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Front cover
Dion Ndlovu is a young Bulawayo-based artist specialising in painting, illustration, and digital sculpture

Instagram:
*@whoisdion_*
e-mail:
dionndlovu35@gmail.com
Website:
https://www.behance.net/dionndlovu

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Volume 31, Issue 4, 2025

South African Society of Occupational Medicine (SASOM)
Claudia Frost
Tel: +27 (0)87 288 0893
e-mail: office@sasom.org
website: www.sasom.org

Southern African Institute for Occupational Hygiene (SAIOH)
Kate Smart
Tel: +27 (0)63 781 0686
e-mail: info@saioh.co.za
website: www.saioh.co.za

Mine Medical Professionals Association (MMPA)
Noluthando Sebe
Tel: +27 (0)11 568 2054
e-mail: noluthandos@mpas.org.za
website: www.mmpa.org.za

EDITOR-IN-CHIEF
Gill Nelson, *PhD (Occupational Health): University of the Witwatersrand, South Africa*
Affiliations: University of the Witwatersrand, South Africa; MMPA life member
e-mail: gill.nelson@wits.ac.za

ASSISTANT EDITOR
Ntombizodwa Ndlovu, *PhD (Occupational Health): University of the Witwatersrand, South Africa*
Affiliation: University of the Witwatersrand
e-mail: zodwa.ndlovu@wits.ac.za

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PUBLISHER
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Affiliation: MettaMedia (Pty) Ltd
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PUBLISHER
MettaMedia (Pty) Ltd
Kevin Beaumont, Cell: +27 (0)82 774 2210
PO Box 210, Tulbagh, 6820
e-mail: kevin@mettamedia.co.za

ADVERTISING
Barbara Spence, Cell: +27 (0)82 881 3454
e-mail: barbara@avenue.co.za

SUBSCRIPTIONS
Kevin Beaumont, Cell: +27 (0)82 774 2210
e-mail: kevin@mettamedia.co.za

PRODUCTION
Perry Digital Media
Michelle Perry, Cell: +27 (0)83 528 7491
e-mail: michelle.perry@perrydigitalmedia.co.za

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Use your personal login details to access past issues. Should you have any queries, e-mail kevin@mettamedia.co.za.

Health and Safety Posters and Toolkit for Teams

The Minerals Council South Africa is pleased to share new Health and Safety materials. The posters and messaging toolkit offer clear reminders that reflect daily work realities. Covering PPE, fatigue, mental health, stress, HIV/AIDS, substance use, GBV, leadership, and teamwork, the resources support a culture of care and reinforce the small steps that help bring employees home safely.

Click here to download the full set of materials



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Publish or perish – beware the ethical hazards



Ntombizodwa Ndlovu, Assistant Editor

This, our last issue for 2025, contains a bumper harvest of original research and opinion papers, reports, and other news. We are proud to profile Dr Dipalesa Mokoboto, who has been promoted to the position of Chief Director in Occupational Health in the Department of Mineral and Petroleum Resources. We wish her every success in her new role.

On 9 December, I presented a webinar on behalf of the OSHAfrica Scientific Committee on Data, Research and Publication, titled *Publish or Perish*. Researchers are familiar with the term, which is defined as *"the pressure put on academics to publish in scholarly journals* ***rapidly and continually*** *as a condition for employment (finding a job), promotion, and even maintaining one's job"*. This continuous and unrelenting race to publish is lifelong, and is the way in which researchers become and remain visible and relevant within the research fraternity. Without visibility, research careers stagnate and die.

In addition to visibility and career progression, the pressure to publish has many benefits. It motivates researchers to increase productivity and promotes healthy competition among peers. The research productivity of individuals contributes to the prestige, rankings, and income of institutions, and the knowledge generated leads to the betterment of society.

Pressure to publish or perish may generate a culture of 'publish at all costs', which emphasises quantity at the expense of quality. To publish rapidly, researchers may resort to unethical practices, which include:

- fabrication: outright invention of results
- falsification: manipulation of results to make them more acceptable
- salami slicing: inappropriate division of one substantial study into several smaller publications that do not add meaningful new knowledge
- duplication: publication of the same or similar results in more than one journal, without proper disclosure or justification
- plagiarism: presenting another person's ideas, words, or work as one's own, without appropriate acknowledgement or citation
- guest authorship: inclusion of individuals as authors, even though they made little or no meaningful contribution to the research and publication
- ghost authorship: exclusion of individuals who contributed significantly to the research and publication[1]

We must be vigilant and ensure that we do not engage in these unethical practices.

Incomplete reporting in publications is an issue that editors encounter often and which should be addressed by authors. All published research should be potentially reproducible. One study found that more than half of the researchers who participated could not reproduce their own experiments.[2] Poor reproducibility can be avoided by use of correct study designs and methodologies, adequate sample sizes, appropriate analytical methods, and describing methods in sufficient detail in manuscripts. Consultations with skilled researchers and statisticians should be done at the proposal stage, to ensure that suitable data collection methods are used, sample sizes are sufficient, and all necessary variables are collected. Similarly, at the analysis stage, experts should be consulted to ensure that appropriate statistical or qualitative methods are used and that findings are interpreted correctly. Several guidelines are available to ensure complete reporting. These include the STROBE for reporting of observational studies, CARE for case reports, and PRISMA for systematic reviews. I strongly recommend that authors follow these guidelines.

An example of the surge in numbers of journal publications is the increase in the number of biomedical records indexed in PubMed – from approximately 15 million in 2004 (Vardakas et al., 2015)[3] to 39 million in 2025 (https://pubmed.ncbi.nlm.nih.gov/about/). The demand for publication has led to a proliferation of new journals, including open access publishing that makes journal papers freely accessible. However, predatory journals, which exploit the open-access model of charging author publication fees, but without legitimate peer review, editorial standards, or quality control, are also common.[4] While the idea of rapid publication is attractive, researchers must avoid publishing in these journals as this may have negative consequences on their careers.

The large number of uncited published papers is of concern, and raises questions around the need to publish for career progression at the expense of scholarship. Citation indices are used to estimate the impact and influence of research, by providing a measure of the number of times scholarly publications are cited by other authors. Unethical practices by researchers to increase citations, such as excessive self-citation, citation cartels, or coercive citation, should be avoided. There are numerous ethical ways to increase citations. For example, publishing high-quality research that addresses important and relevant questions; careful selection of appropriate journals with good visibility and readership; writing clear, informative titles and abstracts; use of widely searched keywords; sharing publications through academic networks; and presenting work at conferences and seminars to increase exposure. This issue of *Occupational Health Southern Africa* contains abstracts from the 8th Mombasa Annual International OSH Conference covering numerous topical issues. I challenge the authors to convert these abstracts into high-quality papers in recognised journals, if they have not already done so.

We thank everyone who has contributed to the journal – authors, reviewers, readers, Editorial Board, and publishing team members. We wish you all a joyous festive season and productive new year.

REFERENCES

1. Rawat S, Meena S. Publish or perish: where are we heading? J Res Med Sci. 2014; 19(2):87-89. PMID: 24778659.

2. Baker M. Is there a reproducibility crisis? Nature. 2016; 533(26):452-454. doi: 10.1038/533452a

3. Vardakas KS, Tsopanakis G, Poulopoulou A, Falagas ME. An analysis of factors contributing to PubMed's growth. J. Informetr. 2015; 9(3):592-617. doi: 10.1016/j.joi.2015.06.001.

4. Elmore SA, Weston EH. Predatory journals: what they are and how to avoid them. Toxicol Pathol. 2020; 48(4):607-610. doi: 10.1177/019262332092020.

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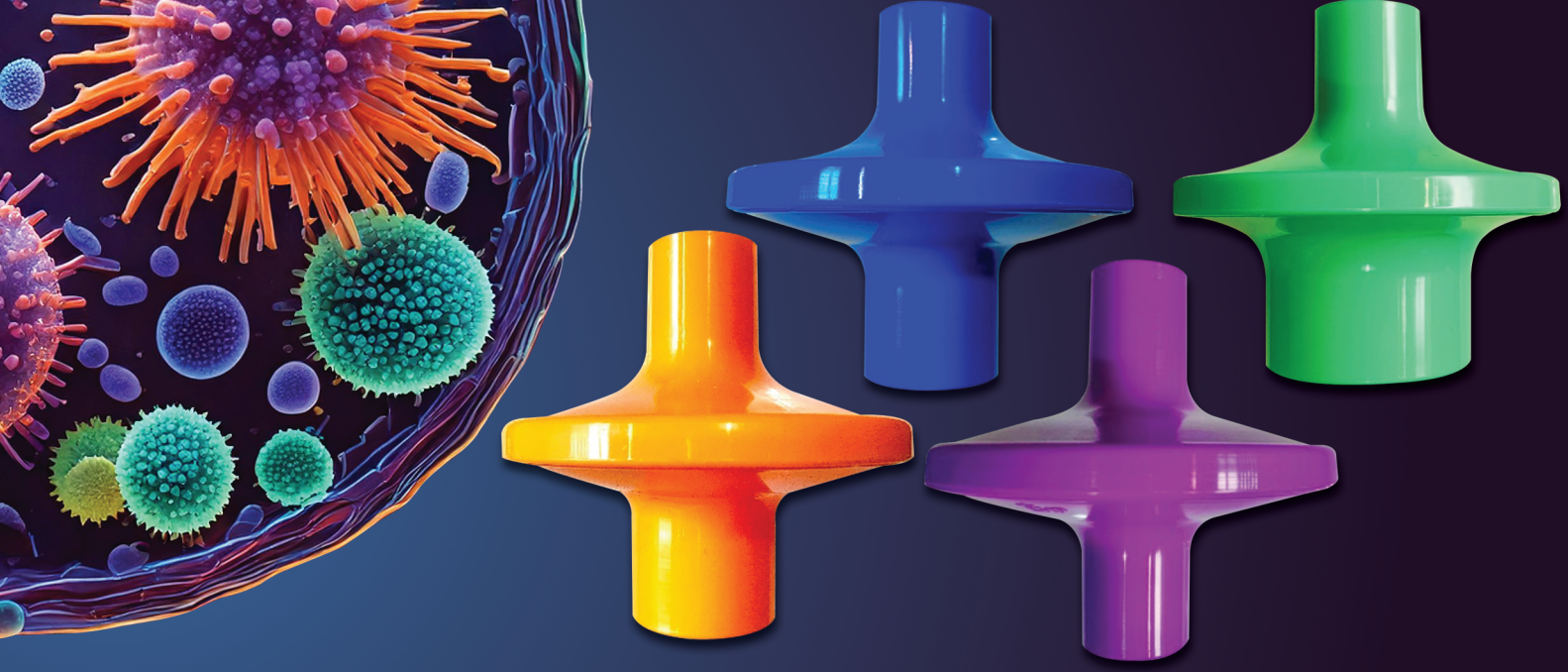
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		Easy on-PC
		EasyOne Pro
		EasyOne Pro LAB
	Schiller	SpiroScout
		SPIROVIT SP-1 G2

Product Code	Spirometer	Model
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	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
		Flowscreen Pro
	Jaeger	MasterScope
		MasterScreen
		Flowmate
		Spiro Pro
	Vyaire	Vyntus SPIRO PC
		Vyntus ONE
	AME	Short Adaptor
	IQ TeQ	Short Adaptor
	ORCAwave	Short Adaptor
	MSG	Short Adaptor
	Thor/Spirosonic	All models

Product Code	Spirometer	Model
PFT-2044 (Small) PFT-2544 (Standard) PFT-2244 (Oval)	nSpire	Digidoser
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SASOM 2025 Conference tackles AI, informal work, and the future of occupational medicine in Africa

Multi-disciplinary summit explores technology's role in advancing medical care for vulnerable workers and strengthening occupational medicine practice

The South African Society of Occupational Medicine (SASOM) successfully convened its 2025 Annual Conference on 15 November 2025 at the Protea Fire & Ice! Menlyn, bringing together occupational medicine practitioners (OMPs) alongside nurses, ergonomists, human resources professionals, and technology innovators to address one of the most pressing challenges facing occupational medicine practice in Africa: the intersection of artificial intelligence (AI), informal work, and worker health protection.

Under the theme *Artificial Intelligence at the Crossroads of Informal Work and Public Health: Risks, Innovations, and Responsibilities,* the conference examined how technology, innovation, and multi-disciplinary collaboration can strengthen occupational medicine's capacity to protect and advance the health of workers in the informal sector – a population representing approximately 60% of the global workforce and over 80% of Africa's labour force.

MULTI-DISCIPLINARY COLLABORATION STRENGTHENS OCCUPATIONAL MEDICINE

The conference showcased how allied disciplines strengthen occupational medicine practice, featuring expertise from cybersecurity, ergonomics, nursing, AI development, and international public health policy working alongside OMPs.

"The challenges facing occupational medicine today cannot be solved by medicine working in isolation", said Prof. Daan Kocks, Chair of SASOM. *"This year's conference demonstrated the power of bringing together diverse perspectives – from cybersecurity experts and AI developers to nurses on the frontlines and ergonomics specialists working in communities. Each discipline brings unique insights that, when integrated with occupational medicine practice, create comprehensive solutions for protecting worker health and wellbeing, particularly for those in vulnerable and informal employment."*

Seven distinguished presenters delivered evidence-based insights spanning cybersecurity threats to healthcare systems (Prof. Joey Jansen van Vuuren, Tshwane University of Technology); the ethical integration of AI in occupational medicine across Africa (Dr Casper Joubert, Stellenbosch University); human factors engineering in informal economies (Ms Sma Ngcamu-Tukulula, President of the Ergonomics Society of South Africa (ESSA), and Mr Andrew Todd, Rhodes University); community-based nursing interventions (Sr Mercia Patience, South African Society of Occupational Health Nursing Practitioners (SASOHN)); AI-powered tuberculosis (TB) screening technology (Mr Johan Coetzee, AI Diagnostics); and global perspectives on migrant and informal worker health (Dr Acran Salmen-Navarro, New York University, USA and President of the Global Coalition on Informal Workers' Health, Safety and Wellbeing (GCIW)).

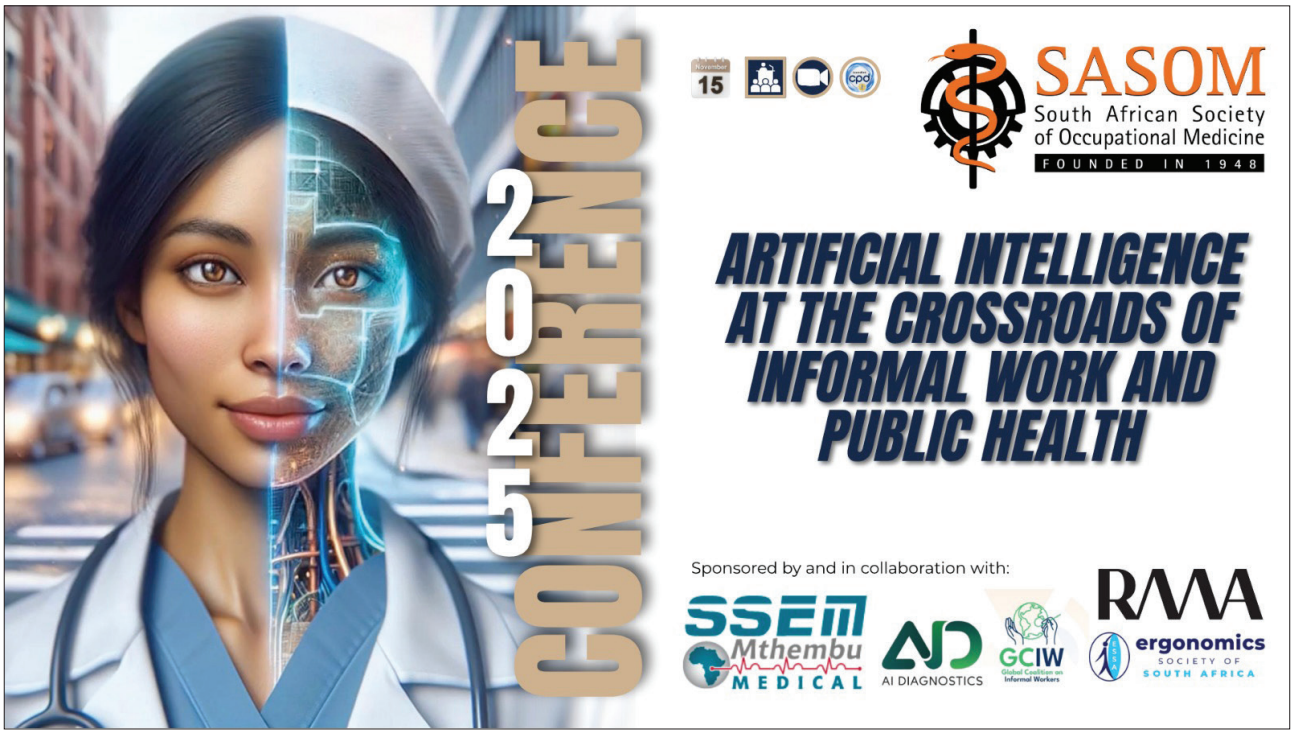


Image: courtesy of SASOM

CENTERING INFORMAL AND MIGRANT WORKERS IN OCCUPATIONAL MEDICINE

A defining focus of the 2025 conference was the urgent need to extend healthcare and occupational medicine protections to informal and migrant workers – populations historically excluded from medical workplace safety systems, despite facing disproportionate health risks.

Ms Sma Ngcamu-Tukulula emphasised the necessity of recalibrating human factors and ergonomics practice to serve Africa's informal economy. *"We must transition from compliance-focused approaches to co-creation with informal workers, from risk avoidance to resilience building, and from human-machine fit to human-system synergy", she stated. "Embedding 'Ubuntu' principles – our African values of collective wellbeing, dignity, and compassion – reinforces the ethical foundation of ergonomics and ensures our solutions truly serve the communities who need them most."*

Dr Acran Salmen-Navarro, joining virtually from New York, provided international context on the precarious conditions facing informal and migrant workers, globally. "*Informal and migrant workers have historically faced what we call '4-D jobs' – dirty, dangerous, difficult, and discriminatory"*, noted Dr Salmen-Navarro. *"As technology reshapes the global workforce, we have both an opportunity and a responsibility to ensure AI and innovation enhance worker dignity and wellbeing rather than deepening existing inequalities. The collaboration between SASOM, GCIW, and African institutions represents exactly the kind of partnership needed to drive meaningful change."*

The conference also previewed the First International Conference on Informal Work: Health, Safety and Wellbeing, scheduled for November 2026 in Santiago de Cali, Colombia – positioning South African OMPs as leaders in this global movement.

AI AS TOOL FOR OCCUPATIONAL MEDICINE PRACTICE

Several presentations explored how AI and digital health technologies can address longstanding gaps in occupational medicine surveillance, diagnosis, and clinical intervention – particularly in resource-constrained settings.

Mr Johan Coetzee presented AI Diagnostics' AI-powered TB screening platform, approved by the South African Health Products Regulatory Authority (SAHPRA), which enables frontline health workers to conduct accurate TB screening using a smart stethoscope and mobile application. This innovation exemplifies how technology can expand access to specialist-level diagnostic capability in communities without requiring costly infrastructure or specialist personnel – strengthening OMPs' reach.

Dr Casper Joubert argued that Africa has a unique opportunity to *"leapfrog"* traditional development barriers by adopting AI strategically and ethically in occupational medicine practice. However, he cautioned that success requires a *"human-in-the-loop"* approach, robust governance, and careful attention to algorithmic bias, data privacy, and worker dignity. Prof. Joey Jansen van Vuuren highlighted the growing cybersecurity risks facing healthcare systems, emphasising that protecting health and medical data is



Participants at the 2025 SASOM Conference – L to R: Dr Jameson Malemela (Sibanye Stillwater), Prof. Daan Kocks (SASOM Chair), and Dr Geoffrey Tafaune (SASOM Treasurer) *Photograph: Claudina Nogueira*

itself a workplace safety and wellbeing issue – particularly given recent ransomware attacks on South Africa's National Health Laboratory Service and other health institutions.

PROFESSIONAL DEVELOPMENT AND CONTINUING MEDICAL EDUCATION

The conference programme was accredited by the South African Medical Association (SAMA) for four Clinical and four Ethical Continuing Education Units (CEUs), automatically awarded to all Health Professions Council of South Africa- (HPCSA-) registered practitioners who attended in full. This accreditation underscores SASOM's commitment to advancing occupational medicine practice through continuing medical education and rigorous professional development. Session chairs – Dr André Kotzé (SASOM Vice-Chair), Dr Mpho Rakgoale (National Institute for Occupational Health), and Dr Geoffrey Tafaune (SASOM Treasurer) – facilitated robust discussions that integrated clinical, ethical, policy, and practical dimensions of contemporary occupational medicine practice.

STRATEGIC PARTNERSHIPS STRENGTHEN OCCUPATIONAL MEDICINE CAPACITY

The conference was made possible through collaboration with the GCIW and ESSA, alongside sponsor support from SSEM Mthembu Medical, Rand Mutual Assurance (RMA), AI Diagnostics, Ampath Laboratories, and Dr Mahmood Jina.

Ms Claudina Nogueira, the International Commission on Occupational Health's (ICOH's) National Secretary for South Africa and President of Workplace Health Without Borders (WHWB), provided updates on ICOH activities and emphasised the value of international collaboration in strengthening South Africa's occupational medicine capacity and global influence.

LOOKING FORWARD

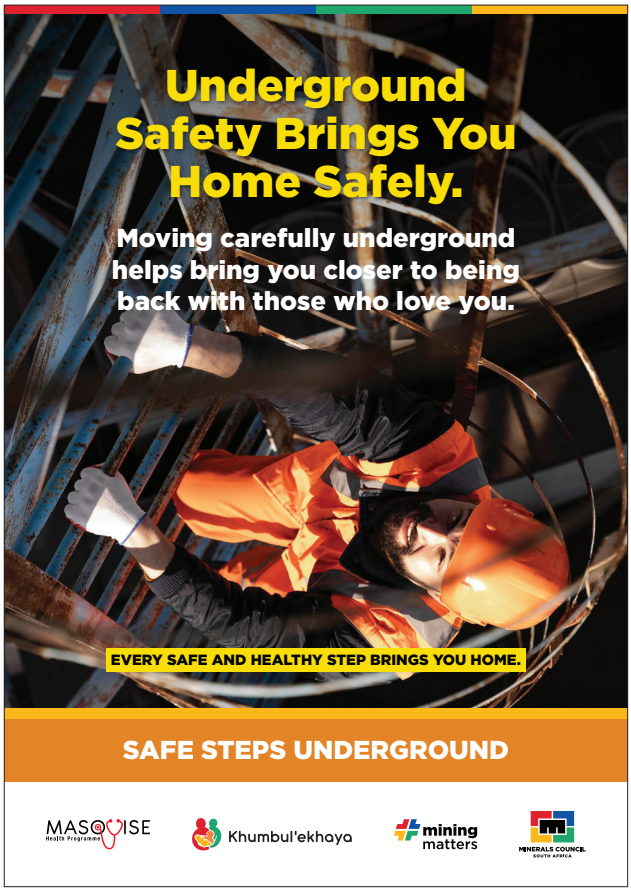
The 2025 SASOM Conference concluded with renewed commitment to advancing occupational medicine through innovation, collaboration, and inclusive practice. The Annual General Meeting (AGM) followed immediately after the conference, with delegates expressing strong support for continuing this momentum into 2026.

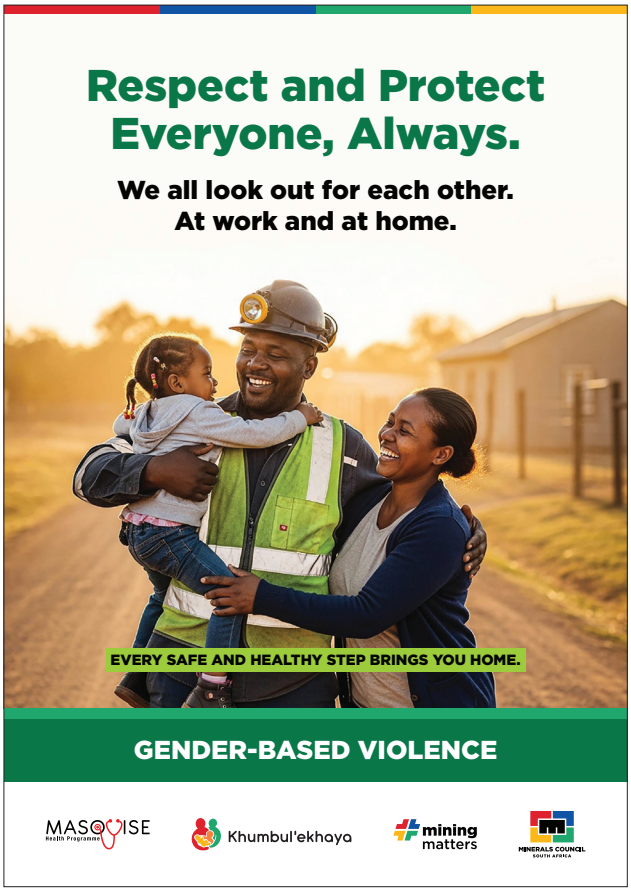
As Africa's workforce continues to evolve – shaped by technological change, migration patterns, climate pressures, and economic transformation – SASOM's role in providing thought leadership, evidence-based medical guidance, and multi-disciplinary platforms for collaboration becomes increasingly vital.

The presentations and discussions from the 2025 SASOM Conference will inform ongoing research, policy development, and occupational medicine practice innovation across South Africa and beyond, particularly in extending healthcare and medical protections to workers in informal, precarious, and non-traditional employment arrangements.

ABOUT SASOM

SASOM is a special interest group of SAMA with links to the World Medical Association. SASOM is affiliated with ICOH and its 37 Scientific Committees. Founded in 1948, SASOM's mission is to promote, protect, and enhance the health of the working population of South Africa. Through guidance, education, standards, and collaboration, SASOM helps professionals navigate evolving risks, technologies, and regulatory expectations, while advancing the recognition of occupational medicine as a speciality field. For more information, visit www.sasom.org





Message from Prof. Cas Badenhorst, SAIOH Vice President

Our President, Karen du Preez, has made the difficult decision to step down from her role, effective 1 January 2026, due to extenuating circumstances and personal reasons associated with these circumstances. While this decision comes midway through her term, it follows careful consideration and is rooted in her need to prioritise matters of personal importance at this time. We fully support her decision and recognise the commitment and integrity with which she has always approached her responsibilities, both professionally and personally.

On behalf of the SAIOH Management Board and Council, as well as the entire membership, we extend our heartfelt gratitude to Karen for her dedicated service, strategic insight, and steadfast leadership. During her tenure, she has contributed meaningfully to strengthening our Institute, advancing the occupational hygiene profession and values, and fostering an engaged and collaborative community. We extend our best wishes to Karen during this time and remain confident that she will continue to be part of our wider professional community.

As the current Vice President of SAIOH, I will step into the role of SAIOH President on 1 January 2026, and a new SAIOH Vice President will be elected early in 2026. The SAIOH Management Board will share further information in the next few weeks regarding the interim leadership arrangements and next steps to ensure continuity of our programmes, governance, and activities.

We thank you for your understanding and continued support.

Postgraduate students in occupational health – African tertiary intitutions invited to list studies on the Journal website

Occupational Health Southern Africa invites tertiary institutions in Africa to list completed occupational health studies of postgraduate students. A study is listed according to its title, abstract, and institution with a link provided to the tertiary institution's open-access repository. Listing of a study will not be considered as a publication in *Occupational Health Southern Africa* in any form, but this listing aims to inform those with an interest in occupational health in Africa of research done by postgraduate students since 2020. For submissions and other criteria, please visit http://www.occhealth.co.za/ under the Postgrad Research menu (top right of page).



Transforming adversity into opportunity for the AIDS response

Salim Abdool Karim: Director of CAPRISA; Pro Vice-Chancellor (Research), University of KwaZulu-Natal, Durban, South Africa

As South Africa commemorates World AIDS Day 2025, themed 'Overcoming disruption, transforming the AIDS response', CAPRISA Director Professor Salim Abdool Karim reflects on the frantic days following this year's unprecedented cuts to health aid and research funding from the US, arguing that the deliberate disruptiveness was designed to be cruel. Nonetheless, he argues, our HIV response must now forge ahead on a path that is more affordable, sustainable, and independent.

STOP WORK!

A *"STOP WORK"* order is immediate.

The Centre for the AIDS Programme of Research in South Africa (CAPRISA) received its first US Government 'STOP WORK' order from the US Agency for International Development (USAID) on 27 January 2025, imposing a 90-day suspension on a major HIV-prevention research project.

A week earlier, on 20 January 2025, incoming US President Donald Trump signed an Executive Order imposing a 90-day freeze on USAID funding. Shortly thereafter, Elon Musk and his Department of Government Efficiency arrived at the USAID headquarters to systematically dismantle it and terminate most of its projects. Within seven days, the full effect of Trump's decision was reverberating across the world. The acute US funding cuts disrupted its foreign aid programmes, which had for years worked to improve the lives of the most vulnerable communities across the globe.

The impact was instantaneous. Several US-funded projects ground to a halt. Feeding programmes for the hungry, shelter projects for those displaced by war and conflict, daycare for abandoned children, and many other programmes in dozens of countries around the world were stopped. The swiftness of the implementation of the USAID dismantling caught the world off guard.



Epidemiologist Prof. Salim Abdool Karim is internationally recognised for his significant contributions to research on HIV treatment and prevention *Photograph: Spotlight*

On 3 February, Secretary of State, Marco Rubio, declared himself to be the new Head of USAID, giving Musk carte blanche to destroy it. That day, I was contacted by journalists from *The New York Times* and from the prestigious magazine *Science* for information on the impact of US funding cuts on our HIV research.

On 7 February, *The New York Times* front page headline, *"Clinical Trials Left in Lurch By Aid Freeze"* informed the world of the impact of the US funding cuts on AIDS research in Africa. It described in graphic detail the impact of the funding cuts on research Dr Leila Mansoor and Dr Disebo Potloane of CAPRISA were undertaking, in partnership with world-leading US scientist Dr Sharon Hillier, in developing new HIV prevention technologies for women.

Exactly a month after the initial 90-day 'STOP WORK' order, we were notified that this US Government-funded project had been officially terminated for good. Several other large US-funded projects in South Africa, such as an HIV-vaccine development project led by Prof. Glenda Gray, also received termination notices.

While the US Government is perfectly entitled – as it sees fit – to stop funding for any of its projects, the deliberate disruptiveness of its implementation was sadly designed to be cruel.

Disownment of science

The Trump administration effectively dislocated the highly effective partnerships forged by the US and South African scientific communities over the past three decades. It was not simply a withdrawal of funding, but the disownment of science that rocked these research collaborations. A devaluing of science and an era of disinformation set in.

False information from the Trump administration is now rife, from debunked theories regarding autism from vaccines to the supposed dangers of paracetamol during pregnancy. This is a threat to the decades of progress made in the AIDS pandemic. Science, in its search for the truth, is under attack, as disinformation-based policies become official.

No time to wallow

Following the initial shock, we realised that we had zero time to wallow in this grief of sorts. CAPRISA went to work mobilising our own resources, reaching out to participants in terminated studies to offer them medical and emotional support. In March and April, our scientists routinely worked late into the night on new grant applications to research funders besides the US Government. That hard work is now beginning to bear fruit as new grants begin to fill the gaps in our research funding.

These unprecedented disruptive funding cuts have been a stark reminder to never take donor funding for granted. And certainly, never to be as heavily reliant on a single donor again. While overseas development aid is intended to be altruistic, it has often come with strings attached. Those strings were a rude awakening in 2025 and left several governments and non-governmental organisations, who were dependent on US foreign aid, in the lurch.

Scientific breakthroughs in HIV, including those by South Africa's many highly accomplished AIDS researchers, have had widespread global impact, benefitting vulnerable groups from all walks of life. Ironically, the funding cuts come at a time when even greater resources are needed for research to successfully navigate the 'last mile' on the way to the United Nations (UN) sustainable development goal of ending AIDS by 2030.

As this year's World AIDS Day theme *Overcoming disruption, transforming the AIDS response* reminds us, this is the time to forge ahead on a path that transforms the response to one that is more affordable, sustainable, and independent. As African scientists, we have already begun to take bold steps on the path to greater independence, thereby shifting our focus away from the disruption towards charting a determined path to a world without AIDS.

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Note: the views expressed in this article are not necessarily shared by the editors of ***Occupational Health Southern Africa****, nor* ***Spotlight****.*

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NCMMA's annual SHE Day promotes 'zero mindset' safety culture in Northern Cape mines

On 2 October 2025, the Northern Cape Mine Managers Association (NCMMA) held its annual Safety, Health, and Environment (SHE) Day. The one-day event brings together the Northern Cape mining community, to showcase expertise and industry best practices relating to safety.

Through a series of friendly competitions, the SHE Day encourages mutual learning and collaboration amongst Association members in fields relating firefighting, first aid, environmental care, safety regulations and overall emergency preparedness.

Organised by the 2025 Association Chair, Kumba Iron Ore (Sishen Mine), the event saw representatives from 24 regional mines participate in this year's instalment, with the Principal Inspector of Mines for the Northern Cape in attendance, alongside other stakeholders from the Department of Mineral and Petroleum Resources (DMPR).

Participating teams that excelled in their respective competition categories were officially recognised during a prize-giving ceremony.

"The Northern Cape Mine Managers Association is an important collaboration platform that perpetuates unity amongst mining companies in the region", says Ntokozo Khanyile: SHEPS & Contractor Management Manager at Kumba Iron Ore.

"The NCMMA SHE Day is an impactful initiative which aligns with the Anglo American 'Zero Mindset' policy, which stipulates that everybody, everywhere should go home safe at the end of their working day. It also provides us with the opportunity to demonstrate to the general public the level of commitment mining companies have towards safety."

"Beyond that, the SHE Day is a great occasion to raise awareness around sensitive topics such as gender-based violence (GBV). Through Kumba's Women in Mining structure, we were enabled to demonstrate support towards women facing challenges within the sector, and embody our purpose of re-imagining mining to improve people's lives."



Kumba Iron Ore General Managers handing over awards at the NCMMA SHE DAY prize-giving ceremony, left to right: Retief Botha (Kolomela Mine General Manager), Andre Roux (Kumba Iron Ore Senior General Manager), Tebogo Mushi (Sishen Mine General Manager)
Photograph: courtesy of Melangini Pillay

Dipalesa Mokoboto

MBChB (UKZN); Master of Philosophy in Medical Law and Ethics (UP); Diploma in Occupational Health and Medicine (DOH &M) (UP); Advanced Health Management (Yale University (FPD Linked)

In December 2025, Dr Dipalesa Mokoboto was promoted to the position of Chief Director in Occupational Health in the Department of Mineral and Petroleum Resources. In this new role, she will be heading and overseeing occupational health in the Mine Health and Safety Inspectorate (MHSI), which is responsible for regulating health and safety in the mining industry. Dipalesa, fondly known as Dips, has been in the occupational health space for more than 20 years. During her clinical years, she worked as a registrar in internal medicine at George Mukhari Academic Hospital, which was a prerequisite for specialising in dermatology, and worked in the pulmonology, diabetes, renal, hypertension, and HIV clinics. She assisted with HIV research and tutored 4th and 5th year medical and dental students. There were only a few spaces available for dermatology registrarship so, while waiting for an opening, Dipalesa registered for a Postgraduate Diploma in Occupational Health and Medicine at the University of Pretoria in 2000.



Dr Dipalesa Mokoboto
Photograph: Dr Dipalesa Mokoboto

Fortunately – or unfortunately – Dipalesa became hooked on occupational health, and continued in that space by working as a *locum tenens* for several companies that required the services of an occupational medicine practitioner (OMP). She was permanently employed as an OMP by AngloGold Ashanti in Klerksdorp, ensuring that miners were fit for their occupations. That was not an easy task, as one had to balance several factors (although many people thought otherwise). Most mineworkers are trained only in specific skills and the possibility of losing their jobs was always at the core of decisions made by the OMP. It was, thus, imperative to ensure that the decision made about the fitness status of employees was fair and justified.

The Department of Mineral Resources recruited Dr Mokoboto as a Director in the policy unit in 2006, where she was responsible for identifying legislative gaps and making recommendations for drafting the necessary legislation required by the MHSI. After a year in the position, the Department decided that Dipalesa would be well placed as a Medical Inspector, as she was a medical doctor with postgraduate qualifications in occupational health and experience in the mining industry.

Dr Mokoboto was then legally appointed as the Medical Inspector of Mines, in line with section 49(1)(b) of the Mine Health and Safety Act (MHSA). During her tenure, she had the opportunity to assist mineworkers who were unfairly declared unfit for their occupations. This was possible through section 20 of the MHSA, which affords mineworkers the right to appeal the OMP's decision regarding their 'unfitness' status. As the Medical Inspector, she investigated all section 20 medical disputes by the mineworkers and made a final ruling on their fitness status. Essentially, she acted as an ombudsman on matters related to the fitness to work of employees. This proved to be challenging, albeit satisfying, especially when the worker could retain their job.

The MHSA encourages tripartism, and Dipalesa found herself representing the State in several committees of the Mine Health and Safety Council (MHSC). She chaired and served on the Mining Occupational Health Advisory Committee (MOHAC), and the Mining Industry TB and HIV Advisory Committee (MITHAC). She also serves on the MHSC Board and the *Occupational Health Southern Africa* Editorial Board. She was appointed by the Director General (DG) to represent the State on the Tshiamiso Trust Advisory Committee, as she had been assisting the Department with queries related to compensation matters.

Dr Mokoboto has contributed to occupational health through many avenues. She was the first government official appointed as President of the Mine Medical Professionals Association (MMPA), and has served as a guest lecturer for Postgraduate Diploma in Occupational Health (PG DOH) students at the University of Pretoria and the University of the Witwatersrand.

As a MOHAC and MITHAC committee member, she has successfully contributed to drafting legislation for the mining industry on matters related to occupational medicine, TB, and HIV – being the lead person on guidelines related to fitness to work and medical incapacity. She has also collaborated with the National Institute for Occupational Health (NIOH) and the World Bank to estimate the prevalence of HIV in the mining industry. The recommendations from the collaboration resulted in mines reporting TB and HIV data to the Department, which they continue to do to date. The data received are key in determining trends and legislative gaps.

As the Medical Inspector of Mines, Dipalesa was tasked with developing regulations on the reporting of occupational diseases by the mines to the Department. The Medical Inspector developed a reporting form – the Health Incident Reporting (HIR) form – which mines have used to report occupational diseases ever since. The regulations drafted by the Medical Inspector were promulgated to guide the industry in the reporting of occupational diseases.

Being a medical person dealing with legislation led to an interest in medical law, which resulted in a Master of Philosophy in the field of Medical Law and Ethics from the University of Pretoria in 2019, and a dissertation on 'The impact of dual loyalty on health care practitioners' decisions', focusing on the mining industry, and involving OMPs. The occupational health space has been fulfilling for Dipalesa, and she has completely forgotten that her initial interest was in dermatology.

Dipalesa prefers to work under the radar and, as a result, people who don't know her are surprised when they do meet her, as they expect a huge person, and not the petite one that she is. Dynamite does come in small packages.

Occupational noise-induced hearing loss in Africa: gaps in hearing conservation, regulatory frameworks, and the role of worker unions

K Khoza-Shangase

Department of Audiology, School of Human and Community Development, University of the Witwatersrand, Johannesburg, South Africa

Correspondence
Prof. Katijah Khoza-Shangase
e-mail: Katijah.Khoza-Shangase@wits.ac.za

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ABSTRACT

Background: Occupational noise-induced hearing loss (ONIHL) is a persistent occupational health challenge in Africa. Despite regulatory frameworks and hearing conservation programmes (HCPs), implementation is inconsistent, and the role of workers' unions in advocating for hearing health remains underexplored.

Objectives: This review analyses ONIHL prevalence and risk factors, identifies gaps in HCP implementation, evaluates the role of trade unions, examines policy and regulatory frameworks, and considers emerging technological innovations relevant to ONIHL mitigation in sub-Saharan Africa.

Methods: A narrative review methodology synthesised findings from 42 studies, categorised by ONIHL prevalence, HCP effectiveness, union involvement, and policy frameworks. Thematic analysis was used to identify key trends and gaps.

Results: The prevalence of ONIHL remains high in the mining, manufacturing, and transport sectors, driven by prolonged noise exposure, poor compliance, and limited access to preventive audiology. Hearing conservation programmes are inconsistently applied, and employer accountability is weak. Trade union involvement is limited, although global benchmarks illustrate their potential in driving policy reforms. African regulatory enforcement is fragmented, while emerging technologies, such as tele-audiology, digital noise monitoring, and artificial intelligence- (AI-) driven risk assessment present opportunities for early detection and prevention.

Conclusion: Strengthening ONIHL prevention requires stricter regulatory enforcement, stronger employer accountability, and enhanced union engagement, alongside investment in innovative technologies. Regional harmonisation of noise exposure regulations and standardised HCPs are critical to reduce ONIHL risks and improve worker health outcomes.

INTRODUCTION

Occupational noise-induced hearing loss (ONIHL) is a significant and largely preventable occupational health concern that affects workers' health, productivity, and quality of life across industries worldwide.[1] The World Health Organization (WHO) and the International Labour Organization (ILO) recognise ONIHL as one of the most prevalent and irreversible occupational diseases. It is entirely preventable, yet remains prevalent due to inadequate workplace safety measures, particularly in industries such as mining, manufacturing, agriculture, and transportation.[2] Despite global recognition of the problem, low- and middle-income countries (LMICs), including those in Africa, continue to struggle with the implementation of effective hearing conservation programmes (HCPs) due to multiple systemic and contextual challenges.[3]

Occupational noise-induced hearing loss is irreversible, developing gradually due to prolonged exposure to hazardous noise levels in workplaces such as mines, construction sites, manufacturing plants, and transportation hubs. Despite numerous international regulations and occupational health and safety (OHS) frameworks, ONIHL continues to be a major concern, particularly in LMICs where enforcement mechanisms of regulatory frameworks are weak, there is poor enforcement of OHS laws, and access to preventive audiological services is limited.[4-6] This enforcement is crucial because Africa's socio-economic landscape is marked by rapid industrialisation, increased mechanisation, and a growing labour force in noisy occupational settings.[4] In the African context, the burden of ONIHL is exacerbated by multiple socio-economic, political, and infrastructural challenges. Many African economies are heavily reliant on industries with high occupational noise exposure, insufficient use of hearing protection devices (HPDs), and a historical disregard for workers' health concerns. In South Africa, for instance, the mining sector remains one of the primary sources of employment, yet it also has one of the highest rates of occupational diseases, including ONIHL.[7]

International research has established that HCPs, if properly implemented, can significantly reduce the prevalence of ONIHL.[8] The National Institute for Occupational Safety and Health (NIOSH) in the United States recommends a hierarchy of controls to mitigate noise exposure, including engineering and administrative controls, and the use of personal protective equipment (PPE).[9,10] However, in the African context, the adoption and success of these interventions are hindered by financial constraints, lack of technical expertise, and inadequate policy enforcement.[11] Unlike high-income countries (HICs) where ONIHL prevention is often a priority within workplace health and safety programmes, African workers face additional barriers such as limited access to healthcare, a lack of awareness of noise hazards, and socio-economic pressures that often prioritise job retention over health.[12]

Internationally, trade unions have historically played a pivotal role in shaping OHS standards. In countries with well-established OHS, including Canada, Australia, and parts of northern Europe, unions have secured legislative reforms, mandating joint health and safety committees, routine

audiometric surveillance, and enforceable HCPs.[9,13-16] These experiences serve as useful benchmarks against which African progress can be evaluated (although they were not included in this review's evidence synthesis). A major gap in Africa's hearing conservation efforts is the role of workers' unions in advocating for OHS. Historically, trade unions have played a critical role in securing workers' rights, including fair wages, advocating for safer working conditions and improved labour rights.[15] In regions like Europe and North America, labour unions have been instrumental in shaping legislative reforms that mandate HCPs, promote worker education on ONIHL, and hold employers accountable for workplace safety.[16,17] In Africa, their involvement in hearing conservation efforts is essential, given the systemic gaps in employer-driven initiatives and government enforcement. However, in contrast, African trade unions often face challenges such as political interference, employer resistance, and limited bargaining power, which undermine their ability to push for stronger OHS regulations and enforcement.[18]

Historical and international perspectives on trade union involvement in occupational health

The involvement of trade unions in occupational health has an extensive analytical tradition, dating back at least five decades.[19] In benchmark settings such as Canada, Australia, and northern Europe, unions have been central to advancing workplace protections, often spearheading campaigns for safer conditions, fair compensation, and stricter enforcement of occupational safety standards.[13,16] In these contexts, trade unions have successfully negotiated for joint health and safety committees, enforceable noise exposure limits, routine audiometric testing, and compensation frameworks that recognise occupational diseases such as ONIHL as compensable conditions.

These developments have often been underpinned by international frameworks, most notably the ILO Conventions. Convention 155 (Occupational Safety and Health) establishes the principle of employer responsibility for safe workplaces and worker participation in OHS.[20] Convention 176 (Safety and Health in Mines) specifically addresses mining, mandating noise control, protective measures, and recognition of worker representatives in health and safety structures.[21] Together, these Conventions articulate expectations for worker representation, union involvement, and employer accountability in occupational health.

As of 2024, 23 African countries had ratified Convention 155, while only nine had ratified Convention 176 on the ILO NORMLEX.[22] This uneven ratification is highly relevant, as it provides insight into the likelihood of institutionalised worker representation across different African contexts. In countries such as South Africa, Ghana, and Tanzania, which have ratified both Conventions, unions theoretically have stronger legal grounding to demand involvement in ONIHL prevention. In contrast, in non-signatory countries, union involvement in occupational health is likely to remain ad hoc and dependent on sectoral bargaining power, rather than international legal frameworks.

While this body of historical and international research is not included in the evidence synthesis of this review, it provides an essential benchmark. Situating African findings against this backdrop highlights both the opportunities and the gaps: whereas unions in benchmark countries are embedded in formal OHS structures and mechanisms that support monitoring, worker representation, and accountability, African unions face systemic barriers to achieving similar influence. This comparative perspective provides critical context for interpreting the African evidence presented later in this paper.

This review responds to a clear evidence gap: while trade unions have long been central to occupational health reforms in many high-income jurisdictions, their specific contribution to hearing conservation in sub-Saharan Africa has received limited attention. By compiling and critically synthesising literature from large-scale industries across five African countries and one African region, the review foregrounds trade unions as a distinct and actionable stakeholder in ONIHL prevention.

Despite the stated challenges, workers' unions remain a vital stakeholder in improving hearing conservation efforts across the continent. Their role can be expanded through several mechanisms: 1) policy advocacy and legal reforms where unions can lobby for stronger regulations, ensuring that employers are held accountable for implementing comprehensive HCPs, while also pushing for ONIHL to be fully recognised as a compensable occupational disease under workers' compensation laws;[17] 2) educational campaigns and worker training where unions can collaborate with audiologists and public health experts to develop training programmes on noise exposure, hearing conservation, and the correct use of PPE;[23] 3) workplace noise monitoring and enforcement where unions can ensure that workplaces comply with noise exposure limits and provide adequate and appropriate hearing protection measures, by conducting independent noise assessments and working with regulatory bodies;[24] 4) ensuring access to hearing protection and medical screening where unions can negotiate with employers to provide regular audiometric testing, ensuring early detection of hearing loss, and where they can advocate for subsidies or funding for high-quality hearing protection devices;[12] and 5) research and data collection where unions can work with universities and research institutions to gather data on ONIHL, strengthening the evidence base for policy advocacy and intervention programmes.[7]

By leveraging their collective power, unions can influence policy development, advocate for mandatory hearing screenings, ensure access to PPE, and raise awareness among workers about the risks of occupational noise exposure. There is a pressing need for African unions to adopt proactive strategies like those implemented in HICs, where trade unions collaborate with health professionals, government agencies, and international organisations to enhance workplace safety and health standards.[23]

This review is a synthesis of findings from five African countries and one region; it does not represent the continent in its entirety. It reflects the current state of the evidence base rather than a deliberate exclusion, as published research on ONIHL and the role of unions remains concentrated in certain regions, particularly South Africa and a few other industrialised economies. Importantly, several of the 'global' or 'Africa-wide' studies included in the review do draw on African data, further strengthening the contextual relevance of the evidence presented. This limitation is acknowledged, with the intention of highlighting both the progress made and the significant research gaps that remain across underrepresented African countries.

We conducted a narrative review to explore the intersection of ONIHL, HCPs, and the role of workers' unions in the African context. The specific objectives of the review were 1) to analyse the current state of occupational noise exposure and ONIHL prevalence in Africa, 2) to examine the gaps in HCPs, with a focus on regulatory, infrastructural, and socio-economic barriers, 3) to evaluate the role of workers' unions in advocating for improved hearing conservation policies and practices, and 4) to propose evidence-based recommendations for strengthening the involvement of trade unions in hearing conservation efforts.

The review contributes to the discourse on occupational health in Africa and provides a framework for policymakers, unions, and occupational health professionals to work collaboratively towards reducing the burden of ONIHL. With the expansion of Africa's labour force and increasingly mechanised industries, ensuring effective hearing conservation measures is both a public health imperative and a workers' rights issue that requires urgent attention.

METHODOLOGY

Study design

This narrative review explored the intersection of ONIHL, HCPs, and the role of workers' unions in the African context. A narrative review design was used because it enabled the synthesis of diverse evidence sources to address the broad and unevenly documented aspects of ONIHL, HCPs, and union involvement across African countries.

Literature search strategy

A structured literature search was conducted in January 2025 using PubMed, Scopus, Web of Science, Google Scholar, ScienceDirect, CINAHL, EBSCOHost, MEDLINE, ProQuest, African Journals Online (AJOL), and institutional repositories, using Levac et al.'s (2010) guidelines.[25] Search terms combined Medical Subject Headings (MeSH) and free-text keywords related to ONIHL, HCPs, occupational health policies, and workers' unions in Africa. Key search terms were combined using Boolean logic, as follows:

- ("occupational noise-induced hearing loss" OR "ONIHL")
- AND ("hearing conservation programmes" OR "hearing conservation policies")
- AND ("workers' unions" OR "trade unions") AND "occupational health"
- AND ("occupational noise exposure in Africa" OR "occupational health legislation in Africa")

Additional literature was identified through manual searches of reference lists in key publications and grey literature sources, including reports from the WHO, ILO, and African Union (AU). Importantly, the involvement of trade unions in occupational health and hearing conservation was a pre-specified analytic focus: studies were screened and extracted with particular attention to union presence, union-led interventions, worker representation mechanisms, and collective bargaining outcomes related to ONIHL.

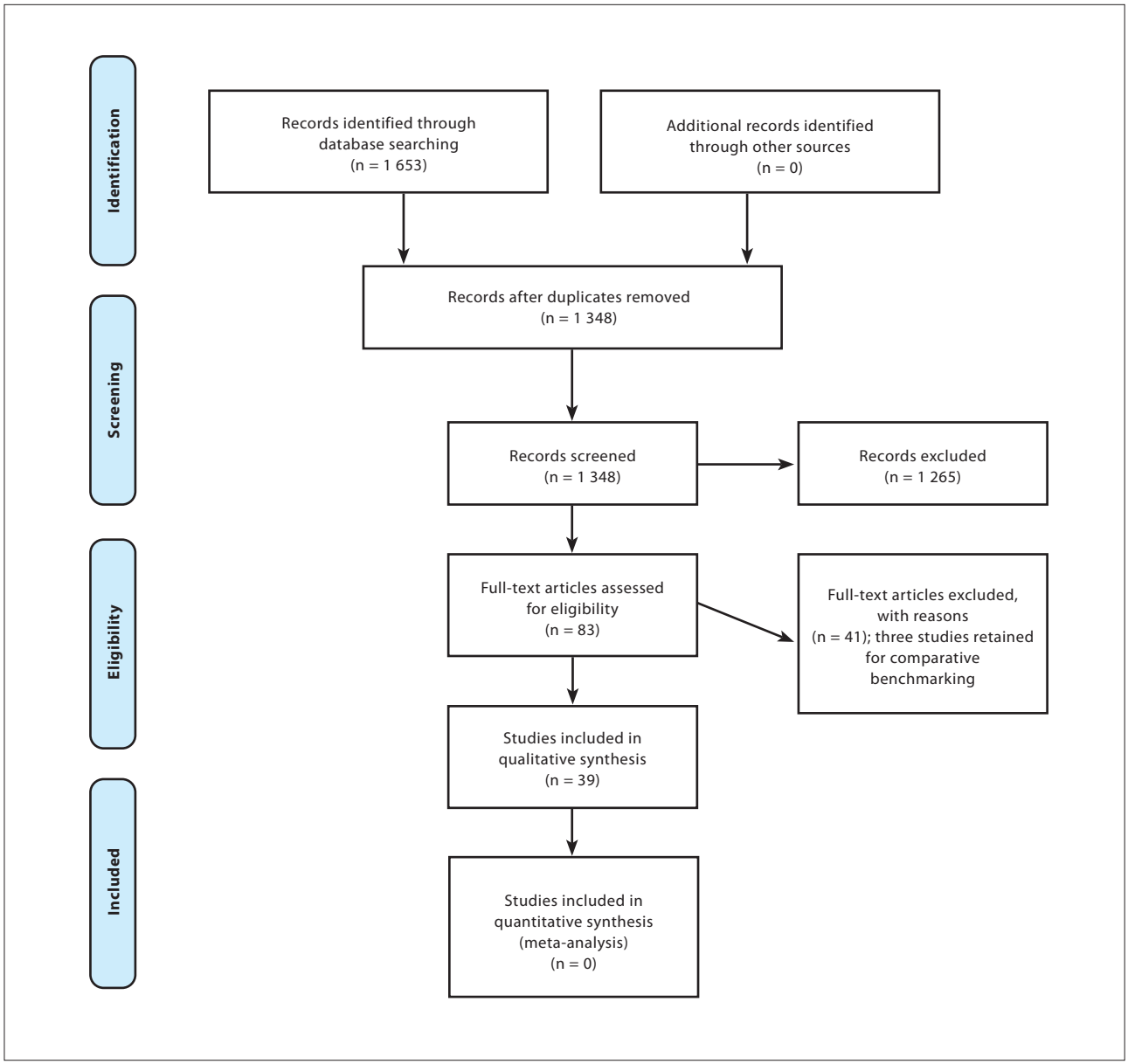


Figure 1. Data extraction process

To ensure relevance, predefined inclusion and exclusion criteria were applied. Studies published from 2000 to 2024 were considered. Included articles focused on ONIHL, hearing conservation, and the role of workers' unions within the African context. Eligible study types were empirical research (quantitative, qualitative, or mixed methods), systematic reviews, policy papers, and reports from reputable organisations. Studies were excluded if they did not address occupational hearing loss, were conducted exclusively outside Africa without providing explicit comparative insights relevant to African or LMIC contexts, or were published in languages other than English without an available translation. International studies from HICs were excluded from the dataset, but are referenced in the introduction and discussion of this paper for comparative framing, best practice benchmarks, and to contextualise African findings.

The review focused on workers in high-risk occupational sectors in Africa (e.g. mining, manufacturing, construction, transportation, and heavy industry). Where studies examined policies or union involvement at national/regional levels, the study population was defined more broadly as the African workforce in noisy industries.

Data extraction and analysis

Guided by Peters et al. (2015),[26] a standardised extraction framework was used to chart relevant studies. From an initial 1 653 identified publications, 83 were screened for relevance. Of these, 39 studies conducted in African countries were judged to be highly relevant, as they directly addressed ONIHL, hearing conservation, and/or workers' unions in Africa. The remainder comprised studies deemed moderately relevant, which provided useful insights, but did not directly address all aspects of the study (though they were used for comparative perspectives), and non-relevant studies, which did not meaningfully contribute to the research objectives. Three global studies[9,27,28] were retained as international/benchmark studies. These were not treated as African evidence, but included to frame best practices, particularly in relation to ILO Conventions, union roles, and HCP models. A further three studies of global scope[29-31] were considered directly relevant because they included African examples, or were authored by African scholars, applying global lessons to the African context. This data extraction process is depicted in the PRISMA-style diagram (Figure 1).

Thus, 42 publications comprised the final evidence base (Supplementary Table 1): 39 African studies and three benchmark international studies. A structured data extraction process was employed, capturing the following variables:

- Study characteristics (authors, year, country, study design)
- Population and industry sector studied
- ONIHL prevalence estimates (or descriptions of exposure risk) and hearing conservation gaps
- HCP components and gaps
- Role of worker unions (where reported)
- Policy and regulatory frameworks referenced

Thematic analysis was conducted to identify key patterns, trends, and gaps in the literature.[32,33] Findings were categorised according to the study's four objectives (ONIHL prevalence, HCP gaps, union involvement, and recommendations). In accordance with the approach used in this narrative review, saturation was reached when additional studies failed to yield new themes; with recurrent findings across different contexts strengthening confidence in the robustness of the analysis.[34,35]

Comparative policy mapping

A structured policy mapping exercise was conducted to compare i) international normative expectations (ILO Conventions C155 and C176), ii) benchmark practices from Canada and Australia; and iii) national legislation and observed practices reported in the African studies (focused on five countries and one region). Seven comparator elements were used, viz. 1) ratification of ILO Conventions, 2) statutory worker representation/joint OHS committees, 3) right to refuse unsafe work, 4) mandated audiometric surveillance with actionable thresholds, 5) prioritisation of engineering/administrative controls (hierarchy of control) over PPE-only approaches, 6) enforcement and inspection capacity, and 7) data access/transparency for unions and worker representatives. Alignment with these benchmarks was assessed using ILO NORMLEX profiles and national legislation, while gaps between law and practice were informed by the empirical studies (Table 1).

Quality assurance and interpretation

Although narrative reviews do not mandate formal scoring systems, rigour was enhanced by i) documenting the search and selection process, ii) triangulating peer-reviewed and grey literature, iii) noting whether studies were empirical or policy/review-based, and iv) reflexively considering the author's positionality.[33-35] This strengthened transparency and highlighted where evidence was limited or uneven (e.g. South African mining versus underrepresented sectors).

Ethical considerations

Although ethical approval was not required for this review, ethical principles were upheld through accurate citation of all sources, reliance on publicly available and peer-reviewed material, and objective presentation of findings. Efforts were made to incorporate diverse perspectives and to minimise bias in data interpretation. Any potential conflicts of interest were declared to preserve the integrity of the review.

RESULTS

Overview of included studies and descriptive profile

Forty-two publications comprised the final evidence base for this review: 39 studies conducted in African countries and three international/benchmark studies retained for comparative purposes (Supplementary Table 1). The literature directly addressing trade union roles in ONIHL in sub-Saharan Africa is limited;[35,36] nonetheless, the studies identified offer important insights into how unions – where present – influence HCP implementation, monitoring, and worker advocacy.

The African evidence spans five countries and one region (South Africa, Kenya, Ghana, Ethiopia, Sudan, and regional east Africa) and includes studies from large-scale industry and sectoral analyses. The distribution is uneven: the majority of studies (n = 23) were conducted in South Africa,[37,38,39] most often in the mining sector. The remaining studies were distributed across the other four countries and one region (Ethiopia,[40] Ghana,[41] Kenya,[42] regional east Africa,[43] and Sudan[6]), in addition to a few Africa-wide studies or multi-country analyses. While the review focused exclusively on African studies, the findings gain meaning when read against international best practice. Benchmarks from Canada, Australia, and northern Europe,[9,27,28] and ILO Conventions, highlighted the gap between African implementation and global standards.

Study designs were heterogeneous and included cross-sectional surveys and workplace epidemiological studies (e.g. Bentil, 2018,[41] Anino et al., 2010,[42] and Chendume, 2021[37]), qualitative and mixed-methods studies that focused on worker perspectives and representative roles

(e.g. Coulson, 2018,[17] Coulson et al., 2019,[38] and Mothiba et al., 2019[44]), theses and site-based risk assessments (e.g. Ntlhakana, 2021,[45] Kubheka, 2021[46]), and systematic/scoping reviews and policy analyses (e.g. Moroe et al., 2018,[47] Khoza-Shangase et al., 2020,[48] and Onyango et al., 2021[43]). Several technical or engineering-focused reviews and position pieces (e.g. Gumede et al., 2014,[24] and Madahana et al., 2020[30]) and a small number of empirical studies from non-mining sectors (e.g. Anino et al., 2010[42] – aviation/airport staff, and Kubheka, 2021[46] – power/construction) were also included.

The predominant worker populations were those in high-noise industries: mining (gold, platinum, coal), manufacturing (chemical and metal plants), construction, and transport/airport ground staff. Several studies examined company-level datasets and audiometry records (e.g. Moroe, 2018,[49] and Ntlhakana et al., 2021[50]), while others used workplace surveys, noise monitoring, and qualitative interviews with workers or safety representatives (e.g. Coulson, 2018[17]).

Thematic findings

Five key themes emerged from the data.

Theme 1: ONIHL prevalence and documented risk factors

Several empirical studies provided prevalence or threshold-shift data. For example, Anino et al. (2010)[42] reported 34.8% prevalence of ONIHL among ground-handling staff at Jomo Kenyatta International Airport (Kenya). Chendume (2021)[37] reported ONIHL prevalence exceeding 40% among selected underground miners in Rustenburg (South Africa). Bentil (2018)[41] reported > 25% of selected gold mineworkers with audiometric threshold shifts (Ghana). Other workplace datasets and predictive analyses (e.g. Ntlhakana et al., 2021[50]) documented frequent exceedances of actionable thresholds and substantial proportions of miners classified as being 'at risk' for standard threshold shifts (STSs). However, not all studies provided pooled prevalence estimates, and approaches to case definition varied across studies. Where prevalence was not reported (qualitative or policy analyses), authors consistently described significant and persistent hearing risk among workers in noisy occupations.[17,47,51]

Prolonged daily and cumulative exposure to high noise levels (common in underground mining and certain manufacturing tasks); inconsistent or incorrect use of HPDs; limited engineering noise controls; poor workplace safety culture; low worker awareness of ONIHL risks;[7] and co-exposure to ototoxic chemicals in some industries[52] emerged as key risk factors for high ONIHL prevalence. Several studies identified underreporting and deficiencies in surveillance as compounding factors.[47,53]

To situate these findings within a broader policy context, a comparative policy mapping exercise was conducted. Table 1 summarises the ratification status of ILO Conventions C155 and C176 and the presence of seven benchmark HCP elements across the five focal African countries.[7,31,48,54,55] Canada and Australia are included as high-income comparators to illustrate how ratification and statutory

Table 1. Comparative analysis: international best practice versus African context

Domain	International conventions/ best practice	African context	Key comparative insights
Legal frameworks and conventions	ILO Convention 155, Convention 176, and EU directives mandate worker representation, enforceable noise limits, and employer responsibility for preventive measures.	South Africa: Mine Health and Safety Act and Occupational Health and Safety Act.[3,12] Ethiopia: situational analysis shows fragmented frameworks.[40] Sudan: governance gaps.[6] East Africa: fragmented legislation, weak enforcement.[43]	International frameworks are binding and monitored; African legislation exists, but enforcement is weak, fragmented, or inconsistently aligned with ILO standards.
Union involvement in occupational health	Strong union roles in Canada, Australia, and northern Europe; unions negotiate collective agreements including HCPs, mandatory training, and monitoring.[14]	South Africa: active but constrained union role in mining safety.[17,18] Ghana: unions less involved in OHS.[41] Limited evidence in Kenya and Sudan.	Unions in Africa are present, but constrained by political interference and weak bargaining power, unlike robust involvement in HICs.
HCP implementation	NIOSH hierarchy of controls prioritises engineering measures and systematic surveillance (audiometry, exposure monitoring). Benchmark countries mandate comprehensive HCPs with enforcement.	South Africa: HCPs rely mainly on PPE, with weak monitoring.[7,31,48] Kenya: gaps in HPD use and noise exposure monitoring.[54] Ghana: limited worker knowledge and inconsistent use of protection.[41]	Best practice emphasises upstream controls and routine monitoring; African HCPs are fragmented, underfunded, and PPE-dependent.
Prevalence of ONIHL	In HICs, ONIHL prevalence is declining due to stronger enforcement and surveillance.[28]	South Africa: persistent ONIHL in mining sector.[48,49] Kenya: evidence among airport and metal workers.[42,54] Ghana: ONIHL risk in mining.[41] Ethiopia: poor OHS systems contribute to risk.[40]	ONIHL prevalence is declining in HICs, but remains high in African industries due to weak HCPs and poor enforcement.
Policy enforcement and inspection	Regular inspections by occupational health authorities, sanctions for non-compliance (e.g. EU/OSHA, Australian regulators).	South Africa: variable enforcement of mine health legislation.[12] Sudan: OHS governance fragmented.[6] East Africa: inconsistent enforcement mechanisms.[43]	International systems ensure compliance through inspections and sanctions; African enforcement is weak or inconsistent.
Integration of new technologies	Tele-audiology, digital exposure monitoring, predictive analytics increasingly used in surveillance and prevention.	South Africa: proposals for tele-audiology integration.[55] Limited adoption elsewhere in Africa due to funding and infrastructure challenges.	HICs adopting innovative solutions widely; African adoption remains limited, though opportunities exist.

EU: European Union, HCP: hearing conservation programme, HIC: high-income country, HPD: hearing protection device, ILO: International Labour Organization, NIOSH: National Institute for Occupational Safety and Health, OHS: occupational health and safety, ONIHL: occupational noise-induced hearing loss, OSHA: Occupational Safety and Health Administration, PPE: personal protective equipment

worker-representation rights are operationalised (examples include mandated joint health and safety committees, and clear statutory protections for worker representatives, such as rights to refuse unsafe work), which are associated with more systematic surveillance and preventive measures being in place.

Theme 2: HCPs: presence, components and documented gaps

Many large mining employers reported formal HCP elements on paper (audiometry, HPD provision, training), but practical implementation, coverage, and quality varied widely.[48,49] A number of studies documented the availability of HPDs and some periodic audiometric screening, yet noted irregular follow-up, inconsistent screening intervals, and inadequate data management.[45,56]

Evaluations of training interventions (e.g. Harmse et al., 2019[57]) showed improved operator knowledge about noise, but no immediate reduction in measured exposure, underscoring the difference between knowledge gains and exposure control. Engineering noise control measures were recommended in policy/technical reviews,[24,30] but were less commonly documented as being fully implemented in workplace studies. Several authors emphasised a continuing reliance on PPE rather than upstream engineering solutions.[7,31] Studies commonly reported limited or inconsistent audiometric surveillance (frequency and quality), data accessibility issues, and gaps in actioning threshold shifts.[49,50,53]

Theme 3: Reported roles and activities of workers' unions in ONIHL prevention

Where unions were present, several studies from South Africa and Ghana described their active involvement in workplace safety forums, advocacy for PPE provision, and training or awareness campaigns.[17,18,41,58] In site-level studies (e.g. Chendume, 2021[37]), unions were documented as advocating for PPE access and raising ONIHL concerns with management.

Limitations of union roles were described. Many qualitative studies and policy analyses reported constraints on union influence, such as employer resistance, political interference, and structural limits to bargaining power, reducing unions' abilities to enforce HCP changes.[12,17,18] Findings from several studies showed that unions often prioritise wages and job security, with ONIHL-specific advocacy being inconsistent or secondary.[44,53] Where reported, unions sometimes participated in safety committees or training programmes; however, routine union access to exposure monitoring data or audiometric records was not consistently documented in the empirical literature.[18,50]

Theme 4: Policy and regulatory frameworks reported in the included studies

The comparative policy mapping (Table 1) illustrates the ratification status of ILO Conventions and legal alignment among focal countries: South Africa has ratified both ILO C155 and C176; Ethiopia has ratified C155; Kenya, Ghana, and Sudan demonstrate variable ratification and implementation profiles.[6,40,43] The included studies describe current legislation in many jurisdictions (e.g. South Africa's Mine Health and Safety Act; national OHS Acts), but also gaps between legal provisions and enforcement.[12,53]

The empirical studies and policy reviews repeatedly documented inconsistent enforcement, limited inspectorate capacity, and infrequent workplace inspections, particularly outside the formal mining sector.[6,43,49] The included literature indicates that mining sectors generally possess more comprehensive regulatory frameworks and workplace HCP documentation (although enforcement is inconsistent), whereas the manufacturing, transport, and informal sectors are less consistently regulated or monitored.[46,51,54]

The variability in legislation, ratification, and unionisation is detailed in Table 2. There are legislative frameworks across the reviewed countries, but they vary significantly in their alignment with international conventions and in the strength of unionisation. As stated, South Africa and Ghana have ratified both ILO C155 and C176 and have well-developed OHS legislation, yet enforcement remains inconsistent. In contrast, Ethiopia and Kenya have not ratified ILO C176, limiting protections in mining sectors. Sudan, which has ratified neither Convention, illustrates the most significant governance gaps. Unionisation also varies: South Africa and Ghana show strong mining unions, Kenya has partial coverage, with informal workers largely excluded, while Ethiopia and Sudan show weaker union structures. This variation directly influences the extent to which unions can engage in ONIHL prevention and hold employers accountable.

Theme 5: Emerging innovations and reported adoption (tele-audiology, predictive analytics, and engineering solutions)

Several papers and articles identified tele-audiology, predictive analytics (machine learning), and digital noise monitoring as promising approaches. For example, Khoza-Shangase and Moroe (2020[a] and 2020[b])[3,59] and Ntlhakana and Khoza-Shangase (2022)[60] presented tele-audiology and machine learning models as potential adjuncts to HCPs; Madahana et al. (2020)[30] and Gumede et al. (2014)[24] reviewed engineering noise-control strategies applicable to mining.

The empirical evidence indicates limited real-world adoption of these technologies in sub-Saharan African workplaces. Most references to tele-audiology or artificial intelligence (AI) appear as proposed solutions, pilot descriptions, or methodological papers rather than widespread, routine implementation.[3,30,59,60] There is little evidence in the literature of unions' active involvement in AI or tele-audiology initiatives; such engagement is described mainly as a potential future role.[58,60]

Summary of descriptive results

- *Geographic and sectoral concentration:* The evidence is concentrated in South African mining studies, with fewer empirical studies from other African countries and limited coverage of informal sectors (Supplementary Table 1).
- *Prevalence and exposure evidence:* Measured ONIHL and STS occurrences are documented in multiple workplace studies (e.g. Anino et al., 2010,[42] Bentil, 2018,[41] Chendume, 2021,[37] and Ntlhakana et al., 2021[50]), with mining and heavy industry documenting the highest burdens. However, heterogeneity in case definitions, screening intervals, and reporting practices preclude a single pooled prevalence estimate from these studies.
- *HCP implementation:* HCP components (audiometry, HPDs, training) are variably present, on paper, in many large employers, but implementation gaps, inconsistent surveillance, and overreliance on PPE are recurrently documented.[7,45,49]
- *Role of unions:* Where unions exist and are active (notably in parts of South Africa and some Ghanaian mining contexts), they participate in training, advocacy, and PPE campaigns; however, the literature documents constraints on unions' capacities to effect sustained HCP improvements.[17,18,41]
- *Regulatory landscape:* National legislation often exists, but enforcement is inconsistent; ratification of ILO instruments varies by country and does not always translate into effective workplace protection.[6,43,53]
- *Innovations:* Tele-audiology, predictive analytics, and engineering solutions are frequently proposed or piloted, but rarely scaled in practice, according to the included studies.

Table 2. Legislation alignment and unionisation

Country	Relevant OHS legislation	ILO Convention ratification (C155/C176)	Industry focus in reviewed studies	Unionisation status	Implications for ONIHL prevention
South Africa	Mine Health and Safety Act, 1996; Occupational Health and Safety Act, 1993	C155: yes C176: yes	Mining (platinum, coal, gold)	Highly unionised (NUM, AMCU)	Strong legislative base and strong unions, but enforcement gaps weaken impact
Ghana	Factories, Offices and Shops Act, 1970; Mining Regulations under Minerals and Mining Act, 2006	C155: yes C176: yes	Mining (gold)	Unionised (GMWU)	Legislative framework exists, unions active, but limited HCP enforcement
Kenya	Occupational Safety and Health Act, 2007	C155: yes C176: no	Aviation (airport workers); informal metalwork (Jua Kali)	Formal sectors unionised, informal sector largely non-unionised	Formal sector aligns with ILO; informal sector lacks coverage
Ethiopia	Labour Proclamation (No. 1156/2019)	C155: yes C176: no	Mixed industries (general OHS review)	Union presence limited/weak	Weak enforcement despite ratification; low union density undermines worker voice
Sudan	OHS governance fragmented[6]	C155: no C176: no	General OHS governance	Weak/fragmented	No ratification, fragmented governance, weak unions → very limited ONIHL prevention role

AMCU: Association of Mineworkers and Construction Union, GMWU: Ghana Mineworkers' Union, HCP: hearing conservation programme, ILO: International Labour Organization, NUM: National Union of Mineworkers, OHS: occupational health and safety, ONIHL: occupational noise-induced hearing loss

Overall, the review provides a comprehensive picture of ONIHL prevalence, HCP implementation, union involvement, and policy frameworks across the included African studies.

What was *not* found in the evidence base

Clear gaps were identified:

- *Limited data from many African countries and informal sectors* (most empirical studies are from a small set of countries and industries)
- *Few longitudinal studies or randomised interventions* addressing HCP effectiveness in African workplaces
- *Sparse documentation of unions' routine access to exposure and audiometric data* and of union-led systematic monitoring programmes
- *Minimal evidence of scaled adoption of tele-audiology and AI-driven surveillance* in routine industry practice

DISCUSSION

The findings from the review are compared to international benchmarks (ILO Conventions and best-practice jurisdictions), the mechanisms by which unions may or may not influence HCPs are explored, and policy and research recommendations are made, in relation to the four objectives, viz.1) assessing the current state of ONIHL prevalence in Africa, 2) examining the gaps in HCPs, 3) evaluating the role of workers' unions in occupational hearing health, and 4) identifying evidence-based strategies for strengthening prevention. The findings highlight both the systemic challenges that constrain ONIHL prevention in Africa and the opportunities for unions, policymakers, and occupational health professionals to leverage existing frameworks and innovations to reduce the burden of occupational hearing loss. They reveal a consistent pattern of high ONIHL prevalence, underdeveloped and inconsistently implemented HCPs, weak union involvement, and fragmented regulatory frameworks. When contrasted with international best practice and ILO Conventions C155 and C176, these findings highlight the significant gaps between African realities and global expectations.

ONIHL prevalence: persistent and underreported

Across South Africa, Ghana, Kenya, Ethiopia, Sudan, and east Africa, ONIHL remains a leading occupational disease, particularly in the mining, construction, transport, and manufacturing sectors.[6,40,42,43,48,49,54] Prevalence estimates were rarely quantified in the studies included in this review and, instead, were described as 'high' or 'persistent', reflecting gaps in surveillance systems. This underreporting is exacerbated by the absence of longitudinal monitoring frameworks and inconsistent use of audiometric testing, unlike in HICs where ONIHL is routinely tracked through national registries.[9,28] Moreover, sub-Saharan African studies highlighted poor compliance with noise exposure limits, low use of HPDs, and co-exposure to ototoxic chemicals.[52,53] These combined risk factors amplify ONIHL burden, but remain poorly addressed in occupational health strategies.

Gaps in HCP implementation

A key finding was that HCPs in sub-Saharan Africa are largely employer driven, inconsistently applied, and under-resourced. In South Africa's mining sector, for example, while HCPs are mandated by the Mine Health and Safety Act, studies document weak enforcement, limited worker involvement, and over-reliance on PPE.[3,7,12,55] Similar trends were observed in Kenya and Ghana, where noise monitoring and worker education were sporadic and PPE compliance was inconsistent.[41,54] By contrast, benchmark jurisdictions such as Canada and Australia implement the NIOSH hierarchy of controls, prioritising engineering and administrative controls alongside systematic surveillance.[13] The reliance of African HCPs on symptomatic reporting delays interventions and leads to irreversible hearing loss, pointing to a structural gap in prevention and monitoring.[61,62]

Union involvement: potential ONIHL prevention advocacy, but underutilised

The review highlights limited and inconsistent union involvement in ONIHL prevention across sub-Saharan Africa. While South African unions, such as the National Union of Mineworkers (NUM) and the Association of

Mineworkers and Construction Union (AMCU) have occasionally advocated for improved access to PPE and worker training,[17,18,56] broader engagement in policy reforms, monitoring, and litigation remains weak. In Ghana and Kenya, unions appear less engaged in occupational hearing health advocacy when compared to other OHS advocacy.[41,54] This contrasts with Canada, Australia, and northern Europe where unions have historically spearheaded reforms mandating joint health and safety committees, routine audiometric testing, and compensation frameworks.[9,14,19] African unions are constrained by fragmented labour policies, limited bargaining power, and political interference,[4,61-64] weakening their ability to institutionalise ONIHL prevention.[65] Strengthening union engagement could provide a powerful mechanism to enforce compliance, expand worker education, and hold employers accountable.

Policy and regulatory gaps

Legislative frameworks exist in several African countries, yet enforcement is weak and uneven. South Africa and Ghana have both ratified ILO Conventions C155 and C176, providing a strong legal foundation,[22] but implementation remains inconsistent.[12,66] Ethiopia and Kenya have ratified C155 but not C176, limiting protection in mining sectors.[40,43] Sudan, which has ratified neither, illustrates the most significant governance gaps.[6] These variations in ratification and unionisation strength explain why ONIHL prevention remains fragmented across the continent. Comparative evidence suggests that ratification is necessary, but not sufficient; active enforcement through inspections, sanctions, and data transparency is essential to make policies meaningful.[13,28]

Emerging innovations: opportunities and limitations

Few African studies explored innovations such as tele-audiology, real-time noise monitoring, and predictive analytics, although promising examples exist in South Africa.[3,59,60,65] By contrast, HICs increasingly integrate these technologies into routine HCPs.[29,30] Tele-audiology and AI-driven risk prediction could be transformative in Africa, where access to audiologists and inspection resources is limited. However, union engagement with these technologies is almost non-existent, suggesting an untapped opportunity for collaborative advocacy and training initiatives.

Synthesis and implications

Together, the findings point to five interlinked priorities for action. First, there is a need for *strengthening surveillance*. National ONIHL registries must be established and routine audiometric testing mandated to quantify prevalence. Second, findings highlight the importance of *reorienting HCPs*. There must be a move from employer-driven PPE programmes toward comprehensive, worker-centred approaches that prioritise engineering and administrative controls. Third, efforts towards the empowering of unions are needed. The roles of unions in noise monitoring, joint health and safety committees, and policy advocacy must be institutionalised to replicate successes seen internationally. Fourth, there is an imperative for *aligning with ILO Conventions*. There must be ratification and meaningful implementation of Conventions C155 and C176, which can provide a stronger legal foundation for ONIHL prevention. Last, Africa must poise for *leveraging technology*. Tele-audiology, AI, and digital monitoring must be integrated into HCPs to bridge access to preventive measures, and policy and regulatory enforcement gaps.

Comparisons with international standards and best practice

Mapping the focal countries and region against ILO instruments (C155 and C176) and exemplar practices from Canada and Australia reveals an explanatory pattern: where a country has formal ratification and strong statutory mechanisms to institutionalise worker participation, there is stronger infrastructure for surveillance, data access, and enforceable HCP elements. South Africa, which has ratified both Conventions, shows the greatest alignment of legal frameworks with ILO expectations and, at least in parts of the mining sector, more formal worker representation structures. Nevertheless, enforcement and application remain variable. Countries without ratification (e.g. Ghana, parts of Kenya, Sudan) display greater legal and institutional gaps that constrain union leverage and systematic HCP implementation. These differences help explain why HCP elements (engineering controls, audiometry, actionable STS policies) are unevenly implemented across the region.

The comparative matrix highlights two policy priorities. First, adoption and domestic implementation of ILO-aligned instruments (or equivalent domestic legal protections) provide the necessary legal scaffolding for effective union participation and statutory HCP elements. Second, ratification alone is not sufficient. Practical enforcement, routine inspections, accessible exposure data, and mechanisms that guarantee worker representatives' access to information and the right to act on hazards are also required. Union empowerment strategies must combine legal advocacy (ratification/domestication), institutional capacity building (inspectorates, surveillance systems), and targeted workplace-level bargaining (joint noise-monitoring programmes, mandated audiometry, engineering-control investment).

Recommendations

Current findings highlight recommendations which indicate that strengthening ONIHL prevention in Africa requires a multifaceted strategy. First, regulatory frameworks must be aligned with international standards such as ILO Conventions C155 and C176, with ratification, followed by rigorous domestic implementation. Countries like South Africa and Ghana, where both Conventions are ratified, demonstrate that legislation alone is insufficient without systematic enforcement and inspection. Second, employer accountability must be reinforced through mandatory reporting of noise exposure data, penalties for non-compliance, and regular workplace inspections. Comparative evidence from Canada and Australia shows that statutory rights for worker representatives, such as joint health and safety committees and the right to refuse unsafe work, are critical mechanisms for ensuring compliance. Third, worker unions must be empowered to be active stakeholders in ONIHL prevention. This includes expanding their role in negotiating for engineering controls, routine audiometric surveillance, and worker training. Where unions have successfully advocated for PPE access and safety training (e.g. South Africa and Ghana), these gains should be scaled and institutionalised across sectors. Fourth, technological advancements should be integrated into HCPs. Tele-audiology, AI-driven risk prediction, and real-time digital noise exposure monitoring have shown promise, globally, and in pilot studies within South Africa. Leveraging these technologies can overcome resource and geographical barriers to early detection and prevention. Finally, interdisciplinary collaboration is essential. Audiologists, occupational health professionals, engineers, policymakers, and unions must work collectively to design and implement evidence-based programmes that reflect both African realities and international best practice. By adopting these measures, African industries can substantially reduce ONIHL prevalence, safeguard worker health, and align with global benchmarks in occupational hearing conservation.

Limitations and future directions

This review is limited by its reliance on published literature, which may bias the findings in that the informal workforce may be underrepresented. Variations in study design, reporting standards, and outcome

measures limit comparability across different contexts. The absence of longitudinal African studies further constrains understanding of the effectiveness of interventions. Future research should include primary data collection across multiple African countries, evaluate union-led interventions, and systematically map ONIHL prevalence across both formal and informal sectors.

CONCLUSION

This review highlights the persistent burden of ONIHL across multiple African industries, highlighting gaps in prevention, regulatory enforcement, and workplace implementation of HCPs. While several countries have established noise exposure laws, compliance remains inconsistent and monitoring poorly enforced. Workers' unions, historically powerful advocates for occupational health in other regions, remain underutilised in sub-Saharan Africa ONIHL prevention efforts, often constrained by fragmented legislation, limited bargaining power, and employer resistance.

By synthesising diverse evidence sources and situating African findings against international standards, the review offers a critical assessment of current challenges and opportunities for ONIHL prevention. It emphasises the need for stronger regulatory mechanisms, improved employer accountability, greater union engagement, and increased adoption of emerging technologies such as tele-audiology and predictive analytics. These insights provide a foundation for strengthening hearing conservation efforts and support the development of coordinated, evidence-based interventions to reduce ONIHL in high-risk sectors.

KEY MESSAGES

1. Occupational noise-induced hearing loss remains a persistent and preventable occupational disease across African industries, with inconsistent enforcement of noise regulations and limited adoption of comprehensive HCPs.
2. Workers' unions are underutilised in ONIHL prevention in sub-Saharan Africa, constrained by weak regulatory alignment, fragmented worker representation, and limited participation in workplace surveillance.
3. Effective ONIHL mitigation requires stronger regulatory enforcement, enhanced worker representation through unions, and greater integration of emerging strategies such as engineering noise controls, tele-audiology, digital noise monitoring, and predictive analytics into workplace health systems.

DECLARATION

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

REFERENCES

1. Kurmis AP, Apps SA. Occupationally-acquired noise-induced hearing loss: a senseless workplace hazard. Int J Occup Med Environ Health. 2007; 20(2):127-136. doi: 10.2478/v10001-007-0016-2.

2. World Health Organization, Burton J. WHO healthy workplace framework and model: background and supporting literature and practices. Geneva: WHO; 2010. Available from: https://iris.who.int/handle/10665/113144 (accessed 24 November 2025).

3. Khoza-Shangase K, Moroe N. South African hearing conservation programmes in the context of tele-audiology: a scoping review. S Afr J Commun Disord. 2020; 67(2):e1-e10. doi: 10.4102/sajcd.v67i2.670.

4. Moroe NF, Khoza-Shangase K. Hearing conservation programmes and the industrial revolutions. In: Khoza-Shangase K, Moroe NF, editors. Occupational Noise-Induced Hearing Loss: An African Perspective. Cape Town: AOSIS Books; 2022. p. 95-110. doi: 10.4102/aosis.2022.BK249.06.

5. Chanda-Kapata P. Public health and mining in East and Southern Africa: a desk review of the evidence. EQUINET Discussion paper 121. Regional Network for Equity in Health in East and Southern Africa (EQUINET). Brussels: EQUINET; April 2020. Available from: https://equinetafrica.org/sites/default/files/uploads/documents/EQ%20Diss121%20Mining%20and%20health%20April2020.pdf (accessed 24 November 2025).

6. Abdelrahim RA, Otitolaiye VO, Omer F, Abdelbasit Z. Scoping review of the occupational health and safety governance in Sudan: the story so far. Saf Health Work. 2023; 14(2): 174-184. doi: 10.1016/j.shaw.2023.03.007.

7. Kanji A, Khoza-Shangase K, Ntlhakana L. Noise-induced hearing loss: what South African mineworkers know. Int J Occup Saf Ergon. 2019; 25(2):305-310. doi: 10.1080/10803548.2017.1412122.

8. Liebenberg A, Gardner M, Nie VM, James CL, Reed S. A scoping review: identifying targeted intervention strategies for workers with occupational hearing loss. Acoust Aust. 2023; 51:407-417. doi: 10.1007/s40857-023-00302-y.

9. McBride DI. Noise-induced hearing loss and hearing conservation in mining. Occup Med (Lond). 2004; 54(5):290-296. doi: 10.1093/occmed/kqh075.

10. Nelson DI, Concha-Barrientos M, Driscoll T, Steenland K, Fingerhut M, Punnett L, et al. The global burden of selected occupational diseases and injury risks: methodology and summary. Am J Ind Med. 2005; 48(6):400-418. doi: 10.1002/ajim.20211.

11. Khoza-Shangase K. Occupational noise-induced hearing loss and preventive audiology: using contemporary evidence to achieve zero ear harm in South African mines. In: Khoza-Shangase K, Moroe NF, editors. Occupational Noise-Induced Hearing Loss: An African Perspective. Cape Town: AOSIS Books; 2022. p. 235-251. doi: 10.4102/aosis.2022.BK209.012.

12. Hermanus M, Coulson N, Pillay N. Mine Occupational Safety and Health Leading Practice Adoption System (MOSH) examined – the promise and pitfalls of this employer-led initiative to improve health and safety in South African Mines. J South Afr Inst Min Metall. 2015; 115(8):717-727. doi: 10.17159/2411-9717/2015/v115n8a8.

13. Walters D, Nichols T. Worker representation and workplace health and safety. London: Palgrave Macmillan; 2007. Available from: https://content.e-bookshelf.de/media/reading/L-399891-762b261663.pdf (accessed 24 November 2025).

14. International Labour Organization (ILO). Improving the safety and health of young workers. Geneva: ILO; 2018. Available from: https://www.ilo.org/resource/news/28-april-2018-improving-safety-and-health-young-workers (accessed 24 November 2025).

15. Mordi C, Ajonbadi HA, Adekoya OD, editors. Employee Relations and Trade Unions in Africa: A Critical Approach. London: Palgrave Macmillan; 2023. doi: 10.1007/978-3-031-26825-0.

16. Bohle P, Quinlan M. Managing occupational health and safety: a multidisciplinary approach. Melbourne: Macmillan Education; 2000. Available from: https://www.researchgate.net/publication/267512495_Managing_occupational_health_and_safety_A_multidisciplinary_approach (accessed 24 November 2024).

17. Coulson N. Risk versus benefit: should not audiologists assess this in the context of occupational noise-induced hearing loss in the mining industry? Resour Policy. 2018; 56:38-48. doi: 10.1016/j.resourpol.2018.02.007.

18. Coulson N, Christofides NJ. Worker health and safety representatives on South African mines: a compassionate voice in the face of employer dominance and health complexity. Extr Ind Soc. 2020; 7(1):161-169. doi: 10.1016/j.exis.2019.12.010.

19. Lloyd-Williams H, Walters D, Wadsworth E, Marsh K, Davies R. Worker representation and consultation on health and safety: an analysis of the findings of the European Survey of Enterprises on New and Emerging Risks (ESENER). Bilbao: European Agency for Safety and Health at Work; 2012. Available from: https://www.academia.edu/26206604/Worker_representation_and_consultation_on_health_and_safety_An_analysis_of_the_findings_of_the_European_Survey_of_Enterprises_on_New_and_Emerging_Risks_ESENER (accessed 24 November 2025).

20. International Labour Organization. C155 – Occupational Safety and Health Convention. Geneva: ILO; 1981. Available from: https://normlex.ilo.org/dyn/nrmlx_en/f?p=NORMLEXPUB:12100:0::NO::P12100_INSTRUMENT_ID:312300 (accessed 24 November 2025).
21. International Labour Organization. C176 – Safety and Health in Mines Convention. Geneva: ILO, 1995. Available from: https://normlex.ilo.org/dyn/nrmlx_en/f?p=NORMLEXPUB:12100:0::NO::P12100_INSTRUMENT_ID:312321 (accessed 24 November 2025).
22. International Labour Organization. NORMLEX – Information System on International Labour Standards; 2024. Available from: https://normlex.ilo.org/dyn/nrmlx_en/f?p=NORMLEXPUB:1:0::NO (accessed 24 November 2025).
23. Dias EC, Oliveira RP, Machado JH, Minayo-Gomez C, Perez MA, Hoefel Mda G, et al. Employment conditions and health inequities: a case study of Brazil. *Cad Saude Publica.* 2011; 27(12):2452-2460. doi: 10.1590/s0102-311x2011001200016.
24. Gumede H, Blomerus K, Coutts D, De Beer J. Strategy towards a mining industry-wide Buy-and-Maintain Quiet initiative to reduce noise induced hearing loss. J S Afr Inst Min Metall. 2014; 114(11):923-928. Available from: https://scielo.org.za/pdf/jsaimm/v114n11/10.pdf (accessed 6 December 2025).
25. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. Implementation Sci. 2010; 5:69. doi: 10.1186/1748-5908-5-69.
26. Peters M, Godfrey C, McInerney P, Soares CB, Khalil H, Parker D. Methodology for JBI scoping reviews. In: The Joanna Briggs Institute Reviewers Manual. Adelaide: Joanna Briggs Institute; 2015. p. 3-24. Available from: https://reben.com.br/revista/wp-content/uploads/2020/10/Scoping.pdf (accessed 24 November 2025).
27. Abdalla S, Apramian SS, Cantley LF, Cullen MR. Occupation and risk for injuries. In: Mock CN, Nugent R, Kobusingye O, Smith KR, editors. Injury Prevention and Environmental Health. 3rd ed. Washington (DC): The International Bank for Reconstruction and Development/The World Bank; 2017. doi: 10.1596/978-1-4648-0522-6_ch6.
28. Sekhon NK, Masterson EA, Themann CL. Prevalence of hearing loss among noise-exposed workers within the services sector, 2006–2015. Int J Audiol. 2020; 59(12):948-961. doi: 10.1080/14992027.2020.1780485.
29. Keefe AR, Demers PA, Neis B, Arrandale VH, Davies HW, Gao Z, et al. A scoping review to identify strategies that work to prevent four important occupational diseases. Am J Ind Med. 2020; 63(6):490-516. doi: 10.1002/ajim.23107.
30. Madahana M, Nyandoro O, Moroe N. Engineering noise control for mines: lessons from the world. S Afr J Commun Disord. 2020; 67(2):a684. doi: 10.4102/sajcd.v67i2.684.
31. Moroe NF, Khoza-Shangase K. Recent advances in hearing conservation programmes: a systematic review. S Afr J Commun Disord. 2020; 67(2):e1-e11. doi: 10.4102/sajcd.v67i2.675.
32. Schiller EP, Malouf DB. Research syntheses: implications for research and practice. In: Gersten R, Schiller EP, Vaughn SR, editors. Contemporary Special Education Research: Syntheses of the Knowledge Base on Critical Instructional Issues. New York: Routledge; 2000; p. 251-262.
33. Sukhera J. Narrative reviews: flexible, rigorous, and practical. J Grad Med Educ. 2022; 14(4):414-417. doi: 10.4300/JGME-D-22-00480.1.
34. Johnson JL, Adkins D, Chauvin S. A review of the quality indicators of rigor in qualitative research. Am J Pharm Educ. 2020; 84(1):7120. doi: 10.5688/ajpe7120.
35. Khoza-Shangase K. Occupational noise regulation and hearing conservation in African LMICs: a narrative policy and implementation review. Environ Dis. 2025; 10(3):69-77. doi: 10.4103/ed.ed_12_25.
36. Khoza-Shangase K. Technology-driven approaches to occupational noise-induced hearing loss management and hearing conservation programmes in Africa. Occup Health S Afr. 2025; 31(2):77-86. doi: 10.62380/ohsa.2025.31.2.4.
37. Chendume P. An assessment of noise induced hearing loss of mine workers: a case study of an active mine in Rustenburg, South Africa (Masters dissertation). Johannesburg: University of Johannesburg, South Africa; 2021. Available from: https://ujcontent.uj.ac.za/esploro/outputs/graduate/An-assessment-of-noise-induced-hearing/991115880769 (accessed 24 November 2025).
38. Coulson N, Stewart PF, Saeed S. South African mineworkers' perspectives on the right to refuse dangerous work and the constraints to worker self-regulation. J South Afr Inst Min Metall. 2019; 119(1):21-30. doi: 10.17159/2411-9717/2019/v119n1a3.
39. Coulson NM. Incentivised self-regulation and the practice of health and safety representatives on South African underground mines (Doctoral thesis). Johannesburg: University of the Witwatersrand; 2020. Available from: https://wiredspace.wits.ac.za/items/cf547788-e7fe-48c5-a85e-0bc20e0bbe92 (accessed 24 November 2025).
40. Kumie A, Amera T, Berhane K, Samet J, Hundal N, G/Michael F, et al. Occupational health and safety in Ethiopia: a review of situational analysis and needs assessment. Ethiop J Health Dev. 2016; 30(1 Spec Iss):17-27. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC5578617/pdf/nihms899327.pdf (accessed 24 November 2025).
41. Bentil RA. Occupational health and safety knowledge and practices of workers in the Anglogold Ashanti Iduapriem Gold Mine Ghana Limited, Tarkwa (Doctoral dissertation). Cape Coast: University of Cape Coast; 2018. Available from: https://ir.ucc.edu.gh/xmlui/handle/123456789/3329 (accessed 24 November 2025).
42. Anino JO, Afullo A, Otieno F. Occupational noise-induced hearing loss among workers at Jomo Kenyatta International Airport, Nairobi. East Afr Med J. 2010; 87(2):49-57. doi: 10.4314/eamj.v87i2.60599.
43. Onyango DO, Kinyua R, Mayaka AN, Kanali C. Overview and analysis of occupational noise-induced hearing loss legislation in East Africa. Eur J Appl Sciences. 2021; 9(5):356-364. doi: 10.14738/AIVP.95.11024.
44. Mothiba TM, Malema RN, Muthelo L. Perceptions about factors contributing to noise-induced hearing loss amongst mine workers at a platinum mine in Limpopo province, South Africa. Occup Health S Afr. 2019; 25(1):11-16. Available from: https://www.occhealth.co.za/_assets/articles/317/1921.pdf (accessed 24 November 2025).
45. Ntlhakana L. Occupational noise induced hearing loss in South African miners: risk assessment explored at a platinum mine in South Africa (Doctoral thesis). Johannesburg: University of the Witwatersrand; 2021. Available from: https://wiredspace.wits.ac.za/items/8884764a-d1c8-4de0-9a9d-1b2b0d5c6eb9 (accessed 24 November 2025).
46. Kubheka MG. The relationship between occupational noise exposure and noise induced hearing loss a power plant construction site in Mpumalanga, South Africa (Masters dissertation). Johannesburg: University of Johannesburg; 2021. Available from: https://ujcontent.uj.ac.za/esploro/outputs/graduate/The-relationship-between-occupational-noise-exposure/9910914507691 (accessed 24 November 2025).
47. Moroe N, Khoza-Shangase K. Management of occupational noise induced hearing loss in the mining sector in South Africa: where are the audiologists? J Occup Health. 2018; 60(5):376-382. doi: 10.1539/joh.2018-0020-OA.
48. Ntlhakana L, Nelson G, Khoza-Shangase K. Estimating miners at risk for occupational noise-induced hearing loss: a review of data from a South African platinum mine. S Afr J Commun Disord. 2020; 67(2):e1-e8. doi: 10.4102/sajcd.v67i2.677.
49. Moroe NF. Occupational noise-induced hearing loss in South African large scale mines: From policy formulation to implementation and monitoring (Doctoral thesis). Johannesburg: University of the Witwatersrand; 2018. Available from: https://wiredspace.wits.ac.za/items/5ed6ded3-21d6-4d59-96a9-d7e04a0a15f1 (accessed 24 November 2025).
50. Ntlhakana L, Nelson G, Khoza-Shangase K, Maposa I. Predicting standard threshold shifts for occupational hearing loss among miners at a large-scale platinum mine in South Africa. J South Afr Inst Min Metall. 2021; 121(8):397-404. doi: 10.17159/2411-9717/1318/2021.
51. Cronjé F, Chenga C. 10 Health issues in a mining community in South Africa. In: Falola T, Heaton MM, Philip A, Takyi BK, Chenga C, Obeng C, et al. HIV/AIDS, Illness and African Well-Being. Rochester: University of Rochester Press; 2007. p. 210-242. doi: 10.1515/9781580466882-013.
52. Pillay M. Chemicals, noise and occupational hearing health in South Africa: a mapping study. S Afr J Commun Disord. 2020; 67(2):e1-e11. doi: 10.4102/sajcd.v67i2.693.
53. Pillay M, Manning WG. A critical analysis of the current South African occupational health law and hearing loss. S Afr J Commun Disord. 2020; 67(2):a694. doi: 10.4102/sajcd.v67i2.694.

54. Kilonzo AM. Predisposing factors to noise induced hearing loss among metal workers in selected Jua Kali Sheds in Mombasa County, Kenya (Doctoral dissertation). Juja: Jomo Kenyatta University of Agriculture and Technology; 2022. Available from: http://ir.jkuat.ac.ke/handle/123456789/5889?show=full (accessed 24 November 2025).
55. Khoza-Shangase K, Moroe NF. Risk versus benefit: should not audiologists assess this in the context of occupational noise-induced hearing loss in the mining industry? S Afr J Commun Disord. 2020; 67(2):e1-e9. doi: 10.4102/sajcd.v67i2.671.
56. Ntlhakana L, Kanji A, Khoza-Shangase K. The use of hearing protection devices in South Africa: exploring the current status in a gold and a non-ferrous mine. Occup Health S Afr. 2015; 21(2):10-15. Available from: https://www.occhealth.co.za/_assets/articles/235/1590.pdf (accessed 24 November 2025).
57. Harmse JL, Engelbrecht JC, Rikhotso O. Process operators' knowledge levels about noise: effectiveness of a noise training programme at a chemical manufacturing company. Occup Health S Afr. 2019; 25(6):183-191. Available from: https://www.occhealth.co.za/_assets/articles/329/2009.pdf (accessed 24 November 2025).
58. Radebe TG. Economic cost of noise-induced hearing loss in individuals exposed to excessive occupational noise within the South African mining sector: practitioner perspective (Masters dissertation). Johannesburg: University of the Witwatersrand; 2021. Available from: https://wiredspace.wits.ac.za/items/6e0d7bc3-4859-4a35-a1fc-3719740f4694 (accessed 24 November 2025).
59. Khoza-Shangase K, Moroe N. South African hearing conservation programmes in the context of tele-audiology: a scoping review. S Afr J Commun Disord. 2020; 67(2): 670. doi: 10.4102/sajcd.v67i2.670.
60. Ntlhakana L, Khoza-Shangase K. Machine learning models: predictive tools for occupational noise-induced hearing loss in the South African mining industry. In: Khoza-Shangase K, Moroe NF, editors. Occupational Noise-Induced Hearing Loss: An African Perspective. Cape Town: AOSIS Books; 2022. p. 253-266. doi: 10.4102/aosis.2022.BK209.013.
61. Moroe NF, Khoza-Shangase K. Exploration of complexities in the management of occupational noise-induced hearing loss in the mining sector in sub-Saharan Africa. In: Khoza-Shangase K, editor. Complexities and Challenges in Preventive Audiology: An African Perspective. Cape Town: AOSIS Books; 2022. doi: 10.4102/aosis.2022.BK311.07.
62. Moroe NF, Khoza-Shangase K. Complexities with hearing conservation programmes in South African mines: applying complex interventions theory. In: Khoza-Shangase K, Moroe NF, editors. Occupational Noise-Induced Hearing Loss: An African Perspective. Cape Town: AOSIS Books; 2022. p. 125-140. doi: 10.4102/aosis.2022.BK311.08.
63. Naicker K. Noise-induced hearing loss and hearing protection: attitudes at a South African coal mine. S Afr J Commun Disord. 2024; 71(1):e1-e12. doi: 10.4102/sajcd.v71i1.966.
64. Moroe N, Khoza-Shangase K. Management of occupational noise induced hearing loss in the mining sector in South Africa: where are the audiologists? J Occup Health. 2018; 60(5):376-382. doi: 10.1539/joh.2018-0020-OA.
65. Khoza-Shangase K, Moroe NF. A call for a paradigm shift in hearing conservation programmes for the management of occupational noise-induced hearing loss in Africa. In: Khoza-Shangase K, Moroe NF, editors. Occupational Noise-Induced Hearing Loss: An African Perspective. Cape Town: AOSIS Books; 2022. p. 3-16. doi: 10.4102/aosis.2022.BK249.01.
66. Khoza-Shangase K. Confronting realities to hearing conservation programmes in South African mines. In: Khoza-Shangase K, Moroe NF, editors. Occupational Noise-Induced hearing loss: An African Perspective. Cape Town: AOSIS Books; 2022. p. 17-38. doi: 10.4102/aosis.2022.BK249.02.

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Macro-environment determinants of occupational injury and illness reporting: a comparison between low- and middle-income workers in South Africa

WF Mudenha[1], T Singh[1,2], E Musenge[3], N Naicker[1,2]

[1] Department of Environmental Health, University of Johannesburg, Doornfontein Campus, Johannesburg, South Africa
[2] National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa
[3] Division of Epidemiology and Biostatistics, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

Correspondence
Mr Wellington Farai Mudenha
e-mail: wellingtonmudenha@gmail.com

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ABSTRACT

Background: Mining, construction, and manufacturing are among the most hazardous industries, globally, with high rates of occupational injuries and illnesses. In South Africa, the Occupational Health and Safety Act and Mine Health and Safety Act require workers to report occupational incidents, but under-reporting remains widespread. Studies have largely focused on workplace-level micro-factors, with limited attention to broader macro-environment influences.

Objective: We examined whether macro-environment economic, political and legal, demographic, socio-cultural, and technological factors outside the workplace influence reporting of injuries and illnesses, and compared reporting patterns between low- and middle-income workers.

Methods: A cross-sectional sequential mixed-methods design was used. Phase 1 involved convenience sampling of 273 low- and middle-income workers in six mining, construction, and manufacturing companies in Gauteng province, South Africa who completed a structured questionnaire. Quantitative data were analysed using SPSS and Stata. Content and construct validity were established using Cronbach's alpha, exploratory, and confirmatory factor analysis. Bivariate analysis was conducted for pairs of categorical data and Pearson's Chi-square was used to assess associations between macro-environment factors and reporting. Univariate and multivariable linear regression analyses (using ordinary least squares) examined how macro-environment and other demographic independent variables influenced reporting. Statistical significance was set at 5%. In phase 2, seven qualitative interviews were held with occupational health and safety (OHS) experts, and analysed using thematic and narrative analysis, with triangulation used to enhance validity.

Results: The response rate was 70.8%. The study participants were predominantly male (88.2%), black African (87.6%), low income (63.3%), and with an education of grade 12 or below (76.9%). More than 94% expressed willingness to report incidents, influenced by employer support and system accessibility. However, macro-environment barriers affected reporting: social factors (language, racial dynamics), economic factors (fear of job loss, reduced income during recovery, reassignment to lower-paid light duty roles, denied promotions or benefits for reporting), and demographic challenges (age-related employment vulnerability). Expert interviews highlighted cultural factors, migrant worker limitations, and Zero Harm incentive schemes. Regression analyses indicated significant associations between reporting and education (post-high school), income group (middle income), industry (manufacturing), and having received OHS training.

Conclusion: Although legislative frameworks support reporting, macro-environment economic, social, and demographic barriers may undermine workers' reporting behaviour. Interventions addressing these broader contextual factors are needed.

INTRODUCTION

The occupational health and safety (OHS) of construction and manufacturing workers in South Africa is safeguarded through the Occupational Health and Safety Act No. 85 of 1993 (OHSA).[1] The OHS of mineworkers is protected by the Mine Health and Safety Act No. 29 of 1996 (MHSA).[2] Although fragmented, both the OHSA and MHSA are supported by multiple regulations.[3] Section 14 of the OHSA and section 22 of the MHSA require workers in construction, manufacturing, and mining to report injuries or illnesses contracted at work to their employers.

Workers who suffer severe occupational injuries, or are diagnosed with occupational illnesses that result in lost time at work, are eligible for compensation under the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 (COIDA).[4] Compensation in respect of certain diseases contracted by persons employed in mining and associated works is provided through the Occupational Diseases in Mines and Works Act No. 78 of 1973 (ODMWA).[5] The Compensation Fund provides compensation for disability, illness, and death resulting from occupational injuries and diseases for multiple sectors under the COIDA.[6] In terms of the COIDA, Rand Mutual Assurance Company Limited (RMA) is licensed to provide workers' compensation for the mining, iron, steel, and metal industries, while Federated Employers Mutual Assurance Company (FEM) is licenced to provide workers' compensation for the construction industry.[7,8] Compensation for eligible mineworkers under the ODMWA is administered by the Medical Bureau for Occupational Diseases (MBOD), a body under the National Department of Health (NDoH).[1]

Globally, a growing body of research suggests that employee under-reporting of workplace incidents is prevalent, and up to 50% of work-related injuries and illnesses may go unreported in industries with precarious employment conditions.[9,10] Non- or under-reporting occurs when workers or employers fail to document and/or formally report work-related incidents to the relevant authorities.[11] Under-reporting results in significant differences between national surveillance data and the true number of non-fatal occupational incidents, which prevents organisations from implementing corrective measures, leading to recurring hazards and risks of further incidents.[9,12,13]

Micro-level factors in workplaces refer to the immediate, worker- and supervisor-level determinants that shape individual decisions and behaviours related to reporting occupational injuries and illnesses.[11] These factors include peer pressure, perceptions of management support, low safety climate in workplaces, inadequate reporting procedures, limited awareness of reporting requirements, poor recording of incidents by employers, poor employer medical management processes, and employer disciplinary programmes or policies that result in fear of reprisals and discourage workers from reporting occupational incidents.[11,13-17] Research has centred around micro-level factors in workplaces that result in under-reporting of workplace incidents. Micro-level factors result in employees withholding information based on the risks that they associate with speaking up or reporting.[18]

The macro-environment comprises economic, political and legal, demographic, socio-cultural, and technological factors in society.[19] Macro-environment factors are broader external forces that influence organisational behaviour and worker outcomes, but exist beyond the immediate control of the workplace.[20,21] Little research has been conducted on the influence of the macro-environment on reporting of occupational incidents. Macro-environment factors create the context in which workplaces operate and are, therefore, capable of affecting the reporting of occupational incidents.[22]

Economic macro-environment factors comprise gross domestic product (GDP) growth, inflation, unemployment rates, economic downturns, job insecurity, and consumer spending, which directly impact market dynamics and shape demand and profitability.[23] When the economy is struggling or jobs are scarce, employees may worry about losing their jobs and choose not to report incidents to the employer to avoid being seen as a burden.[24]

Political and legal macro-environment factors include labour laws, government policies, enforcement of workers' rights, government stability, trade policies, and regulatory frameworks.[25] In countries with weak labour protections or poor enforcement, workers may feel discouraged from reporting injuries due to fear of employer retaliation or lack of legal support.[26] Compensation by external compensation bodies also falls under political and legal macro-environment factors.

Demographic factors comprise age, sex, ethnicity, urbanisation, and the effect of migration on labour markets and consumer needs.[27] Older workers, for example, may be less likely to report injuries due to a belief that pain and discomfort are a natural part of aging, or because they fear being seen as less capable.[28] Sex also plays a role, with men in physically demanding jobs sometimes avoiding reporting injuries due to societal expectations of toughness and endurance.[29]

Socio-cultural factors include cultural values, ethnicity (language, history, and customs), social stigma, lifestyle trends, and consumer behaviour, which influence product and service demand. In some cultures, there is a strong emphasis on resilience and self-reliance, leading workers to downplay injuries or avoid reporting them to avoid being seen as weak.[30]

Technological advancements outside the workplace, such as digital online and mobile reporting platforms, have made it easier for employees and employers to document and submit injury claims. However, these new employee-driven electronic reporting platforms may be hampered by low digital literacy among workers, poor internet access, and dysfunctional communication infrastructure, particularly for workers in low-income or remote areas, which may lead to under-reporting.[31,32]

According to a 2016 Bureau of Market Research (BMR) income segregation, South Africa has eight household income groups, viz. low (less than R89 000 per year: groups 1–2), middle (R89 001–R707 000 per year: groups 3–5), and high (more than R707 001: groups 6–8).[33] Generally, compared to their middle-income counterparts, low-income workers are less likely to report occupational injuries and illnesses, often due to fear of job loss, limited access to reporting mechanisms, and/or greater economic vulnerability.[34]

In this study, we aimed to ascertain associations between macro-environment factors and reporting of workplace injuries and illnesses, and compared reporting between low- and middle-income workers.

METHODS

The study was conducted in the Gauteng province of South Africa from April 2022 to August 2024. A cross-sectional sequential mixed-methods research design was applied. Quantitative data, which provided breadth and generalisability, were collected in phase 1, after which qualitative data, which offered depth and context, were collected in phase 2. Thereafter, findings from the quantitative and qualitative data sources were compared through triangulation, to identify areas of convergence and enhance the validity and reliability of the results.

Phase 1: questionnaires completed by workers

Convenience sampling was used to select nine large-scale companies (three mining, three manufacturing, and three construction companies) that employed more than 100 workers and operated in Gauteng province. However, only six companies (two companies in each industrial sector) provided consent for their employees to participate.

The study population comprised low- and middle-income workers from the six construction, mining, and manufacturing companies. The calculated sample size of 273 workers across the three sectors was based on a confidence level of 90%, 5% margin of error, and an estimated under-reporting prevalence of 50%. Fifty percent was used as there were no South African data available on under-reporting of occupational injuries and illnesses.

The number of participants was not proportionally allocated by sector or income group. Only workers belonging to the low- and middle-income groups were included in the study.[33] High-income workers were excluded because they are more likely to occupy

senior management or executive positions, where exposure to occupational hazards is substantially lower than that of low- and middle-income workers. Participants were 18 years or above old, had literacy levels adequate for reading and completing the questionnaire in one of three languages, and were included regardless of education level, sex, work experience, or technical skills.

Data collection

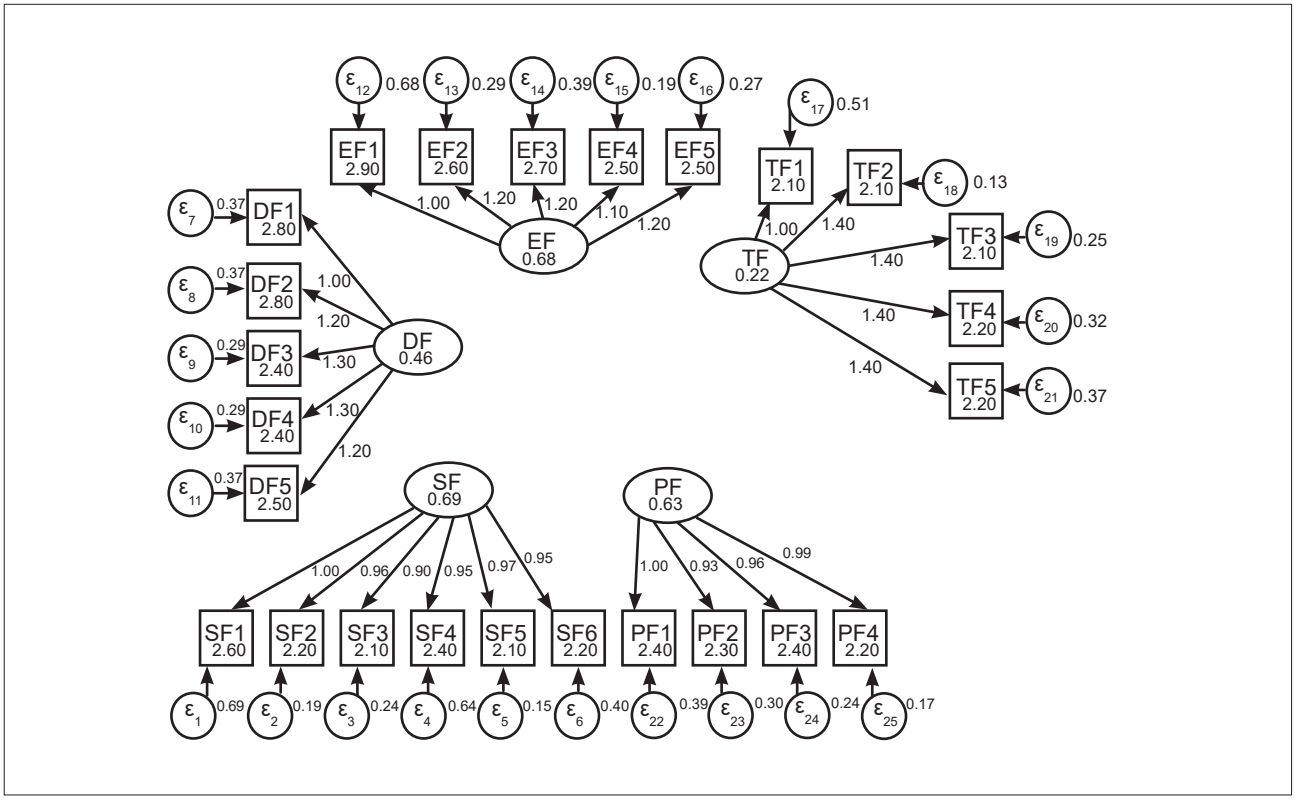
A structured, quantitative questionnaire was developed and translated from English into two of the main local languages spoken in Gauteng province, viz. isiZulu and seSotho. The questionnaire included sections on socio-demographic information, evaluation of workplace health and safety practices, and perceptions of macro-environment factors that could influence reporting. The questionnaire contained dichotomous and categorical questions, with only one open-ended question (for age). Sub-questions on macro-environment factors were measured using a Likert scale.

The self-administered questionnaire was piloted to evaluate its reliability and validity among 15 low- and five middle-income workers, conveniently selected from a small textile manufacturing plant in Johannesburg. Questionnaires were administered in English (n = 10), isiZulu (n = 5), and seSotho (n = 5). They were completed without difficulty, indicating that all items were clearly understood. Consequently, no modifications were made.

In the main study, questionnaires were placed in envelopes together with the participant information sheet and consent form. Each envelope had a sticker instructing participants not to write their names or personal identifiers on the envelope. The researcher (WFM) or safety supervisors distributed the envelopes to workers who met the selection criteria during pre-shift briefings.

Internal consistency and construct validity

Data from the questionnaire were entered into a coding framework in IBM SPSS version 29, and verified for accuracy and consistency. Internal consistency was assessed using Cronbach's alpha for economic, political, demographic, socio-cultural, and technological factors. Cronbach's alpha coefficient was > 0.8 for each factor, indicating good to excellent internal consistency (Table 1) – therefore, none of the questions within the factors were altered.



DF: demographic factor, EF: economic factor, PF: political factor, SF: social factor, TF: technological factor, ε: residual variance

Figure 1. Confirmatory factor analysis latent scores

Table 1. Reliability and validity measures for construct validity

Macro-environment factor	Factor loading range	Cronbach's α coefficient *	Correlation coefficient**
Political factors	0.862–0.902	0.900	0.996
Socio-cultural factors	0.772–0.902	0.913	0.994
Economic factors	0.789–0.909	0.924	0.995
Demographic factors	0.682–0.877	0.867	0.986
Technological factors	0.645–0.879	0.847	0.990

*internal consistency, **for EFA and CFA scores

EFA: exploratory factor analysis, CFA: confirmatory factor analysis

Construct validity for the five macro-environment factors was assessed through two complementary forms of factor analysis, viz. with exploratory (EFA) and confirmatory (CFA) factor analysis. Table 1 shows that the latent scores derived from EFA and CFA, which measured the likelihood of reporting illnesses and injuries, demonstrated strong psychometric properties, with factor loadings ranging from 0.645 to 0.909 across macro-environmental dimensions and high internal consistency (Cronbach's $\alpha = 0.847–0.924$). Correlations between EFA and CFA scores were near perfect (0.986–0.996), confirming construct validity.

Prior to performing the EFA, two statistical tests, namely the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett`s Test of Sphericity, were used to assess the suitability of the data for factor analysis. The KMO value of 0.85 exceeded the recommended threshold of 0.80, indicating that the sample was adequate and that factor analysis was appropriate.[35] Bartlett's Test of Sphericity was statistically significant ($p < 0.05$), confirming that the correlations among variables were sufficient to justify the use of factor analysis.

Figure 1 presents the CFA model, comprising five latent constructs: political factors (PF), socio-cultural factors (SF), economic factors (EF), demographic factors (DF), and technological factors (TF). Each construct was specified with its corresponding observed indicators (PF1–PF4, SF1–SF6, EF1–EF5, DF1–DF5, and TF1–TF5). Error terms were assigned to all measurement items to account for unique variance and to model measurement error, thereby improving the accuracy and reliability of the latent constructs. Factor loadings are displayed to indicate the extent to which each observed item reflects its underlying latent factor.

Having established the suitability of the data, EFA was conducted using a construct validity technique for the macro-environment questions in each section of the questionnaire. The CFA scores were highly correlated with the EFA results, with correlations exceeding 0.98 (Table 1). Following the EFA, composite variables were formulated for the macro-environment economic, political and legal, demographic, socio-cultural, and technological factors.

Statistical analysis

Statistical analyses were conducted using IBM SPSS version 29 and Stata version 19.5. Categorical variables were summarised as counts and percentages. Bivariate analyses were conducted for pairs of categorical data and Pearson's Chi-square was used to compare agreement with factors that affected reporting between low- and middle-income workers. Statistical significance was set at 5%.

For reporting of macro-environment factors associated with reporting, those for which at least 25% of participants indicated agreement on the Likert scale – regarding their influence on the reporting of injuries and illnesses – were included in the results. A 25% response threshold is widely regarded as meaningful in survey research, as it provides a sufficient proportion of participants to suggest the presence of a substantial trend within the sample.[36]

Univariable and multivariable linear regression analyses were conducted to examine factors associated with reporting occupational injuries and illnesses. Linear regression models were constructed using ordinary least squares (OLS) to estimate the model. The reporting of injuries or illnesses was the dependent variable. Single covariate (univariable) or multiple covariate (multivariable) regression analyses were conducted. Independent variables included macro-environment factors (economic, political, demographic, socio-cultural, and technological) and individual characteristics such as sex, age, race, education, income, industry, and work experience. Regression coefficients, standard errors, confidence intervals, p values, and model fit statistics were generated, with statistical significance set at 5%.

Phase 2: interviews with OHS experts

Purposive sampling was used to identify subject matter experts from organisations within the OHS data value chain who receive, process, and report (publish data) on occupational injuries and illnesses in the mining, construction, and manufacturing sectors in South Africa. Experts were selected based on their work experience (job title and level of authority) in current or former roles in OHS-related organisations. Although nine OHS subject matter experts were identified to participate in the study, data saturation was achieved after seven interviews.

The experts interviewed included two former Chief Inspectors (the Department of Employment and Labour (DEL) and the Department of Mineral Resources and Energy (DMRE)), a programme manager at the Mine Health and Safety Council (MHSC), the head of health and safety at a mining exploration company, a senior manager from an organisation that administers compensation, a labour union representative from the mining sector, and an independent OHS consultant for mining and construction.

Data collection

An in-depth interview guide was developed with questions on sector-specific OHS challenges, identification of sector-specific occupational illnesses and injuries, OHS incident reporting protocols and legislation, perceptions of macro-environment impediments to reporting, and the prevalence and implications of under-reporting.

The interviews were conducted by WFM, virtually, on Google Meet and were transcribed electronically on the online platform. Interview transcripts were read for clarity before coding was done. A research supervisor checked the codes. Qualitative data were analysed manually, using thematic content analysis and narrative analysis. Thematic analysis was conducted following Braun and Clarke's six-step framework.[37]

Triangulation of results

The main quantitative findings from phase 1 were compared with the qualitative themes that emerged from the in-depth interviews in phase 2. Similarities and differences between the two sets of data were noted.

Ethical considerations

Permission to conduct the study was obtained from the management of each of the six construction, mining, and manufacturing companies, and the subject matter experts who were interviewed. Ethical approval was obtained from the University of Johannesburg's Research Ethics Committee (Registration number: REC-1377-2022).

RESULTS

Phase 1: questionnaires completed by workers

Of the 305 questionnaires distributed, 216 were completed and returned, yielding a response rate of 70.8 % (Table 2). However, the data of only 169 were analysed as there were missing data in

47 questionnaires. There were similar proportions of participants across the sectors: construction (n = 50, 29.6%), manufacturing (n = 56, 33.1%), and mining (n = 63, 37.3%).

The characteristics of the study participants are summarised in Table 3. The mean overall age was 37.4 ± 9.2 years, ranging from 21–62 years. The mean ages of the workers from the construction, manufacturing, and mining companies were 37.5 ± 8.846, 35.2 ± 9.049, and 39.4 ± 9.212 years, respectively.

Most of the participants were male (n = 149, 88.2%), black African (n = 148, 87.6%), and had up to a high school level education (grade 12) (n = 130, 76.9%). Most participants had 6–15 years' work experience (n = 78, 46.1%) and belonged to households with low income (n = 107, 63.3%).

Training and access to health and safety legislation

Construction (n = 45, 90.0%) and manufacturing (n = 56, 100%) workers reported having access to the OHSA, while mineworkers (n = 58, 92.1%) accessed the MHSA to familiarise themselves with employer and employee health and safety responsibilities. As shown in Table 4, participants reported high levels of health and safety training as required in section 8(2)(i) of the OHSA for construction (n = 44, 88.0%) and manufacturing workers (n = 53, 94.6%), and in section 10 of the MHSA for mineworkers (n = 56, 88.9%). There were more construction (n = 6, 12.0%) and mining (n = 7, 11.1%) workers who reported not receiving training than manufacturing workers (n = 3, 5.4%).

Reporting of injuries and illnesses at work

More than 94% of workers across all three sectors were willing to report workplace injuries and illnesses because they knew the importance of reporting, were aware of who to report to, had clear reporting channels, and felt that the reporting process was simple (Table 5). Workers received training on reporting (n = 148, 87.6%) and were encouraged by their employer to report workplace injuries and illnesses (n = 162, 95.8%).

Table 2. Summary of participation in the study (N = 169)

Questionnaires	Construction		Mining		Manufacturing		Total	
	n	%	n	%	n	%	n	%
Distributed	100		125		80		305	
Returned	72	72.0	80	64.0	64	80.0	216	70.8
Excluded (incomplete)	22		17		8		47	
Analysed (complete)	50	50.0	63	50.4	56	70.0	169	55.4

Table 3. Characteristics of study participants (N = 169)

Characteristic	Construction (n = 50)		Manufacturing (n = 56)		Mining (n = 63)		Total (n = 169)		p value
	n	%	n	%	n	%	n	%	
Sex									
Male	49	98.0	50	89.3	50	79.4	149	88.2	0.009
Female	1	2.0	6	10.7	13	20.6	20	11.8	
Age (years)									
20–30	12	24.0	19	33.9	10	15.9	41	24.3	0.042
31–40	20	40.0	22	39.3	25	39.7	67	39.6	
41–50	14	28.0	11	19.6	19	30.2	44	26.0	
> 50	4	8.0	4	7.1	9	14.3	17	10.1	
Race									
Black African	47	94.0	41	73.2	60	95.2	148	87.6	<0.001
Coloured	2	4.0	3	5.4	3	4.8	8	4.7	
Indian	1	2.0	0	0.0	0	0.0	1	0.6	
White	0	0.0	12	21.4	0	0.0	12	7.1	
Education level									
≤ grade 12	44	88.0	35	62.5	51	81.0	130	76.9	0.003
> grade 12	6	12.0	21	37.5	12	19.0	39	23.1	
Service (years)									
< 1	2	4.0	8	14.3	4	6.3	14	8.3	0.311
1–5	15	30.0	13	23.2	24	38.1	52	30.8	
6–10	8	16.0	16	28.6	10	15.9	34	20.1	
11–15	16	32.0	12	21.4	16	25.4	44	26.0	
16–20	7	14.0	4	7.1	7	11.1	18	10.7	
≥ 21	2	4.0	3	5.4	2	3.2	7	4.1	
Income									
Low	39	78.0	28	50.0	40	63.5	107	63.3	0.012
Medium	11	22.0	28	50.0	23	36.5	62	36.7	

Table 4. Health and safety in construction, manufacturing, and mining (N = 169)

Variable	Construction n = 50		Manufacturing n = 56		Mining n = 63		Total	
	n	%	n	%	n	%	n	%
Access to OHSA/MHSA at work								
Yes	45	90.0	56	100.0	58	92.1	159	94.1
No	5	10.0	0	-	5	7.9	10	5.9
Employees trained on OHS								
Yes	44	88.0	53	94.6	56	88.9	153	90.5
No	6	12.0	3	5.4	7	11.1	16	10.5

OHSA: Occupational Health and Safety Act, MHSA: Mine Health and Safety Act

Table 5. Reporting of workplace injuries and illnesses (N = 169)

Statement	Strongly disagree/ disagree		Neutral		Agree/ strongly agree	
	n	%	n	%	n	%
Aware of importance of reporting to employer (RII1)	9	5.3	1	0.6	159	94.1
Employer encourages employees to report (RII2)	4	2.4	3	1.8	162	95.8
There is an appointed individual to whom to report (RII3)	7	4.1	4	2.4	158	93.5
Employees received training on how to report (RII4)	14	8.3	7	4.1	148	87.6
Willing to report to employer or safety representative (RII5)	5	3.0	3	1.8	161	95.3
There are clear communication channels for reporting (RII6)	8	4.7	7	4.1	154	91.1
It is easy to report to the employer (RII7)	6	3.6	9	5.3	154	91.1

RII1–7: statements related to 'reporting injuries or illnesses'

Table 6. Effects of macro-environment factors on reporting (N = 169)

Factor	Strongly disagree/ disagree		Neutral		Agree/strongly agree	
	n	%	n	%	n	%
Social factors						
Language/communication barriers with individual to report to (SF1)	112	66.3	5	3.0	52	30.8
Difference in nationality with individual to report to (SF2)	140	82.9	9	5.3	20	11.9
Difference in sex with individual to report to (SF3)	145	85.8	4	2.4	20	11.9
Difference in race with individual to report to (SF4)	120	71.0	4	2.4	45	26.7
Ethnic/cultural difference with individual to report to (SF5)	145	85.8	5	3.0	19	11.3
Potential for harassment or intimidation for reporting (SF6)	137	81.1	6	3.6	26	15.4
Demographic factors						
High unemployment among people in my job profession (DF1)	81	47.9	18	10.7	70	41.5
Difficulty in finding future employment due to advanced age (DF2)	100	59.2	13	7.7	56	33.1
Difficulty in finding future employment due to sex (DF3)	119	70.4	20	11.8	30	17.7
Difficulty in finding future employment due to race (DF4)	116	68.6	19	11.2	34	20.2
Difficulty in finding future employment due to nationality (DF5)	116	68.6	15	8.9	38	22.4
Economic factors						
Fear of job termination or layoff due to injury/illness (EF1)	79	46.7	18	10.7	72	42.6
Salary pay cut when recovering at home from injury/illness (EF2)	101	59.7	16	9.5	52	30.7
Reduced work hours or working light duty after injury/illness (EF3)	95	56.3	13	7.7	61	36.1
Demotion from current post upon return from injury/illness (EF4)	114	67.4	17	10.1	38	22.5
Denied promotions or benefits for reporting injury/illness (EF5)	108	63.9	18	10.7	43	25.4
Technological factors						
Fear of job automation or worker substitution with machines (TF1)	133	78.7	19	11.2	17	10.1
Low understanding of technology used to improve safety (TF2)	139	82.2	17	10.1	13	7.7
Fear of retraining and upskilling on technology to improve safety (TF3)	138	81.7	14	8.3	17	10.1
Low understanding of electronic platform to report injuries/illnesses (TF4)	130	77.4	20	11.9	18	10.7
Poor communication infrastructure for reporting injuries/illnesses (TF5)	132	78.1	21	12.4	16	9.5
Political factors						
Uncertainty that a reported injury/illness would be compensated (PF1)	111	65.7	21	12.4	37	21.9
Fear of blame for a reported injury/illness (PF2)	126	74.6	14	8.3	29	17.2
Complex medical tests required after an injury/illness (PF3)	122	72.2	19	11.2	28	16.6
Fear of conflict between labour union and employer for injury/illness (PF4)	130	76.9	18	10.7	21	12.5

DF: demographic factor, EF: economic factor, PF: political factor, SF: social factor, TF: technological factor

The statements in Table 5 were used to derive the reported injuries and illnesses (RII) latent scores (dependent variable), as shown in Figure 2.

Macro-environment factors that influenced reporting

Macro-environment factors that influenced the reporting of workplace injuries and illnesses are summarised in Table 6. Only those factors stated by at least 25% of participants were considered.

Social, demographic, and economic factors

Fifty-two participants (30.8%) stated that language or communication were barriers to reporting. Racial differences with the reporting authority were also identified as a barrier (n = 45, 26.7%). High unemployment levels among workers competing for jobs in the same profession (n = 70, 41.5%) and age-related difficulty in finding future employment after losing a job following an occupational injury or illness (n = 56, 33.1%) were factors that could affect reporting among some workers. Fear of job termination or layoff (n = 72, 42.6%), reduced work hours or working light duty (n = 61, 36.1%), salary pay cuts while recovering at home after an occupational injury or illness (n = 52, 30.7%), and denied promotions or benefits for reporting an injury or illness (n = 43, 25.4%) were economic factors that affected reporting. Technological and political macro-environment factors (all < 25%) were not identified by workers as affecting reporting of occupational injuries and illnesses to employers.

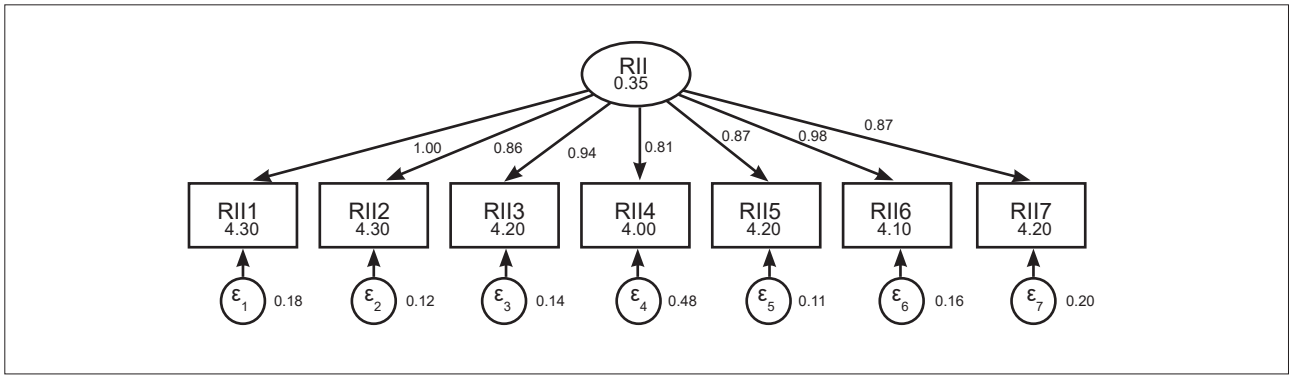


Figure 2. Confirmatory factor analysis for reported injuries and illnesses scores

RII: reporting injuries or illnesses, ε: residual variance

Table 7. Factors affecting reporting of injuries and illnesses in low- and middle-income workers (N = 169)

Factors	Response	Low-income workers		Middle-income workers		Total		p value
		n	%	n	%	n	%	
Social factor								
Language/communication barriers	Strongly disagree/disagree	76	71.0	36	58.1	112	66.3	0.052
	Neutral	4	3.7	1	1.6	5	3.0	
	Agree/strongly agree	27	25.3	25	40.3	52	30.8	
Racial differences with reporting authority	Strongly disagree/disagree	81	75.7	39	62.9	120	71.0	0.325
	Neutral	3	2.8	1	1.6	4	2.4	
	Agree/strongly agree	23	21.5	22	35.5	45	26.7	
Demographic factor								
High unemployment in profession	Strongly disagree/disagree	47	43.9	34	54.9	81	47.9	0.092
	Neutral	15	14.0	3	4.8	18	10.7	
	Agree/strongly agree	45	42.1	25	40.3	70	41.5	
Effect of age on finding new job post injury/ illness	Strongly disagree/disagree	53	49.5	47	75.8	100	59.2	0.014
	Neutral	11	10.3	2	3.2	13	7.7	
	Agree/strongly agree	43	40.2	13	21.0	56	33.1	
Economic factor								
Fear of job termination	Strongly disagree/disagree	42	39.3	37	59.7	79	46.7	0.010
	Neutral	17	15.9	1	1.6	18	10.7	
	Agree/strongly agree	48	44.8	24	38.7	72	42.6	
Fear of salary pay cut while recovering	Strongly disagree/disagree	52	48.6	49	79.0	101	59.8	< 0.001
	Neutral	16	15.0	0	-	16	9.5	
	Agree/strongly agree	39	36.5	13	20.9	52	30.7	
Fear of reduced hours/light duty	Strongly disagree/disagree	51	47.6	44	71.0	95	56.2	0.009
	Neutral	13	12.1	0	-	13	7.7	
	Agree/Strongly agree	43	40.2	18	29.0	61	36.1	
Fear of denied promotions/benefits	Strongly disagree/disagree	58	54.2	50	80.6	108	63.9	0.008
	Neutral	13	12.1	5	8.1	18	10.7	
	Agree/strongly agree	36	33.6	7	11.3	43	25.4	

Low- and middle-income workers

A comparison of the influence of macro-environment factors on reporting between low- and middle-income workers is presented in Table 7. Significantly more low- than middle-income workers feared the effect of age on finding a new job following an injury or illness, job termination, salary loss or reduction during recovery, reduced working hours or assignment to light duty, and denial of promotions or benefits for reporting incidents.

Factors associated with reporting of injuries and illnesses

The results of the univariate and multivariable linear regression analyses to identify individual and macro-environment factors affecting the reporting of injuries or illness are presented in Table 8. Factors that were positively and significantly associated with reporting injuries and illness were education (more than high school), income group (middle income), industry (manufacturing), OHS training (having this), and macro-environment demographic factors.

Phase 2: interviews with OHS experts

Themes that emerged from the in-depth interviews were economic barriers, demographic deterrents, and socio-cultural influences.

Economic barriers

Interviewees noted that, while employers promoted Zero Harm, the goal of eliminating all workplace injuries and fatalities through safe work practices and setting of ambitious targets for employees can lead to under-reporting.[38] Employees may avoid reporting injuries to preserve their employers 'injury-free' status and secure production bonuses tied to Zero Harm metrics. Higher income workers often seek private treatment to avoid affecting bonus eligibility, and lower income workers may collude in non-reporting for similar reasons. Three interviewees emphasised that, in some cases, supervisors have covered medical costs for injured workers to prevent reporting.

> *Socio-economic conditions play a role in what people are willing to report or not report.*
>
> DMRE Chief Inspector

The fear of job termination was identified as a significant economic barrier to reporting workplace injuries and illnesses. Participants emphasised that South Africa's challenging economic conditions, which were worsened by the coronavirus disease-2019 (COVID-19) pandemic, have intensified job insecurity among workers.

> *Over the last decade we have seen many mergers and acquisitions occurring in mining and this has resulted in many workers losing their jobs.*
>
> Head of Health and Safety, mining

Participants stated that the industrial action (strikes) by labour unions for improved wages highlights the tough economic environment affecting workers, which may affect reporting injuries and illnesses at work.

Table 8. Macro-environment and other factors associated with illnesses (N = 169)

	Unadjusted analysis (univariate)				Adjusted analysis (multivariable)			
	β coefficient	SE	95% CIs	p value	β coefficient	SE	95% CIs	p value
Individual factors								
Age	0.001	0.005	-0.008–0.011	0.786	0.011	0.007	-0.003–0.025	0.112
Sex								
Male	Reference							
Female	-0.256	0.136	-0.524–0.012	0.061	-0.261	0.139	-0.536–0.015	0.063
Race								
Black African	Reference							
Coloured	0.174	0.205	-0.231–0.578	0.399	-0.014	0.192	-0.394–0.365	0.940
Indian	0.856	0.567	-0.263–1.975	0.133	0.883	0.538	-0.181–1.948	0.103
White	0.423	0.170	0.088–0.758	0.014	-0.107	0.201	-0.505–0.291	0.595
Education								
≤ grade 12	Reference							
> grade 12	0.431	0.232	-0.027–0.890	0.065	0.608	0.252	0.111–1.106	0.017
Income								
Low	Reference							
Middle	0.486	0.176	0.139–0.833	0.006	0.377	0.182	0.017–0.738	0.040
Industry								
Construction	Reference							
Manufacturing	0.440	0.106	0.230–0.651	< 0.001	0.528	0.126	0.278–0.778	0.000
Mining	0.108	0.104	-0.097–0.312	0.300	0.059	0.110	-0.158–0.276	0.593
Experience (years)								
Other	Reference							
1–5	0.295	0.173	-0.047–0.637	0.090	0.184	0.186	-0.185–0.552	0.326
Access – OHS laws								
No	Reference							
Yes	0.208	0.187	-0.162–0.577	0.269	-0.100	0.202	-0.499–0.300	0.623
OHS training								
No	Reference							
Yes	0.342	0.149	0.048–0.636	0.023	0.418	0.176	0.071–0.766	0.019
Macro-environment factors								
Social	-0.074		-0.183–0.035	0.183	-0.053		-0.191–0.085	0.448
Demographic	0.011		-0.125–0.146	0.875	0.215		0.033–0.397	0.021
Economic	-0.055		-0.165–0.055	0.326	0.021		-0.148–0.191	0.804
Technological	-0.271		-0.464–-0.078	0.006	-0.237		-0.484–0.010	0.060
Political	-0.077		-0.192–0.037	0.185	0.032		-0.128–0.191	0.696

CI: confidence interval, SE: standard error

> *Nowadays there is a strike by almost every union to improve workers remuneration, but those who are employed are aware of how tough it is out there and will do almost anything to keep their jobs.*
>
> Manager, MHSC

Lack of income while recovering from an injury was noted as an economic barrier to reporting.

> *Many contractors hire casual labour waiting desperately for jobs outside construction sites. They don't provide them with reporting structures, don't keep records of casual workers and payoff injured casual workers to disappear.*
>
> OHS consultant, mining and construction

Sick or injured casual workers who do not report for work lose income because employers hire readily available new replacements outside construction sites. Interviewees in the construction industry also stated that many casual workers are contracted to work only for the day. They do not have contracts and can be dismissed if they are injured at work or for reporting injuries. Employers do not follow up to check on sick or injured casual workers.

The assignment of light duty work was identified as a factor contributing to under-reporting of injuries and illnesses, particularly in the mining sector.

> *Mineworkers often avoid disclosing injuries or illnesses to prevent being reassigned to non-production areas, as such reassignments result in the loss of production bonuses which are an essential supplement to the income used to support their families.*
>
> Manager, MHSC

This concern extends to pregnant workers who may choose not to disclose their pregnancies despite potential health risks to their unborn children, to avoid reassignment. Similarly, nursing mothers returning from maternity leave expressed dissatisfaction with light duty placements, due to the associated financial strain caused by the loss of performance incentives.

Demographic factors

Interviewees stated that many undocumented migrant workers have limited employment options, which is a deterrent to reporting. Many from Malawi, Mozambique, Zimbabwe, Lesotho, and other countries are not in a position to exercise their right to refuse unsafe work.

> *It is common for undocumented migrant workers working for sub-contractors in mining and construction to be moved by their employers to other sites in order to prevent a principal contractor or client noticing injuries and probing for answers.*
>
> Chief Inspector, DEL

Interviewees indicated that, in some instances, injured undocumented migrant workers were released from employment by some abusive employers without legal recourse. Reporting injuries and illnesses is, therefore, difficult for undocumented migrant workers.

The high unemployment rate in South Africa was identified as a potential deterrent to reporting. Interviewees stated that high unemployment levels in construction, mining, and manufacturing have emanated from company closures, widespread retrenchments, and other factors. This results in competition for limited jobs and, consequently, encourages self-preservation among employees who fear reporting injuries and illness if it risks losing their jobs. Interviewees argued that high unemployment is more likely to affect reporting by low-income than higher-income workers, who are often skilled and have transferable skills.

Socio-cultural influences

Mining sector experts stated that language is not a factor that affects reporting.

> *Mineworkers across South Africa communicate using Fanagalo – a pidgin language developed during the colonial era, which is understood by local and migrant workers from Mozambique, Lesotho, Swaziland, Zimbabwe, Malawi, etc.*

However, interviewees stated that language differences between workers and supervisors may affect reporting injuries and illnesses in construction and manufacturing, especially with the proliferation of Chinese contractors in South Africa.

> *Miscommunication manifests wherever interpreters are required to issue OHS instructions.*

Interviewees stated that cultural norms between employees significantly influenced the reporting of injuries and illnesses, particularly among mineworkers. One interviewee highlighted that:

> *Culturally, men of African origin are expected to be tough, and therefore masculinity may inhibit reporting what the worker considers to be 'minor OHS ssues' to employers or supervisors.*

All interviewees indicated that racial differences should not ordinarily influence reporting. However, language barriers have a major effect when tied to racism, on account of racial differences. Other participants observed that older black, coloured, or Indian workers in the construction industry are less likely than white workers to report injuries, illnesses, or health and safety concerns. This reluctance was attributed to a history of suppression and conditioning to silence during the apartheid era. In contrast, younger construction workers were described as more proactive in safety matters, often taking on roles as health and safety representatives, due to their comfort in voicing concerns and advocating for workplace safety. Interviewees stated that women may also take long to report, but there is no evidence that they under-report more than men across the mining, manufacturing, and construction sectors.

Triangulation of questionnaire and interview results

Triangulation of qualitative and quantitative findings, summarised in Table 9, revealed alignment across several barriers to reporting workplace injuries and illnesses. Both questionnaire and interview data highlighted language and communication barriers, racial differences with reporting authorities, age-related concerns about job prospects post-injury, and high unemployment in the same profession as key social and demographic factors influencing reporting behaviour. With regard to economic factors, there was strong agreement between data sources about the influence of fear of job termination, salary reductions during recovery, and assignment to light duty work – all of which were consistently reported as deterrents to injury and illness reporting.

Nevertheless, some discrepancies emerged. Denied promotions or benefits for reporting were noted in the workers' questionnaires, but were not raised in the interviews. Cultural norms among workers surfaced in the interviews, but were not covered in the questionnaire. Zero Harm incentive bonuses, where workers may under-report injuries to avoid jeopardising team rewards, were identified in the interviews, suggesting that certain nuanced organisational practices may not be captured with the use of structured questionnaires.

DISCUSSION

Workers in high-exposure jobs across the construction, manufacturing, and mining sectors face a range of OHS risks specific to their sectors. Despite strong legislative frameworks and positive attitudes among the study participants about reporting, there is a possibility of under-reporting among workers in these sectors due to a mix of social, demographic, and economic macro-environment factors, which include language barriers, racial differences, cultural expectations, job insecurity, and financial pressures. These factors all contribute to a climate where some workers choose silence over disclosure, often at the expense of health and safety.

Section 14 of the OHSA and section 22 of the MHSA mandate that workers in construction, manufacturing, and mining report occupational injuries and illnesses. In our study, more than 94% of participants expressed their willingness to report, citing awareness of its importance, employer encouragement, training, and accessible reporting processes. Prior research also shows that high reporting rates are linked to strong OHS programmes that promote awareness of health and safety rights.[11,39] However, under-reporting remains common – globally and locally. Although most workers who participated in the study did not explicitly indicate that macro-environment conditions influenced the reporting of workplace injuries and illnesses, triangulated findings indicate that, in South Africa, specific social, demographic, and economic macro-environment factors have the potential to hinder reporting.

Social macro-environment factors

Social factors such as language, race, and cultural norms may decrease reporting of workplace injuries and illnesses. Language differences result in misunderstanding of the severity of injuries or illnesses, which often leads to under-reporting.[40,41] In contrast, subject matter experts noted that mineworkers experienced fewer language-related issues due to the use of Fanagalo, which facilitates communication among workers from diverse linguistic backgrounds, and has emerged as a practical solution to bridge communication barriers within multilingual workplaces in South Africa's deep-level mining operations.[42]

Racial differences with reporting authorities can be a barrier to reporting, particularly among middle-income workers. Race dynamics can erode trust, especially in sectors with a history of racial inequality such as the three in this study, leading to perceptions that injury reports may be ignored or undervalued.[43] Occupational health and safety experts highlighted that cultural norms – particularly expectations of toughness among African men – may discourage the disclosure of injuries to preserve masculine identity. Such cultural constructions of masculinity have been shown to inhibit reporting by framing vulnerability as a weakness.[44,45]

Demographic macro-environment factors

Low- and middle-income workers shared similar views that the high unemployment rate within their respective professions was a factor that may contribute to under-reporting of workplace injuries and illnesses. Interviewees explained that limited job opportunities, driven by South Africa's high unemployment levels, lead workers to engage in self-preservation by withholding reports of injuries or illnesses out of fear of job loss. This fear is severe in all three sectors represented in our study, which are characterised by high turnover and abundant replacement labour, and collectively shed 20 000 jobs from June 2023 to June 2024.[46] When job security is low and competition is high, the perceived risk of being replaced discourages workers from speaking up.[47]

Age could potentially influence low-income workers, with 40.2% reporting concerns about post-injury employment prospects. Subject matter experts noted that many long-serving workers in mining and manufacturing earned higher wages through tenure rather than qualifications. This awareness of potential wage loss from future employment discourages older workers from reporting, as they fear being seen as less capable or more expendable than their younger counterparts.[48] Interviewees highlighted that migrant workers often encounter adverse working conditions and

Table 9. Triangulation of findings from questionnaires and interviews

Barriers to reporting injuries and illnesses	Questionnaires	Interviews
Social		
Language/communication barriers	Yes	Yes*
Cultural norms among African workers	No	Yes
Racial differences with reporting authority	Yes	Yes
Demographic		
Effect of age on finding new job (post-injury/illness)	Yes	Yes
High unemployment in same profession	Yes	Yes
Migrant workers' limited employment options	No	Yes
Economic		
Fear of job termination	Yes	Yes
Fear of salary pay cut while recovering	Yes	Yes
Fear of reduced hours/light duty	Yes	Yes
Fear of denied promotions/benefits for reporting	Yes	No
Employee Zero Harm incentive bonuses	No	Yes

* manufacturing and construction sectors only

face challenges that inhibit reporting. These include limited employment alternatives, language barriers, lack of familiarity with reporting protocols, and fears of retaliation or deportation, which further reduce reporting among immigrant and minority ethnic workers.[49]

Prior research has shown that workers with higher levels of education are more likely to report work-related injuries and illnesses to management than those with lower educational attainment.[50,51] Workers with lower educational levels may lack awareness of their rights and the importance of reporting injuries, or they may misinterpret reporting procedures, leading to under-reporting.[52]

Economic macro-environment factors

Economic barriers to reporting such as fears of job termination, reduced wages during recovery, reassignment to lower-paid light duty roles, and denied promotions or benefits for reporting may decrease reporting, especially among low-income workers. Many of these workers are primary breadwinners with significant financial responsibilities, and they rely on stable, full-time employment for household income. Experts further linked these economic constraints to the demographic profile of the workforce in the three sectors, which is predominantly male and black African.

Reporting an injury among low-income workers is often seen as a risk, with potential consequences such as reduced shifts or dismissal. Job insecurity fosters a culture of silence, where workers feel compelled to prioritise income over health.[53] For a low-income worker, wage disruptions can have serious consequences, making the threat of reduced hours a strong deterrent to reporting.[54] As a result, many injured workers continue working despite their condition, potentially worsening their health due to insufficient financial support during recovery.[55]

Interviewees linked under-reporting to financial fears, particularly in workplaces offering Zero Harm incentive bonuses. These bonuses, while intended to promote safety, may inadvertently pressure workers to conceal injuries to preserve team-based rewards.[56,57]

Limitations

This study had several limitations that may have influenced both the robustness of the data and the generalisability of the results. Financial and time constraints, coupled with the decision to conduct the study solely within Gauteng province, restricted the scope of data collection and limited the diversity of the sample. The use of convenience sampling may have biased the findings and affected the generalisability of the dataset. Completion of the self-administered questionnaire was contingent upon literacy skills, which effectively reduced the response rate. The questionnaire was only available in English, isiZulu, and seSotho, despite the multilingual nature of the workforce across the three sectors in Gauteng; but the most commonly spoken languages were covered. These language and literacy limitations may have excluded valuable perspectives of non-participants. Finally, the finding that more than 94% of participants expressed willingness to report occupational injuries and illnesses raises the possibility of social desirability bias, which could have led to an overestimation of positive reporting behaviours. Collectively, these limitations suggest that caution should be exercised when extending the findings beyond the study context.

Recommendations

Government policy and regulatory enhancements

Strengthen enforcement and increase monitoring of employer compliance to the OHSA and the MHSA, by regulatory bodies such as the DEL, to improve reporting rates by workers to their employers. Introduce legislative protections against retaliation for workers who report injuries or illnesses, which may include mandatory reinstatement or compensation for unfair dismissal following injury reporting. Standardise compensation and recovery policies to reduce income vulnerability during recovery periods, and introduce government incentives for companies that support injured workers with full pay while they recover.

Workplace-level interventions

Develop multilingual reporting systems, training materials, and signage to improve communication in high-risk sectors. Redesign incentive structures such as Zero Harm bonuses to avoid discouraging reporting, thereby shifting focus from injury-free targets to rewarding proactive OHS behaviour. Promote inclusivity and diversity training to tackle racial and cultural barriers to reporting, and to foster trust and engagement between workers and supervisors.

Education and worker empowerment

Expand access to OHS education and awareness programmes particularly for low-income, migrant, and older workers, to improve reporting of injuries and illnesses. Strengthen the visibility and authority of health and safety representatives to protect vulnerable workers in environments where cultural or economic barriers discourage reporting.

Data collection and research

Improve national injury and illness data systems to capture under-reporting trends and disaggregate data by income level, race, age, and migration status.

CONCLUSION

Occupational health and safety legislation in South Africa provides for reporting workplace injuries or illnesses. In this study, we established that there is a willingness to report, which is driven by awareness, employer support, and accessible systems. However, there is a potential to under-report incidents, which is influenced by social, demographic, and economic factors. These include language barriers, racial differences, cultural expectations, job insecurity, and financial pressures, all of which contribute to a climate where some workers choose silence over disclosure, often at the expense of health and safety. These findings highlight the need for targeted interventions at both the policy and workplace levels. Macro-environment factors should be considered in the development of national OHS policy and workplace practices to foster safe, transparent, and inclusive workplaces in high-risk sectors.

KEY MESSAGES

1. Workers are willing to report workplace injuries and illnesses, but social, economic, and demographic barriers emanating outside workplaces may influence reporting behaviour.
2. Social macro-environment factors may influence reporting by some middle-income workers, whereas economic factors may decrease reporting by some low-income workers.
3. Migrant and older workers may under-report due to job insecurities.
4. Incentive bonus schemes such as Zero Harm bonuses are well intentioned, but may encourage under-reporting.

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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: WFM
Data acquisition: WFM
Data analysis: WFM, EM
Interpretation of the data: WFM, TS, EM, NN
Drafting of the paper: WFM
Critical revision of the paper: WFM, NN, TS, EM

REFERENCES

1. South Africa. Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).
2. South Africa. Mine Health and Safety Act, 1996 (Act No. 29 of 1996).
3. Myeni SS, Ngcobo NJ. The Profile of Occupational Health and Safety in South Africa. Pretoria: Department of Employment and Labour; 2020. Available from: https://www.labour.gov.za/DocumentCenter/Publications/Occupational%20Health%20and%20Safety/The%20Profile%20Occupational%20Health%20and%20Safety%20South%20Africa.pdf (accessed 14 December 2025).
4. South Africa. Compensation for Occupational Injuries and Diseases Act, 1993 (Act No. 130 of 1993).
5. South Africa. Occupational Diseases in Mines and Works Act, 1973 (Act No. 78 of 1973).
6. Compensation Fund (CF). Pretoria: Department of Employment and labour. Available from: https://www.labour.gov.za/About-Us/Pages/Compensation_Fund.aspx (accessed 14 December 2025).
7. Rand Mutual Assurance. Available from: https://www.randmutual.co.za/ (accessed 14 December 2025).
8. The Federated Employers Mutual Assurance Company. Available from: https://www.fem.co.za/ (accessed 14 December 2025).
9. Probst TM, Petitta L, Barbaranelli C. Comparing recall vs. recognition measures of accident under-reporting: a two-country examination. Accid Anal Prev. 2017; 106:1-9. doi:10.1016/j.aap.2017.05.006.
10. Boden LI. Capture-recapture estimates of the undercount of workplace injuries and illnesses: sensitivity analysis. Am J Ind Med. 2014; 57(10):1090-1099. doi: 10.1002/ajim.22247.
11. Probst TM, Estrada AX. Accident under-reporting among employees: testing the moderating influence of psychological safety climate and supervisor enforcement of safety practices. Accid Anal Prev. 2010; 42(5):1438-144. doi:10.1016/j.aap.2009.06.027.
12. Maseko MM. Effects of non-compliance with the Occupational Health and Safety Act (No. 85 of 1993) among the food and beverage industries in selected provinces of South Africa [dissertation]. Pretoria: University of South Africa; 2016. Available from: http://hdl.handle.net/10500/21042.
13. Burke RJ, Richardsen AM, editors. Increasing Occupational Health and Safety in Workplaces: Individual, Work and Organisational Factors. Cheltenham: Edward Elgar Publishing; 2019. doi:10.4337/9781788118095.
14. Picchio M, Van Ours JC. Temporary jobs and the severity of workplace accidents. J Safety Res. 2017; 61:41-51. doi:10.1016/j.jsr.2017.02.004.
15. Fagan KM, Hodgson MJ. Under-recording of work-related injuries and illnesses: an OSHA priority. J Safety Res. 2017; 60: 79-83. doi:10.1016/j.jsr.2016.12.002.
16. Detert J, Edmondson AC. Implicit voice theories: taken-for-granted rules of self-censorship at work. Acad Manage J. 2011; 54(3):461-488. doi:10.5465/amj.2011.61967925.
17. Zadow AJ, Dollard MF, Mclinton SS, Lawrence P, Tuckey MR. Psychosocial safety climate, emotional exhaustion, and work injuries in healthcare workplaces. Stress Health. 2017; 33(5):558-569. doi:10.1002/smi.2740.
18. Knoll M, Neves P, Schyns B, Meyer B. A multi-level approach to direct and indirect relationships between organisational voice climate, team manager openness, implicit voice theories, and silence. Appl Psychol Int Rev. 2020; 70(2):606-642. doi:10.1111/apps.12242.
19. Strzelczyk M, Chłąd M. Use of PESTEL analysis for assessing the situation of Polish transport enterprises (Part I). Zesz Nauk Politech Częst, Zarz. 2017; 27:161-168. doi:10.17512/znpcz.2017.3.2.15.
20. Kotler P, Armstrong G, Harris LC, Piercy N. Principles of Marketing. 6th European ed. Harlow: Pearson Education; 2013. Available from: https://www.pearson.com/en-us/subject-catalog/p/principles-of-marketing/P200000003981.
21. Daft RL. Organization Theory and Design. 12th ed. Boston: Cengage Learning; 2016.
22. Vojtovič S, Krajňáková E. Development of new economy human capital. Vadyba J Manag. 2014; 25(2):145-150. Available from: https://journals.indexcopernicus.com/api/file/viewByFileId/485154 (accessed 14 December 2025).
23. Hitt MA, Ireland RD, Hoskisson RE. Strategic Management: Competitiveness and Globalization: Concepts and Cases. 13th ed. Boston: Cengage Learning; 2020.
24. Quinlan M, Bohle P. Overstretched and unreciprocated commitment: reviewing research on the occupational health and safety effects of downsizing and job insecurity. Int J Health Serv. 2009; 39(1):1-44. doi:10.2190/HS.39.1.a.
25. Rothaermel FT. Strategic Management. 5th ed. New York: McGraw-Hill Education; 2021.
26. Johnstone R, Quinlan M, McNamara M. OHS inspectors and psychosocial risk factors: evidence from Australia. Saf Sci. 2011; 49(4):547-557. doi:10.1016/j.ssci.2010.09.016.
27. Kotler P, Keller KL. Marketing Management, Global Edition. 16th ed. Harlow: Pearson Education Limited; 2021.
28. Berecki-Gisolf J, Clay FJ, Collie A, McClure RJ. The impact of aging on work disability and return to work: insights from workers' compensation claim records. J Occup Environ Med. 2012; 54(3):318-327. doi:10.1097/JOM.0b013e31823fdf9d.
29. Stergiou-Kita M, Mansfield E, Sokoloff S, Colantonio A. Gender influences on return to work after mild traumatic brain injury. Arch Phys Med Rehabil. 2016; 97(2 Suppl):S40-S45. doi:10.1016/j.apmr.2015.04.008.
30. Moore A, Grime J, Campbell P, Richardson J. Troubling stoicism: sociocultural influences and applications to health and illness behaviour. Health (London). 2013; 17(2):159-173. doi:10.1177/1363459312451179.
31. Cunningham TR, Galloway-Williams N, Geller ES. Protecting the planet and its people: how do interventions to promote environmental sustainability and occupational safety and health overlap? J Safety Res. 2010; 41(5):407-416. doi:10.1016/j.jsr.2010.08.002.
32. Alam K, Imran S. The digital divide and social inclusion among refugee migrants: a case in regional Australia. Inf Technol People. 2015; 28(2):344–365. doi: 10.1108/ITP-04-2014-0083.
33. The SA consumer in brief. BMR household income segmentation 2016. Available from: https://www.salga.org.za/SALGA%20Council%20of%20Mayors%20Web/Documents/Standard%20Bank%20SALGA.pdf (accessed 15 December 2021).
34. Takala J, Hämäläinen P, Saarela KL, Yun LY, Manickam K, Jin TW, et al. Global estimates of the burden of injury and illness at work in 2012. J Occup Environ Hyg. 2014; 11(5):326-337. doi:10.1080/15459624.2013.863131.

35. Field A. Discovering statistics using SPSS. 3rd ed. London: SAGE Publications; 2009.
36. Draugalis JR, Coons SJ, Plaza CM. Best practices for survey research reports: a synopsis for authors and reviewers. Am J Pharm Educ. 2008; 72(1):11. doi:10.5688/aj720111.
37. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006; 3(2):77-101. doi:10.1191/1478088706qp063oa.
38. Crush P. The zero harm concept. IOSH Magazine; 2 March 2023. Available from: https://www.ioshmagazine.com/2023/02/27/zero-harm-concept (accessed 18 August 2024).
39. Al-Bayati AJ. impact of construction safety culture and construction safety climate on safety behavior and safety motivation. Safety. 2021; 7(2):41. doi:10.3390/safety7020041.
40. Lingard HC, Yesilyurt Z. The effect of attitudes on the occupational safety actions of Australian construction workers: the results of a field study. J Constr Res. 2003; 4(1):59-69. doi:10.1142/S1609945103000303.
41. Mattila M, Hyttinen M, Rantanen E. Effective supervisory behaviour and safety at the building site. Int J Ind Ergon. 1994; 13(2):85-93. doi: 10.1016/0169-8141(94)90075-2
42. Mesthrie R. South Africa: a sociolinguistic overview. In: Mesthrie R, editor. Language in South Africa. Cambridge: Cambridge University Press; 2002. p. 11-26.
43. Ozier EM, Taylor VJ, Murphy MC. The cognitive effects of experiencing and observing subtle racial discrimination. J Soc Issues. 2019; 75(4):1087-1115. doi: 10.1111/josi.12349
44. Ratele K. African (situated) psychologies of boys, men and masculinities and men. Psychol Soc. 2017; 54:10-28. doi: 10.17159/2309-8708/2017/n54a2.
45. Morrell R, Jewkes R, Lindegger G. Hegemonic masculinity/masculinities in South Africa: culture, power, and gender politics. Men Masculinities. 2012; 15(1):11-30. doi: 10.1177/1097184X12438001.
46. Employment rises in SA's formal non-agricultural sector during Q2:2024. Department of Statistics South Africa (Stats SA). Available from: https://www.statssa.gov.za/?p=17667 (accessed 15 December 2025).
47. Smith TD, DeJoy DM. Occupational injury in America: an analysis of risk factors using data from the General Social Survey (GSS). J Safety Res. 2012; 43(1):67-74. doi:10.1016/j.jsr.2011.12.002.
48. McGonagle AK, Fisher GG, Barnes-Farrell JL, Grosch JW. Individual and work factors related to perceived work ability and labor force outcomes. J Appl Psychol. 2015; 100(2):376–398. doi:10.1037/a0037974.
49. Moyce SC, Schenker M. Migrant workers and their occupational health and safety. Annu Rev Public Health. 2018; 39:351-365. doi: 10.1146/annurev-publhealth-040617-013714.
50. Kyung M, Lee SJ, Dancu C, Hong O. Underreporting of workers' injuries or illnesses and contributing factors: a systematic review. BMC Public Health. 2023; 23(1):558. doi: 10.1186/s12889-023-15487-0.
51. Lee SJ, Kyung M, Leung C, Hong O. Gender differences in experience and reporting of acute symptoms among cleaning staff. Am J Ind Med. 2021; 64(6):528-539. doi: 10.1002/ajim.23246.
52. Beus JM, McCord MA, Zohar D. Workplace safety: a review and research synthesis. Organ Psychol Rev. 2016; 6(4):352-381. doi:10.1177/2041386615626243.
53. Rauscher KJ, Myers DJ. Occupational health literacy and work-related injury among US adolescents. Int J Inj Control Saf Promot. 2014; 21(1):81-89. doi:10.1080/17457300.2013.792288.
54. Lipscomb HJ, Schoenfisch AL, Cameron W. Non-reporting of work injuries and aspects of jobsite safety climate and behavioral-based safety elements among carpenters in Washington State. Am J Ind Med. 2015; 58(4):411-421. doi:10.1002/ajim.22425.
55. Mekonnen TH, Tefera YA, Melsew YA. Sick at work: prevalence and determinants among healthcare workers, western Ethiopia: an institution based cross-sectional study. Ann Occup Environ Med. 2018; 30:2. doi:10.1186/s40557-018-0213-4.
56. Probst TM, Jiang L, Graso M. Leader-member exchange: moderating the health and safety outcomes of job insecurity. J Safety Res. 2016; 56:47-56. doi:10.1016/j.jsr.2015.11.003.
57. Ehrlich R, Montgomery A, Akugizibwe P, Gonsalves G. Public health implications of changing patterns of recruitment into the South African mining industry, 1973–2012: a database analysis. BMC Public Health. 2018; 18(1):93. doi:10.1186/s12889 017 4640 x.

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Aspects hindering hearing conservation programme effectiveness: a narrative review

O Rikhotso[1], TJ Morodi[1], DM Masekameni[2,3]

[1] Department of Environmental Health, Tshwane University of Technology, Pretoria, South Africa
[2] Department of Development Studies, School of Social Sciences, University of South Africa, Pretoria, South Africa
[3] School of Public Health, University of the Witwatersrand, Johannesburg, South Africa

Correspondence
Dr Oscar Rikhotso
e-mail: rikhotsoo@tut.ac.za

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ABSTRACT

Background: Hearing conservation programmes (HCPs) in the manufacturing industry are widespread. However, programme implementation is yet to achieve significant reduction in hearing loss incidence.

Objective: The objective of this narrative literature review was to describe sentiments regarding the efficacy of HCPs.

Methods: A search of the Web of Science Core Collection database focused on HCPs in the manufacturing sector, globally, from January 2002 to December 2022. The search was limited to field studies published in English. The relevant literature was manually analysed for both positive and negative sentiments about the HCP elements, using document analysis.

Results: Fifty-five articles were included in the review. The steel-related industries comprised the largest proportion of the articles included in the review. Negative sentiments about performance of HCPs were reported in most studies. There were limited studies on engineering noise control implementation within HCPs, reflective of industry inaction – a major contributing factor to hearing loss in the sector.

Conclusion: Hearing conservation programme efficacy within the manufacturing sector is hindered by multiple factors, as reflected by negative sentiments. Improvements in HCPs are required urgently to improve hearing conservation efforts in the sector. A digital HCP audit tool, using the findings from this study, could assist employers to identify specific aspects that hinder programme efficacy, and thereby improve engineering controls for noise reduction.

INTRODUCTION

Current noise regulations in South African general industry[1] provide a generic and hierarchal approach to mitigating health effects of noise exposure.[2] Government regulations have generally been ineffective in protecting workers from the health impacts of noise. In response to noise-induced hearing loss (NIHL) in industry, employers implement hearing conservation programmes (HCPs) as a primary control measure. The HCPs are guided by workplace noise standards that prescribe worker exposure levels, implying that compliance can be achieved through administrative controls such as altering work practices. However, adherence to noise standards that prescribe area noise levels requires both administrative and engineering noise controls.[3] In spite of HCPs, NIHL incidence rates are still unacceptably high, globally;[4] workers remain exposed to unnecessary high residual risks in the absence of engineering noise controls. Hearing conservation programmes do not include control of noise emitted from the source. They often rely overly on hearing protection device (HPD) use, the efficacy and reliability of which remains debatable when compared to other available noise controls.[4] In this regard, occupational hygienists, as members of HCPs, should use their advisory status in legal forums, such as health and safety committees, to persuade company management, which usually relies on specialist advice,[5] to implement engineering noise controls.

To manage HCPs, companies should have well-articulated risk management strategies that are informed by regulations.[6] Engineering controls reduce or eliminate noise in work environments, while continuous HCPs rely heavily on HPDs. Engineering controls that can eliminate, contain, and reduce noise at the source should be implemented in preference to continuous HCP procedures.[7] Engineering controls have been successful in reducing noise in the aviation, defence, and mining sectors. However, incentives for companies to control noise by engineering means are inadequate, partly due to lack of awareness about the economic benefits. Often, affordable and simple engineering controls are readily available, but overlooked.[4] Hearing loss imposes a health burden on workers;[8] engineering noise controls need to be prioritised to stop the cycle of exposure and ill-health.[9]

The lack of control through engineering means emanates from flawed risk assessment strategies that omit cost analyses in the 'as low as reasonably practicable' approach.[1] Risk assessment regulations, such as the South African Noise-Induced Hearing Loss Regulations,[1] omit aspects such as protection afforded to workers by hearing protectors, exposure to ototoxic substances, and procedures for conducting the risk assessment – important factors in the risk analysis process. Furthermore, noise risk assessments in South Africa are conducted without regulatory guidance about the acceptability of risk, following the risk analysis.[1] The contributors to HCP performance inefficiencies remains unclear, from both technical and regulatory perspectives.

Some 367 800 NIHL cases were reported in the United States of America (USA) from 1995 to 2013,[10] and the United Kingdom (UK) reported 1 345 cases from 2010 to 2023.[11] In South Africa, 19 084 NIHL cases were reported from 2001 from 2019,[12] representing more than 50% of compensated occupational diseases. This raises questions about the efficacy of the South African noise regulations, risk assessments, and management strategies employed by regulators and employers alike, and highlights failures of HCPs – overall, or in their individual elements.

In view of the issues raised, this narrative review synthesises the scientific literature with the aim of describing sentiments about the efficacy of HCPs in industry. Audiologists, occupational medical practitioners, occupational health nurses, acoustic engineers, and others contribute to the management of HCPs. Research conducted by these professionals provides information about factors that hinder HCP efficacy in industry. The study aligns with the United Nations' sustainable goals 3 (good health and wellbeing) and 8 (decent work and economic growth).[13]

METHODS

The Web of Science Core Collection (WOSCC) database was used to conduct a literature search on studies reporting on HCPs and their elements. The WOSCC database, widely used by researchers as a discovery tool,[14] was selected in view of its earlier inception date than that of other databases, and because it contains the most extensive scientific literature of all available databases.[15] The WOSCC database was also chosen to facilitate the data analysis through the use of Clarivate analytics, which has embedded analytical sorting tools.[14] The main search term used was "hearing conservation programme/program", with the Boolean operator "OR" used for additional keywords, including "noise training programme/program", "noise monitoring/measurement", "audiometry", "audiometric testing", "administrative control for noise", "noise regulations, enforcement, and inspection", "noise induced hearing loss", "hearing loss prevention", "engineering noise control", "hearing protection devices". Clarivate analytics filters were applied to focus and align the search results. The applied filters included "open access", "publication years – 2002 up to 2022", "document types – "articles", "languages – English", Web of Science categories – all". The language filters were applied during the eligibility screening phase of the literature.[16] The publication years were selected to reflect views on both contemporary and current practices.[17] From a South African perspective, the selected timeframe coincided with the enactment and implementation of the Noise-Induced Hearing Loss Regulations over a 20-year timeframe.[1]

Data management

The search results were filtered to remove duplicates and to identify articles categorised in the WOS "acoustics", "audiology and speech language pathology, otolaryngology", "public, environmental and occupational health", and "environmental sciences" categories.

Title, abstract, and WOS category screening resulted in 464 records that were eligible for analysis. Figure 1 outlines the search and screening processes. The titles and abstracts were screened to eliminate studies conducted in sectors other than manufacturing. Only field studies were included. The screening process was conducted by a single reviewer, viz. an occupational hygienist registered with the Southern African Institute for Occupational Hygiene, with expertise in noise exposure. EndNoteX9® reference management software was used for exporting and recording the details of the retrieved studies.

Extraction and synthesis of sentiments about HCP elements

The Bingham and Witkowsky (2022)[18] five-phase qualitative analysis process was adopted in this study, which comprises organising, sorting, understanding, interpreting, and explaining the data. Sentiments about HCPs were extracted, manually, by line-by-line reading of the technical interpretation of the results in each study related to the efficacy or effectiveness of the relevant HCP element. Deductive analysis was used to arrange the sentiments into predetermined[19] HCP elements, which were captured in a Microsoft Word table (Table 2). The HCP elements were derived from the Noise-Induced Hearing Loss Regulations and corresponding codes of practice, and included training, noise monitoring, audiometry, engineering control, administrative control, and HPDs.[1,7] Articles addressing two or more elements of an HCP were assigned to the overall HCP element. The thematic analysis was done manually by one person to ensure the preservation of the extracted text, and to show transparent linkages between sentiments extracted from the analysed articles and conclusions.[20]

Ethical clearance for the review was received from the Tshwane University of Technology (TUT) Faculty Committee on Research Ethics: FCRE 2020/10/015 (FCPS 02) (SCI).

RESULTS

In total, 1 236 research articles were identified and then exported to Microsoft Excel for sorting and eligibility analysis. The screening resulted in 55 eligible records for textual analysis. Table 1 shows the details and the HCP elements reported in the articles included in the analysis. Most of the studies focused on more than one aspect of HCPs (n = 27); engineering controls for noise were investigated in only one study. Sixteen studies emanated from the USA and Asia; only three were from Africa.

Sentiments

Table 2 shows the details of each article, including the author(s) and year, country, industry type, focus of study, and sentiment synthesis. Negative sentiments related to each HCP element highlight the systematic challenges plaguing programme efficacy in the manufacturing industry. Positive sentiments highlight HCP success areas achieved by industry.

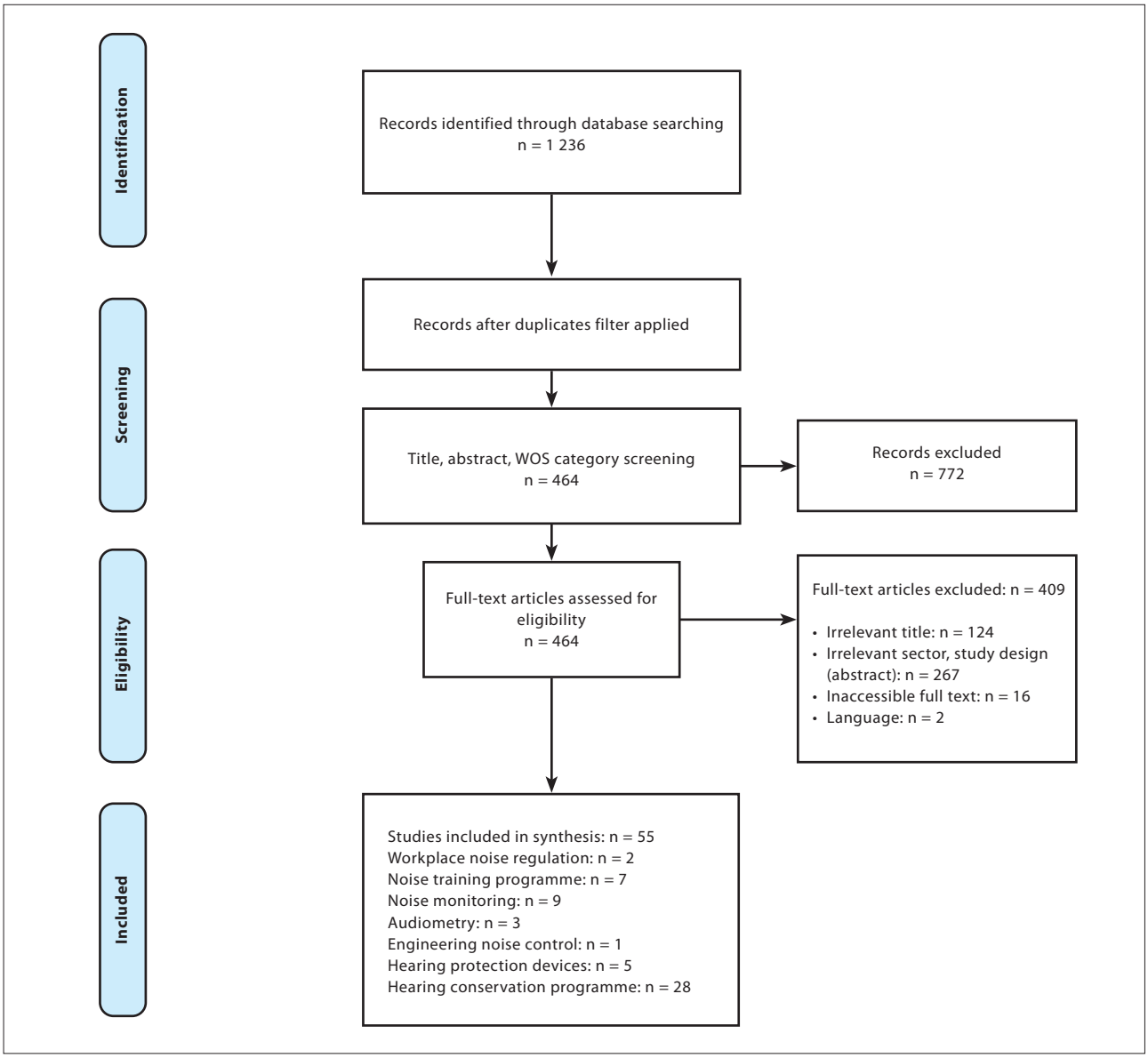
Negative sentiments

Regulation

The two studies focusing on regulation related to HCPs were conducted in the USA, and are indicative of the country's robust inspection and enforcement regime.[21,22] However, violations of regulations in areas of implementing feasible controls were reported,[21] as were noise levels exceeding regulatory limits.[22] Mandatory HCP implementation was incomplete in industries such as carbide tool and saw sharpening, furniture refinishing, stone countertop fabrication, and wood floor finishing.[21] Regulatory inspections were unable to ascertain the regular use of HPDs by workers, and employers failed to implement audiometric testing and noise training programmes.[22]

Training

Training programmes were found to be ineffective in increasing worker knowledge levels, transforming employees' negative attitudes, and altering poor practices relating to NIHL.[24,42] These inadequacies resulted in workers having poor legal knowledge[42,51] and low efficacy scores on HPD use,[27] especially amongst men,[29,24] effectively preventing workers from fulfilling their assigned HCP element responsibilities.[25] In some cases, high awareness about noise was insufficient to change workers' behaviour regarding HPD use.[23] Poor knowledge, attitudes and practices related to HCP elements were also observed in iron and steel manufacturing plants in Tanzania[25] and Iran,[23] and in a print press factory in India.[24]



WOS: Web of Science

Figure 1. Selection of full-text articles for review

Noise monitoring

Noise monitoring results from the reviewed articles confirmed the presence of excessive noise exposure in the manufacturing sector. Workers in Guatemala (sugar cane mill), China (electronics recycling facilities), USA (aluminium, automotive plants), Iran (packing plants), Sweden (paper mills), Kuwait (print industry), and Australia (aluminium plants) were exposed to noise levels exceeding local regulatory limits, in spite of routine and continuous noise monitoring.[30,32,33,35,36] In the iron and steel manufacturing industry in the USA, there were many instances in which noise levels exceeded regulatory limits.[36,38-40] Routine noise monitoring has not persuaded employers to provide workers in noise zones with HPDs.[25,29,31] Employer inaction is confirmed by historical data that show an increase in noise levels and the number of employees exposed to noise above 90 dBA, in some facilities.[37] The noise monitoring process is plagued by uncertainties resulting from conflicting results of task-based full-shift monitoring and time-at-task measurements, which complicates the interpretation of the data.[35] Wearability of modern noise measuring instruments also hinders the monitoring process.[38]

Audiometry

The three studies that reported on audiometry from the USA revealed that there is no international convention regarding NIHL criteria, resulting in adoption of metrics that either under- or overestimate the extent of hearing loss.[40] There is a high prevalence of hearing loss in workers in automotive factories[41] as they are exposed to high noise levels.[72] Audiometric testing has failed to detect NIHL in workers, regardless of their reported use of HPDs.[71]

Engineering controls

The lack of extensive literature on engineering noise controls attests to the low uptake by industry of noise reduction efforts at source. The only study on engineering controls reported a lack of employers' knowledge about noise reduction.[42] Employers' low risk perceptions led to the neglect of cost analysis studies to inform the feasibility of implementing engineering controls. Engineering controls, as part of the overall noise control strategy of HCPs, were not implemented in food and beverage manufacturing plants.[42]

Table 1. Hearing conservation programme elements investigated in the articles analysed

Author(s), year	Country	Manufacturing industry type	Hearing conservation programme element						
			Regulations	Training	Noise monitoring	Audiometry	Engineering controls	HPDs	HCP
Park et al., 2020[21]	USA	Manufacturing*	✓						
Lofgren, 2008[22]	USA	12 industries*	✓						
Laal et al., 2022[23]	Iran	Automobile manufacturing plant (cast iron foundry and aluminium casting)		✓					
Basheer et al., 2020[24]	India	Print press		✓					
Nyarubeli et al., 2019[25]	Tanzania	Manufacturing*		✓					
Tantranont et al., 2017[26]	Thailand	Two ribbed smoked sheet plants, five beverage plants, three frozen food manufacturing plants, power plant, palm oil manufacturing plant, wood furniture factory, plastic bottles plant, asphalt plant		✓					
Smith et al., 2014[27]	USA	Metal container manufacturer		✓					
Tsukada et al., 2008[28]	Japan	Electronic parts manufacturing company		✓					
Kim et al., 2010[29]	South Korea	Thermal power plants		✓					
Alabdulhadi et al., 2021[30]	Kuwait	Printing industry			✓				
Gong et al., 2020[31]	China	Electronics recycling facilities			✓				
Stumpf et al., 2020[32]	Guatemala	Sugar cane mill			✓				
Neitzel et al., 2018[33]	Sweden	Soft tissue paper mill			✓				
Dianat et al., 2016[34]	Iran	Packing plants			✓				
Neitzel et al., 2016[35]	Sweden	Paper mills			✓				
Neitzel et al., 2014[36]	USA	Aluminium manufacturing company			✓				
Brueck et al., 2013[37]	USA	Automotive plants			✓				
Williams et al., 2012[38]	USA	Two aluminium smelters			✓				
Taiwo et al., 2014[39]	Australia, USA	Aluminium production				✓			
Rabinowitz et al., 2012[40]	USA	Aluminium company				✓			
McCullaugh et al., 2011[41]	USA	Automotive factory				✓			
Davies et al., 2012[42]	Canada	Manufacturing*					✓		
Gomes et al., 2018[43]	Brazil	Concrete block manufacturer						✓	
Thepaksorn et al., 2018[44]	Thailand	General manufacturing*						✓	
Biabani et al., 2017[45]	Iran	General industry*						✓	
Voix et al., 2009[46]	Canada	General industry*						✓	
Griffin et al., 2009[47]	USA	Sheet metal shop						✓	
Vosoughi et al., 2022[48]	Iran	Offset printing industry							✓
Gong et al., 2021[49]	China	Four machine shops, two chemical plants, food production plant, lead-acid battery plant, coal-fired electric power plant						✓	
Chiu et al., 2020[50]	Taiwan	Two steel mills, textile factory							✓
Wouters et al., 2020[51]	Nigeria	Brewery							✓

Table continues

Zaw et al., 2020[52]	Myanmar	Textile mill	✓
Liu et al., 2018[53]	China	Manufacturing*	✓
Frederiksen et al., 2017[54]	Denmark	Manufacturing*	✓
Aliabadi et al., 2015[55]	Iran	Press workshop of home appliance factory	✓
Cantley et al., 2015[56]	USA	Alumina manufacturing	✓
Młyński et al., 2014[57]	Poland	Die forging hammers	✓
Nakao et al., 2014[58]	Japan	Rolling mill foundry, steelworks factory, oil refinery	✓
Sayapathi et al., 2014[59]	Malaysia	Automobile industry	✓
Venet et al., 2014[60]	France	Manufacturing*	✓
Bockstael et al., 2013[61]	Belgium	Food industry, metal industry, packaging company, power generation	✓
Hsu et al., 2013[62]	Taiwan	Iron foundry	✓
McTague et al., 2013[63]	USA	Two aluminium smelters, turbine component factory	✓
Rabinowitz et al., 2013[64]	USA	Aluminium production facility	✓
Kusy et al., 2012[65]	France	Steel production, forging, metallurgy, boiler making, mechanical engineering, pneumatics, glass making	✓
Nelisse et al., 2012[66]	Canada	Food transformation, petrochemicals, wood furniture, aluminium transformation, motorised products manufacturer, wood transformation, aeronautics, power production-generator	✓
Pawlaczyk-Luszczynska et al., 2012[67]	Poland	Rolling stock	✓
Heyer et al., 2011[68]	USA	Food processing and automotive plants	✓
Rabinowitz et al., 2011[69]	USA	Alumina manufacturing	✓
Attarchi et al., 2010[70]	Iran	Steel industry	✓
Sbihi et al., 2010[71]	Canada	Lumber mills	✓
Davies et al., 2008[72]	Canada	Lumber mills	✓
Mohammadi, 2008[73]	USA	Metal fabrication industries	✓
Ologe et al., 2008[74]	Nigeria	Bottling factory	✓

* manufacturing includes miscellaneous processes ✓ HCP element investigated
HCP: hearing conservation programme, HPD: hearing protection device, USA: United States of America

Table 2. Sentiments about HCP elements in reviewed articles

Author(s), year	Country, industry type	Focus of study	Sentiment synthesis	
			Positive	Negative
Element: workplace regulation and enforcement				
Park et al., 2020[21]	USA, manufacturing	Analysis of noise standard violation trends in USA	Declining number of violations through the years noted Programmed and unprogrammed inspection and enforcement conducted	Most violations occur in manufacturing sector Most cited standard related to lack of feasible administrative or engineering controls, inadequate HCP
Lofgren, 2008[22]	USA, 12 industries	Workplace inspections	Regulatory inspections and enforcement conducted	Noise levels exceeded regulated limits Inspection failed to ascertain regular HPD usage Workers who were overexposed to noise and had not been provided the required training Non-compliances were found for the provision of annual audiometric testing in each industry
Element: training/education programme				
Laal et al., 2022[23]	Iran, automobile manufacturing plant (cast iron foundry and aluminium casting)	Training intervention on HPD use	Educational intervention improved workers' knowledge on HPD use	High awareness alone was insufficient to change worker behaviour in HPD use
Basheer et al., 2020[24]	India, print press	Worker knowledge, attitudes, and practices regarding hearing loss	-	Workers had inadequate knowledge, negative attitudes, and poor practices Lack of training programmes within HCP to educate workers
Nyarubeli et al., 2019[25]	Tanzania, manufacturing	Knowledge, attitudes and practices regarding occupational noise, NIHL, audiometry, and HPD use	-	Majority of workers displayed poor knowledge and practices Majority (86%) of workers indicated not ever being provided with HPDs
Tantranont et al., 2017[26]	Thailand, two ribbed smoked sheet plants, five beverage plants, three frozen food manufacturing plants, power plant, palm oil manufacturing plant, wood furniture factory, plastic bottles plant, asphalt plant	HPD use	Worker hearing status and interpersonal factors influence HPD use, due to prevailing safety culture	
Smith et al., 2014[27]	USA, metal container manufacturer	Training intervention on HPD use	Significant increase in the PAR post the intervention Field attenuation systems can assist HCP personnel to improve HPD selection and PARs	Workers have low-efficacy scores on HPD use Assigned HPDs not kept in stock Workers wear whatever HPD is available
Tsukada et al., 2008[28]	Japan, electronic parts manufacturing company	Training of use of HPDs	Following intervention, prevalence of regular use of HPDs increased Percentage of workers obtaining adequate attenuation from HPDs increased following intervention Individual training was effective means of increasing usage rate and proper use of HPDs	-
Kim et al., 2010[29]	South Korea, thermal power plants	HPD use	Workers who perceive social benefits of use, use HPDs	Some workers have not used HPDs Males had lowest HPD usage rate

Table continues

Element: noise monitoring				
Alabdulhadi et al., 2021[30]	Kuwait, printing industry	Noise monitoring	Impulsiveness of noise and affected work areas identified	Workers in certain work areas exposed above noise rating limit, despite technological improvements introduced
			Technological improvements resulted in a decrease in noise levels	HPDs made available, but not worn
Gong et al., 2020[31]	Guatemala, sugar cane mill	Personal noise dosimetry	Dosimetry results used as a basis for enrolling workers in an HCP	Majority of workers exposed to noise levels exceeding regulatory limit
Stumpf et al., 2020[32]	China, electronics recycling facilities	Personal noise dosimetry	Implementation of an HCP recommended	Majority of workers exposed to noise levels exceeding regulatory limit
			Pure tone audiometry in place as an administrative control	Workers not provided with HPDs in majority of facilities
			Only one facility provided workers with HPDs	Majority of facilities did not have HPD usage signage
Neitzel et al., 2018[33]	Sweden, soft tissue paper mill	Noise monitoring	A decline in both area and personal dosimetry noise measurements was noted	Half of workers exposed to historically high noise levels, exceeding noise rating limit
			Incremental use of HPDs over time	
			Noise monitoring used to develop job exposure metrics tool that can be used in epidemiological studies of noise-related health outcomes	
			Noise monitoring results used to highlight the need for hearing loss prevention and noise control efforts	
Dianat et al., 2016[34]	Iran, packing plants	Noise monitoring	Noise monitoring results used to highlight need for improving workplace design to enhance health and safety of workers	-
Neitzel et al., 2016[35]	Sweden, paper mills	Noise monitoring	Accuracy of personal dosimetry reinforced compared to area monitoring	Workers exposed to noise levels exceeding national rating levels
				Differences between personal noise dosimetry and area measurements highlights the need to maximise the accuracy of noise exposure estimates
Neitzel et al., 2014[36]	USA, aluminium manufacturing	Noise exposure evaluation by trending	Several facilities showed substantial reduction in exposure over time Individual-level and facility-level results differ amidst the noted reduction over time, useful in identifying problematic noise measurement approaches	Data sets still have noise levels exceeding the regulatory limit
Brueck et al., 2013[37]	USA, automotive plants	Noise exposure trending	Noise exposure levels for many jobs decreased by ≥ 3 dBA, due to operational and equipment changes	Increase in number of workers exposed to noise > 90 dBA noted, due to increased production
			Percentage of workers exposed to noise > 90 dBA decreased from 95% to 54%	
			Reductions in noise levels and percentage of workers exposed to noise levels > 89 dBA indicates success of HCP	
Williams et al., 2012[38]	USA, two aluminium smelters	Noise monitoring	Instrument used allows workers to record noise exposures inside of HPDs	Usability barriers on noise monitoring device
				Ear discomfort when using the instrument

Table continues

Element: audiometric testing				
Taiwo et al., 2014[39]	Australia, USA, aluminium production	Audiometric analysis	Audiometry identified workers with acoustic neuroma Participation in HCP associated with increased risk of acoustic neuroma and detection of acoustic neuroma	-
Rabinowitz et al., 2012[40]	USA, aluminium company	Audiometric review		Different metrics produce discrepant results
McCullaugh et al., 2011[41]	USA, automotive factory	Worker audiograms evaluation	Audiometry identified workers with hearing loss	Significant number (42%) of workers had hearing loss HCP has not prevented hearing loss
Element: engineering controls				
Davies et al., 2012[42]	Canada, manufacturing	Barriers to engineering noise control	Identified barriers can be addressed by applying HCP regulation, education improvement, and regulatory enforcement	HCP not implemented in either company Poor knowledge of relevant regulations, noise reduction options and noise health impacts, low stakeholder risk perception, informal valuation of engineering control costs and feasibility issues
Element: hearing protection devices				
Gomes et al., 2018[43]	Brazil, concrete block manufacturer	Earmuff efficacy using F-MIRE	Corrected noise reduction and attenuation provided by HPD manufacturer showed no statistically significant differences in attenuation for most frequency bands	60% of employees had lower noise attenuation in all frequency bands Differences between laboratory-derived and field attenuation led to recommendation for conducting individual HPD attenuation
Thepaksorn et al., 2018[44]	Thailand, manufacturing	HPD use	Risk perception correlated with HPD use and training	-
Biabani et al., 2017[45]	Iran, general	Individual fit testing of HPDs	Earmuff ergonomics, user experience and awareness levels identified as main factors affecting individual fitting MIRE can be applied as complimentary to increase real-world attenuation	Typical safety eyewear reduced mean personal attenuation rating by approximately 2.5 dB
Voix et al., 2009[46]	Canada, general	Fit testing of HPDs	Individual assessment of HPD enables selection of devices that meet this criterion, and permits workers to hear machines and environment while still protecting their hearing Individual fit testing processes enable better understanding of HPD performance to meet compliance F-MIRE process can aid the selection of an appropriate variety of HPD sufficient for noise levels in a given facility	-
Griffin et al., 2009[47]	USA, sheet metal shop	HPD use and observations	Workers in the steady noise environments self-reported hearing protection use more accurately in surveys than workers in variable noise environments	-

Table continues

Element: hearing conservation programme in its entirety				
Vosoughi et al., 2022[48]	Iran, offset printing industry	Noise monitoring and knowledge of workers on HPD use	Increase in worker knowledge diminishes negative attitudes in hearing conservation Workers with positive attitudes improve hearing conservation practice	Some workers still have poor knowledge on HCP aspects
Gong et al., 2021[49]	China, four machine shops, two chemical plants, food production plant, lead-acid battery plant, coal-fired electric power plant	Training, HPD field testing, and use	One-on-one training along with earplug fit testing contributed to improved PAR Individual fit testing of HPDs confirms attenuation received when using earplugs	Overestimation of APVs indicated by manufacturers during field use
Chiu et al., 2020[50]	Taiwan, two steel mills, textile factory	HPD field testing and training intervention	HPD wearing skills improved through re-education and training	Ineffective protection by HPDs worn by workers
Wouters et al., 2020[51]	Nigeria, brewery	Noise monitoring and audiometric testing	Departments with highest threshold shifts identified Workers in departments with highest noise exposure identified Majority of workers had normal hearing	Employees had poor awareness about noise and hearing loss Some departments have high hearing loss/hearing threshold shift prevalence
Zaw et al., 2020[52]	Myanmar, textile mill	Noise exposure assessment and audiometry	HCP inclusive of occupational hazard education recommended Audiometry identified workers with hearing loss for intervention	66.4% of workers exposed to noise ≥ 85 dBA Prevalence of hearing loss was 25.7%
Liu et al., 2018[53]	China, manufacturing	Effect of training on HPD field attenuation and field use	One-on-one training and fit testing improved PARs and reduced negative impact of protective hair cover use Fit testing is important for earmuffs, due to repeated use	Wide variations in personal attenuation ratings observed among workers
Frederiksen et al., 2017[54]	Denmark, manufacturing	Worker noise exposure, hearing status, and HPD use	Noise levels declined over 10-year period HPD use increased from 70% to 76% No significant impact on hearing thresholds of workers from noise exposure levels, indicating successful implementation of HCPs	-
Aliabadi et al., 2015[55]	Iran, press workshop of home appliance factory	Noise monitoring and audiometric testing	Noise monitoring and audiometric testing lead to the evaluation of the effectiveness of existing HCPs Calculation of risk levels for hearing loss that considers different exposure conditions can be a useful management tool in implementing effective HCPs	Workers with intermittent HPD use had higher prevalence of hearing loss Noise levels exceeding noise rating limits Workers using ear plugs had higher hearing loss prevalence than those using earmuffs
Cantley et al., 2015[56]	USA, aluminium manufacturing	Noise exposure and hearing acuity	-	Noise exposure levels as low as 85 dBA may increase workplace injury risk

Table continues

Młyński et al., 2014[57]	Poland, die forging hammers	Noise monitoring and HPD use	Noise exposure quantified, enabling risk management	Measured impulsive noise levels exceeded exposure limit Some HPDs used were inadequate for the type of noise emitted by forge hammers
Nakao et al., 2014[58]	Japan, rolling mill foundry, steelworks factory, oil refinery	Noise exposure monitoring and HPD use	Noise exposure monitoring established that workers using earphones were exposed above the exposure limit	Workers using earphones were not provided with HPDs The at-ear noise levels whilst using earphones exceeded exposure limit for noise
Sayapathi et al., 2014[59]	Malaysia, automobile factories	HPD use, noise monitoring, audiometric testing to inform policy	Audiometry detected changes in worker hearing threshold Audiometric testing used to demonstrate protective level of 85 dBA among workers at 3 000 Hz compared to those using the 90 dBA rating level	Deterioration of hearing threshold beyond 25 dBA among workers where the 90 dBA rating level was used was clearly demonstrated
Venet et al., 2014[60]	France, manufacturing, construction, services	Noise measurements, exposure history, and audiometry	Measuring worker hearing thresholds helps early detection of changes before onset of hearing loss	-
Bockstael et al., 2013[61]	Belgium, food industry, metal industry, packaging company, power generation	HCP evaluation	Strict HPD policies, including sanctions, resulted in high and consistent usage of HPDs Management role in managing HPD wearing was important Workers understand adverse effects of noise exposure	Variation in HPD use reported between companies Work performed in noisy areas for most of shift cycle Management and workers underestimate risks in workplaces with noise levels recorded at or near noise rating limit
Hsu et al., 2013[62]	Taiwan, iron foundry	Noise monitoring, audiometry and HPD use	Differences in threshold shift noted between workers using and not using HPDs Audiometry demonstrated or linked the association between noise exposure level, or noise exposure duration	Some of the workers were exposed to noise levels above rating limits Some workers had threshold hearing shifts
McTague et al., 2013[63]	USA, two aluminium smelters, turbine component factory	Noise monitoring and HPD field testing	Daily noise exposure monitoring assisted workers to reduce exposure Daily noise exposure monitoring is a feasible HCP intervention	Some workers reported discomfort when wearing HPDs
Rabinowitz et al., 2013[64]	USA, aluminium production facility	Noise monitoring and audiometry	At-ear noise exposures < 85 dBA showed no association with risk of high-frequency hearing loss among workers with substantial past noise exposure and hearing loss at baseline Effective noise control to < 85 dBA may lead to significant reduction in occupational hearing loss risk in such individuals	-

Table continues

Kusy et al., 2012[65]	France, steel production, forging, metallurgy, boiler making, mechanical engineering, pneumatics, glass making	Noise monitoring and HPD field testing		In-situ measurements confirm the overestimation of APVs indicated by the manufacturers Custom-moulded HPDs, like other earplug types, are unsuited to attenuate low frequencies.
Nelisse et al., 2012[66]	Canada, food transformation, petrochemicals, wood furniture, aluminium transformation, motorised products manufacturer, wood transformation, aeronautics, power production generator	Noise monitoring and HPD field testing	PAR, HPD performance ratings and workplace noise levels correctly applied to evaluate HPD performance	Fluctuations in attenuation, due to poor insertion and/or fitting of earplugs amongst workers Low attenuation achieved compared to laboratory-derived attenuation values Earplug was particularly inefficient in the low-frequency range
Pawlaczyk-Luszczynska et al., 2012[67]	Poland, rolling stock	Noise measurements and audiometric testing	Noise levels quantified Audiometry results identified workers with hearing impairment	Workers exposed to noise levels exceeding regulatory limits Half of workers had hearing impairment and hearing difficulties
Heyer et al., 2011[68]	USA, food processing and automotive plants	Audiometric and noise monitoring data review	Enforced use of HPDs significantly reduced NIHL Increased audiometric testing and NIHL resulted in increased participation in screening	Gender differences in occupational noise distributions and compliance with HPD use Workers with greater seniority were less likely to wear HPDs HPDs remain the focus of HCPs, compared to the control or elimination of noise at its source through engineering controls or substitution
Rabinowitz et al., 2011[69]	USA, aluminium manufacturing	Noise monitoring and audiometry	Concurrent monitoring of daily occupational noise exposure inside HPDs with ongoing administrative feedback reduces the risk of occupational NIHL in industrial workers	Measured noise levels exceeded regulatory limits
Attarchi et al., 2010[70]	Iran, steel industry	Noise monitoring and audiometric testing	Noise monitoring identified workers in different exposure bands Audiometry identified workers with STS	Incidence of STS in workers and indicator of shortcomings in the hearing conservation programme in the factory
Sbihi et al., 2010[71]	Canada, lumber mills	Noise exposure and HPD use	High mean cumulative noise exposure results in high mean hearing loss, even with adjustments accounting for HPD use	No significant distribution difference between hearing threshold levels of workers reporting use and nonuse of HPDs – indicative of failure of audiometric testing to detect NIHL
Davies et al., 2008[72]	Canada, lumber mills	Noise measurement, frequency analysis, and HPD usage	Noise exposure quantified Employees exposed to higher noise levels wore HPDs regularly	Some employees reported non-HPD use Hearing protection is high, but their use is unlikely to provide complete protection against noise-induced hearing loss at the observed exposures
Mohammadi, 2008[73]	USA, metal fabrication industries	HCP evaluation	Engineering control, noise monitoring, and HPD use well entrenched as HCP aspects	Majority of metal fabrication industries have high noise levels Administrative controls minimally used Some metal fabrication companies have not instituted HCPs
Ologe et al., 2008[74]	Nigeria, bottling factory	Noise monitoring, audiometry, and HPD use	Noise monitoring and audiometric testing highlighted importance of hearing conservation measures Noise monitoring linked exposure to hearing loss over time	High percentage of workers with STS, despite HCP measures Majority of workers not provided with HPDs Majority or workers provided with HPDs reported irregular usage

APV: assumed protection value, dBA: A-weighted decibel, F-MIRE: field-microphone in real ear, HCP: hearing conservation programme, HPD: hearing protection device, MIRE: microphone in real ear, NIHL: noise-induced hearing loss, PAR: personal attenuation rating, STS: standard threshold shift, USA: United States of America

Hearing protection devices

The incompatibility of HPDs with other personal protective equipment (PPE) for the head reduces effective attenuation of noise.[45] When used in the field, HPDs yielded lower noise attenuation values than those stated on the packaging,[65] as observed in studies conducted in Brazil[43] and Iran.[45] Preferred HPDs were not kept in stock at four different locations of a metal container manufacturer, leading workers to wear any type of HPD that was available.[27] Some HPDs were ineffective,[50] due to scarce use by workers.[74] Custom-moulded HPDs, like other types of earplugs, were reported to be ineffective in attenuating low frequencies,[65,66] while other HPDs caused discomfort.[66]

Hearing conservation programmes

There were systemic challenges relating to HCP efficacy across all continents. These challenges extended to the USA in spite of regulations regarding HCPs. Six metal fabrication industries had not implemented HCPs,[73] while many workers in textile mills,[52] rolling stock plant,[67] aluminium manufacturing,[56,69] and general manufacturing industries were exposed to noise levels exceeding local regulatory limits in Myanmar,[52] Poland,[57,67] Iran,[55] Belgium,[61] Taiwan[62] and the USA.[69,73] Some employees in the Belgian food industry, metal industry, packaging company, and power generation had poor noise risk perceptions,[61] whilst those in an offset printing industry in Iran had poor knowledge about elements of the HCP.[48] This was amidst a deterioration in hearing thresholds among workers exposed to noise at 90 dBA.[59] Specifically, employees in the textile mills,[52] rolling stock plant,[67] aluminium manufacturing[56,69], and steel industries,[70] automotive,[59] bottling industry,[74] brewery[51] and pressing workshop[55] had significant hearing loss. Hearing threshold shifts were higher in workers using earplugs than in those using earmuffs in a press workshop.[55] Hearing protection device use achieved variable noise attenuation[66] compared to noise control at the source, through elimination and substitution.[68] Hearing protection devices were also incorrectly selected in some cases.[57,58] Where provided, HPDs were inconsistently used in a bottling factory in Nigeria,[74] Canadian lumber mills,[71,72] and food processing and automotive plants in the USA.[68] Employees in a bottling factory in Nigeria,[74] a die forge mill in Poland,[57] and a rolling mill steelworks and an oil refinery in Japan[58] were not provided with HPDs, despite working in high-noise areas. The HPD attenuation, derived and assigned through laboratory protocols, overestimates the protection achieved by workers during field use, as demonstrated in manufacturing industries in China,[49,53] France,[65] Canada,[66] and Japan.[58] Hearing protection device efficacy was shown to differ between men and women in food processing and automotive plants in the USA, and to be affected by frequency of noise exposure in various industries in Belgium.[61]

Positive sentiments

Some industry HCPs were reported to have been successful in preventing and reducing hearing loss where there was concurrent use of noise monitoring and audiometry,[51,52,54,55,59,60,62,64,67,69,70,74] and noise monitoring and HPD training interventions.[49,50,53,63,66] In some of the literature, there were positive sentiments associated with increased knowledge[23] and the use of correct and regular HPDs as a result of noise training programmes,[28,29,50,54] as well as the proportion of workers receiving adequate noise attenuation.[27,28,49,53] Training programmes were also reported to improve employee attitudes towards exposure prevention and HCPs.[48]

In some cases, noise monitoring was successfully used as a basis for establishing HCPs, identification of employees for inclusion in the programme,[31,32] and describing trends in noise levels.[30,37] Some HCPs that incorporated HPDs introduced individual fit testing[49,53] and field testing systems that measure real-time attenuation[43,46,66] to improve individual attenuation received.[49,63] Regulatory enforcement has induced employer compliance, in general, as reflected in declining violations of regulations.[21,22]

DISCUSSION

This narrative review explored sentiments about HCPs, providing a platform upon which performance effectiveness of, and benchmarking for, the efficacy of implemented measures can be conducted.[75] Implementation of HCPs by industry is an outcome of legislation and perceptions of 'the right thing to do' amidst prevailing unsafe work conditions, which persist despite regulatory bodies' roles in regulating such conditions.[76] HCPs have become mandatory in many countries – an indication of progress towards compliance with noise regulations. Workplace regulations have been credited for declines in regulatory violations and occupational diseases, in general, in countries such as the USA.[77]

Noise regulations have, however, led to minimal implementation of engineering controls, due to reliance on alternative, accommodative approaches such as the use of HPDs.[78] The accommodative approaches of the noise regulations results in workers being in danger as the economic arguments advanced by industry for the delay in implementing effective engineering controls are accepted. Together with other factors, this has led to minimal investments in engineering controls, creating unsafe conditions for workers.[79] The scarcity of acoustic engineers and the misconception about the high cost of engineering controls are barriers to their implementation.[4] These factors contribute significantly to NIHL.[10] The minimal literature on the implementation of engineering controls – highlighted in this review – is testament to the overreliance of industry on other HCP elements, in general. This is supported by the predominantly negative sentiments inferred in some of the studies reviewed. Successful HCPs depend on the implementation of effective engineering controls, coupled with robust monitoring of audiometry results.[78] Audiometric data generated through baseline, periodic, and exit examinations should be analysed for trends to inform decision-making.[78] Audiometry results can also be used to track HPD use to identify areas where HCP measures have not been effective.

Recommendations for further research

Regulators should address the systematic barriers in the implementation of engineering noise controls through compliance monitoring and enforcement.[42] The manufacturing sector should initiate internal audits of each HCP aspect in line with legislation, to improve programme efficacy. Audits are useful decision-making tools in view of current reliance on the use of hearing threshold shifts, derived through audiometry, as an indicator of HCP efficacy. The reliance on audiograms as an indicator of HCP efficacy has proved inadequate in identifying specific elements that hinder programme efficacy. The manufacturing sector can address deficient programme elements – such as failure to use noise monitoring results – to inform implementation of HCPs, inconsistent use of HPDs, and limited implementation of engineering controls within the context of their risk assessment

frameworks.[6] The risk assessment framework requires companies to identify opportunities for adapting and organising the work and workers, and means of eliminating hazards and reducing risks.[80]

Studies of measurements of daily in-ear noise exposure[69] would be useful to investigate the contribution of HPD design, efficacy, and use in preventing NIHL. The influence of safety climate (the shared perceptions, beliefs, and attitudes of employees about workplace safety) on the use of HPDs by workers should also be explored.[47]

CONCLUSION

Sentiments about HCPs in the manufacturing industry are generally negative and identify elements contributing to NIHL. The combined deficiencies in HCP elements diminish the contribution of HCPs to hearing loss mitigation. Weaknesses in noise regulations associated with ambiguously written standards that lead to incorrect interpretation, and ineffective enforcement, contribute to NIHL. Overall, HCPs are plagued by systematic deficiencies in areas of regulation and enforcement, inadequate training programmes, incorrect use of HPDs, and lack of engineering noise and administrative controls. Improvements in the administration and management of these HCP elements are required to reduce the incidence of NIHL. The positive sentiments associated with the use of engineering controls that deal with noise at the source can prove more cost efficient for industry than the implementation of other hearing conservation elements. Improved HCP measures and new approaches are required in the manufacturing industry to achieve total worker protection. A digital HCP audit tool, based on the identified sentiments, would assist employers to identify aspects of their HCPs that are preventing reduction in NIHL rates.

KEY MESSAGES

1. Hearing conservation programme efficacy in the manufacturing sector is hindered by shortcomings in all elements.
2. Poor enforcement of regulations and employer non-compliance of routine noise monitoring have failed to persuade the manufacturing sector to implement control measures beyond the use of HPDs.
3. Engineering controls are underutilised in HCPs, due to perceptions of high costs and technical challenges in implementing them.

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: OR, TJM, DMM
Data acquisition: OR
Data analysis: OR
Interpretation of the data: OR
Drafting of the paper: OR
Critical revision of the paper: TJM, DMM, OR

REFERENCES

1. South Africa. Occupational Health and Safety Act of 1993. Noise Induced Hearing Loss Regulations. Government Gazette No. 24967; 2003 March 7 (published under Government Gazette Notice R307). Available from: https://www.gov.za/sites/default/files/gcis_document/201409/24967b0.pdf (accessed 10 August 2021).
2. Russ K. Risk assessment in the UK health and safety system: theory and practice. Saf Health Work. 2010; 1(1):11-18. doi: 10.5491/SHAW.2010.1.1.11.
3. United States Environmental Protection Agency. Availability of workplace noise control of technology for selected machines. Washington, DC: United States EPA; 1982. Report No.: 550/9-81-321 Contract No.: 550/9-81-321.
4. Suter AH. Engineering controls for occupational noise exposure. Sound Vib. 2012; 2012(45th anniversary issue):24-31. Available from: http://www.sandv.com/downloads/1201sute.pdf (accessed 11 December 2025).
5. Muto T, Tomita M, Kikuchi S, Watanabe T. Methods to persuade higher management to invest in health promotion programs in the workplace. Occup Med. 1997; 47(4):210-216. doi: 10.1093/occmed/47.4.210.
6. South African Bureau of Standards. South African National Standard. Risk management – guidelines. SANS 31000:2019.
7. South African Bureau of Standards. South African National Standard. The measurement and assessment of occupational noise for hearing conservation purposes. SANS 10083:2023.
8. Palmer KT, Griffin MJ, Syddall HE, Davis A, Pannett B, Coggon D. Occupational exposure to noise and the attributable burden of hearing difficulties in Great Britain. Occup Environ Med. 2002; 59(9):634-639. doi: 10.1136/oem.59.9.634.
9. Bevan S. Economic impact of musculoskeletal disorders (MSDs) on work in Europe. Best Pract Res: Clin Rheumatol. 2015; 29:356-373. doi: 10.1016/j.berh.2015.08.002.
10. US Bureau of Labor Statistics. Injuries, illnesses, and fatalities. Available from: https://www.bls.gov/iif/oshum.htm#19Summary_News_Release (accessed 23 January 2023).
11. Noise-induced hearing loss in Great Britain. Health and Safety Executive; 2023. Available from: http://www.hse.gov.uk/Statistics/causdis/deafness/index.htm. (accessed 8 December 2024).
12. Ruiters M. A statistical review of the burden of occupational disease in South Africa. The Southern African Institute for Occupational Hygiene virtual annual conference 2021; 2021.
13. United Nations. Transforming our world: the 2030 Agenda for Sustainable Development 2023. Available from: https://sdgs.un.org/2030agenda (accessed 18 August 2024).
14. Birkle C, Pendlebury DA, Schnell J, Adams J. Web of Science as a data source for research on scientific and scholarly activity. Quant Sci Stud. 2020; 1:363-376. doi: 10.1162/qss_a_00018.
15. Li J, Goerlandt F, Reniers G. An overview of scientometric mapping for the safety science community: methods, tools, and framework. Saf Sci. 2021; 134:105093. doi: 10.1016/j.ssci.2020.105093.
16. Pieper D, Puljak L. Language restrictions in systematic reviews should not be imposed in the search strategy but in the eligibility criteria if necessary. J Clin Epidemiol. 2021; 132:146-147. doi: 10.1016/j.jclinepi.2020.12.027.
17. Palese A, Mansutti I, Visintini E, Caruzzo D, Moreale R, Longhini J, et al. Framing the time while designing and conducting reviews: a focused mapping review and synthesis. J Clin Nurs. 2022; 31:3523-3534. doi: 10.1111/jocn.16180.
18. Bingham AJ, Witkowsky P. Deductive and inductive approaches to qualitative data analysis. In: Vanover C, Mihas P, Johnny Saldaña J, editors. Analyzing and interpreting qualitative research: after the interview. Washington, DC: Sage Publications; 2022.
19. Bingham AJ. From data management to actionable findings: a five-phase process of qualitative data analysis. Int J Qual Methods. 2023; 22:16094069231183620. doi: 10.1177/16094069231183620.
20. Thomas J, Harden A. Methods for the thematic synthesis of qualitative research in systematic reviews. BMC Med Res Methodol. 2008; 8:45. doi: 10.1186/1471-2288-8-45.
21. Park S, Johnson MD, Hong O. Analysis of Occupational Safety and Health Administration (OSHA) noise standard violations over 50 years: 1972 to 2019. Am J Ind Med. 2020; 63(7):616-623. doi: 10.1002/ajim.23116.

22. Lofgren DJ. Results of inspections in health hazard industries in a region of the State of Washington. J Occup Environ Hyg. 2008; 5(6):367-379. doi: 10.1080/15459620802066133.
23. Laal F, Hossein Khoshakhlagh A, Zarei E, Madvari RF, Dehghan SF. Application of the BASNEF model in safety training in automobile manufacturing plants. Sound Vib. 2022; 56(4):297-306. doi: 10.32604/sv.2022.028255.
24. Basheer R, Bhargavi PG, Prakash HP. Knowledge, attitude, and practice of printing press workers towards noise-induced hearing loss. Noise Health. 2020; 21:62-68. doi: 10.4103/nah.NAH_9_19.
25. Nyarubeli IP, Tungu AM, Bratveit M, Moen BE. Occupational noise exposure and hearing loss: a study of knowledge, attitude and practice among Tanzanian iron and steel workers. Arch Environ Occup Health. 2019; 75(5):1-10. doi: 10.1080/19338244.2019.1607816.
26. Tantranont K, Codchanak N. Predictors of hearing protection use among industrial workers. Workplace Health Saf. 2017; 65(8):365-371. doi: 10.1518/001872095779049390.
27. Smith PS, Monaco BA, Lusk SL. Attitudes toward use of hearing protection devices and effects of an intervention on fit-testing results. Workplace Health Saf. 2014; 62(12):491-499. doi: 10.3928/21650799-20140902-01.
28. Tsukada T, Sakakibara H. A trail of individual education for hearing protection with an instrument that measures the noise attenuation effect of wearing earplugs. Ind Health. 2008; 46:393-396. doi: 10.2486/indhealth.46.393.
29. Kim Y, Jeong I, Hong O-S. Predictors of hearing protection behavior among power plant workers. Asian Nurs Res. 2010; 4(1):10-18. doi: 10.1016/S1976-1317(10)60002-3.
30. Alabdulhadi A, Devey P, Boggess M, Guest M. Personal noise exposure assessment of Kuwaiti printing industry workers. Int J Occup Saf Ergon. 2021; 27(2):578-588. doi: 10.1080/10803548.2019.1677327.
31. Gong W, Zhao L, Ceballos D, Zhu B. Lead and noise exposures at eight Chinese registered electronics recycling facilities. Int J Hyg Environ Health. 2020; 230:113611. doi: 10.1016/j.ijheh.2020.113611.
32. Stumpf AM, Erlandson G, Ruths J, Meinke DK, Newman LS, Krishner L, et al. Noise exposures of sugar came mill workers in Guatemala. Int J Audiol. 2020; 59(S1):S48-S53. doi: 10.1080/14992027.2019.1690171.
33. Neitzel RL, Andersson M, Eriksson H, Toren K, Andersson E. Development of a job exposure matrix for noise in the Swedish soft tissue paper industry. Ann Work Exp Health. 2018; 62(2):195-209. doi: 10.1093/annweh/wxx095.
34. Dianat I, Vahedi A, Dehnavi S. Association between objective and subjective assessments of environmental ergonomic factors in manufacturing plants. Int J Ind Ergon. 2016; 54:26-31. doi: 10.1016/j.ergon.2015.12.004.
35. Neitzel RL, Andersson M, Andersson E. Comparison of multiple measures of noise exposure in paper mills. Ann Occup Hyg. 2016; 60(5):581-596. doi: 10.1093/annhyg/mew001.
36. Neitzel RL, Galusha D, Dixon-Ernst C, Rabinowitz PM. Methods for evaluating temporal trends in noise exposure. Int J Audiol. 2014; 53:S76-S83. doi: 10.3109/14992027.2013.857438.
37. Brueck SE, Panaccio MP, Stancescu D, Woskie S, Estill C, Waters M. Noise exposure reconstruction and evaluation of exposure trends in two large automotive plants. Ann Occup Hyg. 2013; 57(9):1091-1104. doi: 10.1093/annhyg/met035.
38. Williams SC, Rabinowitz PM. Usability of a daily noise exposure monitoring device for industrial workers. Ann Occup Hyg. 2012; 56(8):925-933. doi: 10.1093/annhyg/mes028.
39. Taiwo O, Galusha D, Tessier-Sherman B, Kirsche S, Cantley L, Slade MD, et al. Acoustic neuroma: potential risk factors and audiometric surveillance in the aluminium industry. Occup Environ Med. 2014; 71(9):624-628. doi: 10.1136/oemed-2014-102094.
40. Rabinowitz PM, Galusha D, McTague MF, Slade MD, Wesdock JC, Dixon-Ernst C. Tracking occupational hearing loss across global industries: a comparative analysis of metrics. Noise Health. 2012; 14(56):21-27. doi: 10.4103/1463-1741.93326.
41. McCullaugh MC, Raymond D, Kerr MJ, Lusk SL. Prevalence of hearing loss and accuracy of self-report among factory workers. Noise Health. 2011; 13(54):430-347. doi: 10.4103/1463-1741.85504.
42. Davies HW, Louie A, Nahid M, Shoveller J. Potential barriers to engineered noise control in food and beverage manufacturing in British Columbia, Canada: a qualitative study. Int J Audiol. 2012; 51:S43-S50. doi: 10.3109/14992027.2011.633936.
43. Gomes RF, Samelli AG, Bistafa SR. Earmuff efficacy in the workplace using F-MIRE – a case report. Int J Occup Saf Ergon. 2018; 24(2):577-581. doi: 10.1080/10803548.2017.1333247.
44. Thepaksorn P, Siriwong W, Neitzel RL, Somrongthong R, Techasrivichien T. Relationship between noise-related risk perception, knowledge, and the use of hearing protection devices among Para Rubber Wood sawmill workers. Saf Health Work. 2018; 9:25-29. doi: 10.1016/j.shaw.2017.06.002.
45. Biabani A, Aliabadi M, Golmohammadi R, Farhadian M. Individual fit testing of hearing protection devices based on Microphone in Real Ear. Saf Health Work. 2017; 8(4):364-70. doi: 10.1016/j.shaw.2017.03.005.
46. Voix J, Hager LD. Individual fit testing of hearing protection devices. Int J Occup Saf Ergon. 2009; 15(2):211-219. doi: 10.1080/10803548.2009.11076802.
47. Griffin SC, Neitzel R, Daniell WE, Seixas NS. Indicators of hearing protection use: self-report and researcher observation. J Occup Environ Hyg. 2009; 6(10):639-647. doi: 10.1080/15459620903139060.
48. Vosoughi S, Alimohammadi I, Hosseini AF, Noushabadi ZS. Case study: knowledge, attitude, and practice (KAP) regarding hearing protection: a case study among offset printing industry workers in Tehran province. Noise Control Eng J. 2022; 70(3):270-278. Doi: 10.3397/1/377021.
49. Gong W, Zhang J, Liu X, Ding E, Zhu B. Verifying earplug attenuation and evaluating the effectiveness of one-on-one training along with earplug fit testing at nine facilities in China. Am J Ind Med. 2021; 64(9):771-780. doi: 10.1002/ajim.23270.
50. Chiu CC, Wan TJ. Individual fit testing of hearing-protection devices based on microphones in real ears among workers in industries with high-noise-level manufacturing. Int J Environ Res Public Health. 2020; 17(9):3242. doi: 10.3390/ijerph17093242.
51. Wouters NL, Kaanen CI, Den Ouden PJ, Schilthuis H, Bohringer S, Sorgdrager B, et al. Noise exposure and hearing loss among brewery workers in Lagos, Nigeria. Int J Environ Res Public Health. 2020; 17(8):2880. doi: 10.3390/ijerph17082880.
52. Zaw AK, Myat AM, Thandar M, Htun YM, Aung TH, Tun KM, et al. Assessment of noise exposure and hearing loss among workers in Textile Mill (Thamine), Myanmar: a cross-sectional study. Saf Health Work. 2020; 11(2):199-206. doi: 10.1016/j.shaw.2020.04.002.
53. Liu Y, Yang M. Evaluating the effect of training along with fit testing on earmuff users in a Chinese textile factory. J Occup Environ Hyg. 2018; 15(6):518-526. doi: 10.1080/15459624.2018.1456662.
54. Frederiksen TW, Ramlau-Hansen CH, Stokholm ZA, Gryderup MB, Hansen AM, Kristiansen J, et al. Noise-induced hearing loss – a preventable disease? Results of a 10-year longitudinal study of workers exposed to occupational noise. Noise Health. 2017; 19:103-111. doi: 10.4103/nah.NAH_100_16.
55. Aliabadi M, Fereidan M, Farhadian M, Tajik L. Determining the effect of worker exposure conditions on the risk of hearing loss in noisy industrial workroom using Cox proportional hazard model. Int J Occup Saf Ergon. 2015; 21(2):201-206. doi: 10.1080/10803548.2015.1029725.
56. Cantley LF, Galusha D, Cullen MR, Dixon-Ernst C, Rabinowitz PM, Neitzel RL. Association between ambient noise exposure, hearing acuity, and risk of acute occupational injury. Scand J Work Environ Health. 2015; 41(1):75-83. doi: 10.5271/sjweh.3450.
57. Młyński R, Kozłowski E, Adamczyk J. Assessment of impulse noise hazard and the use of hearing protection devices in workplaces where forging hammers are used. Arch Acoust. 2014; 39(1):73-79. doi: 10.2478/aoa-2014-0008.
58. Nakao T, Kakei M, Araki I, Tsutsui T, Satoh N, Inoue J, et al. Assessment of exposure to voices and noise via earphones in manufacturing industry workers in Japan. J Occup Health. 2014; 56(4):285-291. doi: 10.1539/joh.13-0285-oa.

59. Sayapathi BS, Su AT, Koh D. The impact of different permissible exposure limits on hearing threshold levels beyond 25 dBA. Iran Red Crescent Med J. 2014;16(10):e15520. doi: 10.5812/ircmj.15520.
60. Venet T, Campo P, Rumeau C, Thomas A, Parietti-Winkler C. One-day measurement to assess the auditory risks encountered by noise-exposed workers. Int J Audiol. 2014; 53:737-744. doi: 10.3109/14992027.2014.913210.
61. Bockstael A, De Bruyne L, Vinck B, Botteldooren D. Hearing protection in industry: companies' policy and workers' perception. Int J Ind Ergon. 2013; 43:512-517. doi: 10.1016/j.ergon.2012.08.009.
62. Hsu TY, Wu CC, Chang JG, Lee SY, Hsu CJ. Determinants of bilateral audiometric notches in noise-induced hearing loss. Laryngoscope. 2013; 123(4):1005-1010. doi: 10.1002/lary.23686.
63. McTague MF, Galusha D, Dixon-Ernst C, Kirsche SR, Slade MD, Cullen MR, et al. Impact of daily noise exposure monitoring on occupational noise exposures in manufacturing workers. Int J Audiol. 2013; 52 Suppl 1(01):S3-S8. doi: 10.3109/14992027.2012.743047.
64. Rabinowitz PM, Galusha D, Dixon-Ernst C, Clougherty JE, Neitzel RL. The dose-response relationship between in-ear occupational noise exposure and hearing loss. Occup Environ Med. 2013; 70(10):716-721. doi: 10.1136/oemed-2011-100455.
65. Kusy A, Châtillon J. Real-world attenuation of custom-moulded earplugs: results from industrial in situ F-MIRE measurements. Appl Acoust. 2012; 73(6):639-647. doi: 10.1016/j.apacoust.2012.02.001.
66. Nelisse H, Gaudreau MA, Boutin J, Voix J, Laville F. Measurement of hearing protection devices performance in the workplace during full-shift working operations. Ann Occup Hyg. 2012; 56(2):221-232. doi: 10.1093/annhyg/mer087.
67. Pawlaczyk-Luszczynska M, Dudarewicz A, Zamojska M, Sliwinska-Kowalska M. Self-assessment of hearing status and risk of noise-induced hearing loss in workers in a rolling stock plant. Int J Occup Saf Ergon. 2012; 18(2):279-296. doi: 10.1080/10803548.2012.11076934.
68. Heyer N, Morata TC, Pinkerton LE, Brueck SE, Stancescu D, Panaccio MP, et al. Use of historical data and a novel metric in the evaluation of the effectiveness of hearing conservation program components. Occup Environ Med. 2011; 68(7):510-517. doi: 10.1136/oem.2009.053801.
69. Rabinowitz PM, Galusha D, Kirsche SR, Cullen MR, Slade MD, Dixon-Ernst C. Effect of daily noise exposure monitoring on annual rates of hearing loss in industrial workers. Occup Environ Med. 2011; 68(6):414-418. doi: 10.1136/oem.2010.055905.
70. Attarchi M, Sadeghi Z, Dehghan F, Sohrabi M, Mohammadi S. Assessment of hearing standard threshold shift based on audiometric findings in steel company workers. Iran Red Crescent Med J. 2010; 12(6):644-649. Available from: https://www.ircmj.com/article_204022_f11f16b5181fdfb46787bebeca5a711a.pdf (accessed 11 December 2025).
71. Sbihi H, Teschke K, Macnab YC, Davies HW. An investigation of the adjustment of retrospective noise exposure for use of hearing protection devices. Ann Occup Hyg. 2010; 54(3):329-339. doi: 10.1093/annhyg/meq001.
72. Davies H, Marion S, Teschke K. The impact of hearing conservation programmes on incidence of noise-induced hearing loss in Canadian workers. Am J Ind Med. 2008; 51(1):923-931. doi: 10.1002/ajim.20634.
73. Mohammadi G. Hearing conservation programs in selected metal fabrication industries. Appl Acoust. 2008; 69:287-292. doi: 10.1016/j.apacoust.2006.12.002.
74. Ologe FE, Olajide TG, Nwawolo CC, Oyejola BA. Deterioration of noise-induced hearing loss among bottling factory workers. J Laryngol Otol. 2008; 122(8):786-894. doi: 10.1017/S0022215107000242.
75. Health and Safety Executive. Successful health and safety management. HSG65. Surrey: HSE; 1997.
76. Samuels SU. To furnish a workplace free from recognized hazards: OSHA, state occupational safety and health agencies, and fetal protection policies. Polit Life Sci. 1993; 12(2):243-254. doi: 10.1017/S0730938400024187.
77. Silverstein M. Getting home safe and sound: the Occupational Safety and Health Administration at 38. Am J Public Health. 2008; 98(3):416-423. doi: 10.2105/AJPH.2007.117382.
78. National Institute for Occupational Safety and Health. Best practices in hearing loss prevention. Washington, DC: US Department of Health and Human Services. Centers for Disease Control and Prevention. National Institute for Occupational Safety and Health; 1999.
79. Goldsmith F. Controlling occupational hazards. Proc Acad Polit Sci. 1977; 32(3):106-120. Available from: https://doi.org/10.2307/1173425 (accessed 12 December 2024).
80. South African Bureau of Standards. South African National Standard. Occupational Health and Safety Management Systems – Requirements with guidance for use. ISO 45001:2018.

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Real-time monitoring to measure occupational hazards

SJL Linde

Occupational Hygiene and Health Research Initiative, Faculty of Health Sciences, North-West University, Potchefstroom, South Africa

Correspondence
Prof. Stefan Linde
e-mail: stefan.linde@nwu.ac.za

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As with many aspects of our daily lives, innovations in technology and their increased accessibility are changing the way we practise occupational health and hygiene. The topic of real-time monitoring (RTM) and using direct reading instruments (DRIs) to measure occupational hazards is becoming increasingly popular in southern Africa and, globally, occupational hygiene professionals are discussing how these technological innovations can help create and maintain safer working environments. This was evident at the recent Southern African Institute for Occupational Hygiene (SAIOH) Conference that was held in Umhlanga, KwaZulu-Natal on 20–24 October 2025. During the conference, there were two keynote addresses, five plenary addresses, and nine posters that discussed ways in which RTM can be used to manage occupational hazards such as respirable dust, volatile organic compounds, and noise. Real-time monitoring has been around for a considerable time and is being used routinely to manage occupational exposure to noise, gases, and vapours in various industries. Only recently, with the development of improved particulate matter (PM) sensors, has the discussion shifted towards the feasibility of using RTM to manage occupational exposure to respirable dust. In contrast to noise, gases, and vapours there is more uncertainty regarding the accuracy of PM sensors, which has led to questions on how these sensors can and should be used.[1]

The data from DRIs (the instruments containing the sensors) are generated for a variety of purposes and can be used either during or after the shift. The term 'RTM' is used in cases where DRIs are used during the shift to measure exposure, and where employees can react to high exposures that are deemed to require action.[2] An example of RTM is the continuous measurement of PM that triggers actions by specific employees when a specific concentration is reached. This application has obvious advantages, since unsafe PM concentrations can immediately be identified and investigated. However, the measurement of PM, which is based on the interaction of the particle with light, is a complex process, and is influenced by the particle's density, size, shape, and refractive index, which are unique for every type of dust at a specific location.[2] This causes the sensors to under-sample when compared to gravimetric methods, especially at higher concentrations. Ultimately, PM sensors need to be calibrated or corrected to improve accuracy and reliability, a process that can be complicated and time consuming.[3] Currently, international research initiatives are aiming to improve and standardise this process.[4]

In 2023, the International Occupational Hygiene Association (IOHA) started a community of practice (CoP) on sensor technologies, with representatives from 23 countries, including South Africa, Zambia, and Nigeria. This community, chaired by Dr Emanuele Cauda, holds quarterly meetings to discuss PM sensor developments in the various countries.[5] One such development is the establishment (in process) of a sensor and DRI playbook by the Netherlands Organisation for Applied Scientific Research (TNO) and GCG Health Safety & Hygiene in Australia. From these CoP meetings, it is clear that the global occupational hygiene fraternity considers DRIs for PM to be useful tools, but that standardisation is needed – in terms of both the requirements for instruments and the procedures to be followed in using the instruments in the field.

In South Africa, the main developments have been in the mining industry where mines have been instructed to implement RTM as a measure to help prevent occupational health exposures.[6] Notably, at the 2025 SAIOH Conference, there was a keynote address from the Director of Occupational Hygiene, Department of Mineral and Petroleum Resources (DMPR), Dr Constance Kekana, titled 'Real-time monitoring and responsive controls: advancing policy and practice to reduce exposures in South African mining'. This further emphasises the importance of RTM in the industry moving forward, especially when considering the new mine health and safety milestones for the elimination of occupational lung diseases, which state that, by December 2034, 95% of all exposure measurement results will be below 0.03 mg/m^3 for respirable crystalline silica dust, 1.25 mg/m^3 for respirable coal dust, and 1.00 mg/m^3 for respirable platinum dust.[7] The mining industry is embracing the potential RTM for the control of airborne PM concentrations, especially for the monitoring of the effectiveness of control measures. Some initiatives include projects from the Minerals Council South Africa, which hosts its annual Dust Conference, and manages the Mining Occupational Safety and Health (MOSH) real-time dust monitoring leading practice that supports mines in the implementation of PM RTM initiatives.[8] Additionally, workshops have been organised by the North-West University (2023) and Trolex Ltd (2025), bringing togther representatives from original equipment manufacturers (OEMs), industry, and academia to discuss the opportunities and challenges associated with RTM.

Recent developments suggest that RTM of PM can be a useful tool to help shift the management of occupational exposure to respirable dust from reactive compliance to proactive intervention, and that the occupational hygiene fraternity is open to its use, while still wary of its limitations. Let us continue to encourage collaboration between OEMs, industry, academia, and government so that the use of these instruments can be improved and standardised to such a degree that we will be able to use them without reservation.

These instruments can enable sampling strategies to identify and correct over-exposures more readily, so that workers do not have to be exposed for a further two weeks before we receive laboratory results and are able to apply corrective measures.

REFERENCES

1. International Council on Mining and Metals. Considerations for the adoption of real-time particulate monitoring; January 2022. Available from: https://www.icmm.com/website/publications/pdfs/health-and-safety/2022/briefing_considerations-for-the-adoption-of-rtpm.pdf (accessed 8 August 2025).
2. Cauda E. Measuring respirable aerosol with real-time optical monitors. NIOSH Manual of Analytical Methods. 5th ed. Washington (DC): National Institute for Occupational Safety and Health; 2021. Available from: https://www.cdc.gov/niosh/nmam/pdf/chapter-am.pdf (accessed 8 August 2025).
3. Tefera Y, Ramkissoon C, Jurkowski R, Ahmed H, Rowett S, Gaskin S. Accuracy of real-time dust monitors in quarry settings: a pilot field and laboratory evaluation. Work and Health. 2025; 1(2):8. doi: 10.53941/wah.2025.100008.
4. Using sensors to create a healthy working environment. The Hague: TNO; 2025. Available from: https://www.tno.nl/en/healthy/work-health/occupational-exposome/using-sensors-create-healthy-environment/ (accessed 15 July 2025).
5. IOHA Annual Report – 2023. International Occupational Hygiene Association; 2023. Available from: https://www.hkioeh.org.hk/Documents/PresidentReport/President%20Report%202023.pdf (accessed 19 November 2025).
6. Mongoma BT. Overview of occupational health performance. Turning a new leaf on dust risk management within the South African Mining Industry. Department of Mineral and Petroleum Resources. 2nd Annual Dust Conference; 25 July 2025. Available from: https://www.mosh.co.za/all-categories?task=download.send&id=2149:1-overview-of-occupational-health-mr-brian-mongoma&catid=549 (accessed 19 November 2025).
7. Minerals Council South Africa. New health and safety milestones for adoption beyond 2024; 2024. Available from: https://www.mineralscouncil.org.za/component/jdownloads/?task=download.send&id=2397&catid=3&m=0 (accessed: 8 August 2025).
8. Minerals Council South Africa. Real time dust monitoring on continuous miner: leading practice adoption guide; 2023. Available from: https://www.mosh.co.za/all-categories?task=download.send&id=1947:real-time-dust-monitoring-on-continuous-miner&catid=459 (accessed 8 August 2025).

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Machine learning in occupational hygiene/exposure science is on the doorstep

D Brouwer

Occupational and Environmental Exposure and Health Division, School of Public Health, University of the Witwatersrand, Johannesburg, South Africa

Correspondence
Prof. Derk Brouwer
e-mail: derk.brouwer@wits.ac.za

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A primary goal of occupational hygienists and exposure scientists is to identify suitable controls in the exposure pathway that reduce human exposure to hazards and, consequently, the intake dose. Therefore, hygienists'/exposure scientists' interests should focus on the relationship between cause and effect, i.e. causal inference. The traditional approach is to first identify determinants or modifiers of exposure by statistical modelling, e.g. multiple regression analysis. However, conventional regression techniques perform poorly with the so-called 'small n, large p' problem. This means that, in practice, the number of exposure measurements (n) is usually small, while the number of possible exposure predictors (p) or determinants is large. In a recently published paper, Shkembi et al. (2025) systematically address these issues and provide recommendations for how occupational hygienists and exposure scientists can address them.[1]

In many cases, limited resources (budget and capacity) will reduce the number of measurements that it is feasible to conduct, often resulting in selection bias in the persons included in the study and the associated exposure determinants derived from contextual information. The prerequisite for the concept of similar or homogeneous exposure groups (SEGs or HEGs) is the representativeness of the selected individuals with respect to their activities and the behaviour characteristics that affect exposure. If the interest were only in exposure assessment, then the selection bias could be reduced by increasing the number of persons or measurements, for example, by using low-cost sensors – thereby yielding a better estimate of exposure variability.[2] However, from a causal inference perspective, it would be necessary for the workers included in the sample to have the same characteristics (e.g. age, height, years of experience, hand preference, etc.) as those not sampled. Clearly, this is not possible in real-world practice, which is why statistical methods such as inverse probability weighting (IPW) are used to make the two groups (sampled and unsampled) 'conditionally exchangeable' and reduce potential bias in statistical modelling.

Box 1. Machine learning[4]

Machine learning methods automate the discovery of statistical patterns within data without being explicitly programmed with rigid, rule-based instructions. They use a subset of those data (the training set) to build a flexible mathematical model (the algorithm), which is then validated on unseen data to ensure that it can make accurate predictions or uncover valuable insights on new information.

The starting point is a dataset, where each data point represents various characteristics. The dataset is split into a training set and a test set, typically at a 30%/70% split.

The training set is fed into an ML algorithm. The algorithm is a general mathematical procedure (e.g. for finding a line of best fit, or for drawing boundaries between groups). It starts 'blind' and tries to find patterns that connect the input data (e.g. house size) to the known output (e.g. price). It makes a guess, checks how wrong it is, and then iteratively adjusts its internal parameters to reduce that error. This cycle repeats thousands of times. The output of this training phase is a specific model – a tuned set of parameters that embodies the learned patterns. This model is the 'algorithm' tailored to your particular problem.

The test set acts as the final exam. It contains data that the model has never seen before during training. You use the trained model to make predictions on these new data and compare them to the known correct answers. This tells you how well the model general-ises. A good model performs well on the test set, proving it has learned general principles, rather than just memorised the training examples (a flaw called 'overfitting').

The model's role can usually be described as one of several main tasks:

- Prediction/estimation: *"Given this input (X), what is the most likely output (Y)?"* (e.g. *"Given these patient symptoms, what is the risk of disease?"*). Here, the target variable is continuous, whereas the feature variables can be continuous, ordinal, or nominal.
- Classification: *"Given this input, which category does it belong to?"* (e.g. *"Is this e-mail 'spam' or 'not spam'?"*). Here, the target variable is ordinal or nominal, whereas the feature variables can be continuous, ordinal, or nominal.
- Clustering: *"How can I group these data points based on their inherent similarities?"* (e.g. *"Segment customers into distinct groups based on purchasing behaviour."*)
- Anomaly detection: *"Which data points are unusual or don't fit the normal pattern?"* (e.g. *"Flag this unusual credit card transaction"*).

Box 2. Tree-based machine learning models[4]

Tree-based machine learning models, especially the powerful ensemble versions, are incredibly popular and successful for tabular data (the kind you would find in a spreadsheet or database). The process of building a decision tree involves splitting the data into subsets, based on the value of input features, until a stopping criterion is met. The goal is to create subsets that are as homogeneous as possible (in terms of the target variable) at each step.

Key concepts are:
- Root node: the entire dataset at the start
- Internal/decision nodes: where splits happen, based on feature conditions
- Branches: outcomes of decisions (e.g. *"Yes/No", "≤ threshold/> threshold"*)
- Leaf/terminal nodes: final predictions (classes for classification, values for regression)
- Pruning: removing sub-nodes of a decision node that have little predictive power, to reduce overfitting

Ensemble trees, e.g. random forests and gradient boosting, build multiple trees and combine their predictions.
- Random forest: builds many decision trees on random subsets of the data and features, then averages their predictions (for regression) or takes a vote (for classification). This reduces overfitting and variance.
- Gradient boosting: builds trees sequentially, each tree trying to correct the errors of the previous one. The final prediction is a weighted sum of the tree predictions.

The ensemble tree models mentioned above, as well as many other ML methods, are available in most statistical packages, including the very user-friendly JASP, which can be freely downloaded from *https://jasp-stats.org/*.

Regarding the exposure determinants, it is evident that the focus of occupational hygienists and exposure scientists will be on mechanistic or mathematical approaches, including a limited number of potential determinants, e.g. the physico-chemical properties of relevant substances, as well as process and environmental or workplace parameters. Non-mechanistic causes of exposure (e.g. variation in personal behaviour) are often overlooked. Decades ago, the video exposure monitoring approach was introduced: the simultaneous monitoring of pollutant concentrations by direct-reading devices and the video capture of a person's activities and behaviour. This approach is considered an essential tool for linking behavioural aspects to exposure.[3]

Shkembi et al. (2025) combined four biological monitoring data (heavy metals in blood and urine) for a subset (n = 41) of 226 workers performing e-waste recycling tasks, along with 10-minute video footage of each worker.[1] The 10 minutes were sampled from full-shift recordings and analysed, using a video assessment tool to rate the frequency of each of 44 potential exposure determinants. The determinants related to 1) specific e-waste to be dismantled, 2) tool use, 3) ergonomics and behaviour, and 4) personal protective equipment (PPE) use. The latter was included because the exposure was expressed as heavy metal excretion values, thereby reflecting the dose.

After creating inverse probability weights for the subset, exposure determinant models were developed for each of the four outcome variables, using two traditional statistical methods (linear regression and forward selection linear regression) and three machine learning algorithms (see Box 1). As a result, 41 separate models were constructed for each heavy metal (41 participants × 5 model types × 4 heavy metals = 820 models). The models' performance was evaluated using root-mean-square error.

The random forest models performed best and were used for subsequent analyses (see Box 2). The most important determinants of exposure, as identified by these models, were considered to be the most obvious to include in exposure controls. Examples are workers (stopping) bending their backs while dismantling e-waste, (stop) using 'blunt striking instruments', and (eliminating) neck bending and repetitive hand motion. The models were able to predict individual workers' heavy metal concentrations.

The authors state that causal inference, using machine learning algorithms, overcomes the common limitations of cross-sectional exposure-determinant modelling and the 'small n, large p' problem when traditional approaches are used. It helps occupational hygienists and exposure scientists to select the most effective hazard controls.

As occupational hygienists and exposure scientists, it is vital to keep pace with developments in our field and to go beyond traditional exposure (concentration) compliance testing. Moreover, general textbook recommendations for exposure controls should be refined and adjusted to the exposure scenarios. Sophisticated (observational and statistical) techniques are currently available, and higher education institutions should incorporate them into their occupational hygiene and exposure science training and learning programmes. Leading approved inspection authorities (AIAs) should not hesitate to apply them to leverage occupational hygiene and exposure science quality services in South Africa. The paper by Shkembi et al. (2025) is a call to action.

REFERENCES

1. Shkembi A, Virji MA, He J, Nambunmee K, Ruiz-Rudolph P, Neitzel RL. Using casual inference and machine learning with exposure determinant modeling to identify important workplace controls. Ann Work Expo Health. 2025; wxaf069. doi: 10.1093/annweh/wxaf069.
2. Brouwer D, Lavoué J. Application of low-cost monitoring and sampling devices in occupational hygiene measurement strategies for hazardous chemicals. Occup Health Southern Afr. 2020; 26(3):104-110.
3. Rosén G, Andersson IM, Walsh PT, Clark RD, Säämänen A, Heinonen K, et al. A review of video exposure monitoring as an occupational hygiene tool. 2005; 49(3):201-217. doi: 10.1093/annhyg/meh110.
4. Deepseek. Extract from AI chatbot. Available from: https://chat.deepseek.com/ (accessed 10 December 2025).

Report on the International Commission on Occupational Health Symposium: Biohazards at the workplace – magnitude of the problem and potential solutions

Tanusha Singh: Department of Environmental Health, Faculty of Health Sciences, University of Johannesburg, Johannesburg, South Africa; Secretary of Scientific Committee on Biohazards and Occupational Health (SCBOH)
e-mail: tanushas@uj.ac.za
Mary Ross: School of Public Health, University of the Witwatersrand, Johannesburg, South Africa; Past Chair ICOH Working Group on Occupational Infectious Agents and SCBOH; Executive member of the South African Society of Occupational Health (SASOM)

The first mid-term symposium of the Scientific Committee on Biohazards and Occupational Health (SCBOH) was held in Hamburg, Germany, on 6 and 7 October 2025. The event attracted 58 experts, policymakers, and practitioners in occupational health, infectious disease control, and biosafety, from 11 countries across four continents, to exchange views on research, policy, and practice related to biological hazards in the workplace. The symposium marked a significant milestone for SCBOH, formed in 2022 by the International Commission on Occupational Health (ICOH).

The symposium was hosted by the BGW (Institution for Statutory Accident Insurance and Prevention in the Health and Welfare Services) and supported by the International Social Security Association (ISSA), Competence Centre for Epidemiology and Health Services Research for Healthcare Professionals (CVcare), the University Medical Center Hamburg-Eppendorf (UKE), and the International Labour Organization (ILO).

Global collaboration and expertise

The opening session set a strong collaborative tone with welcome remarks from Prof. Albert Nienhaus (SCBOH chairperson), Miriam Stuckert (ISSA), and Prof. Volker Harth (the German Society for Occupational and Environmental Medicine (DGAUM)), followed by Prof. Mary Ross who traced the evolution of SCBOH from its early roots as the Working Group on Occupational Infectious Agents (WGOIA) to a globally recognised scientific committee. Her address celebrated successes during the 19 years of growth from WGOIA to SCBOH, including contribution to the 2021 ILO technical guidance on biological hazards, and the landmark adoption of the 2025 ILO Convention on Biohazards.

Scientific programme

Within the 14 oral presentations and 16 posters, participants covered a diverse range of topics, from infectious disease risks to non-infectious biohazards, such as advances in vaccine prevention and allergies.



Members of the SCBOH in attendance. Left to right: Prof. Stefano Porru, Dr Augustina Puspitasari, Prof. Mary Ross (first SCBOH Chair), Prof. Tanusha Singh (SCBOH Secretary), Prof. Albert Nienhaus (current SCBOH Chair), Mr Fransisco Santos-O'Connor (ILO, Geneva, non-member), Dr Gianluca Spiteri, Dr Marcella Mauro, Dr Guglielmo Dini *Photograph: courtesy of Bianca Hobusch*



Presenter: Prof. Mohamed Jeebhay (South Africa)
Photograph: courtesy of Bianca Hobusch

South Africa was very well represented in the scientific programme, by four speakers and a poster presentation.

Keynote presentations featured:

- Gerd Schneider (Institute for Occupational Safety, Germany): 'Review of the most important workplace biohazards'
- Francisco Santos-O'Connor (ILO, Geneva): 'New international labour standards on biological hazards'
- Dipti Patel (UK): 'Advances in vaccination and travel medicine for global workforces'
- Michael Hodgson (National Institute for Occupational Safety and Health (NIOSH), USA): 'Reflections of the Centers for Disease Control and Prevention (CDC) and NIOSH under the Trump administration'
- Mohamed Jeebhay (University of Cape Town, South Africa): 'Insights into non-infectious biohazards in the workplace'

Additional sessions highlighted tuberculosis prevention and control in work settings, global surveillance of occupational diseases in travellers, changing climates and reshaping risks for outdoor workers, occupational infections among European healthcare workers, biohazards in veterinary practice, and biohazardous risks among sex workers.

The final presentation covered the SCBOH survey on biohazards as an occupational risk, conducted by Prof. Singh and Prof. Ross through the National Secretaries of the 74 ICOH country members. Preliminary analysis of the 32 questionnaires returned was presented by Prof. Singh.

The symposium's poster exhibition showcased innovative work from multiple countries. Poster awards were presented to:

- Spiteri G, Monaco MGL, Porru S (Italy): 'Vaccine-preventable diseases in healthcare workers and fitness for work: challenges for occupational physicians'
- Rifki AIM, Fachrulrazy D, Hidayat R, Gama R (Indonesia): 'Integrating vector control and occupational health economics: a spacio-temporal model of mosquito-borne disease prevention in Pertamina of mosquito stings in outdoor workers'
- Peitler H, Barnekow T, Nienhaus A (Germany): 'Hantavirus infections as an occupational disease among insured individuals in healthcare and welfare services'

These contributions exemplified the SCBOH's One Health vision and the growing integration of data-driven approaches in occupational biohazard research.

The symposium concluded with a post-conference workshop at the Museum for Medical History at the University Clinics Hamburg, offering a reflective journey through *The History of Pandemics,* emphasising occupational epidemics, including the recent COVID-19 pandemic.

Future focus for the SCBOH

Following the various challenges and requests expressed by the SCBOH survey participants, a pivotal roundtable discussion on 'The future of SCBOH: plans and priorities' charted the committee's strategic roadmap. Delegates emphasised strengthening surveillance systems, promoting ILO Convention ratification, and enhancing collaboration across global regions. A Call to Action was issued, urging countries to adopt the new ILO Biohazards Convention C192 and Recommendation to ensure protection for all workers. C192 and R209 are the first international legal instruments for biohazards, to which members from the WGOIAs contributed.

The symposium confirmed the enthusiasm of the SCBOH members, the strength of their collective expertise, and the shared purpose to transform the way the world understands, prevents, and manages biohazards at work.



Presenters and question sessions (left to right): Prof. Paolo Durando (Italy), Dr Albert de Frey (South Africa), Prof. Albeit Nienhaus (Germany)
Photograph: courtesy of Bianca Hobusch

8th Mombasa Annual International OSH Conference

23–24 October 2025

Conference Abstracts

Organised by OSH Pro Services and supported by the Technical University of Mombasa, the 8th Mombasa Annual International Occupational Safety and Health Conference was held at the PrideInn Beach Resort in Mombasa, Kenya on 23–24 October 2025. The theme of the conference was *Dealing with exposure to occupational hazards.* Dr Khanssa Lagdami from the World Maritime University in Malmö, Sweden delivered a conference curtain-raiser public lecture on nutrition and its impact on worker safety in the maritime industry.

A pre-conference Occupational Hygiene Training Workshop on exposure assessment, study design, and implementation was conducted on 22 October 2025 by Prof. Janvier Gasana from the Global Applied Prevention Center, USA, Ms Mary Cameron from the Health and Safety Executive (HSE), UK, and Dr Anani Afanou from the Norwegian National Institute for Occupational Health. It was held at the Technical University of Mombasa and inaugurated by the university's Vice Chancellor, Prof. Laila Abubakar.

The conference was attended by delegates and speakers from 11 countries (Kenya, Nigeria, South Africa, Ghana, UAE, Norway, Sweden, UK, USA, Canada, Finland). Eminent presenters included Dr Catherine Cornu, Senior Scientific Officer, from the European Chemicals Agency (ECHA) based in Finland, the Presidents of the International Occupational Hygiene Association (IOHA) and OSHAfrica, and experts from the World Maritime University (Malmö, Sweden),



The iconic Mombasa Tusks forming a giant 'M' over Moi Avenue in Mombasa, Kenya

Photograph: https://creativecommons.org/licenses/by/4.0/ Rob Oo at https://flickr.com/photos/105105658@N03/53437335723

Emirates Society of Occupational Medicine (UAE), HSE (UK), Global Applied Prevention Center Inc. (GAPC) (USA), and Norwegian National Institute for Occupational Health.

Oral and poster presentations covered a number of hot-button topics in occupational health and safety, including the impact of climate change and extreme weather on worker health, particularly in Africa; how the integration of new technologies is transforming work, but also causing technostress; and the need for strengthened regulatory frameworks, standards, and training and awareness programmes in Africa as the continent experiences rapid economic development.

A special session was convened by Mr Abdulqadir Suleiman (Norwegian Labour Inspection Authority and OSH Pro Services, Kenya) for key national stakeholders to explore strategies for enhancing chemical safety, hazard communication, and regu-latory alignment with the UN Globally Harmonised System (GHS) for classification and labelling of chemicals. Mr Maxwell Memusi from the Directorate of Occupational Safety and Health Services, Kenya liaised with national agencies and coordinated the programme.

This is a project initiated by the United Nations Environment Programme (UNEP) and European Union (EU) Commission, represented by the ECHA.

Future plans include using some proceedings from the event to inform a project promoting occupational hygiene training, including work in the informal sector.

The 9th edition of the event will be held during the last quarter of 2026. Dates will be confirmed early in 2026.



Built by the Portuguese between 1593 and 1596, Fort Jesus is a landmark UNESCO World Heritage site in Mombasa
Photograph: courtesy https://www.freepik.com/



A lineup of some of the conference presenters

Image: courtesy of OSH Pro Services

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Oral Presentation Abstracts

Ethics of workplace health and safety inspection and effective reporting

Dr Ehi Iden
President: OSHAfrica; CEO: OHSM, Lagos, Nigeria

Workplace health and safety inspections are essential in identifying hazards and recommendations for corrective actions, and ensuring compliance with workplace laws and regulations towards protecting employees from accidents and injuries, while fostering a positive health and safety culture. The role of the inspector is crucial as it serves as the government's representation within the workplace health and safety structure. A health and safety inspector must be seen to maintain an unbiased position and must be knowledgeable not just about regulations or laws, but also competent in the field of workplace health and safety. He or she must be a thorough professional acting in both the interest of employees, employers, and the government.

Workplace inspections are conducted within the ethics of the profession and this has been overlooked in most cases, leading to poor inspection outcomes not strengthening the health and safety practices in organisations. The ethics of inspections talks about a pre-inspection management meeting, walk-around inspection processes, sighting and reviewing of required documents, documentation of findings, a post-inspection management meeting, and inspection report writing and submission. It is important to keep in mind that this does not involve playing a blame-game.

Writing a good inspection report is a crucial part of inspection. It is the total expression of all findings in terms of hazards, where they are in the organisation, the risk posed, required corrective actions, risk rating, and the urgency of mitigation. This is where most inspectors struggle.



Dr Ehi Iden – President: OSHAfrica; CEO: OHSM, Lagos, Nigeria
Photograph: courtesy of OSH Pro Services

Conclusion: Creating opportunities for training and re-training of occupational safety and health and labour inspectors is a useful tool towards scaling the existing inspection skills of the inspectors and, by extension, improving workplace health and safety conditions through safe recommendations and enforcement of occupational health and safety laws and regulatory requirements.

A situational analysis of occupational hygiene in Kenya 2024/2025

Mr John A M Waweru
Directorate of Occupational Safety and Health Services, Kenya

In the workplace, employees are likely to be exposed to workplace health hazards and risks. Monitoring workplace contaminants is crucial to maintain exposure levels within acceptable limits. This study was intended to assess compliance with the Occupational Safety and Health Act of 2007, specifically looking at occupiers that carried out noise, ergonomics, light, and air quality measurements and submitted reports to the Directorate of Occupational Safety and Health Information Management System (DOSHMIS) in the period 2024/2025.

In the period 2024/2025 of study, there were 25 961 registered workplaces, and 35 registered experts as air quality monitors. The air quality monitors are registered competent persons who carry out occupational hygiene measurements in workplaces as per the hazardous substances rules of 2007, a subsidiary legislation under the Occupational Safety and Health Act of 2007. A review of 3 003 occupational hygiene reports from the occupational safety and health information management system covering data in the period 2024/2025 was used. The Microsoft Excel programme was used in data analysis.

The results indicated that 70.4% of noise, 25.2% of air quality pollutants, 3% of light, and 1.4% of ergonomic issues were the most prevalent issues in the total reports analysed. From the results, it was noted that noise surveys were significantly higher than other workplace contaminants evaluated for compliance. One reason is that noise measurement can be performed by anyone, whereas other workplace pollutants require an approved person. It is recommended that more studies should be carried out to establish why there is more compliance with noise measurements.

The impact of new technologies on seafarers and the evolving role of the Maritime Labour Convention (MLC), 2006

Dr Khanssa Lagdami
World Maritime University, Malmö, Sweden

The rapid integration of new technologies, such as automation, digitalisation, and advanced communication systems, is fundamentally transforming life and work on board ships. This presentation examines the multifaceted impact of these advancements on seafarers, highlighting both the opportunities and challenges they present. While technology promises enhanced efficiency, safety, and connectivity, it also introduces risks like technostress, skill gaps, and cyber threats.

Central to managing these changes is the MLC 2006, which serves as the international benchmark for seafarers' rights and welfare. The MLC plays a pivotal role in ensuring that the transition to new technologies does not compromise seafarers' working and living conditions. Recent amendments to the MLC emphasise access to high-quality meals, medical care, including telehealth, and reasonable internet connectivity, directly addressing some of the challenges posed by technological change. The Convention also underscores the need for continuous training and upskilling, supporting seafarers as they adapt to evolving shipboard roles and responsibilities. However, effective implementation and regular updates of the MLC are essential to keep pace with technological advancements and to ensure that regulatory protections remain robust and relevant. The presentation underscored the importance of proactive regulatory frameworks, social dialogue, and ongoing support for seafarers, ensuring that technological progress in the maritime sector enhances, rather than undermines, occupational safety, health, and overall wellbeing.

Advancing seafarers' good nutrition and other occupational health on board ships

Dr Khanssa Lagdami
World Maritime University, Malmö, Sweden

Ensuring access to nutritious, high-quality food on board ship is not only a logistical challenge, but a fundamental human right that underpins seafarers' health, safety, and morale. The Food4Seafarers Project, led by the World Maritime University and sponsored by the ITF Seafarers' Trust, was launched in response to persistent gaps in maritime nutrition, despite rising awareness and regulatory frameworks such as Maritime Labour Convention (MLC) Regulation 3.2. This pilot initiative systematically examines the adequacy, variety, and cultural appropriateness of shipboard catering, employing metrics that account for nutritional content, quality, costs, and stakeholder feedback.

Primary research findings highlight that restricted catering budgets, rising food prices, and supply chain complexities continue to undermine the provision of balanced meals at sea. Scarcity of fresh food and water, weak enforcement of nutrition standards, and limited crew involvement in menu planning further exacerbate these risks, ultimately affecting occupational health outcomes and productivity. The project's multi-stakeholder methods, including interviews with seafarers, cooks, social partners, and ship owners, underscore the need for industry-wide collaboration and policy interventions to prioritise nutrition as a cornerstone of occupational safety.

The presentation addressed why maritime industry-wide action, including enhanced budgets, robust supply chains, and better training, can catalyse a shift from treating good nutrition as a privilege to recognising it as a necessity across global shipping. These recommendations aim to influence both regulatory implementation and everyday practices, supporting resilient occupational health for seafarers and the wider maritime workforce.



Dr Khanssa Lagdami – World Maritime University, Malmö, Sweden

Introducing the UN GHS safety data sheet

Mr Abdulqadir Suleiman
Norwegian Labour Inspection Authority; OSH Pro Services, Mombasa, Kenya

Safety data sheets (SDSs) are an essential tool for chemical hazard communication. They provide detailed information on chemical substances and mixtures, including safe handling during use, storage, and transport.

The UN globally harmonised system (GHS) for classification and labelling of chemicals provides a standardised SDS format. This is a 16-section format SDS, covering identification, hazard details, composition, first-aid measures, fire-fighting techniques, accidental release procedures, handling and storage, exposure controls, physical and chemical properties, stability and reactivity, toxicological data, ecological impact, disposal considerations, transport information, regulatory data, and other relevant details. Each section has several subsections that specify the relevant information required, ensuring comprehensive chemical information.

The most recent revision of the GHS (Rev. 8) introduced updates to SDS content, including new classification criteria, hazard communication elements, and guidance for chemicals under pressure. These enhancements aim to improve global consistency, reduce risks, and support regulatory compliance across industries. Safety data sheets are essential for employers, workers, emergency responders, and regulators to understand chemical risks and implement appropriate safety measures. By harmonising SDS formats and content, GHS facilitates international trade and strengthens workplace safety.



Mr Abdulqadir Suleiman (Norwegian Labour Inspection Authority and OSH Pro Services, Kenya) and 8th Mombasa Annual International OSH Conference organiser *Photograph: OSH Pro Services*

Addressing occupational hygiene priorities in Africa and beyond

Mr Matthew Olota
President: International Occupational Hygiene Association (IOHA), Canada

As we confront a rapidly evolving world of work and the emerging risks that this presents to the worker, the need for strong global standards and practices in safety, health, and wellbeing has never been more critical. This session highlighted key occupational hygiene priorities in Africa and on the global stage, and focused on embedding the newly established fundamental principle and right of safety and health at work into the values and strategies of workplaces. A central theme was the lack of applicable regulatory frameworks, the shortage of qualified practitioners, and the need to build more partnerships to drive change. We discussed the urgency of building a competent and certified workforce, highlighting successful models from other countries, and the broader global implications of such efforts. Additionally, we addressed the challenges of reaching informal and vulnerable workers, and suggest strategies to extend occupational hygiene prevention efforts and worker protection to those often excluded from traditional frameworks. Finally, the session considered the role of advocacy and the call for a collective response to ensure that these vital issues are embedded in future work environments.

Bridging complexity and comprehension: comics as a tool for occupational hygiene knowledge dissemination

Ms Naadiya Mundy
MD: Nexam (Pty) Ltd, South Africa

Effective communication is central to advancing occupational hygiene, yet the field's technical language and complex data often limit engagement among workers and the wider public. Cartoons and comics have proven effective as knowledge-translation tools in science communication (Farinella, 2018) and information-literacy education (McNicol, 2016), offering humour, relatable characters, and visual storytelling to simplify complex exposure-science concepts and capture attention across literacy levels.

Visual representations enhance learning and retention (Nesbit and Adesope, 2006), while pictorial health education materials have repeatedly shown improved comprehension and engagement among audiences with varied literacy levels (Houts et al., 2006). Applying these principles to occupational hygiene demonstrates how original comics can stimulate dialogue in diverse workplace settings, while maintaining scientific accuracy and cultural relevance, consistent with WHO guidance on risk communication and community engagement (WHO, 2021). Integrating visual narratives into training, outreach campaigns, and professional development can, therefore, strengthen awareness and support safer work environments.



Participants enjoying a view of the magnificent Kenyan coastline *Photograph: courtesy of OSH Pro Services*

Occupational medicine in Africa: a critical frontier

Dr Nahid Yassin Hussain Ebinouff
Capital Health Screening Centre, Abu Dhabi, UAE

Occupational medicine focuses on protecting workers' health, safety, and performance by preventing and managing work-related injuries and illnesses. It promotes collaboration among employers, regulators, insurers, and health professionals to create safer workplaces. Globally, nearly three million deaths and over 395 million non-fatal injuries occur annually due to occupational hazards – Africa contributes significantly to this toll.

Africa's rapid economic growth has intensified exposure to high-risk industries. Agriculture, which will employ 30–80% of the workforce by 2025, exposes workers to respiratory illnesses, pesticide toxicity, heat-related conditions, and zoonotic diseases. Mining, with Africa holding nearly 30% of the world's mineral resources, presents risks from hazardous dusts, heavy metals, and crystalline silica. Construction and chemical industries – covering fertilisers, plastics, paints, and pharmaceuticals – add further threats.

Despite these risks, occupational medicine in Africa faces major challenges. Many countries lack strong regulatory frameworks, and enforcement is often weak. There is a shortage of trained professionals, including occupational physicians, nurses, hygienists, and health, safety, and environment (HSE) officers. Limited data on workplace injuries and diseases hamper targeted interventions. Mental health conditions, epilepsy, heart disease, and substance abuse also pose risks in safety-critical roles.

To improve occupational health services, Africa must strengthen legislation, raise awareness, and expand training programmes. Support from organisations like the African Union, World Health Organization (WHO), and International Labour Organization (ILO) is vital. Investing in personal protective equipment (PPE), workplace resources, and research will drive evidence-based practices.

Ultimately, healthier workplaces mean healthier workers. Strengthening occupational medicine is essential for safeguarding lives and boosting productivity across the continent.

Hearing protective devices fit testing

Ms Mary-Kate Cameron
Health and Safety Executive (HSE), UK

Ensuring that hearing protection devices (HPDs) deliver effective protection requires more than simply issuing them to workers. Selection errors, poor fit, or lack of care can all compromise protection and increase the risk of noise-induced hearing loss. This presentation explores the importance of both adequacy and suitability when selecting HPDs, and demonstrates how HPD fit testing provides a critical insight from laboratory attenuation data to real-world performance. Fit testing verifies the actual noise reduction an individual achieves while wearing their particular HPD with their particular fit. Methods such as field microphone in real ear, real-ear attenuation at threshold, and loudness balance tests provide personal attenuation figures. Fit testing can be incorporated into hearing conservation programmes, alongside worker training and audiometric surveillance.

Fit testing offers multiple benefits: it educates wearers on proper HPD fit, reinforces safe practices, highlights over-protection risks, and documents effective training and equipment selection. Ultimately, HPD fit testing ensures that the workers' hearing protection is not just provided, but also proven to work for them, strengthening hearing conservation efforts and safeguarding workers' long-term health.

Hand-arm vibration – a database approach to exposure assessment

Ms Mary-Kate Cameron
Health and Safety Executive (HSE), UK

Assessing hand-arm vibration (HAV) exposure is an important aspect of HAV risk management. On-tool vibration magnitude measurements are often considered in this approach, but this can be time consuming, costly, and often unnecessary when reliable data already exist. This presentation introduces a practical, database-driven approach to assessing HAV exposure. By utilising established online databases of vibration magnitude values – collected in compliance with BS EN ISO 5349 – occupational hygienists can carry out effective desk-based assessments for many typical tools and their application.

The process involves building an inventory of the site's vibrating equipment, populating it with relatable vibration magnitude data, and applying professional judgement to estimate exposures. Tools without reliable database matches can then be prioritised for site-based on-tool measurement, focusing effort where it is most needed. This method not only saves significant time and resources, but also supports proportionate risk management, guiding employers toward effective control measures, health surveillance, and training, rather than time and money spent on superfluous measurements.

Importantly, the database emphasis shifts from forensic precision to practical judgement – providing reasonable exposure estimates that enable quick actions towards worker health protection. The database approach streamlines the HAV risk assessment, while ensuring confidence in outcomes and prioritising risk reduction over exhaustive measurement.

Climate and extreme weather – resilient occupational health: preventing occupational and environmental hazards in workers in Africa, and beyond

Prof. Janvier Gasana
Global Applied Prevention Center Inc., USA

Climate change and extreme weather events pose significant occupational health risks to workers worldwide, particularly in Africa. Rising temperatures, changing precipitation patterns, and increased frequency of extreme weather events can lead to heat stress, vector-borne diseases, and other health problems. This congress topic focused on the impact of climate change on occupational health, highlighting the need for resilient occupational health systems to prevent occupational and environmental hazards.

Key discussion points were 1) climate change and occupational health – understanding the impact of climate change on worker health and safety, 2) extreme weather events and occupational hazards – identifying occupational hazards associated with extreme weather events, 3) resilient occupational health systems – developing strategies for building resilient occupational health systems, and 4) prevention and mitigation – implementing effective prevention and mitigation measures to protect workers.

The objectives are 1) raise awareness about the impact of climate change on occupational health, 2) share best practices for building resilient occupational health systems, and 3) foster collaboration among stakeholders to address occupational health risks. The expected outcomes are 1) increased awareness about the impact of climate change on occupational health, 2) improved resilience of occupational health systems, and 3) effective prevention and mitigation measures to protect workers.

Building strong occupational health: exposure assessment, study design, and implementation

Prof. Janvier Gasana
Global Applied Prevention Center Inc., USA

This pre-congress workshop familiarised participants with concepts in assessing human exposures to environmental and occupational contaminants. It provided information on different sources and routes of exposures, the various methods applied to assess these exposures, and the challenges faced by population-based studies that relate such exposures to health outcomes. It provided an overview of all aspects of environmental exposure assessment.

Exposure assessment is a key component of environmental health and the goal of much of environmental monitoring. The extent, duration, frequency, and magnitude of exposures to chemicals are estimated via various routes (ingestion, inhalation, dermal, or in utero) for individuals/populations. Indirect approach – pollutant concentrations are measured in various locations or during specific human activities to predict exposure distributions within populations – environmental monitoring. Exposures can be estimated by measuring chemical levels in various body tissues (such as hair, blood, and urine) as biomarkers or by using various mathematical models. Direct approach – pollutant concentrations are directly monitored on or within persons through point of contact, biological monitoring (biomarkers).

Exposure science evaluates various problems, because humans (and other species) can encounter physical, chemical, biological, and psychosocial hazards every day, and during natural and other catastrophic events. This workshop covered all major exposure media (air, water, food, soil, etc.) and all the important pathways (inhalation, ingestion, absorption, etc.). It also included exposure assessment study design/implementation with examples, the strengths and weaknesses of various exposure assessment techniques, and how to link exposure assessment with environmental health. Implementation involves 1) study design, 2) data collection, 3) data analysis, 4) interpretation of results, and 5) dissemination of results.

Methods are 1) monitoring – collecting data on exposure levels through air, water, or soil sampling, 2) modeling – using mathematical models to estimate exposure levels, and 3) questionnaires and surveys: collecting self-reported data on exposure.

Poster Presentation Abstracts

Evaluation of work-related musculoskeletal disorders among housekeepers in selected hotels in Mombasa County

Ms Enid Kanyiri
Director, A&Z Nutraceuticals Ltd, Kenya

Background

Work-related musculoskeletal disorders (WRMSDs) affect primarily muscles, tendons, joints, intervertebral discs, peripheral nerves, and the vascular system. Work-related musculoskeletal disorders are a worldwide issue and are experienced by workers in both developed countries and industrially developing countries (IDCs). The prevalence of WRMSDs and their risk factors are not well known among hotel housekeepers in Kenya. Therefore, this study aimed to assess the annual prevalence of WRMSDs, determine the risk factors associated with WRMSDs, and analyse strategies to prevent WRMSDs among housekeepers in selected hotels in Mombasa County.

Methods

The sample size of 276 housekeepers was obtained by considering all the housekeepers working at 18 purposefully selected hotels at the time of study. Data were collected using semi-structured questionnaires. The study used both qualitative and quantitative data analysis. The Statistical Package for Social Sciences (SPSS 23) was used for analysis. This study used descriptive and inferential statistical analysis to analyse quantitative data collected from the structured questions. Descriptive statistical analysis, including frequencies and percentages, and inferential statistical analysis, including the Chi-square test and linear regression, were used to establish the association between variables.

Results

The study found that the housekeepers who had experienced regular joint and muscle pain within a year were 91.7%. Lower back pain was the most common WRMD reported. Leg, shoulder, and neck joint and muscle pain was also reported, resulting from carrying/lifting and pulling/pushing heavy items weighing > 20 kgs.

Conclusion and recommendation

This study recommends that hotels employ adequate staff to ensure reasonable breaks, job rotation, and teamwork. The hotels should also consider mechanisation of equipment, practical training, and reinforcing laws through health committees.

Creating awareness of health and safety risks, both at work and at home

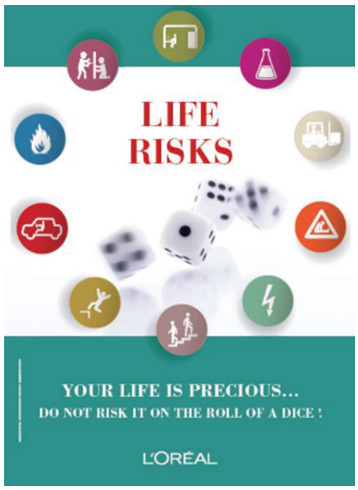
Ms Margaret M Musango
EHS Manager: L'Oréal East Africa, Kenya

Workplaces present different kinds of hazards, some of which could be department-specific. The risks arising from these hazards could vary across different departments. Most of these risks are found both at work and beyond, although most individuals tend to switch off their safety mindset as they leave the workplace. It is, therefore, important to build on a safety culture at work and spread it beyond.

At the beginning of each month, the safety department at L'Oréal East Africa sends department managers the LIFE topic of the month. This includes the conversation starter cards (which have guide questions, as well as the company procedure on the particular LIFE risk. The topic guides the safety moments/safety contacts held before the start of meetings throughout the month. The department managers, with the support of the EHS team, guide the teams through the risks relating to the theme topic and reflect on associated risks at home.

At the end of the month, the department manager reverts with a communication register as well as team commitments for the LIFE risk both at work and at home.

For select LIFE risks, we collaborate with parents and send age-customised questionnaires to guide the LIFE risk discussion with their children.





Linking quantum weirdness with occupational safety and health assessments in the 21st century and beyond

Prof. Charles FL Mbakaya
PhD

Background

While occupational safety and health (OSH) is a science largely informed by measurements in the work environment, this may be subject to the measurement problem of the observer. No wonder the United Nations has declared 2025 the International Year of Quantum Science and Technology.

Objectives

To draw the attention of OSH specialists to quantum weirdness and its possible impact on the field.

Methods

I used theoretical frameworks that bring on board chemistry, physics, theology, history, OSH, and philosophy in a manner that is abductive and practical in reasoning, rather than the contemporary but limited inductive scientific method and theoretical reasoning.

Results and Discussion

I have hypothesised/theorised elsewhere that matter in the universe was intelligently created, with gravity as the binder, and subsequently bombarded with the created light/dark energy (Big Bang) to birth immobile and mobile non-matter (dark matter/aether) in a cyclic process that is maybe faster than the speed of light, complicating reality and the science of measurement (occupational hygiene included). In essence, my two-way arrow of time is best illustrated by evaporation from oceans being favoured by an increase in entropy, while rainwater falling is favoured by gravitation, with potential energy decreasing; this mechanism also elucidates the orchestration of consciousness in the universe. As for the elusive force of gravity even between the sun and Earth, I posit that it involves sharing chemical moieties such as electrons; this being synonymous with chemical bonding and accounting for the instant Newtonian Gravity. So, while Newton may have been describing this part of gravity that instantly pulls, Einstein may have focused on the other, but complementary, part that pushes the chemical mediating moieties in space-time as during evaporation.

Conclusion

Cognisant of the quantum weirdness herein, more refined tools of measurement, including attosecond technologies, may be indicated for use by OSH specialists even to study how chemical hazards impact the hard problem of consciousness, among other things.



Conference participants *Photograph: courtesy of OSH Pro Services*

Beyond job titles: the evolution of essential services designation for tailings dams

Kate Collier: Partner, Webber Wentzel
Amy King: Knowledge Lawyer, Webber Wentzel

A service-based approach to essential services marks a significant shift in how tailings dam operators must approach workforce classification and labour relations, with positive impacts for meeting occupational health and safety imperatives.

The Essential Services Committee's (ESC) recent decision to expand the designation of essential services at tailings dams is more than a simple broadening of scope. It is a fundamental shift from focusing on who performs a service to what service is being performed, culminating in the expansion of essential services based on the recognition of the importance of the safety role played by personnel involved in the management and oversight of tailings dams.

When the ESC first designated services rendered by mud guards and team leaders at tailings dams as essential services on 11 May 2018, it inadvertently created a loophole. Subsequent referrals in terms of section 73(1)(a) and (b) of the Labour Relations Act (LRA) revealed that whilst employees rendered the same or similar services to those performed by 'mud guards' and team leaders, different job titles were used to describe these employees. This resulted in employers and employees finding themselves in disputes about whether the essential services designation applied, with the answer turning on terminology, rather than the substance of the work and services being performed by the persons in these roles.

This prompted the ESC to initiate an investigation to review the designation to determine the actual service as opposed to who renders the service. The shift from a position-based to a service-based approach is not merely semantic, it reflects a deeper understanding of how essential services should be identified and regulated in complex industrial environments, particularly where health and safety are at stake.

This may open the door for a broader approach to considerations of the importance of protecting the health and safety of employees, and non-employees who may be impacted by an employer's operations and the risks that may be presented when employees tasked with health and safety obligations go on strike. This decision highlights whether the consideration of the protection of health and safety should be so essential such that the persons who perform those roles should be prevented from striking.

The ESC's approach must be understood within the constitutional framework governing the right to strike. The Constitutional Court has emphasised that a restrictive interpretation of essential service must, if possible, be adopted so as to avoid impermissibly limiting the right to strike. The law requires that it is the service which is essential, not the industry or the operation within which the service falls; only those employees who are truly performing an essential service may be prohibited from striking; and essential and non-essential service workers may be found working side by side in the same operation. This then requires balancing the right of employees to strike against the need to protect the health and safety of persons who could be negatively impacted by a failure to perform work that safeguards health and safety, especially of the public.

This framework explains why the ESC took such care to delineate precisely which services at tailings dams are essential and which are not. Before the ESC can designate any service as essential, it must be satisfied that the interruption of the said service is likely to endanger life, personal safety, or health of the whole or part of the population; in this regard, essential services designations play an important role as an occupational health and safety mechanism.

The expanded designation covers two distinct operational areas:
Deposition sites – All services that are necessary for the building and/or construction, maintenance, risk management, including monitoring, inspection, and reporting at tailings dams to ensure the integrity, safety, and stability of the deposition sites and/or tailings dams are essential services. These services are about preventing failures that would endanger workers, communities, and ecosystems. For example, monitoring phreatic surfaces, measuring piezometer readings, and inspecting for seepage are early warning systems that detect structural instability before failure occurs. Relocating pipe systems to prevent overtopping and raising catwalks to manage pool depth are active interventions that maintain the physical integrity of tailings dams. The designation ensures that these critical safety monitoring and maintenance functions continue uninterrupted, regardless of the employee's title.

Hydro mining – The hydro mining component of the designation illustrates the ESC's approach to balancing safety imperatives with constitutional rights. All services performed in hydro mining that relate to ensuring the integrity of the water management system, including monitoring and inspecting pipelines to ensure the integrity of slurry delivery pipes, valves, and water lines that must be inspected in order to timeously identify non-conformance and immediately rectify it, are essential services.

In the remining process, it is imperative that water is properly managed to ensure that the integrity of the tailings dam is not compromised, and that monitoring and inspection of pipelines to ensure the integrity of slurry delivery pipes, valves, and water lines is critical to avoid dam failure due to uncontrolled slurry or water. The ESC recognised that water management integrity is essential, whilst the actual remining operations are not.

What mining operators with tailings dams must do

The service-based approach requires mining operators to assess how they classify their workforce beyond job titles. Instead, operators must conduct a detailed analysis of the functions performed to determine which employees perform services falling within the designation.

On one hand, the designation provides operational continuity for critical safety functions. Ensuring these services continue uninterrupted protects not only the mining operation and its employees, but surrounding communities and ecosystems as well. On the other hand, the designation limits the constitutional right to strike for affected employees. This means operators must be precise in their application of the designation, ensuring they do not overreach by classifying non-essential service workers as essential.

The limitation on the right to strike for employees working in connection with tailings dams has important implications for employers and employees alike. Employers should proactively address this limitation during wage negotiations and collective bargaining processes, but may similarly consider whether the principles are equally applicable to other services, which if withdrawn, may significantly impact the ability to protect the health and safety of persons. They should further assess whether this could support additional stakeholder engagements and applications for other services to be included in essential services designations.

The expanded designation requires immediate action in the form of workforce audits, contract reviews, and employee communications. As the mining industry continues to grapple with the legacy of tailings dams and the imperative of responsible management, this designation provides a foundation for balancing competing interests in a manner that prioritises safety without unnecessarily limiting fundamental rights, provided that employers engage constructively with unions to ensure that employees who perform essential services receive appropriate recognition for the restrictions placed upon them, and for the safety-critical nature of the work they perform in protecting lives and the environment.

Following this ruling, the parties have been directed to negotiate and conclude a minimum service agreement by 29 December 2025, 90 days from the designation, which must in turn be ratified by the ESC. Principles of this agreement may equally shape the landscape of the balancing of the rights to safety and to strike.





SASOM news

Claudina Nogueira: Occupational health consultant/Research and technical officer, Stellenbosch University, South Africa; SASOM ExCo member; ICOH National Secretary for South Africa (2024–2027); WHWB President (2024–2026)
e-mail: claudinanogueira@hotmail.com
Daan Kocks: SASOM Chair
e-mail: daniel.kocks@up.ac.za
Claudia Frost: SASOM National Office Coordinator
e-mail: office@sasom.org

SASOM HOSTS TWO NATIONAL WEBINARS IN 2025 ON THE INFORMAL SECTOR

The South African Society of Occupational Medicine (SASOM), an affiliate member of the International Commission on Occupational Health (ICOH), organised and hosted two national webinars in 2025, both themed *Occupational Health of Informal and Migrant Workers*. The webinars were presented in collaboration with the Global Coalition for Informal Workers' Health and Wellbeing (GCIW), and the International Human Factors and Ergonomics Association (IEA) Technical Committee on Informal Work (TC IW). Each high-impact webinar was divided into two 2-hour sessions, accredited for Continuing Professional Development (CPD) points by the South African Medical Association (SAMA). The webinars offered local and international participants global perspectives, updated research, and applications to the real world.

SASOM National Webinar 1, 20 June 2025

The webinar was opened by Prof. Daan Kocks, Chair of SASOM, who welcomed the presenters and participants, and introduced the session chairs. Session 1 was sub-themed *Introducing the Global Coalition for Informal Workers Health and Wellbeing (GCIW)*, and chaired by Ms Claudina Nogueira, SASOM Executive Committee (ExCo) member and ICOH National Secretary for South Africa. Presenters and topics were as follows:

- 'Occupational health for informal workers: the Global Coalition for Informal Workers (GCIW) Initiative' was presented by Dr Acran Salmen-Navarro (MD, MSc, AEP) of the Bellevue/New York University (NYU) Occupational Environmental Medicine Clinic, NYU Grossman School of Medicine, USA, and current Chair of the ICOH Scientific Committee on Occupational Health for Health Workers (SC OHHW). He leads the topic of Occupational Health for Migrant Workers in the ICOH Working Group on the Future of Decent Work and, more recently, is one of the leaders spearheading the establishment of the GCIW.

  This new coalition is dedicated to safeguarding the health and wellbeing of informal workers across the globe. Its members unite to address the unique challenges faced by individuals engaged in informal employment (around 60% of the global workforce), recognising their invaluable contributions to communities and economies, worldwide.

  Dr Salmen-Navarro's presentation set the scene for the webinar by providing background and context on the informal sector from a global perspective. Topics covered included migration; why informal work matters as a social determinant of health; contributions made by migrant and informal workers to national and global economies; the high risks of vulnerability among migrant and informal workers; new forms of work, including the gig economy; and the future of work.

- 'Bridging informal work and ergonomics: perspectives from the International Ergonomics Association (IEA) Technical Committee on Informal Work' was presented by Clive D'Souza (PhD), Department of Rehabilitation Science and Technology, University of Pittsburgh, USA, and current Chair of the IEA TC IW.

  Dr D'Souza provided an overview of the IEA TC IW and its objectives and planned activities for the current year; the key domains of ergonomics and human factors (physical, cognitive, and organisational); the sociotechnical model of ergonomics; and psychosocial factors and worker vulnerabilities in informal economies. He presented a case study on informal electronic waste (e-waste) processing in Ghana, in which he highlighted the interdisciplinarity in addressing informal worker health.

Session 2 was sub-themed *Exposure to occupational heat stress in the informal sector*, and chaired by Dr André Kotzé, Vice Chair of SASOM. Presenters and topics were as follows:

- 'Health effects of occupational heat exposure among informal workers: the South African perspective' was presented by Prof. Rajen Naidoo (MBChB, DOH, MPH, PhD), Head of Discipline of Occupational and Environmental Health, University of KwaZulu-Natal, Durban, South Africa. He discussed how extreme heat is becoming more dangerous for workers every year; informal work in the era of climate change; evidence of heat exposure and heat stress across the African continent; health effects and occupational injuries associated with excessive heat exposure and stress; why informal workers are at greater risk of the health impacts of heat stress; and challenges for heat protection programmes among informal workers. He concluded with necessary and urgent actions and the role that occupational medical practitioners and professional associations can play in managing heat exposure in workplaces, including the informal sector.

- 'Informal women workers on the frontline of the climate crisis: the experience from the Self-Employed Women's Association Bharat (SEWA Bharat) and lessons from India' was presented by Ms Sonal Sharma (MA: Development Studies), senior programme coordinator, SEWA Bharat, India. Ms Sharma is a development practitioner, specialising in informality with a focus on women's economic empowerment. At SEWA Bharat, she has established and expanded programme areas aimed at promoting the growth of women-led micro-enterprises and advancing women's land

rights. She has led and studied community-driven, knowledge-based interventions designed to build resilience and enhance capacity among women in the informal economy. Currently, she is guiding the organisation's exploration of intersections within women's work, such as those between entrepreneurship and the global care agenda, and between livelihoods and climate justice.

Ms Sharma provided an overview and the objectives of SEWA internationally, and more specifically, in India. She also discussed the impact of climate change and environmental degradation on livelihoods, and adaptations by female workers in the informal economy; pathways to a just transition for female workers in the informal economy; and collective action for climate justice, as well as selected key findings and recommendations from a study that gathered insights from more than 1 100 women working in India's informal sector.

Prof. Kocks closed the proceedings by extending appreciation to all presenters for their insightful contributions, as the session greatly enhanced the participants' understanding of occupational health and safety (OHS) and labour issues within the informal sector, from a global perspective (USA, India, and South Africa). He underscored that meaningful progress can be achieved through transformation within the informal sector, using the example of successful e-waste management in Ghana, and stressed that the southern African situation reflects a broader global challenge, and that collective public action remains essential in addressing it. Prof. Kocks also thanked the organisers and session chairs for their support, expertise, and leadership in the various aspects of webinar preparation and delivery. He encouraged participants to remain engaged through the SASOM website and communication channels, and to look out for information about the second webinar later in the year. The recording of the webinar is available in the public domain: https://www.youtube.com/live/1A77-D97ZrM

SASOM National Webinar 2, 29 August 2025

The webinar was opened by Dr Itumeleng Ntatamala (SASOM Western Cape Chapter and University of Cape Town, South Africa), who welcomed the presenters and participants, and introduced the moderator of the first session. Speakers in this session discussed the magnitude of unique hazards faced by informal workers globally, particularly in Africa and Asia, emphasising the lack of legal protection, access to health services, and research. The second session explored the political economy of OHS and informality, presenting the migrant-informal worker cross-section as a critical vulnerability. The discussion also featured models of the social determinants of health to understand the complex relationship between informal work and health outcomes, concluding with the need for policy changes, increased professional capacity, and participatory action research to achieve health equity and decent work.

Session 1 was titled 'Occupational health of informal workers: drivers, new forms of work, and OHS challenges', moderated by Dr Acran Salmen-Navarro (GCIW founding member and recently elected president, Chair of ICOH SC OHHW, and New York University Grossman School of Medicine, USA). Presenters and topics were as follows:

- 'Pathways towards decent work for informal workers' was presented by Mr Mahinda Seneviratne (ICOH Board member, immediate Past Chair of the ICOH Scientific Committee on Occupational Health in Small-Scale Enterprises and the Informal Sector (SC OHSSEIS), and work health strategist, Australia). A Fellow of the Australian Institute of Occupational Hygienists, Mr Seneviratne has led significant initiatives, including i) Ghana's first occupational hygiene workshop in 2011 to build occupational hygiene capability in small enterprises, ii) Australia's implementation of the Globally Harmonised System (GHS) for Classification and Labelling of Hazardous Chemicals, and iii) investigations into silicosis among engineered stone manufacturers and installers that led to landmark legal action in Australia in 2024.



Graphic: Claudia Frost (SASOM, South Africa)

Mr Seneviratne provided a brief overview of the OHS of informal workers, detailing specific challenges and proposing future pathways for action. He highlighted that informal workers constitute a large part of the workforce globally, particularly in Africa and Asia (90% or more). They face unique hazards, such as exposure to high temperatures, effects of climate change, and physical dangers. A critical challenge is the lack of access to basic occupational health services: only about 15% of global workers (formal and informal) have access to these services, and legislation often fails to cover them. Suggested pathways include regulatory reform (e.g. shifting legislation concepts from 'employer' to 'person in control' and from 'employee' to 'worker' to expand coverage); improving prevention through better hazard identification and risk control; and implementing participatory action research. The last is crucial to ensure that workers' voices are heard and taken seriously.

- 'The ergonomics/human factors approach to decent work for informal workers: a South African case study' was presented by Prof. Andrew Thatcher (Psychology Department, University of the Witwatersrand, South Africa and President of the IEA). A certified professional ergonomist with the Ergonomics Society of South Africa (ESSA) and a registered industrial psychologist with the Health Professions Council of South Africa (HPCSA), Prof. Thatcher is a member of the Human Factors and Ergonomics Society of the USA, a member of the Academy of Science of South Africa, and has served as Co-Editor-in-Chief of *Ergonomics*.

  Prof. Thatcher applied an ergonomics and human factors approach to understanding informal workers, using a case study of Warrick Junction, an informal trading market in Durban, KwaZulu-Natal province, South Africa. He noted that extreme inequality and high unemployment rates (over 30% in South Africa) drive people into informal work. Ergonomics is viewed as a design discipline that focuses on optimising system performance and wellbeing (psychological and physical) by considering the system of tasks, tools, and environment. The case study revealed that informal workers, such as cooks of bovine and sheep heads, and water transporters, work under extreme conditions, including exceptionally long working days (up to 15.5 hours) and minimal sleep (as little as 4.5 hours nightly). The ergonomic approach emphasises joint optimisation – integrating formal and informal systems, treating humans as assets, and fostering solutions collaboratively with workers.

- 'Closing the gap: occupational health, poverty, and decent work for informal workers' was presented by Mr Matthew Olota, a chartered occupational hygienist at Irving Oil Limited, New Brunswick, Canada, with more than 15 years of experience across oil and gas, manufacturing, and aviation industries. Mr Olota is President-Elect of the International Occupational Hygiene Association (IOHA) and Board representative of the Association of Industrial Hygienists Nigeria (AIHN). He has led occupational health programmes involving multidisciplinary teams and is highly skilled in health risk assessment, medical surveillance, and workplace health evaluations.

  Mr Olota's presentation focused on the occupational hygiene challenges and the need to close the gap for informal workers. He cited sobering International Labour Organization (ILO) data, indicating that 2.93 million people die annually from work, with 2.6 million deaths from occupational diseases. He emphasised that informal workers (60% of the global workforce) are real people facing real exposures, but they lack professional services such as exposure assessment and medical surveillance. A central challenge is poverty, which makes protective measures unsustainable (e.g. a low-earning worker cannot afford expensive disposable respirators). He highlighted the severe global deficit of certified occupational hygienists (e.g. Africa has 0.5 hygienists per million workers). Proposed solutions included increasing capacity building, utilising low-cost assessment tools and controls (e.g. free health apps), driving systemic change through effective policy and partnerships (especially in terms of engaging politicians and media), and demonstrating value through improved national data collection.

Session 2 was titled 'Occupational health of informal and migrant workers: community engagement and collective action', moderated by Dr Maggie Graf (GCIW founding member and recently elected Treasurer, and Immediate Past Vice President and Secretary General of IEA, Switzerland), who currently serves as the European coordinator of the IEA TC IW. Presenters and topics were as follows:

- 'Political economy of OHS and informality: the struggle for health justice for workers in the informal economy' was presented by Dr Christy Adeola Braham (Workers' Health Coordinator at Women in Informal Employment: Globalizing and Organizing (WIEGO), UK and Belgium). Dr Braham is a public health specialist and doctoral fellow, School of Health and Related Research, University of Sheffield, UK. At WIEGO, she leads health research and advocacy to strengthen grassroots workers' organisations and advance OHS and the right to health for all in the informal economy. A Senior Atlantic Fellow for Health Equity at the Milken Institute School of Public Health at George Washington University, she has coordinated regional health and migration platforms, represented WIEGO in International Labour Conference negotiations for global standards on biological hazards in the working environment, 2024–2025 (ILO Convention 192 and Recommendation 209), and contributed to the Wellcome Collection exhibition 'Hard Graft: Work, Health and Rights' (2024, London, UK).

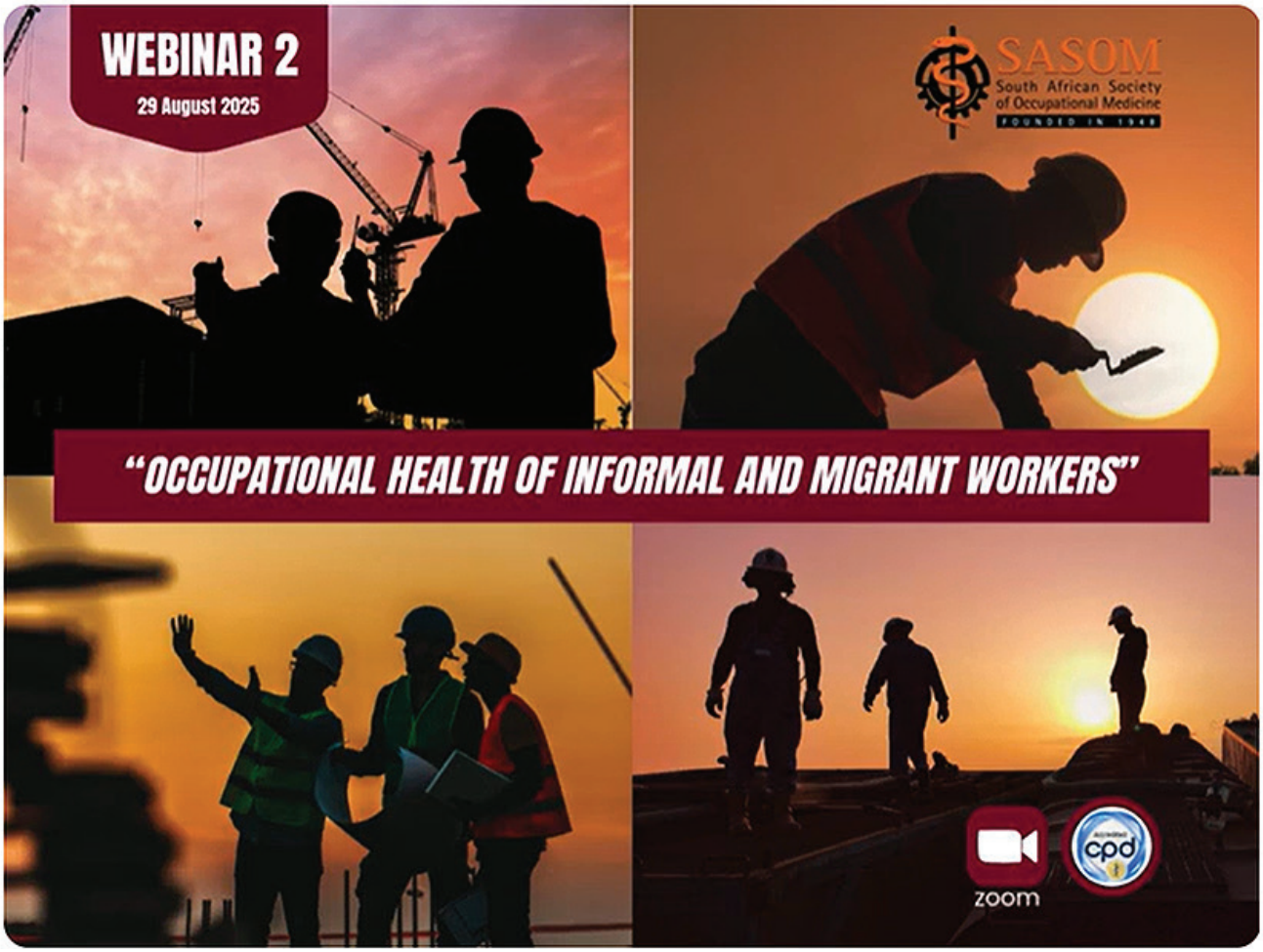
  Dr Braham discussed the political economy and the struggle for health justice for informal workers. She established that informality is the norm and is growing globally. Workers in this sector (waste pickers, street vendors, home-based workers, etc.) lack fundamental protections, often operating outside OHS laws in public or private spaces that are not recognised as legitimate workplaces. This forces workers to be self-reliant amidst extreme income insecurity. She stressed that challenges are fundamentally political, caused by poor collaboration between government ministries, and a systematic lack of value given to marginalised workers. She presented examples of effective grassroots action: the Indonesian Migrant Domestic Workers Association (PERTIMIG) educating members on negotiating vaccination access, and HomeNet Thailand integrating OHS services into universal coverage through mobile vans and enhanced surveillance.

- 'Occupational health for vulnerable workers: the cross-section between migration and informal work' was presented by Dr Acran Salmen-Navarro, moderator of Session 1 (GCIW founding member and recently elected president, Chair of the ICOH SC OHHW, and NYU Grossman School of Medicine, USA). He focused

on the cross-section of migration and informal work, asserting that work is implicit in nearly all social determinants of health. The main drive for migration is often work, and approximately 65% of migrants are prone to entering the informal sector in their host countries. Migrants frequently encounter precarious '4D jobs' (dirty, dangerous, demanding, and discriminatory). Clinically, these workers present unique challenges, sometimes consulting a doctor for the first time in their life, for an occupational injury. Despite vulnerability, they contribute significantly to global economies through remittances (nearly US$ 800 billion in 2022) and local economies (e.g. foreign-born New Yorkers contributed 22% of city GDP in 2017). Good practices include offering clinical and preventive services, regardless of ability to pay or status, such as at the Belleview NYU clinic, and partnering with community-based organisations (CBOs) to perform outreach. He emphasised preparing for the future of decent work, which must address new forms of informal work such as app-based and entrepreneurial options.

- 'Informal work as a social determinant of health' was presented by Prof. Carlos Andrés Fandiño Losada (Chair of the Organising Committee of the First International Conference of the GCIW, and *Universidad del Valle*, Santiago de Cali, Colombia). He is a medical doctor and epidemiologist with a PhD in Medical Sciences from the Karolinska Institute, Sweden. He has worked in the Department of Public Health at the School of Health of *Universidad del Valle*, Colombia since 2010, initially appointed as an assistant professor, and becoming a full professor in 2024. He was appointed as Editor-in-Chief of *Colombia Médica* in 2025 and serves as an associate editor for *Cambridge Prisms: Global Mental Health*. His career includes consultancy work for the Pan-American Health Organization (PAHO) in Colombia's Ministry of Health in Bogotá, and multiple academic collaborations in Latin America and Europe, along with several prestigious awards.

Prof. Fandiño Losada provided a theoretical framework for informal work as a social determinant of health. Using models like the Dahlgren-Whitehead model, he positioned informal work within the layer of living and working conditions. This model is a visual tool, often called the 'rainbow', which maps the relationship between individual, environment, and health by illustrating the layers of determinants that influence health outcomes. It organises these determinants from the individual outward, starting with individual lifestyle factors, moving to social networks and, finally, to broader socioeconomic and environmental conditions. Informal employment is characterised as a form of precarious work. He highlighted that research findings on health consequences (such as mental health, injuries, and mortality) are inconsistent and complex, and often dependent on the reference group used for comparison (e.g. formal workers versus unemployed). While informal work can be linked to poor health and exposure to risk, in specific contexts, some studies show a neutral or even protective effect of working in the informal sector (e.g. allowing for more breastfeeding time for certain urban workers). He concluded that a multi-level research



Graphic: Claudia Frost (SASOM, South Africa)

approach is necessary to understand the structural context that shapes the health consequences of informal work, and to reduce health inequalities.

Dr Geoffrey Tafaune (SASOM Treasurer and University of Pretoria, South Africa) closed the proceedings by wrapping up the event and thanking the organisers, presenters and participants for a successful webinar. The recording of the webinar is available in the public domain: https://www.youtube.com/watch?v=RhWWwu7iE_o

Congratulations and celebrations

The SASOM ExCo and its members are delighted to extend their hearty congratulations to Mr Deon Jansen van Vuuren, registered occupational hygienist (retired) and General Manager of the Southern African Institute for Occupational Hygiene (SAIOH), sister organisation of SASOM, on being bestowed with the prestigious SAIOH Lifetime Achievement Award at the SAIOH Annual Conference 2025, held recently in Umhlanga, KwaZulu-Natal. This follows the award of another prestigious accolade, the IOHA's Lifetime Achievement Award in 2024, bestowed on him at the IOHA International Conference in Dublin, Ireland. These awards are testaments to Deon's illustrious career and lifelong dedication and contribution to the noble profession of occupational hygiene, and its development, at national, regional, and global levels. Congratulations, Deon!

News from the SASOM National Office

SASOM held its Annual General Meeting (AGM) and Conference on 15 November 2025 at the Marriott Hotel Fire & Ice, Menlyn, Pretoria, Gauteng. The hybrid event, themed *Artificial Intelligence (AI) at the Crossroads of Informal Work and Public Health: Risks, Innovations, and Responsibilities*, was hosted and organised by the SASOM National Office in collaboration with GCIW and ESSA. A report on the SASOM Conference is available on pages 169–171 of this issue.

Membership renewals for 2026 will only open after the SASOM AGM. The 2026 membership fees will be confirmed at the AGM on 15 November 2025 and once approved, the renewal portal will be opened, and all current members will be notified by e-mail with instructions to complete their renewal. New applicants can access information about membership and benefits on the website, and follow the instructions for becoming members of SASOM: https://sasom.org/membership/

The SASOM National Office will close for the year-end holiday season on 1 December 2025 and re-open on 12 January 2026.

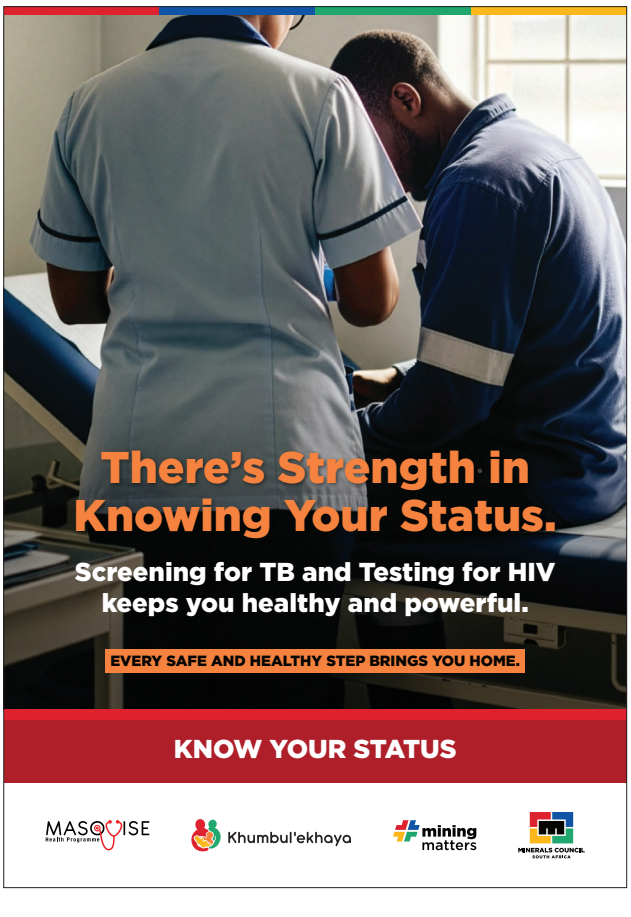
Season's greetings from SASOM

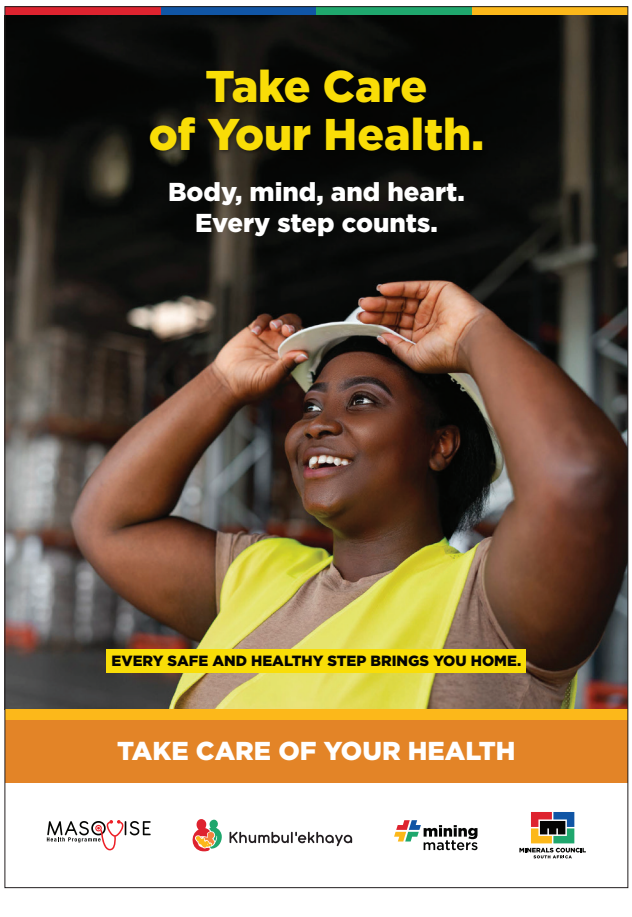
As the festive season approaches, SASOM reaffirms its commitment to the enduring values of gratitude, mindfulness, hope, and reflection. The Society extends its sincere wishes to all members – and to their families, friends, and communities – for a joyful, safe, and peaceful holiday season, marked by good health, optimism, and many blessings.

SASOM wishes all who celebrate Christmas, or other festive occasions at this time of year, a season filled with peace of mind, compassion, and fulfilment. May the New Year bring continued success, personal wellbeing, and professional growth.

The Society remains steadfast in its commitment to advancing excellence in occupational health and medicine, and to providing meaningful support to its members. SASOM also takes pride in its ongoing collaboration with *Occupational Health Southern Africa*, a valued partner and key source of knowledge and expertise in our region.

SASOM extends its appreciation to all members for their dedication and continued engagement. Together, we look forward to a year ahead marked by growth, impact, and shared achievement.





SAIOH news

The Southern African Institute for Occupational Hygiene (SAIOH) remains steadfast in its dedication to its members and the ongoing advancement of the occupational hygiene profession. In pursuit of this commitment, we regularly provide updates and share key developments with our community. SAIOH flourishes through the active participation and ethical contributions of its members, whose engagement continues to shape the field. To further strengthen our collective efforts, we welcome and encourage feedback on the topics covered in this edition of the Journal.

SAIOH PRESIDENT'S ADDRESS

Karen du Preez: SAIOH President
e-mail: president@saioh.co.za



Karen du Preez, SAIOH President
Photograph: courtesy of SAIOH

Occupational hygiene in South Africa: from compliance to accountability

South Africa has sharpened its focus on occupational hygiene, embracing a rigorous framework to identify, assess, and control workplace hazards that impacted worker health. At the heart of this initiative lay a structured process, anchored by occupational hygiene surveys, risk assessments, and ongoing monitoring, designed to uncover hazardous conditions and guide corrective action.

SAIOH's Annual Scientific Conference 2025 keynote speakers revealed that the hygiene journey was not just technical – it was legal, strategic, and deeply human. Mr George Khan's keynote address reframed the legal landscape, challenging the myth of employer and hygienist immunity. South African law, long shaped by outdated frameworks, evolved toward strict liability and reverse onus provisions. Occupational hygienists were no longer shielded by proximity to employers; they were accountable to workers, communities, and the law. This shift underscored the importance of competent, certified professionals such as Approved Inspection Authorities (AIAs), whose roles in conducting surveys and verifying controls became more critical than ever.

Dr Vanessa Govender urged hygienists to look beyond measurement, to prevention. Her work on occupational lung diseases (OLDs) in the mining sector revealed that, while all OLDs are preventable, not all are curable. Prevention is, therefore, the highest duty. Her keynote address emphasised the power of high-fidelity data and artificial intelligence- (AI-)- driven surveillance models that link exposure, medical outcomes, and workforce records – tools that elevate hygiene to strategic leadership conversations.

Ms Constance Titi Kekana built on this theme, showcasing how real-time monitoring and intelligent control systems have reshaped exposure management. From predictive analytics to ventilation on demand, these innovations support both regulatory compliance and proactive risk reduction. However, gaps remain in technology integration, regulatory readiness, and future skillsets, calling for accelerated progress to achieve zero harm.

Millysind Ebygale Ruiters introduced the newly launched Occupational Health and Safety Strategy of the National Department of Employment and Labour (DEL), aligned with the International Labour Organization's global framework. With its three pillars, viz. strengthening occupational health and safety systems, enhancing coordination, and improving workplace management, the strategy reinforces the occupational hygiene process as a national priority. Its five strategic result areas and commitment to monitoring and evaluation mirror the hygiene framework's emphasis on continuous improvement.

Prof. Stefan Linde reminded us that sampling is not a *"one size fits all"* process. Whether assessing chemical, noise, skin, or biological exposures, the strategy needs to match the investigation's purpose. His keynote echoed the hygiene framework's call for precision, highlighting how sampling methods, timing, and analysis need to be tailored to yield meaningful, actionable results.

Together, these insights affirmed that occupational hygiene is more than a regulatory obligation; it is an initiative-taking, multidisciplinary strategy to protect health, ensure accountability, and embed resilience. By integrating legal clarity, data intelligence, and structured processes, South African employers and professionals build safer and smarter workplaces for all.

NATIONAL COUNCIL FEEDBACK

Karen du Preez: SAIOH President
e-mail: president@saioh.co.za
Deon Jansen van Vuuren: SAIOH General Manager
e-mail: deon.jvvuuren@gmail.com

Governance meetings:

- The SAIOH Management Board convened, online, on 6 November 2025, followed by two special board meetings on 11 and 19 November 2025.
- The annual SAIOH Council meeting took place in a hybrid format on 21 October 2025, during the SAIOH 2025 Conference in Umhlanga.

Key engagements and activities:

- The DEL formally appointed SAIOH's representative to the Noise Technical Committee, in relation to the forthcoming Noise Exposure Regulations (NER).
- In collaboration with Nelson Mandela University, the DEL hosted an in-person workshop on the NER and Physical Agents Regulations (PAR) in Gqeberha on 17 November 2025.

- Several SAIOH management members attended the Occupational Hygiene Approved Inspection Authority Association (OH AIA Assoc.) meeting on 21 November 2025.
- On 18 November 2025, SAIOH President, Karen du Preez, delivered an online presentation to Environmental Health students at Tshwane University of Technology (TUT), introducing them to SAIOH and its role in the profession of occupational hygiene.
- The SAIOH administration team held two internal online staff meetings on 13 October and 19 November 2025.

SAIOH Strategic Plan

SAIOH's five-year strategic plan (2023–2027), led by Jaco Pieterse, continues to guide institutional priorities and is reviewed regularly at Management Board and Council meetings.

SAIOH also participated in the Department of Health's Occupational Health and Safety Operational Planning workshop, on 29 and 30 July 2025 at OR Tambo International Airport, represented by Claudina Nogueira.

Ethics

SAIOH is pleased to share an update on the development of its new ethics course, created in partnership with North-West University (NWU). This initiative forms part of our ongoing commitment to uphold and advance ethical standards within the occupational hygiene profession. The course content has been fully developed and is currently undergoing final quality assurance checks to ensure that it meets SAIOH's rigorous standards for accuracy, relevance, and completeness. The official launch is anticipated for mid-2026. Members will be kept informed as we approach the release date.

In the interim, members whose ethics certification is due for renewal in early 2026 may continue to access the 2024 SAIOH Ethics webinar, presented by Terry McDonald. The presentation remains highly relevant and aligned with current professional ethics frameworks. Please note that the accompanying quiz has been updated to reflect the latest standards and expectations. This dual-track approach ensures that all members have access to credible, up-to-date ethics training, whether renewing certification or preparing for the new course rollout.

SAIOH branch activities: September–November 2025

SAIOH branches across the country have remained active and engaged through a variety of meetings, training initiatives, and conference contributions.

- **Western Cape Branch:** an in-person branch meeting and social activity was held on 21 November 2025, offering members an opportunity to reconnect and discuss regional developments.
- **KwaZulu-Natal Branch:** the KZN branch committee played a pivotal role in supporting the hosting and logistics of the SAIOH 2025 Conference, from 20 to 24 October 2025 in Umhlanga.
- **Gauteng Branch:** the Gauteng branch held its third meeting of the year, online, on 12 September 2025, continuing its commitment to accessible member engagement.
- **North-West Branch:** in collaboration with the NWU Occupational Hygiene and Health Research Initiative (OHHRI), the North-West branch hosted a successful one-day training course on 15 October 2025. The course, titled 'Application of ISO 23875 in Operator Cab Filtration, Pressurization, and Certification', was presented by Jeff Moredock of the International Society of Environmental Enclosure Engineers (ISEEE) at NWU. Mr Moredock also contributed to the SAIOH 2025 Conference by presenting a four-hour hybrid professional development course (PDC 03) on 21 October, followed by an in-person full-day course (PDC 07) on 24 October.
- **Eastern Cape Branch formation:** efforts to establish an Eastern Cape branch are underway, led by Council Branch Coordinator, Ms Lizette Greeff, and Dr Shaun Ramroop of Nelson Mandela University in Gqeberha.
- **Inactive branches:** the Central (Free State), Northern Cape, and Mpumalanga Branches, and the Zululand Discussion Group remain inactive.

SAIOH 2025 Annual Scientific Conference

The 2025 SAIOH Annual Scientific Conference, hosted in KwaZulu-Natal, was a resounding success, bringing together professionals, thought leaders, and stakeholders from across the occupational hygiene spectrum. Held in a hybrid format at the Coastlands Hotel and Conference Centre in Umhlanga, the event showcased SAIOH's commitment to excellence, innovation, and inclusivity. With a robust programme of keynote addresses, professional development courses, technical sessions, and strategic engagements, the conference advanced best practices and reaffirmed occupational hygiene as a cornerstone of worker health and national resilience. Eight hundred and eleven delegates attended this five-day conference.

SAIOH 2026 Annual Scientific Conference

Development is underway for the SAIOH 2026 Conference, in collaboration with the National Institute for Occupational Health (NIOH). Initial planning meetings have been held with the NIOH Executive Director, Dr Spo Kgalamono.

International Occupational Hygiene Association Board, National Accreditation Recognition Committee, and Occupational Hygiene Training Association feedback

SAIOH remains actively engaged with international partners and initiatives, reinforcing its commitment to global best practices and professional development.

OHTA and IOHA newsletters

The Occupational Hygiene Training Association (OHTA) and the International Occupational Hygiene Association (IOHA) continue to publish regular newsletters. These are shared with all SAIOH members via e-mail and are also available on the SAIOH website: www.saioh.co.za. Members are encouraged to visit the OHTA website, www.ohtatraining.org, for additional resources.

New IOHA President

SAIOH congratulates Mr Matthew Olota, originally from Nigeria and now based in Canada, on his appointment as IOHA President. He is the third African to hold this prestigious position – an inspiring milestone for the continent.

Member achievement: Mark Harrison

We are delighted to recognise the achievement of Mr Mark Harrison of Occupational Hygiene Monitoring Services (OHMS), who has successfully completed the British Occupational Hygiene Society (BOHS) written projects. Mark is now eligible for the final oral assessment and the awarding of the BOHS Diploma in Professional Occupational Hygiene Competency. This internationally respected qualification is acknowledged by the SAIOH Professional Certification Committee (PCC) as meeting the requirements for assessment at the registered occupational hygienist (ROH) level. Mark previously attained technologist

status by completing all six OHTA modules and earning the OHTA ICertOH certificate. Congratulations, Mark, on this outstanding accomplishment!

Representation on IOHA

Corlia Peens continues to represent SAIOH on the IOHA Board and the National Accreditation Recognition (NAR) Committee, providing regular feedback to the Executive Committee (ExCo) of the PCC. IOHA now comprises 53 member associations, globally.

SAIOH Technical Committee feedback

SAIOH's Technical Committee continues to advance key research and guidance initiatives aimed at strengthening occupational hygiene practice and regulatory alignment.

- Welding fumes research and position paper: Led by Dr Ivan Niranjan and Technical Portfolio Coordinator, Dr Goitsemang Keretetse, the Committee has completed a comprehensive position paper on the measurement and analysis of welding fumes. Developed in collaboration with the OH AIA Assoc., after a final review the paper was circulated to SAIOH members and the DEL, and published on the SAIOH website.
- Heat stress management: A second technical initiative is underway to develop procedures and a SAIOH position paper on heat stress management. SAIOH is working with the Council for Scientific and Industrial Research (CSIR) and Dr Johan Kielblock to support the research. The dual focus remains: to produce a robust technical paper and to inform SAIOH's recommendations for strengthening the PAR.
- Real-time monitoring: Prof. Stefan Linde (NWU) has taken the lead in developing a position paper on real-time monitoring in occupational hygiene. This work is ongoing and will contribute to future technical guidance.
- Ergonomic risk assessment: Under the leadership of Naadiya Mundy, a new sub-committee has been formed to develop procedures and/or guidelines to support SAIOH occupational hygiene professionals in conducting ergonomic risk assessments. Initial meetings have taken place, marking a promising start to this important initiative.

New SAIOH website and Quality Management System

The SAIOH Administration Team is actively working on populating the new SAIOH website, ensuring that it is a comprehensive resource for members. We look forward to launching the new website soon and delivering an improved and streamlined platform for the SAIOH community. Chapter 2 of the PCC's Quality Management System (QMS), which outlines the PCC assessment rules and procedures, is available on the SAIOH website, and offers essential guidance and supporting documentation.

SAIOH communications and editorial engagement: November 2025 update

SAIOH continues to maintain a strong editorial presence and pro-active member engagement through multiple platforms and initiatives.

SAIOH representatives attended the hybrid *Occupational Health Southern Africa* Editorial Board meeting on 20 November 2025. These engagements ensure that SAIOH's voice remains active in shaping regional occupational health discourse.

SAIOH publishes its newsletter and President's Page in two electronic media formats:

- *Occupational Health Southern Africa* journal
- *African Occupational Safety and Health (A-OS&H)* magazine

These publications are released every two-to-three months, with the most recent editions published in September and August 2025, respectively. All issues are distributed to members via Mailchimp and posted on the SAIOH website. SAIOH's latest submissions to the A-OS&H magazine and *Occupational Health Southern Africa* were completed in October and November 2025, respectively.

Global newsletters

The November 2025 edition of the *OHTA Global Link* and the September 2025 issue of the *IOHA Global Exposure Manager* were shared with members via Mailchimp and uploaded to the SAIOH website.

Member communications

SAIOH maintains daily engagement with its members through direct e-mail notifications, phone calls, and virtual meetings. These communications provide timely updates on:

- Legislative changes and new standards
- Industry news and technical developments
- Professional opportunities in occupational hygiene
- Products, services, courses, and webinars related to occupational hygiene, occupational health, and environmental safety

Recent events and announcements

SAIOH sent targeted communications promoting key events and learning opportunities, including:

- NWU Workshop (Potchefstroom): *Support for Occupational Hygiene Practitioners' Knowledge and Experience of the Skin as an Exposure Route* – an in-person workshop linked to an NWU research project.
- CSIR & MHSC Stakeholder Workshop (3 October 2025): a hybrid event on *The Impact of Overexertion on Women's Health and Safety in the Mining Industry*, hosted at the CSIR Convention Centre.
- ESSA Annual Conference (15–16 October 2025): hosted by the Ergonomics Society of South Africa (ESSA), this event highlighted key developments in ergonomics and workplace design.
- SASOM Annual Conference (15 November 2025): a hybrid event on tackling artificial intelligence (AI), informal work, and the future of occupational health and medicine in Africa, held at the Protea Hotel Fire & Ice! in Pretoria.
- Safety-First PPE Conference (10–11 March 2026): rescheduled to take place at Emperors Palace, Johannesburg. SAIOH has been invited to present a paper, with Karen du Preez, Cas Badenhorst, and Jeanneth Manganyi confirmed as speakers.
- ICOH 2026 History Conference (15–17 April 2026): SAIOH continues to promote the 8th International Congress on the History of Occupational and Environmental Health, in Leuven, Belgium.

PROFESSIONAL CERTIFICATION COMMITTEE

Lee Doolan: SAIOH PCC Administrator
e-mail: lee@saioh.co.za
Deon Jansen van Vuuren: SAIOH General Manager
e-mail: deon.jvvuuren@gmail.com
Ivan Niranjan: SAIOH PCC Chairperson
e-mail: ivann@dut.ac.za

The PCC ExCo held its fourth meeting of the year online on 26 September 2025.This was followed by a virtual full PCC meeting on 7 November 2025. Oral assessments were conducted online between 3 and 21 October 2025; the final written assessments took place on 3 October 2025.

Governance and quality assurance updates

Following several rounds of review, the SAIOH QMS Chapter 2: *PCC Assessment Rules and Procedures* was formally approved by the PCC ExCo and is available on the SAIOH website.

Reaching an additional milestone, the South African Qualifications Authority (SAQA) has updated the SAIOH requirements on its website (https://pbdesig.saqa.org.za/viewProfessionalBody.php?id=844) to reflect the PCC's current standards.

Assessment development and training

- The PCC sub-committee tasked with developing the Occupational Hygiene Skill Set for the Self-Assessment and Gap Analysis (SA-GA) Tool has made significant progress. The document is undergoing final checks before submission to the PCC ExCo.
- The team is also developing oral assessment scenarios and refining the PCC Oral Assessment Guidelines.
- Online training workshops for PCC assessors were held on 14 February and 30 May 2025 to support consistent application of the new tools and processes.
- A free hybrid PDC (PDC 04) was hosted at the SAIOH 2025 Conference on 21 October. The first hour introduced the SA-GA Tool to all SAIOH members, while the second session provided in-service training for PCC assessors on the new oral assessment system.

Written assessment challenges and solutions

Efforts to transition the written assessment to an MS Excel-based platform – intended to replace the current learning management system (LMS) and proposed Moodle system – have faced technical and security challenges. Due to concerns around AI integrity and paper leaks, the PCC ExCo resolved to revert to hard-copy assessments at venues, invigilated by at least two PCC assessors. All papers are now couriered to and from assessment centres, coordinated by the PCC Administration Team.

Oral assessments

Oral assessments continue to be conducted online via Zoom or Microsoft Teams, with recordings retained for verification and quality assurance. In-person assessments remain an option, where preferred.

CPD management and compliance

- Registered SAIOH members can now upload continuing professional development (CPD) activities throughout the year via their MySAIOH profiles.
- Effective 1 February 2025, all CPD returns are audited before certificates are issued. Compliance includes proof of claims, payment of annual fees, and a valid Ethics Certificate.
- CPD points are now calculated annually, replacing the previous five-year rolling cycle. Minimum annual requirements are:
  - ROH: 12 points
  - ROHT: 10 points
  - ROHA: 9 points
  - Retirees/fellows: 4 points
- Requests for amnesty or extensions must be submitted in writing, with a strong motivation, to the PCC ExCo via the PCC Administrator (Lee@saioh.co.za).

Sector updates and noteworthy developments

- The South African National Accreditation System (SANAS) has confirmed that 56 OH AIAs are now accredited.
- The DEL's new occupational hygiene report formats came into effect on 30 June 2025 and are strictly enforced during assessments.
- SANAS has commenced assessments and competency declarations aligned with the new NER.

Certification assessments

A summary of results for the assessments that took place from February to October 2025 is provided in Table 1. The PCC assessment dates for 2026 are in Table 2.

Occupational Hygiene Skills Forum

The SAIOH Occupational Hygiene Skills Forum (OHSF) continues to play a pivotal role in strengthening the quality and recognition of occupational hygiene training across South Africa, and beyond.

In 2025, the OHSF actively participated in the OHTA Approved Training Provider Forum meetings, contributing to global dialogue on training standards and quality assurance. The Forum's fourth meeting for the year took place on 25 November 2025.

Table 1. SAIOH PCC certification assessment results as of October 2025

Certification category	Written assessments				Oral assessments			
	Assessed	Passed	Failed	Pass rate	Assessed	Passed	Failed	Pass rate
	n	n	n	%	n	n	n	%
OH assistant	105	95	10	90.5	0	-	-	-
OH technologist	59	48	11	81.4	47	28	19	59.6
Occupational hygienist	44	14	30	31.8	21	13	8	61.9
Total	**208**	**157**	**51**	**75.5**	**68**	**41**	**27**	**60.3**

Table 2. SAIOH PCC written and oral assessment dates and deadlines, 2026

Assessment type	Deadline for applications and payments	Final deadline for all assessment payments	Assessment date
Written	9 January	6 February	27 February
Oral	-	-	27 March*
Written	24 April	15 May	12 June
Oral	-	-	10 July*
Written	7 August	28 August	9 October
Oral	-	-	13 November*

*Oral assessments begin on this date and will be conducted over a two-week period

A core function of the OHSF is to evaluate applications from tertiary institutions seeking recognition for their occupational hygiene-related qualifications. The OHSF Chair has initiated contact with several institutions, including the University of Botswana, University of Pretoria (UP), Durban University of Technology (DUT), University of Johannesburg (UJ), Nelson Mandela University, and the University of Limpopo (UL), to encourage broader participation in the recognition process. Tertiary institutions offering occupational hygiene qualifications are invited to contact the PCC Administrator at lee@saioh.co.za for guidance on the application process. Once finalised, details of recognised training providers and qualifications will be published on the SAIOH website (www.saioh.co.za), providing students and certification candidates with a clear pathway to programmes aligned with SAIOH and international certification standards.

The OHSF was established to coordinate all aspects related to the recognition of occupational hygiene training materials (such as asbestos training), training providers, and institutions. It also supports the development and management of assessment and examination systems, where required.

Looking ahead, the OHSF has resolved to develop a SAIOH-specific Occupational Hygiene Legislation course. This inhouse course will form part of the certification requirements for non-AIA members. Development is scheduled to commence in 2026.

Dr Hennie van der Westhuizen has once again been invited to assist the OHSF in developing CPD-linked questions based on articles published in *Occupational Health Southern Africa*. This initiative aims to promote deeper engagement with the journal and assist members to earn CPD points. We sincerely thank Dr van der Westhuizen for taking this on.



Poster presenters at the SAIOH Annual Conference 2025. Back, L to R: Mosima Letsoalo, Kevin Renton, Jarryd Swanepoel, Lize van der Westhuizen. Front, L to R: Kutlo Tsiako, Dr Shaun Ramroop, Dr Goitsemang Keretetse, Dr Jeanneth Manganyi, Vuyo Tsotsotso

Photograph: Deon Jansen van Vuuren (SAIOH GM)



Prof. Stefan Linde (NWU) receiving a gift from Dr Goitsemang Keretetse (Wits School of Public Health) for delivering a keynote presentation at the SAIOH Annual Conference 2025, titled 'Occupational Hygiene in practice: the importance of matching your sampling strategy to the purpose of your investigation'

Photograph: Deon Jansen van Vuuren (SAIOH GM)



Karen du Preez (SAIOH President, NIOH) presents a gift to Dr Goitsemang Keretetse (Wits School of Public Health) for the best poster presentation at the SAIOH Annual Conference 2025, titled 'Quantitative self-assessment of exposure to solvents among formal and informal nail technicians in Johannesburg, South Africa'

Photograph: Deon Jansen van Vuuren (SAIOH GM)

Getting to zero occupational lung diseases and tuberculosis infections in the South African mining industry

Nothando Moyo: Deputy Head of Health, Minerals Council South Africa, Johannesburg, South Africa
e-mail: nmoyo@mineralscouncil.org.za

ABSTRACT

Occupational lung diseases (OLDs) remain a significant public health challenge in the South African mining industry (SAMI), despite notable progress in disease reduction and dust control. This article reviews the current landscape, challenges, and best practices in OLD management, with a focus on tuberculosis (TB), silicosis, and coal workers' pneumoconiosis. It highlights recent data trends, evaluates the effectiveness of interventions, and proposes a roadmap for achieving zero OLDs in the mining sector.

INTRODUCTION

The mining industry is integral to South Africa's economic development, providing employment to hundreds of thousands of workers and contributing significantly to the nation's GDP. However, this economic progress comes with a substantial public health cost as the sector is associated with a high burden of occupational diseases. Among the most prevalent are OLDs, including tuberculosis (TB), silicosis, and chronic obstructive pulmonary disease (COPD). These conditions not only impact the health and livelihoods of mineworkers, but also affect their families and the broader communities in which they live.

South African mines face unique and complex challenges in managing and preventing OLDs. Hazardous dust exposure remains pervasive, with respirable crystalline silica (RCS) and coal dust representing key risk factors for the development of pulmonary diseases. The high prevalence of human immunodeficiency virus (HIV) exacerbates vulnerabilities, particularly in relation to TB, where coinfection rates remain alarmingly high. Additionally, the mining workforce is highly mobile, with workers often migrating between regions and countries, which makes ongoing health surveillance and consistent disease management more difficult.

Despite these challenges, the imperative to achieve zero OLDs in the mining sector is clear. It is an ethical responsibility to protect workers from preventable illnesses and premature death, as well as a critical public health objective that contributes to the broader wellbeing of society. Achieving this goal will require sustained commitment, innovative interventions, and collaboration among industry stakeholders, government, and labour. This article explores the current status of OLDs in the SAMI, reviews progress and persistent gaps, and sets out a roadmap for eliminating these diseases in the pursuit of a safer and healthier future for all mineworkers.

THE BURDEN OF OCCUPATIONAL LUNG DISEASES

TB: the burning platform

Tuberculosis remains the leading cause of death from a single infectious agent, worldwide, accounting for 1.25 million deaths in 2023, including 161 000 among individuals living with HIV.[1] Within the mining sector, TB is exacerbated by exposure to silica dust and elevated HIV rates, rendering miners particularly vulnerable. Disease management and control are further complicated by the prevalence of multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB).

Trends in disease reduction

From 2008 to 2024, the mining industry achieved substantial reductions in the incidence of OLDs.[2] Total occupational diseases decreased by 82%, pulmonary TB (PTB) by 84%, silicosis by 87%, and other lung diseases by 85%. Despite these successes, TB incidence in the gold sector remains high, with 420 cases per 100 000 individuals recorded in 2024, a rate comparable to the national average.

DUST CONTROL AND MILESTONES

Silica and coal dust

Efforts to minimise RCS and coal dust exposure have produced mixed outcomes. The gold and coal sectors have not consistently achieved the milestone targets established for dust concentrations in 2014 and 2024, emphasising the ongoing need for more robust dust suppression and monitoring strategies.

CHALLENGES AND OPPORTUNITIES

Disease management in mines

Key challenges in disease management include cross-border health issues, stemming from migrant labour, late reporting, medication stockouts for TB treatment, elevated rates of drug-resistant TB, and the presence of stigma and psychosocial barriers to care. Opportunities for improvement exist in the form of enhanced dust control measures, integrated TB/HIV programmes, improved screening processes (including for ex-miners), and comprehensive contact tracing.

Ex-miners and community outreach

Ex-miners continue to face significant risks and obstacles to accessing care. Best practice approaches include regular health screenings such as chest X-rays and spirometry, access to specialised occupational health clinics, legal support for compensation claims, pulmonary rehabilitation, psychosocial support, and strengthened community-based outreach and disease registries.

BEST PRACTICES AND INTERVENTIONS

Tripartite and industry initiatives

Collaborations among the Mine Health and Safety Council, the Minerals Council South Africa, government departments such as the Department of Mineral and Petroleum Resources (DMPR), the Department of Health (DoH), and other stakeholders have been instrumental in the progress that has been made. Initiatives include advancements in occupational hygiene and medicine, such as computer-aided diagnosis, the elimination of TB and HIV, research, and the establishment of new milestone targets for 2024, as well as integrated wellness programmes and monitoring tools.

KEY RECOMMENDATIONS

- Preventive practices: focus on addressing social determinants of health, including improving living conditions and nutrition.
- Infection and dust control: enforce the use of personal protective equipment (PPE), implement regular health screenings, and upgrade ventilation systems.
- Early detection and treatment: employ advanced diagnostic methods and ensure prompt initiation of treatment.
- Community engagement: educate and involve mineworkers and their families to reduce stigma and encourage treatment adherence.
- Cross-border health strategies: develop referral systems for migrant workers to improve continuity of care.
- Integrated wellness programmes: manage TB, HIV, silicosis, and other respiratory diseases through holistic approaches.
- Monitoring and evaluation: use data-driven methods to track health outcomes and inform policy decisions.

CONCLUSION

The SAMI has made notable progress in reducing OLDs. Nevertheless, persistent challenges require renewed commitment and innovative solutions. Achieving zero OLDs will depend on the acceleration of dust control efforts, strengthened collaboration between public and private sectors, integrated and person-centred care for current and former mineworkers, and robust systems for monitoring, evaluation, and policy alignment. The elimination of OLDs is attainable if all stakeholders unite to fast-track interventions and close the gap between mining operations and primary healthcare.

REFERENCES

1. Global tuberculosis report 2024. Geneva: World Health Organization; 2024. Available from: https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2024 (accessed 18 November 2025).
2. Mine Health and Safety Inspectorate Annual Reports. Pretoria: Department of Mineral Resources and Energy. Available from: https://www.dmre.gov.za/mineral-resources/mine-health-and-safety/resource-center (accessed 5 December 2025).

UPCOMING EVENTS

SOUTH AFRICA

NIOH: GHS Safety Data Sheets and Chemical Labels Webinar
Virtual
24-25 February 2026
Register: https://redcap.nioh.ac.za/redcap/surveys/?s=R7M7P9AHAHHR89NW
e-mail: toxicology@nioh.ac.za

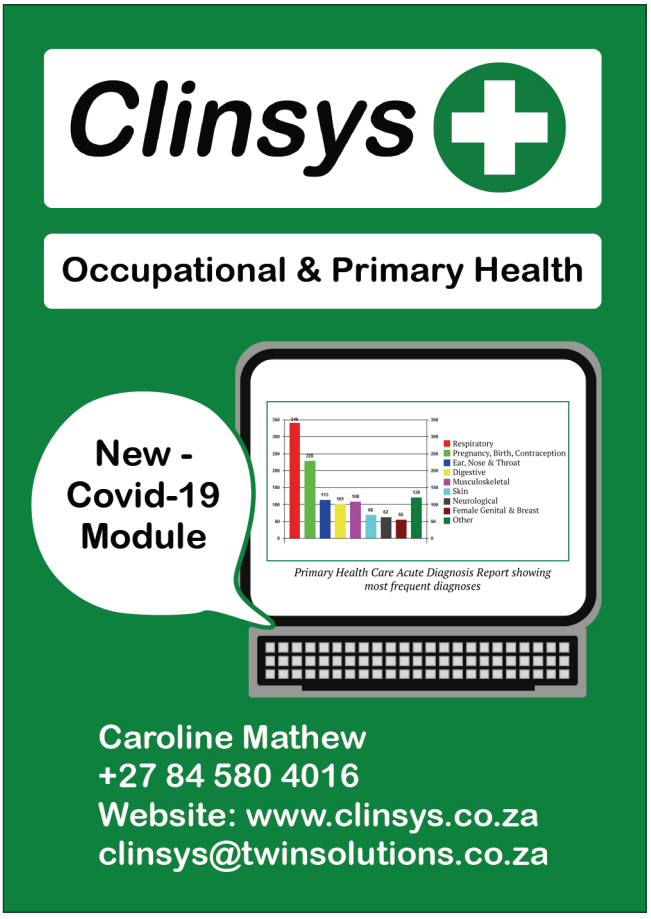
INTERNATIONAL

ICOH History Conference 2026
Leuven, Belgium
15-17 April 2026
Website: https://laislanetwork.org/events/icoh-history-2026/
e-mail: info@icohhistory2026.org

Go to

www.occhealth.co.za
'Upcoming Events'

to see upcoming local and international OH events



Securex Cape Town debut event drives safety and security solutions forward

From 21 to 23 October 2025, the Cape Town International Convention Centre (CTICC) became the hub of the Western Cape's safety and security conversation as the first-ever A-OSH EXPO Cape Town opened its doors. Co-located with Securex, Facilities Management Expo, and Firexpo, the event created a vibrant platform where professionals discovered, compared, and connected around the solutions needed for safer workplaces and communities.

"Securex Cape Town has proved that the Western Cape deserves a dedicated platform for safety and security. The energy on the show floor was exceptional, with exhibitors and visitors alike seeing the value of having this event in Cape Town. We welcomed over 2000 industry professionals to the event, a very promising start. This is only the beginning; we're looking forward to building on this success", says Mark Anderson, Portfolio Director at Montgomery Group Africa.

End-to-end offerings

Cape Town and the Western Cape face distinctive challenges, from the rising demand for estate security, to the operational strain at ports, to the impact of cyber threats on supply chains. Securex South Africa Cape Town brought together suppliers offering surveillance, intrusion detection, cloud-based access control, and integrated perimeter solutions to help organisations mitigate these risks. Demonstrations and discussions focused on practical implementation, ensuring visitors could picture how these tools might work in their own environments.

"With all four shows under one roof, attendees gained a complete view of how security integrates with occupational health and safety, fire protection, and facilities management, for example, how linking fire detection with access control creates greater resilience than siloed approaches", says Anderson.

This connected approach encouraged cross-sector conversations: estate managers considering occupational health and safety (OHS) implications, or logistics operators exploring how fire safety supports continuity planning. The holistic view of risk was one of the most valued aspects of the event.

"The engagement at the event was a winning feature, with estate managers, facilities operators, manufacturing leaders, and logistics professionals connecting face-to-face with solution providers, comparing technologies side by side, and discussing the long-term strategies needed to protect people and property", says Anderson.

Praise for Securex Cape Town

Exhibitors praised the opportunity to reach Cape-based decision-makers, while visitors highlighted the convenience of finding global and local suppliers in one hall. Together, this feedback reinforces the importance of Securex South Africa Cape Town in strengthening the regional security landscape.

"We recently revamped our website and, interestingly, our analytics show that 50% of the enquiries come from Cape Town. We therefore felt this was an opportune time to increase brand awareness in the region with a stand at Securex Cape. We are not only hoping to grow our franchisee base in the Western Cape, but by having a physical presence at the expo, we feel that we have a better chance of reaching potential customers who are swamped with the 'noise' on social media. The visitors we have spoken to are tech-savvy and keen to find out more about our solutions", says Lee Bester, Dealer Development Manager at Digit FMS.



Visitors and exhibitors connect at Securex South Africa Cape Town, where the debut event showcased innovation, integration, and strong regional engagement *Photograph: Montgomery Group Africa*

"I've come all the way from Zambia specifically for this show, and I found it very interesting. I was exposed to the new technology on show, and I'm taking everything I've learned about back to Zambia to see how it will work for us. I was very impressed with the CCTV solutions", says Abel Musonda, CEO at Navari Fleet Management (Zambia).

"Securex Cape Town has not only extended the reach of Africa's leading security exhibition, but also confirmed the strong appetite for a dedicated regional platform. By balancing innovation with practical application, it has positioned itself as a must-attend annual highlight for the Western Cape's safety and security sector. Its success has underlined Cape Town's role as a hub of innovation and opportunity, proving that collaboration between exhibitors and visitors can deliver long-lasting impact. We encourage regular visits to the website – www.securex.co.za – to find out more about the next event, taking place in March 2027, alongside the Cape Town Industrial Technology Exhibition (CITE)", says Anderson.