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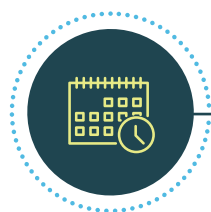
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Altron HealthTech's commitment to enhancing patient outcomes through technology has resulted in strategic collaborations with technology partners, medical professionals, and industry leaders to create a platform ecosystem that enables and leverages the partner network effect.

The business' goal is to continue to provide a differentiated service offering. A customer-centric approach, focusing on clinical knowledge and medical expertise to meet individual needs, ensures a deep understanding of clinical and operational workflows, and how technology can be integrated to enhance efficiency and patient outcomes.

Its strategy is focused on solving real problems through best-in-class technology. This position was further bolstered by the launch of HealthONE Cloud in 2021, a clinical offering which was well-received by the market.

HealthONE Enterprise solutions for OHS management

Altron HealthTech will soon be launching HealthONE Enterprise – a platform-based, highly scalable and secure solution for the enterprise market. HealthONE Enterprise has been designed for use in occupational health and safety – as well as primary – healthcare management across different sectors such as mining, manufacturing, education, construction, agriculture, and petrochemicals.

HealthONE Enterprise provides a patient-centred approach to managing the entire employee or patient healthcare journey. Its platform architecture offers the capability to collect vast amounts of data, providing valuable insights, preferences, and trends that can be leveraged by clinicians and businesses.

Features

HealthONE Enterprise offers numerous features, such as the ability to book an appointment; maintain electronic health records with surgical and medical histories; allow clinicians to manage scripts

and medications referrals; manage chronic and acute conditions; manage occupational health medicals and surveillance, and provide certificates of fitness to ensure compliance and better management of overall employee health. It also provides process efficiencies for medical professionals with a simple click.

Electronic health records allow healthcare practitioners instant access to a patient's healthcare journey, including the ability to upload a patient's X-ray images and pathology results, allowing them to make more informed decisions based on all the available information, and alleviating the need to run duplicate tests.

From an organisational perspective, HealthONE Enterprise helps organisations to better manage the health, safety and wellbeing of employees, while providing several business benefits including regulatory compliance, cost savings, and improved efficiencies and productivity. Rich reporting and trend analysis functionality provide actionable insights into the health, safety, and wellbeing of employees.

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Built on the latest technology and security standards, HealthONE Enterprise is Protection of Personal Information Act- (POPIA-) compliant, and secures healthcare records to ensure patient privacy and to protect personal information.

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The solution has the benefit of being scalable and interoperable with several third-party systems such as human resources, pathology, workforce management, and medical devices, such as e-vitals, audiometry, spirometry, and vision devices. It is also customisable according to an organisation's unique requirements.

Altron HealthTech's core strategy is innovation. The business boasts an impressive array of in-house skills and expertise allowing it to service the entire value chain. Using global best practice and project governance standards, the business offers proactive management and monitoring of the HealthONE Enterprise system, allowing the team to spot issues before they become problems.

"HealthONE Enterprise is a best-in-class occupational health and safety management application that provides seamless end-to-end automation of the entire employee health life cycle", explains Moodley. *"Providing tailored client reporting and unparalleled visibility into employee health data, it enables intelligent workforce management, mitigates workplace risks, ensures Occupational Health and Safety Act (OHSA) compliance and delivers improved productivity gains that other comparative systems cannot match."*

Learn more: <https://eu1.hubs.ly/H0crMHK0> 

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From the Guest Editor . . .

Daan Kocks: SASOM Chair

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Prof. Daan Kocks

Photograph: courtesy of SASOM

This issue of *Occupational Health Southern Africa* illustrates the complexity of a competent person's knowledge and cognitive need to function in the world of occupational health. Scoping reviews, research studies, and legal implications are all part of the required regular training updates and prioritisation. The critical role that this peer-reviewed journal plays in continuing medical education (CME) in the sub-Saharan Africa region cannot be over-emphasised.

The five papers published in this issue have common threads, viz. occupational exposure to hazards (chemical, biological, and psychosocial) in various sectors; health risks and their implications; and the need for research, regulatory oversight, and improved preventive measures.

Schillack et al. discuss the urinary levels of the essential metals copper, zinc, and manganese in copper smelter workers exposed to arsenic, and in non-occupationally exposed residents in a nearby community. The authors showed that workers had higher levels of urinary arsenic than the reference group (up to three times as high). Differences in the concentrations of copper, zinc, and manganese were observed in both groups. The conclusion was that long-term arsenic exposure affects essential metal homeostasis, which can lead to harmful biological effects. Their findings are well aligned with recent studies in copper, lead-zinc, and steel-iron smelting environments and in populations exposed to environmental arsenic, which showed a disruption in metal regulation, with arsenic significantly impacting the metabolism of essential metals, potentially leading to oxidative stress and enzyme dysfunction.^{1,2}

Duba et al. conducted a review on biological exposures among horse grooms – a neglected group of workers in a thriving horse-racing industry. Horse stables are known to have elevated levels of organic dust, endotoxins, and fungal species, which have been linked to respiratory conditions such as asthma, chronic bronchitis, and organic dust toxic syndrome. Exposure to these hazardous biological agents poses a risk to horse grooms in their daily tasks of breeding, foaling, night watch duty, raising and training horses, mucking stalls, landscaping, and horse maintenance. Several studies have drawn parallels between the occupational risks faced by horse grooms and those seen in other animal-related industries, such as swine or poultry farming, where zoonotic diseases like brucellosis and avian influenza can be transmitted between animals and workers.^{3,4} Inadequate housing conditions such as overcrowding, often likened to those in the mining industry, further exacerbate the risk of disease spread, including tuberculosis. There is a growing call for more research on the health risks faced by horse

grooms, particularly in South Africa, where this group of workers is under-represented in occupational health studies. Improved housing conditions, better ventilation in stables, and stricter hygiene measures could help mitigate some of the biological exposures that threaten the health of these workers.

Mathenjwa and Naidoo report on chronic musculoskeletal pain (CMP) and associated psychosocial factors in municipal workers in northern KwaZulu-Natal province, South Africa. Their findings indicate a high prevalence of CMP of around 63% in the presence of associated psychosocial factors, with female workers and those having very demanding jobs being most at risk. Psychosocial factors play a significant role in exacerbating or mitigating pain symptoms. Studies indicate that high job demands, low job satisfaction, and stress contribute to the prevalence of CMP.⁵ In contrast, job satisfaction is often protective, reducing the likelihood of chronic pain. Globally, psychosocial resilience, including social support and coping strategies, has been identified as a mitigating factor for CMP. Targeted interventions addressing these factors may not only reduce pain but also improve overall brain health, as shown in studies linking resilience to reduced 'brain ageing' in chronic pain sufferers.⁶

In their short report on mothers and other women and girls (including domestic workers) who carry children for extended periods, Grobler et al. describe the pulmonary effects of using front face carriers. In this small study, they found that front face infant wearing might temporarily improve lung function, while also disrupting pulmonary mechanics. These findings need to be validated in a larger prospective study.

In the last paper, titled 'Cannabis at home, sobriety at work: legal and policy implications', Laurens explores the legal and policy implications of cannabis zero-tolerance strategies in workplaces, and advocates for scientifically established thresholds for substance testing, bearing in mind that workplace policies must respect employee rights while ensuring workplace safety, and also be aligned with South Africa's Cannabis for Private Purposes Act. Recent legal discussions in South Africa, regarding the use of cannabis at home and maintaining sobriety at work, have gained attention, particularly following the Labour Appeal Court's decision in the case of *Enever v. Barloworld Equipment South Africa* (April 2024).⁷ This recent court case set a precedent that employers must tailor drug policies carefully, balancing safety with constitutional rights and avoiding blanket zero-tolerance approaches that could lead to unfair dismissals.

These five papers call for improved prevention and monitoring measures, and further research, to better understand and mitigate exposures to occupational hazards. The importance of legislation and policies in the workplace cannot be accentuated enough in the development and implementation of frameworks to ensure workers' safety and wellbeing, while respecting employee rights.

Health education in the workplace as regular updated training can also be incorporated into, and aligned with, international health awareness days, some of which are celebrated during the months of September and October 2024:

- 17 September – World Patient Safety Day
- 21 September – World Alzheimer's Day, World Marrow Donor/Sunflower Day
- 26 September – World Environmental Health Day; World Contraception Day
- 28 September – World Rabies Day, World Retina Day
- 1 October – International Day of Older Persons
- 10 October – World Mental Health Day
- 13 October – International Day for Natural Disaster Reduction
- 15 October – Global Handwashing Day
- 17 October – World Trauma Day, International Day for the Eradication of Poverty
- 30 October – Africa Food and Nutrition Security Day

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Chronic conditions are monitored

Winner of the SASOM 2023 Annual Author Prize

We are pleased to announce that Mr Ludwick Lebeka is the winner of the South African Society of Occupational Medicine (SASOM) Annual Author Prize for 2023. He published the following paper in the first issue of *Occupational Health Southern Africa* in 2023:

Lebaka L, Manyike-Modau A, Brouwer D. Effectiveness of retrofitted diesel particulate filters on diesel particulate emissions: a small-scale intervention study. *Occup Health Southern Afr.* 2023; 29(1):6-12.

On behalf of *Occupational Health Southern Africa*, SASOM encourages researchers working in the field of occupational health in Africa to publish their research findings. SASOM provides a cash award to a novice author who is the first author of the best paper published in *Occupational Health Southern Africa* in a calendar year, as judged by the Editorial Advisory Panel. Eligibility for the prize is limited to researchers who have not previously published a paper in *Occupational Health Southern Africa*, or any other accredited academic journal. Membership of SASOM is not a criterion.

Ludwick is a seasoned occupational hygiene professional working for Sibanye Stillwater as an occupational hygiene superintendent. He holds a Master of Science in Medicine: Exposure Science degree from the University of the Witwatersrand. His extensive work experience in occupational hygiene spans 11 years, as he has worked for prominent organisations, including the Nuclear Energy Corporation of South Africa and, more recently, Anglo American Platinum. 



Ludwick Lebeka, winner of the 2023 SASOM Annual Author Prize

Become a reviewer for *Occupational Health Southern Africa*

Submitted manuscripts are most often delayed due to the difficulties in finding reviewers. This causes frustration for authors and the editorial team alike. Authors can wait months for reviewers' comments. The editors spend hours identifying potential reviewers, following up when they promise but don't deliver, and seeking new reviewers when those invited decline or, worse, don't respond at all. We are therefore looking to create a pool of committed reviewers for all aspects of occupational health. If you are interested in joining this pool, please send your details in the link on the website:

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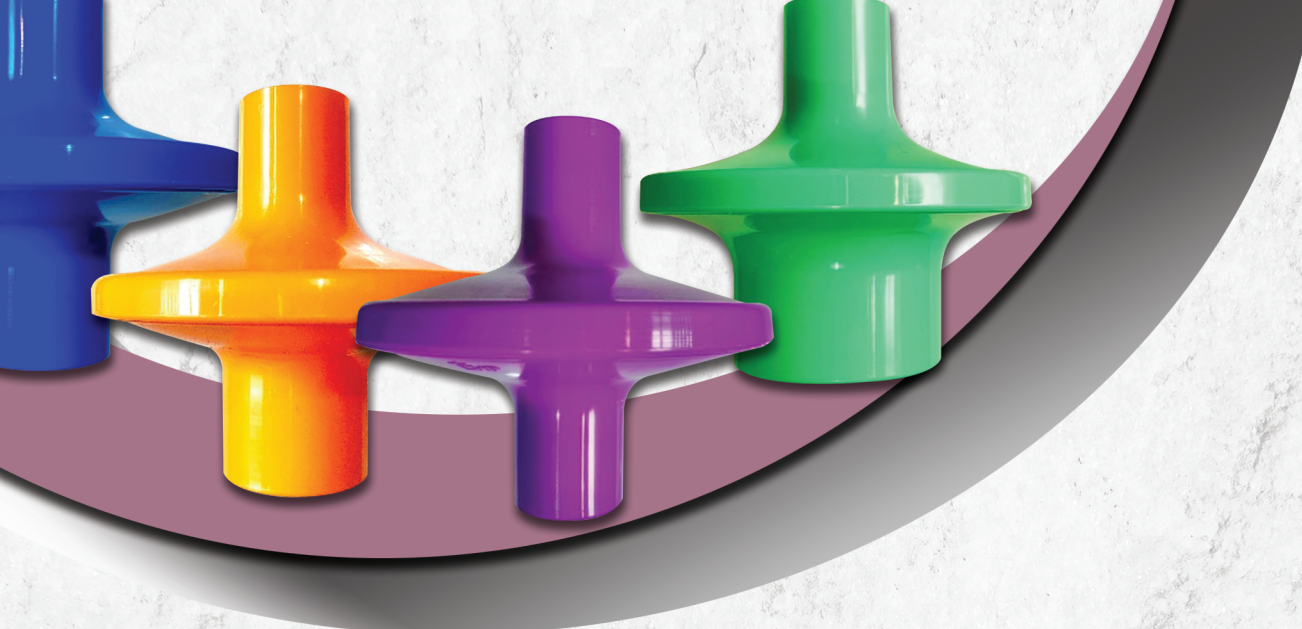
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	Schiller	SpiroScout SPIROVIT SP-1 G2

Product Code	Spirometer	Model
PFT-2030 (Small) PFT-2530 (Standard) PFT-2230 (Oval)	MIR	All models
	Vitalograph	ALPHA Touch ALPHA 6000 In2itive
	Micro Medical	All models
	Schiller	SP-260
	MH	LA303
	COSMED	microQuark Quark Spiro Pony FX
	CONTEC	All models

Product Code	Spirometer	Model
PFT-2033 (Small) PFT-2533 (Standard) PFT-2233 (Oval)	Schiller	SP260
	Jaeger	Flowscreen Pro MasterScope MasterScreen Flowmate
		Spiro Pro
		Vyntus SPIRO PC Vyntus ONE
		Short Adaptor
	Vyaire	Short Adaptor
		Short Adaptor
		Short Adaptor
		Short Adaptor
		All models

Product Code	Spirometer	Model
PFT-2044 (Small) PFT-2544 (Standard) PFT-2244 (Oval)	nSpire	Digidoser KoKo HDcpet 6000 Sx 1000 NHD4500

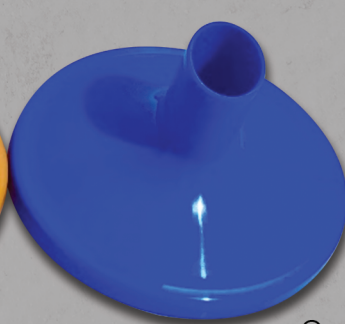
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In memoriam: Dr Ferdie Smith 1938–2024

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Claudina Nogueira: SASOM ExCo member (co-opted)

info@sasom.org

Dr Ferdie Smith, a pioneering figure in the fields of occupational health and community medicine in South Africa, passed away on 1 September 2024 in Pretoria, at the age of 86. Born on 3 April 1938 in Bethal, in the then Transvaal, he was the eldest of five children. His deep passion for nature, bonsai art, classical music, and opera enriched his life, and these interests were shared and enjoyed with his family.

Dr Smith's academic journey began at the University of South Africa (UNISA) where he completed his Bachelor of Science (BSc) degree. He later pursued his medical degree (MBChB) and advanced qualifications at the University of Pretoria (UP), a path that would lead him to become a key advocate for the medical specialisation in community health, now known as public health medicine.

Dr Smith began his medical career as an intern at Boitumelo Hospital in Kroonstad in 1971, followed by his role as a general practitioner in Standerton in 1972. His commitment to community health was evident early in his career, as he served as a part-time medical officer at Standerton Hospital and the South African National Tuberculosis Association (SANTA) Centre, and was also the medical officer of health for the Standerton Town Council during the 1970s.

In 1979, Dr Smith took on the role of Chief Medical Officer at the Pretoria City Council, marking the beginning of a distinguished career in public service. From 1984 until his retirement, he served as a senior lecturer in occupational health in the Department of Community Health, at UP. His academic contributions were extensive, including a six-month tenure as a visiting lecturer at the Catholic University of Leuven in Belgium. He was also an external examiner for several South African universities.



Dr Ferdie Smith

Photograph: courtesy of SASOM

Dr Smith's influence extended beyond the classroom. He was actively involved in various professional bodies, holding key positions such as National Chair of the South African Society of Occupational Medicine (SASOM) from 1993 to 1997, and later becoming an honorary member of the Society in 1998. His commitment to occupational health was further demonstrated through his service as an occupational health consultant to numerous industries and institutions, his role as a medical practitioner for the Statutory Examination of Radiation Workers, and as a medical assessor for the Compensation Board – a position appointed by the Minister of Labour under the Compensation for Occupational Injuries

and Diseases Act (COIDA).

After retiring from UP, Dr Smith continued with his steadfast contributions to occupational health and medicine as the industrial specialist at Tshwane Academic Hospital until 2016. He also served as a specialist witness for the Compensation Commissioner. His selfless dedication to the medical profession and his unwavering commitment to advancing occupational health in South Africa have left an indelible mark on the discipline.

Dr Smith will be remembered not only for his professional achievements but also for his warmth, his love for his family, and his lifelong pursuit of knowledge and cultural enrichment.

His legacy will continue to inspire future generations in the field of occupational health, and beyond.

The SASOM ExCo and members extend their deepest condolences to Ferdie's family, friends, and colleagues, on the loss of such a valuable member of the occupational health and medicine fraternity. He will be sorely missed by many who knew him, and his lifelong commitment to improving the health and wellbeing of workers and communities alike will be remembered. May his soul rest in eternal peace. 🙏

From Suspicion to Submission – Occupational Lung Diseases in the South African Mining Industry

by Dr Vanessa Govender

Managing occupational lung diseases from suspicion through to the prevention, investigation, diagnosis, fitness-to-work evaluation, submission for compensation and ongoing care requires in-depth clinical acumen and tools to equip the clinician. This handbook, *From Suspicion to Submission – Occupational Lung Diseases in the South African Mining Industry*, is written by Dr Vanessa Govender, a specialist in occupational medicine who has navigated a mining medicine journey spanning more than 30 years.

Published by MettaMedia, the handbook is a comprehensive overview of a range of the commonly diagnosed occupational lung diseases in the South African mining industry, enriched by insights and contributions from world-class experts.

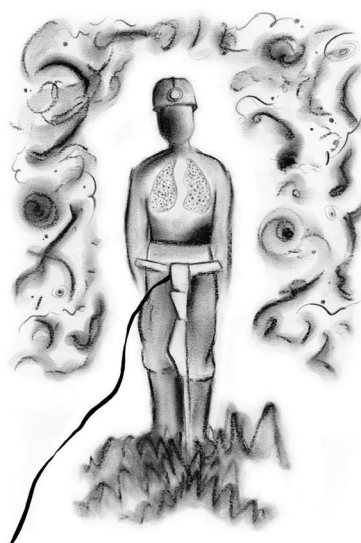
The occupational lung diseases covered in this handbook are:

- Pneumoconioses – silicosis, asbestosis, coal workers' pneumoconiosis, mixed dust pneumoconiosis
- Tuberculosis (TB), including TB complications and post-TB lung disease
- Chronic obstructive pulmonary disease
- Systemic sclerosis
- Work-related asthma
- Lung cancer
- Asbestos-related diseases

The handbook comprises eight well-referenced chapters, which include comprehensive details regarding the compensatable occupational lung diseases, post-mortem examinations, and benefit medical examinations; the latter is presented in a practical question-and-answer format. Set within current South African occupational health laws and policy frameworks, pulmonary function and other medical tests, and the radiographic classification of the pneumoconioses, are discussed. A glossary of terms and definitions, with numerous descriptive tables and figures, insights, case studies, and key concepts provide the reader with a unique experience, making this handbook a blueprint for occupational medicine practitioners in South Africa, as well as those occupational health professionals working across its borders. The handbook's elaborative content and quick reference guides have value for non-medical professionals from the engineering, occupational hygiene, communications, human resources, and legal disciplines, and for mining executives, mineworkers, and their families.

FROM SUSPICION TO SUBMISSION

Occupational Lung Diseases in the South African Mining Industry



For Occupational Medicine Practitioners in South Africa and Beyond

Vanessa Govender

From Suspicion to Submission – Occupational Lung Diseases in the South African Mining Industry will benefit mineworkers (current, former, and deceased) as occupational health professionals will be inspired to use science to drive policy decisions, thereby enhancing workplace practices.

This handbook is dedicated to all workers who mine – past, present, and future.

For further information, or to purchase the book, contact Dr Vanessa Govender at vanessa@masakhanehealth.co.za. 

From Suspicion to Submission – Occupational Lung Diseases in the South African Mining Industry

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A scoping review of occupational biological exposures among horse grooms: a neglected group of workers in a thriving horse-racing industry

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ABSTRACT

Introduction: In addition to grooming, horse grooms' tasks include live breeding, foaling, night watch duty, raising and training horses, mucking stalls, landscaping, and horse maintenance. Horse stables are reported to have high organic dust levels, which pose a risk to horse grooms. Studies have reported an association between working with horses and an increased risk of respiratory symptoms and/or organic dust toxic syndrome. Some studies demonstrated that horses were exposed to high levels of endotoxin as well as (1,3)- β -D-glucan in horse stables.

Objective: To describe occupational biological exposures and associated respiratory diseases among horse grooms, shedding light on their working and living conditions.

Methods: A scoping review was undertaken using the PRISMA extension for scoping reviews (PRISMA-ScR) checklist. Data were extracted using key questions and eligibility criteria as a starting point. The keywords and phrases, occupational health, infectious diseases, workplace exposure, coronavirus disease 2019 (COVID-19), *Mycobacterium tuberculosis*, (1,3)- β -D-glucan, endotoxin, and horse grooms were used to search PubMed, Google Scholar, and ScienceDirect.

Results: Forty-six papers were selected for final review from the 94 identified for potential inclusion. These papers highlighted possible biological exposure in horse grooms' day-to-day tasks. Hostel living conditions, similar to those in the mining industry, were identified as a source of biological exposures. Due to overcrowding, the spread of tuberculosis was highlighted as a major concern.

Conclusion: More research on horse grooms is necessary, considering the paucity of occupational health information in this sector, especially in South Africa. Future studies should focus on environmental conditions, hostel living conditions, health outcomes among horse grooms, and prevention strategies.

INTRODUCTION

Horses played a crucial role in the agricultural, mining, and transport sectors in the growing economy towards the end of the nineteenth century and early in the twentieth century.¹ Currently, horses in South Africa are used in various activities, such as racing, competitive and leisure riding, policing, and military purposes.¹ The sport enjoys a long and rich history in South Africa that can be traced back to 1795.² The first recorded race club meeting of the National Horse Racing Authority took place in 1802.² Racing in South Africa is currently controlled by two bodies: 1) 4Racing (Eastern Cape, Gauteng, Free State, and Northern Cape provinces) and 2) Gold Circle (KwaZulu-Natal and Western Cape provinces).^{2,3} The horse-racing industry is divided into different categories, such as the thoroughbred breeders' association, which focuses on horse breeding, sales, and purchases; the owners' association, which buys and owns these horses; the trainers' association, which trains the horses; and the jockeys' association, whose members ride horses during races.⁴ These entities collectively report to the National Horseracing Authority.⁴ Often overlooked is the South African Grooms Association (SAGA), representing horse grooms in the country, who lack adequate representation and voice within the industry.⁵

The South African horse-racing industry contributed R2.71 billion annually to the country's gross domestic product from 2009 to 2018.⁶ While horse racing can be a thrilling experience for sports fanatics, gamblers, and fashionistas, the glamour and glitz are not shared by all

who work in the industry, such as the grooms who maintain the horses⁷ and play an essential role in their training and overall wellbeing.⁷ Their work in the thoroughbred horse industry includes preparing horses for sale, boarding, and breeding.⁸ Typical tasks include live breeding, foaling, grooming, night watch duty, raising and training horses, cleaning horse stalls, and landscaping.⁸ Grooms also hold down horses during treatment by farriers and veterinarians, and assist with preparations for shipping horses to shows or races.⁷ Horse grooms in South Africa have been reported to work under appalling conditions,⁹ and their plight has been highlighted by both the SAGA and the Department of Employment and Labour.⁵

The working environments of grooms expose them to bioaerosols that include allergens (Table 1), microorganisms, by-products of microbial agents such as endotoxins, (1,3)- β -D-glucans, and organic dust. Elevated endotoxin levels have been measured in horse stables,^{10,11} affirming the presence of endotoxin and (1,3)- β -D-glucan in these environments.¹² Individuals who regularly work with horses, including jockeys, trainers, and horse grooms, experience long-term exposure, leading to allergic diseases.^{12,13} The hostel living conditions of horse grooms are a cause for concern as several workers live in confined spaces similar to those in the mining industry.¹⁴ Up to eight men may occupy a room, with minimal ventilation.¹⁵ The risk of tuberculosis (TB) and severe acute respiratory coronavirus 2 (SARS-CoV-2) transmission have been highlighted,^{16,17} particularly among those with comorbidities.¹⁸

Given the anecdotal information on poor working and living conditions, and the lack of scientific evidence for biological exposures and possible health outcomes among horse grooms in South Africa, further research is warranted. This scoping review sought to investigate potential occupational biological exposures and related respiratory diseases among horse grooms, associated with working and living conditions. The investigation encompassed respiratory diseases such as TB, coronavirus disease 2019 (COVID-19), asthma and allergies caused by *Mycobacterium tuberculosis*, SARS-CoV-2, endotoxin, (1,3)- β -D-glucan, and horse allergens in the horse industry.

METHODS

Search strategy

The search terms used were: (horse grooms OR horse stables) AND (horse allergens OR horse industry OR South African horse racing industry) AND (occupational health OR infectious diseases OR workplace exposure) AND (COVID-19 OR *Mycobacterium tuberculosis* OR endotoxin OR (1,3)- β -D-glucan) AND (workers living hostels OR TB AND COVID-19) in overcrowded areas. English language, peer-reviewed articles published from January 1990 to December 2021 were identified from PubMed, Google Scholar, and ScienceDirect. Information was also obtained from Horse Racing South Africa, the World Health Organization (WHO), 4Racing, and Gold Circle webpages. Figure 1 summarises the search strategy and the selection of articles. The 32-year period was chosen as it likely provided insights into more current conditions, excluding studies from the distant past.

Fifty-five publications (46 articles and nine reports) were included, comprising peer-reviewed journal articles, non-peer-reviewed articles, reports, and webpages. Due to the anticipated limited information on horse grooms, studies related to horse workers' living and working conditions were included. Bioaerosol exposure was confined to TB, COVID-19, endotoxin, (1,3)- β -D-glucan, and horse allergens in the horse industry.

Data extraction

The authors' names, year of publication, article title, country of study, study sample size, living conditions, biological agents, and health effects were extracted from identified articles (Table 2).

RESULTS

Ninety-four potential articles were identified (Figure 1); 10 were removed before screening, and 20 were excluded as the content was unrelated to the review, leaving 64 eligible articles. A further 17 articles were excluded as the full text was unavailable. Ultimately, 55 articles met the inclusion criteria, of which 46 related to the review topic (Table 2). Most articles ($n = 46$, 83.63%) were identified from databases; nine (16.3%) were obtained from websites and organisations but were only used to

support the findings in the other 46 articles. Only five articles on working and living conditions for horse grooms were identified, highlighting the limited literature on this topic.

Occupational exposure to endotoxin and (1,3)- β -D-glucan

Eleven studies reported exposures to endotoxin and (1,3)- β -D-glucan in the horse industry, including horse grooms and veterinary practitioners.^{11,12,21-26} In a study by Hwang et al., 2020, the endotoxin concentration of inhalable particles (geometric mean (GM): 50.2–1,024 EU/m³) was 50 times higher than that of respirable particles (GM: 1.72–19.0 EU/m³).²⁵ They showed that cleaning tasks produced higher concentrations while horse care generated the lowest endotoxin concentrations.²⁵ Similar endotoxin levels were also shown by Samadi et al., 2009, with GM concentrations ranging from 608 EU/m³ to 9 846 EU/m³ in horse stables.¹² However, the measurements in the latter study were collected for a full work shift, while they were collected over a shorter period by Hwang et al., 2020.²⁵ Positive associations were found between endotoxin exposure and respiratory disorders, such as asthma-like symptoms, chronic airway obstruction, and bronchitis.^{21,22} Some studies demonstrated an increased risk of respiratory symptoms, including organic dust toxic syndrome (ODTS), among workers exposed to horses.^{23,24}

Limited data exist for (1,3)- β -D-glucan exposures, with only a few articles reporting airborne concentrations in different horse barns.^{10,25,27} Samadi et al. (2009) demonstrated personal exposure to (1,3)- β -D-glucan with a GM of 9.5 μ g/m³ (0.4–631 μ g/m³) in the horse stables.¹² Elfman et al. (2009) conducted a study in Sweden in summer and winter and found (1,3)- β -glucan levels ranging from 0.01 to 70 ng/m³, with a mean of 20 ng/m³.²⁸ Health effects from exposure to (1,3)- β -D-glucan included cough, wheezing, chest tightness, shortness of breath, nasal irritation, throat and sinus trouble, ODTS, bronchitis, atopy, and asthma.^{23,26,29-32,40}

Occupational exposures to horse allergens

Horse allergens are mainly acidic proteins, of which Equ c1 through c5 have been well characterised.¹⁹ The 16 proteins identified from horses are located in skin dander, hairs, urine, and saliva.^{19,20} There are different allergens of horses (*Equus caballus*) listed in the WHO and International Union of Immunological Society (WHO/IUIS) Allergen Nomenclature Database (Table 1).

Nine studies (Figure 1) reported exposures to horse allergens, including horse hair, dander, and allergens found in bedding materials and feed (Table 2).^{13,19,20,23,24,28,33,34} Health effects included rhinitis, eczema, airway disease, urticaria, conjunctivitis, allergic sensitisation, bronchial inflammation, headache, throat irritation, nasal irritation, and dry productive cough, and chronic obstructive pulmonary disease (COPD) and asthma were also reported.^{13,14,34,35} In a cross-sectional study among horse grooms in Istanbul, asthma was found in 14.4%,

Table 1. Allergenic proteins of *Equus caballus*

Major allergen	Biochemical name	Description
Equ c1	Lipocalin	A 25 kDa lipocalin, which is believed to be the major horse allergen; up to 76% of horse-allergic patients react to Equ c1
Equ c2	Lipocalin	A 17 kDa lipocalin that showed IgE binding, by immunoblotting, in horse-sensitised patients
Equ c3	Serum albumin	A 67 kDa horse serum albumin that showed IgE binding in 50% of patients tested
Equ c4	Latherin	A 17 (20.5) kDa protein with latherin function
Equ c6	-	15 kDa lysozyme, which seems to be both a food and dermal allergen
Horse allergen	-	mAb: 103, 14G4

IgE: immunoglobulin E, kDa: kilodalton, mAb: monoclonal antibodies

Sources: Mittlehner, et al., 2015; Victor, et al., 2019^{19,20}

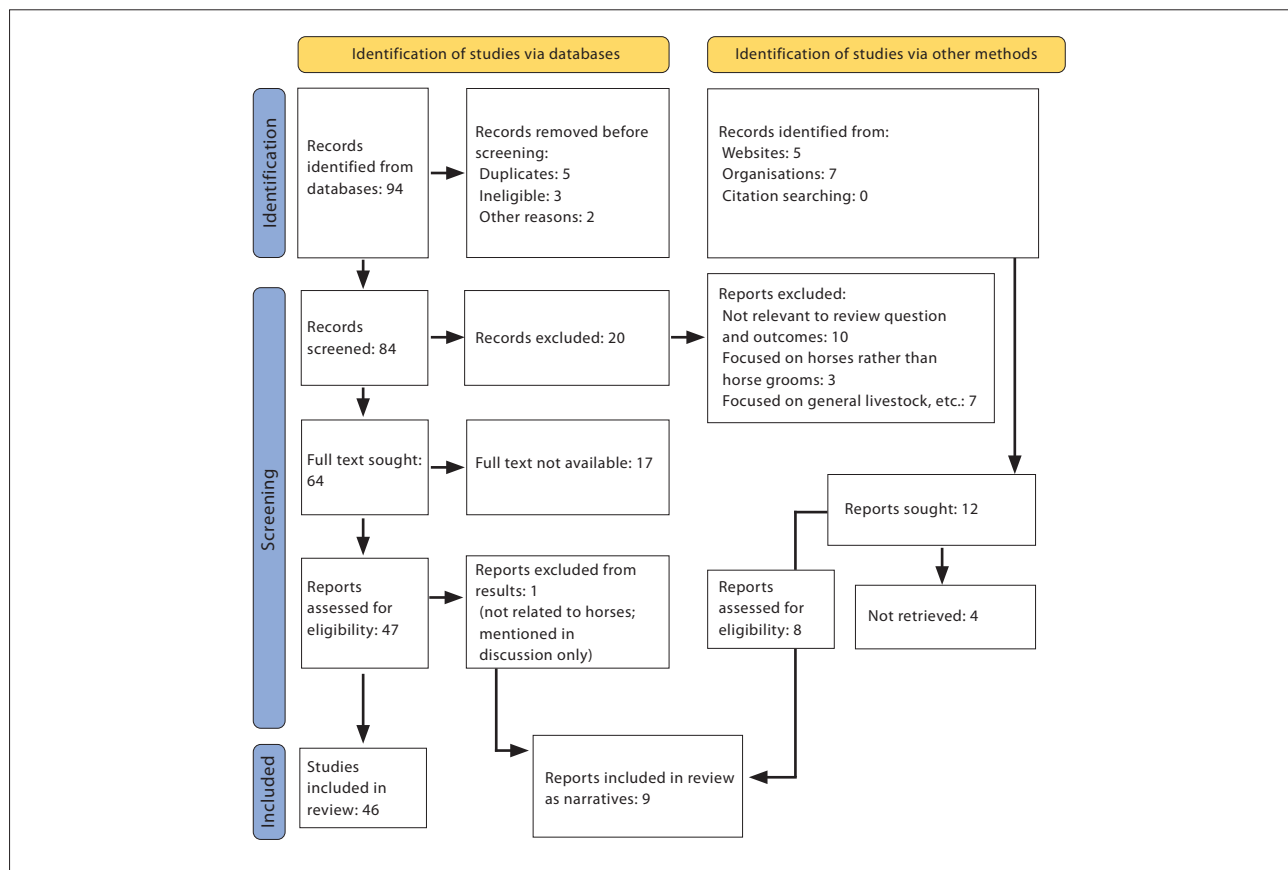


Figure 1. PRISMA flow diagram, summarising selection of articles

allergic rhinitis in 42.4%, allergic conjunctivitis in 35.2%, and allergic skin diseases in 32.8% of the grooms.²⁰ A 1.8-fold increased risk of allergic rhinitis, a 3.9-fold increased risk of allergic conjunctivitis, and a 3.25-fold increased risk of skin diseases were also reported.²⁰

Mycobacterium tuberculosis in horse grooms' hostels

Only six of the studies included in the review related to *M. tuberculosis* exposure in agriculture and hostels.³⁶⁻⁴⁰ According to one South African online news source, horse grooms live in single-sex hostels provided by horse owners or trainers.⁹ Similar to the South African mining industry,¹⁵ most are African male migrant labourers who leave their rural homes in South Africa and neighbouring countries to work at the horse-racing centres. According to a 2019 newspaper article, housing and living conditions of horse grooms are sub-standard and have been associated with adverse health effects, reduced productivity, and poor social wellbeing.⁹ It was reported that the horse grooms' toilets and showers are dirty, and that they sleep on steel beds with mattresses in confined rooms that accommodate four to eight people.^{9, 16}

Potential SARS-CoV-2 in horse grooms' living hostels

Seven studies were related to exposure to SARS-CoV-2.^{17,18,41-45} Poorly ventilated and crowded spaces, such as hostels where grooms reside, may increase the risk of viral transmission and adverse health outcomes, including acute respiratory distress syndrome (ARDS).^{17,41-43,45}

COVID-19 disease spreads in poorly ventilated and/or crowded indoor settings, where people tend to spend longer periods.^{43,46} Two SARS-CoV-2 outbreaks have been associated with poor ventilation.⁴⁷ These outbreaks strongly suggest that many secondary infections may occur in a confined, crowded, and poorly ventilated environment.^{47,45} Like refugees and migrant workers,⁴⁴ horse grooms live in individual and communal accommodations in horse-racing centres. They face similar health threats from COVID-19 as refugees and migrant workers.⁴⁴

DISCUSSION

This scoping review was conducted to describe the occupational biological exposures and related respiratory diseases associated with working and living conditions among horse grooms in the horse industry. The limited literature on horse grooms suggests that they are an under-researched occupational group, particularly regarding exposures. Studies from similar agricultural settings were included in the review to provide context regarding potential biological exposures and health risks. Working conditions involved significant exposure to bioaerosols, including endotoxin and (1,3)- β -D-glucan, which are linked to respiratory diseases such as asthma, bronchitis, and ODTs. Routine activities such as cleaning and caring for horses contribute to these exposures.^{7,19}

The high concentrations of endotoxins reported in the various studies indicate that horse grooms are at risk of developing respiratory symptoms while performing their daily tasks, particularly cleaning activities.²⁰ Additionally, the limited data on (1,3)- β -D-glucan exposure highlights the need for further research to assess its impact on workers' health.^{2,12,22,25} Horse grooms are particularly susceptible to respiratory conditions, infections, and allergic reactions directly linked to prolonged exposure to bioaerosols and microorganisms in the stable environment. These findings emphasise the importance of assessing and managing exposure to endotoxin and (1,3)- β -D-glucan to mitigate respiratory health risks.

The presence of allergens in horse hair, dander, and feed contributes to allergic reactions among workers, including asthma and eczema.^{13,14} Horse grooms face an increased risk of allergic diseases,^{13,14} underscoring the need for preventive measures to reduce allergen exposure.

Horse grooms' poor living conditions, which resemble those of other high-risk groups such as migrant workers and miners, increase the risk of communicable diseases such as TB and COVID-19.^{9,16} Overcrowding and poor ventilation are key factors in the transmission of these diseases.³⁶

Table 2. Summary of articles included in the scoping review (N = 46)

No.	Authors	Country	Study design	Year of data collection	Outcome of interest	Population type	Sample size	Measure and findings	Health effect
<i>Studies with exposure to endotoxins and/or (1,3)-β-D-glucan</i>									
1	Mendy et al., 2019 ²²	USA	Cross-sectional	2005–2006	Increased emergency visits	General population	6 488	Co-exposure to endotoxin and PM2.5 synergistically associated with outcome, increasing odds fivefold (OR 5.01, 95% CI 2.54– 9.87)	Emergency room visits for asthma
2	Hwang and Park, 2018 ²⁵	South Korea	Cross-sectional	2017	Variation of airborne endotoxin levels over one year	Microbiology laboratory workers	174	GM endotoxin levels: 0.240 EU/m ³ Environmental factors affecting endotoxin levels were temperature ($R^2 = -0.388$, $p < 0.001$) and illumination ($R^2 = -0.370$, $p < 0.001$)	Respiratory airway irritation
3	Giofrè et al., 2018 ²⁹	Italy	Cross-sectional	2010–2014	Concentration of airborne endotoxin	Greenhouse workers	30	Significant association ($p = 0.01$) between plant type and number of greenhouses exceeding 100 EU/m ³	Occupational lung diseases, including non-allergic asthma and ODTS
4	Kozajda et al., 2017 ³⁰	Poland	Cross-sectional	2017	Concentrations of inhalable dust, endotoxins, and (1–3)-β-D-glucans	Waste sorting plant workers	42	GM concentrations: inhalable dust: 1.3 mg/m ³ endotoxin: 13.7 ng/m ³ (1,3)-β-D-glucans: 51.8 ng/m ³	Bronchial asthma, ODTS and acute form of byssinosis
5	Samadi et al., 2013 ³¹	Netherlands	Systematic literature review	2013	Levels of bio-aerosols, e.g. as endotoxins, (1,3)-β-D-glucan, and some specific animal allergens	Equine veterinary medicine students	x	Prevalence of sensitisation increased over time Years 3–5: OR 2.4, 95% CI 0.4–15 Year 6: OR 4.7, 95% CI 0.4–49	Prolonged years of exposure to horses as a possible determinant of sensitisation
6	Berndt et al., 2010 ¹⁰	USA	Cross-sectional	2010	Endotoxin levels in stables	Horses	x	Endotoxin exposure significantly higher (~ 8-fold) in stables than in pasture	-
7	Samadi et al., 2009 ¹²	Netherlands	Cross-sectional	2009	Inhalable dust, endotoxins, β(1,3)-glucans	x	90	GMs of personal exposure to dust, endotoxin, and β(1,3)-glucan: 1.4 mg/m ³ , 608 EU/m ³ , and 9.5 μg/m ³ , respectively	Asthma, chronic bronchitis, and ODTS
8	Pirie et al., 2009 ⁴⁸	UK	Experimental	2002	Inhaled endotoxin	x	30	x	Airway inflammation and dysfunction among horses
9	Douwes et al., 2003 ⁴⁹	Netherlands	Reviewed article	2003	Exposure to bioaerosols	Workers	x	x	Respiratory diseases, infectious diseases, acute toxic effects, mycotoxin, allergies, cancer
10	McGorium et al., 1998 ¹¹	UK	Cross-sectional	1997	Airborne endotoxin concentrations	Equine management systems	x	Pooled data: airborne endotoxin concentration of each environment was significantly correlated with its dust concentration (Spearman's rank coefficient = 0.865; $p < 0.01$)	Airway inflammation and dysfunction, broncho-constriction
11	Mackiewicz et al., 1996 ⁵⁰	Poland	Cross-sectional	1996	ODTS	Workers on purebred horse farms	31	Mean concentration of endotoxin: 3.44 g/m ³	ODTS

Studies with exposure to airborne dust									
12	Flunker, 2015 ³²	USA	Cross-sectional	2014	Chronic exposure to dusty barn environments	Latino thoroughbred horse workers	80	Odds of abnormal pulmonary function increased by years of current horse farm employment (OR 6.3, 95% CI 1.15–34.35) and years living in the USA (OR 5.2, 95% CI 1.3–20.6)	Respiratory symptoms: cough wheezing, chest tightness, shortness of breath, nasal irritation, throat and sinus
13	Clements and Pirie, 2007 ²⁶	UK	Cross-sectional	2006	Respirable dust concentrations	Equine stables	60	Mean respirable dust concentrations significantly reduced ($p < 0.05$) in equine stables by changing the environment from hay feed and straw bedding to haylage feed and wood shavings bedding (reduction in mean from 0.087mg/m ³ to 0.026mg/m ³ ; reduction in maximum -4.076mg/m ³ to 0.218mg/m ³)	x
14	Gallagher et al., 2007 ²³	New Zealand	Cross-sectional	1999–2000	Occupational respiratory health	Horse trainers	659	Chronic bronchitis: OR 6.8, 95% CI 2.2–21.4; ODTS: OR 3.5, 95% CI 1.8–6.8	ODTS, bronchitis, atopy, asthma
15	Rosenthal et al., 2006 ³²	USA	Cross-sectional	2006	Airborne particulate levels (RP and TP)	Horse barn workers	50	Mean ratio of RP:TP was 0.63 in summer, 0.34 in winter, and 0.50 for pooled measurements	Respiratory effects
16	Woods, 1993 ²⁷	England	Cross-sectional	1993	Airborne dust and aeroallergen concentration	Horse stable management systems	40	GM concentrations higher in stables with hay feed than in those with wood shavings	Respiratory effects
Studies with exposure to SARS-CoV-2									
17	Song et al., 2021 ¹⁷	China	Cohort study	2020	Impact of comorbidity (asthma and COPD) on COVID-19	COVID-19 patients	961	COPD patients had higher risk of developing severe illness (OR 23.433, 95% CI 1.525–360.135; $p < 0.01$) and ARDS (OR 19.762; 95% CI 1.461–267.369; $p = 0.025$) than asthmatics	COVID-19, asthma, hypertension, diabetes, cardiovascular disease, malignancy, COPD
18	Azuma et al., 2020 ⁴⁴	Japan	Review article	2020	Indoor environmental quality	General population	x	x	COVID-19 transmission
19	Guo et al., 2020 ⁴¹	South Africa	Review article	2020	Clinical therapies for COVID-19	COVID-19 patients	x	x	Fever, cough, fatigue, gastrointestinal infection, ARDS
20	Li et al., 2020 ⁴⁵	China	Cross-sectional	2020	Evidence for aerosol transmission	COVID-19 infected persons	10	Ethane concentration positively associated with risk of acquiring COVID-19 (OR associated with 1% increase in concentration: 1.115; 95% CI: 1.008–1.233; $p = 0.035$)	COVID-19 transmission
21	Morawska and Cao, 2020 ⁴²	China and Australia	Review article	2020	Viral airborne transmission	General population	x	x	COVID-19 transmission
22	Somsen et al., 2020 ⁴³	Netherlands	Review article	2020	Transmission in poorly ventilated spaces	General population	x	x	COVID-19 transmission
23	Wang et al., 2020 ¹⁸	China	Retrospective study	2020	Clinical characteristics	Hospitalised patients	138	NCIP suspected in 41% of patients; 26% of patients received ICU care, mortality was 4.3%	COVID-19, COPD, asthma
Studies with exposure to Mycobacterium tuberculosis									
24	Almekhlief et al., 2016 ³⁷	Syria	Cross-sectional	2015–2016	Risk of latent tuberculosis infection	Internally displaced people	419	Positivity of tuberculin skin test associated with close contact (87/161, 54%) vs no close contact (32/244, 15%), OR 10.36; 95% CI = 5.969–17.997; $p < 0.001$	TB latent infection
25	Carruth et al., 2016 ⁴⁰	Africa	Letter to the editor	2016	Zoonotic tuberculosis challenges	General population	x	x	Zoonotic TB
26	Hlokwe et al., 2016 ³⁹	South Africa	Case report	2005	Molecular characterisation of <i>M. bovis</i>	x	x	x	Bovine TB
27	Narasimhan et al., 2013 ³⁶	Australia	Systematic literature review	2013	Risk factors for TB	General population	x	x	TB
28	Kulchavenya et al., 2012 ³⁸	Russia	Review	2012	Male genital TB	Patients with UGTB	310	x	UGTB

Studies with exposure to allergens									
29	Victor et al., 2019 ²⁰	Sweden	Cross-sectional	2019	Allergen levels of Equ c4 in dander and saliva	Horse owners	170	GM values: Equ c4 in dander 639 U/ μ g protein (range 5–15 264), Equ c4 in saliva 39.5 (range 4–263)	Respiratory symptoms
30	Zahradnik et al., 2018 ³⁵	Germany	Cross-sectional	2016	Allergen levels in horse breeds	Horse breeders	50	Mean allergen concentration of Equ c1 and Equ c4 in hair significantly related to breed and sex combined	x
31	Mitlehner et al., 2015 ¹⁹	Germany	Review	2015	Horse allergy in riders	Equestrian athletes	40	x	Rhinitis, asthma, eczema
32	Elfmán et al., 2009 ²⁸	Sweden	Review	2004–2005	Influence of horse stable environment	Stable personnel	13	Mean endotoxin and (1–3)- β -d-glucan transiently higher when stable doors closed: 31 and 362 ng/m ³ , respectively; dropped to 5 and 85 ng/m ³ , respectively, with doors open	Bronchial obstruction
33	Gawlik et al., 2009 ¹⁴	USA	Case report	x	Anaphylaxis from horse allergy	Horse owners	1	x	Anaphylaxis with specific IgE to horse dander (> 100 kU/l)
34	Mazan et al., 2009 ²⁴	Czech Republic	Cross-sectional	2005–2006	Airway disease symptoms in barn personnel	Barn workers	82	x	Airway disease, asthma
35	Tutluoğlu et al., 2002 ³⁴	Turkey	Cross-sectional	2002	Sensitisation to horse hair	Horse grooms	125	Association for sensitisation to horse hair with asthma: OR 4.5, 95% CI 1.5–13.3, allergic skin diseases: OR 2.4, 95% CI 0.6–9.8, allergic rhinitis: OR 1.5, 95% CI 0.4–5.1	Sensitisation to horse hair, asthma and allergic symptoms, lung function impairment
36	Roberts and Lack, 2000 ¹³	UK	Case report	2000	Horse allergy	Children	3	x	Allergic sensitisation, bronchial inflammation, asthma
37	Felix et al., 1996 ³³	Sweden	Cross-sectional	1996	Allergenic composition of dander extracts	Breeders and patients with asthma	20	x	Asthma, rhino-conjunctivitis
Studies with exposure to respiratory and other agents									
38	Bulfin et al., 2019 ⁵¹	Ireland	Cross-sectional	2018	Equestrian worker's personal RCS and RD exposure; occupational exposures in equestrian centre	Equestrian workers	1	GM RD and RCS exposures: 0.12 mg/m ³ and 0.02 mg/m ³ , respectively	Lung cancer
39	Pelders and Nelson, 2019 ¹⁵	South Africa	Cross-sectional	2014	Living conditions of migrant workers	Migrant workers	875	x	Respirable communicable diseases
40	Wolny-Koladka, 2018 ⁵²	Poland	Cross-sectional	2015–2017	Microbiological air quality in stables	x	x	x	x
41	Bush et al., 2018 ⁵³	USA	Cross-sectional survey	2013–2014	Missed work due to occupational illness	Latino farmworkers	225	Workers with poor self-reported general health (PR 0.72, 95% CI 0.48–1.08), experiencing stress during a typical workday (PR 2.58, 95% CI 1.25–5.32), or spending less time with horses (PR 1.87, 95% CI 1.15–3.05) are significant predictors of missing work	Headache, throat irritation, nasal irritation, dry and productive cough
42	Nowakowicz et al., 2014 ⁵⁴	Poland	Cross-sectional	2014	Level of exposure to air pollution in a stable	Horse caregivers	x	Total number of airborne bacteria in the stable exceeded allowable level of microbiological contamination in animal rooms and safe value for workers (3.2 x 10 ⁵ cfu/m ³ in stable and 1.1 x 10 ⁵ cfu/m ³ in social room)	Unfavourable health effects
43	Swanberg et al., 2013 ⁶	USA	Cross-sectional	2012–2013	Occupational injuries on thoroughbred farms	Latino workers	378	x	Occupational injuries
44	McShane and Swart, 2011 ¹	South Africa	Systematic review	2011	Equine management	Equine breeders	x	x	x
45	Madsen, 2006 ²¹	Denmark	Cross-sectional	2006	Airborne endotoxin levels	General population	169	x	Airway inflammation and dysfunction
46	Curtis et al., 1996 ⁵⁵	Canada	Cross-sectional	1996	Organic dust and ammonia in horse stalls	x	x	Mean concentration	Respiratory disorders

ARDS: acute respiratory distress syndrome, CI: confidence interval, CMAQ: community multi-scale air quality modelling system, COPD: chronic obstructive pulmonary disease, GM: geometric mean, ICU: intensive care unit, NCIP: novel coronavirus (2019-nCoV): infected pneumonia, NO₂: nitrogen dioxide, ODTs: organic dust toxic syndrome, OR: odds ratio, p: probability value, PR: probability value, RCS: respirable crystalline silica, RD: respirable dust, RP: respirable particles, TB: tuberculosis, TP: total particles, UGT8: urogenital tuberculosis, UK: United Kingdom, USA: United States of America; X: not reported/not available

CONCLUSION

Information about exposure to bioaerosols in the horse industry is derived primarily from international studies. The findings of this review highlight the unique occupational hazards faced by horse grooms, including exposure to bioaerosols, allergens, and communicable diseases. Addressing these risks through improved air quality, personal protective equipment, and better living conditions is essential to protect the health and wellbeing of this workforce. There is a need to identify and appropriately quantify the responsible agents and their health impacts on horse grooms in South Africa. Exposure to bioaerosols in South Africa's horse-racing industry is likely exacerbated by prolonged close contact with horses, frequent handling of bedding and feed materials, and inadequate ventilation in both stables and worker accommodations. This review serves as a foundation for future research endeavours and the development of targeted interventions aimed at promoting the occupational health and wellbeing of horse grooms in all relevant industries.

KEY MESSAGES

1. Horse grooms face significant exposure to bioaerosols, such as endotoxin and (1,3)- β -D-glucan, which are linked to respiratory diseases like asthma, bronchitis, and organic dust toxic syndrome.
2. Cleaning tasks contribute significantly to high endotoxin exposure.
3. Horse allergens in hair, dander, bedding materials, and feed pose a significant occupational hazard.
4. Horse grooms often live in overcrowded, poorly ventilated conditions, similar to other high-risk groups such as migrant workers and miners.

DISCLAIMER

Any opinions expressed, conclusions drawn, and recommendations provided here are those of the authors and do not necessarily reflect the views of the NHLS, NIOH, or the University of Johannesburg.

DECLARATION

The authors declare that this is their own work; all the sources used in this paper have been duly acknowledged and there are no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conception and design of the study: TD, TS

Data acquisition: TD

Data analysis: TD

Interpretation of the data: TD, TS, NN

Drafting of the paper: TD, TS, NN

Critical revision of the paper: TD, TS, NN

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Chronic musculoskeletal pain in municipal workers and associated psychosocial factors

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ABSTRACT

Background: Work-related musculoskeletal disorders are a growing global public health problem. In South Africa, studies have reported on the prevalence and physical risk factors for work-related musculoskeletal disorders, including chronic musculoskeletal pain. Associations of psychosocial stressors with chronic musculoskeletal pain in working populations are being increasingly reported, globally, highlighting the need to investigate this association in South African workers.

Objectives: To estimate the prevalence of chronic musculoskeletal pain, and to identify associated demographic and psychosocial factors, in workers employed in the community services department of the uMhlathuze municipality in northern KwaZulu-Natal.

Methods: This cross-sectional study was conducted in the uMhlathuze municipality in 2017. Data were collected using an administered questionnaire following signed informed consent. Means and standard deviations and frequencies and proportions were used to describe continuous and categorical variables, respectively. Multivariable logistic regression was used to determine associations between demographic and psychosocial factors and chronic musculoskeletal pain.

Results: Three hundred and eighty-eight workers employed in 11 sections of the community services department participated in the study. The prevalence of self-reported chronic musculoskeletal pain was 63.1% (n = 245). Being older (45 to 65 years) (AOR 1.89; 95% CI 1.04–3.45), female (AOR 1.72, 95% CI 1.08–2.76), and having a highly demanding job (AOR 1.78, 95% CI 1.11–2.86) were significantly associated with increased reports of chronic musculoskeletal pain. Job satisfaction (AOR 0.47, 95% CI 0.29–0.76) was protective against reported pain.

Conclusion: A high prevalence of chronic musculoskeletal pain, in the presence of associated psychosocial factors in this working population, requires appropriate interventions to prevent further disease.

INTRODUCTION

Musculoskeletal disorders (MSDs) are a group of symptoms that manifest as a result of disorders of the muscles, skeleton, and related tissues. Musculoskeletal disorders associated with the work environment are referred to as work-related musculoskeletal disorders (WRMSDs), and are a growing global public health problem.¹⁻⁴ Analysis of attributable risk in the Global Burden of Disease 2019 study found that occupational risks, such as repetitive movements, working in static postures, and lifting weights were the greatest contributors to MSDs.⁵ Further, occupational risks accounted for 15.31 million disability-adjusted life-years (DALYs) for MSDs, globally. In low to middle sociodemographic index countries, occupational risks accounted for 3.32 million DALYs for MSDs.⁵

Psychosocial stressors and organisational factors in the workplace have also been identified as attributable risks for WRMSDs.⁶⁻¹⁰ Psychosocial factors include job satisfaction, job demand, job control, and social interaction in the work environment. Bezzina et al. (2023) reported that high job demand, low job control, and poor co-worker and manager support in the workplace are associated with WRMSDs.⁹ Andersen et al. (2012),¹⁰ in a study conducted in Denmark, found that low job satisfaction predicted neck and shoulder pain with risks ranging from 1.6 to 2.2, while Sterud et al. (2014) reported that high job demand and poor support from leadership were associated with neck pain and shoulder pain (OR 1.41, 95% CI 1.11–1.78, and OR 1.66, 95% CI 1.08–2.54, respectively).¹¹

Growing industrialisation, together with non-mechanised work systems and absent workplace safety protocols, are resulting in high exposure to physical and psychosocial risk factors, increasing

the burden of WRMSDs amongst both men and women in most low- and middle-income countries (LMICs).¹²⁻¹⁶ Goswami et al. (2016)¹⁵ reported a chronic lower back pain prevalence of 55% in jute mill workers in India, who were lifting weights and performing repetitive movements. Alie et al. (2023) reported lower back pain in 65% of street cleaners and solid waste workers in Ethiopia, who were dissatisfied with their jobs.¹²

In South Africa, the prevalence of WRMSDs has been documented in several occupational groups, including miners, agricultural workers, professionals such as bank workers, nurses and dentists, and municipal workers.¹⁶⁻²² Reported prevalences range from 55.8%²⁰ in oral hygienists to 84.1% in nurses.¹⁹ Only a few South African studies have focused on the psychosocial factors associated with WRMSDs. Nyantumbu-Mkhize (2017), in a study of nurses and bank workers, reported a positive correlation between somatising tendencies and musculoskeletal pain in the past 12 months.¹⁹ Govender and Dlungwane (2018), in their study of oral health workers, found that anxiety and depression were significantly associated with musculoskeletal pain (p = 0.01).²² In light of the associations between WRMSDs and psychosocial occupational factors reported in the literature, and the limited literature on these associations in LMICs, it is important that we study them more extensively to better inform workplace controls and reduce the burden of WRMSDs in countries like South Africa.

Research in South Africa has shown that municipal workers are exposed to a variety of occupational hazards, including psychological stress, and that they report WRMSDs.²³ This requires a better understanding of the association between WRMSDs and psychosocial

risks. In this paper, we report the prevalence of self-reported chronic muscular pain (CMP) as a symptom of WMSDs, and WMSDs and associated psychosocial factors, in workers employed in the community services department of the uMhlathuze municipality, in northern KwaZulu-Natal.

METHODS

This was a cross-sectional study conducted in 2017 in the uMhlathuze municipality in KwaZulu-Natal province. This municipality is situated on the north-east coast and is the third economic hub in the province, with a mix of urban and rural residential areas (<https://municipalities.co.za/overview/1110/city-of-umhlathuze-local-municipality>). The municipality employs approximately 2 000 workers, most of whom are employed in the community services department (n = 900; 40.0%), which has 11 sections. Employees are involved in manual work, including driving refuse removal vehicles, street cleaning, grave digging, building construction and maintenance, firefighting, and grass cutting.

The study population comprised all permanent employees who had worked for more than one year to allow us to estimate the prevalence of CMP, defined as pain in the past 12 months that lasted for more than three months.

Based on published studies conducted in South African working populations,^{18,20} we expected a minimum prevalence of 50%. At a 5% level of significance and 95% confidence interval, we calculated a sample size of 384.²⁴ Stratified sampling was used to proportionally select participants from 11 sections of the community services department. The Director's office, which had less than four staff, was excluded from the study.

Data were collected using a structured questionnaire adapted from two standardised questionnaires: the Standardised Nordic Questionnaire and the Copenhagen Psychosocial Questionnaire.^{25,26} The questionnaire consisted of closed-ended questions with response categories. Question categories included demographic characteristics; psychosocial factors including job demands, social interactions, organisational culture, and job satisfaction; and history of pain in the neck, back, shoulder, elbow, wrist/hand, hip/thigh, knee, and ankle/foot. The questions on psychosocial factors were drawn from a questionnaire developed by Kristensen et al. (2005)²⁶ that focused on job demand, job control, social support, and job satisfaction. Only pain in the past 12 months that lasted for more than three months was considered relevant. Participants were asked to rate their health status on a five-point scale from poor to excellent. The questionnaire was translated into isiZulu and back into English to ensure that the meanings of the questions were preserved.

Data collection procedure

The names of employees in the department were extracted from the municipality clinic register and transferred to the Statistical Package for Social Sciences (SPSS) version 22.0 programme, after which they were randomly selected. Employees who consented to participate in the study were interviewed in a private room. The questionnaires were administered by SSM. The data were coded and captured in Microsoft Excel and imported into STATA for analysis.

Data analysis

Questions on psychosocial factors were grouped into four categories, namely job demand, social interaction, organisational culture, and job satisfaction. A total score for each participant was created for each category as the sum of the responses to the questions. Each category was then dichotomised around the median score. Anatomical sites in which pain was experienced were grouped into neck, back, upper limb

(shoulder, elbow, and wrist/hand), and lower limb (hip/thigh, knee, and ankle/foot). Data are presented as frequencies for categorical variables and as means and ranges for continuous variables.

A logistic regression model, adjusted for age and sex, was used to measure the strength of associations between education, body mass index (BMI), years of employment, job demand and job satisfaction (independent factors) and CMP, the dependent variable, defined as presence or absence of pain in the past 12 months that lasted for more than three months. Independent variables that were identified as being associated with CMP in the univariate logistic regression analyses ($p < 0.3$), and factors identified from the literature as being associated with CMP, were included in the model, viz. age, sex, education level, BMI, regular exercise, years of employment, smoking, alcohol use, job demand, social interaction, organisational culture, and job satisfaction. In the multivariable logistic regression analysis, the level of significance for factors associated with CMP was $p < 0.05$.

The Biomedical Research Committee of the University of KwaZulu-Natal (BREC) granted full ethics approval for the study (BE: 186/17).

Table 1. Characteristics of study participants (N = 388)

Characteristic	n	%
Age (years)		
≤ 44	228	58.8
45–65	160	41.2
Sex		
Male	212	54.6
Female	176	45.4
Highest education level		
None	57	14.7
Primary school	83	21.4
High school	206	53.1
Post high school	42	10.8
Body mass index (kg/m ²)		
< 18.5 (underweight)	15	3.9
18.5–24.9 (normal weight)	187	48.2
25.0–29.9 (overweight)	106	27.3
> 29.9 (obese)	80	20.6
Duration of employment (years)		
< 10	168	43.3
10–19	127	32.7
20–44	93	23.9
Work site		
Parks	79	20.4
Sports	17	4.4
Beach and pools	44	11.3
Library	12	3.1
Halls and buildings	24	6.2
Street cleaning	43	11.1
Cemetery	19	4.9
Waste management	58	14.9
Fire and rescue	44	11.3
Traffic	44	11.3
Clinic	4	1.0
Past work-related injury	61	15.7
Current smoker	29	7.5
Alcohol consumption (yes)	84	21.6
Physical exercise (yes)	147	37.9

RESULTS

A total of 388 employees participated in the study. The demographic characteristics of the participants are presented in Table 1. The majority of participants were male (n = 212, 54.6%); mean age was 42.9 years (24–65 years). Most participants had completed high school education (n = 206, 53.1%). Almost 50% of participants were overweight or obese (n = 186, 47.9%). Around a third exercised regularly (n = 147, 37.9%). A few of the participants were current smokers (n = 29, 7.5%), and

21.6% (n = 84) consumed alcohol. The mean duration of employment was 12.7 years (1–44 years). Most participants (n = 325, 83.7%) worked for eight hours a day, while 10.8% (n = 42) worked 12 hours per day.

Chronic musculoskeletal pain

Chronic musculoskeletal pain was self-reported by 63.1% (n = 245) of participants. The body site with the highest reports of CMP was the back (n = 174, 44.8%), followed by the lower limb (n = 138, 35.6%), upper

Table 2. Characteristics of workers by chronic musculoskeletal pain (N = 388)

Variable	Chronic musculoskeletal pain				All
	Yes	%	No	%	
Age (years)					
≤ 44	133	58.3	95	41.7	228
45–65	112	70.0	48	30.0	160
Sex					
Male	122	57.5	90	42.5	212
Female	123	69.9	53	30.1	176
Highest education level					
None	34	59.6	23	40.4	57
Primary school	60	72.3	23	27.7	83
High school	123	59.7	83	40.3	206
Post high school	28	66.7	14	33.3	42
BMI (kg/m ²)					
< 18.5 (underweight)	12	80.0	3	20.0	15
18.5–24.9 (normal weight)	123	65.8	64	34.2	187
25.0–29.9 (overweight)	65	61.3	41	38.7	106
> 29.9 (obese)	45	56.3	35	43.8	80
Years of employment					
< 20	179	60.7	116	39.3	295
20–44	66	71.0	27	29.0	93
Work site					
Parks	50	63.3	29	36.7	79
Sport	13	76.5	4	23.5	17
Beach	31	70.5	13	29.5	44
Library	7	58.3	5	41.7	12
Halls and buildings	19	79.2	5	20.8	24
Street cleaning	25	58.1	18	41.9	43
Cemetery	13	68.4	6	31.6	19
Waste management	41	70.7	17	29.3	58
Fire and rescue	13	29.5	31	70.5	44
Traffic	30	68.2	14	31.8	44
Clinic	3	75.0	1	25.0	4
Job demand					
Low	136	57.9	99	42.1	235
High	109	71.2	44	28.80	153
Social interaction at work					
Poor	44	57.9	32	42.1	76
Good	201	64.4	111	35.6	312
Organisational culture at work					
Poor	91	62.8	54	37.2	145
Good	154	63.4	89	36.6	243
Job satisfaction					
Low	113	70.6	47	29.4	160
High	132	57.9	96	42.1	228

limb (n = 126, 32.5%), and neck (n = 113, 29.1%). The characteristics of workers with, and without, CMP is shown in Table 2. The highest proportions of CMP were reported by staff working in the halls and buildings section (n = 19, 79.8%); the lowest was reported by those working in the fire department (n = 13, 29.6%).

Workers with highly demanding jobs (n = 109, 71.2%) and low job satisfaction (n = 113, 70.6%) reported higher prevalences of CMP (Table 3).

Factors associated with chronic muscular pain

The results of the logistic regression analyses are presented in Table 3. In the multivariable model, four factors were associated with CMP. Being older (45–65 years) significantly increased the adjusted odds of CMP by 89% (AOR 1.89; 95% CI 1.04–3.45); female significantly increased the adjusted odds of CMP by 72% compared to being male (AOR 1.72; 95% CI 1.08–2.76). Of the four psychosocial factors in the analysis, two were associated with CMP. Having high-demand jobs increased the adjusted odds of CMP by 78% compared to those with low-demand jobs (AOR 1.78; 95% CI 1.11–2.86). Compared with workers with low job satisfaction, those with high job satisfaction had lower odds of having CMP (AOR 0.47; 95% CI 0.29–0.76), that is, the effect was protective.

DISCUSSION

This study investigated the association of psychosocial factors and CMP in municipal workers employed in the community services department of uMhlathuze municipality in KwaZulu-Natal, South Africa. The prevalence of workers with CMP (63.1%) reported in this study, while much higher than the prevalence of CMP reported in the general South African population, was in keeping with the prevalence reported in South African working populations. Chronic pain prevalence in the general South African population was 18.3% (95% CI 17.0–19.7) as reported in the 2016 South Africa Demographic and Household Survey.²⁷ In studies of female agricultural workers and women working in mining, CMP ranges were 42.8–48.3%¹⁸ and 35.1–41.7%,²⁸ respectively.

The prevalence of CMP in the different anatomical sites was highest in the back (44.8%) in this current study. Kabongo and Naidoo reported a lower back prevalence of 40.9% in female miners in South Africa,²⁸ results that are similar to the present study. The slight difference in prevalence could be attributed to differences in the nature of the actual activities of the jobs in the differing work environments.

With regard to work site-specific prevalence, the workers in the halls and buildings section reported the highest prevalence of CMP in this study. This is probably related to the fact that their jobs are physically demanding because they are involved in maintenance.²⁹ Workers in

Table 3. Factors associated with chronic musculoskeletal pain (N = 388)

Variable	n	OR	Chronic musculoskeletal pain				p value
			95% CI	p value	AOR	95% CI	
Age (years)							
≤ 44	228	Ref.			Ref.		
45–65	160	1.66	1.09–2.56	0.019	1.89	1.04–3.45	0.036
Sex							
Male	212	Ref.			Ref.		
Female	176	1.71	1.12–2.61	0.012	1.72	1.08–2.76	0.023
Highest education level							
None	57	Ref.			Ref.		
Primary school	83	1.76	0.86–3.61	0.119	2.17	0.99–4.72	0.051
High school	206	1.00	0.55–1.82	0.994	1.58	0.74–3.38	0.234
Post high school	42	1.35	0.59–3.11	0.476	1.99	0.73–5.43	0.179
BMI (kg/m ²)							
< 18.5 (underweight)	15	Ref.			Ref.		
18.5–24.9 (normal weight)	187	0.48	0.13–1.76	0.269	0.37	0.09–1.47	0.160
25.0–29.9 (overweight)	106	0.40	0.11–1.49	0.171	0.31	0.76–1.23	0.095
> 29.9 (obese)	80	0.32	0.8–1.23	0.097	0.23	0.06–0.97	0.045
Employment (years)							
< 20	295	Ref.			Ref.		
20–44	93	1.58	0.96–2.62	0.074	1.31	0.69–2.49	0.402
Job demand							
Low	235	Ref.			Ref.		
High	153	1.80	1.17–2.79	0.008	1.78	1.11–2.86	0.017
Social interaction at work							
Poor	76	Ref.					
Good	312	1.32	0.79–2.19	0.291	1.49	0.84–2.63	0.173
Organisational culture at work							
Poor	145	Ref.					
Good	243	1.03	0.67–1.57	0.903			
Job satisfaction							
Low	160	Ref.			Ref.		
High	228	0.54	0.35–0.84	0.006	0.47	0.29–0.76	0.002

the fire section reported the lowest prevalence of CMP. Fire fighters in general are required to have high standards of physical fitness, and this may be a reason for the low CMP prevalence report in this group.³⁰

In this study, workers aged 45 years and older were 89% more likely to report CMP compared to younger workers. This finding was not unexpected because research shows that with ageing, workers generally report greater musculoskeletal problems.³¹

Sex differences in pain prevalence have been reported in the literature, with females reporting higher pain prevalence when compared to men.³² Females in this study experienced significantly more CMP (69.9%) than their male counterparts (57.5%) ($p = 0.023$). The multivariable model showed that females suffer significantly more from CMP than males (AOR 1.72; 95% CI 1.08–2.76). Part of the reason for sex differences in CMP prevalence may be because women have lower pain thresholds and are more sensitive when compared to men. In addition, women are at greater risk of experiencing conditions such as osteoarthritis and other hormone-related conditions.³³ Women, by virtue of the roles they play as homemakers in addition to having formal employment, have an increased risk for CMP but also increased stress, which may translate into an increased reporting of CMP.³⁴

Psychosocial factors such as job demand and job satisfaction have been associated with reports of CMP in working populations.^{9,35} In this study on multivariable logistic regression analysis, it was found that workers with a highly demanding job self-reported more CMP compared to those with a less demanding job (AOR 1.78; 95% CI 1.11–2.86), and workers who had high job satisfaction experienced less CMP (AOR 0.47; 95% CI 0.29–0.76). Bezzina et al., in a review of the literature, found that high job demand and job dissatisfaction were associated with musculoskeletal disorders.⁹ Yamada et al. reported that CMP was higher among workers who were dissatisfied with their job (specialists, managers, white-collar workers, sales workers, service workers, and labourers).³⁵

Exposure to psychosocial factors such as demanding jobs and work settings, which result in job dissatisfaction, can lead to stress in workers. Persistent stress can cause CMP.³⁶ In our study, it is possible that workers who found their jobs very demanding or who were dissatisfied with their jobs may have experienced stress reactions. In the South African context with its high levels of unemployment, workers may continue working, even though unhappy in their jobs, for fear of being unemployed³⁷ and so increase the risk of manifesting with CMP. Of concern are the possible long-term effects of psychosocial stressors, of a highly demanding job and job dissatisfaction, in the presence of CMP on worker health.

Owing to the high prevalence of CMP reported by workers in most of the work areas in this study, it is difficult to target a specific employment site for interventions. Interventions should uniformly address all workers, with particular attention paid to women. Psychosocial interventions will have to focus on those workers who find their jobs very demanding and who are dissatisfied. Working with a multidisciplinary team, which includes a psychologist and management, will be beneficial in addressing these issues. Management should review different jobs to better understand the nature of the job demands and reasons for dissatisfaction, so as to intervene appropriately.

Limitations

While the findings of this study provide valuable information that managers of the study population can use to develop interventions, there are some limitations that need to be borne in mind. A questionnaire

was used to determine the prevalence of CMP. Since this was self-reported, a potential reporting bias exists in that the CMP prevalence may be an over-estimation of the true prevalence. This study focused on currently employed workers and did not include workers who were previously employed in the municipality. Hence, our findings may be influenced by the healthy worker effect, where employees with MSDs may have resigned from employment due to ill-health and, thus, were not available to participate in the study. This could have resulted in an under-estimation of the true prevalence of musculoskeletal disorders in this working population. Unfortunately, time and limited finance influenced the choice of the study population. This study sample was confined to workers from one department in the municipality. While the findings may be generalisable to workers who perform similar duties in similar settings, the findings cannot be generalised to all workers in the municipality.

CONCLUSION

The self-reported prevalence of CMP among uMhlathuze municipality workers in the community services department was above 60%, which was similar to other working groups in South Africa. High job demands and low levels of job satisfaction associated with self-reported CMP is a cause for concern in this worker population. Appropriate workplace interventions to reduce the high job demands and improve job satisfaction may assist in reducing CMP in this worker population.

KEY MESSAGES

1. There was a high prevalence of self-reported chronic musculoskeletal pain in this sample of municipal workers.
2. Female workers were more likely to report the chronic musculoskeletal pain than their male counterparts.
3. Psychosocial factors of high job demand and low job satisfaction were associated with increased reports of chronic musculoskeletal pain.

DECLARATION

The authors declare that this is their own work; all the sources used in this paper have been duly acknowledged and there are no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conception and design of the study: SSM, SN

Data acquisition: SSM

Data analysis: SSM

Interpretation of the data: SSM, SN

Drafting of the paper: SN

Critical revision of the paper: SN

Note: SSM passed away before the paper was written; this paper is based on his Master of Public Health research report.

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Correlations between levels of essential metals and arsenic in the urine of exposed copper smelter workers

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ABSTRACT

Background: Arsenic (As) is a toxic metalloid. The toxicity resulting from As exposure is linked to the generation of reactive oxygen intermediates, and various metabolic processes associated with the homeostasis of essential metals. Essential metals are coactivators of several important enzymes, including antioxidant enzymes and proteins necessary for health maintenance. Copper (Cu), manganese (Mn), zinc (Zn), cobalt (Co), chromium (Cr), molybdenum (Mo), and selenium (Se) are all essential metals, and any diet deficiency or excessive levels affect the integrity of various physiological and metabolic processes. Although As has no beneficial effects on the human body, it can affect multiple biological processes, including intracellular and intercellular signaling, cell adhesion, protein folding and maturation, apoptosis, ionic transportation, enzyme regulation, and release of neurotransmitters, by inhibiting or disturbing the homeostasis of essential metals.

Objective: To describe the effects of As exposure on Cu, Mn, and Zn concentrations in copper smelter workers and nearby residents.

Methods: In a cross-sectional study, we measured metals in the urine of 1 671 copper smelter workers and 187 community residents (unexposed reference group) using inductively coupled plasma mass spectrometry (ICP-MS). Correlations between the metalloid, As, and the three essential metals were assessed using Spearman's correlation.

Results: Arsenic concentrations in copper smelter workers were more than three times higher than in the residents (99.3 µg/g and 28.9 µg/g, respectively). Significant differences in Cu, Mn, and Zn concentrations were observed in the two groups. There were significant correlations between urine As, and Zn and Cu in both smelter workers and residents. The strongest correlations were between As and Zn ($R^2 = 0.086$, $p = 0.0004$), and As and Cu ($R^2 = 0.051$, $p = 0.033$) for the copper smelter workers, and between As and Zn ($R^2 = 0.085$, $p = 0.0001$), and As and Cu ($R^2 = 0.033$, $p = 0.012$) for the residents.

Conclusion: Long-term exposure to As can disrupt the normal homeostasis of essential metals, which may adversely affect biological functions within tissues.

INTRODUCTION

Copper smelter workers are exposed to lead (Pb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), manganese (Mn), and nickel (Ni). In addition to copper (Cu), As is refined and marketed as one of the smelter's main income streams. Biological monitoring of copper smelter workers is limited to urine arsenic and blood lead, contaminants at significantly high concentrations throughout the smelting process, and regulated by the Occupational Health and Safety Act No. 85 of 1993. However, inductively coupled plasma mass spectrometry (ICP-MS) now allows the extension of the metal profile to include essential metals Cu, Zn, and Mn, which are not associated with copper smelter activities but are critical to general health.¹

The term 'heavy metals' generally refers to As, Cd, Pb, and mercury (Hg). Arsenic has chemical and physical properties that are intermediate between a metal and non-metal and is often referred to as a metalloid or semi-metal. Exposure to As can occur from smoking cigarettes, drinking and eating contaminated foods, or from As in the workplace or the environment.² Symptoms of As poisoning often develop after long-term, cumulative exposures and include central nervous system disorders, intellectual disability in children, dementia in adults, kidney and liver diseases, insomnia, emotional instability, depression, and vision disturbances.³ The International Agency for Research on Cancer (IARC) has classified As and As compounds as carcinogenic to humans, stating that As in drinking water is carcinogenic to humans, and that long-term ingestion of As-contaminated water and food is associated with cardiovascular disease and diabetes.⁴

Although high concentrations of heavy metals are detrimental to living organisms,^{5,6} some, including Cu and Mn, are essential for maintaining various biochemical and physiological functions and are homeostatically regulated.⁷ The regulation of essential metals occurs at the molecular level, whereby they react with high molecular weight thiol-proteins that mediate the import of critical metals from the extracellular environment to specific intracellular compartments.⁸ Some thiol-proteins are highly selective for a given essential metal, while others are less specific and can interact with multiple metals, including nonessential and toxic metals.⁵ Interactions between metals can be synergistic, which means that one nonessential element, such as As, may promote accumulation or affect the function of another essential or nonessential metal or antagonistic, in which case absorption or utilisation of critical biological functions supported by essential metals is inhibited.⁹

One of the most common essential metal imbalances is caused by elevated Cu and Zn. Zinc is a cofactor for superoxide dismutase (SOD), and any deficiency is associated with an increase in the levels of lipid peroxidation of the mitochondrial and microsomal membranes, and the osmotic fragility of the erythrocyte membrane.¹⁰ The Zn-binding metallothionein proteins are regulated by dietary Zn content and play a significant role in Zn uptake, regulating metal detoxification, maintaining the body's homeostasis within a physiological range, and protecting the body from metal overload damage.¹¹ Copper is vital to human metabolism and critical to the functioning of enzymes. As an antioxidant, it neutralises free radicals; as a prooxidant, it can promote free radical damage.¹²

Arsenic also produces reactive oxygen species (ROS) that can lead to DNA damage.⁴ Chronic exposure to low concentrations of heavy metals can affect the metabolism of the metals and their subsequent excretion from the body.¹³

Metallothionein, a Zn- and Cu-binding protein, mediates the Zn-Cu homeostatic relationship within enterocytes. Zinc and Cu are bound to metallothionein, stored inside enterocytes, or exist unbound. When this system fails to function correctly, an imbalance in the Cu:Zn ratio causes adverse health effects.^{14,15} Thus, when large amounts of dietary Zn are ingested or when workers have been exposed to large amounts of Zn, metallothionein expression increases, and more Zn is bound to metallothionein. More Zn-metallothionein complexes are excreted, disrupting the Cu:Zn equilibrium.^{16,17} Any disruptions in the homeostasis of the Cu:Zn ratio by As and alkylating agents can result in tissue damage and several adverse physiological responses.¹⁸

The toxic effects of metals depend on the forms, routes, concentration, and duration of exposure. The interruptions of intracellular homeostasis associated with the toxicity of As can lead to the formation of lipid peroxides, and induced oxidative stress results in the alteration of antioxidant enzymes such as SOD, catalase (CAT), glutathione peroxidase (GPx), and non-enzymatic factors such as sulfhydryl-containing peptides and proteins.¹⁹ The detoxifying state is regulated by a healthy balance of antioxidants (glutathione, α -tocopherol, ascorbate, etc.) and associated with the quenching of free radicals by suspending the activity of enzymes, whereby humans should be able to resist any onslaught by toxic metal invaders.^{16,20}

Essential metals move across the cell membrane by forming metal phosphate complexes and circulating As ions, which have an affinity for these phosphate sites and can replace the vital metals, thereby inducing cell damage. For example, the transport of As through the cell membrane is highly dependent on the oxidation state of As. The structural similarity of As(V) to phosphate enables it to exert its toxicity by replacing phosphate in normal cell reactions and interrupting the normal homeostasis of essential metals (Cu, Mn, Zn) in the cell.²¹ Trivalent As(III) can affect a variety of transporters, such as glucose transporters (GLUT2, GLUT5), organic anion transporting polypeptides (OATP-B), and aquaporins (AQP3 and AQP10).^{21,22} Thus, As toxicity and cell uptake depend on the oxidation state of As and, therefore, its ability to accumulate within the cellular system.¹⁷

Published research concerning interactions between essential elements and heavy metals is limited.^{21,23} In particular, research on the effect of chronic As exposure to essential metals in the body is sparse, and its impact on the homeostasis of critical metals in occupational settings is generally not monitored.²⁴

We studied a group of copper smelter workers and residents from the local community to determine whether long-term exposure to As affected the concentrations of the essential metals Cu, Mn, and Zn.

METHODS

The results of the urine analysis of 1 671 men and women working in the copper smelter, which were collected over three weeks in 2019 at the end of shifts, were obtained from the company. The company must routinely test individuals exposed to hazardous substances, as stated in the Occupational Health and Safety Act No. 85 of 1993.²⁵ The samples were collected from employees working in predetermined low-, medium-, and high-risk As exposure areas. Urine samples were also collected from 187 individuals living near the smelter.

All samples were collected in metal-free 5 ml polyvinyl chloride (PVC) tubes and tested for creatinine and metals As, Cu, Mn, and Zn. All the urine metal analyses, standards, and control analyses were performed on an Agilent 7900 ICP-MS device equipped with an Integrated Sample Introduction System (ISIS), which has powerful potential for multi-element trace analysis.^{26,27} The main advantages of ICP-MS compared to other analytical methods are increased sensitivity, wide dynamic range, high selectivity, rapid multi-element analysis, low background, and the ability to measure specific metal isotopes.²⁸

The University of Cape Town's Human Research Ethics Committee granted ethical clearance for the study (Reference no.277/2016).

Data analysis

The data were analysed using Microsoft Excel. Because the data were not normally distributed, correlations between non-essential (As) and essential (Cu, Mn, and Zn) elements were determined using Spearman's rank correlation analysis. The trace element concentrations are expressed as median, minimum, and maximum concentrations and referenced to the normal background levels and biological exposure indexes (BEIs),²⁵ where applicable. These BEIs are guidelines for regulating workplace hazardous chemicals levels. The Chi-square test was used to check for associations between the As and the essential metal concentrations.

RESULTS

The smelter workers comprised 1 428 men (85.5%) and 243 women (14.5%), while there were 38 men (20.3%) and 149 women (79.7%) in the group of community participants (Table 1). The smelter workers were aged 21–60 years (mean 38 ± 13.5 years), and the community participants were 18–78 years (mean 51 ± 18.7 years).

Metal concentrations in urine

Table 2 shows the concentrations of the metals measured in the urine of the two groups. The median As urine concentration in the smelter workers was higher than that in the residents (99.3 and 28.9 $\mu\text{g/g}$, respectively), while the concentrations of Mn and Cu were lower.

The numbers and proportions of smelter workers and residents with different concentrations of metals in urine are shown in Table 3.

Only a few of the smelter workers and residents had normal As concentrations (2.0% and 5.3%, respectively). Almost 60% of the workers and 19% of the residents had levels $\geq$ the BEI. Some workers ($n = 124$, 7.4%) and residents ($n = 2$, 0.5%) had concentrations higher than 250 $\mu\text{g/g}$ – nearly five times higher than the BEI.

Table 1. Demographic characteristics of the study participants

	Smelter workers (n = 1 671)		Residents (n = 187)	
	n	%	n	%
Sex				
Male	1 428	85.5	38	20.3
Female	243	14.5	149	79.7
Age (years)				
< 21	0	-	10	5.3
21–30	127	7.6	5	2.7
31–40	625	37.4	11	5.9
41–50	469	28.1	15	8.0
51–60	374	22.4	37	19.8
> 60	76	4.5	109	58.3

Only a few of the smelter workers and residents ($n = 13$, 0.8% and $n = 1$, 0.5%, respectively) had urine Cu levels $> 80 \mu\text{g/g}$. There was an unexpectedly high Cu deficiency among the smelter workers. The proportion of residents with normal urine Cu levels was twice that of smelter workers ($n = 162$, 86.6% and $n = 774$, 46.3%, respectively).

A small proportion of the smelter workers ($n = 222$, 13.2%) and residents ($n = 56$, 29.9%) had normal urine Mn levels ($2\text{--}10 \mu\text{g/g}$). Most of the smelter workers ($n = 1\,407$, 84.1%) and residents ($n = 120$, 64.2%) had Mn levels below the normal threshold of $2 \mu\text{g/g}$. Only a few of the smelter workers and residents ($n = 42$, 2.5% and $n = 11$, 5.8%, respectively) had urine Mn levels above $10 \mu\text{g/g}$.

Most smelter workers ($n = 1\,444$, 86.4%) and residents ($n = 142$, 75.9%) had normal urine Zn concentrations ($89\text{--}900 \mu\text{g/g}$). The proportion of residents with raised urine Zn levels was almost double that of the smelter workers ($n = 45$, 24.1% and $n = 227$, 13.6%, respectively).

The correlations between the different metals in the copper smelter workers and residents are shown in Table 4. The correlations between Zn and Cu were significant in both groups. The As-Zn and As-Cu correlations were significant ($p = 0.0001$) and similar in the smelter workers and residents. There was no correlation between As and Mn in either of the two groups.

DISCUSSION

In this study, we investigated the impact of metalloid As on the homeostatic concentrations of Cu, Mn, and Zn in the urine of copper smelter workers and residents of the surrounding community.

Arsenic

The high As concentrations measured in the urine of the residents were unexpected and possibly due to environmental conditions caused by living close to the smelter. Almost 20% of smelter workers had urine As concentrations $> 150 \mu\text{g/g}$, considered highly exposed. Individuals with urine As levels exceeding $55.0 \mu\text{g/g}$ on a long-term basis are at risk of developing As-related occupational diseases. To reduce these high As concentrations to acceptable levels, it is essential to follow the general hierarchy of controls to mitigate exposure, viz. elimination, substitution, engineering controls, administrative controls, and the use of personal protective equipment. It is also important to investigate other factors that might lead to high As concentrations, e.g. medical conditions, environmental exposures, diet, and personal hygiene habits.

Copper

The urine Cu levels were surprisingly low for individuals working at a copper smelter and some residents living close to the smelter. Proportionally, more smelter workers than residents had Cu levels

Table 2. Concentrations of arsenic, zinc, copper, and manganese in the urine of smelter workers ($n = 1\,671$) and residents ($n = 187$)

	Arsenic		Copper		Manganese		Zinc	
	Median	Range	Median	Range	Median	Range	Median	Range
Smelter workers	99.3	2.5–927.6	9.7	3.1–102.2	0.6	0.1–91.6	512.2	56.1–2497.1
Residents	28.9	4.2–619.2	14.9	5.4–98.5	1.1	0.2–78.1	554.0	108.1–2537.0
Normal population reference [†]	< 24.0		Women: 7.0–72.0 Men: 9.0–43.0		2.0–10.0		89–900.0	
BEI [†]	55.0		45.0		NA*		900.0–1800.0	

* Urine is a poor medium in which to measure biological exposure to Mn.¹⁹

[†] Source: Occupational Health and Safety Act No. 85 of 1993: Regulations for Hazardous Chemical Agents; 2021²⁵

BEI: biological exposure index²⁵

Table 3. Comparison of metal concentrations in the urine of smelter workers and residents

Metal	Concentration ($\mu\text{g/g}$ creatinine)	Interpretation	Smelter workers $n = 1\,671$		Residents $n = 187$	
			n	%	n	%
Arsenic	< 10	normal	34	2.0	10	5.3
	10–55	exposed	639	38.2	140	74.9
	56–150	$\geq$ BEI	669	40.0	32	17.1
	151–250	$\geq$ BEI	205	12.3	3	1.6
	> 250	$\geq$ BEI	124	7.4	2	1.1
Copper	< 10	deficient	879	52.6	12	6.4
	10–45	normal	774	46.3	163	87.2
	46–80	exposed	5	0.3	11	5.9
	> 80	$\geq$ BEI	13	0.8	1	0.5
Manganese	< 2	deficient	1 407	84.2	120	64.2
	2–10	normal	222	13.3	56	29.9
	> 10	exposed	42	2.5	11	5.9
Zinc	89–900	normal	1 444	86.4	142	75.9
	901–1800	above normal	216	12.9	42	22.5
	> 1800	exposed	11	0.7	3	1.6

below the normal range. Why the urine Cu levels in both groups were so low is not fully understood, as exposure to Cu is highly likely in both the copper smelter and the immediate environment. Low urine Cu levels may be due to a general diet deficiency. Reactive oxygen species, one of the significant byproducts of As, can react with Cu, resulting in a lower urine Cu concentration. Although excessive Zn intake can suppress Cu adsorption through metallothionein (MT), there was no indication of excess exposure to Zn in the study participants to explain the low concentrations of Cu in urine.

Zinc

The urine Zn concentrations in the smelter workers and residents were within the normal range, indicating that Zn reserves are unaffected by As exposure.

Manganese

A higher percentage (84.1%) of smelter workers had urine Mn levels below the normal range than the resident group (64.2%). Although there was an Mn deficiency in the urine of both the residents and the smelter workers, the significantly lower Mn concentrations in the smelter workers suggest that exposure to As suppresses Mn. Whether As exposure contributed to the suppression of Mn, or whether daily Mn supplementation is much lower than in a general population, must still be investigated. Manganese deficiency is rare, and related symptoms are not easily identifiable. However, high amounts of dietary iron may decrease Mn absorption as these metals compete for the same proteins that help with their absorption in the intestine.

The strong correlation between As and Zn, and between Zn and Cu, may be due to the interaction of As and Zn metabolism to share the binding sites expressed by the MT protein and their ability to induce MT synthesis, thereby preventing toxicity from As by the formation of As-MT complexes. Essential metal homeostasis is usually maintained within a narrow range and is critical in many biological enzyme actions. Arsenic plays no significant role in homeostasis but can disrupt or mimic the normal function of essential metals, affecting any living organism's health. Our observation supports the hypotheses that essential metals play a significant role in homeostasis and that if the balance is disturbed, it can lead to disease, including occupational diseases, secondary to the effect that As alone has on an individual's health. It might be worthwhile to determine if the homeostasis level of essential metals has been altered, especially in those workers with consistently high As levels (> 55 µg/g) and those exposed to multiple non-essential metals. The high As in the resident reference group requires more detailed speciation testing to establish the source of the As.

There were several limitations and strengths associated with the study. No information regarding the smelter workers' and residents' historical exposure, or general health, was collected. The differences in the metals measured also do not take sex, metabolic activity,

environmental exposure, smoking, or dietary habits of the subjects into account. Further investigations that include all these variables may determine whether chronic exposure to As is detrimental to essential metals homeostasis, potentially affecting an individual's general health. The strength of this investigation lies in the ICP-MS technique's ability to generate additional information about an individual's general essential and heavy metal status, which can assist occupational health practitioners in making more informed holistic diagnoses regarding metal toxicity.

CONCLUSION

In our study, we were interested in contextualising knowledge regarding As exposure and its direct impact on the concentrations of the essential metals Cu, Mn, and Zn in the body. Our findings provide the occupational health practitioner with information concerning the effects of As exposure on the normal homeostasis of essential metals. This study provides evidence that As toxicity can act in two different ways: 1) As on its own has a toxic effect on the body and, 2) As affects the homeostasis of the essential metals Cu, Mn, and Zn, and a deficiency in these essential metals may increase susceptibility to the adverse health effects of exposure to heavy metals.

Understanding the complex interrelationships of essential metal metabolism and the impact that As has on homeostasis is fundamentally important. It should be noted that the correlations between As and Cu, Mn, and Zn are not evidence of causation. However, the correlations described form the basis for further exploration. The next frontier in metal toxicity research is identifying the metal species involved, their interactions, substitutions, oxidation states, and concentrations responsible for toxicity or the disruption of the homeostasis of essential metals.

KEY MESSAGES

1. Urine concentrations of As and essential metals Cu, Mn, and Zn differed in workers compared to the residents.
2. Arsenic exposure can affect the concentrations of the essential metals Cu, Mn, and Zn.
3. It is important to understand the complex interrelationships of essential metal metabolism and the affect of As on homeostasis.

AUTHOR CONTRIBUTIONS

Conception and design of the study: VRS

Data acquisition: VRS

Data analysis: VRS, MWC, ERR

Interpretation of the data: VRS, MWC

Drafting of the paper: VRS, MWC

Critical revision of the paper: VRS, MWC, ERR

DATA AVAILABILITY STATEMENT

The data supporting this study's findings are available from the corresponding author upon reasonable request.

DECLARATION

The authors declare that this is their work; all the sources used in this paper have been duly acknowledged, and there are no conflicts of interest.

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Table 4. Correlations between essential and nonessential metals in the urine of arsenic-exposed copper smelter workers and residents

Metals	Smelter workers (n = 1 671)		Residents (n = 187)	
	R ²	p value	R ²	p value
Zn-Cu	0.139	0.0001	0.258	0.0001
As-Cu	0.051	0.0338	0.033	0.0121
As-Zn	0.086	0.0004	0.085	0.0001
As-Mn	0.020	0.4270	0.028	0.7021

As: arsenic, Cu: copper, Mn: manganese; Zn: zinc

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Acute effects of front face infant wearing on the pulmonary function of carers

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ABSTRACT

Background: Infant wearing is a daily practice in many communities as part of the caring of children. The adverse musculoskeletal effects of this on carers have been documented, but the impact on pulmonary function has not.

Objectives: To describe the acute effects of front face infant wearing on the pulmonary function of carers.

Methods: One hundred women, aged 18-40 years, voluntarily participated in a cross-over study. During the first round of spirometry testing, the first group ($n = 50$) stood without carrying their infant, while the second group ($n = 50$) carried infants front facing. Participants' body mass, stature, and lung function (forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), FEV_1/FVC , and peak expiratory flow rate (PEFR)) were measured. During the second round of spirometry testing, the two groups crossed over. Differences in lung function parameters were assessed using paired t-tests.

Results: The mean FVC of participants was lower when they carried infants than when they did not (2.54 ± 0.63 and 2.49 ± 0.59 , respectively, $p = 0.052$). There were significant differences in FEV_1 (1.98 ± 0.42 vs 1.93 ± 0.42 , $p = 0.005$), FEV_1/FVC (80.47 ± 15.64 vs 78.19 ± 14.48 , $p = 0.040$), and PEFR (2.93 ± 1.25 vs 2.76 ± 0.99 , $p = 0.013$) with and without the load of the infant.

Conclusion: Front face infant wearing may temporarily improve lung function due to posture, activation of core muscles, and increased breathing effort.

INTRODUCTION

Carrying infants (infant wearing) is an age-old practice.¹ Singh (2009) described three fundamental techniques of infant wearing, viz. on the chest, back, or hip (side).² Mothers and carers in rural Asian, African, and American communities predominantly carry their infants or toddlers on their backs (posterior) and chests (anterior).¹ Van Eeden et al. (2023) reported that the traditional method of posterior infant wearing resulted in the adoption of a kypholordotic posture, which increased the risk of musculoskeletal discomfort and injuries.¹ Anterior (front) infant wearing has been reported to impact the carer's posture and muscle activity, significantly.³ Andersen et al. (2007) reported that front infant wearing at elbow height produced excessive hyperextension of the lumbar vertebrae related to increased paraspinal muscle activity; front infant wearing at shoulder height increased greater paraspinal muscle activity.³ Commercial manufacturers have developed various devices to aid infant wearing practices,⁴ which are increasingly used by carers in both urban and rural communities.⁴⁻⁶ As the carers in rural areas often have to walk long distances to the nearest town, carriers are sometimes also utilised for toddlers.

Front face infant wearing (FFIW) is the practice of carrying a baby or a toddler on the carer's anterior torso, ensuring continuous contact between the baby's and the carer's chests,³ freeing the carer's hands for other tasks. Many mothers perceive infant wearing as an opportunity to establish a maternal bond of reassurance and emotional and physical security. Infant wearing has also been shown to reduce maternal stress, infant separation anxiety, and postpartum depression.⁵ However, carrying an infant or toddler alters the carer's postural kinematics, leading to musculoskeletal pain.⁷⁻⁹ Changes in human kinematics also affect physiological systems such as the respiratory system.

The objective of this study was to describe the acute effects of FFIW on the pulmonary function of carers.

METHODS

In this cross-over study, participants were women aged 18 to 40 years, living in the bucolic iLembe district in KwaZulu-Natal province, South Africa. Residents were approached at the local clinic and church to explain the nature of the study. Adverts for volunteers who were fluent in English were placed on street corners and at the local church.

The 100 volunteers reported to the testing station at the church. Each participant chose a yellow or orange sticker, which allocated her into one of two groups (50 in each group). The first group underwent spirometry lung function testing without carrying their infants, while the second group underwent testing while FFIW. The two groups then crossed over and the testing was repeated.

Participants were guided by trained biokineticists to follow the protocol developed by Doung et al. (2013), whereby each stood upright during the testing, wearing a nose clip.¹⁰ Spirometry measurements comprised full lung capacity (FVC), forced expiratory volume in one second (FEV_1), FEV_1/FVC , and peak expiratory flow rate (PEFR). Lung function testing was performed, using a portable ndd EasyOne spirometer (MicroGP, Micro Medical, Chatham IL, USA). If a participant did not adhere to the instructions, requested to rest, or failed to complete the test, the test was repeated after a 15-minute break. Only spirometry tests graded A–C (i.e. reliable measurements) were included in the analysis.

Each participant's body mass was measured to the nearest 0.5 kg, using a portable digital scale (Dismed, USA). Height was measured to the nearest 0.1 cm, using a standard portable stadiometer (Holtain Limited, Crymych, Dyfed, UK). The infants'/toddlers' masses were calculated by weighing each carer while holding the child without the carrier and while unloaded.

Ethical approval for the study was obtained from the Tshwane University of Technology (REC04/9.2.1). Permission from the iLembe Royal Court and local community leaders was obtained before data collection commenced. An iLembe royal staff member acted as an

intermediator during the data collection process. To thank the volunteers for their participation, each received a can of baby formula and a branded towel.

Data analyses

Differences in mean lung function parameters between the loaded and the unloaded states were assessed using paired t-tests. Statistical significance was set at 0.05.

RESULTS

The mean body mass, height, and body mass index of the study participants are shown in Table 1. The mean infant body mass was 12.92 ± 4.64 kg, which equated to a mean of around 19% of the carer's mean body mass.

The selected area in iLembe district is secluded and mountainous, and located 7–10 km from the nearest farming settlement and 30 km from the nearest town. Carers often carry toddlers up to seven or eight years of age, using carriers, on the long walks.

The lung function tests of the participants in their unloaded and FFIW loaded states were significantly different (Table 2). Participants had a smaller FVC but larger FEV_1 , FEV_1/FVC , and PEFR during the loaded than the unloaded state.

DISCUSSION

This is the first study to assess the impact of FFIW on pulmonary function. We found that FFIW marginally reduced the FVC of carers but assisted them to exhale large volumes of inhaled air in the first second of the forced expiration, suggesting higher PEFR.

Pulmonary function variations during unloaded and FFIW states

Front face infant wearing resulted in slightly reduced FVC of the carer compared to their unloaded state. We found that FFIW increased FEV_1 , suggesting that the loaded state improved the forced exhalation rate. The difference in PEFR in our study participants suggests that FFIW temporarily opens the airways.

Based on the increased FEV_1 , FEV_1/FVC , and PEFR when carrying an infant, FFIW does not appear to obstruct pulmonary exhalation. The slightly reduced FVC while FFIW could be due to other restrictive factors influencing inhalation ability, such as posture, mass, or the straps of the infant carrier. We postulate that the mass of the infant and the straps of the infant carrier may prevent the rib cage from expanding maximally to fully inflate the lungs with air during inhalation, resulting in less air available for exhalation. Empirical studies measuring the impact of front faced schoolbag carriage have also indicated that the external mass of the bag restricts the maximum inhalation ability, thereby reducing FVC.^{11–13}

Limitations

The study was set in South Africa and regular power outages were experienced. This led to interruptions during testing as the venue's electricity supply had to be moved to a generator sporadically throughout the day. Although anthropometric data (height and weight) were collected, these variables were not included in the analysis of the effects of FFIW on lung function. It is possible that participants' spirometry testing techniques improved after the first testing, influencing the results of the second round of testing. A further limitation is that the carriers were placed at different heights (i.e. level to the sternum, level to the xiphoid process, or level with the naval), which may have influenced the spirometry results. Due to ethical constraints, we did not record the infants' heights, ages, and other dimensions. These factors can affect the placement of the carrier, as the carer needs an unobstructed view to continue with her tasks. Larger/taller children are typically placed lower on the torso for this reason.

Recommendations

A larger study should be conducted to validate our findings. Prospective longitudinal studies should be conducted to establish the long-term effect of FFIW on carers' pulmonary mechanics and function. The effect of the carer's body mass index should be investigated to assess the effect on lung function during FFIW.

The impacts of the infant's and carer's body masses, and the relative masses on pulmonary dynamics and function should also be investigated. This will provide data for recommendations of upper weight and height limits that are safe for carers to carry their infants and toddlers. Healthcare practitioners can determine the optimal infant body mass, relative to the carer's body mass, that can be front faced carried without adversely affecting the pulmonary dynamics and functions of the carer.

Similar studies in which different types of carriers are used would enable carrier manufacturers to determine the restrictive nature of their products, which would allow them to improve their products to allow for more natural postures and a greater range of movement. Many women use carriers for their own children or when caring for their employers' children, and need to avoid any associated adverse effects.

CONCLUSION

The mean lung function parameters, FEV_1 , FEV_1/FVC , and PEFR, were significantly higher in the loaded than the unloaded phases, indicating that FFIW may temporarily improve lung function, possibly as a result of posture, activation of core muscles, and increased breathing effort.

Table 1. Demographic characteristics of study participants (N = 100)

Characteristic	Mean	SD	Range
Age (years)	28.3	7.07	18–40
Carrier body mass (kg)	73.0	21.12	44.2–135.2
Height (m)	1.57	0.06	1.40–1.76
Body mass index of carrier (kg/m ²)	29.6	8.06	18.9–53.7
Fat mass (%)	31.4	10.70	14.9–42.2
Infant body mass (kg)	12.9	4.64	4.4–34.7
Infant mass relative to carrier's mass (%)	19.0	8.2	4.3–45.4

Table 2. Lung function parameters during unloaded and front face infant wearing loaded postures (N = 100)

Lung function variable	Unloaded		Loaded		p value
	Mean	SD	Mean	SD	
FVC	2.54	0.63	2.49	0.59	0.052
FEV_1	1.93	0.42	1.98	0.42	0.005
FEV_1/FVC	78.19	14.48	80.47	15.64	0.040
PEFR	2.76	0.99	2.93	1.25	0.013

FVC: forced vital capacity; FEV_1 : forced expiratory volume in one second; PEFR: peak expiratory flow rate

KEY MESSAGES

1. Front face infant wearing may disrupt pulmonary mechanics.
2. The weight of the infant on the carer's chest may restrict the ribcage from expanding maximally, thereby reducing the amount of air inhaled and affecting the amount of air exhaled (FVC).
3. The weight of the infant on the carer's chest may compress the rib cage during exhalation, increasing the volume of air exhaled in one second (FEV₁).
4. Front face infant wearing appears to temporarily improve lung function.

DECLARATION

The authors declare that this is their own work; all the sources used in this paper have been duly acknowledged and there are no conflicts of interest.

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AUTHOR CONTRIBUTIONS

Conception and design of the study: BKG, TJE

Data acquisition: BKG, TJE

Data analysis: TJE, BKG

Interpretation of the data: TJE, BKG

Drafting of the paper: BKG, TJE, YP, MBN

Critical revision of the paper: BKG, TJE, YP, MBN

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Cannabis at home, sobriety at work: legal and policy implications

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ABSTRACT

The recent Labour Court of Appeal ruling in the Barloworld case highlights critical issues surrounding cannabis legalisation, workplace safety, and employee rights in South Africa. This decision underscores the need for a refined approach to drug and alcohol testing in the workplace, balancing safety with constitutional rights to privacy, dignity, and equality. The judgment criticises indiscriminate blanket testing, stressing the necessity for employers to tailor testing to specific job roles and associated risks. This paper explores the legal and policy implications of zero-tolerance strategies in workplaces, advocating for scientifically established thresholds for substance testing. It discusses the obligations of both employers and employees under the Occupational Health and Safety Act No. 85 of 1993 and employment contracts, urging a more sophisticated approach to managing off-duty substance use and on-duty impairment. The paper calls for workplace policies that respect employee rights while ensuring safety, reflecting the complex legal landscape, following South Africa's Cannabis for Private Purposes Act No. 7 of 2024.

INTRODUCTION

A recent decision by the Labour Court of Appeal in *Enever v. Barloworld Equipment South Africa* (Barloworld case) highlights the intense assertion of fundamental human rights concerning the legal consumption of cannabis and its testing in the workplace.¹ Employees are often dissatisfied with employer-imposed substance use and testing policies and claim that their rights to equality, privacy, dignity, freedom and security of the person, freedom of religion, belief and opinion, and fair labour practices are diminished.² The recent enactment of the Cannabis for Private Purposes Act No. 7 of 2024 (Cannabis Act) has also officially legalised the private use of cannabis, aligning its regulatory status closely with that of alcohol, albeit with some distinct regulatory nuances.³

The Barloworld judgment emphasises that results from drug and alcohol tests are insufficient for termination in terms of the Occupational Health and Safety Act No. 85 of 1993 (OHSA),⁴ insisting on undeniable evidence of on-duty intoxication or impairment. This legal decision complicates how employers currently manage and regulate substance use, affecting risk factors such as employee safety, property, financial stability, public image, and vicarious liability.

It is essential to recognise that testing for drugs and alcohol in workplaces is a biomedical intervention intersecting with human rights governed by the Constitution of South Africa.⁵ Moreover, it is common for medical ethics and science to influence legal standards where explicit legislative directives are absent. Unlike jurisdictions such as the United States of America⁶ and the European Union,⁷ South Africa lacks formal legislative guidelines for workplace drug and alcohol testing. Employers are well advised to refine their 'zero-tolerance' strategies beyond simple 'umbrella' testing and disciplining employees for substance use that does not negatively affect their job performance, or impact the health and safety of an organisation.

In all crucial decisions with decisive outcomes, it is essential to determine the correct question to be answered and to conduct the relevant inquiry. In the realm of drug testing, the initial question must revolve around the reason for testing a specific employee for a particular substance in a particular biomatrix. Different testing

strategies may be required if the reason for testing is to prevent on-site impairment or intoxication in terms of the OHSA and to minimise other risk factors, as opposed to investigating a person's drug use habits during a pre-employment consultation.

The primary goal of most workplace drug and alcohol testing policies is often to ensure that an employee is not under the influence of any substances at all. In essence, the employer must justify why a person is tested for a specific substance, reflecting the notion of "treating equals equally and unequals unequally". This discourse will attempt to address this issue with considerations of medical science, law, and ethics in mind.

THE BARLOWORLD V. ENEVER CASE

Barloworld Equipment terminated Bernadette Enever's employment after she tested positive for the metabolite of delta-9-tetrahydrocannabinol (Δ^9 -THC) in urine. She acknowledged that she is a regular cannabis user; however, she uses cannabis privately outside of work hours. The dismissal was based on the company's stringent 'zero-tolerance' policy on drug use. Enever challenged her dismissal, contending that her cannabis consumption occurred at home and did not affect her workplace performance.

The pivotal legal issue revolved around whether the dismissal constituted unfair discrimination and was automatically unfair, focusing on Enever's legal off-duty cannabis use, potentially leading to on-duty impairment. The Court adopted a balanced approach in its legal analysis, prioritising both workplace safety and individual rights, explicitly highlighting the right to privacy. It was concluded that Barloworld's zero-tolerance policy infringed upon Enever's constitutional rights, given that her cannabis use was private, did not hinder her job performance, and presented no harm to others and the organisation, according to the evidence that was offered.

Barloworld cited the OHSA to underscore the necessity of maintaining a safe working environment. However, the Judge noted that the OHSA should not extend to regulating private behaviour without tangible evidence of impairment or safety risks at the workplace. The Court found Barloworld's policy excessively intrusive, as it regulated employees' private lives without demonstrating any work-related impairment or hazard.

The Court ultimately ruled the dismissal as automatically unfair, pointing out Barloworld's failure to prove that Enever's private cannabis consumption detrimentally impacted her work performance or presented a safety threat. The zero-tolerance policy was deemed a breach of her constitutional right to privacy. Consequently, Enever was awarded compensation equivalent to 24 months' salary for the unfair dismissal.

COMMON LAW AND STATUTORY OBLIGATIONS OF THE EMPLOYEE AND THE EMPLOYER

At common law, it is crucial to note that the law of contract, particularly the employment contract between Enever and Barloworld, was not invoked. Instead, the case was examined under the OHSA, which targets intoxication and under the influence in safety-sensitive settings. The OHSA's primary concern is safety rather than safeguarding an organisation's additional interests such as property, vicarious liability, financial stability, and reputation.

The employment contract delineates terms and conditions but is bounded by labour laws that constrain the freedom to define these terms independently. For the contract to be valid and enforceable, it must adhere to legal standards, facilitating the employee's ability to fulfil his/her contractual duties with a clear mutual understanding of the contract's specifics.

Employees are obligated to perform their duties as outlined in their contract. Non-performance constitutes a breach, allowing the employer to act based on the severity of the violation. Employees are expected to execute their duties diligently and efficiently without being impaired or under the influence of substances, which would be a contractual breach, justifying disciplinary measures for failing to meet performance expectations, such as arriving fit for work. Employers also have a common law duty to ensure workplace safety and may attempt to minimise other risks to an organisation.

In terms of statutory law, Regulation 2A of the General Safety Regulations under the OHSA is pivotal for preventing off-duty drug and alcohol use that results in on-duty intoxication. This regulation mandates workplace substance policies as follows: *"Intoxication: (1) An employer shall not permit any person who is or appears to be under the influence of intoxicating liquor or drugs to enter or remain at a workplace; (2) No person at a workplace shall be under the influence of, or have in their possession, or consume, or offer any other person intoxicating liquor or drugs"*.

Dual approach – observational detection or exceeding a predetermined cutoff concentration

The approach to managing workplace intoxication can be dual, similar to that used in the National Road Traffic Act No. 93 of 1996 (NRTA),⁸ although this is typically only applicable to workplaces where driving on public roads is part of the job. Under this approach, an organisation can discipline an employee either for being under the influence or for exceeding the defined threshold concentrations of drugs or alcohol. The latter, often referred to as a *"per se"* approach, is based strictly on the rules, i.e. cutoff concentrations set out in the employment contract, and can be used independently to justify disciplinary action.

UNDERSTANDING INTOXICATION AND UNDER THE INFLUENCE IN THE WORKPLACE: LEGAL AND PRACTICAL PERSPECTIVES

The legal concepts of *"intoxication"* and *"under the influence"* are fundamental in both common law and statutory frameworks, such as the OHSA. These terms, however, entail a complex classification

process due to the significant variability in how *"intoxication"* and *"under the influence"* can manifest within and between individuals. This variability was described in the Barloworld case as a *"matter of degree"*, emphasising the challenge of determining the exact point at which an employee becomes a risk to themselves, others, or their ability to perform their job duties.^{9,10} The complexity of proving *"under the influence"* allegations is encapsulated in the analogy of the *"difference between a farm worker and a pilot."*¹¹ The degree of intoxication necessary to impair a pilot, who must operate complex machinery, differs significantly from that of a farm worker. Legally and practically, an employee is only considered *"under the influence"* if he/she is unable to perform his/her specific job functions to the standard expected of a sober individual, especially in roles involving critical safety responsibilities. *"Intoxication"* is not merely a binary state, but a spectrum where the specific demands of the job determine the implications of an employee's impairment.

It is important to note that, when intoxication becomes visible, such as through impaired motor functions or altered behaviour, it may even be that the individual is already well beyond the safe threshold for workplace activities. In the opinion of the author, this is problematic when using only observational detection, which has many times also been regarded as 'biased'. Yet, the mere presence of substances like alcohol or Δ^9 -THC in one's system, as revealed through blood, breath, urine, or oral fluid tests on the other hand, does not necessarily directly correlate with functional impairment due to the diverse ways that people metabolise and respond to drugs and alcohol.

The role of observation in determining *"under the influence"*

In practice, determining whether an employee is under the influence involves a combination of professional or layperson observations and, if available, corroborative blood, urine, or oral fluid test results. While a breathalyser can quantify the amount of alcohol in the breath, for instance, it alone cannot substantiate a claim of impairment; however, it can serve as supportive evidence of impairment.

Observations should focus on multiple symptoms and behaviours, such as steadiness of gait, slurred speech, and general demeanour. These observations should ideally be systematically recorded, using tools like an 'observation sheet', in the presence of an independent witness.

Factors such as medication or specific medical conditions can also mimic the appearance of intoxication. Therefore, identifying the exact substance causing the observed effects, with a chemical analytical test for instance, is essential for a fair and accurate assessment of an individual's condition.

"Per se" approach

In line with the philosophy of practicability and the elimination of subjectivity that may arise in the case of observational testing, like that outlined in the NRTA for public road drivers, employers might select specific markers of intoxication – which may serve as the best proxy – such as alcohol or Δ^9 -THC concentrations in the blood, oral fluid, or urine. Exceeding the threshold would provide sufficient grounds for decisive action if the cutoff had been agreed upon in the employment contract. Employers can then establish rational scientific bases for specifying threshold concentrations for various substances, including drug parent compounds or metabolites in biological matrices such as blood, breath, oral fluid, or urine. The choice of substances and the thresholds must be rational, not unduly restrictive of worker freedom, and must balance safety with the risk of invading privacy.

Current understanding and research indicate that Δ^9 -THC concentrations in the blood are not reliable predictors to predict accurately cannabis-induced impairment, due to variation in response within and between individuals. One critical concept in understanding this variability is the “*counterclockwise hysteresis*” effect experienced for inhaled cannabis. This phenomenon describes the delay between peak Δ^9 -THC concentrations and their observable psychotropic effects, meaning that the maximum drug levels do not align with peak impairment times, i.e. the initial ‘high’ is followed by the peak blood concentration. This is in contrast to substances like alcohol, where peak blood levels typically correlate with the highest degree of impairment. Additionally, the distinctive pharmacokinetic profile of Δ^9 -THC, especially when consumed orally, further complicates this relationship, as ingested cannabinoids are metabolised more slowly by the liver, leading to less predictable effects on blood THC levels.^{6,12}

Despite these discrepancies, cutoff levels for Δ^9 -THC are employed internationally in blood, oral fluid, and urine tests.¹² In South Africa, a “*per se*” cutoff concentration for Δ^9 -THC in blood was recently established through the amendment of the NRTA, by the Cannabis Act. Even though the NRTA does not apply in the labour law environment, unless driving is part of a person’s job, it created a precedent by establishing a cutoff of 2 nanograms per millilitre (ng/mL) Δ^9 -THC in blood. In combination with alcohol, the “*per se*” level is 1 ng/mL Δ^9 -THC and 0.01 grams of alcohol per millilitre of blood.

EMPLOYMENT CONTRACT AND THRESHOLD (CUTOFF) CONCENTRATIONS FOR DRUGS AND ALCOHOL IN SOUTH AFRICAN WORKPLACES

The specification of threshold or cutoff concentrations for substances that can impair an employee’s ability to perform their duties is a critical element that should be clearly defined in the employment contract. These thresholds, outlined in the organisation’s drug and alcohol testing policy, set the limits that employees should not exceed. Ensuring compliance with these thresholds, as agreed upon in the employment contract, is essential, and employees must voluntarily consent to these terms as part of the hiring process. This consent process must align with constitutional rights to bodily integrity and adhere to medical ethics.

The employment contract should inform the individual about the testing programme before the formal employment relationship begins, detailing both the testing methods and the consequences of failing these tests. This ensures that the employee’s consent is informed and voluntary, respecting his/her autonomy.

Blanket testing of all employees in the organisation

A crucial point raised by the Judge in the Barloworld case was the need for organisations to justify drug or alcohol testing on everyone in a company; indiscriminate “*blanket testing*” is unacceptable. In the case of Enever, who held an administrative role, no evidence was led to justify the testing, thereby infringing on her constitutional right to privacy. In another case, the Court emphasised the importance of the inherent requirements of the job and the need for a tailored approach to testing, based on specific job roles and safety concerns.¹³

The author suggests that drug and alcohol testing programmes should be based not only on risk to safety, which is very important, but also on rationally assessed risks, considering factors such as financial interests, property, vicarious liability, and responsibility towards the public, company image, reputation, and other operational and inherent requirements of the job.

RETHINKING ‘ZERO-TOLERANCE’ POLICIES IN THE WORKPLACE

The concept of ‘zero-tolerance’ is frequently employed in workplace drug and alcohol policies within industries in South Africa. Given the seriousness of the issue, many sectors have adopted a stringent ‘zero-tolerance’ approach. This term, however, can be interpreted in many distinct ways.

Zero-tolerance as absence of mitigating factors

In some instances, ‘zero-tolerance’ implies that mitigating circumstances are deemed irrelevant. This interpretation suggests that, no matter the context or background of the infraction, the same strict policy is applied. For example, in one case, the zero-tolerance policy was enforced even though the employee cited personal issues such as family problems. It was clarified that ‘zero-tolerance’ does not always necessitate immediate dismissal for alcohol abuse; instead, disciplinary actions might vary, based on the specific situation. However, in another case, the Court ruled that factors like private use of marijuana or a previously clean disciplinary record were immaterial when a zero-tolerance policy was consistently enforced. This demonstrates that, in such contexts, ‘zero-tolerance’ can signify an uncompromising stance where no mitigating factors are considered relevant.¹⁴

Zero-tolerance as a strict liability with rebuttal on a balance of probability

‘Zero-tolerance’ may also refer to a case where an individual is held strictly liable, even on a no-fault basis, which does not require intent or negligence, once it has been established that he/she transgressed one of the rules stipulated in the drug and alcohol policy. However, the evidence may be rebutted on the balance of probabilities, such as where the individual unknowingly consumed cannabis (for example, in herbal medications or foodstuff laced with cannabis). Unknowingly consuming cannabis does not meet the element of intentional or negligent use; however, the individual will still be processed by immediately removing him/her from a safety-sensitive position, for instance.

Zero-tolerance as zero-concentration cutoffs

Alternatively, ‘zero-tolerance’ can refer to policies that require zero detectable levels of substances such as alcohol or drugs. This approach is evident in several workplace policies that mandate employees and contractors to maintain a zero (or, erroneously, even a negative reading sometimes) for any alcohol or drug-related products.¹⁵ For instance, one company’s policy stipulated that employees must be completely sober, meaning that any detectable level of alcohol would constitute a breach of the zero-tolerance policy, leading to immediate consequences, regardless of the concentration.¹⁶ Another company’s policy specified an alcohol limit of 0.00% on its premises, rejecting the more lenient legal driving limits of 0.02% or 0.05%. These examples illustrate how zero-tolerance can be strictly interpreted to mean zero allowable concentration of prohibited substances, underscoring the absolute nature of such policies.¹⁷

In the author’s view, a threshold cutoff concentration of ‘0.00’ is fundamentally a scientific misinterpretation of the employers’ intent and may lead to contractual impossibility – it may be more accurate to describe it as inherently unfair to employees. The author advocates for the promotion of the ‘no-tolerance’ concept over ‘zero-tolerance’. The latter often leads laypersons to the erroneous conclusion that the threshold cutoff concentration must be ‘zero’. It does not necessarily mean a zero concentration.

Additionally, it is scientifically more accurate to adopt a detection limit approach because all analytical equipment has a detection limit – a zero-concentration detection limit is scientifically unachievable. However, users of breath testing equipment persist in incorrectly demanding a zero-concentration detection limit. The issue of detection limits and zero concentration detection was addressed in a recent Labour Court case involving breath alcohol.¹⁸ The author believes that users of alcohol, which is legal, like cannabis, will similarly challenge the so-called ‘zero-tolerance’ approach, which is often misinterpreted as requiring zero concentration.

A typical example to illustrate this view is when an employee is exposed to cannabis smoke in a public vehicle as their only form of transport to work. Passive inhalation of cannabis smoke could result in a urine Δ^9 -THC metabolite concentration of approximately 10 ng/mL of urine.¹⁹ The Substance Abuse and Mental Health Services Administration (SAMHSA) guidelines recommend a cutoff concentration for this metabolite of 15 ng/mL of urine, not 0.00 ng/mL.

CONCLUSION

The Barloworld judgment underscores the critical need for a dual approach to substance testing in the workplace, blending observational methods with precise, scientifically established “*per se*” cutoff limits. This decision highlights the importance of integrating these cutoff limits explicitly into employment contracts, ensuring they are clearly defined and legally enforceable. Employers must develop drug and alcohol testing policies that respect individual privacy and dignity, tailored to specific job roles, and justified by legitimate safety concerns. This case advocates for policies that are both comprehensive and specific, combining cutoff concentrations with observational evidence to effectively manage off-duty substance use and on-duty impairment. As South Africa adjusts to the legalisation of cannabis, ensuring that workplace policies protect safety while respecting constitutional rights is crucial for fostering a fair and inclusive workplace culture.

KEY MESSAGES

1. Employers must demonstrate that an individual was “*under the influence*” and unable to perform his/her duties safely when invoking the Occupational Health and Safety Act No. 85 of 1993, for both drug and alcohol testing.
2. Employment contracts should specify threshold or cutoff concentrations for drugs and alcohol in biomatrices.
3. The notion of ‘zero-tolerance’ should be approached cautiously, as it may infringe on human rights, as demonstrated in the Barloworld case.
4. Companies must justify why a specific individual is tested; “*blanket testing*” of all employees may not be acceptable.

DECLARATION

The author declares this is his own work; all sources used in this paper have been duly acknowledged, and there are no conflicts of interest.

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ISO 23875 implementation: what success looks like

Part 3

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ABSTRACT

The third article in this series explores the varying definitions of success for different stakeholders involved in the implementation of ISO 23875, the international Standard for air quality in mining operator enclosures. This article examines success from the perspectives of standards development, original equipment manufacturers producing certified cabins under ISO 23875, mining companies evolving their culture around indoor air quality, and regulators utilising industry best practices. The discussion includes potential benefits, such as improved operator health outcomes, enhanced public image, reduced legal liability, increased stakeholder accountability, and site-wide compliance fostered by a mining culture that fully supports operator enclosure air quality.

INTRODUCTION

This final article in the three-part series examines the impact of ISO 23875 as it becomes widely implemented. The foundation for these observations is the experiences of the author over the past three-and-a-half years, travelling extensively to mine sites and machine manufacturers, and presenting to various occupational hygiene associates and government regulators in the USA, Australia, Canada, and South Africa. The impact of ISO 23875 will play out over the next decade as it becomes the way in which the world does business related to operator air quality. Extensive input has been provided on the Standard by users in all sectors, which will contribute to future revisions, further enhancing its usefulness and effectiveness.

WHAT DOES A SUCCESSFUL ISO 23875 IMPLEMENTATION LOOK LIKE: DEFINING SUCCESS FOR DIFFERENT STAKEHOLDERS

Success in implementing ISO 23875 varies among stakeholders.

Occupational hygienists: success is measured by quantifiable results, such as a reduction in the incidence of sickness related to workplace exposures to respirable crystalline silica (RCS).

Administrative teams: success is defined as a process that is transparent, auditable, and consistent, ensuring accountability and regulatory compliance.

Mine worker recruiters: success means the ability to staff mine operations consistently, which is facilitated by providing safe and healthy working environments.

C-suite executives: success involves fully implementing a sustainable process that promotes healthy working conditions while minimising company risks.

Machine operators: success means going to work knowing that time spent in the operator enclosure will be a pleasant experience with no negative health impacts.

Maintenance teams: success is having clear maintenance expectations and checklists, enabling effective machine maintenance and meeting of both operators' and management's expectations.

Mine site operations: success is defined by the productivity of both workers and machines. ISO 23875 addresses both worker health and machine health, making it crucial for all stakeholders at a mining site.

THE ROLE OF ISO 23875 IN DEFINING SUCCESS

ISO 23875 provides a framework that aligns the interests of all stakeholders. It offers clear guidance on implementing and maintaining solutions that ensure air quality inside operator enclosures. Properly

constructed and utilised standards can harmonise and synthesise diverse stakeholder objectives, fostering a culture of safety and accountability within mine sites.

ORIGINAL EQUIPMENT MANUFACTURERS AND THE FUTURE OF ISO 23875

Since the publication of ISO 23875 in 2021, original equipment manufacturers (OEMs) have been assessing market interest in the Standard. Adoption by mining companies has led to machine tenders requiring ISO 23875 compliance, motivating manufacturers to redesign their machines to meet customer demands. As of this writing, every major mining machine manufacturer was addressing the need to produce ISO 23875-certified cabins.

Mining companies are motivated to comply with ISO 23875 by several factors, including regulatory requirements and stakeholder demands for good air quality. Adopting the Standard significantly mitigates risks associated with poor air quality, demonstrating to employees, regulators, and investors that air quality is a corporate priority. This also aids recruitment efforts and reduces legal risks. Despite concerns about the initial costs, the benefits include lower maintenance costs, increased machine and operator uptime, and a culture that promotes good air quality.

CASE STUDY: IMPLEMENTATION AND CULTURAL SHIFT

A recent case study from a coal mine with a large fleet of haul trucks illustrates the benefits of implementing ISO 23875. Each truck was retrofitted to comply with the Standard. According to the site's occupational hygienist, the site culture shifted dramatically as more machines were retrofitted, with operator opinions evolving from indifference to strong support. The site achieved 95% compliance, with machines operating at average dust concentrations below 25 µg/m³. Operators now expect good air quality and comply with guidelines, such as keeping doors closed while operating machines. The union, maintenance personnel, and operators have all embraced the Standard, and efforts are underway to implement it site-wide.

CHALLENGES AND FUTURE DIRECTIONS

The primary challenge to universal adoption of ISO 23875 is widescale implementation. Educating all stakeholders at the mine site remains a critical need. The International Society of Environmental Enclosure Engineers (ISEEE.net), in partnership

with mining companies, is developing a universally available stakeholder education curriculum. This curriculum focuses on both in-person and online training opportunities tailored to the specific needs of each stakeholder.

Experience shows that immediate improvements in operator air quality occur when the engineering controls required by ISO 23875 are implemented. However, maintaining cabin air quality over the life of the machines requires ongoing administrative oversight to ensure sustained compliance and continued benefits for all stakeholders.

CONCLUSION

The benefits of ISO 23875 extend to all stakeholder groups, enhancing health outcomes, improving public image, reducing legal liabilities, and fostering a culture of safety and accountability. Despite the initial costs of retrofitting machines to comply with the Standard, the long-term benefits include reduced maintenance costs, increased productivity, and a healthier, more engaged workforce. Full realisation of these benefits depends on comprehensive implementation and integration into mine site culture, and establishing ISO 23875 as the standard practice for mining industry operator enclosures. 🌐

UPCOMING EVENTS

OCCUPATIONALhealth
SOUTHERN AFRICA

SOUTH AFRICA

SASOHN 43rd Conference 2024

ANEW Resort White River

20-22 November 2024

Website: <https://www.occhealth.co.za/pdf/events/SASOHN%2043rd%20Conference%202024%20Invitation.pdf>

INTERNATIONAL

Connection from occupational practice to research and global evidence: An ICOH webinar for practitioners

Virtual, 14h00 to 16h00 CET, 21 October 2024

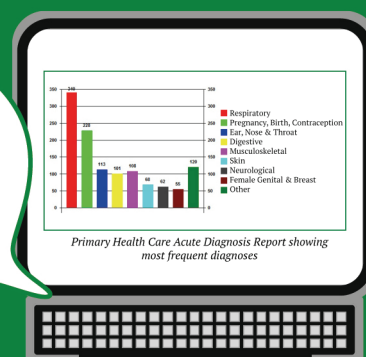
Register: <https://www.icohweb.org/site/webinars.asp>

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International Labour Conference first standard-setting discussion: protection against biological hazards

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In June 2024, Mr Sean Chester and Ms Bulelwa Huna had the privilege of being part of the South African delegation attending the International Labour Conference (ILC) in Geneva – an experience that was both challenging and rewarding. As South Africa has ratified the Tripartite Convention,¹ this delegation consisted of representatives from Government, organised business, and organised labour. In this particular Standard Setting Committee, Sean Chester was appointed by Business Unity South Africa (BUSA) to serve on the Employers' Committee as an occupational hygiene subject specialist. The Government technical expert was Ms Bulelwa Huna – Head of Occupational Hygiene at the Department of Employment and Labour. Organised labour was represented by Ms Riefda Ajam, General Secretary of the Federation of Unions of South Africa (FEDUSA).

Our primary task was to compile the Biological Hazards Convention, supported by a recommendation – a critical document aimed at safeguarding workers from both routine (inherent) and emergency (outbreak) biological risks in the workplace. This was no small feat. The complexity of the subject matter required a deep understanding of both the scientific aspects of biological hazards, and the practical implications for governments, employers, and workers.

The Standard Setting Committee's focus on biological hazards in workplaces is not only unprecedented in the ILC, but also crucial in aiding members to safeguard their workers and businesses. This is particularly relevant in regions like Africa and South America, where small and medium enterprises (SMEs) and informal employment form the backbone of their economies. These regions do not enjoy the protection afforded by multinationals, although this is a requirement in the Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy.²

The passion of the tripartite groups for their mandates has set a dynamic tone for our negotiations. We all know that changing mindsets can be challenging, and our discussions have been a

testament to this. While we found common ground in many areas, consensus on some fundamentals, including the definition of a biological hazard, proved elusive.

Further to this, the placement and understanding of definitions and concepts within the draft convention sparked considerable debate. Terms such as risk, risk assessment, risk-based approach, reasonably practicable and, of course, biological hazard, were discussed repeatedly, underscoring their importance in the draft.

During the 110th Session in June 2022 of the ILC, all social partners ensured the recognition of the Occupational Safety and Health Convention, 1981 (No. 155),³ and the Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187),⁴ as fundamental conventions within the meaning of the International Labour Organization (ILO) Declaration on Fundamental Principles and Rights at Work. This meant that occupational safety and health at work was added as the fifth principle of the ILO's fundamental rights and principles at work. Following the decision, the convention on protection against biological hazards was the first to be developed, and therefore all discussions had to emulate this fundamental right.

Like other conventions (e.g. Chemical Convention, C170),⁵ this particular convention had to be specific on requirements for protection against biological hazards, as there are member states that do not have legal frameworks and wholly rely on such conventions. Although substantial time was devoted to aligning the discussions to principles outlined in both C155 (Occupational Safety and Health Convention, 1981)³ and C187 (Promotional Framework for Occupational Safety and Health Convention, 2006),⁴ this was perhaps at the expense of technical detail. Poor oversight in these areas would have disastrous consequences for government, workers, and employers.

The hours were long, often stretching late into the night. Each day was filled with intense – often combative – discussions, debates, and meticulous review of every clause and provision. Despite the



Organised labour was represented by Ms Riefda Ajam, General Secretary of the FEDUSA

Photograph: courtesy of the ILC



The ILC facilities are set up to accommodate multiple languages and hundreds of participants

Photograph: courtesy of the ILC

demanding schedule, the sense of purpose that permeated the committee was palpable. We were united by a common goal: to create a binding instrument that would make a tangible difference in the lives of workers around the world, whilst safeguarding the sustainability of businesses in times of biological hazard emergencies and pandemics.

The tripartite process was rigorous, involving employers, governments, and workers who represented the interests of 187 member countries, but it was also an opportunity for learning and growth. There was an opportunity to engage with experts from diverse countries and fields, gaining insights that broadened our perspectives and deepened understanding and appreciation of the way the world navigates when drafting international instruments such as conventions.

In the end, the hard work paid off. As a first draft, the convention that was compiled was comprehensive, practical, and forward-thinking. It was a testament to the power of collaboration and the collective commitment to improving workplace safety and health.

Looking back, South Africa was well represented and this significant project was an opportune moment to showcase the importance of occupational hygiene in the world of work. The experience was a powerful reminder of the impact we can have when we come together to address complex issues. It was hard work, but it was also incredibly fulfilling. We look forward to returning to finalise the document in June next year.

In closing, appreciation goes to the Department of Employment and Labour as it ensured that the South African delegation was prepared for the task at hand, and played a pivotal role in providing substantial inputs to promote worker health and wellbeing and to support business continuity. Through this first sitting, the Standard Setting Committee on Biological Hazards demonstrated the commitment to contribute to the United Nations (UN) Sustainable Development Goal (SDG) 8, i.e. to promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all; as well as Target 8.8 – to protect labour rights and promote safe and secure working environments of all workers, including migrant workers, particularly women migrants and those in precarious employment. Within the South African context, this is addressed in National Development Plan (NDP) Outcome 4. The work of the Standard Setting Committee also responds to SDG 3, i.e. to ensure healthy lives and promote wellbeing for all, at all ages; and Target 3.3, which has relevance to biological hazards and occupational health. These targets and NDP outcomes support our aspirations for the *Africa we Want*, as

espoused by the African Union, especially Aspiration 1: to have a prosperous Africa based on inclusive growth and sustainable development.

As an employer representative, Sean Chester would like to acknowledge BUSA and his South African colleagues, particularly Mr Kaizer Moyane, Ms Sanelisiwe Jantjies, Ms Jahni de Villiers, and Ms Bevely Jack; the Biological Hazards Employer Committee Chair, Ms Isabel Maya Rubio and Vice Chair, Mr Pierre Vincensini; and the International Organisation of Employers (IOE) Adviser, Mr. Robert Marinkovic, and the colleagues on the employers' committee. Thanks also go to the Worker Committee Chair, Mr James Ritchie, International Trade Union Confederation (ITUC) advisers, and the workers' representatives, who ensured that robust deliberations were held throughout the sessions. Without the voice of government representatives, the discussions would not have resulted in the draft report that was tabled to the conference plenary for adoption. Special appreciation goes to the South African Government representative Ms Bulelwa Huna and the African Group representative, Dr Betty Nyereyegona (Zimbabwe Medical Advisor: Occupational Health). These two government representatives are top-shelf specialists who had a huge impact on the drafting of the convention.

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Sean Chester was honoured to add to the proceedings of the employers' concluding statement to the entire conference

Photograph: courtesy of the ILC



L-R: Dr Betty Nyereyegona, Ms Bulelwa Huna, Ms Petrina Nghidengwa, Dr Benjamin, Mr Sean Chester

Photograph: courtesy of the ILC

Trust faces delays in processing mineworkers' silicosis and TB claims

Johannesburg, 30 August 2024

The Tshiamiso Trust today announced significant delays in processing thousands of claims to determine their eligibility for compensation. These delays can occur for various reasons, including restrictions on the sources and content of the medical information which may be used to certify a claim, and gaps in the documentation presented to the Trust for certification.

The Trust's operating agreement, known as the Trust Deed, was created through a settlement between the mining companies and the claimants' attorneys, and became effective in 2019. In the process of implementing the Trust Deed, several difficulties arise in the interpretation and practical application of some of its provisions. Substantial progress has been made through the six amendments to the Trust Deed to date, but some interpretation issues are yet to be settled – resulting in significant delays in finalising many claims. While these delays impact some categories of living ex-mineworkers, the dependents of deceased mineworkers are affected the most, with only 14% (2 613) of the 187 27 claims paid to date being for deceased mineworkers.

The Trust has been engaged in extensive discussions and, later, legal processes to clarify these complex issues with the parties to the Trust Deed. Where possible, the formulation of suitable amendments to the Deed is pursued in an effort to avoid potentially drawn-out and costly arbitration and other legal processes. These protracted proceedings consume significant resources and impact the Trust's ability to process impacted claims, thus preventing many claims from advancing to the payment stage.

The key areas of difference include:

- **Definition of an official death certificate:** whether an "official death certificate" is limited to the death certificate issued by the Department of Home Affairs, or equivalent in other countries, as the sole source document to determine the primary cause of death.
- **Use of National Institute for Occupational Health (NIOH) post-mortem examination reports to determine the primary cause of death:** whether the NIOH autopsy reports can be used to determine the primary cause of death where silicosis and/or tuberculosis (TB) is referred to in the main findings of the post-mortem examination, irrespective of whether it is stated as the clinical cause of death.
- **Eligibility of claims for previous TB:** whether all qualifying mineworkers who developed permanent lung impairment from work-related TB should be included, regardless of when they were examined and diagnosed with this impairment by an accredited practitioner. This applies to mineworkers who are living, or were

alive at the effective date, and were diagnosed with TB while, or within 12 months of being employed for risk work at a qualifying mine, during a qualifying period.

- **Acceptance of certain specified Occupational Diseases in Mines and Works Act (ODMWA) certificates ("the Approved ODMWA Certificates"):** whether, in accepting an Approved ODMWA Certificate, the Trust should first assess the underlying medical records on which basis the ODMWA Certificate was issued, by the medical doctors serving on the Medical Bureau for Occupational Disease's (MBOD's) ODMWA Certification Committee at the time.

Despite the challenges, the Trust remains committed to resolving these matters as swiftly as possible. The Trust and the settling parties are now engaged in further discussions aimed at finding a resolution within the next few weeks. "As Trustees, we understand that these delays have caused considerable hardship and frustration for many claimants", said Dr May Hermanus, Chairperson of the Tshiamiso Trust. "Our focus remains on providing fair and equitable compensation to those affected, within the provisions of the Trust Deed."

The Trust will continue to provide updates on the progress of these discussions and the impact on claim processing.

Useful links

To see if the mineworker qualifies to lodge a claim:

<https://www.tshiamisotrust.com/information/status-check/>

To view the claims process:

<https://www.tshiamisotrust.com/information/how-to-claim/>

To view the compensation classes:

<https://www.tshiamisotrust.com/information/compensation-classes/>

To view daily progress of claims and payments:

<https://www.tshiamisotrust.com/information/progress-report/>

About the Tshiamiso Trust

The Tshiamiso Trust was established to give effect to the settlement agreement reached between six mining companies and claimant attorneys in the historic silicosis and TB class action. The companies are African Rainbow Minerals, Anglo American South Africa, AngloGold Ashanti, Harmony Gold, Sibanye Stillwater, and Gold Fields. The Trust is responsible for compensating all eligible current and former mineworkers across southern Africa with permanent impairment due to silicosis or work-related TB, or their dependants where the mineworker has passed away.

Issued on behalf of:

Tshiamiso Trust: Stakeholder Relations & Communications

e-mail: communications@tshiamisotrust.com 

IOSH issues new call for research proposals

The Institution of Occupational Safety and Health (IOSH) has launched its 2024–2025 call for research proposals.

IOSH is inviting proposals for timely and original research that influences policy and practice in the field of occupational safety, health, and wellbeing.

There are four different topic areas included in the call.

Firefighters' exposure to toxic chemicals: barriers and facilitators to adopting decontamination practices

With firefighters often exposed to various toxic agents through doing their duties, and research highlighting potential gaps in the cleaning and decontamination of their kit and personal protective equipment, IOSH is looking to understand more about this.

It is seeking research that explores and compares the barriers and facilitators to the implementation of effective decontamination protocols and practices for firefighters in the United Kingdom. As part of this, it would welcome comparisons with developed economies such as Canada, USA, and Sweden.

Occupational health training for occupational safety and health (OSH) professionals: context, challenges, and opportunities

Despite OSH professionals playing a key role in supporting the health and work ability of employees, often their role is limited to a focus on safety matters. This part of the call is seeking to explore the aspects of existing occupational health training for OSH professionals in countries with sophisticated and mature regulatory frameworks.

This research should support the evaluation of a number of areas, including the knowledge of the health impacts of occupational hazards, the competencies required to prevent work-related diseases and ill health, and the role, type, and content of education and training programmes designed to equip OSH practitioners with the skills and knowledge to prevent and address occupational disease.

Occupational safety and health and climate change – the impact of psychosocial factors in the agricultural sector

Climate change is increasingly becoming a factor that OSH professionals have to consider in their work. As well as the clear safety factors that it causes, there are many psychosocial risks that it brings about.

This is why IOSH has included this in its list of research topics. There are two aspects to this call:

- To explore the impact of climate change on the mental health of agricultural workers in Africa and/or Asia and identify ways that these impacts can be mitigated to support good practice

- To evaluate the work-related psychosocial impact of climate change on agricultural workers, contrasting those in low- and medium-income countries (i.e. those in Africa and/or Asia) with those in high-income countries such as in Europe

The robustness of national OSH statistics in the United Kingdom

National statistics provide key insights into many different parts of a country's economy and society. Among them, OSH statistics are crucial when it comes to understanding trends in this area. It is crucial, therefore, that the data provided is accurate and a true reflection of the situation.

IOSH is looking for research that explores three aspects of the UK's OSH reporting structures and statistics. These are:

- The robustness and reliability of current reporting structures, available data sources, data collection mechanisms, and the categorisation for work-related disease, injury, and ill-health to reflect the modern workplace
- Identification of the strengths and weaknesses within the current recognised data sources at both national and local levels
- An analysis of national policy impacts on the reliability of national OSH statistics and OSH enforcement

The IOSH research team

IOSH commissions a range of projects to establish evidence for health and safety policies and practice on many OSH topics. It often focuses on research that leads to the development of practical resources for the workplace, such as guidance, tools, and case studies.

The IOSH research team includes subject-matter experts involved in:

- Research monitoring and reporting
- Attending conferences and events
- Advising on the research activities of others

The Institution's research is overseen by a panel of IOSH-appointed experts and OSH professionals who provide specialist research-related advice to uphold our rigorous process for the commissioning of research.

Find out more

The IOSH research call involves a one-stage application process with a deadline of 11:59 GMT on Monday, 13 January 2025. For more detailed information on this call, including accessing the application form, visit iosh.com/research24 

SASOM news

Claudina Nogueira: Occupational health consultant/Project manager, University of Pretoria South Africa; SASOM ExCo member; ICOH National Secretary for South Africa (2024–2027); WHWB Board member

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Daan Kocks: SASOM Chair

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Claudia Frost: SASOM National Office Coordinator

e-mail: info@sasom.org

ICOH2024 CONGRESS IN MARRAKESH, MOROCCO: THE WRAP-UP

- Accepted abstracts were published in July 2024 as open access Proceedings of the 34th International Congress on Occupational Health (ICOH2024) of the International Commission on Occupational Health (ICOH), in an online supplement of *Occupational Medicine*, one of the key international journals in its field and part of the Oxford Academic, Oxford University Press (OUP) platform, with an impact factor of 5.1. To view the published abstracts, please visit the following link: https://academic.oup.com/occmed/issue/74/Supplement_1
- The newly elected ICOH Officers and Board members for the current triennium (2024–2027) took up office at the end of the ICOH2024 Congress, holding their first meetings in Marrakesh. The South African Society of Occupational Medicine (SASOM), the only affiliate ICOH member from Africa, wishes the newly elected incumbents all of the best for a healthy, safe, productive, and rewarding tenure.
- A photographic compilation of the ICOH2024 Congress can be accessed here: https://www.occhealth.co.za/pdf/ICOH2024_Congress.pdf

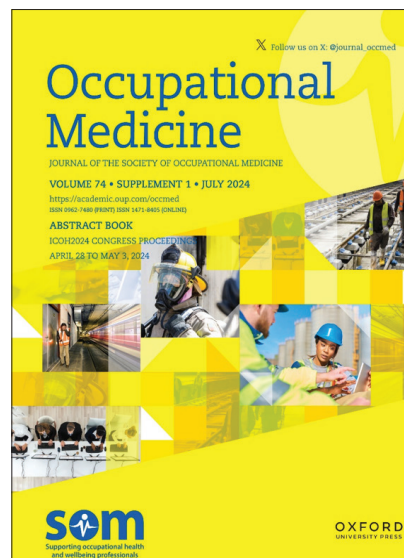


Image: courtesy of ICOH



A new broom sweeps clean – ICOH movers and shakers for the current triennium (2024–2027)

Newly elected ICOH Board members, standing, L to R: Charles Yarborough (USA), Akizumi Tsutsumi (Japan), Quentin Durand-Moreau (Canada), Rim El Kholi (Morocco), Stefan Esser (Germany), R Rajesh (India), Alexis Descatha (France), Riitta Sauni (Finland), Mahinda Seneviratne (Australia), Ashish Mishra (India), Kamal Wifaq (Morocco), and Dongmug Kang (Republic of Korea). ICOH Officers, seated, L to R: Jukka Takala (Past President, Finland), Martin Hogan (Vice President for Scientific Committees, Ireland), Seong-Kyu Kang (President, Republic of Korea), Diana Gagliardi (Secretary General, Italy), and Shyam Pingle (Vice President for National Secretaries, India). Absent ICOH Board members: Rosylane Rocha (Brazil), Giovanna Spatari (Italy), Aida Fajardo Montiel (Mexico), and Naesinee Chaiear (Thailand)

Photograph: courtesy of the ICOH Secretariat (Italy)

SASOM NATIONAL ROADSHOW 2024

The National Roadshow initiative replaces SASOM's annual congress and is aimed at addressing the challenges faced by occupational medicine practitioners (OMPs) and enhancing SASOM's visibility in the occupational health and medicine community after a four-year absence of face-to-face scientific events. The Roadshow was organised in response to the multiple concerns raised by OMPs regarding service provision by non-OMPs, convoluted and illegal business settings, and unethical practices in the field of occupational medicine.

The theme of the 2024 Roadshow is *Occupational Medicine is a highly specific discipline in workers' health* and its objectives are: 1) to address OMP challenges and provide solutions through interactive sessions, 2) to resume in-person visibility of SASOM and strengthen its presence in the occupational health community, 3) to offer Continuing Professional Development (CPD) opportunities for SASOM member OMPs, 4) to facilitate networking among attendees and engagement with key stakeholders, and 5) to provide community services aimed at improving occupational health services for employers and employees.

By providing a platform for discussion, learning, and collaboration, it is envisioned that the Roadshow will directly contribute to the enhancement of occupational health standards and practices. To this end, three sessions with individual sub-themes have been arranged from July to October 2024, culminating in the SASOM annual general meeting (AGM) and associated academic day, in Cape Town on Saturday, 9 November 2024, which will be hosted by the SASOM Western Cape Chapter. Each Roadshow session has been accredited by the South African Medical Association (SAMA) for four Ethical Continuing Professional Development (CPD) points for full attendance.

Session 1: 'Occupational Medicine as a peer-based discipline'

The first session was held on Wednesday, 3 July 2024 (in hybrid format) in Gqeberha, and was chaired by Mrs Claudia Frost (SASOM National Office Coordinator). Three invited speakers delivered four presentations aligned with the session theme.

- Dr Jan Lapere (private practitioner in occupational medicine, medico-legal and social labour law, Gqeberha, South Africa) presented 'The employer's occupational health duty and South Africa's legal framework for occupational medicine', and 'The knowledge needed by the (non-medical) attendees to make the right decision in terms of occupational medical services and identify and deal with the perverse practices by unqualified service providers'. Take-home messages included: 1) the OMP must practice in a manner consistent with the ethical and legal duties of healthcare practitioners, 2) beyond the natural duties and moral obligations applicable to all registered medical practitioners, the OMP has specific institutional and legal duties, 3) the nature of occupational medical practice requires the management of dual responsibilities, 4) selecting and appointing the appropriate OMP is not without pitfalls – key parameters to consider include the doctor's qualifications, registration, experience, knowledge, technological proficiency, professional competence, ethics, communication skills, professionalism, and positive references, and 5) it is important that employers can identify and avoid engagement with prevailing perverse practices by unqualified service providers.
- Dr Haidee M Williams (specialist occupational medicine consultant and honorary senior lecturer at the School of Public Health and Family Medicine, University of Cape Town, South Africa) presented

'The role of OMPs in the chemical industry' and highlighted that: 1) the OMP plays a vital role within the chemical industry, and knowledge of the innate harmfulness of the chemical(s) guides the OMP in establishing the medical surveillance test selection and the medical exclusions or restrictions, 2) the OMP is responsible for identification of early adverse effects as well as occupational disease management, and 3) the OMP plays an important role in education and training of workers, and in identifying trends from medical surveillance data and reporting the findings to the company's Health, Safety and Environment (HSE) Committee.

- Dr Alex Govender (private occupational medicine practitioner, Uitenhage, Eastern Cape, South Africa) presented 'Occupational health practice in China: What are the realities?'. Take-home messages from his personal experience of working in China for a number of years were: 1) China is a fast-growing economic power, rapidly catching up to the leading countries of the world and becoming a major contributor to globalisation, 2) with the growth of business opportunities in China, many health challenges have emerged, 3) to cope with these health challenges, China has enacted a number of laws and regulations and has shown the most regulatory activity in the south-eastern Asia region by strictly enforcing laws and imposing stringent penalties, and 4) whilst legislation and enforcement in China are regarded as strict, the actual practice of providing occupational health services is very different to South Africa.

Session 2: 'Peer-review networking of OMPs'

The second session was held on Wednesday, 14 August 2024 (in virtual format only), and was chaired by Ms Claudina Nogueira (SASOM ExCo member and ICOH National Secretary for South Africa). Four invited speakers delivered four presentations aligned with the session's theme.

- Dr Jan Lapere presented 'The scope of profession of OMPs' and highlighted that: 1) registered OMPs must conform to all the ethical rules and duties of the Health Professions Council of South Africa (HPCSA), 2) the clinical scope of practice of OMPs includes fitness for work, health screening and medical surveillance, health and wellness promotion, ill health work capacity and rehabilitation, fitness for duty, workplace injury and disease management, primary health care, and wellness, 3) non-clinical functions of OMPs include workplace risk assessments, the development and management of risk-based employer occupational health services, occupational health and medico-legal governance, training, health and wellness promotion at work, and emergency planning, and 4) there are specific pitfalls with respect to supersession, dealing with the professional reputation of colleagues, professional confidentiality, signing official documents, certificates, and reports, professional registration and appointments, exploitation, and the reporting of impairment or of unprofessional, illegal, or unethical conduct.
- Dr Jesne Kistan (specialist in public health medicine and palliative medicine at the Association of Palliative Care Practitioners of South Africa (PALPRAC) and Zazen Respite Care, Gauteng, South Africa) presented 'An overview of palliative care: Why does it matter to occupational health practitioners (OHPs)?', which focused on empowering practitioners with the basics of palliative care to improve the quality of life of patients with serious, irreversible disease. She discussed the following: 1) palliative care is specialised medical care for patients with serious illnesses, and not only for terminally ill patients, 2) the World Health Organization advocates

for palliative care to begin at the diagnosis of a serious illness, alongside curative care, 3) OHPs may encounter patients with severe, irreversible illness as a result of work-related diseases, 4) many of these patients are not referred to palliative care practitioners due to lack of practitioner knowledge, fear of introducing palliative care to patients and removing hope, and common misconceptions regarding palliative care, and 5) palliative care teams are composed of various specialties working together to support patients.

- Dr Nicholas van der Water (lead physician at Medmark Occupational Healthcare, Galway, Ireland) presented 'Different but good: A tale of an OMP's journey to the Emerald Isle'. He explored the differences and similarities between occupational medicine practices in Ireland and South Africa, through the lens of an occupational physician who trained in South Africa and transitioned to practice in Ireland during the COVID-19 pandemic. He discussed the topics of training, guidelines that inform practice, and peer-review networking of OMPs, aiming to highlight areas where OMPs in these two distinct regions could learn from and support each other in ongoing practice and promotion of the speciality in their separate jurisdictions. In his animated presentation, Dr van de Water also shared learnings and personal anecdotes from integrating into the Irish system.
- Dr Geoffrey Tafaune (lecturer and occupational medicine specialist at the University of Pretoria and Gauteng Department of Health, Pretoria, South Africa) presented 'Lower back pain evaluation by the OMP: Remember the red and yellow flags'. Points of discussion included: 1) chronic low back pain is a common problem in the workplace, with a lifetime prevalence of more than 80%, 2) a good history, thorough physical examination, and appropriate special investigations should place patients into one of several categories of lower back pain, which can then be managed according to specific directives, 3) paracetamol and non-steroidal anti-inflammatory drugs are first-line medications for chronic low back pain, although other classes of medication may benefit some patients who do not respond to such drugs, and 4) alternative therapies such as acupuncture, exercise therapy, multidisciplinary rehabilitation programmes, massage, behaviour therapy, and spinal manipulation are effective in certain clinical situations. Dr Tafaune stressed the importance of multidisciplinary teams in the management of chronic lower back pain and emphasised that most patients will not benefit from surgery, hence it is of paramount importance for the OMP to remember the red and yellow flags of low back pain, as discussed, when evaluating clinical cases.

Session 3: 'Duties and responsibilities of occupational medicine practitioners' will be held in hybrid format at the Incredible India Restaurant and Conference Centre, The Pearls of Umhlanga, Durban on Wednesday 16 October 2024 and will be hosted by the SASOM KwaZulu-Natal Chapter.

CONGRATULATIONS AND CELEBRATIONS

SASOM is proud to congratulate Dr Vanessa Govender, member of ICOH and the Mine Medical Professionals Association (MMPA), on the publication and official launch of her book titled *From Suspicion to Submission: Occupational Lung Diseases in the South African Mining Industry* – a handbook for occupational medicine practitioners in South Africa and beyond. Her book is "dedicated to all workers who mine – past, present, and future".



Publish, release, launch and celebrate

The official unveiling of *From Suspicion to Submission: Occupational Lung Diseases in the South African Mining Industry* was held at the Wits School of Public Health on 28 August 2024. As part of the programme, the author, Dr Vanessa Govender (left), gave an address, which was followed by an interview. Claudina Nogueira (right) attended the launch in her personal capacity as an invited guest, and also represented SASOM in her capacity of SASOM ExCo member (co-opted)

Photograph: courtesy of Vanessa Govender

Dr Govender is a specialist in occupational medicine with more than 30 years of experience in the mining industry, where she advises, diagnoses, treats, and manages cases of occupational lung disease for compensation claims. She is currently the Director of Masakhane Strategic Health Consulting (Pty) Ltd, an honorary lecturer in the Wits School of Public Health, an associate member of the Colleges of Public Health Medicine of South Africa, and a member of the Tshiamiso Trust's Medical Advisory Panel. The Tshiamiso Trust manages thousands of claims for mineworkers eligible for compensation due to contracting tuberculosis or silicosis from working in certain gold mines.

In the words of the book reviewer, Jack Parker, MD – Professor Emeritus of Medicine, Radiology, Public Health, Occupational and Environmental Health Sciences, West Virginia University, USA: "With the rich history of internationally recognised scientific excellence in occupational lung diseases that resides in South Africa, it is not surprising that an elegant handbook such as this one should have been written by a South African occupational medicine specialist. It is clearly a labour of love and the product of a desire to share knowledge, driven by the noble cause of prevention of occupational respiratory diseases".

The book is published by [MettaMedia Publishing \(Pty\) Ltd](#) and was edited by Prof. Gill Nelson, editor of *Occupational Health Southern Africa* and Head of the Occupational Health Division, Wits School of Public Health. The book is available for purchase by emailing vanessa@masakhanehealth.co.za 

SAIOH news

As part of our service to members, in this newsletter we provide feedback on the latest developments within the Southern African Institute for Occupational Hygiene (SAIOH). SAIOH exists for its members and is reliant on them to continue to serve this noble profession, ethically. Therefore, we invite your inputs and feedback on any matters communicated below.

SAIOH PRESIDENT'S ADDRESS

Naadiya Mundy: SAIOH President

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Naadiya Mundy

Photograph: courtesy of SAIOH

The remarkable speed at which SAIOH has achieved and continues to achieve success is a testament to the tireless efforts of our dedicated volunteers. Their unwavering commitment to our institution's success is truly commendable. We are grateful for their hard work and appreciate their unwavering dedication to our shared goals.

'Guardians of the Workplace': Occupational/Industrial Hygiene as a career path

I recently read a featured article in the *African OS&H* magazine titled

'Storytelling in training'.¹ This inspired me to explore a storytelling approach as a means to both celebrate the profession to which I belong, and encourage young professionals to consider it as a career path.

In the epic saga of *Star Wars*, heroes like Luke Skywalker, Princess Leia, and Han Solo rise to the occasion, defending the galaxy against the tyranny of the dark side. They wield lightsabres, pilot starships, and strategise battles to ensure the safety and freedom of countless planets. Their bravery and dedication epitomise what it means to be a hero, standing up against overwhelming odds to protect what is 'just' and 'right'.

Similarly, occupational hygienists are the unsung heroes of our everyday world. While they may not battle Sith Lords or engage in interstellar warfare, their mission is equally crucial, with their main focus on protecting workers' health. These professionals are dedicated to identifying, evaluating, and controlling health hazards in the workplace, ensuring that employees can work in safe and healthy environments. Their tools may not be lightsabres, but they utilise advanced technology and scientific principles to combat invisible threats such as toxic chemicals, harmful dust, and excessive noise. These methods are not arbitrary. Much like the *Star Wars* heroes who use their skills and knowledge to protect the galaxy, occupational hygienists employ their expertise in physiology, toxicology, and industrial hygiene to safeguard the wellbeing of workers across industries. Their ability to assess risks accurately and implement effective control measures hinges on their technical knowledge,²

skills, and adherence to strict professional and ethical standards. This commitment ensures that their work is not only effective but also responsible and trustworthy, highlighting the importance of maintaining high ethical standards in the field.

More specifically, occupational hygiene is defined as the science and art dedicated to anticipating, recognising, evaluating, and controlling environmental factors or stressors in the workplace that may cause sickness, impaired health and wellbeing, or significant discomfort among workers or the broader community.³ Occupational hygienists are adept at managing biological, chemical, and physical hazards in workplace environments.⁴ They are often academically trained across multiple disciplines, and are equipped with established methodologies and frameworks for hazard assessment and control.⁴ Pursuing a career in occupational/industrial hygiene offers numerous benefits and opportunities for those passionate about health and safety. Some key elements include:

- Adherence to ethical standards: adherence to ethical guidelines that prioritise the health and safety of workers and the community. This includes honesty, integrity, and accountability in all professional activities.
- Competency and continuous learning: occupational hygienists must maintain a high level of expertise through continuous education and professional development. This ensures that they remain up to date with scientific and regulatory advancements, and can effectively address emerging hazards.
- Effective communication: clear and effective communication with stakeholders, including workers, employers, and regulatory bodies.
- Commitment to best practices: use of established best practices and evidence-based methods in the anticipation, recognition, evaluation, and control of workplace hazards.
- Collaboration and leadership: the ability to work within multidisciplinary teams, and demonstration of strong leadership and collaborative skills.

In essence, both *Star Wars* heroes and occupational hygienists share a common goal: to protect and preserve life. While one defends against cosmic threats and the forces of evil, the other ensures that workplaces are free from hazards that can harm health. Their efforts might not be as visible as those of a Jedi in battle, but the impact of occupational hygienists is profound, making them true guardians of our health and safety.

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NATIONAL COUNCIL FEEDBACK

Naadiya Mundy: SAIOH President

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The SAIOH management and Council held and participated in several meetings during the period April to July 2024, focusing on collaboration and goal achievements. Further meetings were held to strategise and plan the updating of the SAIOH quality management system (QMS), the way forward, with David O'Malley of the British Occupational Hygiene Society (BOHS) and their training M-modules, the new SAIOH website, and the SAIOH 2024 conference. Discussions were held with Prof. Johan du Plessis of North-West University on the development of SAIOH's own occupational hygiene ethics course.

During this period, SAIOH management also met with Workplace Health Without Borders (WHWB), the International Occupational Hygiene Association (IOHA), and other occupational hygiene organisations to discuss the threat to occupational hygiene, worldwide.

The Southern African Institute for Occupational Hygiene also hosted the Department of Employment and Labour's (DoEL's) workshop on Hazardous Chemical Agents and attended the DoEL/SAIOH/Occupational Hygiene Approved Inspection Authority (OH AIA) Association's liaison meeting and the OH AIA Association's meeting.

Strategic plan

The SAIOH Council continues to review the 2023–2027 strategy, ensure that targets are being met, and explore further strategic developments for the institute and its members.

Ethics

NGO Law has advised that the legal review of SAIOH's ethics policy and procedure(s) falls outside their expertise, and they have recommended seeking assistance from specialised lawyers. This is an urgent matter as it is crucial for the Ethics Committee to begin its work. The ethics plan is a vital component of SAIOH's strategy.

SAIOH branch activities

The Western Cape branch's second meeting took place on Friday, 7 June 2024 in an online format. The Gauteng branch hosted its second meeting on Friday, 12 July 2024. The meeting was held in-person at the Franklin Roosevelt Park Golf Club in Johannesburg. Presentations on new occupational hygiene technologies by G. Warne (AMS Haden), and an interactive session on welding fumes by Jaco van Rensburg (Gijima), were followed by attendees playing bowls, eating tasty hamburgers, and interacting socially.

The Botswana Association for Occupational Hygiene (BAOH) is meeting regularly, and is involved with the organising of the SAIOH-BAOH 2024 conference in Gaborone from 21 to 24 October 2024.

SAIOH 2024 annual scientific conference

The Botswana branch will host the SAIOH-BAOH annual 2024 conference in Gaborone from 21 to 24 October at the Phakalane Golf Estate and Conference Hotel. The detailed programme and registration details are available on the SAIOH website (www.saioh.co.za). The Southern African Institute for Occupational Hygiene will provide detailed feedback in the next issue of *Occupational Health Southern Africa*.



Image: courtesy of SAIOH

International Occupational Hygiene Association (IOHA) and Occupational Hygiene Training Association (OHTA) feedback

The SAIOH General Manager, Deon Jansen van Vuuren, President, Naadiya Mundy, and OHTA representative, Jakes Jacobs, met several times with the OHTA and BOHS at the IOHA 2024 Conference in Dublin, regarding their 'new' Occupational Hygiene (OH) Certificates. This was to enable SAIOH's acceptance of these qualifications at the relevant Professional Certification Committee (PCC) qualification requirement level.

Emerging Leaders Institute Programme

Three South Africans, Naadiya Mundy, Goitseman Keretsetse, and Deon Swanepoel, were selected to attend the Emerging Leaders Institute (ELI) Programme, which was held in conjunction with the IOHA 2024 Conference in Dublin, Ireland. The Emerging Leaders Institute is dedicated to enhancing the leadership skills of early-career occupational, environmental, health and safety (OEHS) and product stewardship professionals with less than 15 years of experience.

The programme, an extensive three-day initiative, offered numerous key benefits, including:

- Enhanced leadership capabilities: participants expanded their awareness and influence of self and others, developing skills in strategic thinking, decision-making, and effective communication.
- Team management: training focused on building and managing high-performance teams, equipping attendees with essential team leadership skills.
- Professional impact: the programme emphasised making a lasting impact on the future of the profession, fostering a sense of responsibility and forward-thinking among participants.

Moreover, the ELI provided valuable networking opportunities with other emerging leaders, industry experts, and mentors, thereby enhancing professional connections. The focus on career advancement was evident, as the programme equipped participants with the skills needed to take on leadership roles, boosting their career prospects and professional growth.

Deon Jansen van Vuuren received the 2024 **IOHA Lifetime Achiever award** and gave a talk on:
‘Selling of occupational hygiene ... difficult, but extremely important’.

Some quick statistics from the IOHA conference:

- Forty-two associations, globally, are members of IOHA, representing 8 222 National Accreditation Recognition- (NAR-) certified occupational hygienists.
- The three newest associations are Mongolia, Chile, and Nigeria (the second in Africa).
- Eighteen associations' certification schemes are now accredited by the NAR Committee.
- SAIOH has the second-largest number of registered occupational hygienists, globally, viz. 223 (in June 2024), but is dwarfed by The Board for Global, Environment, Safety, and Health Credentialing, Inc. The Board of Global Credentialing (BGC), previously called the American Board of Industrial Hygiene, which has 6 807 registered occupational hygienists.

International Occupational Hygiene Association NAR Committee feedback:

- The NAR Committee developed a revised accreditation evaluation matrix with updated requirements, which was approved at the IOHA Board meeting.
- SAIOH's Professional Certification Committee (PCC) meets and exceeds the IOHA minimum requirements for ethics, qualifications, experience, and certification system.

The Southern African Institute for Occupational Hygiene's NAR is an important step in maintaining its credibility and reputation in the field of occupational hygiene. The re-application process has begun, with the PCC Exco team diligently working on submitting necessary documentation to IOHA for review.

Deon Jansen van Vuuren is now on the IOHA Governance Committee, working on updates to the IOHA management system, quality procedures, and document management system.

The IOHA has relaunched its *Global Exposure Manager* (GEM) newsletter, which is available on its website.

SAIOH Technical Committee feedback

The SAIOH Technical Committee is conducting research on welding fumes, focusing on measurement and analysis. Dr Ivan Niranjani, the Technical Portfolio Coordinator, is leading this project. Additionally, a sub-committee was established by SAIOH and OH AIA to create a technical and position paper on the topic. This collaborative approach aims to provide a comprehensive understanding of welding fumes, measurement, and the impact of exposure.

SAIOH's second Technical Committee has been actively developing technical procedures and a position paper on heat stress management, in addition to conducting research on the topic. The committee's two-fold focus is to create a technical paper that will enable SAIOH to submit well-rounded and relevant proposals to strengthen the Physical Agents Regulations in 2024.

Wessel van Wyk, the former Technical Coordinator, is actively working on a position paper regarding real-time monitoring. The document will be shared with SAIOH members and stakeholders once it is approved by SAIOH's technical sub-committee and the Technical Committee. The paper aims to provide insights on real-time monitoring,



Attendees at the IOHA National Accreditation Recognition (NAR) Committee meeting at the IOHA conference

Photograph: courtesy of Deon Jansen van Vuuren

enabling informed decision-making and collaboration among industry professionals.

The Department of Employment and Labour requested comments on the new Lead Regulations by 31 May 2024. A collaborative effort was made by SAIOH, the OH AIA Association, and SASOL, after which comments were submitted to the DoEL. The team would like to extend thanks to Tatjana Rogowski for her instrumental role in driving this initiative.

Communications

The Southern African Institute for Occupational Hygiene publishes its newsletter/Presidents' page in two electronic media formats, namely *Occupational Health Southern Africa*, and the *African OS&H* magazine (A-OS&H).

FROM THE PROFESSIONAL CERTIFICATION COMMITTEE

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Certification assessments

A summary of results for the assessments that took place mid-March to July 2024 is provided in Table 1.

Table 1. SAIOH PCC certification assessment results (March–July 2024)

Certification category	Written assessments				Oral assessments			
	Assessed	Passed	Failed	Pass rate	Assessed	Passed	Failed	Pass rate
	n	n	n	%	n	n	n	%
OH assistant	109	107	2	98.2	0	0	0	-
OH technologist	58	45	13	77.6	67	34	33	50.7
Occupational hygienist	29	19	10	65.5	27	13	14	48.1
Total	196	171	25	87.2	94	47	47	50.0

PCC assessment improvements

The PCC technical team has revised the 17 occupational hygiene skillsets and is now developing scenario questions in line with the requirements for oral assessments.

Occupational Hygiene Skills Forum

One of the functions of the Occupational Hygiene Skills Forum (OHSF) is to evaluate applications from tertiary institutions for recognition of their occupational hygiene-related qualifications. The OHSF is progressing well with these accreditations and is currently evaluating the Cape Peninsula University of Technology's (CPUT's) occupational health qualification. All tertiary institutions that offer occupational hygiene qualifications are encouraged to contact the PCC Administrator for information regarding application for recognition: lee@saioh.co.za.

Three asbestos modules from the SAIOH OHSF are now available for registered training providers. These modules, specifically AP101 – Asbestos Counting, AP102 – Asbestos Bulk Analysis, and AP103 – Risk Management, are ready for distribution and training. These comprehensive modules will enable providers to offer in-depth training in asbestos-related topics, providing individuals with essential skills and knowledge in the field. Please contact Lee Doolan (lee@saioh.co.za) for further information. 