LOD, % of measurements under the analytical limit of detection; AM – arithmetic mean; GM – geometric mean; GSD – geometric standard deviation; TWA – time weighted average.

*% Measurements greater or equal to the South African Occupational Exposure Limit of 100 μg.m^{-3} for respirable quartz.

† Measurements greater or equal to the NIOSH Recommended Exposure Limit of 50 μg.m^{-3} for respirable quartz.

‡% Measurements greater or equal to the ACGIH Threshold Limit Value of 25 μg.m^{-3} for respirable quartz.

Adapted from Swanepoel et al., 2011 with kind permission from RightsLink[10]

exposure x days] …+ [task *n* average exposure x *n* days] = annual cumulative exposure index (CEI) in mg.m^{-3} - days). The CEI was estimated for a typical farm worker on the sandy soil farm using the median exposure for each task and days of exposure provided by the farmer, and it was 7.41 μg.m^{-3} - days. This is 0.29 relative to the annual cumulative exposure of a worker exposed at 100 μg.m^{-3} (the South African OEL) and 0.59 relative to the annual cumulative exposure of a worker exposed at 50 μg.m^{-3} (the NIOSH REL). If the highest exposure measured for each task, rather than the median, is used to derive the CEI i.e. a worst case exposure scenario, then the cumulative exposure would be substantially larger than 7.41 μg.m^{-3} - days.

DISCUSSION

The study considerably adds to the evidence that over-exposure to quartz may be a risk in farming in some settings and has identified the need for practical interventions and research gaps. It is also the biggest study of its kind in that it is the first to measure a large number of personal respirable quartz concentrations (298) across various tasks on three farms known to have different soil types.

We have shown that silica exposure above two generally used OELs was found on all of the farms, with similar exposures for the sandy and sandy loam soil farms, whereas the clay soil farm generated a smaller proportion of exposures above 50 and none above 100 μg.m^{-3}. Of particular interest is that no measurements exceeded the South African OEL of 100 μg.m^{-3} on the clay soil farm; but 9% of them were between 50 - 100 μg.m^{-3}. Additionally, on each of the three farms the median silica exposures were all above the ACGIH TLV of 25 μg.m^{-3} suggesting a possible risk of over-exposure to silica even on the clay soil farm. The annual cumulative exposure to silica of the most heavily exposed farm worker on a sandy soil farm may exceed the annual cumulative exposure if exposed at the NIOSH REL of 50 μg.m^{-3}.

Two important considerations should be borne in mind when considering these results: the findings may not be generalisable to farming in South Africa; and the potency of silica may be reduced on farms. Farming covers a large variety of commodities and tasks of differing sophistication from simple manual handling to the use of large combine harvesters. Additionally, weather and soil type may affect respirable dust and respirable silica generation. Consequently, findings on three farms are unlikely to reliably describe exposure on the many thousands of South African farms. A number of factors affect the potency of respirable silica, most of them pertinent to farming. The United Kingdom's Health

and Safety Executive (HSE) reviewed potency factors with regard to their ability to cause silicosis and summarised their conclusions in a respirable crystalline silica potency matrix.[23] The HSE concluded that the particle size, age of fractured silica, clays and wetting of freshly cut surfaces influence the potency of silica. Extremely small particle size enhances silica potency and particle size may be relatively large in farm soils; although, this has not been characterised to any degree. Freshly-fractured silica dust is known to be more pathogenic than silica aged by contact with air (e.g. most silica in soil).[24-25] Silica in soils is likely to be aged, with most farming activities producing little freshly fractured material; although, it might be caused by contact with metal during activities such as ploughing and discing. Only a small portion of the soil is in contact with machinery, while the majority of dust is from the disturbed soil. Thus, it seems likely that freshly fractured dust would not comprise more than a small fraction of respirable soil dust.

Aluminium-containing clay coatings on silica particles reduce potency and clay is a common constituent of farm soils. Wetting of surfaces reduces silica potency compared to dry freshly cut surfaces, but wetting to reduce dust is infrequently practiced in farming as big tractors and implements may get stuck in wet soils.

Despite the probable presence of silica potency reducing factors in farming, given the large numbers of farm workers possibly exposed to silica and the seriousness of silica-associated diseases, a number of dust-related occupational health interventions should be considered in South Africa, particularly because during the course of the studies on these South African farms few if any dust control measures were observed and none of the farms had medical surveillance programmes.

POTENTIAL DUST-RELATED OCCUPATIONAL HEALTH INTERVENTIONS

Primary prevention of silica-associated diseases, i.e. the control of dust to concentrations at which disease will not occur, is the optimum form of prevention and should be the overriding goal of national and workplace occupational health programmes. Methods to improve dust control in farming are challenging but are important to protect the health of farm workers particularly those involved in the most dusty jobs. The most common approach followed by occupational hygiene professionals is the "hierarchy of controls", which suggests that the hazard be removed or controlled at source followed by engineering and administrative controls ultimately ending with the use of PPE. Since silica cannot be removed from farm soils, other methods are necessary to control exposure. Limited studies describe dust control in farming (none in South Africa), but some evidence exists that differences in equipment and the manner in which a task is done may affect exposures.[26]

The presence of an enclosed cabin on the tractor has been associated with a decrease in personal dust levels[27,28] and so has lower tractor speed.[27] However, the effect of machinery on exposure potential should be carefully considered, since mechanisation may either increase or decrease potential for dust exposure.[29] The proper use of a closed cab may reduce dust exposure of a tractor driver but excessive silica exposure has been reported even for drivers of cabbed tractors in North Carolina.[12] Although an enclosed tractor cab has been suggested to be the single most effective intervention to reduce inorganic dust exposure,[30] it is very costly and dust filters need proper maintenance. Modern tractors fitted with enclosed cabins typically cost around R 2 000 000.00, probably unaffordable for the majority of small scale farmers. Theoretically, wetting, either with water or water with wetting agents, could be used to reduce dust (as is done in quarries, for example) but given the large areas to be covered on farms, the cost, the potential damage to seeds and crops and that wet soils may hinder movement of heavy machinery, wetting is a problematic solution.

Although engineering methods can be used to control dust in farming, the likelihood of their use depends upon the attitudes of farmers and farm workers toward dust exposure and legislation among other things. Two-thirds of Californian farm workers perceived farming to be less hazardous than other occupations, and respiratory problems ranked after injuries and exposure to pesticides.[27]

The provision and use of PPE should be considered by farmers particularly for farm workers involved in dusty jobs. The use of PPE amongst farm workers may however pose a challenge. One study showed that PPE use increased with an increase in exposure to noise and pesticides but not with an increase in dust exposure.[31] Perceptions of workers about dust and silica dust in farming may be a barrier to the implementation of exposure reduction measures, consequently raising awareness of the health effects of dust exposure is needed to promote their use.

Even with the limited exposure data available it seems reasonable to recommend surveillance of long-service farm workers (possibly those employed for 20 years or longer) for silicosis and tuberculosis Besides the health reasons, this would be an important step to determine the burden of disease in farming. Initially surveillance could be limited to large well-resourced farms targeting long service workers, particularly those involved in the most dusty jobs for substantial times during their yearly routine.

General practitioners practicing in farming areas need to be aware of the potential for silica-associated disease and submit claims under the Compensation for Occupational Injuries and Diseases Act. Silicosis cases should be eligible if they have clinical features consistent with the disease and no other occupations to account for it, but other silica-associated diseases are less clear. The Circular Instruction Regarding Compensation for Pulmonary Tuberculosis Associated with Silica Dust Exposure[32] stipulates that PTB is an occupational disease if the claimant has silicosis and PTB or if there is no radiological evidence of silicosis but the employee has been exposed to silica for two years and silica dust exposure is inherent to his/her work process or occupation. Too little is known about exposures in farming to conclude that silica dust exposure is inherent to many farming jobs. COPD and lung cancer present the same difficulties. A possible approach is to submit long-service heavily dust-exposed workers with these diseases; even if rejected the claims would constitute a rudimentary register of cases.

RESEARCH NEEDS

Despite evidence that silica exposure in farming can exceed generally accepted standards[9-10,12,30] the role of determinants of silica exposure in farming has not been explicitly addressed. Exposure assessment in agriculture is difficult and complicated by a number of factors.[12] For example, workers often perform many tasks, making it difficult to characterise exposure over time. It is not unusual for workers to walk from field to field with potentially different soil types, thereby introducing further variability in personal exposure to silica. This is compounded by the fact that farming is usually conducted outdoors; weather conditions (e.g. rainfall, humidity, wind speed, wind direction and pressure) are likely to play an important role in exposure variability.

> "Throughout the study, no engineering dust controls were observed . . ."

Additional exposure assessments should further examine the role these potential determinants of silica exposure (i.e. soil types, commodities, activities, processes [mechanical versus manual] and weather) may have on silica exposures in farming.

Potency modifiers of silica exposure also need to be better defined. The HSE describes possible silica potency modifiers[23] but very little research exists on the impact of these factors in farming. The role of particle sizes and dry, freshly fractured silica during farming activities need to be explicitly addressed so that occupational health professionals can be alert to farming activities producing very fine, freshly fractured, dry particles.

In South Africa, no study has been done to define the burden of silica-associated diseases in farming. A starting point may be to perform radiological surveys on long service farm workers (possibly more than 20 years service and performing dusty jobs) on a sandy soil farm, as sandy soils are likely to produce the highest silica levels.[12] This will give some indication if silicosis occurs in farm workers during worst case exposure scenarios.

An effort should also be made to define the duration and intensity of silica exposure in farming over the annual cycle. Some processes and jobs may produce high levels of silica in the breathing zone of a worker (for example during ploughing and discing)[27] and workers may do these jobs for a large number of days in a farming year, but this is largely unknown. Better definition of cumulative exposure relative to jobs that are known to cause silica-associated diseases are required to better understand the risk of these diseases in farming.

Lastly, cost-effective methods to reduce respirable dust and silica exposure in farming in South Africa should be identified. South Africa has a large small to medium scale farming sector employing a considerable number of people. These farmers do not have the money to introduce costly control solutions such as closed-cabbed tractors. There is a need to identify cost-effective dust control methods appropriate for settings in South Africa.

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CONFLICT OF INTEREST

There were no conflicts of interest.

LESSONS LEARNED

1. **Over-exposure to respirable quartz may occur in farming in South Africa.**
2. **Over-exposure is probably not only limited to sandy soil farms.**
3. **Practitioners working in farming areas should be aware that silica-associated diseases may occur in farm workers.**
4. **Despite limited evidence for silica associated disease, occupational health interventions appear justified.**
5. **Further research is required to identify possible determinants and exposure modifiers of respirable quartz during farming and to determine if silicosis occurs in farm workers.**

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Is ISO 9001 an effective quality system for African SMMEs as well? Part 2

Danie Bosman, GM LexisNexis Compliance South Africa, supported by information from articles by **Chris Amponsah, Anne DeClouette, Dwight Dew, Elizabeth Pogue and Clint Wilson**

In the July/August 2011 issue, we introduced the background to ISO standards and ISO 9000, and described the importance, benefit and process for becoming certified. In this part, we continue by explaining how this certification is just a starting point and discuss some of the benefits that have ensued.

The beauty of the ISO 9001 concept is its objectivity. The registration process culminates in a third-party audit of international standards that lends credibility to the certification. An independent organisation, called a registrar, measures the company against the ISO 9001 standard that is accepted globally as the defining set of quality management system requirements. As a result, what could otherwise be viewed as a self-serving marketing claim becomes a third-party endorsement that is respected in the marketplace as being totally objective. This independent evaluation assures existing and respective customers that an effective quality management system is in place.

For this to be most effective for both the company and prospective clients, the consultants who assist the company with the implementation of their system and the certification body should be of the same mind, without colluding, in order to ensure the company who gets certified is in fact doing what it professes to do (the basis of ISO 9001:2008) and that its documentation that is available to prospective clients in fact reflects this situation as accurately as is possible. This allows for a prospective client to assess whether he wants to do business with the certified company and, if indeed he still wants to, he can also ascertain what and how his own processes should be adapted to make for a good match. The value lies in knowing each others' strengths and weaknesses without bias, and thus one has a known platform from where good business can come because you know where to support each others' weaknesses while sharing each in each others' strengths.

Seeing ISO 9001:2008 certification as a starting point is consistent with the observation by researchers, and other nationally and internationally recognised standards such as ISO 14001 (environment) ISO 31000 (risk) ISO 22000 (food) and OHSAS 18001 (safety) are examples of systems that are based on the same principles as ISO 9001. BSI, Kitemark, and Underwriters Laboratories, use ISO 9001 as a baseline requirement. ISO 9001 is therefore effective as an international benchmark because it serves as a foundation for other certifications.

In 2002 researchers noted that proponents of ISO 9001 certification cite benefits such as "having the ability to improve product or service quality, efficiency and productivity, customer confidence, and competitive advantage" as well as "better control of business, increased sales/business, reduced costs, increased productivity and fewer customer complaints" and similarly stressed better control, lower costs, and fewer customer complaints.

Asian Researchers noted already in 2003 that most companies have experienced an increase in overall sales after ISO 9001 certification. They further noted that ISO 9001-certified companies attained better rates of return and additional benefits of better documentation, greater quality awareness among employees, better internal communication, and an increase in operational awareness. All of these factors sharpen a company's competitive edge. ISO 9001 certification allows a company to have better internal processes through clearer working procedures, better bottom line profitability, and stronger exports from expansion into international markets. Another study in 2006 reached a similar conclusion that ISO 9001-certified companies engaged in software engineering achieved increased profitability.

There's a well-documented difference in ISO 9001 certification benefits reaped by small and large companies. Large companies, for example, tend to enjoy a boost in stock price upon announcing they are pursuing certification. The marketplace believes that such an announcement is a harbinger of improved future revenues for the companies involved due to improved quality, which leads to reduced fixed costs, reduced variable-support costs that increase as sales volume increases, and increased revenues from sales.

Smaller companies are less likely to automatically reap these benefits unless they are required to have recognised certification in order to do business with the larger companies such as is increasingly the case in South Africa and indeed in Africa. It's more difficult for customers in the business-to-business market to ascertain if a small company is well-run which means that those who are ISO 9001:2008 certified will be assessed as of higher repute, in the final assessment of suppliers. So while smaller companies may not get the automatic boost in status from ISO 9001 certification enjoyed by larger companies, they can still leverage certification to prove to the world they have greater control of their business. In 2006 researchers specifically cited benefits to small companies which have achieved certification: They were more technologically advanced than their peers, and were more likely to have implemented standard training/development and human resource management practices.

While standardisation is important for companies, so is product differentiation – making a product that stands out from the crowd. While external standards, such as those described by ISO 9001, require rigid management principles, internal company standards need to be flexible and dynamic to ensure that client needs are met consistently and without too long delays. Companies that are most successful at creating and sustaining competitive advantage are those that maintain continuously renewing internal standards while still conforming to the broader management system framework.

But it's not enough merely to have these advantages: companies must communicate their advantages to other businesses, or the company will not prosper. Standardisation through the ISO certification process allows an organisation to communicate with other businesses, through a "common language", even as its own internal processes are changing.

Ultimately results are what matter. Does being ISO 9001-certified actually result in improved product quality? In the late '90s researchers studied companies in four countries to test the link between ISO 9001 registration and quality; the study found that certified companies had significantly higher scores on measures of the eight quality constructs: leadership, information and analysis, strategic quality planning, human resource development, quality assurance, supplier relationships, customer orientation, and quality results.

LexisNexis Compliance recently acquired a licence to offer internationally accredited ISO 9001:2008, ISO 14001:2004 OHSAS 18001:2007 and integrated management systems in the African Region and are in a unique position to offer SMMEs cost-effective guidance and certification without compromising the ethical boundaries between consulting and certifying.

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Seasonal trends in potential sunburn risk among outdoor workers in South Africa using monitored ambient solar UV radiation levels

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ABSTRACT

Exposure to solar ultraviolet (UV) radiation is an occupational health and safety issue. Excessive personal exposure is associated with adverse health effects, including skin cancers and eye conditions. Sunburn is a proxy for acute sun exposure and is implicated in skin cancer aetiology. To estimate national potential sunburn risk among outdoor workers, monitored ambient solar UV radiation levels at six sites across South Africa were converted into possible outdoor worker solar UV radiation exposures, calculated as 20% of total daily ambient solar UV radiation, by skin type and season. Mean total daily ambient solar UV radiation levels exhibited typical seasonal patterns with highest values during summer and late spring. Outdoor workers with skin types I, II and III (ranging from extremely to moderately sensitive) were identified as being at greatest risk of sunburn all year-round. Outdoor workers with skin types IV, V and VI were at risk during summer, spring and autumn. Real-time personal exposure monitoring of outdoor workers as well as information on skin cancer incidence among outdoor workers is required to better understand local exposure patterns and sun-protective practices to inform sun awareness campaigns.

Key words: solar ultraviolet radiation, outdoor workers, sunburn, risk

INTRODUCTION

For humans, sun exposure has both positive and negative health effects. Some sun exposure promotes vitamin D production.[1] Skin cancers, i.e. non-melanoma and melanoma skin cancers, are the two most commonly experienced adverse health effects.[1] Non-melanoma skin cancers are seldom fatal; however, they may be disfiguring and painful. Melanoma is fatal if undetected sufficiently early enough for treatment. According to the most recently available and reported National Cancer Registry records, melanoma and non-melanoma skin cancers account for approximately 30% (~ 35 000 cases in 1998 and 1999; 7000 melanomas and 28 000 non-melanoma skin cancers) of all histologically-diagnosed cancers in South Africa.[2] Sunburn is a proxy for acute sun exposure and is implicated in skin cancer aetiology.[3] Ocular sun exposure is also a concern and related health outcomes include cataracts and pterygia.[4] Emerging health concerns include the impact of excess solar UV radiation on immune response as well as on the efficacy of vaccinations.[5]

The relationship between sun exposure, sunburn and skin cancer is complex.[3] Chronic exposure is generally associated with non-melanoma skin cancers, while the relationship between sun exposure and melanoma is more tenuous.[3] Individual risk is also determined by the amount of melanin in human skin affording some natural protection against the harmful effects of excess solar UV radiation. Table 1 provides an indication of the risk of sunburn depending on melanin content and exposure to the sun according to six phototypes.[6] Individuals with minimum natural protection, i.e. melanin, including fair-skinned individuals and albinos, and those spending extended periods of time outdoors, such as outdoor workers, and without sufficient sun protection, may be at risk.[7]

Personal sun exposure is influenced by, among other factors, timing and duration of exposure, type of activity, body position and use of sun protection.[4] In 2007, the World Health Organization emphasised the need for adequate protection of outdoor workers from solar UV radiation.[7] Outdoor workers

Table 1. Skin phototype classification with solar UV radiation exposure estimates likely to cause sunburn on un-tanned skin[16]

Skin type; Unexposed skin colour; UV radiation sensitivity	Constitutive characteristics	History of sunburn	Continuous UV radiation exposure estimated to elicit sunburn on un-tanned skin (SED*)
I White Extremely sensitive	Fair skin, blue or light eyes and freckles	Always burns on minimal exposure	2 - 3
II White Very sensitive	Red or blonde hair, blue, hazel or brown eyes and freckles	Burns very readily, freckles common	2.5 - 3
III White or light brown Moderately sensitive	Brown hair and blue, hazel or brown eyes	May burn on regular exposure with no protection, tans slowly	3 - 5
IV Light brown Relatively tolerant to UVR	Brown hair and dark eyes	Burns rarely, tans rapidly with minimal exposure	4.5 - 6
V Brown Variable	Brown eyes and dark brown or black hair	Despite pigment, may burn easily on exposure	6 - 20
VI Black Relatively insensitive	Brown eyes and dark brown or black hair	Rarely burns, though sunburn is difficult to detect on heavily pigmented skin	6 - 20

*SED, Standard Erythemal Dose; 1 SED = 100 Jm^{-2}.

are particularly susceptible to the effects of non-melanoma skin cancer and ocular diseases because of the regular and prolonged nature of their sun exposure.[8] The nature of occupation and use of personal protective equipment are also important factors.[9] While their total risk is a combination of occupational and recreational sun exposure, workplace exposure is an important occupational health issue. Although the exact number of outdoor workers in South Africa is unknown, the large range of outdoor occupations present in the country suggests this subpopulation is sizeable. In addition, there are no solar UV radiation-specific legislation or safety limits for outdoor workers in South Africa. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) exposure limit of 0.3 SEDs (SED = Standard Erythemal Dose, 0.3 SEDs = 30 Jm^{-2}) issued in 1999 has been adopted in some countries for occupational exposure (8-hr) to UV radiation for exposure to artificial sources.[10] Thus, an occupational limit does exist for indoor ultraviolet radiation exposure, for example, during arc welding, but there are no occupational limits defined by time or exposure for outdoor occupational exposure and ICNIRP advises that personal discretion is applied. Previous studies done elsewhere have shown that outdoor workers do not make regular use of adequate control strategies, including protective clothing, hats, shade, sunglasses and sunscreen[11] and there may be ethno-racial differences in sunscreen and sunglasses use, as noted among outdoor workers in southern California.[12]

To date, no attempts have been made to empirically measure the personal solar UV radiation exposure or sun protection habits of South African outdoor workers. In 2000, a desktop study comprising a human health risk assessment of solar UV radiation exposure was carried out on four lifestyle scenarios, including an outdoor worker, living in Durban and results indicated that outdoor workers were at high risk of excess sun exposure.[13] While a sample of Durban schoolchildren's sun exposure has been measured using personal dosimeters,[14] no such study has been carried out among outdoor workers living in South Africa. This knowledge is needed to help guide skin cancer prevention and sun awareness campaigns, and motivate to employers to educate and support sun awareness among their employees. This research used ambient solar UV radiation data to estimate possible outdoor worker exposure among South Africans as a first step towards understanding exposure and sunburn risk patterns by season and skin type at a national level. This level of information is needed to develop a comprehensive strategy to minimise sun-related risks, since the sun cannot

be controlled in the same way as other workplace exposure hazards. Improved sun awareness and skin cancer prevention education is needed among outdoor workers and their employers. Co-ordinated, evidence-based research programmes are required to abate the public health risks associated with excess solar UV radiation exposure, awareness campaigns and prevention methods.[15]

MATERIALS AND METHODS

Ambient solar UV radiation data

Solar UV radiation is divided into three electromagnetic bands: UV-C, UV-B and UV-A.[4] Most UV-C is absorbed by stratospheric ozone in the atmosphere and only a small portion reaches the Earth's surface. UV-B and UV-A are more likely to reach the Earth's surface and pose human health risks. Several factors influence the amount of solar UV radiation received at the Earth's surface, such as altitude, latitude, aerosols, thickness and distribution of clouds, stratospheric ozone, surface reflection, solar zenith angle and time of day.[4] Erythemal or sunburn-causing UV radiation is defined as UV-B irradiance weighted by the action spectrum for sunburn or erythema.[16] Exposure to solar UV-B radiation has been associated with the occurrence of sunburn.[4] For this reason, solar UV-B radiation was the focus of this research.

The South African Weather Service (SAWS) monitors ambient solar erythemal UV-B (defined as between 290-320 nm) levels at six stations around South Africa, namely Pretoria (25.7° S, 28.2° E), Durban (30.0° S, 31.0° E), Cape Town (33.98° S, 18.6° E), Cape Point (34.35° S, 18.48° E), De Aar (30.7° S, 24.0° E), and Port Elizabeth (33.9° S, 25.5° E) (Figure 1). The main purpose of the solar UV radiation monitoring network is to create and enhance public awareness and provide real-time information about the hazard of personal sun exposure.

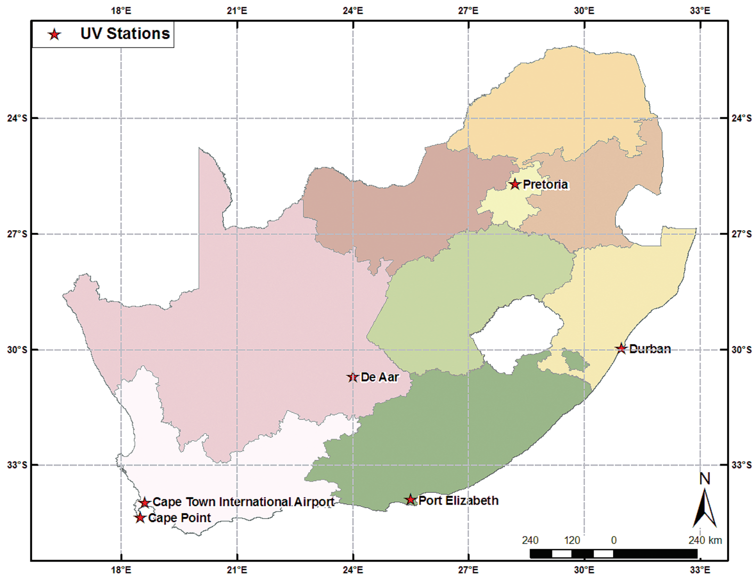


Figure 1. Location of six solar UV radiation monitoring stations across South Africa

The instrument used to measure daily ambient solar UV radiation, from sunrise to sunset, is a UV Biometer (model 501) comprising a Robertson-Berger pattern UV radiation detector, digital recorder and control unit. The erythemal UV-B spectral range closely mimics the McKinley / Diffey Erythemal Action Spectrum.[16] Logged readings were converted into hourly SED values, the international standard unit for expressing solar UV radiation exposure (defined as 1 SED = 100 Jm^{-2}).[7] Data for 2006 were applied in this study since this data set was the most complete (8 days missing during December for the Port Elizabeth station) and recent (at the time of carrying out this research) for all six stations. A full investigation of the monitored ambient solar UV radiation levels to explain inter-station differences requires geophysical and atmospheric data, as well as calibration factors, currently unavailable in South Africa. Hence, the focus of this work was on the measured solar UV radiation data recorded at the monitoring stations.

Possible outdoor worker solar UV radiation exposure calculations

No South African personal UV radiation exposure study has determined the solar UV radiation exposure levels among outdoor workers. However, international population studies have done so. In a New Zealand personal UV radiation dosimetry study among outdoor workers, defined as builders, horticulturalists and road workers, monitored results showed that outdoor workers received about 20% of the total daily ambient solar UV radiation levels.[9] This percentage was similar to that found in several other studies in Australia[18] and Germany[19] and lower than that found in Switzerland.[20] Several factors may influence this percentage including type of outdoor work, anatomical attachment site of the personal UV dosimeter, local ambient solar UV radiation and temperature levels, and personal sun protection practices. Previous studies found that outdoor workers received about 10–70%[21] of the total daily ambient solar UV radiation depending on the amount of work time spent outdoors; and the anatomical site of measurement may vary this percentage from 11% (on the chest)[22] 24% on the back[22] and 2–17% for the eyes depending on hat use and seasonal variations.[23]

For this study, potential outdoor worker solar UV radiation exposure was defined as 20% of the measured total daily ambient solar UV radiation levels. The rationale for selecting 20% was a conservative, median estimate of all studies that have considered outdoor worker sun exposure as a percentage of the ambient solar UV radiation exposure, as well as generalised for all anatomical sites. This percentage may be higher or lower for specific outdoor occupation types or different anatomic sites. For example, in a recent study among Italian vineyard workers, for spring months, backs received between 53% and 87% of ambient exposure, and arms between 30% and 60%.[24] Possible outdoor worker solar UV radiation exposures were calculated for the six cities or towns where ambient solar UV radiation was monitored

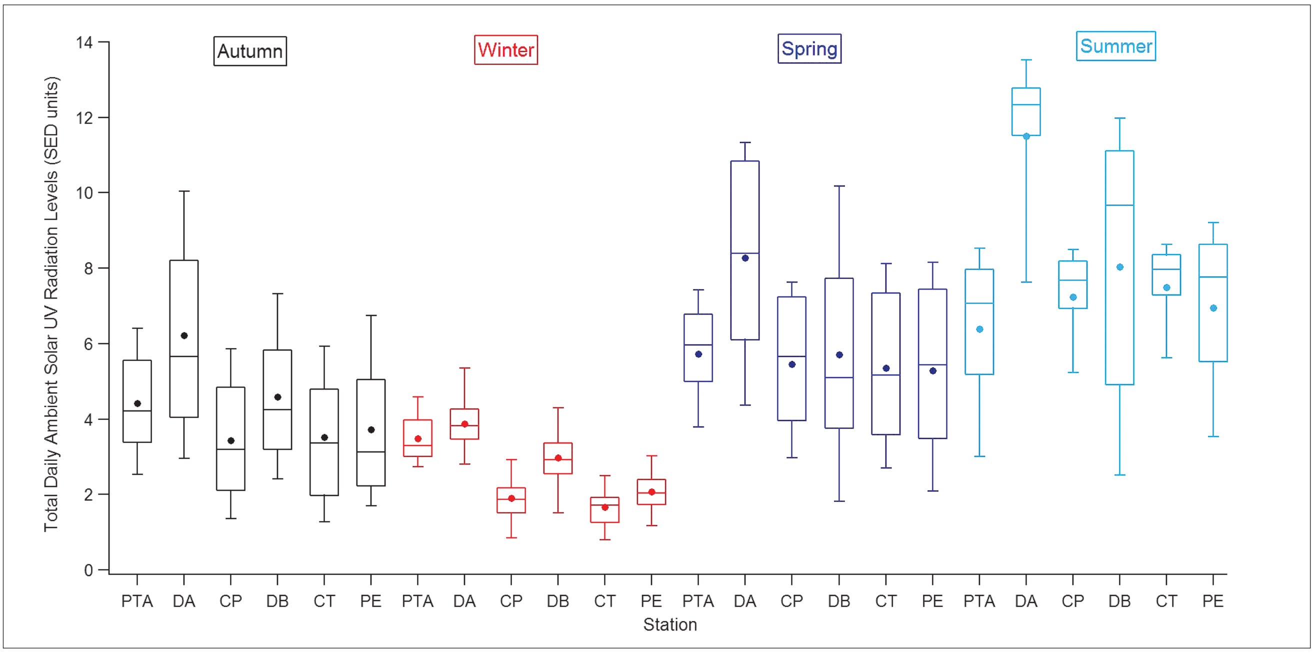


Figure 2. Total daily ambient solar UV radiation levels (SED units) by season at six monitoring stations in South Africa

by SAWS. Seasonal trends in possible solar UV radiation exposure patterns among outdoor workers are described. Summer, autumn, winter and spring were defined by the months of December, January and February; March, April and May; June, July and August; and September, October and November, respectively.

The risk of sunburn, an indication of excess sun exposure and associated in skin cancer aetiology, has been defined by skin type (see Table 1). This was overlaid onto the quantified outdoor worker solar UV radiation exposures to provide an indication of exposure and, subsequently, the health risk of sunburn. By superimposing the minimal amount of solar UV radiation exposure required to elicit sunburn response for different skin types onto the annual variation in outdoor workers' solar UV radiation exposure, the number of days during one year when an outdoor worker of a particular skin type may be at risk of sunburn was estimated. Since some outdoor workers, such as farmers, work seven days per week, weekdays, weekend days and public holidays were included. No individuals were involved in this study and only hypothetical scenarios were applied.

RESULTS AND DISCUSSION

Ambient solar UV radiation levels

Figure 2 shows the mean and median total daily ambient solar UV radiation levels (SED units) at six monitoring stations in South Africa. The typical pattern of highest levels during summer and lowest levels during winter is evident. Highest total daily ambient levels, ranging between 35.8 SEDs in Port Elizabeth and 70.7 SEDs in De Aar, were recorded during summer months (i.e. December, January and February) for all stations. Total daily ambient levels in De Aar were consistently higher than all other stations, probably because it is a small town in the Northern Cape with little industrial activity and relatively clear skies. Pretoria and Durban, northern sites compared to those situated in the Western Cape and Eastern Cape, experienced relatively high total daily ambient solar UV radiation levels during summer with mean values of 38.8 and 48.2 SEDs, respectively. Wintertime values ranged between 8.9 SEDs at Cape Point and 17.4 SEDs and 18.7 SEDs in Pretoria and De Aar, respectively. Even though Cape Point and Cape Town appear to be relatively closely situated in Figure 1, differences in the ambient solar UV radiation levels, shown in Figure 2, measured at these two sites may be on account of localised and highly variable cloud and aerosol conditions at the respective sites.

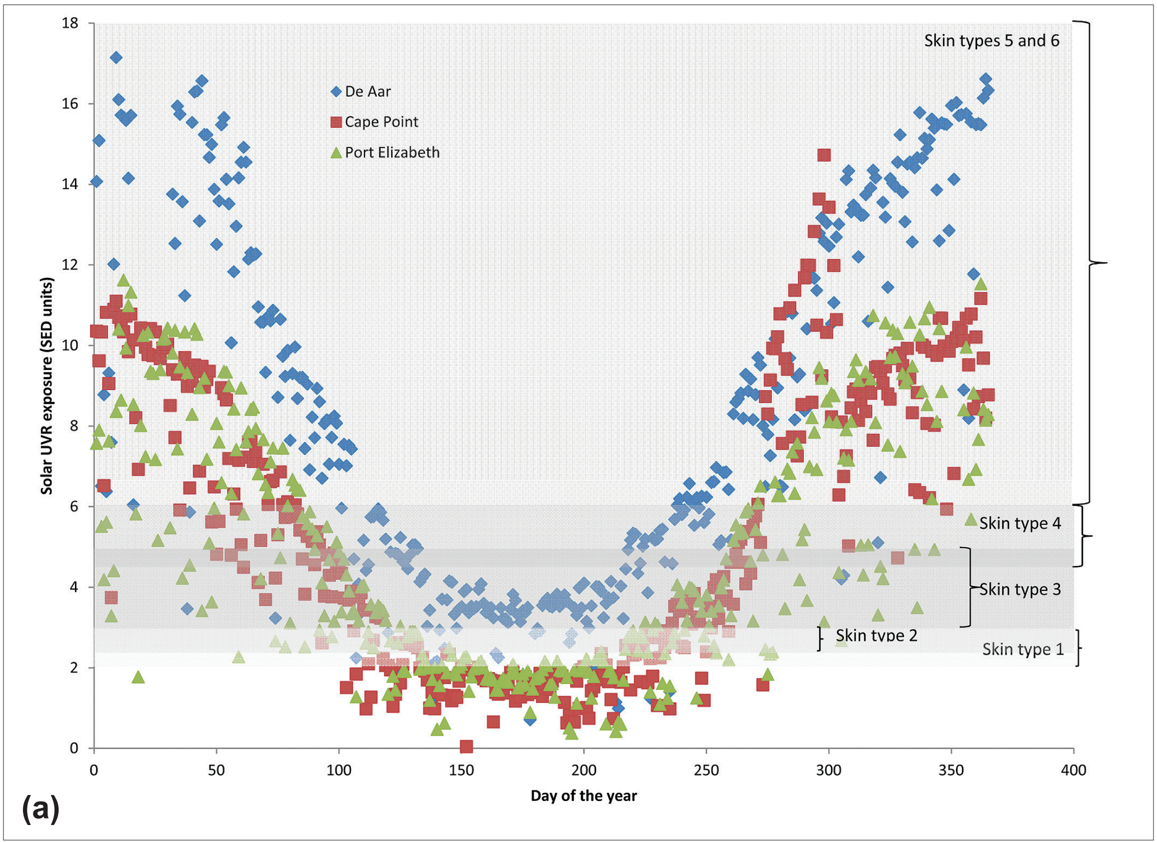
Total daily solar UV radiation exposures among outdoor workers

For a national perspective, a worst-case scenario for total daily solar UV radiation exposure among outdoor workers

Continued on page 27

The UV biometer

The UV biometer data-logger



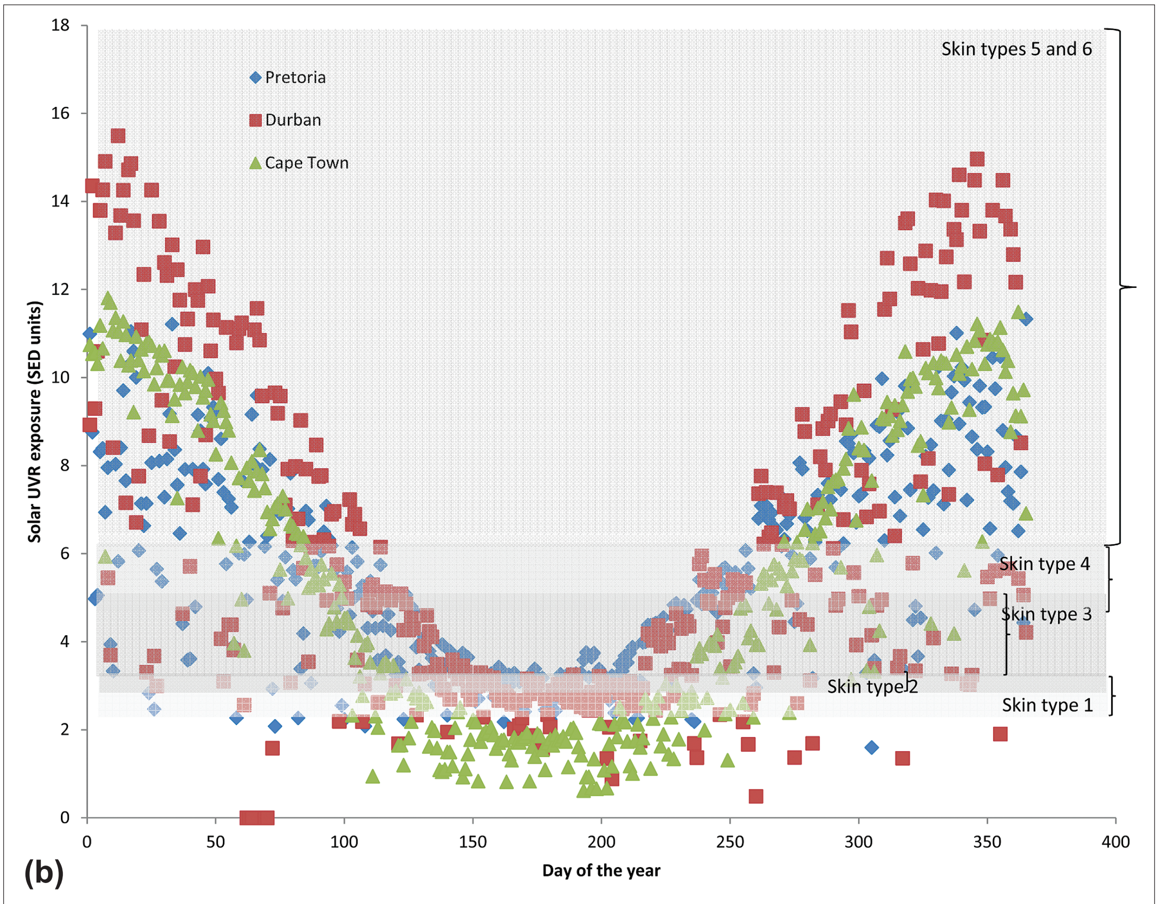


Figure 3. Potential total daily outdoor worker solar UV radiation exposure (SED units, 1 SED = 100 Jm^{-2}) at (a) De Aar, Cape Point and Port Elizabeth and (b) Pretoria, Durban and Cape Town.

Continued from page 25

was calculated using 20% of the total daily ambient solar UV radiation levels. The mean (median and range in parentheses) in total daily solar UV radiation exposures (in SED units, 1 SED = 100 Jm^{-2}) among outdoor workers during one year for Pretoria, De Aar, Durban, Cape Town, Cape Point and Port Elizabeth were 5.64 (5.37; 2.27-11.33), 6.08 (4.94; 1.90-15.49), 5.53 (5.22; 3.96-11.81), 7.92 (6.84; 3.46-17.15), 5.45 (4.80; 3.74-11.16) and 4.77 (3.97; 1.77-11.62), respectively.

These results compare favourably with the measured personal exposure among outdoor workers in New Zealand (geometric mean total daily UV radiation exposure was 5.32 SEDs for the shoulder bone / lapel anatomic site, worn as a badge)[9] and Australia (median measured exposure was 4.53 SEDs at the lapel site, worn as a badge).[18] In Australia, the International Commission Non-Ionizing Radiation Protection (ICNIRP) exposure limit of 0.3 SEDs (30 Jm^{-2}), revised in 2004,[10] was adopted for occupational exposure (8-hr) to UV radiation including exposure to artificial sources and solar UV radiation. Applying this exposure limit, very few potential total daily solar UV radiation exposures among South African workers would comply.

Personal sun exposure is influenced by, among other factors, timing and duration of exposure, type of activity, body position and use of sun protection.[4] Occupational sun exposure may be influenced by working hours, nature of occupation and use of personal protective equipment. Since total daily ambient solar UV radiation levels were applied, these factors cannot be included or considered. Real-time personal exposure monitoring using time-activity diaries, measures of sun protection practices and personal solar UV radiation dosimetry is needed among outdoor workers to validate these findings.

Potential outdoor worker sunburn risk by geographical location, season and skin type

Figures 3a and 3b depict the potential outdoor worker total daily solar UV radiation exposure for De Aar, Cape Point and Post Elizabeth, and Pretoria, Durban and Cape Town, respectively. Sunburn risk is overlaid by skin type according to the required solar UV radiation exposure amount needed to cause a sunburn response as defined in Table 1. For an outdoor worker with skin type II (moderately sensitive), continuous exposure of between 2.5 - 3 SEDs may cause a sunburn response, depending on bodily orientation, sun protection etc.

The general pattern in calculated solar UV radiation exposure among outdoor workers is typical of seasonal trends through one year in ambient solar UV radiation levels. An envelope-shape is evident and the scatter below the envelope for each location is usually indicative of cloud effects. There were very few days in a year when sunburn was unlikely to be experienced by an outdoor worker in any location. Outdoor workers with skin types I and II in all locations were identified as being at risk of sunburn almost all year round. Outdoor workers in De Aar, Pretoria and Durban tended to have higher exposure values compared to Cape Town, Cape Point and Port Elizabeth, the main reason being the impact of geographic latitude on ambient solar UV radiation. In South Africa, solar UV radiation levels are higher closer to the Equator, i.e. at lower latitudes, where the sun is more directly overhead compared to at higher latitudes closer to the poles.[25]

> "Outdoor workers are particularly susceptible to the effects of non-melanoma skin cancer and ocular diseases . . ."

The total number of days during one year that outdoor workers in Pretoria, Durban, De Aar, Cape Town, Cape Point and Port Elizabeth may be at risk of experiencing sunburn is shown in Table 2. As noted earlier, weekend days have not been excluded since some outdoor workers may work 5-, 6- or 7-day weeks depending on the nature of their occupation. This would mean that for outdoor workers working from Monday to Friday, the calculated total number of days when they were at risk of experiencing sunburn may not be a true reflection of their risk because they may not have been at work.

Seasonal differences in the number of days that outdoor workers may be at risk of experiencing sunburn based on their potential total daily solar UV radiation exposures are given in Table 2. Outdoor workers in all locations were at greatest risk of experiencing sunburn during summer and spring months,

Table 2. Total number of days per year and per season that outdoor workers of varying skin types may be at risk of experiencing sunburn from excess solar UV radiation exposure depending on activity and sun protection, using an estimated personal exposure of 20% of the total daily ambient solar UV radiation levels

	Skin type I					Skin type II					Skin type II					Skin type VI					Skin type V & VI				
Site	Total	Sum	Aut	Win	Spr	Total	Sum	Aut	Win	Spr	Total	Sum	Aut	Win	Spr	Total	Sum	Aut	Win	Spr	Total	Sum	Aut	Win	Spr
Pretoria	364	90	92	92	90	346	88	86	82	90	330	87	82	72	89	223	80	48	14	81	153	71	21	0	61
Durban	343	89	84	84	86	327	89	81	73	84	281	88	73	39	81	199	75	50	7	67	144	66	29	0	49
De Aar	341	75	90	85	91	334	75	86	82	91	324	75	83	76	90	149	74	65	21	89	202	73	44	4	81
Port Elizabeth	272	81	76	26	89	250	80	68	18	84	221	80	52	8	81	166	73	32	0	61	124	62	18	0	44
Cape Town	290	90	74	36	90	259	90	65	18	86	237	90	55	7	85	194	88	38	0	68	156	86	21	0	49
Cape Point	278	90	70	30	88	253	90	60	16	87	231	90	50	6	85	191	89	31	0	71	156	82	14	0	60

Note: Sum = Summer (Dec, Jan, Feb); Aut = Autumn (Mar, Apr, May); Win = Winter (Jun, Jul, Aug); and Spr = Spring (Sep, Oct, Nov) however, for almost all seasons, locations and skin types, there was at least one day when sunburn risk was possible. For all locations, except De Aar, outdoor workers of skin types I - IV were also at risk of sunburn during winter months. The melanin content in the skin of outdoor workers with skin types V and VI would provide sufficient sun protection for the relatively lower ambient solar UV radiation levels experienced during winter months, except

> "... there are no solar UV radiation-specific legislation or safety limits for outdoor workers in South Africa."

for the 4 days during winter in De Aar. The likely reason for this high number of sunburn risk days for outdoor workers all year around is duration of their exposure, in this case, having used 20% of the total daily ambient solar UV radiation to estimate outdoor worker exposure.

The timing of exposure is important as solar UV radiation levels follow a diurnal pattern that increases from sunrise to solar noon (i.e. around midday) and then decreases as sunset draws nearer. Between 12h00 to 13h00 when the sun is directly overhead, outdoor workers may seek shade for a lunchtime break; however, their total daily exposure is likely to remain high due to lengthy time periods outdoors either side of midday. The World Health Organization recommends limiting exposure during and / or use of adequate sun protection between 10h00 and 16h00 when ambient solar UV radiation levels are at their highest.[7] Outdoor workers' tasks may require that they spend time outdoors during this period of the day in which case adequate personal sun protective equipment is required, particularly for individuals with sensitive and moderately sensitive skin types.

CONCLUSION AND RECOMMENDATIONS

Given the relatively high rate of skin cancer and eye-related conditions in South Africa (although substantive recent and available data are sparse), and the World Health Organization's priority to protect outdoor workers from solar UV radiation,[7] it was deemed important to assess potential outdoor worker sunburn risk patterns for South Africa. In this study, ambient total daily solar UV radiation levels, measured using a nation-wide monitoring network used for the primary objective of raising awareness, were used to estimate the potential total daily solar UV radiation exposure for outdoor workers in South Africa. Limitations of this approach include the use of total daily ambient solar UV radiation levels; applying a generalised percentage of 20% of the total daily ambient solar UV radiation for outdoor worker sun exposure and for a generalised anatomic site; and including weekend days and public holidays in estimations since some outdoor workers may work 5-, 6- or 7-day weeks. The

preferred method for estimating personal sun exposure is using real-time, time-stamped solar UV radiation measurements and self-recorded activity patterns; however, this has not been done in South Africa.

Outdoor workers of all skin types were at risk on at least some days in all seasons (except skin types V and VI during winter, excluding in De Aar) of excess solar UV radiation exposure and sunburn. Further research, in addition to this study's findings and including information on skin cancer incidence among outdoor workers, is needed to develop comprehensive research, awareness and prevention strategies to minimise risks associated with excess occupational sun exposure.

ACKNOWLEDGEMENTS

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Conflict of interest and affiliation: None.

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LESSONS LEARNED

- Outdoor workers with skin types I, II and III (ranging from extremely to moderately sensitive) were identified as being at greatest risk of sunburn all year-round.
- Personal protective equipment and clothing for outdoor workers, especially for those with skin types I, II and III, should include sun protection, i.e. broad-brimmed hat, long-sleeve shirt and sunscreen.
- The World Health Organization recommends limiting exposure between 10h00 and 16h00 when ambient solar UV radiation levels are at their highest.

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Celebrating 21 years of biological monitoring

An overview 1990 – 2011

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INTRODUCTION

Over the last 21 years we as occupational health workers together with industry – the central resources for occupational exposures – have developed a knowledge base that can be compared to the best in the world. Our principles of evidence-based medicine, action-oriented exposure control and action monitoring with multiple stakeholders has supported successful relationships and creative solutions. Our main premise is that monitoring per se does not change exposure. Unless engineering controls or PPE mitigate exposure are implemented, no amount of monitoring will improve or lead to a decrease in levels in humans.

Our comprehensive approach follows the basic guidelines of Lauwreys and Perrine Hoet[1] and Casarett et al.[2] and leans heavily on data collection to contain exposures in the prevention of possible health impairment that may result from chemical exposure in the workplace.

Assessing the health risk of a population exposed to occupational or environmental pollutants may be carried out by three types of monitoring, i.e. ambient monitoring, biological monitoring and health surveillance. These correspond to the different levels shown on the pathway in Figure 1.

AMBIENT MONITORING

Ambient monitoring assesses the health risk by measuring the external exposure to the chemical, i.e. the concentration in air, water and the like. In industry, ambient monitoring usually means monitoring the airborne concentration of

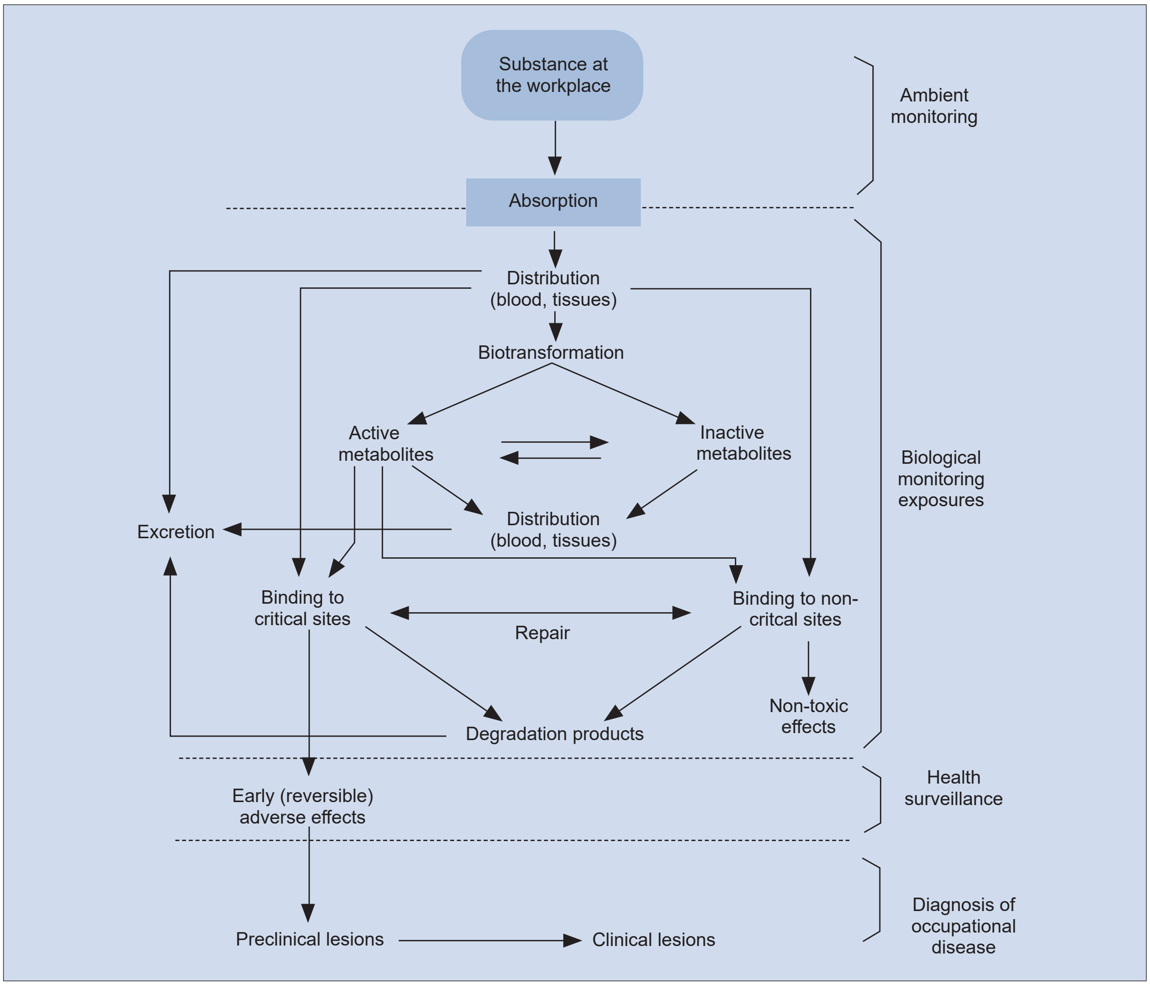

Figure 1. The fate of a chemical from the environment to the target molecule in the organism

the chemical. Depending on the type of sampling system selected – stationary or personal – the estimate of the risk may be carried out on a group or individuals. The presence of a health hazard is estimated by the reference to environmental exposure limits, such as the threshold limit value and the time-weighted average.

BIOLOGICAL MONITORING EXPOSURE

Biological monitoring exposure assesses the health risk through the evaluation of the internal dose. The main goal of biological monitoring of exposure is to ensure that the current or past exposure of the workers is "safe" (i.e. does not entail an unacceptable health risk). It is essentially a preventative medical activity. The presence of a risk is appreciated by reference to permissible levels in biological media, i.e. biological limit values.

HEALTH SURVEILLANCE OR BIOLOGICAL MONITORING EFFECTS

Health surveillance must be clearly distinguished from ambient and biological monitoring of exposure. Whereas the latter attempts to detect unhealthy exposure conditions (health risks), health surveillance evaluates the health status and aims at identifying individuals with early signs of adverse health effects, i.e. effects which are likely to be reversible or which do not progress to significant functional impairments when the exposure conditions are improved. Health surveillance must also be distinguished from the diagnosis of occupational diseases, which is the consequence of inadequate preventive programmes.

The processes have relied on a networking of systems which combines different expertise and disciplines within the health and safety environment. Proving, witnessing and investigating processes beyond the obvious and relying on the scientific evidence and data to support any risk associated with the work environment has and always will be our prime approach of investigation.

The information critical to determining potential occupational risk starts with the following:

- Identification of hazards and processes associated with a potential to contribute to such a risk.
- Evaluation (environment/workplace) before even considering a risk assessment plan. Workplace functions/processes which have a negative impact on the environment must always form part of the evaluation process.
- Control processes should be the primary focus within any working environment and it is essential to ensure that they are in place. Monitoring the environment, workplace and

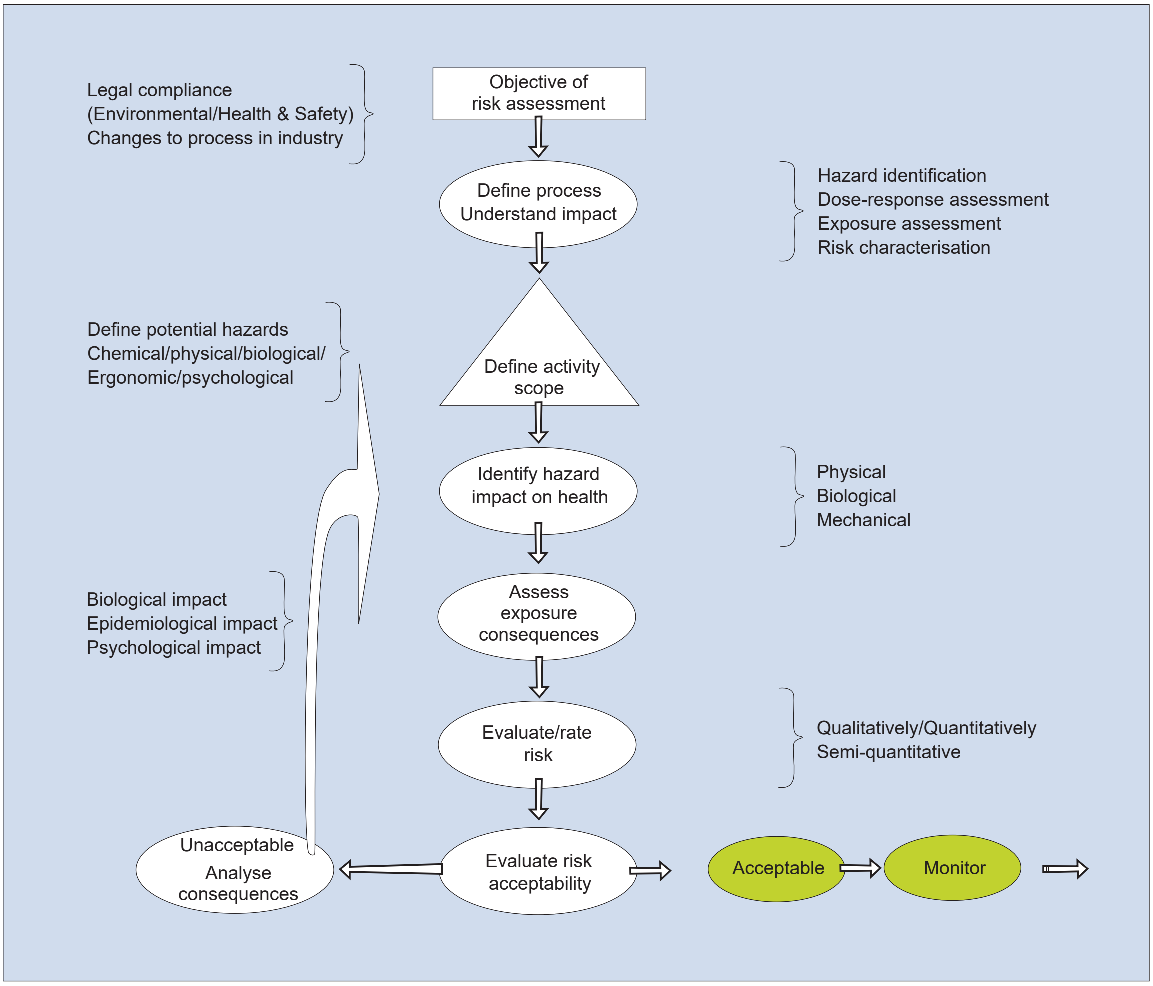

Figure 2. Flow diagram illustrating the principles of a well designed cost-effective programme

employees (biological, chemical, physical and psychological) status normally is a good indicator of the efficacy of the control processes in the workplace.

- Evaluation (of the individual person) has become an integral part of the evaluation process. Lifestyle habits, historical exposure and epidemiology, which deals with the occurrence of disorders in a population, should not be underestimated in occupational health services. Confounders, like the uncontrolled monitoring of smoking, drinking and other generally operating determinants, should always from part of any group or individual evaluation process.
- Control groups should always be included in any biological monitoring process. Comparing normal populations or unexposed employees to exposed employees should form part of any evaluation process.
- Control re-evaluation (environment, workplace and personal) should always feature high on any risk assessment programme, first and foremost a need for evaluating its validity, that is, whether there might be some selection or observational bias or confounding not adjusted for that might have a direct or indirect impact on the result.

Increasingly, occupational health practitioners are expected to demonstrate how existing and foreseeable risk have been addressed, namely what actions have been put in place to reduce exposure levels to tolerable/acceptable levels. Monitoring should be done in a systematic well defined manner to ensure that nothing is missed, exposures are limited and early aberrations are observed or detected before progressing to diagnosable occupational disease.

The flow diagram (Figure 2) illustrates the basic principles behind having a well organised, well designed effective cost-effective programme that will be able to monitor the control process within the industry.

CONCLUSION

"The precautionary principle": The precautionary principle in business is complementary to occupational health science. The key element to this principle is that action should be taken in event of uncertainty, rather than delaying the action until more "evidence" is generated.

Twenty-one years of biological monitoring has taught us that any risk assessment programme is a multi disciplinary activity which revolves around many facets and should be holistically approached. Ultimately, the objective is to prevent excessive exposure to hazards that may cause a chronic adverse health effect. Delaying the process might be very costly. However, it is the health professional's ethical responsibility to share sufficient information with respect to the processes, hazards and implication before and after monitoring without compromising the individual's right to confidentiality with management. However, this can't be done in isolation and when not addressed efficiently this can lead to an occupational disease and have far reaching implication far beyond the workplace or industry.

Table 1 shows a list of articles we have published on biological monitoring.

Table 1. Articles published on biological monitoring

Article number	Topic	Name
0905	Biological monitoring	Are we on the right track?
1104	Biological monitoring	Role of biomonitoring in the prevention of occupational disease.
1105	Biological monitoring	The relationship between external and internal doses of organic solvent vapours.
1106	Biological monitoring	Suppression of the metabolism in the employees exposed to a mixture of chemical, drugs and medication.
1201	Human biomonitoring	Making sense of human biomonitoring.
1206	Biological monitoring	Part 1. Reporting (statistical analysis).
1301	Biological monitoring	Part 2. Individual versus group results (statistical analysis).
1303	Biological monitoring	Part 3. Occupational and environmental exposure to hazardous chemical substances in SA: private sector lab reports.
1306	Biological monitoring	Assessment of confounders.
1401	Biological monitoring	The role of Biological Monitoring as a supplement to environment monitoring.
1403	Biological monitoring	Creating value in hazardous chemical substances, medicla surveillance and biomonitoring through computerized data analysis and interpretation.
1501	Biological monitoring	Are we on the right track with biological monitoring in SA?
1502	Biological monitoring	Manganese and manganism – an illusive diagnosis?
1506	Biological monitoring	Future prospects: the role of biomarkers in monitoring exposure to chemicals.
1601	Medical surveillance and BM	The dynamics of chemical/drug absorption and elimination and the impact it has on the monitoring of exposure to (hazardous) chemicals.
	Biological monitoring	Exposure to chemicals in the environment and workplace.
	Biological monitoring	Exposure to chemicals in the environment and workplace: the relationship between external and internal doses of organic solvent vapours.

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Gloves In A Bottle

Just like an invisible pair of gloves, the application of Gloves In A Bottle (GIAB) results in the formation of a protective barrier or shield on the skin surface that assists in keeping out harmful irritants and chemicals. It also allows for the natural oils and water to remain in the skin, and so assists in the healing process.

Conventional moisturisers only replace natural oils with artificial oils. These generally offer temporary relief and their regular use can actually result in the body producing less natural oils. When these oils are removed from the outer layer of skin, the water in that layer of skin is rapidly depleted, leaving the skin feeling dry, irritated and itchy – an indication that the natural protective layer has been stripped away. The deeper layers of skin are then exposed to harsh damaging substances, including solvents, detergents, cleaners, paint, thinners, dirt and grease, and a wide variety of other chemicals regularly used in the workplace – too many to mention. The end result is that this dry, irritated and itchy skin becomes chapped, cracked and excessively damaged.

GIAB is a shielding lotion. It forms a web or bond with the outer layer of skin and helps to lock in the natural oils and moisture whilst simultaneously assisting in the protection from harmful irritants – the key reason why dermatologists recommend GIAB as an effective dry skin treatment.

GIAB keeps the outer layer of skin functioning so well that the skin is able to breathe and perspire naturally. The fact that Gloves In A Bottle becomes part of the outer layer of skin itself prevents it from being washed off like conventional moisturisers and lotions. It comes off naturally with natural exfoliation and should be reapplied every 4 – 12 hours depending on your daily exposure and working environment. GIAB is not a replacement for required safety protection and manufacturer's safety directions should always be adhered to when handling harmful substances.

GIAB is simple and easy to apply – very little is required. In fact the American manufacturer states "one drop is all you need". This obviously refers to the hands, but the product can be used anywhere on the outer body. The product is grease free, odorless and leaves the skin with a soft 'satin' feeling.

Herewith a list of a few notable satisfied customers currently using GIAB internationally: General Motors, Kaiser Hospitals (197 hospitals), Southern California Gas Company, Ford Motor Company, BF Goodrich Tire and Rubber Company, Castrol Industrial, USA Federal Reserve Bank, Indiana State Police, UL laboratories, Mitsubishi, US Naval Hospital. Visit www. glovesinabottle.com for a more comprehensive listing.

The indications for the application of Gloves In A Bottle are extremely versatile. Should you or your workforce be exposed to environments or work practices which are associated with the risk of dry, itchy damaged skin, you have to give GIAB a try. By visiting the website you will be able to gain knowledge on completed clinical studies, ingredients, skin care professionals, a detailed explanation on how the product works, and testimonials relating to skin problems such as dry cracked skin, eczema, psoriasis, allergies, facial skin care, etc.

Gloves In A Bottle – innovative, affordable skin care and protection that works.

Workers' compensation, minimum wages, and moral hazard scope: stylized considerations on a South African case

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ABSTRACT

Viewing issues from the perspective of workers' compensation, the article highlights how for some South African sectors the simultaneous provision of a minimum wage and a permanent disablement coverage increases moral hazard scope. From an economy-wide perspective this increasing scope means that employers (and society) not only pay too much to provide workers' compensation, but are doing so at a mounting pace. The article considers some policy options that are overall not too drastic as regards the elimination of the increasing scope, and in so doing it also reminds us about the crucial importance of careful institutional design.

Key words: **COIDA, minimum wages, moral hazard, public institutions, South Africa, workers' compensation**

1. INTRODUCTION

Workers' compensation in South Africa is regulated by the Compensation for Occupational Injuries and Diseases Act of 1993 (COIDA).[1] Among other functions, the COIDA sets up a system of no-fault compensation for employees who are injured or contract diseases because of their job. More precisely, it establishes that, with few exceptions, an aggrieved party is entitled to compensation without the concurrent necessity to prove that any other party is at fault.[1,2]

It is well-known that the presence of workers' compensation creates excess burdens, or social inefficiencies, especially in the form of what economics terms moral hazard.[3-6] Moral hazard basically involves a shifting of responsibility: it occurs when an individual behaves differently according to whether or not she fully will bear the costs tied to the consequences of her actions. For example, if our home is insured against theft, then we may more often leave the windows ajar when we go to work, i.e. we are willing to incur a higher risk of theft as the insurance company will be responsible for the consequences of theft. When there are misaligned incentives between the insured and the insurer, because some of the actions of the insured – such as leaving the windows ajar – are hidden to the insurer, we have room for moral hazard. With workers' compensation – itself a form of insurance – matters are not much different. Classic moral hazard examples in this case include an employee taking less care on the job (e.g., not always wearing rubber gloves or safety goggles when required), reporting a permanent disablement that is not causally related to the job (e.g., she could report a domestic accident as a work accident), and an employee intentionally injuring herself.[7,8] The bottom line is that moral hazard is one reflection of what economics terms rational behaviour – namely that an individual usually opts for what's best for her based on the evaluation of personal relative costs and benefits, and not necessarily based on any ethical conduct or calculation of resulting cost transferred onto others.

For simplicity, this article solely considers misaligned incentives tied to some aspects of the relation between two extant public institutions, viz. minimum wages and permanent disablement coverage. It points out how at present, for some sectors, the simultaneous public provision of a minimum wage and permanent disablement coverage increases moral hazard scope, suggesting that the full socioeconomic objectives of compensation are neither as efficient nor as equitable as commonly thought.

The argument considers matters from the perspective of workers' compensation. Moreover, it employs stylized facts, a common heuristic expedient in economics to abstract from

Table 1. Degree of permanent disablement[1]

Injury		Percentage of permanent disablement
Loss of two limbs		100
Loss of both hands, or of all fingers and both thumbs		100
Total loss of sight		100
Total paralysis		100
Injuries resulting in employee being permanently bedridden		100
Loss of arm at shoulder		65
Loss of arm between elbow and shoulder		65
Loss of arm at elbow		55
Loss of arm between wrist and elbow		55
Loss of hand at wrist		50
Loss of four fingers and thumb of one hand		50
Loss of four fingers		40
Loss of thumb:	Both phalanges	25
	One phalanx	15
Loss of index finger:	Three phalanges	10
	Two phalanges	8
	One phalanx	5
Loss of ring finger:	Three phalanges	8
	Two phalanges	6
	One phalanx	4
Loss of little finger:	Three phalanges	6
	Two phalanges	5
	One phalanx	3
Loss of metacarpals:	First, second or third (additional)	4
	Fourth or fifth (additional)	2
Loss of leg:	At hip	70
	Between knee and hip	45 to 70
	Below knee	35 to 45
Loss of toes:	All	15
	Big, both phalanges	7
	Big, one phalanx	3
	Toes other than big toes:	
	Four toes	7
	Three toes	5
	Two toes	3
	One toe	1
Loss of eye:	Whole eye	30
	Sight	30
	Sight except perception of light	30
Loss of hearing:	Both ears	50
	One ear	7

Note 1: Total permanent loss of the use of a limb shall be treated as the loss of the limb.

Note 2: Any injury to the left arm or hand and, in the case of a left-handed employee, to the right arm or hand, may in the discretion of the Director-General be rated at ninety percent of the above percentage.

Note 3: If there are two or more injuries the sum of the percentages for such injuries may be increased, in the discretion of the Director-General.

data trends to aid theoretical reasoning.[9-11] The stylized facts are two, in the main regard minimum and maximum benefits for permanent disablement and a sample of minimum wages, and are based on recent data that are openly available. The first stylized fact identifies the origin of the moral hazard of interest, while the second – which defines our principal concern – indicates why the scope of the moral hazard of interest widens as time goes by. Thus, our point about exacerbating misaligned incentives derives from institutional considerations, rather than from any moral hazard instance. We conclude, however, that not all may be lost, at least as regards the second fact: there are some policy options that are not in the main overly drastic, and that at the same time remind us about how important it is to perform careful institutional design.

2. COVERAGE FOR PERMANENT DISABLEMENT ACCORDING TO THE COIDA: SOME BASICS

Permanent disablement, which can range from 1% to 100%, means that an occupational injury or disease results in a permanent anatomical defect, loss of anatomical function or disfigurement that is tantamount to disablement for employment.[1] Permanent disablement thus can include total or partial loss of a limb, impairment of movement of a joint, loss of vision or hearing, restricted lung function, or loss of an organ. Table 1 reports degrees of permanent disablement.

Under the COIDA, compensation for permanent disablement is paid either in a lump-sum or as a monthly pension depending on the degree of disablement. Permanent disablement assessed to be within the inclusive range from 1% to 30% is paid in the form of a lump-sum.[1] For the calculation of permanent disablement within this inclusive range, the upper limit of 30% acts as the yardstick for calculations of compensation for permanent disablement below it. For example, the lump-sum compensation for 30% permanent disablement is calculated at 15 times an employee's earnings as prescribed by the COIDA, subject to a prescribed maximum and minimum of such earnings. Thus, the lump-sum compensation in the event of permanent disablement at less than 30% is calculated pro rata to the lump-sum for 30%.

For permanent disablement assessed within the inclusive range from 1% to 30%, the 2009 minimum earnings threshold is R2790 per month and the maximum earnings threshold is R11 163 per month. If an employee earns less than the minimum earnings threshold, her compensation will be calculated using the minimum earnings figure rather than her own wage. Therefore, the minimum lump-sum compensation for 30% permanent disablement is R41850 (i.e., 15 × R2790).

To illustrate, consider the case of the permanent disablement from the loss of one ear. According to the COIDA guidelines reproduced in Table 1, this is a 7% permanent disablement that will yield the lump-sum compensation of [(7% × 100)/30)] × (15 × Monthly Gross Earnings). The generic calculation for permanent disablement up to 30% – where the monthly earnings are subject to the minimum and maximum prescribed by the COIDA – accordingly is,

[(% Disablement × 100)/30] × (15 × Monthly Gross Earnings),

where (% Disablement) is determined by Section 2 of the COIDA.

If the permanent disablement is assessed at 31% inclusive or more, then the employee will receive a monthly pension for life. Compensation for 100% permanent disablement is calculated at 75% of the employee's monthly earnings, again subject to a prescribed maximum and minimum of such earnings. The pension for permanent disablement, within the

Table 2. Minimum compensation threshold for 100% permanent disablement (2008-2009) and some minimum wages

Industry	Sub-sector	Occupation	COIDA pension (Rands 2009)	Minimum wage (Rands 2009)	Difference between COIDA pension and minimum wage (Percentage 2009)	COIDA pension (Rands 2008)	Minimum wage (Rands 2008)	Difference between COIDA pension and minimum wage (Percentage 2008)
Agriculture	–	Farm worker	2092.50	1316.69	-37	–	–	–
Community, social & personal services	Hair salon	General assistant	2092.50	1756.81	-16	1875.00	1611.76	-14
Construction	Building	Labourer/cleaner	2092.50	1920.44	-8	1875.00	1769.93	-6
Construction	Building	Labourer	2092.50	1998.73	-4	1875.00	1754.51	-6
Construction	Electrical	General worker	2092.50	1964.52	-6	1875.00	1688.05	-10
Construction	Building	General worker	2092.50	1434.96	-31	1875.00	1301.16	-31
Finance	Business services, Contract cleaning	Cleaner	2092.50	1658.17	-21	1875.00	1541.26	-18
Forestry	–	Employee	2092.50	1138.71	-46%	–	–	–
Manufacturing	Furniture, bedding & upholstery	Labourer	2092.50	1732.00	-17	1875.00	1732.00	-8
Manufacturing	Curtaining	General worker	2092.50	1635.31	-22	1875.00	1635.31	-13
Manufacturing	Curtaining	Labourer	2092.50	1580.00	-24	1875.00	1580.00	-16
Manufacturing	Wood	Labourer	2092.50	1505.00	-28	1875.00	1400.00	-25
Wholesale and retail trade	Restaurants, catering and allied trade	General assistant	2092.50	–	–	1875.00	1724.25	-8
Wholesale and retail trade	Restaurants, catering and allied trade	General assistant	2092.50	–	–	1875.00	1660.77	-11
Wholesale and retail trade	Retail trade	Forecourt attendant	2092.50	1660.12	-21	1875.00	1545.33	-18
Wholesale and retail trade	Meat	Cleaner	2092.50	1645.96	-21	1875.00	1496.19	-20
Wholesale and retail trade	Restaurants, catering and allied trade	General assistant	2092.50	–	–	1875.00	1399.02	-25
Average	–	–	2092.50	1639.10	-18	1875.00	1598.30	-15

Note 1: All compensations are increased annually, depending on Compensation Fund reserves available and not on changes of inflation. Minimum wages also increase annually but, unlike compensations, the increases follow inflation. The increases for both compensations and minimum wages are published in the Government Gazette.

Source: Compiled by the authors using other sources[12,14]

Table 3. CPI and minimum compensation pension figures

	2003	2004	2005	2006	2007	2008	2009	Average
Annual average CPI (%)	5.8	1.4	3.4	4.6	7.2	11.5	7.1	5.9
Permanent disablement COIDA minimum pension (Rands)	1019.25	1146.15	1224.00	1410.75	1626.75	1875.00	2092.50	–
Annual growth in permanent disablement COIDA minimum pension (%)	–	12.45	6.79	15.26	15.31	15.26	11.60	12.8

Note 1: The gazetted annual increase for minimum wages is CPI plus 1% or 2% depending on the sector.
Note 2: From 2009, the CPI figures were calculated using a new basket of goods and new weights.
Note 3: The CPI above is the average rate for the year (for illustrative purposes), whereas, in general, the CPI used for wage increases is the one available six weeks prior to the increase. Wages in different sectors are increased at different times of the year, e.g., forestry wages are increased in April each year while those in farming are increased in March each year.[12]

Source: Compiled by the authors using other sources[12,14-16]

inclusive range from 31% to 99%, will be calculated on a pro rata basis to the pension for 100% disablement.

For permanent disablement assessed at 31% inclusive or more, the 2009 minimum earnings threshold is R2790 per month and the maximum earnings threshold is R19 931 per month. If an employee earns less than the minimum earnings threshold, her compensation will be calculated using the minimum earnings rather than her own wage. Therefore, the minimum compensation pension for 100% permanent disablement is R2092.50 per month (i.e., R2790 × 75%). The maximum compensation pension for 100% permanent disablement is R14 948.25 (i.e., R19 931 × 75%). The compensation pension – where, once more, the monthly earnings are subject to the minimum and maximum prescribed by the COIDA – is calculated according to,

(% Disablement) × (Monthly Gross Earnings × 75%),

where (% Disablement) again is determined by Section 2 of the COIDA.[1]

3. TWO STYLIZED FACTS

Table 2 compares minimum wages in a number of occupations with the minimum compensation for 100% permanent disablement. The minimum compensation is R1875.00 for 2008 and R2092.50 for 2009; while the average minimum wage for jobs of all sectors is R2451.24 for 2008 and R2723.80 for 2009.[12] However, there is significant variation in the minimum wage amount for each individual sector.

Employees ("labourers") in the paper sector and in the petroleum manufacturing sectors received a minimum wage of between R4500 and R5000 in 2008 and 2009, i.e. more than double the minimum monthly pension payment from the COIDA. Because these wages are above the minimum threshold, in the event of 100% permanent disablement, these employees are eligible for 75% of their wage. On the other hand, employees in the wood manufacturing sector and in the construction industry ("general workers") only face a minimum monthly wage of between R1435 and R1505, which is up to 31% less than the monthly minimum pension they would receive from the COIDA. In the event of 100% permanent disablement, these employees are eligible for a monthly pension that is approximately 46% higher than their wage. Thus, we have a first stylized fact (SF):

SF1. In some instances, the minimum threshold for compensation for 100% permanent disablement exceeds gazetted minimum wages.

Additionally, as Table 2 further shows, the gap between compensation and minimum wages shows variation between sector and occupation, as well as from one year to another. In 2009, employees in construction earned 8% less than minimum compensation for permanent disablement under the COIDA, while a cleaner in wholesale and retail trade earned 21% less than the minimum compensation. Also, for employees in the manufacturing sector, the gap between compensation and minimum wage has grown from 2008 to 2009, meaning that the manufacturing employees are earning comparatively less each year as compared to the minimum compensation threshold.

Table 3 gives this observed gap broader context. It reports data over 2003–2009 on the Consumer Price Index (or CPI, the index used by economists to measure inflation, and according to which annual increases for minimum wages are determined), the Permanent Disablement COIDA Minimum Pension, and the change in the latter. Depending on sector, the minimum wages increase either at CPI + 1% (e.g., farm and forestry wages) or CPI + 2% (e.g., hospitality sector wages). Thus, Table 3 shows that over the relevant period and depending on sector, the average increase in minimum wages was approximately either 6.9% (i.e., average CPI + 1%) or 7.9% (i.e., average CPI + 2%). But from 2003 to 2009 the average increase to the minimum pension under the COIDA was 12.8%. Hence, minimum compensation pensions from permanent disablement, which are higher than some of the minimum wages, are also growing higher annually than the minimum wages. Therefore, the legislated compensation is out of line with at least a subset of minimum wages. While a longer time series would be useful to comment more fully, there still is a broad trend:

SF2. There is no convergence in the growth rates of permanent compensation benefits and of minimum wages.

4. DISCUSSION

In the concrete South African case, we can identify three scenarios.

(a) Within the inclusive minimum and maximum earnings threshold, the permanent disablement pension is 75% of gross earnings.

(b) If earnings are above the maximum earnings threshold, then the employee receives less than 75% of her gross earnings in the form of a permanent disablement pension.

(c) If earnings are below the minimum earnings threshold, then the employee receives more than 75% of her gross earnings in the form of a permanent disablement pension.

SF1 highlights that the minimum earnings threshold – (c) – is the weak link. For it is at this threshold that misaligned incentives kick in: in some employment categories, the employee can obtain a monthly disablement pension greater than her minimum wage. This discrepancy is exacerbated if one considers that minimum wage legislation is not always complied to: employees in many cases are receiving a wage lower than the legislated minimum.[13]

SF2 complicates matters. For it renders weak link (c) even weaker. SF2 enlarges moral hazard scope, namely it stimulates other incentives for intentional self-injury. The fact that the gap between compensation and wages keeps on getting larger and larger implies that the decision of intentionally injuring oneself keeps on getting more attractive as time goes on for the benefits of doing so are getting larger and larger. Hence, all else equal, the maximum benefit foregone of not intentionally injuring oneself increases with time.

Consider a forestry employee who earns R1138.71 per month. In 2009, to obtain a permanent disablement pension equivalent to her monthly wage she would have to inflict an injury of 55% permanent disablement (e.g., loss of arm between wrist and elbow). But if we consider the gap between compensation pensions and minimum wages and if wages and pensions continue to grow at their current rates, by 2015 our forestry employee will have to inflict an injury of 39% permanent disablement (e.g., loss of four fingers and thumb of one hand) to obtain a pension that is equivalent to her wage; by 2020, the self-injury would need to be of 30%; in 2025, 23%; in 2030, 18%; in 2035, 13%. If we consider the curtaining manufacturing sector the situation is not so different, where by 2035 the required self-injury would be 19%. The same holds for, e.g., agriculture, where in 2035 the figure would be 16%. And so on. (See Box 1 for the calculation formula.)

Recall now that a 30% and below injury is compensated only with a lump-sum payment. Eventually, the extent of self-injury for a minimum wage employee in any sector to obtain an equivalent permanent pension will reach the lowest limit for pension entitlement, namely 31% (e.g., the loss of a thumb and a little finger). Thus, as time goes by, the identified moral hazard scope, which is defined in tandem by the current institutions of compensation and minimum wage, increases.

5. POLICY CONSIDERATIONS

In order to reduce moral hazard scope – assuming one wants to maintain both compensation and minimum wages – minimum wages and compensation pensions need to be aligned. In hindsight, there seem to be two immediate policy options to correct the mismatch. If we approach the matter from the perspective that the minimum permanent disablement pension is too high, the first option is to decrease compensation in order for it to be in line with minimum wages. While simple, this policy option may cause social unrest as, e.g., individuals already receiving compensation may oppose it because they would be worse-off. The alternative is to approach the misalignment from the perspective that minimum wages are too low. From this perspective, the second policy option is to increase minimum wages to be in line with compensation. However, an outright increase in minimum wages to exactly meet compensation, though popular for the politician in the short run, would be too high a price to pay for all in the long run; e.g., it would arguably increase labour market distortions. Therefore, neither of these immediate policy solutions would be advisable.

One alternative to an immediate policy solution approach – still in keeping with the assumption that one wants to maintain both compensation and minimum wages – is to try to remedy the misalignment by narrowing the gap between minimum wages and minimum permanent disablement pensions gradually. If the minimum permanent disablement pension threshold is kept constant or increased at a lower rate as compared to the minimum wage rate increases, then the gap between the two will narrow over time. In fact, provided the minimum permanent disablement pension is increased at the same rate as inflation, then employees and those who receive such pensions will not be worse-off in terms of their purchasing power. Since minimum wages increase at a rate one or two percentage points higher than the inflation rate, this type of increase will ensure that minimum wages increase at a faster rate than the minimum permanent disablement pension. Thus the gap between the two will gradually close. Once the gap has closed, a provision – essentially a fairly inflexible rule that also obviates discretionary interventions – can be made to ensure that both the minimum compensation pension and minimum wages increase at the same rate.

Take note, however, that closing the gap will not eliminate moral hazard generally tied to compensation. Keeping everything else constant, the closure of the gap will only eliminate the exacerbation of the identified moral hazard through time. Thus, even if possibility (c) is eliminated, the mere presence of compensation, as implied, creates room for moral hazard. Still, it is believed that the benefit of having compensation outweighs the general moral hazard costs tied to it. As a result, the elimination of moral hazard requires a more resolute, if politically unpopular, policy.

BOX 1. FORMULA FOR GROWTH RATES

Using data from Tables 2 and 3, the calculations are based on the following formula, where the averages from Table 3 are proxies for growth rates:

$$\text{growth rate} = 100\times \frac{\text{minimum wage}(1 + \text{growth rate of minimum wage})^{\text{year} - \text{base year}}}{\text{minimum compensation}(1 + \text{growth rate of minimum compensation})^{\text{year} - \text{base year}}}$$

For example, if we consider agriculture (a “farmworker”) in 2015 and recall that the growth rate of the minimum wage is average CPI + 1 we obtain,

$$\text{growth rate} = 100\times \frac{\text{R}1316.69\ (1+0.069)^{2015-2009}}{\text{R}2092.50\ (1+0.128)^{2015-2009}} = 45.6\%$$

6. CONCLUSION

The two public institutions of minimum wages and permanent disablement pensions define, in conjunction and for some employment categories, two related moral hazard problems. The first problem originates from a typical case of the left hand not knowing what the right one is doing – the COIDA[1] was not designed considering the already-existing institution of minimum wages. At the very least, this problem entails that the intended beneficial socio-economic effects of the two institutions in some instances may cancel each other out. The second problem, our main interest, originates from the widening gap between minimum wages and permanent disablement pensions. Since compensation pensions are increasing at a higher rate than minimum wages, the benefits from the last unit of intentional self-injury are increasingly outweighing their respective costs. However, from an economy-wide perspective – and of course this is the whole point – matters are different: employers (and society) not only pay too much to provide workers' compensation, but are doing so at a mounting pace. The responsibility shift is not free, and its excess burden increases every day.

LESSONS LEARNED

1. Economic analysis suggests that the combined social effects of the existing institutions of worker compensation and minimum wages increase moral hazard scope in South Africa.
2. An employee who receives a minimum wage faces an increasing incentive to trade-off her wage in favour of a permanent disablement pension.
3. The increasing scope of moral hazard poses serious cost implications for South African employers and, more generally, for society.
4. Policy recommendations in the form of bringing annual increases of worker compensation in line with inflation to reduce the scope of moral hazard are suggested.

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Department of Health releases Human Resource Strategy

Elsabé Klinck

On 11 October 2011 the Department of Health (DoH) released its 2012 – 2017 Human Resource for Health Strategy (HRHS). It has long been recognised that without a sufficient and appropriate supply of healthcare professionals, the envisaged National Health Insurance (NHI) system would be a mere pipedream.

The document analyses the status quo, and then deals with recommendations in relation to three themes, i.e. the supply of health professionals and equity of access; education, training and research and the working environment. No analysis is included on occupational health, and how this links into the overall HRHS.

It also sets eight strategic priorities, objectives and activities under each. The former will be listed below, and described in detail in the next issue. It proposes the establishment of Task Teams, Units, Centres, Committees and Institutes to implement the strategy (see Figure 1).

WHERE SOUTH AFRICA STANDS CURRENTLY

The HRHS reflects the current numbers of healthcare professionals as follows:

Although an announcement has been made that the intake of medical students will double within the next three years, where the growing of specialists are concerned, it is reported that 30% of academic specialist and surgical clinical posts are unfilled and unfunded.

Over the period 2006/7 to 2010/11 public sector expenditure on personnel increased annually on average by 27%. Over R58bn was spent on personnel in 2010/11.

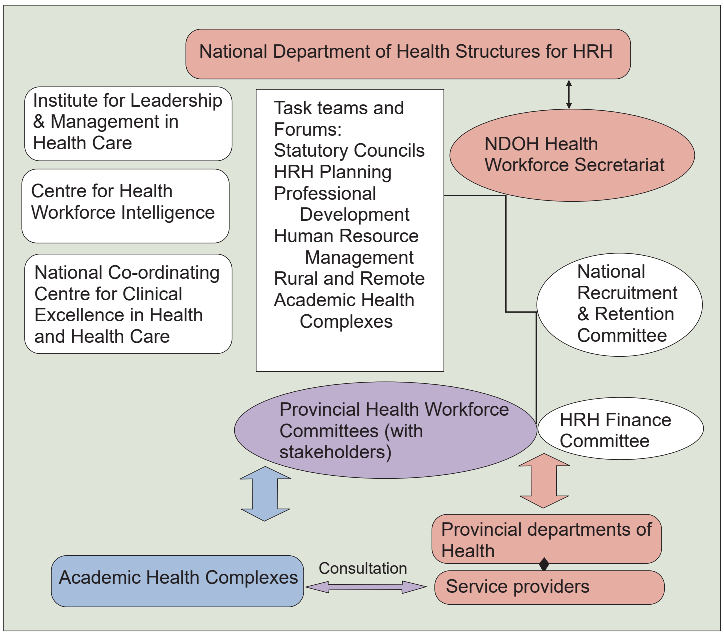

Figure 1. Structures to implement HRHS

(Source: HRHS, Figure 9, Chapter 5)

Table 1. Numbers of healthcare professionals

Type of healthcare professional	Total professionals	Professionals in public sector
Medical practitioners	18 147	11 664
Specialists	9 637	4 513
Professional nurses	93 049	55 309
Nursing assistants	56 039	35 376
Pharmacists	11 425	3 285
Physiotherapists	5 850	970
Occupational therapists	3 779	837

(Compiled from Table 2, Chapter 3 – and Table 1, Annexure A, HRHS)

CONTEXT AND LEGAL MANDATE

The HRHS document draws its mandate from sections 51 and 52 of the National Health Act of 2003. Section 51 authorises the establishment of academic complexes and section 52 envisages regulations on adequate resources, categories of healthcare personnel, skills shortages, recruitment of foreign healthcare professionals, institutional capacity and strategies for human resources (HR) planning, development and management.

STRATEGIC PRIORITIES

As noted above, the HRHS sets eight strategic priorities. They are to: provide proactive leadership and an enabling framework to achieve the objectives of the National Department of Health (NDOH) HRHS; establish a Centre for Health Workforce Intelligence (see Figure 1); meet workforce requirements of new and emerging service strategies; ensure the revitalisation of the production of a health workforce; strengthen Academic Health Complexes and nursing colleges; effectively manage human resources; develop a health workforce that delivers an evidenced based quality service, with competence, care and compassion; and promote access to health professionals in rural and remote areas. These priorities will be explained in greater detail in the January/February 2012 issue of *OHSA*.

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SASOM events in 2011 are shaping the future

SASOM has had a busy year with several successful projects and 50 new members. Perhaps the biggest single project was the hosting of an international congress.

AFRICAN REGIONAL ASSOCIATION OF OCCUPATIONAL HEALTH (ARAOH)

Following up on the objective born at the ICOH2009 Congress to revive and strengthen ARAOH and consequently improve occupational health care for workers in all countries in Africa, SASOM hosted the international ARAOH/SASOM Congress in August 2011.

After ten months of planning, the two and a half day event went off very well, with excellent presentations from many countries. Co-operation between African countries was strengthened and SASOM offered to provide a secretariat and logistical support for ARAOH. ARAOH membership application forms in English and in French have been distributed. There will be no membership subscription at first. A competition has been launched for the design of a logo, and a website was established at www.araoh.org, with an email address as info@araoh.org

The next international congress will take place in 2014.

OTHER CONFERENCES, SEMINARS AND WORKSHOPS IN 2011

To coincide with the AGM on 26 November 2010, the KwaZulu-Natal Chapter staged an excellent conference at the Oyster Box in Umhlanga. SASOM arranged a one-day conference with help from local occupational medical practitioners in Kimberley on 11 March and a week later at Mercedes Benz in East London. The Cape Chapter is hosting a stimulating conference and the SASOM Annual General Meeting and dinner on 25 November this year.

NEW SASOM BRANCHES

It is becoming increasingly difficult and costly for our members to leave their practice to attend conferences in the larger centres. In an effort to take new information to occupational health practitioners in towns and cities off the beaten track and to encourage local networking, SASOM established the following new SASOM branches over the course of the year:

- 11 March – Northern Cape in Kimberley. Chair: Dr LizeMare Steenkamp
- 18 March – East London. Chair: Dr Les Trollope
- 30 March – Bloemfontein. Chair: Prof Willem Kruger
- 21 September – Mpumalanga in Nelspruit. Chair: Dr Victor Mothlale
- 26 October – Polokwane. Chair: Dr Victor Matabane

These branches have held meetings and arranged presentations and visits to industries, and the enthusiasm is tangible. More branches are planned in 2012.

SASOM GUIDELINES

Guidelines on aspects of occupational health practice have been updated and several new ones were added by Dr Danie Ungerer and his team in March 2011. In August a revised guideline, *Medical requirements for fitness to drive,* was added by Dr Greg Kew. Thirty-four guidelines are on a CD and an order form is available from the SASOM office.

SPECIAL MEETINGS

A meeting was called in May to address issues around the signing of certificates of fitness to work. On this matter, members of the SASOM Executive met with the HPCSA attorney before Dr Jan Lapere, a SASOM member and lawyer, led a team who discussed the legal and practical implications of signing off certificates. SASOM members have also attended meetings with the Accreditation Committee and represented SASOM in meetings with the Department of Transport on medical requirements for fitness to drive.

NATIONAL OFFICE

Membership renewal forms and subscription invoices for 2012 will be sent to all members at the end of November. To ensure that members receive all the journals, fees must be paid before 31 January 2012 and proof of payment be sent together with the renewal form to the SASOM office. The renewal forms are vital to update the SASOM database with accurate contact details and check that payments on the bank statement are allocated correctly.

Please note that SASOM has a new bank account.

The National Office hours are from 09:00 until 16:00, Monday to Thursday and 09:00 to 15:30 on a Friday. As usual the office will be closed over the festive season from 15 December to 9 January 2012.

The SASOM Chairman and Executive Committee appreciate the contribution to occupational health care by all occupational health practitioners and wish them a peaceful festive season with a renewed passion to provide the highest level of care to all in 2012.

Jenny Acutt
SASOM Project Coordinator
Tel: +27 (0)12 803 7418, E-mail: info@sasom.org

SASOM South African Society of Occupational Medicine FOUNDED IN 1948

Book launch November 2011

INTRODUCTION

The 3rd November 2011 saw the launch of the SASOHN Book – *A practical approach to occupational health nursing.* In 2005 SASOHN celebrated 25 years as a professional organisation and a gala dinner befitting the occasion was made even more special through the presence of Stella Coetzee, the first SASOHN President. Stella has sadly passed on since this event but before her passing she handed the copyrights to her book, *Occupational health nursing in South Africa*, to SASOHN. The intention was to update the book and publish a revised edition. Sadly, many original authors were unavailable to update material published in that book. After a number of years SASOHN decided to write a new book incorporating four chapters from the original work.

The goal of this publication is to provide the occupational health nurse practitioner (OHNP) with insight into aspects of occupational health nursing (OHN) that impact service delivery. A practical approach has been taken by sharing examples of how successful programmes are achieved in the workplace setting. Subject specialists and experts have written material that will assist OHNPs in the development of their level of expertise as well as service delivery to both employee and employer. There are 23 chapters and over 400 pages of varied topics which include: the roles and functions of an OHNP, establishing a service, models of service delivery, absenteeism, specific worker populations, emergency care, toxicology, and many more.

SASOHN OBJECTIVES

SASOHN has six organisational objectives and four of these are directly and indirectly impacted through various chapters of this publication. These include: upgrading the professional image of OHN through improving standards; building relations with other bodies involved or impacting Occupational Health; developing an entrance level reference book for the OHNP and increasing the awareness that OHNPs have of national policies and guidelines.

SASOHN BURSARY FUND

All profits raised from the sale of this publication will be used to boost the SASOHN bursary fund, which will address another SASOHN objective (continued support of professional development). This fund is used to assist SASOHN members financially with studies directly related to OHN.

ACKNOWLEDGEMENTS

This, SASOHN's first formal publication, has been made possible through the valuable contribution of a number of very special people. On a personal level I would be amiss not to start by thanking my family for their support while working on the publication. Anivesh Singh, from Ripple Effect, has provided unwavering encouragement and tremendous generosity through sponsorship of the artwork. Contributing authors, each of whom has given freely of their precious and limited time, as well as their expertise. Their contributions make the book the practical and valuable resource that it is. Readers can be assured that they are provided with a diverse approach to and an expert opinion on a number of topics. These authors are (in alphabetical order): B Botha, L Botha, S Coetzee (posthumous), Dr M Coombs, C Deacon, E Dixon, N Geyer, Dr L Grainger, L Haskins, A Hastings, L Jansen van Rensburg, Dr W Kloeck, E Klinck, S Kruger, K Michell, N Pieterse, A Pretorius, L Pretorius, Prof M Ross, C Savage, V Schillack, S Severn, L Smith and Prof C Wicht.

There were Peer Reviewers who patiently reviewed each of the chapters in this book and gave valuable input into the chapters. I would be amiss not to mention you by name: Dr A Edwards, D Michell, P Orton, L van der Linden and Dr L Zungu, as well as some of the contributing authors who assisted in this regard. Also to the proof readers for patiently checking for the errors I missed.

I trust readers will benefit from this publication and SASOHN welcomes all feedback that will help to strengthen future revisions.

Karen Michell

SASOHN Natal Inland Branch

WORKSHOP 19TH AUGUST 2011

In August 2011 SASOHN Natal Inland held a workshop focusing on improving the dietary status of workers with HIV, and understanding the interactions of antiretroviral and other drugs. The South African Sugar Association (SASA) sponsored the morning session and provided the speaker, Pride Mseleku, a nutrition liaison officer at SASA. Pride began her presentation discussing weight changes, wasting and lipodystrophy. A very informative part of her talk was how to use the Food Based Dietary Guidelines.[1] These guidelines were written in South Africa, to suit the diverse population needs. They are practical, and are used to teach clients how to maximise the food they have available and how to add to this food making it more nutritious. Delegates were given insight into the correct use of the guidelines with examples on application for the HIV patient.

There were two speakers for the afternoon session, both from Capresa. The first speaker, Janet Frohlich (D Cur), is an HIV/AIDS researcher who was involved in the Tenovir Gel research and testing. As Janet had spoken previously to this audience, she updated them on the current progress with trials in HIV research. The second speaker, Mukelisiwe Mlotshwa, works in clinics where these trials are conducted. She explained how the trials were carried out, and how they dealt with problems that arose from the trials.

Everyone thoroughly enjoyed the day and felt they had gained valuable knowledge and networking opportunities. Members left with a renewed sense of enthusiasm, and an inspiration to do the best they could in educating clients, preventing disease progression and treating clients. A highlight was the attendance of non SASOHN members from Lifeline, Hospice and the University of KwaZulu-Natal which created a chance to network and form working bonds.

All in all a very successful workshop, which provided us with an opportunity for active interaction, questions and debate. Delegates felt proudly South African as both the Dietary Guidelines and Tenovir Gel were South African initiatives which are proving to be successful and meeting our country's needs.

Mary Rose Johnson (NIB Secretary)

REFERENCE

1. Department of Health, Directorate: Nutrition. South African guidelines for healthy eating. Pretoria: DoH; 2004. Accessed on 1 November 2011. Available at: ftp://ftp.fao.org/es/esn/nutrition/dietary_guidelines/zaf_eating.pdf.

SAIOH news

As the year draws to an end and our members are planning their holidays it is important to remember to stay focused on what is required from you in the workplace and not to let your guard down. SAIOH had many challenges during 2011 and resources were stretched to the limit, but in the end everything went well with our organisation.

Deon van Vuuren and Jakes Jacobs recently flew to Singapore to attend the second workshop ever to be held by the IOHA National Accreditation Recognition Committee (NARC), as well as the International Occupational Hygiene Association (IOHA) Board meeting and AGM. Their feedback follows.

NARC WORKSHOP – 9TH OCTOBER 2011

NARC, a Sub-committee of IOHA, evaluates IOHA Member Association's schemes, whereby they certify and register their Professional members. In SA this registration is a legislated requirement for anybody to practice occupational hygiene. NARC consists of one member from each of the IOHA Recognised Certification Boards. Each Board recommends a committee member (usually a senior Board member, e.g. the past Chairman) to the IOHA Board. The latter appoints members to the NARC, who serve a three-year term, which can be renewed once (for a total of 6 years' committee service).

Eleven countries have had their accreditation processes "recognised" internationally by NARC – Australia, Canada, France, Italy, Netherlands, Norway, South Africa, Sweden, Switzerland, United Kingdom, and United States. In 2006 SAIOH was the sixth country to be accredited. The recognition is valid for five years; our accreditation will lapse at the end of September 2011. SAIOH's re-application for recognition and new procedures and evaluation requirements around it were discussed at length. The review was done by the NARC Co-ordinator after the workshop and forwarded to NARC members for voting. Recommendations from the Co-ordinator look extremely positive. Renewal in effect means SAIOH's Certification Scheme is still recognised by IOHA to comply with international standards and our certified members can work internationally/overseas in occupational hygiene and be accepted by the different international associations.

IOHA BOARD MEETING AND AGM – 10TH OCTOBER 2011

IOHA currently consists of 29 member countries world-wide (Europe, USA, South America, Southern Africa, Asia, Australia, etc.). Deon van Vuuren attended as SAIOH's IOHA Board representative and Jakes Jacobs as an observer. Deon is also a Director of this Board. (Visit IOHA's Website – www.ioha.net, SAIOH also has a Member Profile on this site.) Deon was elected as the new Chairperson of the IOHA NARC and will serve a two-year term.

The 9th IOHA Scientific Conference will take place in Kuala Lumpur in Malaysia in 2012, over the period 16 – 20 September 2012, during which IOHA will celebrate its 25th anniversary. Draft programmes, registration details and a call for papers are available at www.ioha2012.net.

The Singapore Occupational Hygiene Association was welcomed as the newest and 29th Member to IOHA. The new IOHA President, Noel Tresider (from Australia) also took the chair after the AGM and the new Vice-President for IOHA, Jakob Naerheim (from Norway) was elected.

IOHA is currently reviewing its Code of Ethics in line with ICOH's new one. SAIOH has forwarded its code in compliance with a request for all members to do so. After detailed discussions on IOHA's financial position and 2012 budget, the annual membership or capitation fees were increased by 25% to £1.25 (GBP) per member of each association, with effect from the next financial year, 2012. This fee was fixed at 1 GBP from the inception of IOHA.

OHTA: a full report was given on the progress of the International Occupational Hygiene Training Modules. There are already 38 Approved Training Providers worldwide, including three universities, and a network of 200 volunteers developing new ones of re-writing modules. Eight Modules have been completed and deployed. (Visit www.OHLearning.com) The next IOHA Board Meeting is on 17th June 2012 in Indianapolis, USA, before the AIHce2012 Conference.

SAIOH PROFESSIONALS CERTIFICATION BOARD NEWS

The draft Occupational Hygiene Legal Knowledge document, which deals with the minimum knowledge requirements expected of IOHA of certified members of the Member Associations, was distributed for final comments and approval at the next meeting.

The updated Certification Procedure will be in effect from 1st January 2012. The pass rate for Certification is also improving slowly with Assistants 85%, OH technologists 60% and Occ. Hygienists, still very low at 35%. Deon Jansen van Vuuren is also the new Chairperson of SAIOH's PCB and Julie Hills (from KZN) has been elected as Vice-Chairperson. (Visit www.saioh.co.za or E-mail: info@saioh.co.za) The PCB has also reached an agreement with OHTA and the BOHS Faculty and will start rolling out the OHTA International OH Training Modules in 2012. SAIOH will co-ordinate these modules in SA and all examinations will be written at SAIOH Assessment Centres country-wide. The BOHS Faculty will provide and mark these papers. After passing the six core modules and undergoing the Personal Learning Profile system of practical experience under an approved mentor, OHTA will issue successful candidates an Intermediate Certificate in Occupational Hygiene (equivalent to OH Technologist level). These certificates are also approved by IOHA. SAIOH PCB has already accepted that candidates applying for and already in possession of this certificate will be evaluated at Technologist level and do not have to undergo the current written assessment. More information will be forwarded to all potential Training Providers and all SAIOH members in due course and published on SAIOH's website.

SAIOH Council would like to congratulate and express our sincere thanks to Deon for his passion and dedication to our profession. I think that congratulations are in order as this is a strong vote of confidence, not only Deon's abilities but also the high standards SAIOH as an organisation is maintaining. SAIOH also wishes all its members and their families a prosperous festive season and, we believe, a well-deserved rest.

Johann Beukes,
SAIOH President

Newly elected committee members (left to right): Noel Tresider (AIOH), Deon Van Vuuren (SAIOH), Chris Laszcz-Davis (ABIH), Jakob Naerheim (NOHA), Luc Hamelin (CRBOH), Danilo Cottica (AIDII), Gerard Tiernan (AIOH), Domenico Cavallo (AIDII).

Upcoming events

HEALTH AWARENESS DAYS, WEEKS AND MONTHS

DECEMBER 2011
Prevention of Injuries Month

DAY	TOPIC
1	World AIDS Day
3	International Day of Disabled Persons
5	International Volunteers Day
9	World Patient Safety Day
10	International Human Rights Day

JANUARY 2012

DAY	TOPIC
29	World Leprosy Day

FEBRUARY 2012
Healthy Lifestyle Awareness Month
Reproductive Health Month

DAY	TOPIC
1 Feb – 31 May	Immunisation Campaign
4	World Cancer Day
12 – 18	STI / Condom Week
12 – 18	Pregnancy Awareness Week
17	Healthy Lifestyles Awareness Day

2012 SAIOH COUNCIL AND CERTIFICATION BOARD MEETINGS AND EXAMINATION DATES (PROPOSED)

Date	Time	Meeting	Assessment
3 February 2012	07h00	PCB	Oral
2 March 2012	07h00	Council	Written
13 April 2012	07h00	PCB	Oral

INTERNATIONAL CONFERENCES

DATE	PLACE	TOPIC	MORE INFORMATION
18 – 24 Mar 2012	Cancun, Mexico	30th ICOH Congress – Occupational Health For All: From research to practice	E-mail: admin@icohcongress2012.org www.icohcongress2012.org
2 – 4 April 2012	Nancy, France	INRS Occupational Health Research Conference 2012: Health risks associated with mixed exposures	E-mail: mixed-expo2012@inrs.fr
16 – 20 Sept 2012	Kuala Lumpur, Malaysia	9th IOHA Scientific Conference	www.ioha2012.net
19 – 21 Sept 2012	Tarragona, Spain	5th Federation of Occupational Health Nurses within the EU (FOHNEU) Congress. Embracing the future – influencing change!	www.fohneutarragona2012.com
14 – 16 Nov 2012	Mahidol University, Bangkok, Thailand	ICOWHI 19th International Congress on "Women's Health 2012: Partnering for a Brighter Global Future"	www.icowhi.org/