30 YEARS ANNIVERSARY EDITION

OCCUPATIONALhealth

SOUTHERN AFRICA

Volume 30, Issue 2, 2024

ISSN 2226-6097



OFFICIAL JOURNAL

South African Society of Occupational Medicine (SASOM)

Southern African Institute for Occupational Hygiene (SAIOH)

Mine Medical Professionals Association (MMPA)

An accredited peer-reviewed journal of the Department of Higher Education and Training (DHET)

Front cover
Hande S Emirmahmutoğlu is a young artist based in Istanbul, Turkey, but who also has a strong connection to South Africa. She works primarily in the fields of illustration, painting and sculpture.
Instagram:
@byhandemirm
e-mail:
handeemirmahmutoglu@outlook.com
Website:
https://www.handeemirmahmutoglu.com

OCCUPATIONALhealth
SOUTHERN AFRICA

Volume 30, Issue 2, 2024

South African Society of Occupational Medicine (SASOM)
Claudia Frost
Tel: +27 (0)87 288 0893
e-mail: info@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)
Raymond van der Berg
Tel: +27 (0)11 568 2054
e-mail: raymondvdb@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

EDITORIAL BOARD
SOCIETY REPRESENTATIVES
Johan du Plessis, *PhD (Occupational Hygiene): North-West University, South Africa*
Affiliations: North-West University, South Africa; SAIOH member
Deon Jansen van Vuuren, *BSc Hons (industrial Physiology): North-West University, South Africa*
Affiliation: SAIOH General Manager
Spo Kgalamono, *FCPHM (Occ Med): CMSA, South Africa; MMed (Comm Health) University of the Witwatersrand, South Africa*
Affiliations: National Institute for Occupational Health (NHLS), South Africa; University of the Witwatersrand, South Africa; SASOM ExCo member
Daan Kocks, *MD: Medical University of Southern Africa, South Africa; FCPHM (Occ Med): CMSA, South Africa*
Affiliations: University of Pretoria, South Africa; SASOM Chair
Dipalesa Mokoboto, *MBChB: University of KwaZulu-Natal, South Africa; MPhil (Medical Law and Ethics): University of Pretoria, South Africa*
Affiliations: Department of Mineral Resources and Energy, South Africa; University of Pretoria, South Africa; MMPA Past President
Vusumuzi Nhlapho, *DOccMed: RCP, London, UK*
Affiliations: 3SixtyHealth, South Africa; MMPA Past President

PUBLISHER
Kevin Beaumont, *MA (English): University of KwaZulu-Natal, South Africa*
Affiliation: MettaMedia (Pty) Ltd
MettaMedia (Pty) Ltd
www.mettamedia.co.za

EDITORIAL ADVISORY PANEL
Thomas Fuller, *ScD (Industrial Hygiene/Work Environment): University of Massachusetts Lowell, USA; MSPH (Radiological Hygiene): University of North Carolina, USA; MBA (Finance): Suffolk University, USA; Professor Emeritus, Illinois State University, USA*
Affiliations: Occupational Hygiene Training Association, UK; IOHA Past President; President, Iberoamerican Board of Occupational Hygiene
Karen Michell, *PhD: University of the Witwatersrand, South Africa; Fellow of the Academy of Nursing of South Africa*
Affiliations: Institution of Occupational Safety and Health, UK
Jim Phillips, *PhD: Leeds University, UK*
Andre Rose, *MBBCH, MMed (Community Health), FCPHM, PhD: University of the Free State, South Africa*
Affiliation: DSI-SAMRC South African Population Research Infrastructure Network (SAPRIN)
Mary Ross, *MBChB: University of Birmingham; Fellowships in Occupational Medicine (South Africa and UK), Public Health South Africa, Travel Medicine UK, Tropical Medicine Australasia*
Affiliations: University of the Witwatersrand, South Africa; Faculty of Occupational Medicine, UK; Journal of the Society for Occupational Medicine, UK; International Commission for Occupational Health; World Health Organization; SASOM honorary life member; MMPA honorary life member

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

Audit Bureau of Circulations of South Africa 2019

© **Copyright** Material appearing in this issue may not be reproduced without the permission of the editors or publishers in any form whatsoever.

Disclaimer: The publishers, editors, SASOM, SAIOH and MMPA are not liable for any damages or loss incurred as a result of any statement contained in this Journal. Whilst every effort is made to ensure accuracy in this publication, neither the publishers, editors, SASOM, SAIOH, nor MMPA accept any responsibility for errors or omissions in the content and reserve the right to edit all contributions. The views expressed in this publication are not necessarily those of the publishers, editors, SASOM, SAIOH, or MMPA, neither do these Societies, publishers or editors endorse or guarantee the products or services advertised, or claims made by the manufacturers. It is the author's responsibility to obtain the necessary permissions to publish articles.

Occupational Health Southern Africa **is on the Department of Higher Education and Training's list of Approved South African Journals; authors of peer-reviewed papers thus qualify for subsidies for their affiliated tertiary institutions. It is also listed in African Index Medicus; and is on the International Committee of Medical Journal Editors (ICMJE) website list of journals following the ICMJE recommendations for the conduct, reporting, editing and publication of scholarly work in medical journals.**

How to subscribe

Join SASOM, SAIOH or MMPA and receive a premier subscription to *Occupational Health Southern Africa* as a benefit of Society membership. Alternatively, contact us at Kevin@mettamedia.co.za to subscribe directly.

PUBLISHED BY
MettaMedia

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

MASOYISE
Health Programme

Report foreword



Mike Teke
Masoyise Chair and CEO of Seriti Resources

The Masoyise Health Programme (Masoyise) which was launched for the first time in 2016, by the Board of the Minerals Council South Africa (Minerals Council), has been a game changer for tangible outcomes on tuberculosis (TB), human immunodeficiency virus (HIV), occupational lung diseases (OLDs) and non-communicable diseases (NCDs), including mental health. The key differences, introduced through Masoyise, were the multi-stakeholder approach, close monitoring and reporting on performance and promoting best practices from our member companies.

We have made considerable progress in reducing TB incidence rates in the industry. This progress was also sustained by milestone targets we set through the tripartite structures in the Mine Health and Safety Council (MHSC). In 2014, we set a milestone that our TB incidence rate should be at or below the South African TB incidence rate by 2024. We are pleased to state that, over the past few years, this milestone target has been achieved in all commodities, except in the gold sector.

Our target now is to eliminate TB in our industry and achieve the "healthy worker effect", which states that those who are employed have better health than the unemployed.

The South African National AIDS Council's (SANAC's) National Strategic Plan (NSP) for HIV, TB and sexually transmitted infections (STIs) 2023-2028 included mental health screening, treatment, and psychosocial support for anxiety, depression and harmful drug use as part of the minimum package of care for the general population. It is against this background that we must track the impact of mental health on our employees.

2023 has been a groundbreaking year for all of us and more especially in the mining sector. For the first time, Masoyise added mental health to their targets, with primary targets being the sector-wide awareness of, and easy access to effective mental health services by 2030. A mental health seminar was held in October 2023 to raise awareness and to educate our health practitioners on identifying and managing mental health disorders in employees.

I am pleased with the support our members have shown in ensuring that they improve their health performance reporting and continue to implement robust programmes on TB, HIV, OLDs and NCDs. Reporting on Masoyise indicators improved to 80% in 2023, from 73% in 2022. There was a significant increase in the screening of employees in 2023 across the board except for the newly added targets for NCDs. The TB incidence rate for the industry continued to improve and was 223 per 100,000 population in 2023, from 236 per 100,000 population in 2022. We do not underestimate the efforts by our member companies that went into achieving these targets.

I believe that we need to share our good news stories, identify best practices, and learn from each other to improve the health of all our employees.

Click here to read the full report

23

ANNUAL REPORT

June 2024

OCCUPATIONALhealth
SOUTHERN AFRICA
Volume 30, Issue 2, 2024

Contents

Editorial 50

IOHA Awards
Deon Jansen van Vuuren wins IOHA Lifetime Achievement Award 2024 53

People on the Move
Dr Tumi Legobye, Harmony Health and Wellness Executive 55

Original Research
Prevalence of needle stick and sharps injuries and associated factors among nursing students in Gauteng province, South Africa
GI Manenzhe, T Singh 56

Determinants of psychological resilience among healthcare workers in low- and middle-income countries, using the Connor-Davidson Resilience Scale: a narrative literature review
T Mcizana, S Adams, I Ntatamala 63

Case Report
Work-related upper limb disorders in health workers: a case of de Quervain's tenosynovitis with ongoing hand pain
Y Williams, I Ntatamala, S Adams 72

Obituary
Petrus Cornelius Schutte: 8 December 1950–28 September 2023 80

Tribute
John Carol Anthony (Tony) Davies: 28 August 1931–3 March 2024 82

Standards
Unlocking the transformative potential of ISO 23875 for mine site culture and operator air quality *(Part 2)*
J Moredock 88

Sponsored Articles
Rand Mutual Assurance putting a spotlight on safety and prevention in the workplace
RMA 90

Understanding z-scores in spirometry using the Vitalograph Spirotrac 6 software and ViBAC® Bacterial Viral Filter: a South African occupational health perspective
SSEM Mthembu 91

Reports
The Southern African Tuberculosis and Health Systems Support (SATBHSS) project achievements
AUDA-NEPAD 95

American Industrial Hygiene Association Emerging Economies Microgrant Advisory Group
AIHA 97

SASOM report on the ICOH2024 Congress and the Scientific Committee for Biohazards and Occupational Health
SASOM 100

Society Newsletters
SASOM 103
SAIOH 114
MMPA 117

From the Editor . . .

30 YEARS ANNIVERSARY EDITION

Happy 30th birthday to *Occupational Health Southern Africa*



Gill Nelson,
Editor-in-Chief

Just over four years ago, near the beginning of the COVID-19 pandemic, in April 2020, *Occupational Health Southern Africa* published an issue dedicated to the history of occupational health (https://www.occhealth.co.za/index.php?p=issue&i=331). This was to coincide with the International Commission on Occupational Health (ICOH) 7th International Conference on the History of Occupational and Environmental Health, which was planned to take place the following month at the University of KwaZulu-Natal in Durban. A write-up of the history of *Occupational Health Southern Africa* was included in that issue.[1]

Prof. Rajen Naidoo, the main organiser and host of the conference, made the wise decision to postpone the event until 2022, rather than hold it virtually. At that time, no-one knew that the Pandemic and associated South African lockdown would continue for two years. Although the National State of Disaster ended on 4 April 2022, the country's COVID-19 law was only repealed in June 2022, and the conference was further delayed. It was eventually held in November 2023 and was a resounding success.[2]

Not to be left out, *Occupational Health Southern Africa* presented a poster, detailing the history of the Journal just short of its 30th birthday. This year, the Journal is celebrating that milestone, having published its first issue at the beginning of 1995 (https://www.occhealth.co.za/pdf/journal/vol1no1.pdf) – a respectable 36 pages of news, informative articles, and research.

Fundamentally, over the years, the Journal has remained true to its vision as described by the first Editor, Chris van Selm, in his editorial of the first issue of 1995 (https://www.occhealth.co.za/pdf/journal/vol1no1.pdf), i.e. to provide readers with *"information and articles which are of interest and use to them"*. This vision has since expanded to, amongst other things, create a platform for emerging researchers to publish their work, update readers about legislative changes related to occupational health, and publish abstracts from conferences, where appropriate.

The efforts by the authors who have submitted articles, comments, opinions etc to this issue are acknowledged with appreciation. The future of the journal depends on us providing our readers with information and articles which are of interest and use to them. Once again, we emphasise that the combined efforts of SASOHN and SASOM have achieved a remarkable breakthrough in supporting the recognition and changes in the vital roles that occupational health practitioners play in the services provided.

There is a range of contributions available to authors from short reports to original and review articles, to letters to the editor. Each edition will have a case-study section intended to be educational and of interest, as well as a personality profile about people who have made a contribution to occupational health. It is hoped that occupational health workers will use this journal to air their views, and initiate some lively discussion.

Excerpt from the editorial of Volume 1, Issue 1, 1995 of *Occupational Health Southern Africa* (Chris van Selm)

The *"personality profile about people who have made a contribution to occupational health"* that was envisaged from the genesis of the Journal, has continued, albeit sporadically. We have profiled Anja Franken, Pieter de Jager, Spo Kgalamono, Vanessa Govender, Muzimkhulu Zungu, Derk Brouwer, and others. In this issue, we profile Tumi Legobye, the Mine Medical Professionals Association (MMPA) President and Health and Wellness Executive at Harmony Mines. Please send us names of those persons you believe deserve to be featured in future issues.

Interestingly, some of those who published articles in the first issue are still active in occupational health research, including David Rees (Professor Emeritus, retired, and still an active researcher and regular contributor to the Journal), Renay Weiner (doctor, co-founder and Director of Research and Training for Health and Development), Mary Ross (Professor, retired; an Editorial Advisory Panel member of, and regular contributor to, *Occupational Health Southern Africa*), and Jill Murray (retired, and still an active researcher).

We have sadly lost occupational health colleagues along the way. REG Rendall published a case report on 'Mesothelioma resulting from asbestos cement exposure' in the 1st issue of the Journal, and later died from the disease. The first obituary was for Dr Gerard Sluis-Cremer, another prolific researcher of occupational diseases in the mining industry; in this issue, we write about two other noteworthy occupational health proponents who recently passed away– Schu Schutte and Tony Davies. Others who have passed away in the intervening years include Lee Baker, Anton Stoltz, Brenda Wortmann, Conrad Bosch, Neil White, Margot Becklake, Jock McCulloch, Danuta Kielkowski, Phiroshaw Camay, Brendan Girdler-Brown, Rosalie Lowe, Eric (Terry) Geddes, Sean Cheevers, Johan Mets, and Johann Beukes. Not all have been featured in *Occupational Health Southern Africa*, but all will be remembered for a long time for their contributions towards improving workers' health.

For two and half decades, the Journal was published in print form and mailed to the many thousands of members of the contributing societies and subscribers, both within South Africa and across its borders. The Pandemic, however, changed the face of publishing and the Journal moved to an electronic platform, like many other scientific and non-scientific publications. This change both reduced costs and increased the reach of the journal. Something that has not changed is our reliance on advertising to build critical financial sustainability reserves. Advertising, too, has advanced with technology. Some other notable improvements over the years include recognition by the Department of Higher Education and Training in 2004, moving from a manual to an electronic submission and review system (Scholastica) in



Adcock Ingram advert from issue 1, 1995 – the first advertiser in OHSA

2018, development (2007) and upgrade (2022) of the website, and the introduction of the SASOM award for the best paper by a novice author in 2020. The winner of the SASOM Annual Author Award for 2023 will be announced in the next issue of the Journal.

For now, you can read three research papers in this issue about the difficulties that healthcare workers face, viz. the high prevalence of sharps injuries, factors associated with psychological resilience, and the consequences of performing repetitive tasks. In addition to other interesting news and articles, we celebrate Deon Jansen van Vuuren's well-deserved IOHA Lifetime Achievement Award, and recognise the importance and scope of the triennial ICOH2024 Congress that was held in Marrakesh, Morocco in April/May this year, and its Scientific Committees. South Africa was well represented in the congress.

We have just passed the winter solstice in the southern hemisphere, so can look forward to longer days. Keep warm – spring is only two months away!

REFERENCES

1. Nelson G. Commemorating 25 years of publishing research and information for OH practitioners. 2020; 26(2):84-89. Available from: https://www.occhealth.co.za/_assets/articles/331/2053.pdf (accessed 23 June 2024).
2. 7th International Conference on the History of Occupational and Environmental Health, 15–17 November 2023, Durban, South Africa. 2023; 29(4):189-210. Available from: https://www.occhealth.co.za/_assets/articles/351/2460.pdf (accessed 23 June 2024).



South Africans at the recent ICOH2024 Congress in Marrakesh, Morocco. Front, L–R: Vanessa Govender, Thuthula Balfour, David Mamphita, Florence Magampa, Fatheela Brovko, Claudia Frost, Mary Ross, Goitsemang Keretetse, Gill Nelson, Zodwa Ndlovu. Back, L–R: Daan Kocks and Dushendra Naidoo

OCCUPATIONALhealth SOUTHERN AFRICA

Occupational Health Southern Africa – a brief history

Gill Nelson[1] and Kevin Beaumont[2]

[1] Editor-in-Chief: School of Public Health, University of the Witwatersrand, Johannesburg, South Africa, gill.nelson@wits.ac.za
[2] Publisher: Mettamedia, Tulbagh, South Africa, kevin@mettamedia.co.za

1994 — **Launch of *Occupational Health Southern Africa***
The first issue of the only occupational health journal in the region is subsidised by the South African Society of Occupational Medicine (SASOM) and the South African Society of Occupational Health Nursing Practitioners (SASOHN).

1998 — **SAIOH joins**
OHASA (Occupational Hygiene Association of South Africa) and IOHSA (Institute of Occupational Hygienists of Southern Africa) merge to form SAIOH (Southern African Institute for Occupational Hygiene), which joins SASOM and SASOHN as partners on the journal.

2002 — **MMPA joins**
The MMPA (Mine Medical Professionals Association) – previously the MMOA (The Mine Medical Officers' Association) – joins the journal as the 4th partner.

2004 — **DHET accreditation**
The journal is officially accredited by the South African Department of Higher Education and Training (DHET).

2007 — **Website launched**

2011 — **Licensing agreement with Sabinet**
The journal is added to the Sabinet African Journals online journal platform.
In 2012, African Index Medicus includes the journal in its online database.

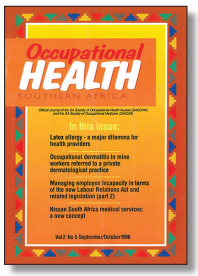
2018 — **Online editorial management system implemented**
The journal moves from a manual to an online review management system (Scholastica).

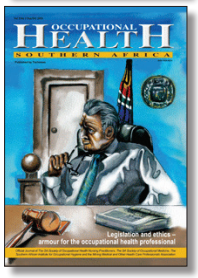
2019 — **Editorial Advisory Panel is formed**
Complementing the Editorial Board, the panel comprises local and international occupational health experts.

2020 — **Move from print to digital format**

2022 — **Website overhauled**

2023 — **Publishing frequency changes**
The journal changes from publishing bimonthly to quarterly issues.
SASOHN leaves due to financial constraints.













Chris van Selm
Editor
1995-1998



Mike Baker
Editor
1998-2000



Fiona Robinson
Editor
2001-2005



Linda Grainger
Editor
2006-2012



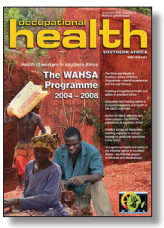
Andrew Swanepoel
Assistant Editor
2013-2016



Gill Nelson
Editor-in-Chief
2013-present



Ntombizodwa Ndlovu
Assistant Editor
2016-present



Special issue 2009

Prior to 1994, the South African Society of Occupational Medicine (SASOM) published a short newsletter for its members. Chris van Selm and Mike Baker proposed that the newsletter be developed into a journal.



Special issue 2009

Initially, the publication was in a hybrid 'journal-magazine' format. Over the years, it has developed into a respected scientific journal that is now published quarterly by a small team of two editors, a publisher, and a two-person production team.



Special issue 2020

The Editorial Board has always comprised representatives from the funding societies, and the publisher.

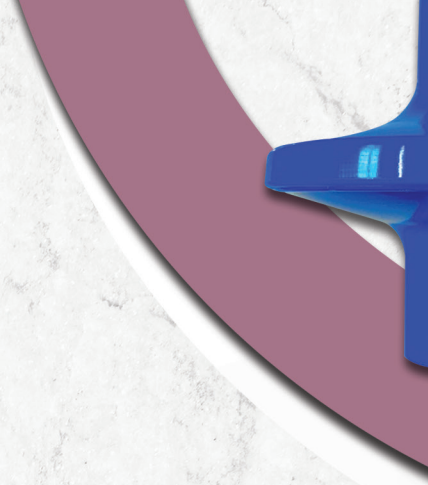


Special issue 2020

www.occhealth.co.za

Gill Nelson, Kevin Beaumont. *Occupational Health Southern Africa* – a brief history. Poster presented at the ICOH 7th International Conference on the History of Occupational and Environmental Health, Durban, November 2023. The major milestones over the years are depicted, together with the Editors, since the Journal was launched in 1994

Efficient Hygiene solution



Amtronix and **Stanyer Electroserve** now offer a comprehensive range of Bacterial/Viral filters for Pulmonary Function and Spirometry from CHP.

CHP filters use a high-quality electrostatic filtration medium with filtration efficiency exceeding 99%, capable of trapping bacteria, viruses and other micro-organisms.

Designed for inspiratory and expiratory manoeuvres, single-use bacterial/viral filters provide an efficient hygiene solution, and protection that virtually eliminates cross-contamination, which keeps both the patient and operator safe without compromising system performance.

The CHP range is available to fit most leading makes of Spirometers and PFT systems and do not have to be approved for use. The filters are independently tested and validated to meet the requirements of local and international standards (ATS/ERS/SATS).

Features:

- The CHP range includes both round and oval filters
- Colour-coded port sizes are tailored to fit a wide selection of equipment
- Unique filter design provides an airtight connection with equipment for accurate results
- Minimal dead space as needed for lung volume and DLCO testing
- Excellent filtration efficiency of bacteria, viruses and micro-organisms
- Low resistance to airflow for accurate Spirometry and lung function results
- Exceeds ATS/ERS guidelines for all criteria

Specifications:

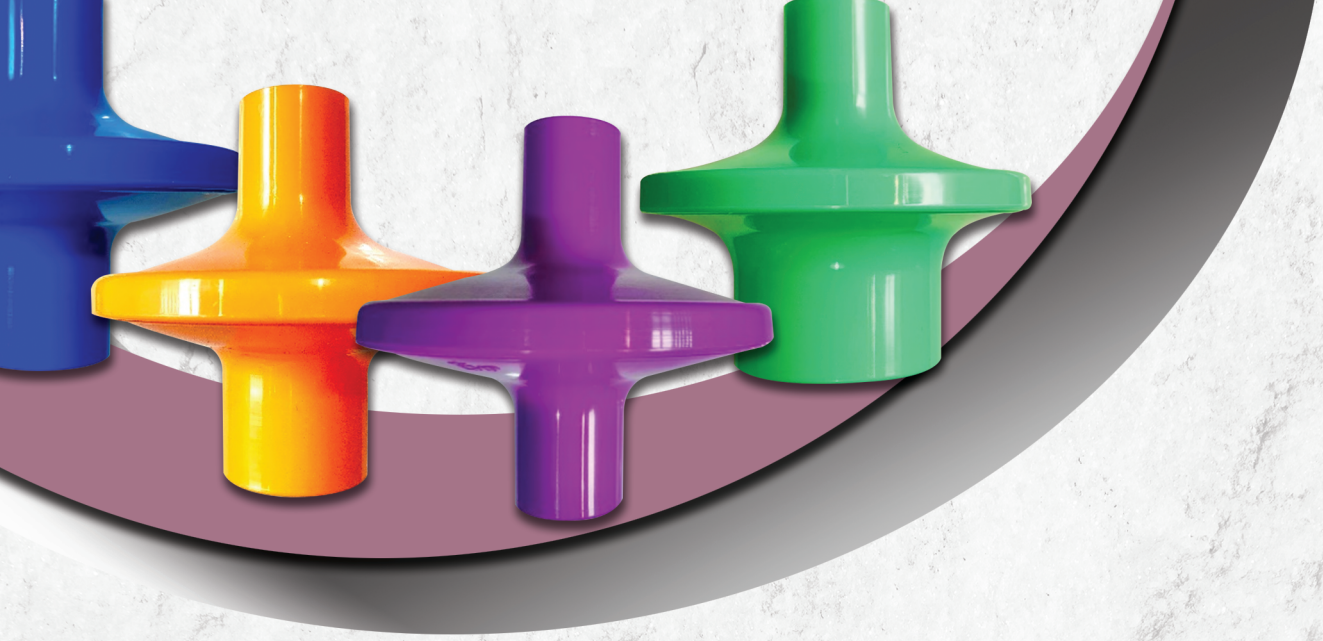
Filtration efficiency: > 99%
Differential pressure: < 1.5cm/H2O/L/sec
Minimal deadspace: < 42 ml

*Specifications are filter dependant. For detailed specifications please contact us.

Amtronix PTY LIMITED
Amtronix - breaking the sound barrier

THE OCCUPATIONAL HEALTH SPECIALISTS

ISO 13485:2016 certificate number 210610062701
SAHPRA licence number: 01156MD
Radiation control certificate: 979



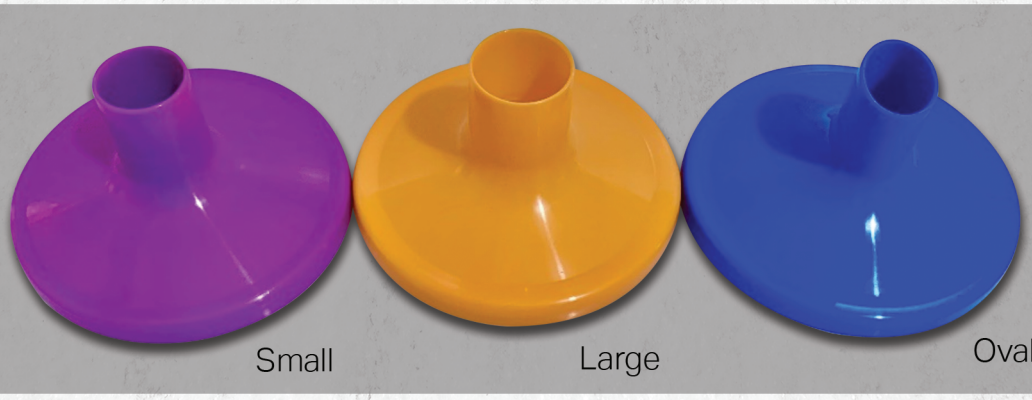
Product Code	Spirometer	Model
PFT-2025 (Standard) PFT-2225 (Oval)	ndd Medical Technologies	EasyOne Air
		Easy on-PC
		EasyOne Pro
		EasyOne Pro LAB
	Schiller	SpiroScout
		SPIROVIT SP-1 G2

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

Product Code	Spirometer	Model
PFT-2033 (Small) PFT-2533 (Standard) PFT-2233 (Oval)	Schiller	SP260
		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
		KoKo
		HDcpet 6000
		Sx 1000
		NHD4500

Three mouthpiece options*



0861 268 766 | +27 11 894 4632
info@amtronix.co.za | www.amtronix.co.za

Deon Jansen van Vuuren wins IOHA Lifetime Achievement Award 2024

TRIBUTE FROM SAIOH

Naadiya Mundy: SAIOH President

The Southern African Institute for Occupational Hygiene (SAIOH) is proud to announce that Deon Jansen van Vuuren, General Manager of SAIOH, has been awarded the prestigious Lifetime Achievement Award 2024 by the International Occupational Hygiene Association (IOHA).

Over the past few decades, occupational hygiene professionals and regulatory bodies around the globe have dedicated significant resources to improving methods and assisting with knowledge related to assessing workplace exposures. Within this realm, the IOHA bestows its most prestigious honour: the Lifetime Achievement Award. This accolade serves as a beacon, highlighting significant contributions of occupational hygiene (OH) professionals who have dedicated their careers to advancing OH practices and improving the lives of workers worldwide.

This award not only offers global acknowledgment, but also symbolises a tribute to dedication, expertise, and impactful service. To merit consideration for this honour, an individual must have devoted at least 15 years to the field of occupational hygiene, demonstrating unwavering commitment and ongoing involvement. Moreover, the recipient's endeavours must have significantly advanced the discipline, whether through pioneering research, the establishment of comprehensive hygiene programmes, advocacy for service quality enhancement, or contributions to the standardisation of best practices.

One hallmark of the award is its alignment with the objectives outlined in the Association's Memorandum and Articles. Each recipient's accomplishments serve as a testament to these guiding principles, demonstrating a commitment to excellence, collaboration, and the advancement of occupational hygiene on a global scale. By honouring individuals whose work exemplifies these ideals, the IOHA underscores the importance of collective action in pursuit of safer and healthier workplaces.

Keeping these requirements in mind, we at SAIOH are proud to acknowledge that Deon Jansen van Vuuren (a proud South African) has been awarded this prestigious title. Deon has devoted nearly 43 years to the field of occupational hygiene. He is widely recognised within the international occupational hygiene community for his advocacy for worker health protection, especially in his early years, when he served in the military and developed various occupational health and safety (OHS) training courses and workshops throughout South Africa.

Deon has occupied high-level managerial roles with worldwide responsibilities in several multinational companies, prominently in the National Occupational Safety Association (NOSA), a local government council (Roodepoort City Council), Columbus Stainless, Gencor, Anglo American, and Gijima. Throughout his tenure at SAIOH, he led the professional advancement of his team, with approximately 45% registered as occupational hygiene assistants, 25% as occupational hygiene technologists, and an impressive 30% as registered occupational hygienists. When Deon retired at the age of 65, the occupational hygiene Business Unit (BU) boasted 85 individuals, making it the largest of its kind in South Africa, with numerous others passing through its ranks.

Letter from the IOHA

The IOHA Lifetime Achievement Award honours individuals who have made significant contributions to the promotion and development of occupational hygiene practices that improve the health and welfare of working men and women. Special consideration is given to candidates from regions without an established tradition in occupational hygiene.

This year, four strong applications were received by the Lifetime Achievement Award Committee, which is comprised of the last three IOHA Presidents. After reviewing each of the candidate submission materials and documenting the results on the IOHA Nomination Evaluation Scoring Tool, the Committee determined that one candidate in particular excelled at meeting and surpassing the ranking criterion.



Deon Jansen van Vuuren
Photograph: courtesy of SAIOH

Deon Jansen van Vuuren was selected as the Lifetime Achievement Award recipient for 2024. His rousing nomination from the Southern African Institute for Occupational Hygiene (SAIOH) can perhaps be best described by a quote from their letter of recommendation:

> *"It is truly difficult to overemphasize Deon's worthiness for a "lifetime" achievement award in Occupational Hygiene. His consistent and enduring contributions have left an indelible mark on the field, impacting the lives and well-being of countless individuals. Deon's legacy is one of selflessness, expertise, and a profound passion for the improvement of occupational hygiene standards."*

In addition to a long career in occupational safety, risk management, and occupational hygiene, Deon has been on the SAIOH Executive Committee or Board for more than 21 years. Active in the SAIOH Professional Certification Committee (PCC), Deon was an early participant in the IOHA National Accreditation Recognition Committee (NARC) and was the NARC Chair for four years from 2011 to 2015. In addition to teaching numerous seminars and courses on occupational hygiene, Deon has been an active member of the American Industrial Hygiene Association and the British Occupational Hygiene Society.

Congratulations to Deon for his latest award and *"Thank You"* for your lifelong leadership and commitment to worker safety and our profession!

Lifetime Achievement Award Committee:
Thomas P Fuller, Maharshi Mehta, and Norhazlina Mydin



Samantha Connell (IOHA President) handing the IOHA Lifetime Achievement Award to Deon Jansen van Vuuren at the IOHA 2024 Conference in Dublin, Ireland
Photograph: courtesy of SAIOH

"Deon has been an integral part of SAIOH, spanning many years, and his leadership stands out by the nature of his commitment and the integrity of his character."

The period under Deon's leadership has left a lasting, positive influence on occupational hygiene in South Africa. He became proactive in the professional occupational hygiene field and initially joined the Occupational Hygiene Association of South Africa (OHASA) in 1980, where he was voted onto their Council. He also joined the Institute of Occupational Hygienists of Southern Africa (IOHSA) in 1993, where he soon joined the Examination Board. SAIOH was formed in 2001 when OHASA and IOHSA joined ranks. On the international front, Deon became the IOHA National Accreditation Recognition Committee (NARC) Chair, a position he held for four years. Although retired, Deon participates as the General Manager for SAIOH, where he contributes significantly to the promotion of occupational hygiene.

Thus, this award is not just a certificate; it acknowledges the profound impact of its recipients on the promotion and development of occupational hygiene. These individuals are not merely practitioners; they are trailblazers who have left an indelible mark on their profession and the broader community. Moreover, it fosters a sense of community and camaraderie among practitioners, reinforcing the importance of collaboration and shared purpose in achieving common goals. The IOHA Lifetime Achievement Award stands as a symbol of excellence in occupational hygiene – a tribute to those whose contributions have elevated the practice and advanced the wellbeing of workers worldwide.

"Earlier this evening, I was marking SAIOH exam papers and whilst looking at the quality of the papers it occurred to me that SAIOH has come a long way since the OHASA days. We as an Institute are operating within the international arena and our members, including yourself, have featured in leadership roles in IOHA. Since the dawn of occupational hygiene as we know it in South Africa, you played a key role in the navigation of our Institute to where we are today. Congratulations – your award is a token of local and international recognition of your lifelong dedication in establishing and honing our profession."

Hennie van der Westhuizen, Past SAIOH President

The prestigious award was conferred on Deon during the 13th IOHA International Scientific Conference (IOHA 2024), in association with the Occupational Hygiene Society of Ireland (OHSI) and the British Occupational Hygiene Society (BOHS).

IOHA COLLABORATION AWARD WINNER

The Collaboration Award Chair and Jury

The 2024 IOHA Collaboration Award is a recognition bestowed upon groups and projects that exemplify exceptional collaboration within the occupational hygiene community. There were four submissions of exceptional quality and, after thorough evaluation by the jury, the Occupational Hygiene Training Association (OHTA) was chosen for its outstanding achievement.

The submitted projects were scored on the following criteria:

- Size of the population directly involved and reached/impacted by the project
- Originality of the topic and methodologies used within the project to enhance collaboration
- Level of inspiration for other occupational hygienists worldwide
- Direct impact on working conditions in the country where the project was carried out
- Level of collaboration between the parties
- Level of continuity for the future; can the project be promoted as a good practice for cooperation; did the cooperation lead to sustainable improvement(s)?
- How well is the project in line with IOHA's mission to *"Enhance the international network of occupational hygiene organisations that promote, develop, and improve occupational hygiene worldwide, providing a safe and healthy working environment for all"*?
- Quality of three-minute video which tells the story of the collaboration

The jury was chaired by Samantha Connell (IOHA President, and Swiss Society for Occupational Hygiene, SSOH) and three IOHA Board members: Mariella Carrieri (Italian Industrial Hygiene Association, AIDII), Ellen Jensen (Norsk Yrkeshygienisk Forening, NYF), and Kerry Cheung (New Zealand Occupational Hygiene Society, NZOHS). The Chair abstained from voting.

The OHTA impressed the jury with the remarkable impact of its project, which scored high across all evaluation criteria. The project, which focused on improving worker health protection in the developing and developed world, through training in the basic rubrics of occupational hygiene, demonstrated a profound commitment to enhancing collaboration and promoting occupational hygiene on a global scale.

From the size of the population directly impacted to the level of inspiration it offers to occupational hygienists, worldwide, OHTA's project excelled in every aspect. Moreover, the Association's long-term collaboration efforts and dedication to sustainable improvement truly align with the mission of the IOHA to provide a safe and healthy working environment for all.

Dr Tumi Legobye, Harmony Health and Wellness Executive

Dr Boitumelo Legobye, also known as Dr Tumi, is an occupational health practitioner, registered with the Health Professions Council of South Africa. She serves as an executive member of Harmony Gold Mining Company Limited ('Harmony'), overseeing the health and wellness portfolio for the company.

With extensive experience at Harmony, Dr Tumi has demonstrated significant expertise in her field. Her journey at Harmony began in 2008 as an occupational medical practitioner, a role she held until 2011 when she was promoted to Hospital Manager. Subsequently, she served as a Regional Manager from 2011 to 2013, before assuming the position of Group Health Risk Manager from 2013 to 2015. Her career progression continued, culminating in her appointment as Head of Health in 2015 and, later, as an executive responsible for Health and Wellness in 2017.



Dr Tumi Legobye
Photograph: courtesy of Tumi Legobye

Dr Tumi's career advancements align with her academic background and wealth of experience. She obtained her medical degree from the University of KwaZulu-Natal in 1996, after which she furthered her academic pursuits by obtaining a Postgraduate Diploma in Occupational Health from the University of the Witwatersrand in 2001. Currently, she is engaged in studies focusing on management and leadership.

With more than 24 years of experience in occupational health, of which more than 20 have been in the mining industry, Dr Tumi has made significant contributions to Harmony. Under her leadership, the company received recognition for the Best Healthcare Model for the Mining Industry in 2016 at the Mine Safe Conference. She has represented Harmony at various forums, including the HIV International Conference in Sydney in 2014.

Dr Tumi's involvement in occupational health extends beyond Harmony. She has served on various committees of the Minerals Council South Africa, and currently holds board positions in a number of organisations, including BestMed Medical Scheme, Rand Mutual Assurance, and Rand Mutual Holdings. She is the current President of the Mine Medical Professionals Association.

Dr Tumi's dedication to advancing health and wellness in the mining industry highlights her commitment to promoting a safe and healthy work environment for all employees.

MASTER OF SCIENCE IN MEDICINE (EXPOSURE SCIENCE)

Short Courses 2024



MASTER OF SCIENCE IN MEDICINE (EXPOSURE SCIENCE) SHORT COURSES FOR 2024					
Course Name	**Course Code**	**Certificate Type**	**Cost**	**Dates**	**Application Deadline**
Exposure Assessment Methods II	SPUH0154	Attendance	R6 500	22 - 26 Apr 2024	8 Apr 2024
Exposure Assessment Methods II	SPUH0155	Competence	R7 500	22 - 26 Apr 2024	8 Apr 2024
Computational Exposure Assessment	SPUH0152	Attendance	R6 500	19 - 23 Aug 2024	5 Aug 2024
Computational Exposure Assessment	SPUH0153	Competence	R7 500	19 - 23 Aug 2024	5 Aug 2024

EXPOSURE ASSESSMENT METHODS II

The short course aims to acquaint participants with data analytics and data analysis skills and address data exploitation and processing. The course covers statistical methods for exposure data analysis, efficacy testing, and compliance testing.

THE COURSE COVERS THE FOLLOWING TOPICS:

- Integration of high quality and low-quality data in measurements strategies
- Analysis of real-time data; time series and auto correlation
- Exposure variance (within-between worker)
- Introduction to Bayesian statistics and decision-making support
- Compliance testing & tools

COMPUTATIONAL EXPOSURE ASSESSMENT

The short course aims to introduce participants to concepts and domains of exposure (and risk) modelling, to understand and explore their strengths and weaknesses. This knowledge is important in selecting and applying appropriate models and tools. The strengths and limitations of different exposure models, in general, will be explored with practical exercises as well as their application in evaluating different exposure scenarios.

FOR ENQUIRIES:
Dr Goitsemang Keretetse
Email: goitsemang.keretetse@wits.ac.za
Tel: +27 11 717 2288

FOR APPLICATIONS:
Mr Oscah Molife
Email: oscah.molife@wits.ac.za
Tel: +27 11 717 2314

To apply, e-mail a letter of motivation and your current CV to Mr Oscah Molife, and specify if you are interested in the attendance or competence option.

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG | WITS School of Public Health

Prevalence of needle stick and sharps injuries and associated factors among nursing students in Gauteng province, South Africa

GI Manenzhe[1], T Singh [1,2]

[1] Department of Environmental Health, University of Johannesburg, Johannesburg, South Africa
[2] National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa

Correspondence
Mr Gumanzi Isaac Manenzhe
e-mail: manenzhee@gmail.com

Keywords
occupational injuries, healthcare workers, university students, occupational hazard

How to cite this paper
Manenzhe GI, Singh T. Prevalence of needle stick and sharps injuries and associated factors among nursing students in Gauteng province, South Africa. Occup Health Southern Afr. 2024; 30(2):56-62. doi: 10.62380/ohsa.2024.30.2.1

ABSTRACT

Background: The occurrence of needle stick and sharps injuries (NSSIs) in healthcare settings remains a global concern. Nursing students are at a high risk of being exposed to NSSIs, mainly due to their lack of clinical skills and experience.

Objective: The objective of the study was to estimate the prevalence of NSSIs, and associated risk factors among nursing students.

Methods: This cross-sectional study was conducted in 2022 among 142 nursing students from two hospitals in Gauteng province, South Africa. Data were collected using a structured questionnaire. Chi-square tests and binary univariate and multivariable logistic regression were used to examine associations between NSSIs and various factors. Statistical significance was set at $p < 0.05$.

Results: Sixty-one (43.0%) of the study participants had experienced an NSSI. The majority reported that they had received training on injections and handling of needles (n = 117, 82.4%), but nearly half of these trained students experienced NSSIs (n = 53, 45.3%). Instruments most prone to causing NSSIs were needles (n = 48, 75.0%), medication vials (n = 10, 15.6%), and surgical equipment (n = 5, 7.8%). The procedure most commonly implicated in NSSIs was the administration of injections (n = 19, 29.2%). Most of the NSSIs occurred in the surgical (n = 17, 25.8%), medical (n = 14, 21.2%), and maternity (n = 13, 19.7%) wards. Most were superficial (n = 44, 72.1%) and 47.5% (n = 29) of the exposed participants received post-exposure prophylaxis. Study participants who worked for 40 and more than 40 hours per week were 2.59 (95% CI 1.07–6.29, p = 0.036) and 4.52 (95% CI 1.59–12.93, p = 0.005) times more likely to have an NSSI than those who worked less than 40 hours per week, respectively.

Conclusion: There was a high prevalence of NSSIs among the nursing students in this study. Needles, medication vials, and injection procedures contributed to NSSIs. Working for 40 or more hours a week was associated with experiencing an NSSI. Current training procedures for administering injections and handling needles may be ineffective in preventing NSSIs, necessitating re-evaluation of training programmes.

INTRODUCTION

Needle stick and sharps injuries (NSSIs) remain an occupational hazard among healthcare workers (HCWs), worldwide.[1] Approximately 35 million HCWs are exposed to NSSIs in the workplace annually.[2] It is estimated that 40–65% of hepatitis B and C infections in low- and middle-income countries (LMICs) are attributable to percutaneous occupational exposures.[3,4] Healthcare workers can experience NSSIs when injecting patients, recapping needles during surgery, and cleaning or exchanging medical instruments after surgery.[5] Contributing factors include anxiety, stress, high workload, lack of concentration, limited work experience, and lack of training about the handling of instruments and opening of ampoules.[6,7]

Due to insufficient clinical experience and poor attention to personal safety, nursing students are generally prone to workplace NSSIs.[8] In 2020, the pooled global prevalence of NSSIs in nursing students was reported to be 45.3%.[9] The prevalence differs vastly by country, with 15.0%, 26.2%, 56.3%, and 60.3% reported in nursing students in the Philippines,[10] Jordan,[11] Iran,[12] and China,[8] respectively. Most nursing students who experienced NSSIs in a Chinese study, published in 2018, were young women who worked night shifts and did not receive training on the safe use and handling of needles.[8] The NSSI prevalence among student nurses in African studies has been reported to be low, viz. 17.0% in Namibia in 2011,[13] and 15.6% in South Africa in 2008.[14]

While prevalence studies on NSSIs among HCWs, specifically doctors, dental students, and qualified nurses, have been widely conducted in South Africa,[6,15,16] investigations about the prevalence of, and associated risk factors for, NSSIs among nursing students are limited and outdated, to the best of our knowledge. The most recent study was published in 2008 and included an assessment of knowledge of NSSIs as well as prevalence and risk factors.[14] In our study, we sought to investigate the prevalence of, and factors associated with, NSSIs among South African nursing students in South Africa.

METHODS

A cross-sectional study was conducted from May to August 2022 among nursing students at two tertiary public hospitals in Gauteng province. All students aged 18 years or older, irrespective of year of study, and doing practical work at the two hospitals, were selected to participate.

An anonymised, self-administered questionnaire was developed, using information obtained from published research papers.[7-8,11,14,18-20] It consisted of closed-ended questions in English in four sections: demographic, work environment, behavioural, and NSSIs characteristics. Perceptions about whether anxiety caused by the COVID-19 pandemic may have contributed to the occurrence of NSSIs among nursing students were assessed using a 5-point Likert scale. Each question was pre-coded. The questionnaire was tested in a pilot study, comprising six nursing students engaged in practical work at a non-participating hospital in Gauteng province. The pilot study participants did not raise any issues with language or clarity of questions, but minor formatting changes were made to the questionnaire prior to the main study.

The sample size was calculated using EPI INFO version 7.2 (Centers for Disease Control and Prevention, United States) for a population survey/descriptive study, using an estimated population size of 4 434 (in-training nursing students in Gauteng province as of 31 December 2020).[17] Based on the literature, an acceptance margin of error of 6% and an estimated NSSI frequency of 15.6%[14] were used to calculate the sample size of 139 at a 95% confidence level, with a design effect of 1.0. A 10% contingency for refusals and/or missing data was added, resulting in a sample size of 153.

Student nurses were identified by their uniforms at each of the healthcare facilities. A systematic sampling technique was used whereby every second nursing student encountered was invited to participate in the study until the desired sample size was obtained. Those who agreed to participate were given a hard copy of the questionnaire.

Permission to conduct the study was obtained from the management of both tertiary hospitals. Ethical approval was granted by the University of Johannesburg Research Ethics Committee (REC-1285-2021).

Data management

Data were captured and cleaned in Microsoft Excel, and exported into the Statistical Package for Social Sciences (SPSS) (IBM Corp. Released 2021. IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY) for analysis. The dependent variable, NSSI, was a binary (yes/no) variable. All other variables were divided into two or more categories.

Data analysis

The data were summarised using frequencies and percentages. Differences in the characteristics of student nurses who reported having had an NSSI and those who did not were determined using the chi-square test. Univariate binary logistic regression analysis was conducted with NSSI as the dependent variable. Variables that were significantly different between student nurses with and without NSSIs at $p \leq 0.2$ in the chi-square or univariate logistic regression analysis, and work-related factors that were associated with NSSIs in the literature, were included in the multivariable logistic regression analysis. The final regression model included job-related stress, working in overcrowded areas, recapping of needles after use, training on injection of needles, wearing of face shields/goggles, and total hours worked per week. A p value of < 0.05 inferred statistical significance; 95% confidence intervals are also reported.

Table 1. Demographic characteristics by NSSI status (N = 142)

Characteristic	All (n = 142)		No NSSI (n = 81)		NSSI (n = 61)		p value
	n	% (col)	n	% (row)	n	% (row)	
Age group (years)							
18–25	116	81.7	66	56.9	50	43.1	
26–39	24	16.9	13	54.2	11	45.8	0.452
≥ 40	2	1.4	2	100.0	0	0	
Sex							
Female	116	81.7	65	56.0	51	44.0	0.608
Male	26	18.3	16	61.5	10	38.5	
Marital status							
Single	136	95.8	79	58.1	57	41.9	0.231
Married	6	4.2	2	33.3	4	66.7	
Highest education level							
Grade 12	108	76.1	63	58.3	45	41.7	
Diploma	12	8.5	7	58.3	5	41.7	0.768
Degree	22	15.5	11	50.0	11	50.0	
Residential area*							
Urban	87	62.1	50	57.5	37	42.5	0.920
Rural	53	37.9	30	56.6	23	43.4	
Number of years working as a nursing student							
< 2	54	38.0	32	59.3	22	40.7	0.068
≥ 2	88	62.0	49	55.7	39	44.3	

* Missing for two study participants; denominator = 140
NSSI: needle stick and sharps injury

RESULTS

Demographic characteristics of the study participants

Of the 153 nursing students recruited into the study, 142 returned the completed questionnaires (86 from one hospital and 56 from the other), yielding an overall response rate of 92.8%. Most participants were aged 18–25 years (n = 116, 81.7%), female (n = 116, 81.7%), single (n = 136, 95.8%), and had a minimum of a Grade 12 education (n = 108, 76.1%); almost two-thirds (n =87, 62.1%) originated from urban areas (Table 1). Sixty-two per cent (n = 88) of the participants had more than two years' experience working as a nursing student.

Prevalence of needle stick and sharps injuries

Sixty-one (43.0%) of the 142 student nurses reported having had an NSSI at their workplace. However, NSSIs were not significantly associated with any demographic characteristic in the bivariate analysis (Table 1).

Work-related factors

Approximately half of the participants (n = 77, 54.2%) reported working in crowded areas. Most (n = 62, 43.7%) worked 40 hours per week and 32 (22.5%) worked more than 40 hours per week (Table 2). One hundred and twenty (84.5%) stated that waste disposal containers for needles and sharps were always available at their workstations. Most (n = 97, 68.3%) reported having received basic occupational health and safety training. Of the 117 (82.4%) who received training on injections and handling of needles, 69.2% (n = 81) received both theoretical and practical training, while 20.5% (n = 24) and 10.3% (n = 12) received only theoretical or practical training, respectively. Job-related stress was reported by two-thirds of the participants (n = 86, 60.6%). Needle stick and sharp injuries were significantly associated with long working hours and job-related stress (p = 0.007 and p = 0.036, respectively).

As shown in Table 3, 39 (27.5%) and eight (5.6%) of the participants, respectively, agreed and strongly agreed that anxiety caused by the COVID-19 pandemic might have contributed to the occurrence of NSSIs among nursing students; 18 (12.7%) strongly disagreed. Most study participants (n = 132, 93.0%) agreed that adherence to safety policies could reduce their risk of NSSIs. Two-thirds of the participants (n = 93, 65.5%) reported that they did not recap needles after use. The majority (n = 137, 96.5%) knew the types of infections that can be transmitted through NSSIs.

Needle stick and sharps injury characteristics

Of the 61 participants who experienced NSSIs, 40 (65.6%) reported that they only had one NSSI since the beginning of the COVID-19 pandemic, while 12 (19.7%) had more than one NSSI (Table 4). In comparison, nine (14.8%) reported that they had experienced NSSIs only before the COVID-19 pandemic. Most of the NSSIs encountered by the participants were superficial (n = 44, 72.1%). Approximately half of the participants (n = 32, 52.5%) reported having not received any post-exposure prophylaxis (PEP) following the NSSI.

Needles were responsible for most NSSIs (n = 48, 75.0%), followed by medication vials (n = 10, 15.6%) and surgical equipment (n = 5, 7.8%). NSSIs were most common when giving injections (n = 19, 29.2%), followed by needle recapping (n = 8, 12.3%), suturing (n = 8, 12.3%), and drawing blood (n = 7, 10.8%). Most NSSIs occurred in the surgical, medical and maternity wards (n = 44, 66.7%); fewer occurred in the emergency and outpatient rooms (n = 13, 19.7%). At

Table 2. Work-related characteristics by NSSI status (N = 142)

Characteristic	All		No NSSI (n = 81)		NSSI (n = 61)		p value
	n	% (col)	n	% (row)	n	% (row)	
Working in overcrowded areas							
Yes	77	54.2	38	49.4	39	50.6	
No	52	36.6	32	61.5	20	38.5	0.059
Not sure	12	8.5	10	83.3	2	16.7	
Hours worked per week							
< 40	48	33.8	35	72.9	13	27.1	
40	62	43.7	34	54.8	28	45.2	0.007
> 40	32	22.5	12	37.5	20	62.5	
Availability of waste disposal containers at the workplace							
Yes	120	84.5	69	57.5	51	42.5	
No	7	4.9	2	28.6	5	71.4	0.235
Sometimes	15	10.6	10	66.7	5	33.3	
Basic training in occupational health and safety							
Yes	97	68.3	57	58.8	40	41.2	
No	28	19.7	16	57.1	12	42.9	0.667
Cannot recall	17	12.0	8	47.1	9	52.9	
Training on injections and handling of needles							
Yes	117	82.4	64	54.7	53	45.3	
No	24	16.9	16	66.7	8	33.3	0.382
Not sure	1	0.7	1	100.0	0	0	
Job-related stress							
Yes	86	60.6	43	50.0	43	50.0	0.036
No	56	39.4	38	67.9	18	32.1	

NSSI: needle stick and sharps injury

the time of the study, 49 (80.3%) of the participants who reported NSSIs did not wear double gloves when using needles. Almost all who were exposed to NSSIs reported not wearing face shields or goggles (n = 57, 93.4%). The two who wore goggles reported that the goggles were misty at the time of the NSSI encounter.

Factors associated with needle stick and sharps injuries

Table 5 shows the results of the univariate and multivariable logistic regression analyses. Fourteen cases were excluded from the analysis due to missing data. At the univariate level, student nurses with job-related stress were less likely to experience NSSIs than those without stress (OR = 0.47, 95% CI 0.24–0.96, p = 0.037). Working hours were associated with NSSIs. Those who worked for 40 hours a week were twice as likely than those who worked less than 40 hours a week to experience an NSSI (OR = 2.22, 95% CI 0.99–4.98, p = 0.054), while those who worked more than 40 hours a week were more than four times as likely to have an NSSI than those who worked less than 40 hours (OR = 4.49, 95% CI 1.72–11.68, p = 0.002).

In the multivariable logistic regression analysis, only hours worked per week were significantly associated with having an NSSI (Table 5).

Table 3. Perceptions, behavioural characteristics, and practices related to NSSIs (N = 142)

Variable	Category	n	%
COVID-19 pandemic-induced anxiety contributes to NSSI	Strongly disagree	18	12.7
	Disagree	37	26.1
	Neither agree nor disagree	38	26.8
	Agree	39	27.5
	Strongly agree	8	5.6
	No response	2	1.4
Perception that adherence to safety policies reduces NSSIs	No	10	7.0
	Yes	132	93.0
Attempted to recap needles after use	No	93	65.5
	Yes	49	34.5
Knowledge of infections transmitted through NSSIs	No	5	3.5
	Yes	137	96.5
Smoking or consumption of alcohol	No	82	57.7
	Yes	59	41.5
	No response	1	0.7
Wearing face shield/goggles when working with needles/sharp objects	No	120	84.5
	Yes	22	15.5

NSSIs: needle stick and sharps injuries

Table 4. Characteristics of needle stick and sharp injuries-associated factors among nursing students (N = 61)

Variable	Category	n	%
Number of NSSIs encountered since the start of the COVID-19 pandemic	1	40	65.6
	> 1	12	19.7
	None*	9	14.8
NSSI severity	Superficial (skin abrasion)	44	72.1
	Moderate (skin puncture)	17	27.9
Instrument that caused NSSI n = 64†	Needle	48	75.0
	Medication vial	10	15.6
	Surgical equipment	5	7.8
	Other	1	1.6
Task/procedure that led to NSSI n = 65†	Injection	19	29.2
	Suturing	8	12.3
	Needle recapping	8	12.3
	Withdrawing blood	7	10.8
	Other (combined)‡	23	35.4
Post-exposure prophylaxis after NSSI	No	32	52.5
	Yes	29	47.5
Hospital ward where NSSI occurred n = 66†	Surgical	17	25.8
	Medical	14	21.2
	Maternity	13	19.7
	Emergency	8	12.1
	Outpatient	5	7.6
	Other§	9	13.6
Was wearing double gloves when NSSI occurred	No	49	80.3
	Cannot remember	10	16.4
	Yes	2	3.3
Was wearing a face shield or goggles when NSSI occurred	No	57	93.4
	Cannot remember	2	3.3
	Yes	2	3.3

* Encountered NSSIs before the COVID-19 pandemic
† Number of responses > 61 because some students encountered > 1 NSSI
‡ Bed making, checking blood glucose, giving medication, hemo glucose test monitoring, opening vials, insertion of central venous pressure line, and a needle left in bed
§ Antenatal care, clinic, orthopaedics, paediatric ward, and not specified

Nursing students who worked 40 hours per week were 2.59 times more likely to have an NSSI than those who worked less than 40 hours per week (AOR = 2.59, 95% CI 1.07–6.29, p = 0.036). Those who worked more than 40 hours per week were 4.52 times more likely to have an NSSI than those who worked less than 40 hours per week (AOR = 4.52, 95% CI 1.59–12.93, p = 0.005).

DISCUSSION

The prevalence of NSSIs among the nursing students in this study was 43.0%, similar to that reported in a systematic review and meta-analysis, published in 2020, where the pooled global NSSI prevalence among nursing students was 45.3%.[9] Lower NSSI prevalences of 15.0–26.2% have been reported in similar NSSI studies conducted in the Philippines,[10] Jordan,[11] Namibia,[13] and South Africa,[14] but higher prevalences of 67.0% and 56.3% have been reported in similar studies conducted in China and Iran, respectively.[18,12] These differences may be attributed to different healthcare settings and other factors such as working hours, training policies, and student nurse-to-patient ratios. The difference in NSSI prevalences between our study (43.0%) and a previous study (15.6%) conducted in South Africa in 2008 (15.6%)[14] may be due to a higher patient to nurse ratio in 2022 than in 2008, due to the COVID-19 pandemic. Nurses experienced high workloads during the Pandemic due to the surge in patients, enhanced infection control measures, and the need for additional personal protective equipment (PPE). In addition, working in high-risk environments increased stress levels during the Pandemic.[21]

Almost 70% of the students who participated in the study reported that they did not attempt to recap needles after use. This is good practice as recapping needles has been reported to be associated with NSSIs.[22] Of the 61 participants who experienced an NSSI, most were not wearing appropriate PPE, such as double gloves or face shields/goggles, at the time of the injury. In addition, more than 80% of the nursing students did not wear face shields or goggles when working with needles and/or sharp objects, suggesting that poor fit and texture of gloves, or poor visibility of face shields or goggles, was not associated with NSSIs among these participants.

Despite receiving training on injections and the handling of needles, the majority of the study participants encountered an NSSI; of those who received occupational health and safety training, many still encountered an NSSI. This finding was surprising and other studies have shown that training in occupational health and safety is associated with fewer NSSI encounters.[8,23] The training undertaken by nursing students in the two hospitals may not be effective in reducing the prevalence of NSSIs.

The majority (72.0%) of the NSSIs experienced by nursing students were superficial (abrasion of the epidermis),[19] which is consistent with findings by Mishra et al. (2021) who reported that 81.0% of NSSIs among nursing students in India were superficial.[19] The three most common instruments responsible for NSSIs were needles (75.0%), medication vials (15.6%), and surgical equipment (7.8%), similar to findings reported in China in 2018.[8]

The most common procedures that resulted in NSSIs were injections, suturing, and needle recapping, which supports findings from similar studies in Turkey and Ethiopia.[4,20] In our study, NSSIs were most commonly encountered in the surgical, medical, and maternity wards. These wards have also been reported as high-risk areas in an Ethiopian study, in addition to the emergency unit.[24] Nursing students working in these high-risk wards may reduce the risks of NSSIs by adhering to safe working practices, which include avoiding needle recapping after use, placing sharp containers at eye level and at arm's reach, and emptying sharps containers before they are full.[25]

The number of hours worked per week was associated with NSSIs. Nursing students who worked 40 hours per week were almost three times more likely to experience an NSSI than those who worked less than 40 hours per week, while those who worked more than 40 hours per week were 4.5 times more likely to encounter NSSIs. Similar findings were reported in a study conducted in Ethiopia, where nurses who worked more than 40 hours per week were nearly three times more likely to experience an NSSI than those who worked less than 40 hours per week.[22] A study conducted in Iran also reported that hours worked per week were significantly associated with NSSIs.[26] In South Africa, the legislated maximum number of working hours per week is 45;[27] 23% of the nursing students in our study worked for more than 40 hours.

Table 5. Work environment-related factors associated with NSSIs (N = 128)

Variable	n	Crude OR (95% CI)	p value	AOR (95% CI)	p value
Working in overcrowded areas					
Yes	76	0.61 (0.30–1.25)	0.174	1.45 (0.67–3.12)	0.342
No	52	Reference		Reference	
Job-related stress					
Yes	79	0.47 (0.24–0.96)	0.037*	1.77 (0.81–3.88)	0.154
No	49	Reference		Reference	
Attempt to recap a needle after use					
Yes	46	0.89 (0.44–1.78)	0.735	1.09 (0.49–2.43)	0.836
No	82	Reference		Reference	
Training on injection and use of needles					
Yes	106	0.60 (0.24–1.52)	0.284	1.79 (0.66–4.90)	0.255
No	22	Reference		Reference	
Hours worked per week					
< 40	41	Reference		Reference	
40	58	2.22 (0.99–4.98)	0.054	2.59 (1.07–6.29)	0.036
> 40	29	4.49 (1.72–11.68)	0.002	4.52 (1.59–12.93)	0.005
Wearing face shields/goggles when working with needles and sharp objects					
Yes	59	1.38 (0.54–3.54)	0.50	1.02 (0.39–2.94)	0.961
No	69	Reference		Reference	

OR: odds ratio, AOR: adjusted odd ratio, NSSIs: needle stick and sharps injuries

The strength of our study is that it was conducted amongst college nursing students and university nursing students doing practical work at two large tertiary public hospitals in Gauteng province, South Africa. The students were from different educational backgrounds and clinical settings, which increases the generalisability of the findings, provides valuable insights across different stages of nursing education, and increases the relevance of the findings to real-world practice.

Limitations include the use of a self-administered questionnaire that was not validated (although it was piloted before use), which may have introduced response bias if the participants discussed the study amongst themselves. There was potential selection bias as the two hospitals were selected based on size and convenience. The sample size of 142 was relatively small and may have affected the validity of the findings.

Recommendations

Training programmes that address injection procedures and handling of needles should be strengthened to ensure that they are in line with international best practice for nursing students against NSSIs. Working hours should be strictly adhered to as long hours were associated with NSSIs in our study. Appropriate training programmes should be developed and targeted at nurses working in high-risk areas such as maternity, surgical, and medical wards. Additionally, student nurses working in these wards should be closely monitored by senior nurses. Safety needles should be used in preference to traditional needles to reduce the incidence of NSSIs among nursing students. The use of safety-engineered devices such as safety needles, combined with training programmes, has been shown to be a cost-effective strategy to reduce NSSIs in South Africa.[28] Further research on NSSIs in South Africa is warranted, including larger studies in both public and private tertiary hospitals.

CONCLUSION

The prevalence of NSSIs among nursing students doing practical work at public health facilities in South Africa is high and current training procedures appear to be inadequate in preventing these injuries. The findings can assist healthcare authorities to develop targeted training programmes to reduce the incidence of NSSIs among nursing students, including monitoring working hours.

KEY MESSAGES

1. The prevalence of NSSIs among nursing students is high, requiring targeted training programmes.
2. Needles, injection procedures, and working in surgical, medical, and maternity wards were high-risk factors for NSSIs.
3. Long working hours were associated with NSSIs.

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.

ACKNOWLEDGEMENTS

The authors would like to thank and acknowledge all the nursing students who participated in the study, and the management of the healthcare facilities for granting permission to execute the research. Special thanks to Lufuno Ndou for assistance with data collection.

AUTHOR CONTRIBUTIONS

Conception and design of the study: GIM, TS
Data acquisition: GIM
Data analysis: GIM
Interpretation of the data: GIM, TS
Drafting of the paper: GIM
Critical revision of the paper: TS
Both authors approved the final manuscript

REFERENCES

1. Hanafi MI, Mohamed AM, Kassem MS, Shawki M. Needle stick injuries among health care workers of University of Alexandria hospitals. East Mediterr Health J. 2011; 17(1):26-36.

2. Hosseinipalangi Z, Golmohammadi Z, Ghashghaee A, Ahmadi N, Hosseinifard H, Mejareh ZN, et al. Global, regional and national incidence and causes of needlestick injuries: a systematic review and meta-analysis. East Mediterr Health J. 2022; 28(3):233-241.

3. Eshwari K, Shenoy S, Nair S. Health care workers and Hepatitis B prevention: perceptions and practices in a tertiary care hospital in coastal Karnataka. Clin Epidemiol Glob Health. 2022; 16:101082. doi. 10.1016/j.cegh.2022.101082.

4. Prüss-Üstün A, Rapiti E, Hutin Y. Sharps injuries. Global burden of disease from sharps injuries to health-care workers. Environmental Burden of Disease Series, No. 3. Geneva; World Health Organization; 2003; Available from: https://iris.who.int/bitstream/handle/10665/42743/9241562463.pdf?sequence=1 (accessed 17 June 2021).

5. Kargin C, Akyol AD. Needle stick and sharp injuries among nurses. Global J Nurs Forensic Stud. 2016; 1:109. doi: 10.4172/2572-0899.1000109.

6. Alfulayw KH, Al-Otaibi ST, Alqahtani HA. Factors associated with needle stick injuries among healthcare workers: implications for prevention. BMC Health Serv Res. 2021; 21(1):1074). doi: 10.1186/s12913-021-07110-y.

7. Musekene E, Modjadji P, Madiba S. The occurrence and contributing factors of needle stick and sharp injuries among dental students in a South African University. Open Public Health J. 2020; 13:126-133. doi: 10.2174/1874944502013010126.

8. Zhang X, ChenY, Li Y, Hu J, Zhang C, Li Z, et al. Needle stick and sharps injuries among nursing students in Nanjing, China. Workplace Health Saf. 2018; 66(6):276-284. doi: 10.1177/2165079917732799.

9. Bouya S, Balouchi A, Rafiemanesh H, Amirshahi M, Dastres M, Moghadam MP, et al. Global prevalence and device related causes of needle stick injuries among health care workers: a systematic review and meta-analysis. Ann Glob Health. 2020; 86(1):35. doi: 10.5334/aogh.2698.

10. Ditching NA, Furatero AGF, Iquiña RVS, Sabulao ADM, Supremo JM, Oducado RMF. Factors associated with nursing students' intention to report needle stick injuries: applying the theory of planned behavior. Nurse Media J Nurs. 2020; 10(3):234-243. doi: 10.14710/nmjn.v10i3.31975.

11. Suliman M, Al Qadire M, Alazzam M, Aloush S, Alsaraireh A, Alsaraireh FA. Student nurses' knowledge and prevalence of needle stick injury in Jordan. Nurse Educ Today. 2018; 60:23-27. doi: 10.1016/j.nedt.2017.09.015.

12. Hosseini senjedak SM, Makki OF, Vagharseyyedin SA. Prevalence of needle stick injuries and some related factors among the nursing students. J Health Care. 2013; 15(4):30-38. Available from: http://hcjournal.arums.ac.ir/article-1-185-en.html (accessed 17 June 2024).

13. Small L, Pretorius L, Walters A, Ackerman MJ. A surveillance of needlestick injuries amongst student nurses at the University of Namibia. Health SA Gesondheid. 2011; 16(1).

14. Zungu LI, Sengane ML, Setswe KG. Knowledge and experiences of needle prick injuries (NPI) among nursing students at a university in Gauteng, South Africa. S Afr Fam Pract. 2008; 50(5):48-48c. doi: 10.1080/20786204.2008.10873762.

15. Kruger WH. Needle stick injuries among nurses in a regional hospital in South Africa. Occup Health Southern Afr. 2012; 8(3):4-7. Available from: https://

www.occhealth.co.za/_assets/articles/218/1351.pdf (accessed 17 June 2024).
16. Ledibane T. The profile and management of needle-stick injuries among healthcare workers in a primary health sub-district in Mangaung from 2008 to 2011. Occup Health Southern Afr. 2015; 21(6):17-21. Available from: https://www.occhealth.co.za/_assets/articles/240/1649.pdf (accessed 17 June 2024).
17. SANC geographical distribution 2020. Provincial distribution of nursing manpower versus the population of South Africa – 2020. Available from: https://www.sanc.co.za/wp-content/uploads/2021/04/Distribution-2020.htm (accessed 18 June 2024).
18. Wang D, Anuwatnonthakate A, Nilvarangkul K. Knowledge attitude and practice regarding prevention of needle stick injuries among nursing students in Henan province, China. J Pak Med Assoc. 2021; 71(10):2420-2422. doi: 10.47391/JPMA.03-4294.
19. Mishra R, Sharma SK, Gupta PK, Gupta P, Kalyani CV. Occupational Health Cognizance: needle stick injuries among student nurses. Int J Afr Nurs Sci. 2021; 15(100370). doi: 10.1016/j.ijans.2021.100370.
20. Kebede A, Gerensea H. Prevalence of needle stick injury and its associated factors among nurses working in public hospitals of Dessie town, Northeast Ethiopia. BMC Res Notes. 2018; 11(1):413. doi: 10.1186/s13104-018-3529-9.
21. Tomaszewska K, Majchrowicz B, Snarska K, Telega D. Stress and Occupational Burnout of Nurses Working with COVID-19 Patients. Int J Environ Res Public Health. 2022; 19(19):12688. doi: 10.3390/ijerph191912688.
22. Assen S, Wubshet M, Kifle M, Wubayehu T, Aregawi B.G. Magnitude and associated factors of needle stick and sharps injuries among health care workers in Dessie City Hospitals, north east Ethiopia. BMC Nurs. 2020; 19:31. doi: 10.1186/s12912-020-00422-0.
23. Weldesamuel E, Gebreyesus H, Beyene B, Teweldemedhin M, Welegebriel Z, Tetemke D. Assessment of needle stick and sharp injuries among health care workers in central zone of Tigray, northern Ethiopia. BMC Res Notes. 2019; 12(1):654. doi: 10.1186/s13104-019-4683-4.
24. Bekele T, Gebremariam A, Kaso M, Ahmed K. Factors associated with occupational needle stick and sharp injuries among hospital healthcare worker in Bale Zone, Southeast Ethiopia. PLoS One. 2015; 10(10):e0140382. doi: 10.1371/journal.pone.0140382.
25. Handiyani H, Kurniawidjaja LM, Irawaty D, Damayanti R. The effective needle stick injury prevention strategies for nursing students in the clinical settings: a literature review. Enferm Clin. 2018; 28(Suppl 1):167-171. doi: 10.1016/S1130-8621(18)30060-3.
26. Jahangiri M, Rostamabadi A, Hoboubi N, Tadayon N, Soleimani A. Needle stick injuries and their related safety measures among nurses in a university hospital, Shiraz, Iran. Saf Health Work. 2016; 7(1):72-77. doi: 10.1016/j.shaw.2015.07.006.
27. South Africa. Basic Conditions of Employment Act, 1997 (Act No. 75 of 1997) as amended by Basic Conditions of Employment Amendment Act, 2002 (Act No. 11 of 2002). Available from https://www.ilo.org/dyn/travail/docs/2259/Amended%20Basic%20Conditions%20of%20Employment%20Act%201997%20as%20amended%202002.pdf (accessed 21 October 2022).
28. De Jager P, Zungu M, Dyers RE. Economic evaluation of safety-engineered devices and training in reducing needlestick injuries among healthcare workers in South Africa. S Afr Med J. 2018; 108(6):477-483. doi: 10.7196/SAMJ.2018.v108i6.12913.

Determinants of psychological resilience among healthcare workers in low- and middle-income countries, using the Connor-Davidson Resilience Scale: a narrative literature review

T Mcizana, S Adams, I Ntatamala

Division of Occupational Medicine and Centre for Environmental and Occupational Health Research, School of Public Health, University of Cape Town, Cape Town, South Africa

Shahieda Adams and Itumeleng Ntatamala are members of SASOM

Correspondence: Thandokazi Mcizana
e-mail: mcztha001@myuct.ac.za

Keywords
resilience, CD-RISC, coping mechanism, COVID-19

How to cite this paper
Mcizana T, Adams S, Ntatamala I. Determinants of psychological resilience among healthcare workers in low- and middle-income countries, using the Connor-Davidson Resilience Scale: a narrative literature review. Occup Health Southern Afr. 2024; 30(2):63-71. doi: 10.62380/ohsa.2024.30.2.2

ABSTRACT

Background: Psychological resilience has been described as a means of facilitating adaptation in stressful environments. Little is known about the factors that predict psychological resilience of healthcare workers in low- and middle-income countries (LMICs).

Objectives: The aim of this review was to identify factors associated with the psychological resilience of healthcare workers (excluding nurses) practising in LMIC settings, using the Connor-Davidson Resilience Scale (CD-RISC).

Methods: A narrative literature search was conducted, using four public databases to investigate determinants of psychological resilience among healthcare workers in LMICs using the CD-RISC. Studies considering only nurses or nursing students were excluded.

Results: The review included 22 journal papers, published from 2013 to 2023. The factors associated with resilience amongst healthcare workers in LMIC settings were categorised as personal, social, and lifestyle; work-related and organisational support; and policy level factors.

Conclusion: Research on psychological resilience for non-nursing healthcare workers operating in LMICs is limited and contradictory in some instances, and has been conducted mainly in China. Further evidence-based research is needed in LMICs to better characterise factors associated with psychological resilience of healthcare workers to enable improved support of this important occupational group.

INTRODUCTION

Frontline healthcare workers are frequently the first to be called upon during major public health emergencies and are exposed to several occupational and social pressures, including witnessing human suffering and death, moral injury and distress, isolation, long work shifts and increased public scrutiny.[1] On 30 January 2020, the coronavirus disease 2019 (COVID-19) was declared a public health emergency by the World Health Organization. The levels of psychological resilience and coping skills that were required of healthcare workers to deal with the increased pressures brought about by the COVID-19 pandemic were higher than those required of the general population.[2]

Psychological resilience is a multidimensional term, with varying definitions used in different contexts.[3-5] Herrman et al. (2011) described resilience as the inherent ability of one to adapt positively, following adversity or stressful events.[3] In a systematic review, Huey and Palaganas (2020) noted that most studies in healthcare workers used the word *"adversity"* in their definition of resilience.[6] Others have described psychological resilience in terms of an individual's coping mechanism, optimism, self-efficacy, sense of coherence, high levels of hope, and thriving mental health amid adversity and challenging circumstances.[7] For this review, we draw on these definitions and define psychological resilience in broad terms as a means of facilitating adaptation in stressful environments.

The healthcare systems of most low- and middle-income countries (LMICs) are under severe strain due to high patient numbers, lack of finance and human resources, the brain drain phenomenon, corruption, and poor administration.[8-10] In addition, many LMICs suffer from a double burden of disease: communicable and non-communicable diseases.[9] These challenges place immense pressure on healthcare workers. Psychological resilience may protect them against burnout and adverse mental health outcomes, and support the delivery of healthcare services in LMICs.[11] Table 1 provides a summary of systematic reviews focusing on resilience amongst healthcare workers published to date, with resilience as the main or one of the outcomes of interest. The table highlights that most studies published prior to the COVID-19 pandemic originated from high-income countries (HICs), and used the Connor-Davidson Resilience Scale (CD-RISC) to measure resilience.

There is currently no 'gold standard' scale or tool for measuring psychological resilience.[11,12] At least 15 key psychological resilience measurement scales have been described and validated for use in adult populations.[12] The choice of tool depends on the study population of interest, the cost of the tool, and resources available to the researchers to distribute the tool. The different approaches to measuring resilience have, thus, resulted in inconsistent findings, which makes it difficult to compare results from different studies.[12,13]

Table 1. Systematic reviews and meta-analyses of resilience amongst healthcare workers

Author, year	Aim	Papers reviewed (HIC/LMIC setting)	Most commonly used resilience tool	Main findings
Hart et al., 2014[16]	To determine factors associated with nurse resilience	Seven studies; all HICs	CD-RISC	*Positive predictors:* hope, coping, toughening up, work-life balance, self-efficacy, critical reflection, reconciliation, social support *Negative predictors:* challenging workplaces, diminishing inner balance, sense of dissonance, psychological emptiness
Robertson et al., 2016[4]	To examine research on resilience in primary healthcare professionals	13 studies; 12 HICs, one LMIC	RS	*Positive predictors:* personal growth, leisure time, accomplishment, high persistence, coping, high self-directedness, demanding professional role, physical activity, low avoidance of challenges, family support, control *Negative predictors:* numbers of hours worked, alcohol use in male GPs, responsibilities for home and family
McKinley et al., 2019[5]	To review the literature on influences of resilience in medical doctors	24 studies; 23 HICs, one LMIC	RS and CD-RISC	*Positive predictors:* self-compassion, mindfulness, hobbies, determination, persistence, coping, adversity, support (family, community, networks, superiors), patients' connection, early adversity, control, lighter workload, career development, tolerance of clinical uncertainly, physical and cultural activities, influence at work, freedom in the workplace *Negative predictors:* harm avoidance
Yu et al., 2019[13]	To determine personal and workplace-related factors associated with resilience in nurses	38 studies; all HICs	CD-RISC	*Positive predictors:* coping, social support, self-efficacy, job satisfaction, general wellbeing, job retention *Negative predictors:* stress, post-traumatic stress disorder, burnout, fatigue, workplace bullying
Li and Hasson, 2020[17]	To investigate interactions between stress, resilience and wellbeing amongst student nurses	12 studies; eight HICs, four LMICs	CD-RISC	*Positive predictors:* psychological health, self-efficacy, years of study, academic efficacy, wellbeing *Negative predictors:* emotional exhaustion, stress
Zanatta et al., 2020[21]	To describe resilience in palliative care healthcare workers	Six studies; all HICs	CD-RISC	*Positive predictors:* openness to new experiences, sense of humour, vicarious post-traumatic growth *Negative predictors:* death anxiety, secondary traumatic stress
Labrague, 2021[19]	To investigate coping behaviours, resilience, and social support for healthcare workers during COVID-19	31 studies: 13 HICs, 18 LMICs	CD-RISC	*Positive predictors:* group skill training programmes, effective leadership, organisational support, safe working environment, communication *Negative predictors:* COVID-19, anxiety, depression
Cheng et al., 2022[11]	To investigate resilience among healthcare workers: prevalence and risk factors	41 studies; 33 HICs, eight LMICs	RS	*Positive predictors:* social support *Negative predictors:* stressful, unhealthy job demands, workload, worry of transmitting disease to family, working hours
Jeamjitvibool et al., 2022[14]	To examine resilience and psychological distress during COVID-19: healthcare workers, population, and patients	17 studies including healthcare workers; two HICs, 14 LMICs	CD-RISC	*Positive predictors:* psychosocial support *Negative predictors:* psychological distress
Castillo-González et al., 2023[18]	To investigate burnout and resilience in nursing populations: factors associated with resilience	29 studies; 17 HICs, 12 LMICs	CD-RISC	*Positive predictors:* service experience, acceptable salaries, working non-rotating shifts, nuclear-style family, education status, male *Negative predictors:* workload, burnout, emotional exhaustion, depersonalisation

CD-RISC: Connor-Davidson Resilience Scale, COVID-19: coronavirus disease 2019, GPs: general practitioners, HICs: high-income countries, LMICs: low- and middle-income countries, RS: resilience scale

The aim of this review was to identify factors associated with the psychological resilience of healthcare workers (excluding nurses) practising in LMIC settings, using the CD-RISC. The CD-RISC has been the preferred psychological resilience measurement scale due to its ease of completion and administration; high levels of acceptability and interpretability; high internal consistency and reliability; and wide use in research and clinical settings across the world (Table 1).[12,14] The original CD-RISC-25 comprises 25 questions, using a 5-point Likert scale. Later versions include the 10-item questionnaire (CD-RISC-10), and the 2-item questionnaire (CD-RISC-2), translated into several languages.[15]

Poor psychological resilience has largely been described, in the literature, as an explanation for mental health outcomes such as anxiety, depression, burnout, and post-traumatic stress disorder (PTSD) in healthcare workers. Resilience of nurses, in particular, has been the subject of much past research. Four of the 10 systematic reviews in Table 1 focused exclusively on nurses;[13,16-18] a further two focused on implications of resilience for nursing management.[11,19] The psychological resilience of nurses has, thus, been extensively studied, particularly due to the global shortage of nurses and the link to burnout.[16,20] Thus, our review excluded studies conducted exclusively on nurses. We focused on studies that comprised a combination of healthcare workers (doctors, therapists, paramedics, and nurses). To our knowledge, this is the first review regarding the psychological resilience of healthcare workers in LMICs beyond nurses.

METHODS

Search process

The literature search was conducted using four public databases: PubMed, Web of Science, Scopus, and EBSCOhost. The last search was conducted on 22 August 2023. The following search strings were used: resilience AND (healthcare workers OR doctors OR paramedics OR first responders OR emergency personnel OR nurses OR pharmacists) AND (Connor-Davidson Resilience OR CD Risk scale OR CD-RISC). The LMIC search filter provided by the University of Cape Town library (August 2021 version) was used to identify journal articles relevant to LMICs. The search terms were adapted for each public database, as appropriate.

A senior university librarian assisted in developing and refining the search terms. The computer searches were supplemented by manually searching the reference lists of the articles that fulfilled the inclusion criteria.

The criteria for relevant journal articles were: published in English, published in a peer-reviewed online journal, healthcare workers as the study population, investigation of factors associated with psychological resilience, and use of the CD-RISC as the measure of resilience. No date restrictions were applied. Research considering only nurses or nursing students was excluded.

The journal papers that met these criteria were extracted, and duplicates were removed, using Rayyan Systematic Review software. The eligibility of each article was assessed by the three authors. The title and abstract were first reviewed, after which the reviewers extracted relevant information from each paper, including the author(s), year of publication, study population, measurement tool and statistics, and risk and protective factors associated with psychological resilience.

The searched databases are publicly available, and no ethics clearance was required.

RESULTS

Search results

We identified 636 journal papers; 22 remained after the removal of duplicates (n = 462) and those that did not meet the eligibility criteria (n = 152; 74 of which included only nursing professionals), as shown in Figure 1.

Characteristics of included studies

Prior to COVID-19, there was little research published on the resilience of healthcare workers in LMICs. Thirteen of the 22 journal articles stated that COVID-19 was the motivation for the study. Most studies (n = 12) were conducted in China.

The mean resilience scores ranged from 50.6 to 75.4, using the CD-RISC-25 (n = 14); and from 23.2 to 30.9, using the CD-RISC-10 (n = 6). No studies used the CD-RISC-2. The weighted average resilience scores by number of participants, for the 9 862 participants in the 22 studies (where provided), were 63.5 and 26.0 for the CD-RISC-25 and CD-RISC-10, respectively. The categories of scores obtained from the CD-RISC-10 are low: 0–27.48, low-medium: 27.49–28.30, medium: 28.31–28.88 and high: 28.89–40 for the CD-RISC-10, resulting in the mean resilience score falling in the low level. For the CD-RISC-25, the categories are, low: 0–61.38, low-medium: 61.39–65.48, medium: 65.49–67.76 and high: 67.7–100, resulting in the CD-Risc-25 mean resilience score falling into the low-medium category. Table 2 summarises the 22 studies included in the review.

Psychological resilience was reported to be influenced by several personal characteristics and social or lifestyle factors; workplace or occupational factors; and policy level factors (Figure 2). Female sex, poor physical and/or mental health, use of medicine, depression, fatigue, anxiety, and stress were identified as the main risk factors for resilience. Workplace factors such as organisation injustice, bullying, heavy workload, and low income were also identified as risk factors. Older age, tertiary education, self-efficacy, personal accomplishment, spiritual and social support, and sports involvement were reported to be positively associated with resilience, as were workplace factors such as years of experience, training, and organisational support. During the Pandemic, knowledge about COVID-19 increased access to protective material, and increased perceptions of safety were found to improve resilience amongst healthcare workers.

DISCUSSION

The socio-ecological model framework is used to discuss these factors – a framework used in previous reviews and studies on resilience.[45,46]

Personal, lifestyle, and social factors

Increase in age of healthcare workers in LMICs has been associated with higher psychological resilience. This is likely due to older healthcare workers receiving more clinical and self-care training; and having better professional and/or life experience and skills, relationships within the workplace, and social support, all of which may assist in dealing with difficult situations in the workplace.[25,27] A positive correlation between increasing age and years of experience and better resilience or grit have been described in healthcare workers: r = 0.145 and r = 0.233 in China and Jordan, respectively.[27,43] Hart et al. (2014), however, found inconsistent evidence of an association between resilience and age in their systematic review of studies in nurses, all of which were from HICs.[16]

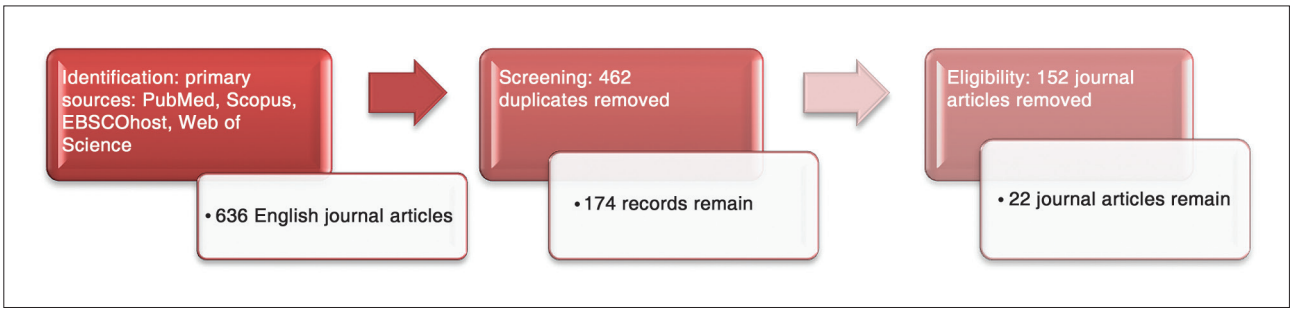


Figure 1. Flow diagram of process of identifying eligible journal papers

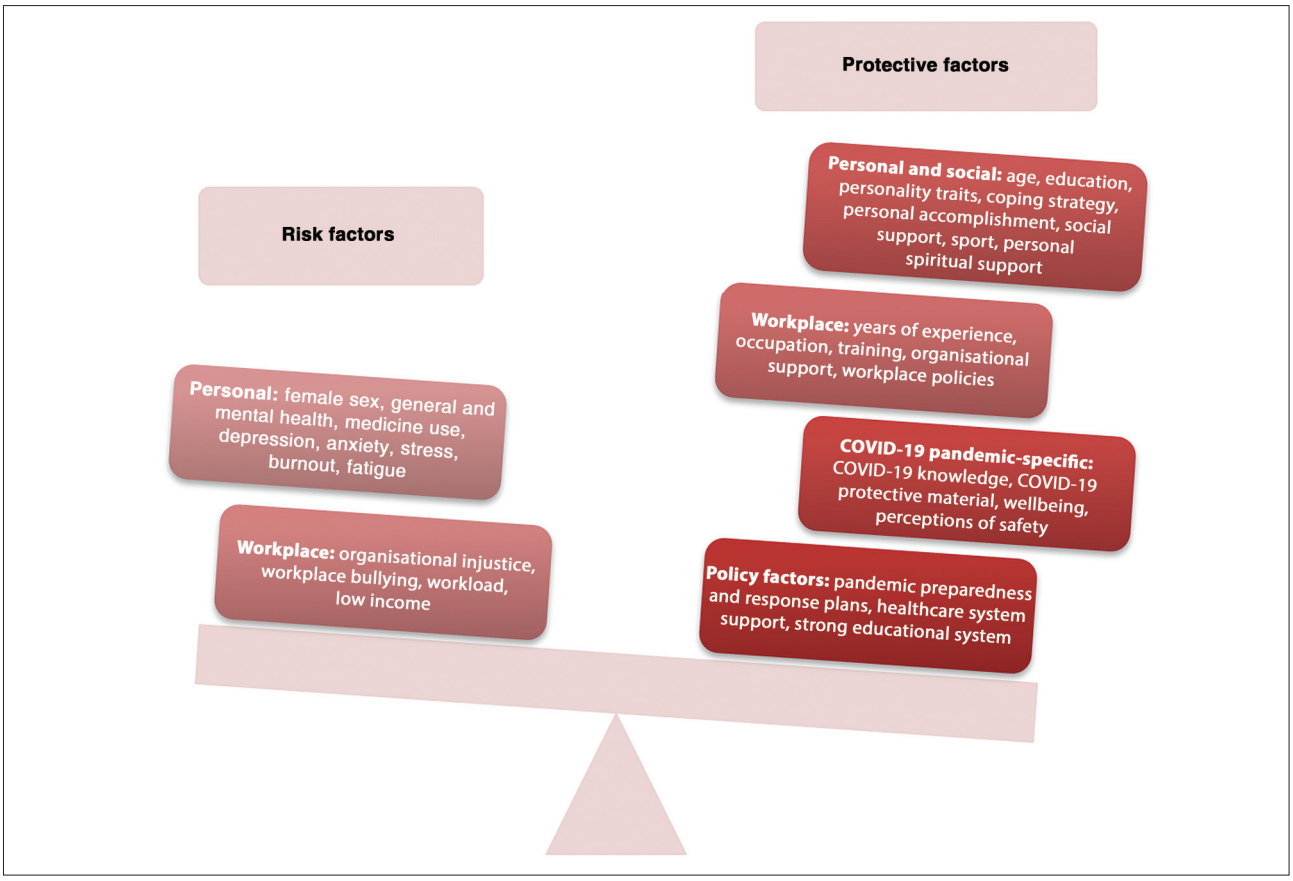


Figure 2. Summary of identified protective and risk factors associated with psychological resilience of healthcare workers (excluding nurses) in LMIC settings

With regard to demographic factors, male sex has been reported to be a protective factor for resilience.[4] Huang et al. (2020)[24] and Elkudssiah Ismail et al. (2022)[32] found that females in middle-income Asian contexts (China and Malaysia) had significantly lower resilience than males ($\beta = -4.738$; $\beta = -2.573$ respectively). This finding could be attributed to cultural contexts and upbringing, where females assume multiple roles at home and in the workplace, experiencing more emotional exhaustion and being more susceptible to stress.[4,24] The results could also be due to social desirability bias, with males answering questions in a way that portrays them as being able to manage pressure well.[32] Similar findings were reported in a systematic review of studies in primary healthcare professionals, mostly in HICs, by Robertson et al. (2016), who concluded that this may point to females having poor work-life balance.[4]

A systematic review of the link between sociodemographic variables and resilience, by Castillo-González et al. (2023), described similar findings in largely female nursing professionals.[18] Personal sociodemographic characteristics such as older age, sex (male), higher educational level, and a nuclear family structure were all positively associated with psychological resilience in nurses.[18] In contrast, Rossouw et al. (2013),[22] Wang et al. (2021),[29] and Yue et al. (2022)[40] did not find any significant correlations between resilience and sociodemographic factors (age, education, and sex) in healthcare workers. Herrman et al. (2011) noted that these inconsistences between resilience and sociodemographic factors may be due to differences in study methodologies and the definition of resilience used by the researchers.[3]

Several studies in LMICs reported strong correlations between resilience and the diagnosis of general medical and mental health conditions, including substance abuse, depression, anxiety, and post-traumatic growth.[5,22,33] Rossouw et al. (2013) found that healthcare workers in Cape Town, South Africa using medication had significantly lower resilience than those not using medication ($p = 0.030$).[22] Medication and substance abuse are recognised as coping mechanisms used by those with mental health issues or work-related stress.[47] Song et al. (2023) similarly reported a negative correlation between anxiety and resilience amongst paediatric residents in China ($r = -0.566$, $p < 0.010$).[44] These associations between

Table 2. Resilience amongst healthcare workers in low- and middle-income countries, measured by the CD-RISC

Author, year	Country	Study population	Mean/median resilience score (SD/IQR)*	Factors significantly associated with resilience (p < 0.05)
Rossouw et al., 2013[22]	South Africa	132 HCWs in primary healthcare	CD-RISC-25: 71.51 ± 2.77	*Positive predictors:* personal accomplishment, delivered quality care *Negative predictors:* medication use
Kang et al., 2018[23]	China	227 ambulance personnel	CD-RISC-10: 28.97 ± 6.75	*Positive predictors:* social support (r = 0.418), VPTG (r = 0.670), relating to others (r = 0.570), new possibilities (r = 0.597), spiritual change (r = 0.632), appreciation of life (r = 0.534), personal strength (r = 0.632)
Huang et al., 2020[24]	China	587 HCWs in radiology department	CD-RISC-25: 65.76 ± 17.26	*Positive predictors:* knowledge of COVID-19 (β = 2.884), knowledge of COVID-19 protective measures (β = 3.260), availability of protective materials (β = −1.268) *Negative predictors:* perceived stress (β = −1.318) *Lower resilience:* female (β = −4.738)
Lin et al., 2020[25]	China	114 non-local HCWs sent to Wuhan	CD-RISC-25: 67.03 ± 13.22	*Positive predictors:* employment type, active coping styles (β = 1.314), training or support (β = 3.510) *Negative predictors:* anxiety (β = −1.091), depression (β = −0.806)
Van der Merwe et al., 2020[26]	South Africa	270 pre-clinical; 230 clinical medical students	CD-RISC-25: Pre-clinical: 72.5 ± 14.5; Clinical: 75.4 ± 11.7	*Higher resilience:* adaptive coping strategies *Lower resilience:* dysfunctional coping strategies
Wang et al., 2020[27]	China	274 HCWs	CD-RISC-10: mean = 28	*Positive predictors:* age (r = 0.145), years of experience (r = 0.128)
Tam et al., 2021[28]	China	1 029 HCWs in HIV clinic	Not reported	*Positive predictors:* institutional support (r = 0.280) *Negative predictors:* COVID-19 stressors (r = −0.130), psychological distress (r = −0.430)
Wang et al., 2021[29]	China	115 military medical staff	CD-RISC-25: 66.45 ± 13.27	*Negative predictors:* fatigue (β = −0.520), anxiety (β = −0.240)
Xuan et al., 2021[30]	Malaysia	524 medical interns	CD-RISC-10: 28.6 ± 6.33	*Positive predictors:* active sport (β = 1.090), emotional quotient (β = 0.560), interest to become a doctor (β = 0.810), coping using humour (β = 0.540) *Negative predictors:* coping by venting (β = −0.450) *Lower resilience:* failures in any clinical posting (β = −1.000)
Alameddine et al., 2022[31]	Lebanon	459 community pharmacists	CD-RISC-25: 68.0 ± 13.37	*Positive predictors:* perception of safety (β = 0.267), married (β = 0.384) *Negative predictors:* workload (β = 0.275), burnout (β = 0.321)
Elkudssiah Ismail et al., 2022[32]	Malaysia	164 general practitioners; 87 community pharmacists	CD-RISC-10: GPs: 30.93 ± 6.25 CPs: 28.20 ± 6.12	*GPs: Positive predictors:* age (β = −0.534), years of experience (β = 0.753) *Lower resilience:* female (β = −2.573) *CPs:* none
Ghaedi-Heidari et al., 2022[33]	Iran	235 medical students	CD-RISC-25: 50.60 ± 15.9	*Positive predictors:* post-traumatic growth (r = 0.420)
Hatami et al., 2022[34]	Iran	150 dental students	CD-RISC-25: 65.19 ± 5.03	*Positive predictors:* spiritual health (r = 0.500)
Keragholi et al., 2022[35]	Iran	115 emergency personnel	CD-RISC-25: 72.25 ± 12.63	*Positive predictors:* employment type (β = 13.350) *Negative predictors:* mental health (β = −0.770)
Li et al., 2022[36]	China	309 HCWs in isolation wards	CD-RISC-25: 60.8 ± 15.7	*Positive predictors:* active coping (r = 0.610), quality of life (r = 0.570) *Negative predictors:* COVID-19 stress (r = −0.210)
Liu et al., 2022[37]	China	390 HCWs	CD-RISC-25: 63.28 ± 14.83	*Positive predictors:* coping style (r = 0.700), self-efficacy (r = 0.530)
Ramadianto et al., 2022[38]	Indonesia	532 medical students	CD-RISC-25: 68 (IQR: 58–77)	*Negative predictors:* depressive symptoms (r = −0.428), anxiety symptoms (r = −0.298)
Rayani et al., 2022[39]	Iran	184 HCWs	CD-RISC-25: 63.10 ± 15.84	*Positive predictors:* more children (r = 0.210) *Negative predictors:* anxiety (r = −0.211)
Yue et al., 2022[40]	China	2 217 postgraduate medical students	CD-RISC-25: 60.35 ± 15.49	*Positive predictors:* physical activity (r = 0.190)
Zhang et al., 2022[41]	China	1 064 HCWs	CD-RISC-10: 27.31 ± 6.98	*Positive predictors:* social support (r = 0.530) *Negative predictors:* psychological distress (r = −0.312) (r = −0.312)
Zhou et al., 2022[42]	China	1 877 resident doctors	CD-RISC-10: 23.24 ± 9.27	*Positive predictors:* wellbeing (r = 0.547), life satisfaction (r = 0.500) Negative predictors: insomnia (r = −0.330), workplace bullying (r = −0.302), organisational Injustice (r = −0.244)
Hamdan et al., 2023[43]	Jordan	135 orthopaedic surgeons	Not reported	*Positive predictors:* age (r = 0.233), years of experience (r = 0.269), grit (r = 0.477) *Negative predictors:* burnout (r = −0.312)
Song et al., 2023[44]	China	138 paediatric residents	CD-RISC-25: 58.26 ± 15.66	*Positive predictors:* social support (r = 0.430) *Negative predictors:* stress (r = −0.542), anxiety (r = −0.566)

β: standardised regression coefficient, CD-RISC: Connor-Davidson Resilience Scale, COVID-19: coronavirus disease 2019, CPs: community pharmacists, GPs: general practitioners, HCWs: healthcare workers, HIV: human immunodeficiency virus, IQR: interquartile range, r: correlation coefficient, SD: standard deviation, VPTG: vicarious post-traumatic growth
*CD-RISC tool used in table (score range): CD-RISC-25 (0–100), CD-RISC-10 (0–40)

mental health and general wellbeing and resilience are similar to those found in nurses in HICs, as reported in a systematic review by Yu et al. (2016).[13] The reported associations between resilience and mental health conditions are similar in several LMICs and HICs.

Personality traits such as self-confidence, self-control, self-efficacy and optimism were found to be positively associated with resilience in various LMICs.[3,5] Liu et al. (2022) reported a significantly positive association between resilience and positive coping style ($\beta = 0.700$, $p < 0.001$) and general self-efficacy ($\beta = 0.530$, $p < 0.001$) in healthcare workers in China.[37] Hart et al. (2014), in their systematic review of nurses (all from HICs), also found personality traits such as hope, self-efficacy, self-determination and coping to be positively associated with resilience.[16] Positive personality traits are considered to be characteristics of resilient people.[7]

Social and contextual factors such as access to educational and community facilities, religiosity, participation in sports, cultural/traditional and recreational opportunities, social relationships, and safe and supportive social and family environments have been found to be positively associated with resilience.[3,4] Social support has been observed to be positively associated with resilience in Chinese healthcare workers.[23,41,44] Individuals with high social support are better able to cope with stress, which is strongly associated with psychological status and resilience.[19,41] Both Xuan et al. (2021)[30] and Yue et al. (2022)[40] observed a significantly positive association between resilience and active involvement in sports ($\beta = 1.090$ and $r = 0.190$, respectively). Involvement in sports and physical activities is likely a distraction and coping mechanism, which builds resilience.[19] Hatami and Shekarchizadeh (2022) found a significantly positive correlation between dental students' spiritual health and resilience ($r = 0.500$, $p < 0.001$).[34] They noted that spirituality can compensate for various mental health conditions and challenges, and contributes positively to an individual's coping strategies, building resilience.[34] These findings are similar to those reported in HICs by McKinley et al. (2019)[5] and Yu et al. (2019),[13] who showed that resilience is built through establishing professional networks and improving team dynamics.

Work-related factors and organisational factors

Psychological resilience in healthcare workers is positively correlated with several workplace and occupational factors, including income/salary, longer work experience, occupational seniority, increased workplace training, better workload control, supportive colleagues and leaders, and transparent organisational policies.[5,19] Wang et al. (2020)[27] and Hamdan et al. (2023)[43] found that the resilience was positively correlated with longer work experience in healthcare workers in China ($r = 0.128$) and Jordan ($r = 0.269$), respectively. Lin et al. (2020) noted that resilience level was highest for physicians (CD-RISC-25 mean score = 73.48 ± 11.49), followed by support staff (CD-RISC-25 mean score = 67.78 ± 12.43) and nurses (CD-RISC-25 mean score = 64.86 ± 13.46) in non-local Chinese healthcare workers ($p = 0.029$).[25] Croghan et al. (2021) argued that nurses have more stressors due to greater direct exposure to patients and their families than doctors, which can result in lower resilience.[48] Tam et al. (2021) found that resilience was positively correlated with receiving institutional workplace support amongst healthcare workers in China ($r = 0.28$, $p < 0.001$).[28] These positive associations between resilience and reduced workload, higher salaries, and more years of experience were also found in a nursing population, in both LMICs and HICs, by Castillo-González et al. (2023).[18] However, others have found no statistically significant associations between resilience and work-related factors such as job description, education, overtime hours, and years in practice in healthcare workers in LMICs.[22,39]

The COVID-19 pandemic had a significant impact on healthcare workers in LMICs. Psychological resilience was reported to be significantly associated with organisational support provided to healthcare workers, including provision of clear COVID-19 protocols, open communication, supply of adequate personal protective equipment, and access to regular COVID-19 testing.[24,31,45] Li et al. (2022) observed a negative correlation between resilience and COVID-19 stress in workers in isolation wards in China ($r = -0.210$, $p < 0.001$).[36] Huang et al. (2020) observed a positive correlation between resilience and availability of adequate protective materials in healthcare workers in a radiology department ($\beta = -1.268$, $p = 0.039$).[24] Adequate protective material can improve psychological security and provide personal safety, which may result in greater resilience and feelings of being protected by the employer.[24] Alameddine et al. (2022) found that pharmacists in Lebanon who had reduced workloads during the Pandemic had significantly lower resilience than those whose workloads increased ($\beta = 0.275$).[31] The income of community pharmacists in Lebanon is directly related to their sales volumes; higher workloads result in better income, which leads to greater job satisfaction and higher resilience.[31] Labrague (2021), in a systematic review of resilience amongst healthcare workers in both LMICs and HICs during the Pandemic, similarly found that organisational support and a safe working environment were positive predictors of resilience, further highlighting the importance of organisational factors on healthcare workers' psychological resilience.[19]

Policy level factors

Government policies have a direct impact on the quality and strength of the healthcare system of a country. As such, the government can control the working environment of healthcare workers. A prime example is South Africa – a middle-income country – which introduced free care in 1996, removing fees for all public primary care services for vulnerable groups.[49] Although access to healthcare increased for most previously disadvantaged populations, the unintended consequence was increased workloads of, and demands on, public sector healthcare workers.[49] South Africa's government is in the process of implementing the National Health Insurance scheme, but the country's preparedness remains uncertain, especially given the shortage of healthcare workers.[10]

Government policies and regulations introduced during the COVID-19 pandemic significantly impacted healthcare workers' occupational health and safety and resilience levels.[45] For example, China's central government sent healthcare workers from various provinces to Wuhan to relieve local healthcare workers at the beginning of the Pandemic.[25] Lin et al. (2020) argued that the mental health and resilience of non-local healthcare workers during this period was likely to have differed significantly from that of local workers, due to being away from their families and homes, and working in unfamiliar work environments with new colleagues.[25]

Regulations of a country with respect to education vary and impact the level of education, training, and experience of healthcare workers.[45] Studies in HICs have shown that education level and training is positively associated with greater resilience.[3,45] Herrman et al. (2011) argued that more can be done by government and state entities to create healthcare environments conducive to the wellbeing of healthcare workers.[3] The need to consider the community and environment in which healthcare workers operate is increasingly recognised as being important, when considering resilience and interventions to improve resilience.[46]

Implications for managing healthcare workers in LMICs

This review highlights the importance of building healthcare workers' psychological resilience, especially given the challenges of healthcare systems in LMICs. The average resilience of healthcare workers included in this review was low, suggesting that resilience training should be a high priority for managers and leaders of healthcare workers in LMICs. Improving resilience of healthcare workers in LMICs should be considered as a vital employment benefit and preventive measure against burnout. Our review showed that both personal and modifiable workplace-related factors affect resilience. Managers of healthcare workers should consider facilitating social support, access to counselling services, and webinars in the workplace to foster positive coping strategies for healthcare workers.[19] Labrague (2021) highlighted the effectiveness of online workshops, webinars, cognitive behavioural therapy, and debriefing programmes in a systematic review of coping behaviours, resilience, and social support for healthcare workers during COVID-19.[19] These interventions should take the cultural and environment contexts of healthcare workers in different LMICs into account. Employers must prioritise the implementation of strategies that have proven to be effective in the region, and consider wider organisational changes to support resilience-building.[46]

A Cochrane review by Kunzler et al. (2020), assessing the effectiveness of resilience-promoting interventions on healthcare workers, found little evidence for the effectiveness of these interventions.[50] Thirty of the 44 studies comprised group interventions and most (n = 36) were conducted in HICs.[50] The authors noted a lack of reporting about the long-term effectiveness of such interventions and small study samples.[50] There is need for more research in this area, especially in LMICs. Pollock et al. (2019), in another Cochrane review assessing the effectiveness of interventions to support resilience of healthcare workers during disease outbreaks, found that adapting interventions to the local context, using effective communication, and providing adequate resourcing increased the effectiveness of the interventions. [51]

Limitations of the study

Our literature review included only English peer-reviewed journal papers, which might have introduced a publication bias. Considering only quantitative studies that used the CD-RISC limited the papers included in the review, but this strategy ensured consistency with respect to research methodologies. Most studies in our review were conducted in China, which affects the generalisability of the findings; however, this also highlights the need for further research in other LMICs. We included only quantitative research, which potentially limited the range of topics explored and factors identified in the literature. Last, the exclusion of studies on nurses reduced the number of research papers included in the review, but also reduced heterogeneity in the review.

CONCLUSION

This review identified many factors that have been positively and negatively associated with resilience in non-nursing healthcare workers in LMICs, viz. personal, social, and lifestyle factors, work-related factors and organisational support, and policy level factors. Research on psychological resilience for non-nursing healthcare workers operating in LMICs is limited and contradictory in some instances, and has been conducted mainly in China. Further research is needed in other LMICs to better characterise the sociodemographic and work-related factors impacting the psychological resilience of healthcare workers in other regions, which will potentially enable stronger support of healthcare workers in these countries.

KEY MESSAGES

1. Factors associated with psychological resilience in healthcare workers in LMICs can be categorised as personal, social, and lifestyle-related, work-related and organisational, and policy-related.
2. There has been an increase in research on the psychological resilience of frontline healthcare workers since the COVID-19 pandemic.
3. Research on the psychological resilience of healthcare workers in LMICs is limited and findings are sometimes contradictory.

FUNDING

The authors received no financial support for any aspects of this narrative literature review.

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.

ACKNOWLEDGEMENTS

The researchers express their gratitude to Ms Namhla Madini, Principal Librarian at the University of Cape Town, for her assistance with the literature search and formulating the search strategy.

AUTHOR CONTRIBUTIONS

Conception and design of the study: TM, IN, SA
Data acquisition: TM
Data analysis: TM, IN, SA
Interpretation of the data: TM, IN, SA
Drafting of the paper: TM, IN, SA
Critical revision of the paper: TM, IN, SA

REFERENCES

1. Cook LJ, Hassem T, Laher S, Variava T, Schutte E. Mental health experiences of healthcare professionals during COVID-19. SA J. Ind. Psychol. 2021; 47:1865. doi: 10.4102/sajip.v47i0.1865.

2. Liang Y, Wu K, Zhou Y, Huang X, Zhou Y, Liu Z. Mental health in frontline medical workers during the 2019 novel Coronavirus disease epidemic in China: a comparison with the general population. Int J Environ Res Public Health. 2020; 17(18):6550. doi: 10.3390/ijerph17186550.

3. Herrman H, Stewart DE, Diaz-Granados N, Berger EL, Jackson B, Yuen T. What is resilience? Can J Psychiatry. 2011; 56(5):258-265. doi:10.1177/070674371105600504.

4. Robertson HD, Elliott AM, Burton C, Iversen L, Murchie P, Porteous T, et al. Resilience of primary healthcare professionals: a systematic review. Br J Gen Pract. 2016; 66(647):e423-e433. doi: 10.3399/bjgp16X685261.

5. McKinley N, Karayiannis PN, Convie L, Clarke M, Kirk SJ, Campbell WJ. Resilience in medical doctors: a systematic review. Postgrad Med J. 2019; 95(1121):140-147. doi: 10.1136/postgradmedj-2018-136135.

6. Huey CWT, Palaganas JC. What are the factors affecting resilience in health professionals? A synthesis of systematic reviews. Med Teach. 2020; 42(5):550-560. doi:10.1080/0142159X.2020.1714020.

7. Koen MP, Van Eeden C, Wissing MP. The prevalence of resilience in a group of professional nurses. Health SA Gesondheid. 2011; 16(1). doi: 10.4102/hsag.v16i1.576.

8. Bangdiwala SI, Fonn S, Okoye O, Tollman S. Workforce resources for health in developing countries. Public Health Rev. 2010; 32(1):296-318. doi: 10.1007/BF03391604.

9. Kruk ME, Gage AD, Arsenault C, Jordan K, Leslie HH, Roder-DeWan S, et al. High-quality health systems in the Sustainable Development Goals era: time for a revolution. Lancet Glob Health. 2018; 6(11):e1196-e1252. doi:10.1016/S2214-109X(18)30386-3.

10. Ndebele NC, Mlambo VH, Molepo JN, Sibiya LM. The South African health sector and the World Health Organization. South Africa's health sector and its preparedness for the National Health Insurance (NHI): challenges and opportunities. European J Economics, Law, Soc Sci. 2021. Available from: https://openscholar.ump.ac.za/bitstream/20.500.12714/509/3/The-South-African-health-sector-and-the-World-Health-Organization.pdf (accessed 11 June 2024).

11. Cheng CKT, Chua JH, Cheng LJ, Ang WHD, Lau Y. Global prevalence of resilience in health care professionals: a systematic review, meta-analysis and meta-regression. J Nurs Manag. 2022; 30(3):795-816. doi: 10.1111/jonm.13558.

12. Windle G, Bennett KM, Noyes J. A methodological review of resilience measurement scales. Health Qual Life Outcomes. 2011; 9:8. doi: 10.1186/1477-7525-9-8.

13. Yu F, Raphael D, Mackay L, Smith M, King A. Personal and work-related factors associated with nurse resilience: a systematic review. Int J Nurs Stud. 2019; 93:129-140. doi: 10.1016/j.ijnurstu.2019.02.014.

14. Jeamjitvibool T, Duangchan C, Mousa A, Mahikul W. The association between resilience and psychological distress during the COVID-19 pandemic: a systematic review and meta-analysis. Int J Environ Res Public Health. 2022; 19(22):14854. doi: 10.3390/ijerph192214854.

15. Connor KM, Davidson JRT. Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). Depress Anxiety. 2003; 18(2):76-82. doi: 10.1002/da.10113.

16. Hart PL, Brannan JD, De Chesnay M. Resilience in nurses: an integrative review. J Nurs Manag. 2014; 22(6):720-734. doi: 10.1111/j.1365-2834.2012.01485.x.

17. Li ZS, Hasson F. Resilience, stress, and psychological well-being in nursing students: a systematic review. Nurse Educ Today. 2020; 90:104440. doi: 10.1016/j.nedt.2020.104440.

18. Castillo-González A, Velando-Soriano A, De La Fuente-Solana EI, Martos-Cabrera BM, Membrive-Jiménez MJ, Lucía R, et al. Relation and effect of resilience on burnout in nurses: a literature review and meta-analysis. Int Nurs Rev. 2023. doi: 10.1111/inr.12838.

19. Labrague LJ. Psychological resilience, coping behaviours and social support among health care workers during the COVID-19 pandemic: a systematic review of quantitative studies. J Nurs Manag. 2021; 29(7):1893-1905. doi: 10.1111/jonm.13336.

20. Guo YF, Luo YH, Lam L, Cross W, Plummer V, Zhang JP. Burnout and its association with resilience in nurses: a cross-sectional study. J Clin Nurs. 2018; 27(1-2):441-449. doi: 10.1111/jocn.13952.

21. Zanatta F, Maffoni M, Giardini A. Resilience in palliative healthcare professionals: a systematic review. Support Care Cancer. 2020; 28(3):971-978. doi: 10.1007/s00520-019-05194-1.

22. Rossouw L, Seedat S, Emsley RA, Hagemeister D, Suliman S. The prevalence of burnout and depression in medical doctors working in the Cape Town Metropolitan Municipality community healthcare clinics and district hospitals of the Provincial Government of the Western Cape: a cross-sectional study. S Afr Fam Pract. 2013; 55(6):567-573. doi: 10.1080/20786204.2013.10874418.

23. Kang X, Fang Y, Li S, Liu Y, Zhao D, Feng X, et al. The benefits of indirect exposure to trauma: the relationships among vicarious posttraumatic growth, social support, and resilience in ambulance personnel in China. Psychiatry Investig. 2018; 15(5):452-459. doi: 10.30773/pi.2017.11.08.1.

24. Huang L, Wang Y, Liu J, Ye P, Chen X, Xu H, et al. Factors influencing anxiety of health care workers in the radiology department with high exposure risk to COVID-19. Med Sci Monit. 2020; 26:e926008. doi: 10.12659/MSM.926008.

25. Lin J, Ren YH, Gan HJ, Chen Y, Huang YF, You XM. Factors associated with resilience among non-local medical workers sent to Wuhan, China during the COVID-19 outbreak. BMC Psychiatry. 2020; 20(1):417. doi: 10.1186/s12888-020-02821-8.

26. Van der Merwe LJ, Botha A, Joubert G. Resilience and coping strategies of undergraduate medical students at the University of the Free State. S Afr J Psychiatr. 2020; 26:1471. doi: 10.4102/sajpsychiatry.v26i0.1471.

27. Wang LQ, Zhang M, Liu GM, Nan SY, Li T, Xu L, et al. Psychological impact of coronavirus disease (2019) (COVID-19) epidemic on medical staff in different posts in China: a multicenter study. J Psychiatr Res. 2020; 129:198-205. doi: 10.1016/j.jpsychires.2020.07.008.

28. Tam CC, Sun S, Yang X, Li X, Zhou Y, Shen Z. Psychological distress among HIV healthcare providers during the COVID-19 pandemic in China: mediating roles of institutional support and resilience. AIDS Behav. 2021; 25(1):9-17. doi: 10.1007/s10461-020-03068-w.

29. Wang J, Li D, Bai X, Cui J, Yang L, Mu X, et al. The physical and mental health of the medical staff in Wuhan Huoshenshan Hospital during COVID-19 epidemic: a structural equation modeling approach. Eur J Integr Med. 2021; 44:101323. doi: 10.1016/j.eujim.2021.101323.

30. Xuan OY, Hassan NM, Daud N, Mahdi NNRN, Ibrahim MS, Yusop YM. Modifiable factors influencing resilience among medical interns. Asian J Pharmaceut Res Health Care. 2021; 13(3):266-274. doi: 10.18311/ajprhc/2021/27976.

31. Alameddine M, Bou-Karroum K, Hijazi MA. A national study on the resilience of community pharmacists in Lebanon: a cross-sectional survey. J Pharm Policy Pract. 2022; 15(1):8. doi: 10.1186/s40545-022-00406-2.

32. Elkudssiah Ismail N, Hui WM, Goh KW, Jimam NS, Hermansyah A, Ming LC. Resilience among Malaysian community pharmacists and general medical practitioners using the 10-Item Connor-Davidson resilience scale (CD-RISC): the first national survey. Behav Sci (Basel). 2022; 12(8):272. doi: 10.3390/bs12080272.

33. Ghaedi-Heidari F, Lohrasbi F, Chaharsoughi NT, Samsamshariat S, Nasab FRS. The relationship between anxiety, resilience, and posttraumatic growth of the medical students in COVID-19 pandemic in Iran. Iran J Psychiatry Behav Sci. 2022; 16(4): e115333. doi: 10.5812/ijpbs-115333.

34. Hatami S, Shekarchizadeh H. Relationship between spiritual health, resilience, and happiness among a group of dental students: a cross-sectional study with structural equation modeling method. BMC Med Educ. 2022; 22:184. doi: 10.1186/s12909-022-03243-8.

35. Keragholi AJ, Mojarad FA, Hosseinnataj A, Yaghoubi T, Jouybari L. Mental health and resilience in emergency medical services practitioners during the COVID-19 pandemic. Iran J Psychiatry Behav Sci. 2022; 16(2). doi: 10.5812/ijpbs-121010.

36. Li WQ, Yuan P, Sun J, Xu ML, Wang QX, Ge DD, et al. Resilience, coping style, and COVID-19 stress: effects on the quality of life in frontline health care workers. Psychol Health Med. 2022; 27(2):312-324. doi: 10.1080/13548506.2021.1905860.

37. Liu Y, Hou T, Gu H, Wen J, Shao X, Xie Y, et al. Resilience and anxiety among healthcare workers during the spread of the SARS-CoV-2 delta variant: a moderated mediation model. Front Psychiatry. 2022; 13:804538. doi: 10.3389/fpsyt.2022.804538.

38. Ramadianto AS, Kusumadewi I, Agiananda F, Raharjanti NW. Symptoms of depression and anxiety in Indonesian medical students: association with coping strategy and resilience. BMC Psychiatry. 2022; 22(1):92. doi: 10.1186/s12888-022-03745-1.

39. Rayani S, Rayani M, Najafi-Sharjabad F. Correlation between anxiety and resilience of healthcare workers during COVID-19 pandemic in the southwest of Iran. Environ Sci Pollut Res Int. 2022; 29(15):21528-21536. doi: 10.1007/s11356-021-17284-x.

40. Yue CL, Ge X, Liu M, Zhang B, Koda S, Yan C. The association between physical activity and mental health in medical postgraduates in China during COVID-19 pandemic. Front Psychiatry. 2022; 13:1036414. doi: 10.3389/fpsyt.2022.1036414.

41. Zhang Q, Dong G, Meng W, Chen Z, Cao Y, Zhang M. Perceived stress and psychological impact among healthcare workers at a tertiary hospital in China during the COVID-19 outbreak: the moderating role of resilience and social support. Front Psychiatry. 2022; 12:570971. doi: 10.3389/fpsyt.2021.570971.
42. Zhou S, Chen J, Lin H, Ye Y, Xiao Y, Ouyang N, et al. Associations among workplace bullying, resilience, insomnia severity, and subjective wellbeing in Chinese resident doctors. Front Psychiatry. 2022; 13:840945. doi: 10.3389/fpsyt.2022.840945.
43. Hamdan M, Haddad BI, Alshrouf MA, Al-Ani A, Alisi MS, Hammad Y, et al. Burnout, grit and resilience among Jordanian orthopedic surgeons: a cross-sectional study. BMC Med Educ. 2023; 23(1):593. doi: 10.1186/s12909-023-04572-y.
44. Song C, Du XT, Hong YX, Mao JH, Zhang W. Association between social supports and negative emotions among pediatric residents in China: the chain-mediating role of psychological resilience and burnout. Front Public Health. 2023; 10:962259. doi: 10.3389/fpubh.2022.962259.
45. Jo S, Kurt S, Bennett JA, Mayer K, Pituch KA, Simpson V, et al. Nurses' resilience in the face of coronavirus (COVID-19): an international view. Nurs Health Sci. 2021; 23(3):646-657. doi: 10.1111/nhs.12863.
46. Ungar M, Theron L. Resilience and mental health: how multisystemic processes contribute to positive outcomes. Lancet Psychiatry. 2020; 7(5): 441-448. doi: 10.1016/S2215-0366(19)30434-1.
47. Sinha R. Chronic stress, drug use, and vulnerability to addiction. Ann N Y Acad Sci. 2008; 1141:105-130. doi: 10.1196/annals.1441.030.
48. Croghan IT, Chesak SS, Adusumalli J, Fischer KM, Beck EW, Patel SR, et al. Stress, resilience, and coping of healthcare workers during the COVID-19 pandemic. J Prim Care Community Health. 2021; 12:21501327211008448. doi: 10.1177/21501327211008448.
49. Walker L, Gilson L. 'We are bitter but we are satisfied': nurses as street-level bureaucrats in South Africa. Soc Sci Med. 2004; 59(6):1251-1261. doi: 10.1016/j.socscimed.2003.12.020.
50. Kunzler AM, Helmreich I, Chmitorz A, König J, Binder H, Wessa M, et al. Psychological interventions to foster resilience in healthcare professionals. Cochrane Database Syst Rev. 2020; 7(7):CD012527. doi: 10.1002/14651858.CD012527.pub2.
51. Pollock A, Campbell P, Cheyne J, Cowie J, Davis B, McCallum J, et al. Interventions to support the resilience and mental health of frontline health and social care professionals during and after a disease outbreak, epidemic or pandemic: a mixed methods systematic review. Cochrane Database Syst Rev. 2020; 11(11):CD013779. doi: 10.1002/14651858.CD013779.

Work-related upper limb disorders in health workers: a case of de Quervain's tenosynovitis with ongoing hand pain

Y Williams, I Ntatamala , S Adams

Division of Occupational Medicine and Centre for Environmental & Occupational Health, School of Public Health, University of Cape Town, South Africa

Correspondence:
Dr Yumna Williams
e-mail: yumna.williams-mohamed@westerncape.gov.za

Keywords
work-related musculoskeletal disorders, WRULDS, healthcare workers, work-related risk factors, ergonomics

How to cite this paper
Williams Y, Ntatamala I, Adams S. Work-related upper limb disorders in health workers: a case of de Quervain's tenosynovitis with ongoing hand pain. Occup Health Southern Afr. 2024; 30(2):72-79. doi: 10.62380/ohsa.2024.30.2.3

ABSTRACT

Purpose: Work-related upper limb disorders (WRULDs) refer to soft tissue disorders or injuries of the tendons, ligaments, muscles, nerves, and vasculature of the upper limb caused by, or contributed to, by occupational exposures or injuries. This can result in significant functional incapacity of workers and suboptimal functionality in the workplace. Work-related upper limb disorders can incur substantial financial burdens through absenteeism, and work replacement, medical, and compensation costs. The suboptimal management of WRULDs can worsen the health and financial burdens they create. This case study highlights the consequences of the suboptimal management of de Quervain's tenosynovitis (DQT) in a healthcare worker (HCW). It illustrates that timeous management through a graduated return-to-work programme, using a multidisciplinary team, yields better outcomes for the worker and workplace.

Findings: A 42-year-old HCW employed as a hospital steriliser operator was diagnosed with DQT. She experienced ongoing right-hand pain despite initial conservative treatment with local anaesthetic and steroid injections, followed by the surgical release of the affected tendons. She had resumed normal work duties five days after the surgery, with no clear post-operative management plan. In particular, there was no referral to allied health professionals for assistance with rehabilitation and no referral to occupational health professionals to manage the return-to-work process. Workplace risk factors were not assessed or addressed.

Conclusions: The HCW was successfully re-integrated into the workforce with full functionality, following the introduction of a graduated return-to-work process, rehabilitative support from allied health professionals, and after addressing workplace risk factors.

Recommendations: The case highlights the importance of avoiding small, repetitive hand movements that trigger symptoms of DQT; surgical intervention to provide symptomatic relief where conservative and medical management of DQT has failed; conducting health risk assessments; making the correct diagnosis and referring promptly and appropriately; engaging allied health professionals to assist with treatment and rehabilitation, and occupational health professionals to implement graduated return-to-work programmes; submitting compensation claims; educating and training employees about workplace ergonomic factors; and implementing workplace control measures and medical surveillance programmes to mitigate risk and improve health outcomes.

INTRODUCTION

Work-related upper limb disorders in healthcare settings

Classification of work-related upper limb disorders

The term 'work-related upper limb disorders' (WRULDs) is used to describe soft tissue disorders or injuries of the tendons, ligaments, muscles, nerves, and vasculature of the upper limb caused by, or contributed to, by occupational exposures or injuries.[1-4] The WRULD spectrum includes carpal tunnel syndrome (CTS), de Quervain's tenosynovitis (DQT), and hand arm vibration syndrome (HAVS), in addition to non-specific disorders referred to as repetitive strain injuries. Certain WRULDs are reportable and compensable under the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 (COIDA) in South Africa.[5]

Common work-related upper limb disorders in healthcare workers

Work-related upper limb disorders are largely determined by the specific job task performed by HCWs. Kacem et al. (2021)[1] showed that thumb disorders were most common in Tunisian midwives (7.6–52.5%), while Greiner et al. (2019)[2] reported shoulder injuries to be most common in physical therapists (53.2%; 95% CI = 47.9–58.7). Highly repetitive movements, use of force, awkward sustained positions, movements at extremes of reach, contact stress, and exposure to vibration are common risk factors for WRULDs.[1-4] Hospital-based healthcare workers (HCWs) are at higher risk of incapacitating symptoms (35.7% vs 23.3%) due to the high work demands of large health facilities.[2]

Consequences of work-related upper limb disorders

Work-related upper limb disorders can have major repercussions on HCWs' functional abilities in the workplace and activities of daily living, reducing their quality of life considerably. Consequences of WRULDs include lost work time, decreased patient numbers, job transfers, concern about employability, job security, and even leaving the profession.[3] The productivity, functionality, and morale of the workplace can, thus, be adversely affected.

Furthermore, WRULDs are associated with considerable direct and indirect financial expenditures through absenteeism, work replacement

costs, loss of productivity, medical, and compensation costs.[1-4,6,7] Dong et al. (2019) reported that work-related musculoskeletal disorders (which include WRULDs) accounted for approximately 5.8% of the gross domestic product in the United States in 2014.[8] British studies by the Health and Safety Executive estimated that WRULDs incurred costs of approximately £1.25 billion per year.[9]

Aetiology and treatment of work-related upper limb disorders

The ergonomic factors associated with WRULDs include work-related postures, highly repetitive tasks, fast-paced movements, movements requiring force, exposure to vibration, and contact stress.[1-4] Movements requiring high repetition and force result in tissue microtrauma, which can trigger a localised, acute inflammatory response involving oedema, macrophage infiltration, and increased production of pro-inflammatory cytokines and mediators.[1-4,6,7]

Several explanations for the underlying cause of DQT have been proposed. Highly repetitive movements, degenerative and inflammatory mechanisms, anatomical variations, and genetic predisposition are among the suggested causative factors. The exact aetiology, however, remains somewhat disputed, with a multifactorial origin being most plausible.

Current treatment modalities for WRULDs encompass splinting, physiotherapy, local anaesthetic and corticosteroid injections, therapeutic ultrasound, and surgical intervention if indicated. The specific treatment regimen may require customisation based on the nature of the injury.

CASE PRESENTATION

We describe a case of a WRULD in a steriliser operator in the central sterilising services department (CSSD) of a tertiary public sector hospital in South Africa.

Informed consent was obtained from the patient for the publication of the clinical case. The occupational medicine clinic also received global ethics approval for capturing and publishing anonymised clinical data on patients seen at the specialist occupational medicine clinic (HREC R035/2016).

Presenting complaint

A 42-year-old female HCW experienced ongoing pain and fatiguability in her right hand, following surgery for de Quervain's tenosynovitis (DQT). She responded well to surgery, initially, with complete resolution of her symptoms. After two months, she noticed a progressive increase in pain in her right hand, localised to the medial aspect of the wrist and exacerbated by extension and abduction of the thumb. Work triggers included the repeated opening of surgical instruments and the folding of surgical gowns and hospital linen. Consequently, her work ability and productivity were suboptimal. At this stage, she was referred to the occupational health clinic (OHC), at the tertiary hospital where she was employed, by her line manager for an assessment regarding her fitness to work. By the time she presented for an assessment at the OHC, she was only able to perform 25 minutes of work before the pain was triggered, compared to the three hours of work she could perform comfortably in the post-operative period. Impairment in activities of daily living and leisure was also apparent. Writing, texting, using scissors, opening pegs, and folding washing were activities that elicited symptoms. She did not report night-time waking or early morning sensory disturbances, weakness, or skin colour changes to suggest neurovascular compromise.

According to the patient, colleagues performing the same job tasks experienced milder symptoms, and absenteeism in the workplace was common. Additional workloads were placed on the staff who reported for duty. Non-steroidal anti-inflammatories (NSAIDs) and rest provided partial, temporary symptomatic relief.

History of the presenting complaint

The HCW was diagnosed with DQT by an orthopaedic surgeon at the hospital's specialist hand clinic. She presented with pain, fatiguability, and reduced grip strength for six weeks prior to her appointment. Conservative management was pursued with the administration of a local anaesthetic and steroid injection (LASI) into the right wrist on three occasions, approximately two months apart. Each LASI provided symptomatic relief for about a week before symptoms steadily increased in intensity. An occupational history was not taken at the hand clinic and a workplace risk assessment was not conducted at the time. The HCW was referred to an occupational therapist for a hand splint, but no kinetic training or physiotherapy was offered. Symptoms persisted despite conservative measures, and a decision was made to operate seven months after her initial presentation to the hand clinic. Post-operatively, she was booked off for five days, after which she assumed normal work duties. No post-operative plan was documented or discussed with the HCW or employer, and there was no referral to occupational therapy or physiotherapy to assist with post-operative rehabilitation. The HCW was discharged from the hand clinic with no planned follow up.

Relevant medical, social, and occupational history

Other than her age and sex, no individual risk factors for WRULDs were identified. She had no history of diabetes, hypothyroidism, connective tissue disease, recent or current pregnancy, or psychiatric conditions. She had no young children that she carried and had no hobbies that involved repetitive movements of the hands. She had been employed as a steriliser operator for a cumulative period of 10 years at two different hospitals, with similar job tasks at both facilities.

Worksite assessment and job task analysis

A workplace health risk assessment (HRA) of the area in which the HCW was stationed was conducted by a multidisciplinary team (an occupational health doctor, nurse, occupational therapist, and a safety officer). The primary aim of the HRA was to evaluate the causatory or contributory role of ergonomic, psychosocial, and organisational occupational hazards in the development of DQT (and other health risks).

The main ergonomic risk factors identified were small, repetitive movements of the right (dominant) hand and prolonged standing. Psychosocial risks included a fast-paced, high-demand work environment with considerable target pressures on employees. High absenteeism rates and staff shortages exacerbated the ergonomic and psychosocial risks. Table 1 outlines the health risk rating of the main ergonomic and psychosocial occupational hazards related to DQT, and recommended risk mitigation strategies.

The HCW's main job tasks included folding hospital gowns and linen, and packing instruments. The folding of hospital gowns involved more than 24 small, repetitive hand movements per folded garment, mainly rotational and flexing movements of wrist (Figure 1). The hospital required up to 400 folded garments per day (> 100/person/day), depending on ward or theatre demands. During periods of high demand, more than 2 400 movements per day could be performed by each employee. The folding of hospital linen was less demanding and involved fewer (six to seven), gentler movements of the hands, with less rotation and opposition required.

Table 1. Main occupational hazards identified by a worksite assessment for the healthcare worker

Hazard	Employees exposed	Health effects	Risk rating	Existing controls	Recommendations
Ergonomic Small repetitive movements	All CSSD staff	• Carpal tunnel syndrome • de Quervain's tenosynovitis • Trigger finger • Tenosynovitis • Entrapment syndromes	16 (4x4)	• Shift rotation • 07:00–18:00 shift • Four times per week • Three days off • Scheduled breaks • 30-minutes tea break • One-hour lunch • Education and training on kinetic handling at induction	• Conduct refresher training around the health effects of repetitive movements • Provide written protocols to encourage early reporting of symptoms • Review equipment and tools used, and monitor research advancements in tool or ergonomic design that may reduce ergonomic exposures • Provide written protocols/questionnaires to encourage early reporting of symptoms to occupational health services • Consider the introduction of a medical surveillance programme to detect early symptoms, leading to timeous intervention through treatment or accommodation and, thus, reducing the need for surgical intervention
Prolonged standing	All CSSD staff	Mechanical strain of cervical and lumbar-sacral regions	12 (3X4)	• Shift rotation • Scheduled breaks	• Split sessions into shifts • Mandate scheduled beaks • Provide education and training in kinetic handling and ergonomics
Psychosocial • Fast-paced work • High demands • Staff shortages • Shift work	All CSSD staff	• Anxiety • Depression • Stress • Burnout • Insomnia • Relationship difficulties	12 (3X4)	• Supportive management • Wellness programmes can be accessed easily	• Ensure easy access to counselling services, occupational health services • Introduce monitoring tools to encourage early recognition of symptoms and reporting of symptoms • Split shifts into sessions • Address staff shortages • Allow for staff input and control over work organisation

High: 16–25 Medium: 9–15

*Risk rating obtained using the 5 x 5 Malaysian Health Risk Assessment Matrix (severity x likelihood of occurrence of an occupational hazard)[10]
CSSD: central sterilising services department

Quality inspection of instruments involved repetitive abduction and extension of the thumb. Significant force was required to open instruments during the checking procedure. Generally, about 40 small hand movements were required per pack (Figure 2). However, certain packs required 60–70 movements (e.g. gynaecological packs). Employees were expected to pack 15–20 packs per day, equating to 900–1 400 hand movements per day.

Physical examination

Clinical examination at presentation to the OHC revealed a generally well patient with normal vital signs (temperature = 36.2 ^{o}C, blood pressure (BP) = 120/80, pulse = 72 bpm), a normal body mass index (BMI) of 21 kg/m^2, and glucose level of 4.3 mmol/L. The thyroid gland was not enlarged. A musculoskeletal examination of the right hand revealed no swelling, inflammation, bruising or deformities. Slight sensitivity around the surgical scar was noted. She had full, pain-free active and passive wrist movement. She was able to make a full fist; however, grip strength was reduced. Wrist strength was reduced with weak extensors. Slight pain at the right thumb base was experienced. Passive and active extension and abduction of the thumb, in addition to opposition of the right thumb and other fingers, elicited pain. Finkelstein's, Tinel's and Phalen's tests were negative. Examination of the left hand, cervical, and shoulder regions were normal as was the rest of the physical examination.



Figure 1. Folding of hospital gowns requiring up to 2 400 hand movements/day
Photograph: Yumna Williams

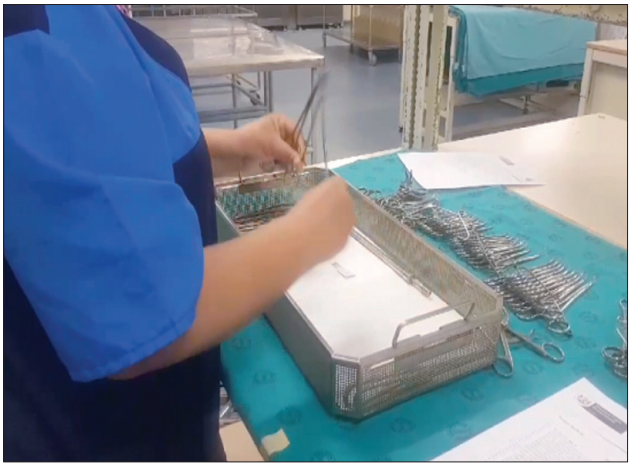


Figure 2. Quality checking instruments requiring up to 900–1 400 hand movements/day
Photograph: Yumna Williams

At the time of the diagnosis of the DQT, Finkelstein's test was positive, with pain localised to the radial side of the wrist and limited, painful abduction and extension of the thumb.

Assessment

The HCW was assessed as a previously well woman who had ongoing right-hand pain and limitation of movement, following surgical release of DQT. No post-surgical complications, and no concomitant musculoskeletal or psychiatric diagnoses, which are associated with ongoing pain, were identified. The persistent pain was precipitated by ongoing workplace exposure to ergonomic hazards, and suboptimal rehabilitation. This resulted in continued incapacity in the workplace, limitation in activities of daily living and leisure, and reduced productivity in the CSSD unit. She was certified as fit to work with restrictions.

Management

The management of the HCW focused on the person (worker), plant (workplace), and powers (legal requirements), commonly referred to as the 3 Ps.

The person (worker)

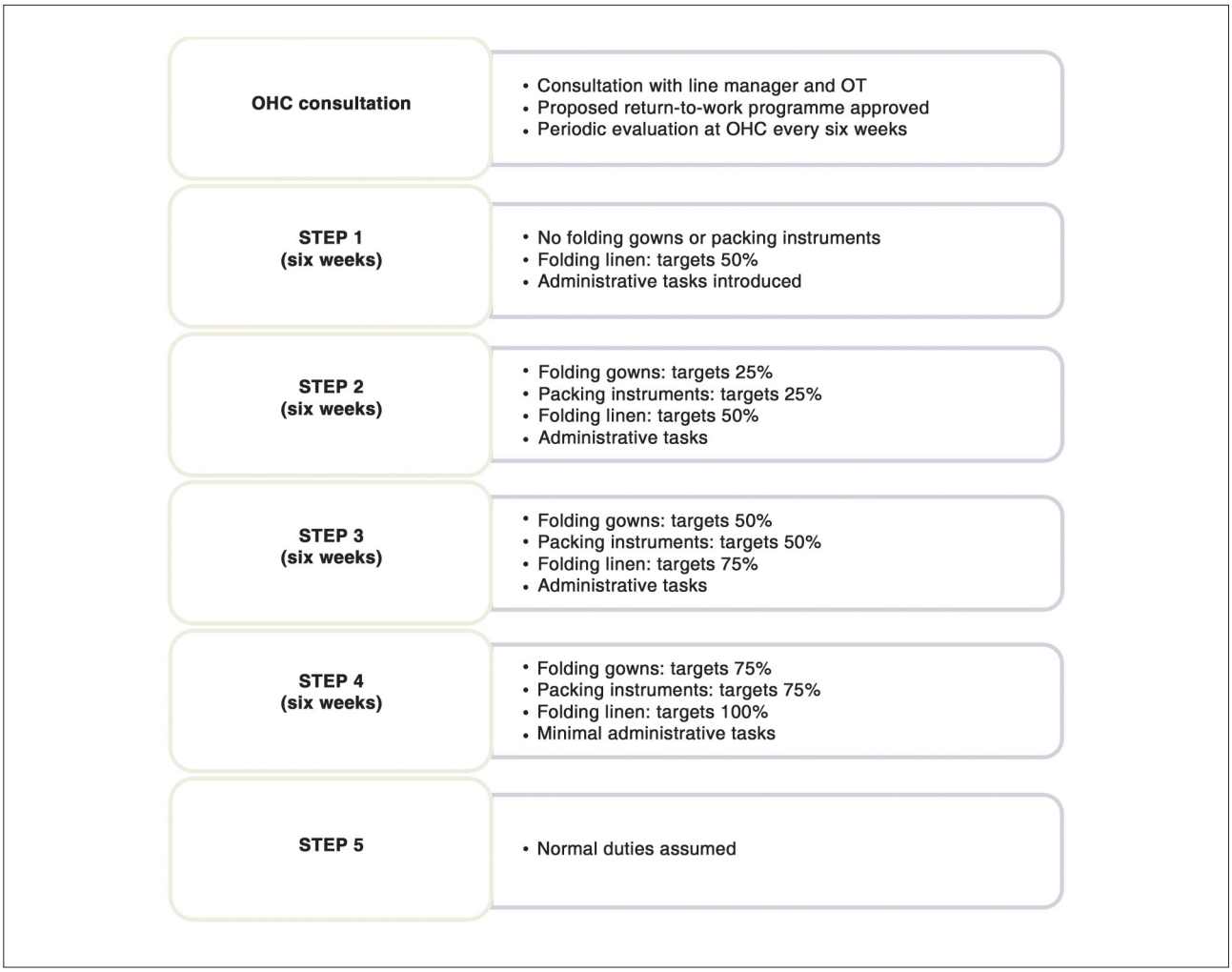
The HCW was temporarily accommodated away from job tasks that required numerous repetitive movements of the hands. A graduated return-to-work programme, approved by the supervisor, was implemented (Figure 3). Her daily targets were reduced, folding was limited to small linen items, and more administrative tasks were introduced. She was evaluated periodically at the OHC to assess her clinical response and to determine the need for ongoing temporary accommodation. The HCW was referred to a physiotherapist for ultrasound treatment and hand strengthening exercises. Her pain was managed pharmacologically with NSAIDs.

The plant (workplace)

The workplace HRA focused on the qualitative identification of workplace risks, the assessment of co-workers for symptoms, the review of tools and work processes, and the evaluation of the adequacy of existing control measures (Table 1). Based on the HRA, risk mitigation strategies that were recommended included addressing staff shortages, splitting work sessions, task rotation, the continuation of scheduled breaks, and passive medical surveillance through self-reporting of symptoms via a questionnaire developed for the hospital's HCWs. An active medical surveillance programme, including a questionnaire and biennial examination aimed at detecting early work-related symptoms of the upper limb, was to be implemented if the number of workers reporting symptoms was significant.

The powers (legal requirements)

Education and kinetic training on induction and periodically, as stipulated by the Ergonomic Regulations under the Occupational Health and Safety Act No. 85 of 1993 (OHSA), were to be enforced by the operational manager.[11] Training sessions were to focus on the



OHC: occupational health clinic, OT: occupational therapist

Figure 3. Graduated return-to-work programme

recognition of ergonomic risks, existing workplace controls, potential health consequences, and means of reporting early symptoms. A claim for a WRULD in accordance with Circular Instruction No. 180 of the COIDA was submitted. As per statutory requirements, the Chief Inspector of the Department of Employment and Labour was notified of the diagnosis of a WRULD in this HCW.

Outcome

The HCW responded well to therapeutic ultrasound treatment administered by a physiotherapist, weekly for three consecutive weeks. Pulsed ultrasound at a frequency of 1 MHz was used during the sessions with an intensity of 1–2 W/cm^2 for two to four minutes. This was followed by soft tissue massage to relieve pain and swelling. The graduated return-to-work programme (Figure 3) was successful and the HCW was fully functional at six months, coping well with the recommencement of normal duties and targets. Although this fell within the expected recovery period, extensive workplace support was required. The worker subsequently took up employment at a paediatric hospital where garments are smaller and production demands are lower than in her previous workplace. The outcome of the WRULD claim is pending.

DISCUSSION

De Quervain's tenosynovitis

Aetiology of de Quervains tenosynovitis

De Quervain's tenosynovitis is a condition that affects the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) tendons that control the movement of the thumb (Figure 4). These tendons run through a fibro-osseous sheath that becomes constricted and inflamed, producing pain.[12] The exact aetiology of DQT remains disputed. While some suggest that DQT results from myxoid degeneration and fibrous tissue deposition,[13,14] others report an inflammatory-mediated pathway in DQT causation.[14,15] Considerable evidence for both the degenerative and inflammatory-mediated pathways in DQT causation exists.[16] Furthermore, studies have shown that underlying anatomical variation increases the propensity for developing DQT and influences treatment responses.[16,17] Anatomical variations associated with an increased risk of DQT include the increased angulation of the radial head, multiple tendon slips, and separate fibro-osseus canals for the APL and EPB tendons.[17,18] Additional risk factors for DQT have recently been reported by Yardakul et al. (2017), when describing a case of DQT in a young patient receiving somatotropin treatment for growth hormone deficiency.[19] A possible genetic predisposition to DQT was reported by Kim et al. (2017), who found an association between DQT and rs35360670 on chromosome 8 when conducting a genome-wide association screen.[20] Although several explanations for the underlying cause of DQT have been proposed, the exact aetiology remains somewhat disputed, with a multifactorial origin being most plausible.

Clinical presentation and diagnosis

Patients with DQT typically exhibit pain localised to the radial aspect of the wrist. Additionally, they may experience pain and limitation during thumb extension and abduction. The classic clinical diagnostic test for DQT is Finkelstein's test (Figure 5). However, as a passive test, it has limitations in that it can potentially stretch structures not directly involved in DQT pathology.[19] An alternative active diagnostic test, the wrist hyperflexion and abduction of the thumb test (WHAT), has been used clinically. During WHAT, the examiner applies counter-pressure while the patient actively hyperflexes the wrist and abducts the thumb. This manoeuvre elicits pain if DQT is present.[19]

Emerging evidence suggests that ultrasonography may be a critical diagnostic tool for DQT. This modality allows for visualisation of tendon sheath swelling and thickening, identification of anatomical variations, and differentiation of DQT from other causes of wrist pain.[19] This information can potentially inform treatment planning and reduce post-operative complications.[19]

Pathogenesis of de Quervain's tenosynovitis

Microtrauma, caused by highly repetitive movements and movements requiring force, results in an inflammatory response, which entails the release of several inflammatory mediators, including macrophages, neutrophil elastases, and COX-2.[13,14,19] These molecules play a crucial role in the pathogenesis of DQT. Immune cells recruited to the site of injury by these inflammatory mediators increase the permeability of blood vessels, resulting in oedema and pain.[13,14] In addition, they stimulate the release of reactive oxygen species and enzymes (such as matrix metalloproteinases), which damage the extracellular matrix of tissues.[14,19] Chronic, ongoing exposure to microtrauma can lead to a chronic inflammatory response characterised by angiogenesis and fibroblast activation, resulting in the deposition of fibrous connective tissue.[16] Fibrotic tissue not only impairs function but increases the susceptibility to future injuries, even under less strenuous conditions.

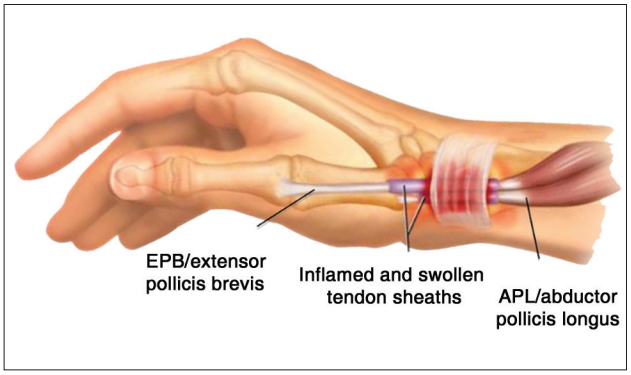


Figure 4. Anatomy of wrist showing abductor pollicis longus and extensor pollicis brevis

Source: https://www.osmifw.com/hand-therapy-center-in-fort-worth/de-quervains-tenosynovitis-2/

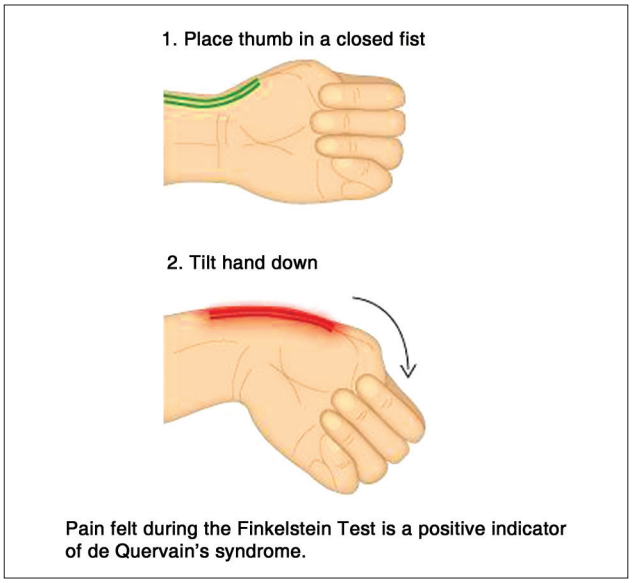


Figure 5. Finkelstein's test

Source: https://www.facebook.com/thespecialistparamedic/posts/2606559139634726/

While inflammation plays an important role in the pathogenesis of DQT, some researchers assert that the histological presence of inflammation may confound the true underlying pathology of myxoid degeneration.[13] Myxoid degeneration refers to the replacement of normal tissue with deposits of a mucoid substance containing new glycosaminoglycans like mucopolysaccharides. Read et al. (2000) postulated that inflammation masks underlying myxoid degeneration in DQT, based on his histological examination of the tendons of women with DQT, where intramural deposits of mucopolysaccharides were observed.[13]

The development of DQT in HCWs is multifactorial, with workplace exposures, workplace organisational factors, and individual factors playing a contributory role (Table 2).[1-4,6,21] Physiotherapists, midwives, dentists, surgeons, and nurses are among those HCWs commonly affected.

Workplace risk factors frequently associated with DQT (and WRULDs) in HCWs include treating a large number of patients daily, performing manual job tasks, working in sustained positions for extended periods of time, taking insufficient breaks, continuing to work while injured, and inadequate training about ergonomic risks.[1-4] Ergonomic and organisational workplace factors, therefore, impact on the development and exacerbation of DQT in HCWs.

Pathology of de Quervain's tenosynovitis

The histological examination of the tendon sheaths of individuals with DQT demonstrates dense mucinous deposition and myxoid degeneration within the synovium, with increased vascularity of the fibrous sheath centre.[13,14,16] The presence of an active inflammatory process is variable.[21]

Treatment of de Quervain's tenosynovitis

De Quervain's tenosynovitis can be treated a) conservatively with NSAIDs, rest and splinting, b) medically with the administration of LASI and/or therapeutic ultrasound, and c) surgically. Conservative and medical treatment cure 62–93% of cases.[21] Surgical intervention may be indicated if conservative and/or medical management of DQT fail; factors associated with failure are listed below.[21-26] Surgical intervention involves the incision of the tendon sheath containing the APL and EPB tendons (Figure 6). Complete healing can take up to six months. Post-surgical complications include radial nerve damage, bruising and swelling, haematoma formation, and the displacement of tendons.

Table 2. Common risk factors associated with de Quervain's tenosynovitis

Category	Factor
Workplace	
1. Physical	• Performance of manual tasks* • Repetitive movements* • Working in sustained positions for long periods* • Continuing to work while injured* • Working with difficult patients • Awkward postures
2. Organisational	• High workloads* • High pressure/demand environments* • Insufficient breaks • Inadequate training in ergonomic risks* • Low control/input in work organisation by workers • Inadequate renumeration • Inadequate use of worker skillsets
3. Individual	• Age* • Female sex* • Obesity • Diabetes • Hypothyroidism • Connective tissue disease • Concomitant psychiatric diagnoses, e.g. anxiety, depression • Anatomical anomalies, e.g. multiple tendon slips, separate fibro-osseus canal for APL and EPB tendons

*Risk factors applicable to the HCW
APL: abductor pollicis longus, EPB: extensor pollicis brevis

Factors associated with failed conservative measures of de Quervain's tenosynovitis

Failed conservative measures for DQT are higher in HCWs with: [21-26]

1. Concurrent musculoskeletal diagnoses (carpal tunnel syndrome, trigger finger)
2. Anatomical differences (separate fibro-osseus canal for APL and EPB, multiple tendon slips)
3. Psychiatric diagnoses (depression, anxiety)
4. Incapacitated work status
5. Longer duration and greater severity of symptoms prior to presentation

Therapeutic applications of ultrasound in de Quervain's tenosynovitis

Therapeutic ultrasound has been investigated as a treatment modality for DQT, alongside its roles in ultrasound-guided LASI and diagnostic imaging of musculoskeletal conditions. The potential therapeutic benefits of ultrasound in DQT include analgesia, improved tissue extensibility, promotion of soft tissue healing (including bone and tendon), and tissue regeneration.[27] The optimal ultrasound frequency for therapeutic applications depends on the depth of the targeted tissue. Generally, higher frequencies (around 3 MHz) are employed for superficial structures, while lower frequencies (approximately 1 MHz) penetrate deeper tissues.[27] In the context of DQT, non-thermal (pulsed) therapeutic ultrasound is typically used, with an intensity of 0–2 W/cm^2, followed by soft tissue massage along the first dorsal compartment to relieve pain and swelling.[27]

Case discussion

This case demonstrates the important role of ergonomic and organisational factors in the development of WRULDs in healthcare settings. The manual, repetitive nature of work tasks, assumption of sustained positions for extended periods of time, high work demands, staff shortages, and continuation of work while injured contributed to the development of DQT in this HCW.

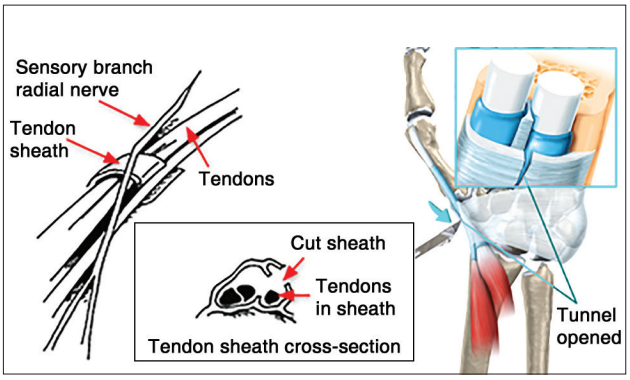


Figure 6. Surgical intervention for de Quervain's tenosynovitis
Source: https://www.drgordongroh.com/orthopaedic-injuries-treatment/hand-wrist/de-quervains-tendinosis/

The initial diagnosis of DQT appeared to be accurate. There was no evidence of alternative pathology (cervical nerve root impingement), concomitant musculoskeletal pathology (carpal tunnel syndrome), post-operative complications (radial nerve or tendon damage), or psychiatric diagnoses (anxiety or depression) to explain the ongoing pain.

The post-operative management was suboptimal. The HCW was not managed proactively or comprehensively, with input from a multidisciplinary team. A physiotherapist and occupational therapist were not engaged early in the management process to assist with kinetic training, pain management, and rehabilitation, nor was an occupational health practitioner consulted to manage the return-to-work process through a graduated programme to allow for maximal healing.

The workplace risk factors were not assessed or addressed at the initial assessment. Therefore, the causative or contributory role of workplace factors was not appreciated at the outset. There was continued exposure to ergonomic risks in the workplace in the post-operative period. Staff shortages and absenteeism impacted on the workload, placing additional pressures on the workers in this high-demand CSSD unit. Given the high-risk rating of ergonomic and psychosocial hazards revealed by the workplace HRA, it was concluded that ergonomic and organisational workplace risk factors played a major role in the development of DQT in this HCW. The delayed recognition of the contribution of occupational risk factors to the development of DQT in this HCW resulted in continued exposure to ergonomic risks, ongoing pain, limitation in work and activities of daily living, and delayed recovery.

The work-relatedness of DQT remains a subject of debate across medical disciplines. Dunn et al. (2019) argue that the observed pathology in DQT is characterised by myxoid degeneration with fibrous tissue deposition, suggesting a non-inflammatory degenerative process rather than acute synovial inflammation.[26] However, research has indicated that highly repetitive movements can result in tissue changes with no histological evidence of localised inflammation.[18,19,28] Barr and Barbe (2002) demonstrated a decrement in task performance in a rodent model, following exposure to highly repetitive movements, without any histological evidence of localised inflammation.[28] This supports the idea that resulting tissue injury is not necessarily accompanied by inflammation.[28] While some orthopaedic surgeons contend that a definitive link between work-related factors and DQT has not been established in epidemiological studies,[26] occupational medicine practitioners have affirmed the work-relatedness of DQT, specifically in occupations requiring highly repetitive movements.[29,30] It is hypothesised that repetitive movements performed by individuals with a propensity for DQT results in tissue damage with or without an inflammatory response.[16,27] In the case presented in our paper, the workplace HRA clearly indicated the presence of ergonomic and psychosocial risks, and the large attribution of occupational factors in DQT causation in the HCW.

The successful reintegration of the HCW into the workplace was facilitated by engaging a multidisciplinary team to manage the HCW comprehensively, the introduction of a graduated return-to-work programme (Figure 3), and open, transparent communication between the line manager and the occupational health practitioner, who outlined expected recovery times and treatment goals.

This case presentation underscores the established association between suboptimal post-operative pain management and a protracted recovery period. Inadequate pain control, possibly compounded by the HCW's strong work ethic and focus on achieving performance targets, could have contributed to the development of re-injury. The adverse consequences of poor pain management in the HCW included impaired physical function at work and during daily activities, a diminished quality of life, and a protracted recovery period.

The adverse effects of WRULDs on the functionality of the workplace and the associated financial implications were clearly demonstrated. Moreover, concerns about employability, persistent symptoms, and future health concerns were apparent, and resulted in the HCW transferring to a new job.

CONCLUSION

This case highlights valuable learning points in the management of WRULDs, including the failure to recognise and manage ergonomic risks in the workplace that may result in a WRULD – a compensable occupational injury. The failure to initiate a post-operative, multidisciplinary management plan to facilitate recovery and rehabilitation can result in delayed recovery and reintegration into the workplace. The implementation of a graduated return-to-work process in workers susceptible to relapse (if reasonably practicable) allows for optimal recovery time, and guards against re-injury in the workplace during the recovery phase. The suboptimal management of post-operative pain in the HCW resulted in adverse outcomes, including persistent pain, limitations in physical function, and a prolonged recovery period. The vital role of allied health professionals, such as occupational therapists and physiotherapists, in the education and training of workers, prevention of occupational injuries, and the recovery and rehabilitation of workers is essential to improve outcomes related to WRULDs. Future research should focus on evaluating the relative efficacy of various treatment modalities for DQT to establish optimal treatment protocols, and investigating how anatomical variations in the affected wrist region influence treatment responses and guide treatment choices.

KEY MESSAGES

1. Healthcare workers are at increased risk of WRULDs, due to the manual nature of their work.
2. Work-related upper limb disorders have adverse functional and financial consequences on the worker and the workplace.
3. Optimal management, through a graduated return-to-work programme and a multidisciplinary approach, can mitigate the health and financial burdens associated with WRULDs.

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

Data acquisition: YW
Interpretation of the data: YW, IN, SA
Drafting of the paper: YW
Critical revision of the paper: YW, IN, SA

ACKNOWLEDGEMENTS

We express our gratitude to the healthcare worker for consenting to the use of her clinical information for publication purposes.

REFERENCES

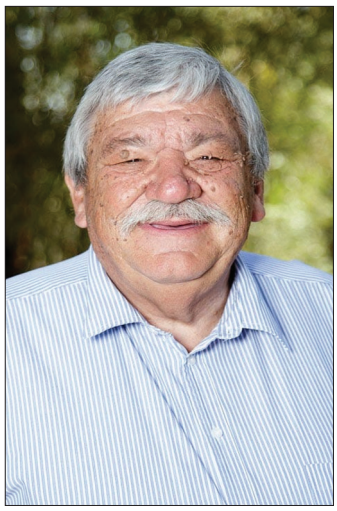
1. Kacem I, Boughattas W, Ghardallou M, Maoua M, Hafsia M, Ben Ahmed H, et al. Prevalence of work-related upper limb disorders and the associated psychosocial factors among midwives. Int J Nurs Sci. 2021; 15:100336. doi: 10.1016/j.ijans.2021.100336.
2. Greiner BA, Nolan S, Hogan DAM. Work-related upper limb symptoms in hand-intensive health care occupations: a cross-sectional study with a health and safety perspective. Phys Ther. 2019; 99(1):62-73. doi: 10.1093/ptj/pzy124.
3. Waller E, Bowens A, Washmuth N. Prevalence of and prevention for work-related upper limb disorders among physical therapists: a systematic review. BMC Musculoskelet Disord. 2022; 23(1):453. doi: 10.1186/s12891-022-05412-8.
4. Chung SH, Her JG, Ko T, Ko J, Kim H, Lee JS, et al. Work-related musculoskeletal disorders among Korean physical therapists. J Phys Ther Sci. 2013; 25(1):55-59. doi: 10.1589/jpts.25.55.
5. South Africa. Compensation for Occupational Injuries and Diseases Act, 1993 (Act No. 130 of 1993). Available from: https://www.gov.za/sites/default/files/gcis_document/201409/act130of1993.pdf (accessed 16 June 2024).
6. Cromie JE, Robertson VJ, Best MO. Work-related musculoskeletal disorders in physical therapists: prevalence, severity, risks, and responses. Phys Ther. 2000; 80(4):336-351. doi: 10.1093/ptj/80.4.336.
7. Adegoke BO, Akodu AK, Oyeyemi AL. Work-related musculoskeletal disorders among Nigerian Physiotherapists. BMC Musculoskelet Disord. 2008; 9:112. doi: 10.1186/1471-2474-9-112.
8. Dong XS, Betit E, Dale AM, Barlet G, Wei Q. Trends of musculoskeletal disorders and interventions in the construction industry. CPWR quarterly data report; 3rd quarter 2019; 2019. Available from: https://stacks.cdc.gov/view/cdc/86273 (accessed 15 November 2023).
9. Buckle PW, Devereux JJ. The nature of work-related neck and upper limb musculoskeletal disorders. Appl Ergon. 2002; 33(3):207-217. doi: 10.1016/s0003-6870(02)00014-5.
10. Malaysia. Department of Occupational Safety and Health. Guidelines for Hazard Identification Risk Assessment and Risk Control (HIRARC); 2008. Available from: https://www.dosh.gov.my/index.php/legislation/guidelines/hirarc-2/1846-01-guidelines-for-hazard-identification-risk-assessment-and-risk-control-hirarc-2008/file (accessed 16 June 2024).
11. South Africa. 2022. Occupational Health and Safety Act, 1993 (Act No. 85 1993): Ergonomics Regulations, 2019. Government Gazette No. 42894, 2019 December 6 (published under Government Notice R1589). Available from: https://www.labour.gov.za/DocumentCenter/Regulations%20and%20Notices/Regulations/Occupational%20Health%20and%20Safety/Ergonomics%20Regulations%202019.pdf (accessed on 5 June 2024)
12. Chaya B, Bakhach E, Bakhach J. The de-Quervain tenosynovitis: literature review. Biomed J Sci Tech Res. 2018; 8(4):6650-6642. doi: 10.26717/BJSTR.2018.08.001691.
13. Read HS, Hooper G, Davie R. Histological appearances in post-partum de Quervain's disease. J Hand Surg Br. 2000; 25(1):70-72. doi: 10.1054/jhsb.1999.0308.
14. Kuo YL, Hsu CC, Kuo LC, Wu PT, Shao CJ, Wu KC, et al. Inflammation is present in de Quervain disease – correlation study between biochemical and histopathological evaluation. Ann Plast Surg. 2015; 74 Suppl 2:S146-S151. doi: 10.1097/SAP.0000000000000459.
15. Kuo YL, Jou IM, Wang PH, Yang TH, Shen CJ, Hsu CC. Correlation between IL-20 and de Quervain's disease severity. Ann Plast Surg. 2019; 82(1S Suppl):S6-S12. doi: 10.1097/SAP.0000000000001701.
16. Fakoya AO, Tarzian M, Sabater EL, Burgos DM, Maldonado Marty GI. De Quervain's disease: a discourse on etiology, diagnosis, and treatment. Cureus. 2023; 15(4):e38079. doi: 10.7759/cureus.38079.
17. Gonzalez MH, Sohlberg R, Brown A, Weinzweig N. The first dorsal extensor compartment: an anatomic study. J Hand Surg Am.1995; 20:657-660. doi: 10.1016/S0363-5023(05)80286-2.
18. Lipscomb PR. Stenosing tenosynovitis at the radial styloid process (de Quervain's disease). Ann Surg. 1951; 134:110-115. doi: 10.1097/00000658-195107000-00013.
19. Yurdakul OV, Aytüre L, Yalçinkaya EY. Persistent de Quervain tenosynovitis induced by somatotropin treatment. J Pediatr Endocrinol Metab. 2017; 30(11):1223-1126. doi: 10.1515/jpem-2017-0085.
20. Kim SK, Ahmed MA, Avins AL, Ioannidis JPA. A genetic marker associated with de Quervain's tenosynovitis. Int J Sports Med. 2017; 38(12):942-948. doi: 10.1055/s-0043-116669.
21. Petit Le Manac'h A, Roquelaure Y, Ha C, Bodin J, Meyer G, Bigot F, et al. Risk factors for de Quervain's disease in a French working population. Scand J Work Environ Health. 2011; 37(5):394-401. doi: 10.5271/sjweh.3160.
22. Kazmers NH, Liu TC, Gordon JA, Bozentka DJ, Steinberg DR, Gray BL. Patient- and disease-specific factors associated with operative management of de Quervain tendinopathy. J Hand Surg Am. 2017; 42(11):931.e1-931e7. doi: 10.1016/j.jhsa.2017.07.017.
23. Lane LB, Boretz RS, Stuchin SA. Treatment of de Quervain's disease: role of conservative management. J Hand Surg Br. 2001; 26(3):258-260. doi: 10.1054/jhsb.2001.0568.
24. Weiss A-PC, Akelman E, Tabatabai M. Treatment of de Quervain's disease. J Hand Surg Am. 1994; 19(4):595-598. doi: 10.1016/0363-5023(94)90262-3.
25. Earp BE, Han CH, Floyd WE, Rozenthal TD, Blazar PE. De Quervain tendinopathy: survivorship and prognostic indicators of recurrence following a single corticosteroid injection. J Hand Surg Am. 2015; 40(6):1161-1165. doi: 10.1016/j.jhsa.2014.12.027.
26. Dunn JC, Polmear MM, Nesti LJ. Dispelling the myth of work-related de Quervain's tenosynovitis. J Wrist Surg. 2019; 8(2):90-92. doi: 10.1055/s-0039-1677741.
27. Goel R, Abzug JM. de Quervain's tenosynovitis: a review of the rehabilitative options. Hand (NY). 2015; 10(1):1-5. doi: 10.1007/s11552-014-9649-3.
28. Barr AE, Barbe MF. Pathophysiological tissue changes associated with repetitive movement: a review of the evidence. Phys Ther. 2002; 82(2):173-187. doi: 10.1093/ptj/82.2.173.
29. Stahl S, Vida D, Meisner C, Lotter O, Rothenberger J, Schaller HE, et al. Systematic review and meta-analysis on the work-related cause of de Quervain tenosynovitis: a critical appraisal of its recognition as an occupational disease. Plast Recon Surg. 2013; 132(6):1479-1491. doi: 10.1097/01.prs.0000434409.32594.1b.
30. Al Badri F. Work-related de Quervain's tenosynovitis (DQT): the diagnosis dilemma. Cureus. 2023; 15(1):e33458. doi: 10.7759/cureus.33458.

Petrus Cornelius Schutte: 8 December 1950–28 September 2023

Deon Jansen van Vuuren: SAIOH General Manager

Petrus Schutte (Schu) was a prominent figure in the occupational hygiene and scientific communities. Sadly, he passed away in 2023. In this obituary, we acknowledge the huge contributions that he made to the occupational hygiene profession in southern Africa.

Schu was a giant of a man, not just in size, but also in his work and family life – a true gentleman. I first met Schu at an Intervarsity rugby match in Bloemfontein, where he was playing prop for the PUKKE (University of Potchefstroom) first rugby team. A few years later, when I was enrolled in a BSc Honours degree in industrial physiology, I met him again at the Chamber of Mines Research Organisation (COMRO), where I did my practical work. Our paths continued to cross intermittently and met up again at the (then) Occupational Hygiene Association of South Africa (OHASA), which, 20 odd years later, is now the Southern African Institute for Occupational Hygiene (SAIOH).



Schu Schutte
Photograph: courtesy of the Schutte family

Schu was a popular figure in the field of occupational hygiene, and known for his willingness to assist, whether in brainstorming or giving presentations at workshops and annual conferences. He was your 'go-to' man.

While at COMRO, Schu conducted internationally recognised, groundbreaking research on various topics in the mining industry, including heat stress, occupational hygiene, and acclimatisation of workers in deep gold mines. This led to quite a few sessions in the hot and steamy acclimatisation chambers, and exposure to illumination, noise, and self-rescuers (self-contained breathing systems). Schu's career was ever-evolving, and he became an expert in ergonomics and fatigue management. At one stage he even worked for Columbus Stainless in Middelburg as an occupational hygienist, saying *"I need some exposure to industry also"*.

In mid-2023, shortly before his death, Schu facilitated a SAIOH workshop on heat stress management at the Council for Scientific and Industrial Research (CSIR). He had the ability to break down complex technical facts and equations into comprehensible information. In true Schu style, he spent time before, during, and after lunch with the young occupational hygiene practitioners to answer their questions and chat.

It was an immense shock when his wife, Manda, advised that he was seriously ill and in ICU, and even more so when she called to tell me of his death. At his memorial service, everyone had stories to tell of how Father Petrus, later Grandfather Petrus, watched their rugby games, sitting next to the field, even when it was raining, seldom missing a game and always ready with support and good advice.

With Schu's passing, messages of condolence came flooding in – a testament of how much he was loved and admired. This is what some had to say about him:

Dr Johan Kielblock, boss, and colleague at COMRO, and the first SAIOH fellow:
"I met Schu Schutte in 1980 when I joined the Chamber of Mines Research Organisation ('COMRO'). We both had a fondness for heat physiology, and the applied research that came from it. Schu was an extremely capable practical researcher and we, as a team, produced excellent work, in my humble opinion. The best example was the creation of a heat screening test, or rather, 'heat tolerance screening' (HTS). With this method, the existing climate chamber acclimatisation process, which was extremely unpopular and even discriminatory, was done away with. After more than 30 years, this method is still the mainstay of physical screening for working in hot underground mines and is recognised as such by the Department of Mineral Resources and Energy in its official guidance to mines. Schu Schutte made an undeniable contribution in this field."

Cecilia Pretorius, long-time colleague of Schu at CSIR Miningtek, and now with CPRAS (Cecilia Pretorius Research and Advisory Services (Pty) Ltd):
"Schu Schutte was a well-known researcher in the field of occupational hygiene and ergonomics in South Africa and abroad. For more than 40 years he was at the forefront of research on topics such heat stress, ergonomics, fatigue management, human factors, and accident analysis in the mining industry. He was a humble man with a kind heart, who cared about people, especially mining people. He leaves a gap in industry and very few people will be able to fill his shoes! He was always willing to assist and continued to 'help out' even after his retirement. His friends and colleagues in industry will miss his advice and guidance. Above all, they will miss him as a person."

Jodi Pelders, Researcher, CSIR:
"Schu Schutte was my manager when I joined the Human Factors research group at the Centre for Mining Innovation at the CSIR in 2011. He was always kind and supportive and enabled me to contribute to and lead work relating to ergonomics in the southern African mining sector. He was also a co-supervisor of my PhD research at the School of Public Health at the University of the Witwatersrand. He was knowledgeable and a leader in the field of ergonomics and occupational health. His formal qualifications included industrial physiology, and he was a

registered occupational hygienist with the Southern African Institute for Occupational Hygiene (SAIOH). Schu's experience in mining-related occupational health and safety research and application activities spanned decades (1974 to 2023). These activities included the implementation of heat stress management procedures, the assessment of physiological strain and workplace stress, the development of an operator fatigue management programme, and an ergonomics strategy and programmes for the South African mining industry. He was author or co-author of at least 110 research reports, 12 chapters in handbooks, and 22 papers in scientific or technical publications. Even when retired from the CSIR, Schu was available to assist us with projects. Most recently, was one relating to the use of body cooling garments by rescue team members, completed in 2023. He was committed and willing to give beyond what was required. As far as I am aware, he was content to continue with research until his departure from earth. He made a big impact in the mining industry, and his inputs have a lasting influence on improving the lives of people in the mining industry. He was a loving and caring husband, father, and grandfather. I would like to offer my prayers and condolences to his family and all who knew him."

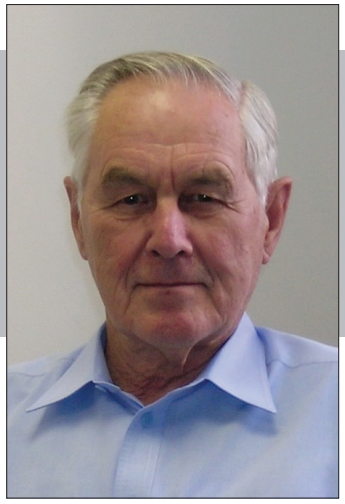
Vuyo Tsotsotso, Researcher CSIR Environmental Engineering Mining:
"Schu was my mentor, and I got the privilege of working very closely with him on the heat tolerance screening service for the last 3–4 years. I learnt a lot from him to say the least. He was able to impart an immense amount of knowledge to me while conducting occupational health and safety projects and on our long drives across the South African landscape to provide the mines with the heat tolerance screening service. He was an exceedingly kind, accommodating and understanding man whose presence was felt in every room he walked in. He was immensely respected and trusted in the occupational hygiene space and the quality of his work was second to none. I will inherently use his teachings for the rest my career. It is not an exaggeration to say his contributions to the advancement and understanding of heat stress in the mining industry are irreplaceable."

Directors of the occupational hygiene AIA Association forwarded this to their members:
"Morning members. Very sad news. We were informed this morning that Schu Schutte passed away early this morning. Our deepest sympathy goes to his family and friends. Let us keep them in our prayers and thoughts."

Prof. Gill Nelson, Wits School of Public Health, and Editor-in-Chief of *Occupational Health Southern Africa*, wrote this letter to Schu while he was in hospital:
"Dear Schu, I and many of your other colleagues who have happily worked with you for so many years are very distressed to hear about your recent health challenges. On behalf of the Editorial Board and Advisory Panel of Occupational Health Southern Africa, we wish you a speedy recovery. We will keep you and your family in our thoughts and prayers."

The **SAIOH** e-mail notification read:
"Dear SAIOH member, it is with deep sadness and heavy hearts that we at SAIOH inform you of the death of Schu Schutte, who passed away on Thursday 28 September 2023. Schu passed away suddenly after a recent prognosis. Schu was not just our colleague but a good friend as well to many of our SAIOH members. His contribution to occupational hygiene is a huge loss to SAIOH and South Africa."

I would like to end Schu's obituary with these words:
"I was very privileged to know and have worked with Schu. He was such a compassionate person, with big empathy for everyone and I will always remember him as a true gentleman whose love for his wife, Manda, and his family was sacrosanct. I cannot begin to imagine how much we will miss Schu."



John Carol Anthony (Tony) Davies:

28 August 1931–3 March 2024

Professor Emeritus, School of Public Health, University of the Witwatersrand; past Director, National Centre for Occupational Health, Johannesburg, South Africa

Compiled by **Gill Nelson**: Editor-in-Chief, *Occupational Health Southern Africa*

In the previous issue of *Occupational Health Southern Africa*, we announced the passing of Professor Emeritus Tony Davies after a short illness. Although Tony officially retired in 2015, he continued to be a protagonist of workers' health, and he and his wife, Deirdre, were instrumental in assisting many people to claim compensation for asbestos-related diseases. He spent the last years of his life in Kenton-on-Sea in the Eastern Cape province, working on a book about these and his other experiences as an occupational medicine doctor. Less than six weeks after Tony's passing, Deirdre also passed away – testament to their close bond that was undoubtedly strengthened during the time they spent together, helping those so much less fortunate than themselves.

I was privileged to be among the early group of doctors mentored by Tony at the National Centre for Occupational Health (NCOH) in the mid-1980s. Although I left the Centre in 1987, the lessons I learned and the colleagues and friends I made have lasted me my whole career. This experience was, in large part, due to the ethos created by Tony during a very troubled time in our country's history. He encouraged our endeavours, took pride in our achievements, and protected us from Pretoria.

In an unfashionable discipline, the commitment he showed to recompense and justice, for the miners who had given their health to dig the wealth of this country, embodied social medicine in a clear form. His manner was courteous but his impatience and anger for what passed as business as usual in government and industry were righteous. These characteristics, as much as the technical skills that were learned, were, for me, the markers of a fulfilled career and a contribution to society.

Those of us who stayed in the unfashionable discipline are Tony's professional offspring and are grateful for it. We honour his life and mourn his passing.

Rodney Ehrlich
Professor Emeritus, University of Cape Town

In 1991, Tony and Deirdre examined thousands of ex-asbestos miners – they stayed in simple quarters at two hospitals on numerous occasions for six years. It cumulated in a six-month sojourn at HC Boshofff Hospital in Maandag's Hoek in Limpopo province. Together, they published a paper about the 770 women they examined, who were eligible for compensation because of their work in asbestos mines. It is the first paper to be published about women cobbers. In addition to the women, they helped more than 2 000 ex-asbestos miners receive compensation. The two of them endured tough working conditions to leave a formidable legacy.

Marianne Felix
CEO: Stretch Education SA

It was with a heavy heart that the South African Society of Occupational Medicine (SASOM) and its members offered deepest condolences to the family, friends, and colleagues of Professor Emeritus Tony Davies, a long-time friend of SASOM, promoter and ambassador of the occupational health and medicine disciplines in southern Africa, and a stalwart protector of workers. Ever the inspiration and a guiding light to generations of OSH professionals and occupational medical practitioners, Prof. Davies' legacy lives on. He will be sorely missed by all of us!

Claudina Nogueira
University of Pretoria, on behalf of SASOM



Adler Museum function, 2008. L–R: Rochelle Keene, Tony Davies, Sharon Fonn
Photograph: Rochelle Keene



Tony and Deirdre Davies, 2015
Photograph: Gill Nelson

I remember Tony as a regular attendee at the Wits School of Public Health (SPH) academic meetings every Friday, when these were still a vibrant part of the academic life of the School. Notwithstanding Tony's vast knowledge of public health, he always treated junior or emerging researchers as if they knew a whole lot more than him. He asked gentle questions and made insightful comments.

The Wits SPH has a strong focus on occupational health, given the long history of mining in South Africa. In 2011, Tony contributed to the Special Issue that celebrated the Centre for Health Policy with enthusiasm and excitement.[1] Together with Jill Murray and David Rees, Tony highlighted the disjuncture between progressive health policies and implementation. Despite extensive research on silicosis, tuberculosis, HIV and AIDS, and compensation for occupational disease, there has been limited policy implementation, reflected in high levels of occupational diseases.[2] I enjoyed Tony's support when I became Head of School in 2012, and our light banter about split infinitives (which both of us disliked). Above all, I remember Tony's dry sense of humour. Rest in peace Tony Davies.

REFERENCES

1. Rispel LC, Padarath A, Walt G. Strengthening health systems for equity and social justice in South Africa: the 24th anniversary of the Centre for Health Policy [editorial]. J Public Health Policy. 2011; 32 Suppl 1:S1-9. doi: 10.1057/jphp.2011.38.

2. Murray J, Davies T, Rees D. Occupational lung disease in the South African mining industry: research and policy implementation. J Public Health Policy. 2011; 32 Suppl 1:S65-79. doi: 10.1057/jphp.2011.25.

Laetitia Rispel
SARChI Chair: Research on the Health Workforce for Equity and Quality
University of the Witwatersrand

Along with many others in public and occupational health, both practitioners and beneficiaries, I have a lot to thank Prof. Tony Davies for. Tony was a truly effective mentor – in some ways, before his time – because he supported the development of people, both professionally and personally. At Prof. Jill Murray's suggestion, I have written a short account about some of Tony's work on asbestos, because it tells us a lot about him professionally.

With Tony's guidance and support, Marianne Felix did her PhD in the Mafefe area in Limpopo province. Mafefe is home to numerous asbestos deposits and also Penge – then a big asbestos mine. Marianne's was the first South African community-based study of asbestos exposure and asbestos disease. She uncovered high rates of previously unreported disease in a rural community.

Evaluating patients and submitting claims for workers' compensation can be drudgery, but Tony did this for many months over several years with the strong support of his wife, Deirdre. They published a paper in the *South African Journal of Science* in 2001[1] in which they reported that 96% of the 770 women miners they examined had asbestos-related disease. Again, this was done in a vulnerable rural community. Their work was valuable, scientifically, but more importantly, Tony's and Deirdre's work resulted in a much-needed flow of money into this poor community.

We have two Trusts in South Africa that compensate people with asbestos diseases – the Asbestos Relief Trust and the Kgalagadi Relief Trust. Both have been very successful, and thousands of people have benefited. Tony was instrumental in the early days of these Trusts. Richard Meiring of Leigh Day, the lead lawyer in the matter for beneficiaries, had high praise for Tony.

Brian Gibson the 'issue manager' for Everite – the big asbestos-cement company – and Tony became friends, in part because of Brian's admiration for Tony. Brian told me that Tony had resolved several deadlocks in the negotiations around the setting up of medical evaluations of former Everite workers.

Tony was an activist, a philosopher in some respects, and an academic who stimulated and supported important research, often in marginalised communities, but also a pragmatist who was able to get things done.

REFERENCE

1. Davies JCA, Williams BG, Debeila MA, Davies DA. Asbestos-related lung disease among women in the Northern Province of South Africa. S Afr J Sci 2001; 97 March/April:87-92.

David Rees
Professor Emeritus, University of the Witwatersrand
Former Director, NIOH

Tony Davies was a critical pillar in academic occupational health in South Africa, an architect who, along with other leaders, established the foundation of our discipline. Tony played a role in moving occupational health in KwaZulu-Natal, when he seconded a short-term post from the National Centre for Occupational Health to the (then) University of Natal around 1995. This was a critical resource in our early days in trying to establish academic occupational medicine/health in the province. Similarly, I have no doubt, Tony's quiet but purposeful manner extended occupational health to the far reaches of our country during his tenure at the NCOH/NIOH, Wits, and the Department of Health.

Rajen Naidoo
University of KwaZulu-Natal

"From 2005 to 2014 Professor JCA (Tony) Davies became the co-editor [of the Adler Museum Bulletin]. The Curator of the Museum, Ms Rochelle Keene, served as co-editor of the Bulletin from 2004 to 2014. Professor Davies' first editorial in 2005 marked the 30-year anniversary of the Bulletin. From the time he became co-editor, until his retirement in February 2015, he wrote 18 editorials, 5 articles and 3 book reviews." (Extract from the editorial of the June 2015 issue of the *Adler Museum Bulletin*, by Prof. Jim Phillips.)

Tony also made an invaluable contribution to the Museum's Board of Control on which he served from 2005 to 2014. He visited the Museum frequently, being invested in its progress. We talked endlessly about all sorts of subjects, including, occasionally, his choir practice the previous night. We shared many hours pouring over manuscripts and, if accepted, days and days of editing them and producing many volumes, which gave us great satisfaction. We agreed that the *Bulletin* did not get a wide enough recognition or distribution.

His 18 editorials were unusual, topical, sometimes historical, sometimes philosophical, but always extremely interesting. They were frequently about his primary interest: occupational health. He also did not shy away from criticising the failing public health system in this country in editorials, which included:

- 'A lifetime of service, looking critically at the role of mission hospitals in South Africa and asking, in the failing health system in this country, if they should not be brought back' (June 2008)
- 'South Africa's health service: time for a re-think?' in which he wrote, *"Apart from two disastrous epidemics of communicable disease* [since 1994]*, we have watched the steady decline of the health service to the point at which much of it can justifiably be described as dysfunctional"* (December 2009)
- 'Jobs half done, or just begun', in which he stated, *"It is clear that the present development failure in this country includes at least three important health science related elements: the failure to control chronic communicable diseases; the mounting burden of non-communicable (lifestyle) conditions requiring continuing care; and the decline of the health system …"* (December 2010)
- 'Wanted – a launch pad', where he criticised the proposal, in principle, to establish a National Health Insurance Service (NHIS) in South Africa, which had become *"trapped in uncertainty and discussions of complex issues of marginal significance"* (December 2014)

Several editorials delved deeply into the topics of the annual AJ Orenstein Memorial Lectures, giving readers additional insights. These included:

- 'What did Sydney Brenner say?' (June 2006), related to the lecture, 'Human biology: health and disease'
- 'Disease knows no boundaries – and will find the chinks in our armour' (December 2011), related to the 2011 lecture delivered by Prof. WD Francois Venter ('HIV transmission and sex in Africa: Why can't we get it right?'), in which he emphasised that occupational health services and public health services should be expert in recognising and ranking risks to health, prioritising them, and taking action to increase the size of the non-risk fraction of the workforce or the population in question
- 'Going backwards to make progress' (December 2012), related to the lecture delivered by Professor Karl von Holdt, 'Towards the clinician-led management team: a strategy for fixing hospitals?'
- 'A place in the sun?' (June 2013), related to the lecture delivered by Prof. Jock McCulloch titled, 'Dust, Disease and Politics on South Africa's Gold Mines'

His articles for the *Bulletin*, as one would expect, all related to occupational health, mines, and mining history. Given Tony's deep interest in occupational disease, it is no surprise that his first article for the *Bulletin* related to an historical moment which he felt was important to record for posterity; about the first recipient of a Wits postgraduate degree titled, 'A set of firsts: a brief appreciation of Dr George Frederick Mills Slade (1898–1976)' (December 2005). Slade was a member of the first class to study medicine at Wits and became the first medical graduate to receive a doctorate. He was the first medical officer to be employed by a South African chrysotile mining company. His MD thesis describes the first systematic study of the health effects of chrysotile asbestos dust on exposed miners. Tony, interestingly, noted that only one bound copy of Slade's thesis, titled, 'The incidence of respiratory disability in workers employed in asbestos mining, with special reference to the type of disability caused by the inhalation of asbestos dust', is in the AJ Orenstein Library for Industrial Health at the National Institute for Occupational Health (NIOH), donated by the late Prof. Ian Webster in 1981. Copies lodged with Wits and the documents relating to the examination of the thesis and the conferring of the degree are thought to have been destroyed in a fire.

Other articles that Tony wrote for the *Bulletin* were:

- 'Dust and fibre levels at Penge amosite mine 1970–1971', where he cited Roderick Edward George (REG) Rendall as his co-author (June 2007). Rendall was a mining engineer by training, who worked for the greater part of his life in the Occupational Hygiene Section of the National Centre for Occupational Health (NCOH). He was responsible for milling the standard preparations of asbestos used in research studies all over the world, and pioneered the methods of dust sampling and fibre counting in South Africa. The article written by Tony acknowledged one of his major unpublished pieces of work.
- 'Enquiries into health and safety in South African mines in the 20th century: what did they have to say about occupational lung disease?' (June 2010): he wrote that the future of the working man or woman was bleaker and more uncertain than ever. *"In the hands of the captains of industry, the rich and powerful, dust levels and the prevalence of work-related disease and injury do not decline without tough state intervention",* he wrote in an introduction to the proposed amendments to the South African Mine Health and Safety Act.
- 'What was known about miners' phthisis in South African Gold mines by 1930?' (June 2014). He compiled the article from archival material at the NIOH.

Tony wrote reviews of several books: *Yes, Health Minister. 40 years Inside the NHS Working for Children* by Dr Sonya Leff (June 2007) (reviewed with Rochelle Keene); *Adventure of Life. Reminiscences of Pauline Podlashuk* (December 2010); *An Uneasy Story: The Nationalising of South African Mission Hospitals 1960–1976: A Personal Account* by Dr Ronald Ingle (June 2011); and *South Africa's Gold Mines and the Politics of Silicosis* by Professor Jock McCulloch (June 2013). He also paid tribute to Prof. PV Tobias in an editorial titled, 'A deliberate scholar' (June 2012).

I know that Tony was writing a book when he passed away. He wrote to me: *"I quote from Archie Cochrane and have called my book* 'Another Man's Medicine'. *It is about medical practice in Rhodesia and Zimbabwe and I am trying to keep me-me-me out of the book. I am collecting electronic copies of everything published with my name on it as an author or co-author. When collected, as in the case of editorials in the* Adler Bulletin*,* [they are] *surprisingly interesting and polished and ignored."*

It was so like Tony to be modest about his considerable contributions in so many ways.

Rochelle Keene
Former Curator, Adler Museum of Medicine, Faculty of Health Sciences
University of the Witwatersrand

I worked at the NCOH from 1983 to1986 when Tony Davies, a senior ex-'Rhodesian' public health officer took up the directorship. This was not long after Zimbabwean independence and was the last decade of the increasingly brutal apartheid system, in the face of popular resistance.

Tony Davies went out of his way to support our cohort: progressive young doctors, health workers, and researchers with a public health vision and belief in equity and social justice. He aided us in upgrading the NCOH workers' health clinic and promoted our engagement with workers facing health threats at work. He encouraged us to talk and take time to learn about and record working conditions, liaise with their trade union representatives and advocates, and act to secure better health and working conditions. He recognised the value of careful history-taking and precise documentation. He encouraged and facilitated follow-up visits to workplaces, measurement of toxins and particulates, and firm engagement with employers who sacrificed health for profit.

Tony Davies was especially concerned about workers who had spent their working lives in hazardous jobs being discarded to the 'Bantustans', where health, medical care, and compensation for work-related ill-health and injuries were rare. He sought to ensure that those exposed to asbestos in the community received justice. He wanted occupational health and the associated ethical considerations to be mainstreamed for medical students, public health and general practitioners, and specialists.

Tony encouraged us to research and teach, to write and pursue our specific interests. He enabled our work with trade unions and progressive organisations – National Medical and Dental Association (NAMDA), Health Information Centre (HIC), Technical Advisory Group (TAG), Critical Health, and others. He greatly respected the research and analyses of thoughtful colleagues in Cape Town and Natal, and facilitated our collaboration.

He was always energetic and would, at times, literally jump up with enthusiasm. Yet he took a long-term and considered view; I remember him saying, more than once, *"slowly slowly… catch the monkey…"*. Rushing into things was neither wise nor strategic.

Alongside other mentors and teachers, I owe him a debt of gratitude. He impressed upon me the importance of using my privileged education and professional opportunities to do something concrete, however small, to address the inadequacies, inequities, and injustices of health in South Africa.

I remember Tony Davies with fondness and appreciation.

Anthony Zwi
UNSW Sydney, Australia



L–R: Deirdre Davies, Jim Phillips, Laetitia Rispel, Tony Davies, Karl von Holdt, Joyce Mogale, Sophie Kisting, David Rees
Photograph: Sophie Kisting

I have fond memories of Tony making all the effort to accompany doctors of the Industrial Health Research Group on our occupational health audits of asbestos mines in Kuruman in the Northern Cape, as the mines closed down in the 1990s. There were many workers with mesothelioma in the little hospital and lots more with other asbestos-related diseases. Tony, with his white coat and stethoscope in hand, demonstrated the *"fine late inspiratory crepitations in the axillary area"*, which he emphasised was pathognomonic of clinical asbestosis. Our audits of many asbestos mines highlighted the suboptimal medical surveillance and compensation of these miners. These audits formed the basis of our submission to the Leon Commission of Inquiry into Safety and Health in the Mining Industry in 1994, of which Tony was a panel member. The Inquiry was a key milestone for occupational health and safety in South Africa and formed the basis for the Mine Health and Safety Act promulgated in 1996.

Mohamed Jeebhay
Head of Occupational Medicine, University of Cape Town

Tony hired me in the National Centre for Occupational Health's epidemiology team in 1984 on account of reading a paper I wrote about the epidemiology of cholera, but with no formal training on the topic. Margo Becklake started the department while on sabbatical from Montreal and Anthony Zwi took over as head soon thereafter, and we just got on with our various projects. These included work on asbestos, silica dust, the poultry industry, chest radiographs of workers, occupational health services and the like. Others who joined around that time were Gill Nelson, Danuta Kielkowski, David Rees, Clifford Goldsmith, Eric Buch, Umesh Lalloo, and Rodney Erlich, all of whom still have illustrious careers in South Africa and abroad. Tony protected us from a very stiff bureaucracy, managed by Pretoria. Being based in Johannesburg may have had certain benefits, being slightly out of arms' reach from the top bureaucrats in Pretoria. Being in the research side, I was labelled *"amper 'n amptenaar"* [almost an official] by one of the administrators, which probably reflected Pretoria's view of all of us.

Freddy Sitas
UNSW Sydney, Australia



Adler Museum Christmas lunch, 2012. Back, L–R: David Sekgwele, Gilbert Singo. Front, L–R: Tony Davies, Rochelle Keene, Cheryl-Anne Cromie
Photograph: Rochelle Keene

Tony had an enormous impact on occupational health and safety – nationally, regionally and internationally. Similarly, he quietly had a major impact on my own journey in occupational health and I wish to share some of that. I first met Tony while doing a Master's degree at Wits University in the early 1990s. He provided input on occupational health in classes in Soweto and introduced the postgraduate class of medical doctors to the importance of the regular use of the ILO International Classification of Radiographs of Pneumoconioses. This set of X-rays, subsequently obtained from the ILO, became a mainstay in my future occupational medicine work.

As the Executive Director of the NCOH, subsequently the NIOH, for more than a decade, he steered it into a well-known and trusted centre of excellence for occupational health and safety, for research and for service provision to workers sick with occupational diseases. He almost unconditionally supported efforts to improve occupational health. On many occasions Tony readily agreed to personally join a group of us from the Industrial Health Research Group at UCT, at the request of the very active trade unions at the time, to visit various distant rural workplaces to audit medical surveillance programmes. In this context, we visited asbestos mines where we read the chest X-rays of workers, using the ILO international classification, even at night by the light of generators, to complete the work within a working week. Similarly, Tony joined us for the reading of chest X-rays of hundreds of asbestos cement workers, as per the ILO classification. He provided the full support of the NIOH to us to collaborate with a group of occupational hygienists from Sweden, who were running workshops for workers in southern Africa to explore international methods to protect workers from exposure to silica dust.



Wits Faculty of Health Sciences function, 2007. L–R: Alan Rothberg, Rochelle Keene, Tony Davies
Photograph: Rochelle Keene

In his public health lectures, he emphasised the great importance of dedicated support for PATHAUT, the database established in 1973 at the NIOH, which contains details of autopsies of deceased mineworkers. The annual reports are available in the public domain. The database provides surveillance data as well as information for teaching, training, and research.

Through his engagement in the Leon Commission, he – perhaps unknowingly – inspired many colleagues in the occupational health and safety sphere to commit to the importance of contributing to a better occupational and legislative environment in mining.

When I became the Executive Director at the NIOH, he was a regular and trusted visitor, an inspirational mentor and a father-figure. Always ready with great advice, copies of the latest interesting occupational health and safety publications, which he marked-up for easy reference, and some snippet of news which invariably made one laugh.

We will fondly remember his inspirational spirit, his inclusive approach to occupational health and safety, his conviction that a better world of work is possible, and his beautiful collaboration with Deirdre amongst the men, women, and families in asbestos mining.

Hamba Kahle, Tony and Deirdre.

Sophie Kisting
Former NIOH Executive Director

I first met Tony in 1994, when he was Director of the NIOH. I had been pointed in his direction by the National Union of Mineworkers to learn about the epidemic of asbestos-related disease in South Africa. The case against Cape plc lasted nine years and was fraught and unpleasant, with Tony also being subjected to unfair personal criticism by Cape's lawyers for his passionate commitment to the rights and health of workers. His expertise, encouragement, and unwavering support was crucial to the case and remained steadfast throughout.

His advice and efforts throughout the gold miners' silicosis litigation from 2004 to 2016 were equally invaluable. He was patient and generous, spending a huge amount of his time at the NIOH and through written notes, explaining medical and technical concepts to me and my colleagues, and drawing our attention to important historical evidence.

He was highly principled and fearless in standing up for justice and redress for workers, and for irresponsible companies to be held accountable. I witnessed first-hand his kindness in his treatment of workers – he and Deidre spending months of their own time, annually, in Limpopo, examining and helping sick miners secure desperately needed compensation. On one occasion when I stayed there with them in the early days, I had started tucking into supper and had to abruptly put down my fork when I noticed Tony saying grace. I realised from then that his commitment to people was motivated by his deep, discreetly held, faith, which I did not share but greatly respected. Tony was a dedicated doctor and friend – and a truly inspirational man.

Richard Meeran
Partner, Joint Head of International & Group Litigation, Leigh Day

I have a lot to thank Tony for. If it wasn't for him, I would not have been an occupational health epidemiologist. He hired me, fresh out of my Honours degree, to work with Margot Becklake in the Epidemiology Unit of the NCOH, together with several others in the mid-1980s. He called us *"bright young things"* and watched with pride as we flourished in our individual careers over the next decades. Many of those people are still my colleagues today and I know that they, too, remember the early NCOH days with some nostalgia. Tony was kind, generous, supportive, and totally committed to improving workers' health, way beyond his retirement in 2015. I visited him and Deirdre in late 2023, just a few months before he passed away. His mind was still sharp, his laugh was still loud, and his interest in what was happening in my and others' lives was genuine. My last sight of him was walking down the long driveway towards his house – a proud and deeply good man.

Gill Nelson
Wits School of Public Health



Tony Davies retirement function, 2015. L–R: David Rees, Charles Feldman, Steve Tollman, Tony Davies, Gill Nelson, Haroon Saloojee
Photograph: Gill Nelson

U-MASK™

PROTECT YOUR WORKFORCE WITH THE ULTIMATE IN PARTICLE PROTECTION

Engineered for maximum performance and comfort in every environment

- ✓ **Comprehensive Compliance:** Ensure your workplace meets regulatory standards effortlessly with masks that comply with international safety and quality certifications.
- ✓ **Perfect Fit:** Experience all-day comfort with a snug fit that conforms to all face shapes, Available in three sizes: small, medium, and large for a personalized fit.
- ✓ **Absolute Protection:** Our advanced filtration technology ensures that even the smallest particles can't penetrate, giving you peace of mind to focus on your job without worry.
- ✓ **Onsite User Product Training:** Maximize safety and efficiency with our onsite user training, ensuring your team knows how to properly use and maintain their masks for optimal protection.



9200 | FFP2
PREMIUM



9201 | FFP2
PREMIUM VALVE



9202 | FFP2
PREMIUM CARBON VALVE



9300 | FFP3
PREMIUM VALVE

NRCS

TÜVRheinland CERTIFIED
Management System ISO 9001:2015
www.tuv.com ID 9000000719

A PRODUCT OF USP™
UNIVERSAL SAFETY PRODUCTS

Unlocking the transformative potential of ISO 23875 for mine site culture and operator air quality

Part 2

Jeffrey L Moredock: Project Lead: ISO 23875, Sy-Klone International, e-mail: Jeff.Moredock@sy-klone.com

ABSTRACT

The mining industry is characterised by its multifaceted challenges. Ensuring regulatory compliant air quality within operator enclosures has been a longstanding concern. In response to this critical need, the International Standards Organisation (ISO) Technical Committee- (TC-) 82 Mining developed ISO 23875:2021, which provides a comprehensive framework for air quality control system integration that prioritises simplicity, practicality, and stakeholder involvement. This article explores the technical intricacies of ISO 23875, shedding light on its benefits, strategies for stakeholder education, and the transformative potential it holds for mine site culture.

INTRODUCTION

Part 1 of this three-part series explored the genesis of ISO 23875, support by research, and critical milestones on the path to its development. In this second article, we explore ISO 23875's rationale and structure as a life-cycle standard, designed to promote continuous compliant air quality in operator enclosures. We demonstrate how its unified approach is designed to permanently change mine site culture to ensure better operator air quality.

Understanding operator enclosure air quality

Understanding operator enclosures and their impact on air quality has required extensive research and exploration. The broader ecosystem of operator enclosure air quality management includes the heating, ventilation and air conditioning (HVAC) system, cab seal integrity, intake air, recirculation air filtration, pressurisation, and real-time monitoring – all of which are indispensable for complying with legislated air quality standards.[1]

Striking a balance: encouraging innovation without compromising standards

The imposition of strict engineering controls risks stifling innovation and deterring market participation. Therefore, ISO 23875 adopts a balanced approach of fostering innovation while ensuring adherence to critical specifications.[2] Embedding performance requirements[3] into the Standard not only encourages stakeholder engagement, but also catalyses the evolution of effective solutions.

Validation and certification

Validation of system design is of paramount importance and necessitates accurate and easily understandable performance tests.[4] These tests, designed to be conducted in field conditions, evaluate crucial factors such as carbon dioxide (CO_2) concentration, pressurisation capability, dust removal efficacy, and seal integrity. Self-certification under ISO 17050[5] – the normative reference in ISO 23875 – empowers equipment manufacturers and retrofitters to validate cab air quality performance for the end user, thereby establishing a baseline for comparison and maintenance.

Driving maintenance through performance metrics

The robust documentation process required by the Standard,[6] complemented by accurate installation records and performance metrics, facilitates informed decision-making regarding maintenance activities. Objective verification of work ensures compliance with best practices, thereby enhancing the longevity and effectiveness of air quality systems.

Integrating ISO 23875 into auditable processes

Incorporating ISO 23875 into ISO 9001[7] auditable processes enhances accountability and transparency within mining operations. Regular audits not only reinforce compliance but also foster behavioural change, aligning organisational practices with industry best practices.

The role of stakeholder education

Comprehensive stakeholder education is central to the success of ISO 23875 because it fosters a deep appreciation for the importance of air quality, beyond mere compliance to the Standard. The International Society of Environmental Enclosure Engineers (ISEEE)[8] develops technical content and standardised stakeholder education materials in collaboration with mining stakeholders. These materials are accessible to, and implemented at, mining sites and can be made part of the site occupational health and safety management system.[9] Materials include tailored educational resources for operators, maintenance technicians, and management. These resources seek to change mine site culture through the adoption and implementation of the Standard.

The ISEEE provides the Advanced Cab Theory Workshop (ACTW)[10] for site professionals and technicians who desire to be subject matter experts on operator enclosure air quality systems. A 2023 ACTW graduate and site occupational hygienist had the following to say about the impact of the course:

> *"We have started doing ISO 23875 performance testing and got the protocol dialled in. The maintenance and operations staff are coming to me to test cabs . . . Maintenance leadership trusts my word and recommendations and we are getting this gear up to snuff, everyone is talking ISO 23875 as the Gospel, the standard to meet as the right thing to do, no questions asked . . . You would be impressed with the assessments we are doing and the technical level of detail coming out . . . I am so glad I went to the ISEEE ACTW. I am figuring these systems out and it all makes sense, once you start doing it in practice, the whole picture comes together, rather than just looking at data or saying HEPA and cab pressure are the only answer."*

The ACTW will be offered for Professional Development Credit (PDC) prior to the start of the Southern African Institute for Occupational Hygiene (SAIOH) conference in Botswana later this year. Those interested in attending the ACTW should note their interest on the conference registration form.

Economic benefits of compliance

Beyond regulatory obligations, adherence to ISO 23875 yields tangible economic benefits. Enhanced worker productivity, reduced machine warranties, and reduced maintenance costs[11] underscore the financial incentives of prioritising air quality. Compliance also influences human resource recruitment and retention, with organisations that embrace compliant air quality being likely to have lower staff turnover and improved recruitment through positive social media influence.[12]

Addressing legal and moral imperatives

Recent class action suits[13-15] underscore the urgency of promoting worker health and documenting air quality improvement efforts. ISO 23875 provides a structured pathway for mine operators to demonstrate compliance, mitigate risks, and fulfil their ethical responsibilities towards worker wellbeing.

CONCLUSION

ISO 23875 epitomises collaborative industry efforts to enhance operator enclosure air quality. With its emphasis on simplicity, stakeholder involvement, and practicality, it offers a transformative framework that transcends regulatory compliance to deliver tangible benefits for all stakeholders. Embracing ISO 23875 can propel the mining industry towards a safer, healthier, and more sustainable future.

In the third and final article of this series, we will examine what a successful ISO 23875 implementation looks like from the perspective of the various stakeholders in operator enclosure air quality.

REFERENCES

1. ISO 23875:2021/Amd 1:2022 Mining air quality control systems for operator enclosures. Performance requirements and test methods.
2. ISO 23875:2021/Amd 1:2022 Mining air quality control systems for operator enclosures. Performance requirements and test methods. Clause 4.2 – Engineering design.
3. ISO 23875:2021/Amd 1:2022 Mining air quality control systems for operator enclosures. Performance requirements and test methods. Clause 4.1 – Performance requirements.
4. ISO 23875:2021/Amd 1:2022 Mining air quality control systems for operator enclosures. Performance requirements and test methods. Clause 5.1.3 – Test methods.
5. ISO 17050-1, Conformity assessment – Suppliers declaration of conformity. Part 1: General requirements.
6. ISO 23875:2021/Amd 1:2022 Mining air quality control systems for operator enclosures. Performance requirements and test methods. Clause 6 – Operation and maintenance instruction.
7. ISO 9001:2015 Quality management systems requirements.
8. The International Society of Environmental Enclosure Engineers (ISEEE). www.ise3.com.
9. ISO 23875:2021/Amd 1:2022 Mining air quality control systems for operator enclosures. Performance requirements and test methods. Annex B (informative): Recommendations for the operational integration of this document.
10. ISEEE Advanced Cab Theory Workshop. Available from: https://www.ise3.com/advancedcabtheoryworkshop (accessed 18 February 2024).
11. 11 Tips to reduce heavy equipment maintenance costs. Available from: https://www.warrencat.com/news/tips-to-reduce-heavy-equipment-maintenance-costs/#tips (accessed 2 June 2024).
12. Mullard Z. The application of social media in the mining industry [dissertation]. Vancouver: University of British Columbia; 2010. Available from: https://open.library.ubc.ca/media/stream/pdf/24/1.0071344/1 (accessed 2 June 2024).
13. Gold miner silicosis litigation (re So. Africa). Business & Human Rights Resource Centre; undated. Available from: https://www.business-human-rights.org/en/latest-news/gold-miner-silicosis-litigation-re-so-africa/ (accessed 2 June 2024).
14. Stoddard E, Aruo P. South Africa miners reach 5 billion rand silicosis settlement with mining companies. Reuters; 2028 May 3. Available from: https://www.reuters.com/article/idUSKBN1I41D8/ (accessed 2 June 2024).
15. Arnold T. South African bishops file class-action suit against mining company over black lung disease. Catholic News Agency; 2023 August 18. Available from: https://www.catholicnewsagency.com/news/255131/south-african-bishops-file-class-action-suit-against-mining-company-over-black-lung-disease (accessed 2 June 2024).

Occupational & Primary Health

Healthy employees Successful business

With over 28 years' experience, we provide industry-leading **occupational health solutions including medical surveillance and primary care** to enhance your business' financial health. We have the expertise to engage and guide your business, to successfully integrate your workplace wellness requirements by making sure of the following:


Risk insights and management are reported


Employees are declared fit for duty through a medical


All occupational health legal requirements are met successfully


Early risk identification and management measures are put in place


Mobile and walk-in clinics, where medical surveillance is provided, are present


Injury-on-duty and COID claims are effectively managed


Chronic conditions are monitored

marketing.wellness@momentum.co.za

momentumhealthsolutions.co.za/occhealth

Momentum Wellness is a division of Momentum Health Solutions (Pty) Ltd, part of Momentum Metropolitan Holdings Limited.

momentum wellness

Rand Mutual Assurance putting a spotlight on safety and prevention in the workplace

The inaugural Prevention Awards, presented by Rand Mutual Assurance (RMA) with pride, recently honoured innovation, hard effort, and success in worker health, safety, and wellness in the metals industry. This esteemed occasion demonstrated RMA's and its Metals clients' persistent dedication to establishing safer and better work conditions for nearly 700 000 workers across organisations.

Prominent individuals graced the occasion, including the Chief Inspector of the Department of Employment and Labour, the Acting Commissioner of the Compensation Fund, our Metals sector stakeholders, and representatives from numerous labour and employer unions. Their presence served as a reminder of the need for cooperation and shared accountability in promoting workplace safety, health, and wellness.

The awards honoured outstanding companies, employees, and initiatives that have shown originality and calibre in preventative efforts. The success of last year's Prevention Conference was followed by this year's awards, underscoring RMA's dedication to cooperation and ongoing development.

Since its launch in 2022, RMA's Prevention Programme has expanded rapidly, involving over 50 companies across approximately 135 sites, and having a positive influence on about 24 000 lives. Notable accomplishments include companies who have demonstrated a reduction in their disabling injury frequency rates (DIFRs) in less than a year.

"Our objective has always been clear: a 30% decrease in the incidence rate within the Metals industry by 2030", said Mandla Shezi, Group Chief Executive Officer (CEO) of RMA. *"With the dedication and collaborative spirit of everyone involved, we are confident in achieving this target."*

The RMA Top Prevention Award, the Best Prevention Campaign Award, and the Rising Star of the Year Award were among the seven distinct categories whose recipients were honoured during the evening. Every award emphasised the value of persistent work and dedication to workplace safety.

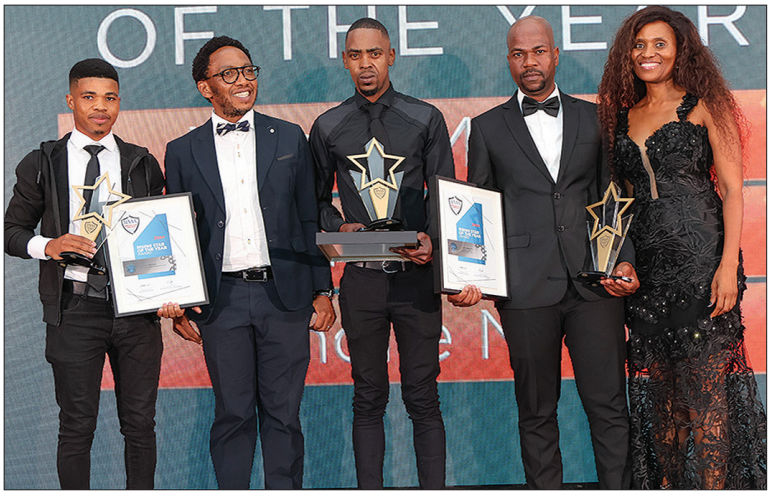
The CEO stressed, *"Collaboration is the cornerstone of our success as RMA looks to the future. We all have a responsibility to work together to create a safer workplace. Let's make an effort to be more and do more to make sure that every worker gets home safely."*

A moving message was delivered as the event came to an end: *"Nobody goes to work to die. Workplaces that are safer for both employees and managers are more effective and productive. It benefits everyone equally."*

For more information on the RMA Prevention Programme, please contact rmaprevention@randmutual.co.za.



Prevention Champion Award
Photograph: courtesy of RMA



Rising Star Award
Photograph: courtesy of RMA



Top Prevention Award
Photograph: courtesy of RMA

RMA | **COID**

Preventing occupational injuries and diseases; ensuring livelihoods

PREVENTION | OHS | FINANCIAL WELLNESS



Our PREVENTION PROGRAMME

is a blend of Occupational Health and Safety (OHS) and financial wellness solutions developed in line with leading Occupational Health and Safety (OHS) and Financial Wellness standards.

The programme is designed to complement existing employer safety programmes and enhance the drive toward the overall physical and financial wellness of employees within our Class Metals (Iron, Steel, Artificial Limbs, Galvanising, Garages, Metals, etc.) client base.

Ultimately a reduced incident rate ensure healthy and stable families.

Taking care of lives **since 1894**

For more information, contact us:

Tel: 0860 646 274
Email: rmaprevention@randmutual.co.za
www.randmutual.co.za

RMA
Caring | Compassionate | Compensation

Rand Mutual Admin Services (Pty) Ltd is an authorised Financial Services Provider (FSP No. 46113) licensed with the Financial Service Conduct Authority and forms part of the Rand Mutual Group of Companies

Understanding z-scores in spirometry using the Vitalograph Spirotrac 6 software and ViBAC® Bacterial Viral Filter: a South African occupational health perspective

Matsobane Andries Shiburi: National Product Manager, Cardiac and Respiratory Diagnostic Devices, SSEM Mthembu Medical (Pty)Ltd
e-mail: andriess@ssemmthembu.co.za

INTRODUCTION

Spirometry is a critical tool in occupational health (OH) for assessing lung function and diagnosing respiratory conditions. The American Thoracic Society (ATS) and the European Respiratory Society (ERS) have established guidelines for interpreting spirometry results, with the latest updates emphasising the use of z-scores. In South Africa, utilising these standards, along with tools like the Vitalograph Spirotrac 6 software used with the Vitalograph Pneumotrac 6800 Spirometer, can enhance the accuracy and relevance of spirometry in OH clinics.

WHAT ARE Z-SCORES IN SPIROMETRY?

A z-score, also known as a standard score, indicates how many standard deviations a measurement is from the mean of a reference population. In spirometry, z-scores provide a more nuanced interpretation of lung function compared to traditional percent predicted values.

LATEST ATS/ERS SPIROMETRY UPDATE

The ATS/ERS 2019 update introduced the use of the Global Lung Initiative (GLI) reference equations, which provide age, sex, height, and ethnicity-specific reference values. This is particularly relevant in South Africa, where a diverse population requires tailored reference standards for accurate spirometry interpretation.

HOW TO INTERPRET Z-SCORES

Figure 1 shows the results of a spirometry test. z-scores are interpreted as follows:

- z-score of 0: represents the mean or average lung function for the reference population
- Negative z-scores: indicate values below the mean. For example, a z-score of -1.0 means the lung function is one standard deviation below the average
- Positive z-scores: indicate values above the mean. For example, a z-score of 1.0 means the lung function is one standard deviation above the average



Matsobane Andries Shiburi and Xolani Marcus Mthabela demonstrating the equipment
Photograph: Lebogang Maseko

Dynamic Spirometry

Parameter	Units	Pre-Bronchodilator Result	LLN	z-score	% Pred	Post-Bronchodilator Result	z-score	% Pred	% Chg
FVC	L	7.49	4.26	2.40	135	7.48	2.40	135	0
FEV_1	L	5.17	3.23	1.55	121	5.14	1.50	121	-1
FEV_1/FVC	%	69	65	-1.16		69	-1.15		0
FET	s	12.03	6.00	---		14.63	---		22

Reference: GLI 2017 Test Quality: Pre BD: FEV_1 = A, FVC = A Post BD: FEV_1 = B, FVC = A

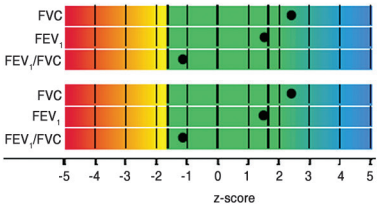


Figure 1. Spirometry results with pre- and post-bronchodilator z-scores

Clinical interpretation

- Z-score between -1.64 and +1.64: considered within normal limits
- Z-score below -1.64: suggests below-average lung function, potentially indicating a restrictive or obstructive pattern, depending on other spirometry parameters
- Z-score above +1.64: suggests above-average lung function, though less common and often of less clinical concern

USING VITALOGRAPH SPIROTRAC 6 SOFTWARE

The Vitalograph Spirotrac 6 software simplifies the collection and interpretation of spirometry data. Here's how it integrates z-scores:

1. Data collection

- Spirotrac 6 captures spirometry data through various tests such as forced vital capacity (FVC) and forced expiratory volume in one second (FEV_1).
- Forced vital capacity measures the total volume of air a person can forcibly exhale after taking the deepest breath possible.
- Forced expiratory volume in one second measures the volume of air exhaled in the first second of the FVC manoeuvre.
- Other tests include peak expiratory flow (PEF) and forced expiratory flow (FEF) 25–75%. *There are over 60 parameters on Spirotrac 6, which can be customised on both the software view and report based on your preference.*

2. Setting up

- Calibration: Ensure the spirometer is calibrated according to the manufacturer's guidelines. In this example, the spirometer calibration was within a 2.5% tolerance.
- Patient data entry: Enter the patient information including age, sex, height, and ethnicity to utilise the correct reference values.

3. Performing the test

- Preparation: Ensure the patient is seated comfortably and understands the procedure. Instruct him/her to use a nose clip to prevent air from escaping through the nose. Use a ViBAC Bacterial Viral Filter with a bacterial filtration efficiency of 99.992%, manufactured by SSEMBU for SSEM Mthembu Medical (Pty) Ltd, to ensure patient safety, end user safety, and infection control within the clinic, which reduces cross contamination.
- Environmental conditions: Conduct the test in an air-conditioned, well-ventilated room with a temperature of 21 °C, humidity of 38%, and barometric pressure of 861 hPa, as per spirometry standards.
- Execution: The patient performs the FVC manoeuvre, exhaling forcefully into the spirometer as coached by the end user. Repeat the test at a minimum of three efforts and a maximum of eight efforts to ensure reproducibility. In the example in Figure 2, the patient performed four efforts, with one effort invalidated and deleted by the end user due to a detected cough, due to usability error.

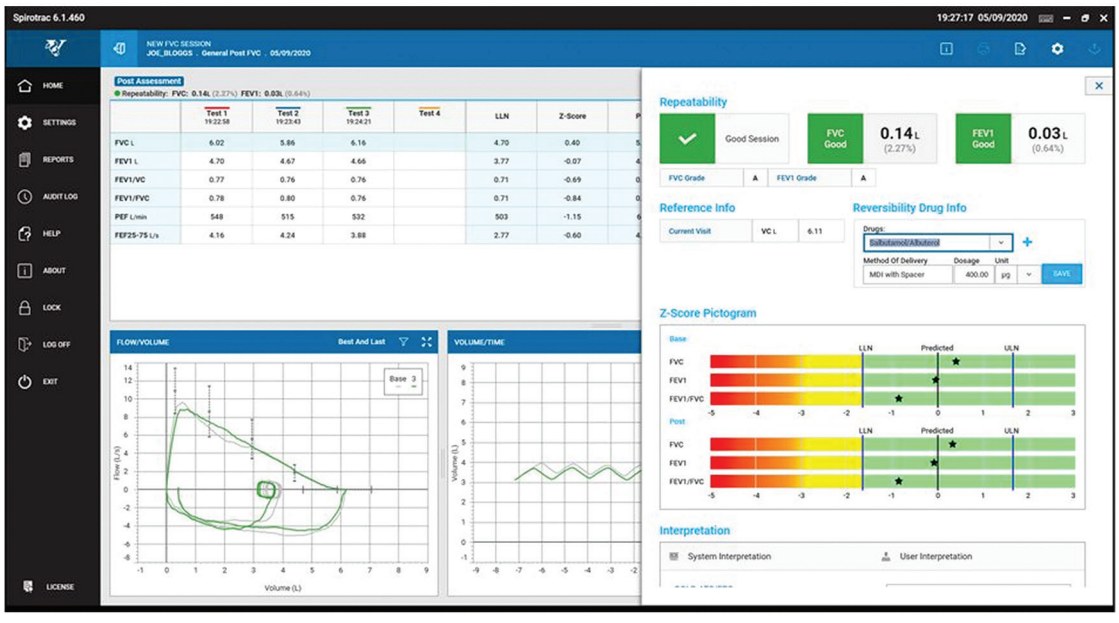


Figure 2. Spirotrac 6 software testing and results window

4. Data capture and analysis

- Recording: Spirotrac 6 captures and records the test results, displaying real-time flow-volume and volume-time curves.
- Automated calculations: The software automatically calculates key parameters like FVC, FEV_1, PEF, FEF 25–75%, and more.

5. Interpreting z-scores

- GLI reference equations: Spirotrac 6 uses GLI reference values, which are tailored for diverse populations, including those in South Africa.
- Z-score calculation: The software provides z-scores for each parameter, indicating how the patient's results compare to the reference population.

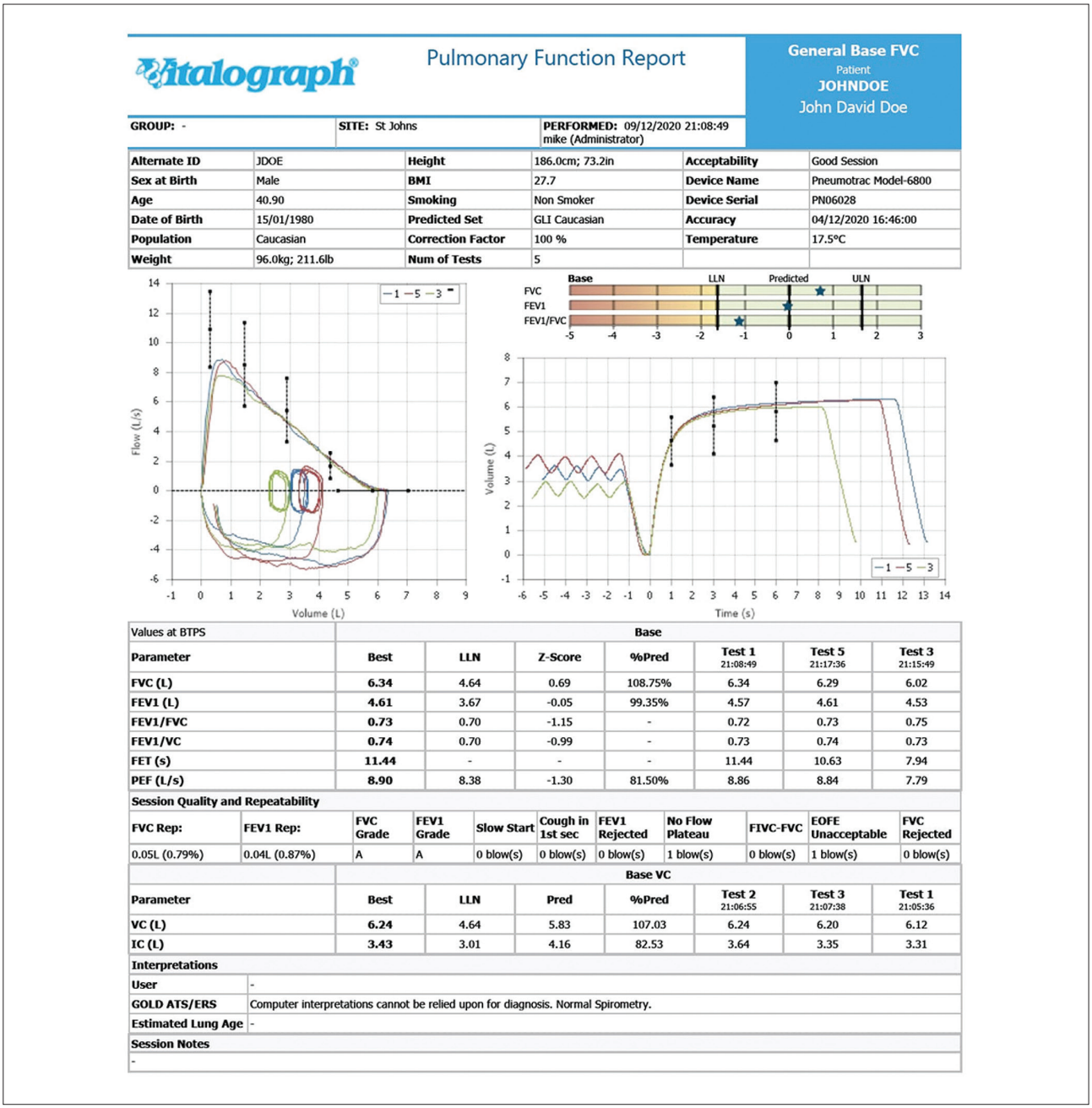
6. Generating reports

As shown in Figure 3, Spirotrac 6 generates comprehensive and detailed reports that include spirometry results, z-scores, and interpretive comments. The reports can be customised to highlight critical findings and recommendations for follow-up or further testing.

PRACTICAL APPLICATION IN SOUTH AFRICAN OH CLINICS

Using Spirotrac 6 in a South African OH setting involves the following steps:

1. Baseline or pre-testing: Establish baseline lung function for new employees to identify pre-existing conditions and ensure they are fit for their roles.
2. Periodic monitoring: Conduct regular spirometry tests to monitor any changes in lung function, particularly for workers exposed to respiratory hazards.
3. Interpreting results: Use z-scores to detect early signs of occupational lung diseases, enabling timely interventions.
4. Documentation and follow-up: Maintain detailed records of all spirometry tests and follow up with any workers showing abnormal results, for further evaluation and management.



Vitalograph

Pulmonary Function Report

General Base FVC
Patient
JOHNDOE
John David Doe

GROUP: -		**SITE:** St Johns		**PERFORMED:** 09/12/2020 21:08:49 mike (Administrator)	
Alternate ID	JDOE	**Height**	186.0cm; 73.2in	**Acceptability**	Good Session
Sex at Birth	Male	**BMI**	27.7	**Device Name**	Pneumotrac Model-6800
Age	40.90	**Smoking**	Non Smoker	**Device Serial**	PN06028
Date of Birth	15/01/1980	**Predicted Set**	GLI Caucasian	**Accuracy**	04/12/2020 16:46:00
Population	Caucasian	**Correction Factor**	100 %	**Temperature**	17.5°C
Weight	96.0kg; 211.6lb	**Num of Tests**	5		

Values at BTPS	Base						
Parameter	**Best**	**LLN**	**Z-Score**	**%Pred**	**Test 1** 21:08:49	**Test 5** 21:17:36	**Test 3** 21:15:49
FVC (L)	**6.34**	4.64	0.69	108.75%	6.34	6.29	6.02
FEV1 (L)	**4.61**	3.67	-0.05	99.35%	4.57	4.61	4.53
FEV1/FVC	**0.73**	0.70	-1.15	-	0.72	0.73	0.75
FEV1/VC	**0.74**	0.70	-0.99	-	0.73	0.74	0.73
FET (s)	**11.44**	-	-	-	11.44	10.63	7.94
PEF (L/s)	**8.90**	8.38	-1.30	81.50%	8.86	8.84	7.79

Session Quality and Repeatability									
FVC Rep:	**FEV1 Rep:**	**FVC Grade**	**FEV1 Grade**	**Slow Start**	**Cough in 1st sec**	**FEV1 Rejected**	**No Flow Plateau**	**FIVC-FVC**	**EOFE Unacceptable**	**FVC Rejected**
0.05L (0.79%)	0.04L (0.87%)	A	A	0 blow(s)	0 blow(s)	0 blow(s)	1 blow(s)	0 blow(s)	1 blow(s)	0 blow(s)

	Base VC						
Parameter	**Best**	**LLN**	**Pred**	**%Pred**	**Test 2** 21:06:55	**Test 3** 21:07:38	**Test 1** 21:05:36
VC (L)	**6.24**	4.64	5.83	107.03	6.24	6.20	6.12
IC (L)	**3.43**	3.01	4.16	82.53	3.64	3.35	3.31

Interpretations	
User	-
GOLD ATS/ERS	Computer interpretations cannot be relied upon for diagnosis. Normal Spirometry.
Estimated Lung Age	-
Session Notes	
-	

Figure 3. Spirometry final report generated by Spirotrac 6 software

EXAMPLE CASE STUDY

Patient profile

- Age: 35 years
- Sex: Male
- Ethnicity: Non-Caucasian
- Height: 170 cm
- Weight: 69 kg
- Occupation: Miner in Rustenburg
- Test: Pre-bronchodilator spirometry

Environmental conditions

- Room Temperature: 21 °C
- Humidity: 38%
- Barometric Pressure: 861 hPa
- Filter used: ViBAC Bacterial Viral Filter with 99.992% bacterial filtration efficiency (BFE)

Spirometry results

- FVC: 3.5 L (predicted: 4.0 L)
- FEV_1: 2.8 L (predicted: 3.6 L)
- FEV_1/FVC ratio: 0.8 (predicted: 0.9)
- Efforts: 4 (one effort deleted due to cough detection by Spirotrac 6)

Interpretation using z-scores

1. FVC z-score:

- Reference FVC for a non-Caucasian male of height 170 cm: 4.0 L
- Measured FVC: 3.5 L
- Standard deviation (SD) for FVC: 0.5 L
- z-score calculation: (3.5–4.0)/0.5 = -1.0

2. FEV1 z-score:

- Reference FEV_1 for a non-Caucasian male of height 170 cm: 3.6 L
- Measured FEV_1: 2.8 L
- Standard deviation (SD) for FEV_1: 0.4 L
- z-score calculation: (2.8–3.6)/0.4 = -2.0

3. FEV1/FVC ratio:

- Reference FEV_1/FVC ratio: 0.9
- Measured ratio: 0.8
- Interpretation: ratio is within the lower limit of normal, indicating a mild obstruction

Clinical interpretation

- The FVC z-score of -1.0 is within normal limits.
- The FEV_1 z-score of -2.0 indicates below-average lung function, suggesting mild obstruction.
- The FEV_1/FVC ratio further supports the presence of an obstructive pattern.

Recommendations

- The patient shows mild pulmonary obstruction, which may affect his ability to work in the underground mining environment.
- A detailed pulmonary evaluation and consideration of occupational adjustments to prevent further respiratory compromise is recommended.
- Regular spirometry monitoring is advised to track any changes in lung function.

CONCLUSION

The Vitalograph Spirotrac 6 software, integrated with z-scores and aligned with the latest ATS/ERS guidelines and GLI reference values, emerges as an indispensable asset for OH professionals in South Africa. This advanced tool not only ensures precise and standardised spirometry testing, but also empowers clinicians to detect early signs of respiratory issues, guide targeted interventions, and ultimately safeguard the respiratory health of workers in diverse occupational environments. Its contribution extends beyond diagnostics, serving as a cornerstone in promoting a culture of proactive respiratory care within the workplace.

Disclaimer: The information provided in this article is intended for informational purposes only. It is not a substitute for professional medical advice, diagnosis, or treatment. Readers are advised to consult qualified healthcare professionals.

BIBLIOGRAPHY

1. Graham BL, Steenbruggen I, Miller MR, Barjaktarevic IZ, Cooper BG, Hall GL, et al. Standardization of Spirometry 2019 Update. An Official American Thoracic Society and European Respiratory Society Technical Statement. Am J Respir Crit Care Med. 2019; 200(8):e70-e88. doi: 10.1164/rccm.201908-1590ST.

2. Quanjer PH, Stanojevic S, Cole TJ, Baur X, Hall GL, Culver BH, et al. ERS Global Lung Function Initiative. Multi-ethnic reference values for spirometry for the 3–95-yr age range: the global lung function 2012 equations. Eur Respir J. 2012:1324-1343. doi: 10.1183/09031936.00080312.

3. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, et al. Standardisation of spirometry. Eur Respir J. 2005; 26(2):319-338. doi: 10.1183/09031936.05.00034805.

4. Vitalograph. Spirotrac 6 Model 7000. Instructions for use. Available from: https://www.vitalograph.jp/files/07790_3_Spirotrac_6_IFU_SCREEN.pdf (accessed 28 June 2024).

5. Stanojevic S, Wade A, Stocks J, Hankinson J, Coates AL, Pan H, et al. Reference ranges for spirometry across all ages: a new approach. Am J Respir Crit Care Med. 2008; 177(3):253-260. doi: 10.1164/rccm.200708-1248OC.

6. Pellegrino R, Viegi G, Brusasco V, Crapo RO, Burgos F, Casaburi R, et al. Interpretative strategies for lung function tests. Eur Respir J. 2005; 26(5):948-68. doi: 10.1183/09031936.05.00035205.

7. Hankinson JL, Odencrantz JR, Fedan KB. Spirometric reference values from a sample of the general U.S. population. Am J Respir Crit Care Med. 1999; 159(1):179-187. doi: 10.1164/ajrccm.159.1.9712108.

8. Louw SJ, et al. Lung function reference values in South African men aged 15–64 years. South African Medical Journal. 1996; 86(4):312-319.

9. Townsend MC and the Occupational and Environmental Lung Disorders Committee. Spirometry in the occupational health setting – 2011 update. J Occup Environ Med. 2011; 53(5):569-584. doi: 10.1097/JOM.0b013e31821aa964.

10. Gold WM, Koth LL. Pulmonary Function Testing. Murray and Nadel's Textbook of Respiratory Medicine. 2016:407-435.e18. doi: 10.1016/B978-1-4557-3383-5.00025-7.

11. Knudson RJ, Slatin RC, Lebowitz MD, Burrows B. The maximal expiratory flow-volume curve. Normal standards, variability, and effects of age. Am Rev Respir Dis. 1976; 113(5):587-600. doi: 10.1164/arrd.1976.113.5.587.

Upgrade Your Medical Practice Equipment

Riester-Vitalograph

Special Combo Offer

ALL for ONLY R60,500 excl.VAT *

- **Vitalograph Micro** Entry Level Spirometer
- **Riester RBP-100** Clinical Grade Blood Pressure Machine
- **Riester Duplex 2.0** Stethoscope
- **Laptop & Printer**





Micro Spirometer includes:
A box of 50 filters, a calibration syringe and a weather station



RBP-100 Blood Pressure Machine includes:
Standard and large adult cuff and mobile stand with accessory basket

*** Offer valid till 31 December 2024**

Johannesburg 011 430-7000
Cape Town 021 983-1300
East London 043 727-1241
Durban 031 266-5518
Gqeberha 041 363-4928
Bloemfontein 051 448-2183
Sharecall 086 111 7736
Website www.ssemmthembu.co.za

The Pulse of Technology

SSEM Mthembu MEDICAL

The Southern African Tuberculosis and Health Systems Support (SATBHSS) project achievements

Norman Khoza: Senior OHS specialist: African Union Development Agency (AUDA-NEPAD); SAIOH Regional Coordinator, 2024
e-mail: normank@nepad.org

Background

The African Union Development Agency - New Partnership for Africa's Development (AUDA-NEPAD) regional Implementation Completion Report (ICR) provides a comprehensive evaluation of the Southern African Tuberculosis and Health Systems Support (SATBHSS) project, covering all aspects in the main ICR, which will be published in a special issue of *Occupational Health Southern Africa* in August this year. This summary highlights key achievements, challenges, and lessons from the project.

The SATBHSS project supported innovative and progressive interventions over the seven years of implementation across Lesotho, Malawi, Mozambique, and Zambia. Regional leadership was provided by the AUDA-NEPAD and the East, Central and Southern Africa Health Community (ECSA-HC), with the AUDA-NEPAD taking leadership on occupational health and safety (OHS) interventions. The project development objectives (PDOs) were to i) improve coverage and quality of tuberculosis (TB) control and occupational lung disease services in targeted geographic areas of the participating countries, ii) strengthen regional capacity to manage the burden of TB and occupational diseases, and iii) strengthen country-level and cross-border preparedness and responses to disease outbreaks (this PDO was added during the 2020 financing meeting). The PDO was technically sound and highly relevant for the project.

Achievements

Several achievements have been registered across the region, challenges have been documented, and lessons have been learned during the implementation of the project. Summaries are presented in the report from the huge amount of data generated. The voices of the countries and partners highlight the achievements made towards ending TB and occupational lung diseases, using regional and country approaches.

The project has strongly and successfully supported countries with regard to reviews of OHS legislation/regulations, and human capacity development to bring issues of OHS to the top of public health intervention agendas in the region. The SATBHSS project has improved occupational and public health systems in project countries. Improvements include equipment, infrastructure, policies, and skills, such as the constructed and renovated OHS clinics in Lesotho, Malawi, Mozambique, and Zambia; procurement of GeneXpert machines, digital X-ray machines, occupational health and hygiene sampling equipment, and occupational hygiene and microbiology analysis equipment; the Centre of Excellence in Occupational Health and Safety (CoE-OHS); the OHS baseline study; reviewed OHS policies; and capacity development of several government officials. The project has been a success in the four project countries and needs to be scaled up to include the entire continent. The few project achievements listed below, and Figures 1–4, provide more information.

Key project achievements

- Regional occupational health and hygiene monitoring equipment guidelines that list all OHS, environmental, and hygiene monitoring equipment were compiled.
- An OHS train-the-trainer manual was produced (a regional tailor-made training manual for government inspectors and other government officials).
- Use of the International Labour Organization International Classification of Radiographs of Pneumoconioses (ILO-ICRP) to aid in the training of occupational medical doctors and radiologists in the correct diagnosis of occupational lung diseases such as silicosis, TB, etc. was implemented.
- Under the project's technical support, one OHS Act was passed in Lesotho, and one Mines and Minerals Act in Malawi was reviewed and passed into law, with a notable inclusion of artisanal small-scale mining.



Figure 1. Solwezi Occupational Health Services Centre (OHSC), Zambia
Photograph: Norman Khoza



Figure 2. OHS and TB mobile truck, Zambia
Photograph: Norman Khoza



Figure 3. Children's Drug-Resistant Tuberculosis (DR-TB) Centre of Excellence in Matola, Mozambique
Photograph: Norman Khoza

- COVID-19 regional interventions led to the publication of six workplace-specific guidelines, which were widely used by member states to develop their own national guidelines.
- Local and regional training in OHS was provided for occupational health nurses, medical doctors, hygienists, and health and safety inspectors.
- Several occupational health and safety laws, regulations, guidelines, and standard operating procedures have been developed and reviewed, and are waiting for in-country approval processes so that they can be passed into law.

Challenges

Like all projects, the SATBHSS project had challenges that impeded implementation, including i) procurement-related difficulties that resulted in delays in completion of civil works and equipment installation; ii) inefficiencies in government procedures in some countries, which resulted in delays in staff recruitment, release of funds, and legislative approvals; iii) inadequate sustainability plans and underfunding of national programmes; and iv) exogenous factors (e.g. the COVID-19 pandemic, cyclones, and disease outbreaks).

Lessons and recommendations

The SATBHSS project has been instrumental in ensuring that learning can be applied to future regional health projects. Countries adopting and finalising the remaining OHS country legislations



Figure 4. Occupational noise sound booth, Ressano Garcia OHSC, Mozambique
Photograph: Norman Khoza

and policies will accelerate institutionalisation and financing of OHS interventions. Continuous mentorship is needed to provide technical support in OHS implementation and management. Countries need to develop means of funding the maintenance of equipment. Drafting and reviewing of occupational health and safety policies, laws, regulations, and guidelines need to continue to sustain OHS interventions. There is also a need for continuous collaborations between the African Union, the AUDA-NEPAD, member states, and development partners to sustain the project interventions.

ACKNOWLEDGEMENTS

The World Bank funds the SATBHSS project: P155658 and P173228. For more information, visit www.satbhss.org and www.nepad.org. AUDA-NEPAD acknowledges the World Bank, project countries (Lesotho, Malawi, Mozambique, and Zambia), and partners.

American Industrial Hygiene Association Emerging Economies Microgrant Advisory Group

Thomas Fuller: President, Iberoamerican Board of Occupational Hygiene
e-mail: tpfuller1@gmail.com

INTRODUCTION

In 2018, the American Industrial Hygiene Association (AIHA) International Affairs Committee (IAC) created the Emerging Economies Microgrant Subcommittee as a means to provide financial support for occupational hygiene research and training projects to improve worker health and safety in developing parts of the world. The goals of the subcommittee were to improve the transparency and fairness regarding the evaluation and funding of international projects by AIHA. The subcommittee also provided a clear process for proposal submission and descriptions of criteria used in selecting projects to support. Its mission was to build occupational hygiene capacity worldwide, at the grassroots level.

In 2018, the subcommittee developed operating procedures, proposal selection criteria, ranking methods, and project reporting and tracking requirements. Subcommittee members were comprised of willing volunteers from the IAC, who had international experience with philanthropic research and training groups.

In 2022, the AIHA Board formed the opinion that the efforts of this group warranted an advisory structure – the Emerging Economies Microgrant Advisory Group (EEMAG) – to solidify the programme and establish a permanent fund to build upon over time. The creation of the EEMAG provided greater stability, visibility, and oversight than is typically undertaken by a technical committee subcommittee. The EEMAG facilitates networking and information exchange among members, contributes to public policy debate, and assists with collaboration among allied organisations. The commitment to the EEMAG programme is reflected in the AIHA Strategic Plan 2022–2024: Advancement and Dissemination of Knowledge (https://www.aiha.org/about-aiha/aiha-strategic-plan).

AIHA EMERGING ECONOMIES MICROGRANT ADVISORY GROUP CHARTER

Mission

The mission of the AIHA Emerging Economies Microgrant Advisory Group is to provide a fair, structured, transparent, and consistent mechanism for funding educational and research projects that promote occupational hygiene in economically developing nations.

Vision

The vision of the group is to expand occupational hygiene awareness and capacity, globally, in order to reduce the risk of injury, illness, and fatality to workers in nations with the fewest resources.

PROJECTS FUNDED TO DATE

Since 2018, the subcommittee and, subsequently, the EEMAG has funded 52 projects to the value of USD148 550. Table 1 provides a full accounting of projects, funding provided, and countries, by year, since the programme's inception.

Table 1. Microgrant projects funded, 2018–2023

Year/Country	Project title	Amount (USD)
2018		
Lebanon, India, Nepal	DWOI Block Grant for three proposals: exposure assessment training in Beirut, Lebanon; environmental monitoring for asbestos, Environics, India; training on OHS in Nepal. Developing and implementing training, performing asbestos sampling	3 000
Various	DWOI: Technical Projects and Training Block Grant	5 000
Various	Belgian Centre for Occupational Hygiene: training video of air sampling process for sampling silica during brick production in developing countries	1 500
Vietnam	Centre for Development and Integration (CDI)	5 000
	OHS capacity building on chemical hazards in the electronics industry	
Nepal	WHWH: establishing a Centre for Environmental and Occupational Health (related to Brick Kiln) at Kathmandu University	2 500
Mexico	Training and workshops (under the leadership of US Maquiladora Health and Safety Support Network)	3 000
	Total	**20 000**
2019		
Various	DWOI: 2019–2020 Technical Project and Training Workshop Block Grant Request	5 000
Various	DWOI: Block Grant Request for three proposals	3 258
Bangladesh	Maquiladora Health and Safety Support Network OHS Initiative for Workers and Community, Dhaka	5 000
Various	Training video of air sampling process for sampling silica during brick production in developing countries	2 242
Nepal	Establishment of the Centre for Environmental and Occupational Health	4 500
	Total	**20 000**

Continued on page 98

Continued from page 97

Year/Country	Project title	Amount (USD)
2020		
Cameroon	Air monitoring of safer artisanal mining practices, eastern Cameroon	4 190
Various	DWOI Block Grant for 2021 Technical Projects and Training Workshops	7 500
India	Health and safety education to promote wellbeing at work for women informal workers	2 500
Various	Strengthening productivity and improving working conditions for small to mid-sized enterprises by applying OSH methods	2 535
Vietnam	Improving the ability to identify the OEH hazards of e-waste for employers and workers	2 535
Vietnam	One-day training workshop on OHS for the OSH officers working at healthcare facilities	500
Mozambique	Occupational risk assessment at Eduardo Mondlane University (UEM)	1 000
Peru	Peruvian Cooperation for Elimination of Silicosis	3 000
	Total	**23 760**
2021		
Various	DWOI Block Grant for 2022 Technical Projects and Training Workshops	5 050
Malaysia	In the new norm of COVID-19 pandemic: industrial hygiene practices guideline for Malaysian small and medium-sized enterprise workers	2 200
Various	Intervention of occupational injury through applying occupational safety practice in large-scale textile industries	2 000
Vietnam	Evaluation of airborne silica dust using video exposure monitoring (VEM) to pinpoint high exposure processes	4 000
Bangladesh	OHS initiative for workers and community	2 250
Guyana	Promoting occupational health and safety in artisanal and small-scale gold mining	2 000
Various	Capacity building and skills improvement training for African OSH and labour inspectors	1 500
Malaysia	Building capacity of an effective management of occupational health hazards in the plantation industry	3 500
India	Respiratory protection training for waste pickers	2 500
	Total	**25 000**
2022		
Philippines	A descriptive exploration on the OHS risks for Filipino jeepney drivers in the time of COVID-19 for the promotion of OHS committee and policy building	2 000
Bangladesh	A study on OSH practices in the stone crushing sector	2 000
Vietnam	Addressing the mental health impacts among healthcare workers during the COVID-19 pandemic	3 500
Cameroon	Air monitoring of safer artisanal mining practices, eastern Cameroon	644
Ethiopia	Ethiopia Initiative – OHS and industrial hygiene capacity building collaboration, WHWB-US Branch and Wolaita Sodo University	1 000
Malaysia	Evaluating occupational health for Malaysian army personnel working in a World War II-era warehouse	3 450
Tanzania	Introduction of safer mining practices to artisanal miners, southern Tanzania	2 500
Sri Lanka	Mitigating the COVID-19 pandemic in the apparel sector and empowering women/factory workers to face day-to-day challengers along with the Pandemic	1 100
Bangladesh	OHS initiative for workers and community, Dhaka	3 500
Vietnam	One-day training workshop on risk assessment, prevention, and control measures of COVID-19 infection in workplace settings	900
Kenya	Prevention of hearing damage from exposure to high noise	2 250
DRC	Risk assessment and occupational hazards prevention in artisanal mines: a training programme, Kolwezi	3 500
Uganda	Study of the impact of mercury use by artisanal gold miners	2 000
India	Study of the hazardous effects of silicosis among mineworkers and improving their quality of life while increasing their lifespan	2 500
Mongolia	Welding fume exposure assessment	3 480
	Total	**34 324**
2023		
Ghana	Informal sector: roadside mechanic shop activities	3 500
Kenya	OSH in the informal sector	3 500
Uganda	Status of chemical exposure among workers in textile industries: a case study of industries along the shores of Lake Victoria at Walukuba-Masese, Jinja	2 000
Uganda	Training farmers on the safe use of pesticides, central Uganda	3 500
Bangladesh	A study on OHS conditions of sanitation workers, Dhaka	3 226
Malaysia	OSH pocket book as a simple yet practical guide for small-medium enterprises	2 800
Uganda	Enhancement of protective workplace practices in small-scale mining	3 440
Tanzania	Prevention of respiratory health problems caused by welding fumes exposure	3 500
Vietnam	Conference support grant for hazardous substances in manufacturing and construction sectors	3 500
	Total	**25 466**
	Grand Total	**148 550**

DRC: Democratic Republic of the Congo, DWOI: Developing World Outreach Initiative, OEH: occupational and environmental health, OHS: occupational health and safety, OSH: occupational safety and health, WHWB: Workplace Health Without Borders, US: United States

Funding has been provided each year since 2018, with the full support of the AIHA Board. In 2022 and 2023, projects were supported with additional funding from Amazon, with donations of USD25 000 each year. Amazon has pledged an additional USD25 000 for the Microgrants Programme for 2024. Amazon employee, Jake Ward, is a valued volunteer member of the EEMAG.

PROJECT PROPOSAL SUBMISSION PROCESS

Educational and research project proposals can be submitted on the AIHA Emerging Economies Microgrant Group project proposal webpage portal (https://www.aiha.org/get-involved/volunteer-groups/emerging-economy-micro-grants-program) at any time throughout the year. Proposals are distributed to Advisory Group members for review, ranking, and decisions about funding and the amount, if approved.

Proposal selection criteria

The Advisory Group will review project proposals and recommend the allocation of funds, according to the following criteria. Higher scores are awarded to those projects that reflect these parameters.

1. *Organisation eligibility:* preference for projects led by non-profit entities, such as charities, and non-government, academic, and philanthropic organisations. Corporations and individuals are not excluded from applying, but the benefits to the project recipients should clearly outweigh the benefits to the individual or the company providing the services.
2. *Stand-alone project addressing primary prevention consistent with the AIHA's mission and strategic priorities:* project promotes occupational hygiene through education, research, training, and development.
3. *Development and promotion of the occupational and environmental health and safety (OEHS) profession:* project supports research and development efforts necessary to solve occupational health problems and improve working conditions/environment. Capacity building is evident through education, research, training, and outreach.
4. *Projects addressing known or potential worker health issues:* project demonstrates research on hazardous workplace exposures, outcomes, and emerging issues of control methods to minimise associated workplace risks. It may address any emerging or ongoing concerns related to occupational health and safety (OHS).
5. *Requested support does not exceed USD3 500 per project:* project can achieve its goals with a smaller overall budget, and still make significant impacts in regions of greatest need.
6. *Adequately describes needs to make project viable and successful:* project has a high likelihood of achieving its stated objectives within the required project timeframe (one year from funding).
7. *Sources of proposal support, technical assistance, and collaboration:* project describes how it may fit into a larger picture of regional or host country development through other support and organisations.
8. *Ability to improve public and environmental health, achieve results, feasibility, practicality:* whether through prior AIHA microgrant projects or other means, a project or sponsoring organisation can show past experience and success in goal-oriented projects.

AWARD NOTIFICATION, PROPOSAL PROJECT TRACKING, AND REPORTING

Once a determination regarding funding support is made by the Advisory Group, a letter is sent to the affected parties and monies are sent to the designated project manager. Stipulations are reiterated, upon award notification, that recipients are expected to provide quarterly reports regarding the status of their projects to the AIHA and the Advisory Group. Updates are to include documents such as written descriptions of activities completed to date, timelines, photographs of events or activities, and results of research activities. At the end of the project, a final report, summarising the activities and results of the project, must be provided. Copies of relevant videos, photographs, or published reports should also be sent to the AIHA. These documents are then shared with the AIHA Board of Directors, microgrant sponsors, and the occupational hygiene community, to highlight successes of the programme in building worldwide occupational hygiene capacity at the grassroots level.

ADVANCEMENT AND DISSEMINATION OF KNOWLEDGE

In 2023, the EEMAG contributed to the AIHA's ability to explore, develop, and disseminate cutting-edge educational, technical, and career enrichment resources to advance the OEHS profession and professionals, by providing small-scale funding to several projects in emerging economy countries including Uganda, Bangladesh, Malaysia, Kenya, Tanzania, and Vietnam. Academic organisations and NGOs were, thus, enabled to purchase equipment, laboratory support, and other necessary materials to conduct meaningful and effective research on workplace hazards and exposures in developing nation workplaces. Results of these projects are disseminated in publications and at national and international conferences. Many EEMAG-funded projects are directly linked to training programme development and training provided to workers, managers, and regulatory agents. In parts of the world where occupational hazards are unknown and undocumented, the EEMAG programme provides an important platform for understanding occupational hazards, and for spreading awareness of the AIHA and its capabilities and resources.

INTEGRITY OF PROFESSIONAL PRACTICE

In 2023, the EEMAG Microgrant Programme solicited proposals and funded projects in Uganda, Bangladesh, Malaysia, Kenya, Tanzania, and Vietnam that facilitated the development of leading metrics, and best practices, for worker and community health and safety in those countries. The opportunity to expand research and training provides a rich opportunity to influence how workers, managers, educators, and society in general approach and view worker health and safety. Building the integrity of occupational hygiene practice is perhaps the most important benefit of the EEMAG grants.

ADVOCACY

In 2023, the EMMAG added to the AIHA's ability to influence the actions of the public and organisations to advance worker and community health and safety, by actively advocating OHS in regions of the world where it is in short supply. In developed countries, there are many well-educated and experienced industrial hygienists using modern technologies to evaluate and control hazardous exposures and conditions. But, in many parts of the world, millions of workers are not protected from workplace hazards. The EEMAG's 2023 promotion of the Microgrant Programme to facilitate small research projects and training programmes in Uganda, Bangladesh, Malaysia, Kenya, Tanzania, and Vietnam, using and developing local professionals, will help to address this problem. Beginning with small projects and training programmes, the AIHA can make a huge impact through outreach to dozens of nations and workers in need around the world.

CONCLUSION

Microgrants have been shown to be an effective and efficient means of allocating funds for humanitarian projects in developing regions of the globe. By allocating smaller packages of funds, broadly and transparently, distribution is equitable and impacts a larger number of workers. Microgrant benefits are maximised through the use of volunteers to oversee project proposal reviews, funding, and tracking of project completion. The AIHA Emerging Economies Microgrant Advisory Group has been successful in its implementing of this model. The AIHA, by creating an ongoing project proposal and acceptance review and funding process, has made a positive impact in the lives of thousands of workers in numerous developing regions of the world.

SASOM report on the ICOH2024 Congress and the Scientific Committee for Biohazards and Occupational Health

Mary H Ross: Scientific Committee on Biohazards and Occupational Health, International Commission on Occupational Health; School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa
e-mail: profmaryross@yahoo.com
Tanusha Singh: Scientific Committee on Biohazards and Occupational Health, International Commission on Occupational Health; Department of Environmental Health, Faculty of Health Sciences, University of Johannesburg, Johannesburg, South Africa
e-mail: tanushas@uj.ac.za

Prof. Mary Ross is an Honorary Life Member of SASOM and MMPA

BACKGROUND

This report covers aspects of the 2024 Congress of the International Commission for Occupational Health (ICOH2024) held in Marrakesh, Morocco from 28 April to 3 May 2024. The main focus for the authors was on the newly created ICOH Scientific Committee for Biohazards and Occupational Health (SCBOH), for which they were Chair (Prof. Mary Ross) and Secretary (Prof. Tanusha Singh) from the inception in 2022 until ICOH2024.[1] Nine of the 17 members of the SCBOH attended the congress, providing an opportunity for personal interaction and group discussion at the sessions organised by the authors (Special, Free paper and Poster sessions) and the first SCBOH Business Meeting.

Following the previous congress, ICOH2022, which was affected by the coronavirus disease 2019 (COVID-19) pandemic, ICOH2024 continued to have an emphasis on COVID-19 in a number of different scientific committees and presentations, particularly the long-term effects on physical and mental health. The COVID-19 pandemic is particularly relevant to the SCBOH since its far-reaching health, economic, and social effects in the workplace underly recognition by ICOH of the need to transition from the Working Group on Occupational Infectious Agents (WGOIA) to the SCBOH. The in-person congress afforded the opportunity not only for attendance at the organised sessions, but also for personal interactions on particular areas of interest applicable to occupational health.

SCBOH SPECIAL SESSION, FREE PAPER SESSION AND POSTER SESSION

The congress served as a pivotal platform for the SCBOH to unite experts, researchers, and practitioners from around the world to delve into the latest trends, challenges, and advancements in biohazards and occupational health. The diverse array of topics discussed across the special session, free sessions, and poster presentations highlighted the complex nature of biohazards and the multifaceted strategies needed to tackle them effectively. With 22 presenters hailing from 11 countries, including Argentina, Belgium, Brazil, Denmark, France, Germany, Italy, Japan, Pakistan, South Africa, Taiwan, and Tunisia, the congress truly encapsulated a global perspective. The special session, "Emerging and Continuing Biohazards in the Workplace", chaired by Prof. Mary Ross from South Africa, provided a deep dive into the ever-evolving landscape of occupational biohazards. She stressed the imperative of addressing workplace biohazards and implementing robust risk management strategies. The presentations within the special session offered valuable historical insights and illuminated current challenges, especially amid the COVID-19 pandemic. Prof. Ross highlighted the necessity of global and national commitment to tackle emerging biohazard threats. Prof. Stefano Porru delved into pertinent queries about COVID-19 and its ramifications on occupational health, drawing from the extensive data of the European ORCHESTRA study. The significance of vaccination and risk assessment in safeguarding health workers was underscored. Prof. Albert Nienhaus shed light



Front row, L–R: Prof. Albert Nienhaus, Ms Claudina Nogueira (non-member), Dr Bill Buchta; Middle row L–R: Dr Itumeleng Ntatamala, Dr Marcella Mauro, Prof. Tanusha Singh; Back row L–R: Prof. Toru Yoshikawa, Ms Dikeledi Mutaka (non-member), Prof. Stefano Porru, Prof. Mary Ross
Photograph: courtesy of Tanusha Singh

on the occupational health risks encountered by hairdressers during the Pandemic, emphasising the pivotal role of effective workplace regulations. Prof. Singh presented findings from a compelling case series, exploring mould exposure across diverse occupational settings and highlighting the importance of preventive measures.

The free sessions explored a myriad of research topics, including rubella immunity among the working generation; the role of anti-S IgG against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) during the Omicron variant wave among healthcare workers; influenza vaccination among workers during the COVID-19 pandemic; surface disinfection against ESKAPE organisms; latent tuberculosis infection among healthcare students in a low-incidence country; long COVID-19 syndrome; bioaerosol exposure among recycling workers; and the risk of sexually transmitted infections among hotel workers. Presenters from various corners of the globe shared their insights, enriching our understanding of occupational health challenges and interventions.

The poster presentations showcased an array of research endeavours, spanning chikungunya disease, histoplasmosis to hepatitis B vaccinations, SARS-CoV-2 infection, drug-resistant bacteria, immune responses to vaccination, COVID-19 vaccine acceptance, and the antimicrobial effects of automobile screen washer on *Legionella pneumophila*. These diverse studies encapsulated the breadth of occupational health research on a global scale.

SCIENTIFIC COMMITTEE FOR BIOHAZARDS AND OCCUPATIONAL HEALTH BUSINESS MEETING

The SCBOH Business Meeting agenda and the triennium report to ICOH were circulated to members prior to ICOH2024. The meeting was attended by eight members, the ICOH Vice President for Scientific Committees, and four visitors, two of whom expressed an interest in joining the SCBOH. The scope, covering both infectious and non-infectious biohazards, and the strategy of the SCBOH were discussed as an introduction to the achievements of the SCBOH and its predecessor, the WGOIA, since ICOH2022. Contributions towards the goal of increasing awareness about biohazards in the workplace included input to the International Labour Organization (ILO) Biohazards Guide adopted by the ILO in November 2022.[2]

COVID-19 contributed to the increased attention to biohazards at work, resulting in great interest in a potential focus of the SCBOH on research into post-Pandemic health and safety measures in workplaces. Research on post-COVID-19 was proposed, particularly across various non-healthcare occupational settings as studies have mainly covered health workers.[3] This started a discussion on how the SCBOH should set priorities in view of the scope covering infectious and non-infectious biohazards in diverse workplaces. The well-established One Health approach offers an ideal strategy to identify both types of biohazards and relevant preventive measures to complement research on the diseases. The interaction between public health and occupational health is another dimension for the SCBOH to consider, for issues such as pandemic preparedness and workplace immunisation.

After serving as Chair of the WGOIA for four triennia and the SCBOH for its first triennium, Prof. Ross handed the Chair to Prof. Albert Nienhaus, an occupational physician and epidemiologist from Germany, who works at the University Clinics of Hamburg-Eppendorf (UKE) and the compensation board for healthcare workers. He will be supported by Prof. Singh, who serves as Secretary. He outlined plans for the administration of the SCBOH, emphasising institutional support and strategies for increasing visibility. This includes the SCBOH conducting a post-Pandemic survey of ICOH members on various aspects of surveillance, identification, mitigation, reporting, and compensation of occupational diseases from exposure to biohazards. Such research could be compared with the pre-Pandemic 2017 WGOIA survey and will complement the ILO's current activities. The ILO is exploring the adoption of an instrument or instruments to measure biological hazards in the working environment, following a questionnaire distributed to member states to ascertain what is already in place regarding occupational biohazards, and views on the scope and content of the possible future instrument or instruments.[4]

The SCBOH will follow relevant developments within the World Health Organization (WHO), particularly those related to pandemics and the workplace. During the COVID-19 pandemic, shortcomings in the implementation of the International Health Regulations (2005) (IHR), adopted after the severe acute respiratory syndrome (SARS) outbreak, had repercussions for public health and workers involved in cross-border work. The IHR were deemed inadequate for dealing with the global spread of pandemics and the WHO is reviewing amendments to them. In addition, WHO member countries are engaged in drafting a comprehensive pandemic accord to make sure that signatories are better prepared for future pandemics, and have access to the necessary means to prevent potential outbreaks.

Recently, the WHO released a report from a global technical collaboration between public health agencies, clarifying a consensus on terminology for transmission of pathogens through the air.[5] This followed the initial confusion about SARS-CoV-2 transmission that hampered not only relevant COVID-19 public health preventive measures, but also in challenged employers, workers, and occupational health practitioners in workplaces. The confusing terms used interchangeably included: 'airborne', 'airborne transmission', and 'aerosol transmission', with 'aerosols' implying generally smaller particles and 'droplets' implying generally larger particles. New terminology is based on 'infectious respirable particles' (IRPs), which exist on a spectrum of sizes. The mode of transmission of IRPs through the air is by 'airborne transmission/inhalation' or 'direct deposition' on mucosal surfaces (mouth, nose or eyes), so entering the respiratory tract and potentially causing infection.

OTHER HIGHLIGHTS FROM ICOH2024 OF RELEVANCE FOR THE SCBOH

The Business Meeting of members of the Partnership for European Research in Occupational Safety and Health (PEROSH) welcomed the SCBOH Chair as a visitor. The attendees discussed joint research programmes of the consortium of 14 European research institutes in 13 countries, including a clearing house for systematic reviews and the impact of artificial intelligence (AI) systems. Also discussed were the ethics of sharing information, given the increasing scrutiny of data sharing and the protection of personal information, particularly between countries, and secondments of researchers among its members to stimulate the exchange of researchers between the PEROSH members. It would benefit the SCBOH to emulate the model of the PEROSH collaboration between members and national research teams investigating biohazards. Two of the completed PEROSH projects of interest to the SCBOH and the readers of *Occupational Health Southern Africa* are:

- **The biological working environment of waste collection workers**
  This is a study of occupational exposure to microorganisms related to new waste sorting instructions and the associated reduced frequency rate of waste collection.
  PEROSH fact sheet waste workers exposure

- **OSH evidence – clearinghouse of systematic reviews 2009–2015**
  The aims of the project were to collect systematic reviews on occupational health topics and to exchange experiences on any aspect of systematic reviews. It resulted in training material for researchers on conducting occupational health systematic reviews, and an accessible database of the 27 reviews conducted. OSH Evidence – Clearinghouse of Systematic Reviews 2009-2015 - PEROSH

Another session of interest to the SCBOH was the presentation, by Halim Hamzaoui (Switzerland), on biological hazards, which offered a foundational exploration of the ramifications of biohazards in work settings and underscored the importance of preventive measures. He referred to the ILO's technical guidelines on Biological Hazards in the Working Environment,[2] which emphasised the substantial contribution of the committee as three members contributed to the technical report that informed the development of this guideline.

The final fascinating and insightful plenary presentation at ICOH2024 was given by Prof. Malcolm Sim – 'From Ramazzini to robots: the impact of new technologies on occupational health'. A brief history of the development of occupational health research, evidence, and quality of information led to interviews with robots on whether or not they would replace humans. The tantalising video clips left the audience apprehensive and uncertain of the conclusion! As AI is both an asset and a challenge to occupational health in the future, this was a fitting end to a very successful ICOH congress.

ACKNOWLEDGEMENTS

The authors wish to thank the South African Society of Occupational Medicine (SASOM) for funding TS and partially funding MR to attend ICOH2024, and ICOH for waiving the registration fee for TS for furthering the SCBOH and its future activities for ICOH. Thanks also go to the Editor-in-Chief of *Occupational Health Southern Africa*, Prof. Gill Nelson, for assisting with the arrangements to attend the congress.

DECLARATION

The authors declare that they are Past Chair and Secretary (past and current) of the Scientific Committee for Biohazards and Occupational Health; all sources used in this report have been duly acknowledged, and there are no conflicts of interest.

REFERENCES

1. Ross MH, Singh T. Renewed focus on re-emerging occupational biohazards. Occup Health Southern Afr. 2023; 29(1):28-30. Available from: https://www.occhealth.co.za/_assets/articles/348/2405.pdf (accessed 26 May 2024).
2. International Labour Organization. Technical guidelines on biological hazards in the working environment. Geneva: International Labour Office, 2023. Available from: https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@ed_dialogue/@lab_admin/documents/publication/wcms_887758.pdf (accessed 26 May 2024).
3. Society of Occupational Health. Occupational Medicine special issue: long COVID and rehabilitation. Oxford University Press. 2024; 74(1):1-130. Available from: https://academic.oup.com/occmed/issue/74/1 (accessed 26 May 2024).
4. International Labour Organization. Biological hazards in the working environment. Geneva: International Labour Office; 2022. Available from: https://www.ilo.org/media/240346/download (accessed 26 May 2024).
5. World Health Organization. Global technical consultation report on proposed terminology for pathogens that transmit through the air. Geneva: WHO; 2024. Available from: https://www.who.int/publications/m/item/global-technical-consultation-report-on-proposed-terminology-for-pathogens-that-transmit-through-the-air (accessed 26 May 2024).

UPCOMING EVENTS

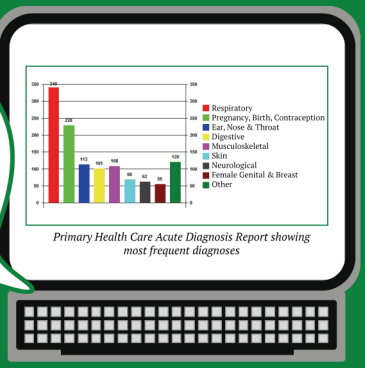
OCCUPATIONALhealth
SOUTHERN AFRICA

SOUTH AFRICA
SASOM Roadshow Session 1 - Occupational medicine as a peer-based discipline
Hybrid, Gqeberha
3 July 2024
Website: https://www.occhealth.co.za/pdf/events/SASOM%20Roadshow%20Circulation.pdf

INTERNATIONAL
OEESC 2024
Hyatt Regency Dulles, Herndon VA
23-25 September 2024
Website: https://www.aiha.org/our-events/oeesc/oeesc-about-us

Go to
www.occhealth.co.za
'Upcoming Events'

to see upcoming local and international OH events

Clinsys
Occupational & Primary Health
New - Covid-19 Module


Primary Health Care Acute Diagnosis Report showing most frequent diagnoses
Caroline Mathew
+27 84 580 4016
Website: www.clinsys.co.za
clinsys@twinsolutions.co.za

34th International Congress on Occupational Health (ICOH2024): the Marrakesh Express arrives at its final destination

Claudina Nogueira: Occupational health consultant/Project manager, University of Pretoria (South Africa); SASOM ExCo member; ICOH Immediate Past Vice President for Scientific Committees (2018–2024); WHWB Board member
e-mail: claudinanogueira@hotmail.com
Daan Kocks: SASOM Chair
e-mail: info@sasom.org
Claudia Frost: SASOM National Office Coordinator
e-mail: info@sasom.org

Marrakesh meander: a never-to-be-forgotten experience

The essence of Marrakesh – the 'Ochre City, in Morocco' – is a blend of vibrant colours, bustling souks (markets), rich history, and diverse cultures. It is a city where ancient traditions meet modern influences, creating a unique tapestry of experiences for leisure and business travellers alike.

One of the defining features of Marrakesh is its medina – a maze-like ancient city filled with narrow alleyways, humming bazaars, and treasure troves of hidden gems, waiting to be discovered. The sounds of hawkers, the aroma of spices, and the dazzling colours of textiles create a sensory overload that is both exhilarating and enchanting. The Jemaa el-Fnaa square in the heart of the medina is a UNESCO World Heritage site. By day, it is filled with colourful stalls selling everything under the sun (literally). By night, it transforms into a lively open-air spectacle, with storytellers, musicians, snake charmers, and food vendors creating an electric atmosphere. From artisan workshops and souks to hammams (traditional Moroccan bath houses) and centuries-old riads (traditional Moroccan homes or guesthouses built around a central courtyard or garden), the medina is a feast for the senses at every turn.

The architecture of Marrakesh is another key aspect of its essence. From the intricate tilework of the Ben Youssef Madrasa and the grandeur of the Bahia Palace, to the historic landmarks of the Koutoubia Mosque – the largest and most iconic in the city – and the Saadian Tombs dating back to the 16th century, the city's buildings are a testament to its rich past and cultural heritage.

Marrakesh cuisine is as diverse and appetising as the city itself – a tantalising fusion of flavours, drawing influence from Berber, Arab, Moorish, and Andalusian culinary traditions. The iconic tagine (a slow-cooked stew of meat and vegetables), couscous (steamed semolina grain), pastilla (sweet-savoury pastry), mechoui (succulent, slow-roasted lamb), and harira (a hearty soup) entice the taste buds, whether you are sampling street food in the souks and cafés or dining in a riad or a fine restaurant. No meal in Marrakesh is complete without a glass of traditional mint tea. Made with green tea, fresh mint leaves, and a generous amount of sugar, this sweet and refreshing beverage is a staple of Moroccan hospitality and is enjoyed throughout the day; there is an art and science to pouring and serving the mint tea!

Peaceful oases like the Majorelle Garden – a haven of exotic plants, serene ponds, and vibrant blue buildings, all set against the backdrop of the Atlas Mountains, and the Menara Garden, dating back to the 12th century and originally used as an orchard and olive grove by the rulers of Marrakesh – provide escapes from the hustle and bustle of the medina, and opportunities to soak up the tranquillity of nature.

However, the true essence of Marrakesh lies in its people. The warmth and hospitality of the locals, known as 'Marrakchis', are legendary. Whether you're sipping mint tea in a riad or bargaining for handmade crafts and jewellery in the souks, you'll find yourself welcomed with open arms and treated like family.



The Marrakesh medina – In the labyrinthian ancient part of the city, the clamour of vendors, the fragrance of spices, and the vivid hues of fabrics combine to overwhelm the senses in a way that is thrilling and captivating
Photograph: Claudia Frost (South Africa)

Marrakesh is a vibrant blend of history, culture, and hospitality that captivates the senses and leaves a lasting impression on all who visit. A leisurely stroll or ride in a horse-drawn carriage through the winding streets and lively markets of the city, taking in the sights, sounds, and aromas that make Marrakesh so enchanting, was proof positive that the 'Ochre City' was the perfect venue to host the ICOH2024 Congress!



Moroccan craftsmanship in the heart of Marrakesh – Visiting the Bahia Palace is a popular tourist activity, offering a chance to admire its exquisite architecture, learn about Moroccan history, and experience the beauty of its gardens
Photograph: Claudia Frost (South Africa)

Introduction to the ICOH2024 Congress

ICOH2024 – the 34th International Congress on Occupational Health of the International Commission on Occupational Health (ICOH) – themed *Enhancing Occupational Health Research and Practices: Closing the Gaps!*, was held from 28 April to 3 May 2024, at the *Palais de Congrès* in Marrakesh, Morocco. ICOH is grateful to its scientific committees (SCs), working groups (WGs) and members for their valuable contributions and ongoing commitment and dedication to occupational health, which ensure the sustainability and continuity of the ICOH congress. The congress organisers (ICOH, supported by the Moroccan Organising and Scientific Committee members, the Moroccan Occupational Health Association (MOHA), the Faculty of Medicine and Pharmacy of the University Hassan II of Casablanca, and working in close collaboration with the professional congress organiser, 'We Mice You') endeavoured to reinstate the flavour of the traditional ICOH triennial congresses, in post-pandemic times, by returning to an in-presence format.

During the condensed past triennium (two years: 2022–2024) instead of three, as a direct result of the impact of the Pandemic and an extended previous triennium of four years (2018–2022) instead of three, the SCs, WGs and Board members of ICOH and the National Scientific Committee (Morocco) contributed extensively and enthusiastically to the development of the scientific content of the congress in various ways, e.g. by recommending plenary and semi-plenary speakers, sourcing presenters, organising 73 special sessions, and providing reviewers for the abstracts submitted to free paper session topics as oral or e-poster presentations.

Fast facts on the ICOH2024 Congress

- Approximately 1 300 participants (occupational health experts, researchers, practitioners, trainers, and educators)
- 93 countries from six continents
- Approximately 900 presentations delivered across all oral sessions
- Registration fee waivers granted to 99 presenters (ICOH members in good standing) from low- and middle-income countries (LMICs)
- One opening keynote address
- 10 plenary presentations
- 32 semi-plenary presentations
- Global Policy Forum – 'Strategies to improve occupational health and safety policies and implementation in low- and middle-income countries'
- 73 special sessions with close to 300 presentations
- 78 free paper sessions with 1 394 presentations (513 oral communications and 881 e-posters) across the 51 free paper session topics (see Tables 1 to 6)
- Scientific content – 350 hours across all sessions
- ICOH2024 was accredited by the European Accreditation Council for Continuing Medical Education (EACCME®) for a maximum of 28 European CME credits (ECMEC®s)
- Accepted abstracts are in the process of being published as open access ICOH2024 Congress Proceedings in an online supplement of *Occupational Medicine*, one of the key international journals in its field and part of the Oxford Academic, Oxford University Press (OUP) platform, with an impact factor of 5.1
- 34 of the 66 applications received for the International Labour Organization (ILO) Master Fellowship in OSH Award (open to ICOH members from LMICs with a scientific contribution at the congress) met the basic requirements; 14 applicants submitted the additional requested documents to be admitted to the selection process. Two winners were identified:
  - Dr Anissa Thattil (India)
  - Dr Cheng Lim Yin (Malaysia)
- Eight winners in the student poster competition and two winners of the Moroccan best poster award (see Table 7)

ICOH2024 Congress special sessions

The congress organisers endeavoured to grant at least one special session to all SCs and WGs that submitted proposals. Preference was given to special sessions organised, collaboratively, by more than one SC and/or WG and/or other entity.

Several special sessions were organised and presented by external (non-ICOH) organisations, in some cases in collaboration with ICOH SCs, e.g. Barcelona Institute for Global Health (ISGlobal), Spain; Cochrane Thematic Group 'Work and Health and Social Security'; European Academy of Allergy and Clinical Immunology (EAACI) Taskforce on Work-related Asthma Questionnaires and Algorithms for Screening and Surveillance (WAQASS); European Association of Schools of Occupational Medicine (EASOM); European Union of Medical Specialists (UEMS); European Agency for Safety and Health at Work (EU-OSHA); French Society of Occupational Health; Global Network for Evidence Synthesis in OSH; Human Factors and Ergonomics Society (HFES); International Agency for Research on Cancer (IARC); International Association of Labour Inspection (IALI); International Centre for Rural Health, Milan, Italy; International Ergonomics Association (IEA); International Organization of Migration (IOM); International Social Security Association (ISSA) – Research and Construction Sections; ISO TC283 OHS Management Systems; Kuwait University; MEDICHEM; Migration Health and Development Research Initiative (MHADRI); Nordic Labour Inspections (Nordic Future of Work Group for OSH Practice); OSHAfrica; Partnership for European Research on Occupational Safety and Health (PEROSH); Workplace Health Without Borders (WHWB); Women in Informal Employment: Globalising and Organising (WIEGO); the ILO; and the World Health Organization (WHO).



Publish or perish – The special session on publishing research on workers' health brought together Editors-in-Chief of a sample of international journals. L–R: Won-Jun Choi, *ICOH Newsletter* (Republic of Korea); Seong-Kyu Kang, *Safety and Health at Work* (Republic of Korea); Hans Kromhout, *Occupational and Environmental Medicine* (The Netherlands); Gill Nelson, *Occupational Health Southern Africa* (South Africa); Ingrid Siversind Mehlum, *Scandinavian Journal of Work Environmental Health* (Finland); Paul Blanc, *Journal of Occupational Medicine and Toxicology* (USA); Alexis Descatha (France) and Jacqueline Moline (USA), *Archives of Occupational and Environmental Diseases*; and Hyoung-Ryoul Kim, Chair of the session and Associate Editor of *Safety and Health at Work* (Republic of Korea)

Photograph: courtesy of Prof. Seong-Kyu Kang (Republic of Korea)

One ICOH sustaining member and two affiliate members, respectively, organised/co-organised one special session each:

- Institution of Occupational Safety and Health (IOSH, UK) – 'Proactive approach to accident prevention through risk management', in collaboration with the ICOH SC on Accident Prevention. The session explored the risks associated with vulnerable and high-risk sectors, e.g. high-risk industries such as oil and gas, as well as small- and medium-sized enterprises, and provided insights into how injury and disease prevention, and safe and healthy work for all, can be achieved.
- Colombian Society of Occupational Medicine – 'Psychosocial risks and mental health promotion in Colombia', which included the following presentations: i) futuristic vision: mental health in Colombia; ii) mental health management in companies: the importance and impact of health promotion strategies; and iii) impact and assessment of mental health issues/consequences as occupational diseases.
- Society of Occupational Medicine of the Province of Buenos Aires, Argentina (SMTBA) – 'Occupational health in Latin America: postgraduate student presentations'. The presentations, in Spanish, were on the following topics: i) factors associated with daytime sleepiness in public transportation drivers in Lima, Peru; ii) validation of the Computer Vision Syndrome Questionnaire (CVS-Q) instrument among administrative workers in Lima, Peru; iii) toluene use and exposure and its implications for the visual health of restorers of works of art; and iv) potential nano-toxicological risks of carbon nanotubules in workers' health.



From a region full of diversity, culture, traditions, and joy of life – Presenters, Chair and commentator of the Special Session 'Occupational health in Latin America: Postgraduate student presentations', delivered in Spanish. L–R: Jonh Astete Cornejo (session commentator) and Yessenia Huapaya (Peru); Graciela Molina, Claudio Taboadela (session organiser and Chair), and Santiago Aldaz (Argentina)

Photograph: courtesy of Dr Claudio Taboadela (Argentina)

The special session 'How to publish your work on workers' health: insights from the Editors-in-Chief of several OSH journals', organised by the ICOH President, Prof. Seong-Kyu Kang, was very well attended. Scientists usually seek to publish their work in renowned international journals, primarily indexed in Web of Science (WoS) or Scopus. However, young scientists often face challenges in publishing their manuscripts due to a lack of submission strategy, despite the adequate quality of their work. In this session, Editors-in-Chief of major OSH journals provided insights into the status of their journals and offered strategies for successful submission. The seven OSH journals represented in this session, and their respective Editors-in-Chief (or their representatives), were: *Journal of Occupational Health*, Japan – Narufumi Suganuma; *Occupational and Environmental Medicine*, UK – Hans Kromhout; *Safety and Health at Work*, Republic of Korea – Seong-Kyu Kang; *Scandinavian Journal of Work Environmental Health*, Finland – Ingrid Sivesind Mehlum; *Archives of Occupational and Environmental Diseases*, France – Alexis Descatha; *Journal of Occupational Medicine and Toxicology*, USA – Paul Blanc; and *Occupational Health Southern Africa*, South Africa – Gill Nelson.

The National Scientific Committee and other Moroccan entities also contributed to the special session organisation, viz. the Association of Occupational Medicine and Ergonomics of the Northern Region of Morocco; the Association of Occupational Medicine of the Eastern Region of Morocco (AMETRO); the Interprofessional Group for Prevention and Industrial Safety (GIPSI); the Moroccan Federation of Insurance and Reinsurance Companies (FMSAR); Moroccan Society of Maritime Medicine (SMMM); and the Professional Association of Cement Manufacturers (APC).

The special session titled 'The organisation of Moroccan crafts and government policy in the artistic crafts sector', was delivered in French. The four presentations delved into common risks faced by artisans, such as exposure to toxic chemicals, and poor working conditions; explored how addressing these risks aligns with the UN's Sustainable Development Goals; tackled the issue of persistent child labour in the handicraft sector despite the ratification of international conventions; focused on the socio-economic and demographic characteristics of craft production; and discussed the organisation of Moroccan crafts and government policies in the artistic crafts sector.

The special sessions spanned a diverse range of topics, with some recurring themes across different sessions, such as vulnerable workers, OSH in LMICs, risk prevention, climate change; and the inclusion of various sectors and industries. Some examples of the special sessions are:

- Adverse human health and safety impacts of chemical use among small-scale miners, and their households and community, and interventions
- Bottlenecks and solutions in starting and progressing basic occupational health services
- Building global consensus for occupational health and safety management through ISO standardisation
- Building knowledge capacities for the future of work in the chemical industry
- Climate change and occupational safety and health
- Combating occupational heat stress: moving towards a global approach
- Core values at work: everyday tools for the workplace
- Effective delivery of occupational health services: promoting safety and health as a universal fundamental right at work
- Electronic waste (E-waste) and informal work in LMICs
- Emerging and continuing biohazards in the workplace
- Ergonomics and musculoskeletal disorders in health workers and healthcare settings
- Guidelines for emergency preparedness and management: learnings from situations like the 9/11 disaster and the COVID-19 pandemic
- IARC Monographs update: opportunities and challenges in occupational epidemiology and exposure characterisation
- New developments in pesticides: enhancing occupational health and safety
- Nordic and global collaborations for OSH impact: integrating 'Vision Zero', climate change, and non-communicable disease prevention to create safe, sustainable, and healthy workplaces for all
- Occupational and environmental medicine in Africa
- Occupational cancer: what are we missing?
- Occupational disease coverage system in Morocco and international market perspectives (session in French)
- Occupational health for indigenous and migrant workers: challenges and opportunities
- Occupational health in the automotive industry in Tangiers, Northern Morocco (session in French)
- Occupational health of the fisherman
- Occupational health training and education in LMICs: overcoming challenges and developing solutions
- Occupational safety and health and decent work
- Off-job experiences and wellbeing
- Prevention of exposure to radiation risks: current updates and implications for workers' health
- Road safety programme in the Moroccan cement industry (session in French)
- SDG 8 Decent Work: healthy workplaces for vulnerable workers
- Screening and surveillance for work-related asthma
- Shiftwork, health, and the individual: challenges and opportunities for research and prevention
- The future of work after the COVID-19 pandemic: ethical issues and proposed solutions
- The history of occupational health on the African continent
- The jigsaw of job insecurity
- 'Vision Zero' for promoting a culture of prevention in construction: role of leadership, stakeholders, and technology
- Women, health, and work in post-pandemic times

ICOH2024 free paper communications (orals and e-posters)

Details regarding geographical origin, the most popular topics for abstract submission, the 10 countries with the highest numbers of accepted abstracts, and the poster awards, are provided in Tables 1–7.

Since the ICOH2009 Congress in Cape Town, the student poster competition has been a main event at ICOH congresses. Free membership for the 2024–2027 triennium was awarded to all eight winners; monetary prizes were awarded to the top three winners (see Table 7).

Various ICOH SCs and WGs and other organisations used the congress as an opportunity to hold business meetings, and two 'meet and greet' sessions were held for 'old' and 'new' SC leadership (outgoing and incoming Chairs and/or Secretaries) and the ICOH National Secretaries. The non-profit international organisation, WHWB, held a meeting to discuss the proposal for the launch of an African branch of WHWB.

Table 1. Geographical origin of ICOH2024 Congress free paper (oral and e-poster) presentations

Continent	No.
Africa	325
Asia	384
Europe	470
North America	113
Oceania	28
South America	74
Total	**1 394**

Table 2. Accepted oral and e-poster presentation abstracts by continent

Continent	No. oral abstracts	No. e-poster abstracts
Europe	194	276
Asia	119	265
Africa	105	220
North America	60	53
South America	20	54
Oceania	15	13
Total	**513**	**881**

Table 3. Accepted oral presentation abstracts for the 11 most popular free paper sessions

Free paper session	No.
Occupational safety and health (OSH) in Morocco	34
Epidemiology in occupational health	34
Positive mental health, work engagement, and wellbeing	31
Occupational medicine	28
Occupational health for health workers	27
OSH in low- and middle-income countries (LMICs): sharing good practices	26
Women, health, and work	20
Education and training in occupational health	18
Psychosocial risks: regulation and policies from an international comparative perspective	14
Evidence-based prevention in occupational health	14
Occupational health in small-scale enterprises	14
Total	**260**

Table 4. Accepted oral presentation abstracts by the top 10 countries

Country	No.
Morocco	49
Italy	36
India	29
Canada	27
United States	27
Belgium	23
Germany	23
China	21
France	20
Sweden	16
Total	**271**

Table 5. Accepted e-poster presentation abstracts for the 10 most popular free paper sessions

Free paper session	No.
Occupational health for health workers	85
Epidemiology in occupational health	63
Occupational medicine	56
Occupational toxicology, human biomonitoring, and neurotoxicology	45
Positive mental health, work engagement, and wellbeing	44
Education and training in occupational health	38
Work-related musculoskeletal disorders: the new ways of working and prevention among informal workers	31
Shiftwork and working time	28
Evidence-based prevention in occupational health	28
Occupational safety and health (OSH) in Morocco	26
Total	**444**

Table 6. Accepted e-poster presentation abstracts by the top 10 countries

Country	No.
Tunisia	89
Morocco	67
India	53
Italy	51
Japan	50
Germany	31
China	30
Brazil	29
France	27
Belgium	26
Total	**453**

Table 7. Winners of poster competitions

Student winners	Name	Country	Title of poster
First	Adam Moskowitz	USA	Occupational injury from patient handling and workplace violence at residential disability and mental health facilities
Second	Shinhyeong Kim	Korea	The impact of long working hours (LWH) and the use of work-related communication devices outside regular working hours (WDOW) on computer vision syndrome (CVS) among workers intensively utilising visual display terminals (VDTs)
Third	Kian Kiong Yap	Malaysia	Predictors of noise-related hearing disorder among vector control workers in Kuala Lumpur
Runner-up	Marieme Tah	Tunisia	Work-related factors affecting life and job satisfaction among medical residents
Runner-up	Aicha Haddar	Tunisia	Assessment of radiological risk in the operating rooms of a university hospital in Sfax, Tunisia
Runner-up	Chayma Sridi	Tunisia	Extremely low frequency electro-magnetic fields and quality of sleep: a cross-sectional study in a power plant in Tunisia
Runner-up	Moustafa Sherif	UAE	Genotoxicity of occupational pesticide exposures among agricultural workers in Arab countries
Runner-up	Amanda Voss	Germany	Evaluation of secondary aspects of online teaching by medical students
Jaouad El Jaï Prize – best Moroccan poster	Nadia Manar	Morocco	Prevalence of respiratory symptoms, diseases and ventilatory disorders among dental technicians
	Imane Zerrad	Morocco	Child labour in Moroccan legislation: view of an occupational physician



'Empowering people to change their working conditions' – Workplace Health Without Borders (www.whwb.org) leadership, members, OSHAfrica representatives, and friends of occupational safety and health met at the ICOH2024 Congress to start discussing a proposal to launch an African branch of WHWB

Photograph: courtesy of Ehi Iden (Nigeria)

First ICOH General Assembly

The First ICOH General Assembly, held on Sunday 28 April 2024, was attended by ICOH members in good standing only; it comprised the following presentations and topics of discussion:

- Opening address – Prof. Seong-Kyu Kang, ICOH President
- Approval of the minutes of the previous General Assembly (ICOH2022 Rome-Melbourne Digital Congress, held virtually in February 2022)
- President's Report – Prof. Seong-Kyu Kang
- Report on ICOH Scientific Committees – Claudina Nogueira, ICOH Vice President
- Report on ICOH National Secretaries – Dr Martin Hogan, ICOH Vice President
- Secretary General's Report – Dr Diana Gagliardi
- The ICOH Triennium Report (2022–2024) – available on the ICOH website (https://www.icohweb.org/site/news-detail.asp?id=254)
- *ICOH Newsletter* – Prof. Won-Jun Choi, Editor-in-Chief of the *ICOH Newsletter*
- Auditor and Vice Auditor election
- Amendments to the ICOH Constitution
- Honorary ICOH membership was bestowed on Prof. Bonnie Rogers – Past ICOH Vice President (USA), and Prof. Toshiaki Higashi (Japan), in recognition of their distinguished contributions to global occupational health
- Venue for the ICOH2030 Congress – presentations by bid committees from the two candidate cities – Medellín (Colombia) and Rome (Italy) – and explanation of the voting procedure during the congress week

ICOH2024 Congress opening ceremony

The opening ceremony followed the First General Assembly. Ms Rim El Kholti (ICOH National Secretary for Morocco) was the master of ceremonies. Welcome addresses were delivered by two Presidents, viz. Prof. Abdeljalil El Kholti (ICOH2024 Congress President) and Prof. Seong-Kyu Kang (ICOH President). Congratulatory addresses were delivered by national authorities, United Nations agencies and sister organisations, represented by various invited dignitaries:

- Wafaa Asri – Secretary General of the Ministry of Economic Inclusion, Small Business, Employment and Skills, representing Younes Sekkouri – Minister of Economic Inclusion, Small Business, Employment and Skills, Rabat, Morocco
- Fanfan Rwanyindo Kayirangwa – Regional Director for Africa and Assistant Director General, ILO
- Maria Neira – Director, Department of Public Health and Environment, WHO, representing Tedros Adhanom Ghebreyesus, Director General, WHO
- Karim Cheikh – President of the General Confederation of Enterprises of Morocco (CGEM), Human Capital Commission
- Ana Ercoreca de la Cruz – Secretary General, IALI
- Samantha Connell – President, International Occupational Hygiene Association (IOHA)

The opening keynote address was delivered by Dr Elisabete Weiderpass, Director of the IARC in Lyon, France, who presented a paper on global cancer burden due to occupational exposures.

Dr Diana Gagliardi, ICOH Secretary General, introduced Dr Marilyn Fingerhut (USA), who was honoured with the ICOH Lifetime Achievement Award in recognition of her longstanding commitment, dedication, and support to the ICOH community, and invaluable contribution to global occupational health. Dr Fingerhut, an ICOH member for more than two decades, participated remotely in the ceremony and expressed her thanks to the audience, which responded with a standing ovation. Dr Fingerhut, PhD and a molecular biologist by qualification, is retired from the National Institute for Occupational Safety and Health (NIOSH, USA), where she worked for 25 years. She also worked for NIOSH at the WHO in Geneva, Switzerland. She served as an ICOH Board member for two triennia (2009–2015) and as ICOH vice president for two non-consecutive triennia (2006–2009 and 2015–2018). She contributed to the ICOH leadership, organising several congresses, and assisted in the founding of the SCs on Women, Health and Work (SC WHW) and Mining Occupational Safety and Health (SC MinOSH).



Dr Marilyn Fingerhut
Photograph: courtesy of ICOH

The welcome cocktail followed the opening ceremony, and was held in the pool area of the Mövenpick Hotel Mansour Eddahbi, a haven of lush greenery, tranquillity, and luxury, located adjacent to the *Palais de Congrès*. It was an animated event of Moroccan hospitality, sumptuous cuisine, and world music, very conducive to socialising under the Marrakesh evening sky. Friends and colleagues in occupational health from across the globe were offered the perfect opportunity to meet again, face-to-face, and to catch up after the long hiatus brought about by the global Pandemic.

ICOH2024 Congress Global Policy Forum

The Global Policy Forum, titled 'Strategies to improve occupational health and safety policies and implementation in low- and middle-income countries', a highlight of the congress, was held on Tuesday, 30 April 2024. The main focus of the forum was the practical implementation of research findings to improve workers' health, in the era of globalisation. The forum also explored the lessons learned from high-income countries and the realities facing LMICs, with the main aim of formulating strategies for priority actions and programmes that can help to create a more harmonised world of work in the future. The forum addressed pressing occupational

risk issues on each continent, particularly in LMICs, the current status of practices for managing these risks, and gaps between research and practice.

Leading experts in the fields of research and practice in occupational health from international and national policy-making organisations, public institutes, and professional associations were invited to engage in interactive discussions with congress participants. Speakers were selected with the aim of achieving representation from different regions of the world, including the host country, and professional organisations from various disciplines.

The moderator was Prof. Seong-Kyu Kang (ICOH President), Gachon University Gil Medical Center, Incheon, Republic of Korea. The invited panel participants, representing various sectors, were as follows:

- International organisations
  - WHO – Dr Tedros Adhanom Ghebreyesus, Director General (video recorded message), Geneva, Switzerland
  - WHO – Dr Ivan Ivanov, Cross-cutting Lead, Occupational and Workplace Health, ECH Directors' Office, HQ/HEP/ECH, Geneva, Switzerland
  - ILO – Joaquim Pintado Nunes, Chief of Labour Administration, Labour Inspection and Occupational Safety and Health, Geneva, Switzerland
- Enforcement authority
  - Africa – Younes Sekkouri, Minister of Economic Inclusion, Small Business, Employment and Skills, Rabat, Morocco
- Regional organisation
  - Europe – William Cockburn, Executive Director, EU-OSHA, Bilbao, Spain
- Research
  - North America – Dr Lyne Sauvageau, President and CEO, Robert-Sauvé Research Institute on Health and Safety at Work (IRSST – *Institut de Recherche Robert-Sauvé en Santé et en Sécurité du Travail*), Montreal, Canada
- Academia
  - South America – Prof. Marcia Bandini, Latin American Association of Occupational Health (ALSO – *Asociación Latinoamericana de Salud Ocupacional*), University of Campinas, São Paulo, Brazil
- Practice
  - Asia – Teresita S Cucueco, Consultant, Philippines College of Occupational Medicine (PCOM), Former Executive Director, Occupational Safety and Health Centre, Department of Labour and Employment (DOLE-OSHC), Manilla, Philippines

The deliberations arising from the forum and the scientific programme throughout the congress week served as the foundation for the 'Marrakesh Declaration on Occupational Health', which was adopted by the ICOH2024 Congress on 3 May 2024. The Declaration expresses the commitment of ICOH to take action for the development of occupational health, wellbeing, work ability, and decent work and life for all workers of the world, in collaboration with other relevant international actors. More specifically, ICOH calls for support from the ILO and WHO, through: (i) the revitalisation of the Joint ILO/WHO Committee on Occupational Health, (ii) a request from the ILO to its member states to ratify the ILO Convention 161, and (iii) a request for the WHO to revitalise and expand its global and regional networks of Collaborating Centres in Occupational Health. The Declaration was signed by Prof. Abdeljalil El Kholti, President of the ICOH2024 Congress, and Prof. Seong-Kyu Kang, ICOH President, and has been published in *Safety and Health at Work* (https://doi.org/10.1016/j.shaw.2024.05.006).



The dotted line uniting two Presidents – ICOH President, Prof. Seong-Kyu Kang (left) and ICOH2024 Congress President, Prof. Abdeljalil El Kholti, sign the 'Marrakesh Declaration on Occupational Health'

Photograph: courtesy of ICOH

During the congress, three international organisations in occupational health – the ICOH, International Ergonomics Association (IEA), and IOHA – renewed their Memorandum of Understanding (MoU) for ongoing closer collaboration.



United we stand (and sit) – Signing of the MoU between the ICOH, IOHA and IEA. Standing, L–R: ICOH Vice Presidents Martin Hogan (Ireland) and Claudina Nogueira (South Africa); Diana Gagliardi, ICOH Secretary General (Italy); Paulo António Barros Oliveira (Brazilian Ergonomics Association); Frida Marina Fischer, ICOH Board member (Brazil). Seated, L–R: Samantha Connell, IOHA President (Switzerland); Seong-Kyu Kang, ICOH President (Republic of Korea); José Orlando Gomes, IEA President (Brazil)

Photograph: courtesy of Prof. Frida Marina Fischer (Brazil)

ICOH2024 Congress plenary and semi-plenary presentations

The following plenary and semi-plenary presentations were delivered from 29 April to 3 May 2024 (in alphabetical order of presenter surnames):

Plenary presentations

- Nicola Cherry (Canada) – Department of Public Health, University of Alberta: 'Occupational health epidemiology in the face of disasters'
- Titilola Hameed (Nigeria) – Legal Professor, Nigerian Law School: 'Occupational safety and health: probing the legislative affairs within the African continent'
- Bobby Joseph (India) – Head, Department of Community Health, St. John's Medical College, Bangalore: 'Development of occupational health services in a medical college setting in India: looking back over 25 years to inform the future'
- Maria Neira (Spain) – Director, Department of Public Health and Environment, WHO, Geneva, Switzerland: 'Healthy, safe, and resilient workplaces for all'
- Stéphane Pimbert (France) – General Director, French National Institute for Research and Safety (INRS): 'Occupational health and public policies'
- Kathy A Seabrook (USA) – CEO, Global Solutions, Inc.: 'Connecting the dots: the value of people at work and their health, safety and wellbeing'
- João Silvestre Silva-Junior (Brazil) – Professor, University of São Paulo Medical School and São Camilo University Centre: 'Mental health of frontline healthcare workers during the COVID-19 pandemic'
- Malcolm Sim (Australia) – Professor Emeritus, School of Public Health and Preventive Medicine, Monash University, Melbourne: 'From Ramazzini to robots: the impact of new technologies on occupational health'
- Loubna Tahri (Morocco) – Assistant Professor, Faculty of Medicine and Pharmacy, Hassan II University of Casablanca: 'Most wanted OSH actions in Morocco: current state, lessons learned and the way forward'
- Ken Takahashi (Japan) – Professor Emeritus, Advisor for International Centre, University of Occupational and Environmental Health: 'Global spread of asbestos-related diseases: still seriously under-recognised'

Semi-plenary presentations

- Ken Addley (Ireland) – 'Health inequality in work: advocating for occupational health in Ireland'
- Salima Admi (Morocco) – 'Impact of international regulatory standards in the implementation of public occupational safety and health policies'
- Houssine Azeddoug (Morocco) – 'Leading innovation for excellence in occupational health in Moroccan universities on the eve of major world-class projects'
- Ana Bakic (Montenegro) – 'Heavy physical work and fatigue in healthcare workers'
- Thuthula Balfour (South Africa) – 'Prevention culture in the mining industry: a female perspective from the African region'
- Amy Behrman (USA) – 'Vaccine recommendations, and mandates for adults and specific worker populations'
- Mohammed Ali Benmakhlouf (Morocco) – 'Ethical issues of global health'
- Jorge Morales Camino (Mexico) – 'Long COVID impact on workers and its monitoring in occupational health'
- Jiabin Chen (People's Republic of China) – 'Post-pandemic occupational health services in Guangdong Province, China'
- San Daniel Choi (USA) – 'Prevention through design (PTD) and research to practice to research (RTPTR) in the ageing US construction workforce: bridging the gap between academia and practitioners'
- Cecilia Colautti (Argentina) – 'Risks and challenges in the ferro-port work of the General Ports Administration (AGP), Port of Buenos Aires, Argentina'
- Martin Cottam (UK) – 'Building global consensus for occupational health and safety management through ISO standardisation'
- Andrew Curran (UK) – 'Transmission of SARS-CoV-2: findings from a national core study'
- Tiaan de Jager (South Africa) – 'Endocrine disrupting chemicals: impact on the environment and human health'
- Marie-Agnès Denis (France) – 'Mental health and occupational health'
- Alexis Descatha (France) – 'Job exposure matrices: past, present, and future'
- Jorge Barroso Dias (Portugal) – 'Promoting longevity by means of 'ATOS' – alcohol, tobacco, obesity, and sleep: measuring, intervening, and controlling major risk factors in the workplace'
- Marie Diallo (Senegal) – 'The culture of workplace improvement in Senegal: the social security strategies'
- Maria Claudia Borda Gallon (Colombia) – 'Lifestyle medicine as a strategy for health and productivity in the workplace'
- Fabriziomaria Gobba (Italy) – 'Occupational health surveillance of workers exposed to non-ionizing radiation: lessons learned and new challenges'
- Halim Hamzaoui (Switzerland) – 'Biological hazards'
- Chakib El Houssine Laraqui Hossini (Morocco) – 'Occupational health and safety of coastal fishermen: a gap to fill in developing countries'
- Jan Hoving (The Netherlands) – 'Development and validation of a core outcome set for work participation'
- Louis Laurent (France) – 'Research and occupational health'
- Koji Mori (Japan) – 'Development, success factors and challenges of health and productivity management initiatives in Japan'
- Suvarna Moti (India) – 'Basic occupational health services: challenges and opportunities for universal occupational healthcare'
- Ade Mutiara (Indonesia) – 'Digitalisation in occupational health programmes: the new challenges'
- Dorothy Ngajilo (Tanzania) – 'Caring for those who care: safeguarding health, safety and wellbeing of health workers'
- Noriko Nishikido (Japan) – 'Support for balancing medical treatment and work in small- and medium-sized enterprises: the role and function of occupational health nurses'
- Diane Rohlman (USA) – 'Health effects of organophosphorus pesticides on children working in the agricultural industry'
- Evgeny Shigan (Russian Federation) – 'Modern requirements for occupational physician professional competencies'
- Jin-Ha Yoon (Republic of Korea) – 'Platform workers: social inequity in occupational safety and health'

ICOH2024 Congress gala dinner

The congress gala dinner was held on Thursday 2 May 2024, at the *Palais Dar Soukkar* ('Sugar Palace', in Arabic), a stunning historic mansion located in the heart of Marrakesh, renowned for its intricate and

elegant design, and rich history. Built during the late 19th century by a wealthy Moroccan family as a residence, one of its most notable features is its Moorish architecture, characterised by elaborate tilework, ornate plaster carvings, and intricately carved wooden ceilings. The interior is adorned with colourful mosaics, marble columns, and luxurious furnishings, showcasing the craftsmanship and artistic flair of Moroccan artisans. In 2004, the *Palais* was renovated into a boutique hotel, to host prestigious private events such as the Marrakesh International Film Festival, the *Marrakesh Du Rire* (comedy festival), and the Dior evenings. In 2016, *Dar Soukkar* launched its charming and unmissable dinner and entertainment show to the wider global community. Diners were treated to an unforgettable night – unique ambience, delectable cuisine (a fusion of Moroccan, Asian and Mediterranean flavours and culinary traditions), and spectacular entertainment (musicians, fire eaters, dancers… in essence, cultural magicians!). The *Palais Dar Soukkar* stands as a testament to Morocco's rich architectural heritage and serves as a captivating destination for travellers seeking to immerse themselves in the beauty, splendour, and tradition of Marrakesh. The décor is exquisite and authentic, the dimmed lights and lanterns create the illusion of a mystical arch, the water features are illuminated, and the gardens are lush – well worth a return visit!



The gala dinner was held in the sumptuous *Palais Dar Soukkar*
Source of graphics: https://www.darsoukkar.com/



Entertainers at the gala dinner
Source of graphics: https://www.darsoukkar.com/



Occupational health doyens from the South – L–R: Profs Daan Kocks (SASOM Chair and ICOH National Secretary for South Africa, 2018–2024), Gill Nelson (OHSA Editor-in-Chief and University of the Witwatersrand) and Mary Ross (Chair: SC on Biohazards and Occupational Health, 2022–2024 and University of the Witwatersrand) flew the South African flag high at the ICOH2024 Congress
Photograph: courtesy of Prof. Gill Nelson (South Africa)

ICOH2024 Congress closing ceremony

The closing ceremony was held on Friday 3 May 2024. The Congress President, Prof. Abdeljalil El Kholti, presented overall highlights and a short report on the congress. The ICOH President, Prof. Seong-Kyu Kang, presented highlights and take-home messages from the Global Policy Forum. This was followed by a summary of the scientific programme and statistics for free paper and special sessions, presented by the two congress scientific co-chairs: Prof. Kamal Wifaq (Chair of the National Scientific Committee and University Hassan II of Casablanca, Morocco) and Claudina Nogueira (ICOH Vice President for SCs and Chair of the International Scientific Advisory Committee, and SASOM ExCo member, South Africa). The awards for the winners of the student poster competition, the ILO Master Fellowships in OSH, and the best poster presentation by a Moroccan delegate (the Jaouad El Jaï Prize) were announced by Claudina Nogueira, Dr Diana Gagliardi, and Prof. Kamal Wifaq, respectively.

The ICOH flag was passed from Prof. Abdeljalil El Kholti, President of the Congress, to the Organising Committee members of the ICOH2027 Congress, themed *Occupational Health – Growth and Sustainability in Changing Times*, to be held in Mumbai, India, 14–19 February 2027. The handover of the flag followed video presentations about the next congress, and highlights of ICOH2024. The congress was declared officially closed by the ICOH President, Prof. Seong-Kyu Kang, after his vote of thanks to all individuals and teams involved, especially the participants, in making the ICOH2024 Congress a resounding success.

Second ICOH General Assembly

The closing ceremony was followed by the Second ICOH General Assembly, which was attended by ICOH members in good standing only; it included the following presentations and events:

- Opening address – Prof. Seong-Kyu Kang, ICOH President
- Farewell to ICOH Officers and Board members of the previous triennium 2022–2024, and respective service awards – Dr Diana Gagliardi, ICOH Secretary General



Reunited for the last time – ICOH Officers and Board members of the 2022–2024 triennium. Standing, L–R: Akizumi Tsutsumi (Japan), Sandeep Sharma (India), Maureen Dollard (Australia), Alexis Descatha (France), Riitta Sauni (Finland), Olivier Lo (Singapore), Stavroula Leka (UK), Sergio Iavicoli (Italy), Dingani Moyo (Zimbabwe), Shyam Pingle (India), Paul Schulte (USA). Seated, L–R: Jukka Takala (Finland), Claudina Nogueira (South Africa), Seong-Kyu Kang (Republic of Korea), Diana Gagliardi (Italy), Martin Hogan (Ireland), Frida Marina Fischer (Brazil)

Photograph: courtesy of ICOH

- Report from the scrutineers' committee of the elections of the ICOH Officers and Board members for the new triennium (2024–2027) – Dr Jorge Camino Morales, President of the ICOH2012 Congress, Cancún, Mexico
- Results of the elections of ICOH Officers and Board members for the new triennium (2024–2027)
  - ICOH Officers:
    - President – Prof. Seong-Kyu Kang (Republic of Korea)
    - Secretary General – Dr Diana Gagliardi (Italy)
    - Vice President for Scientific Committees – Dr Martin Hogan (Ireland)
    - Vice President for National Secretaries – Dr Shyam Pingle (India)
    - Past President – Dr Jukka Takala (Finland)
  - ICOH Board members:
    - Naesinee Chaiear (Thailand), Alexis Descatha (France), Quentin Durand-Moreau (Canada), Rim El Kholti (Morocco), Stefan Esser (Germany), Dongmug Kang (Republic of Korea), Ashish Mishra (India), Aida Fajardo Montiel (Mexico), R Rajesh (India), Rosylane Rocha (Brazil), Riitta Sauni (Finland), Mahinda Seneviratne (Australia), Giovanna Spatari (Italy), Akizumi Tsutsumi (Japan), Kamal Wifaq (Morocco), and Charles Yarborough (USA)
    - President's address and strategy for 2024–2027
    - Bid results of the vote for the venue of the ICOH2030 Congress: Congratulations to Rome, Italy, for winning the bid to host the ICOH Congress in 2030!



From traditional craftsmanship to modern marvel – The production of argan oil in Morocco is an art form that combines tradition, dedication, and innovation. From the painstaking labour carried out by Berber women to the incorporation of modern techniques, the result is a pure and exquisite oil that captures the essence of Moroccan heritage, and is highly prized in the cosmetics industry

Photograph: Claudia Frost (South Africa)



Lights, camera, action – The congress social programme included a Moroccan cultural evening showcasing traditional music and lively dance

Photograph: Claudia Frost (South Africa)

ICOH Board and other meetings associated with the ICOH2024 Congress

The meetings of the ICOH Officers and Board members from the previous triennium (2022–2024) were held prior to the ICOH2024 Congress – on 27 and 28 April 2024. The newly appointed Officers and Board members met for the first time after the congress, on 4 May 2024, in Marrakesh, Morocco.

The 13th Meeting of the Global Network of WHO Collaborating Centres for Occupational Health was held in hybrid format before the congress, from 25 to 26 April 2024, at the Grand Mogador Menara Hotel, Marrakesh, Morocco.

Photographs, congress statistics, and approval for the use of the ICOH and ICOH2024 Congress logos: courtesy of ICOH and the ICOH2024 Congress Organisers (Morocco), unless stated otherwise.

ICOH Statements at the ILO's 112th International Labour Conference

Source: International Labour Organization (ILO)

The ICOH Officers, Prof. Seong-Kyu Kang (President), Dr Diana Gagliardi (Secretary General), and Dr Jukka Takala (Past President) represented ICOH at the ILO's 112th International Labour Conference, held in Geneva, Switzerland, from 3 to 14 June 2024. Delegates representing worker, employer and government sectors from the ILO's 187 member states addressed a wide range of issues, including (i) a standard-setting discussion on protection against biological hazards, (ii) a recurring discussion on the strategic objective of fundamental principles and rights at work, and (iii) a general discussion on decent work and the care economy. The ILO Conference also elected members of the Governing Body for the 2024–2027 term of office.

On this occasion, two ICOH statements were presented, verbally:

- 'The road for decent work together with healthy workers' at a conference plenary session: https://www.icohweb.org/site/multimedia/news/pdf/The%20Road%20for%20Decent%20Work.pdf
- 'The importance of successful prevention of biological hazards' at the Biological Hazards Committee session: https://www.icohweb.org/site/multimedia/news/pdf/Biorisks%20ILC%20112%20June%202024.pdf

The recording of the plenary address on decent work delivered by the ICOH President can be accessed at: https://live.ilo.org/events/plenary-debates-afternoon-sitting-2024-06-04?segmentid=89a3b3f4-4a77-435c-b6e0-14819d8563ef



'To get to know, to discover, to publish; this is the destiny of a scientist' – François Arago
The ICOH2024 Congress scientific programme comprised 73 special sessions (including 'How to publish your work on workers' health: insights from the Editors-in-Chief of several OSH journals', pictured) and 78 free paper sessions on a wide range of topics
Photograph: Prof. Seong-Kyu Kang (Republic of Korea)

SAIOH news

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

SAIOH PRESIDENT'S ADDRESS

Naadiya Mundy: SAIOH President
e-mail: president@saioh.co.za



Naadiya Mundy
Photograph: courtesy of SAIOH

As *Occupational Health Southern Africa* celebrates its 30th anniversary, it is essential to acknowledge the symbiotic relationship with the Southern African Institute for Occupational Hygiene (SAIOH) in advancing workplace health and safety. It is a true testament to the hard work and dedication of the team, authors, and readers. SAIOH's tireless efforts in research, education, and collaboration have undoubtedly enriched the content and discussions within the Journal's pages over the years. By providing a platform for disseminating groundbreaking research, sharing best practices, and fostering dialogue among professionals, the Journal has been instrumental in amplifying SAIOH's contributions to the field of occupational hygiene. As we applaud the accomplishments of SAIOH, let us also recognise the pivotal role the Journal has played in shaping the discourse and driving progress in occupational health and safety over the past three decades.

The speed with which SAIOH has achieved success is a testament to the hard work and commitment of our volunteers, who have been determined to see our Institute succeed. We thank you for your dedication.

Keeping cool: can use of PPE contribute to the heat burden?

Heat stress is a significant concern in occupational hygiene, especially when workers are required to wear personal protective equipment (PPE) that can contribute to heat build-up. 'Hot' working environments include foundries, construction sites, mines, etc. Personal protective equipment such as protective clothing, gloves, and respirators can impede the body's ability to regulate temperature, leading to increased heat retention. This is particularly problematic in hot and humid environments where sweat evaporation – a key mechanism for cooling the body – is compromised. Workers wearing PPE are more susceptible to heat stress, which can manifest as heat exhaustion, heat stroke, or other heat-related illnesses.

Thermal comfort has emerged as a significant concern in advancing Sustainable Development Goals (SDGs) 3, 7, and 11, which target *"good health and well-being"*, *"affordable and clean energy"*, and *"sustainable cities and communities"*. Thermal comfort is defined as an individual's perception of satisfaction with the thermal environment.[1] Air temperature, radiant temperature, relative humidity, air velocity, metabolic rate, and clothing insulation are all intricately linked to thermal comfort. Consequently, alterations in these factors can affect human thermal comfort.[2]

The human body's thermal physiology is intricate, operating as a thermodynamic system that manages heat to keep the internal body temperature close to 37 °C.[3] Thermal comfort is, thus, linked to the challenge of either dissipating or retaining heat to sustain an optimal body temperature. While essential for numerous work tasks, the use of PPE can disrupt this thermal equilibrium, by impeding the body's ability to dissipate excess heat through convection, radiation, and evaporation. Heat retention occurs whenever the body cannot sufficiently shed heat due to the thermal insulation provided by PPE, leading to a rise in body temperature.[4] Body temperature is regulated through perspiration, where heat is transferred from the body through convection of heat from the skin and the evaporation of sweat. A reduced rate of evaporation slows down the body's cooling process, leading to an increased sense of heat and discomfort.

High-temperature environments, combined with impaired heat dissipation due to PPE usage, can pose significant thermal physiological risks. Severe heat stress reactions in such conditions can be detrimental to human health and may even be fatal. Psychological stress and anxiety, along with the thermal stress induced by high temperatures when wearing PPE, are important risk factors that impact individuals' health and wellbeing.[5] The inability to dissipate heat while wearing PPE in high-temperature environments can lead to heat stress, increasing physical strain, stress, and anxiety. Studies have shown that heat stress raises the likelihood of heat-related disorders, such as headaches, palpitations, breathing difficulties, and dermatitis.[4] Exposure to heat can also impact normal behaviour and cognitive processes. In various occupations, increased heat can reduce productivity and raise the risk of errors, heightening the danger of the job.[6] High humidity intensifies thermal stress in hot environments, rendering the work environment intolerable. The combination of increased skin moisture and inhalation of hot, humid air can greatly discomfort individuals wearing PPE. The combination of wearing PPE and exposure to high temperatures can be harmful to workers, particularly if they are unacclimatised to hot work environments, immune-compromised, and /or taking prescription medication. Although we make use of indicators to measure and assess heat stress, such as the wet bulb globe temperature (WBGT) index, and associated guidelines, e.g. the American Conference of Governmental Industrial Hygienists' (ACGIH's) threshold limit values (TLVs), and the US National Institute for Occupational Safety and Health's (NIOSH's) recommended exposure limits (RELs) to protect workers, adjustment factors should be applied to clothing in high-risk environments.

To address heat burden, it is important for occupational hygienists to consider heat stress within their risk assessments, as well as to encourage employers to implement strategies to mitigate heat

stress, such as providing adequate ventilation, rest breaks in cool areas, hydration, and using PPE designed to minimise heat build-up. Using technology, such as wearable sensors, to monitor workers' physiological responses to heat stress, and adjust workloads accordingly, could potentially reduce risks for thermal discomfort and heat stress. Training workers to recognise the signs of heat stress and encouraging them to monitor their own conditions can further help to prevent serious health issues.

REFERENCES

1. Djongyang N, Tchinda R, Njomo D. Thermal comfort: a review paper. Renew Sustain Energy Rev. 2010; 14(9):2626-2640. doi: 10.1016/j.rser.2010.07.040.
2. Aqilah N, Rijal HB, Zaki SA. A review of thermal comfort in residential buildings: comfort threads and energy saving potential. Energies (Basel). 2022; 15(23):9012. doi: 10.3390/en15239012.
3. De Almeida RA, Veiga MM, De Castro Moura Duarte FJ, Meirelles LA, Veiga LB. Thermal comfort and personal protective equipment (PPE). Work. 2012; 41 Suppl 1:4979-4982. doi: 10.3233/WOR-2012-0042-4979.
4. Crockford CW. Protective clothing and heat stress: introduction. Ann Occup Hyg; 1999; 43(5):287-288.
5. Khan S, Siddique R, Ali A, Bai Q, Li Z, Li H, et al. The spread of novel coronavirus has created an alarming situation worldwide. J Infect Public Health. 2020; 13(4):469-471. doi: 10.1016/j.jiph.2020.03.005.
6. Jiang H, Cao B, Zhu Y. Thermal comfort of personal protective equipment (PPE) wearers in different temperatures and activity conditions. J Build Eng. 2023; 78:107609. doi.org/10.1016/j.jobe.2023.107609.

NATIONAL COUNCIL FEEDBACK

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

SAIOH held its first Council meeting on 18 March 2024 and welcomed the newly elected Council members. SAIOH Council members have had a busy four months with numerous meetings taking place with the Department of Employment and Labour, Occupational Hygiene Approved Training Providers, and the Occupational Hygiene Training Association (OHTA).

Strategic plan

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

Ethics

SAIOH's ethics policy and procedure(s) remain with NGO Law, our legal advisors, who are in the process of reviewing and reworking the document for comment and approval by Council. SAIOH and North-West University (NWU) are in talks to develop SAIOH's own Ethics course, focusing on ethics in occupational hygiene, and hope to have the NWU team present the course at the 2024 SAIOH Annual Conference in Botswana in October.

SAIOH branch activities

The Western Cape branch had its first meeting of the year on 8 March 2024. Presentations included SAIOH's Asbestos Bulk Analysis course, using polarised light microscopy, and U-Masks' presentation on protective face masks. This was the first meeting chaired by the newly elected Western Cape branch Chair, Vuyiseka Zikolo.

The Gauteng branch hosted its first meeting on Friday 1 December 2023, with presentations on radiation and ultra-violet and infrared safety lenses. The new Gauteng branch Chair is Cecil-Roux Steyn.

The Zululand branch had a re-launch meeting on 19 February, during which a new committee was elected. Their newly elected Chair is Alott Baloyi. The Zululand branch is organising the Noise Masterclass that will be held in Richards Bay on 24 April 2024.

The Botswana Association for Occupational Hygiene (BAOH) meets regularly and is fully committed to organising the SAIOH 2024 Conference to be held Gaborone on from 21 to 24 October 2024.

International Occupational Hygiene Association and Occupational Hygiene Training Association feedback

The Occupational Hygiene Training Association (OHTA) examination system recently underwent a complete revision and OHTA will now manage the process internally. SAIOH's service, as the administering body of the OHTA201 assessments, has been rescinded, effective 30 April 2024. As from 1 May 2024, OHTA will be the only awarding body for all its modules; all training material and assessments must be done via OHTA.

The 2024 IOHA Lifetime Achiever Award has been conferred on Deon Jansen van Vuuren

This award honours individuals who have made significant contributions to the promotion and development of occupational hygiene practice that improve the health and welfare of working men and women.

The International Occupational Hygiene Association (IOHA) has relaunched its *Global Exposure Manager* (GEM) newsletter, which is available on the IOHA website. The IOHA National Accreditation Recognition (NAR) Committee is revising the accreditation evaluation matrix for all new and reaccredited associations. The IOHA Governance Committee is updating its management system, quality procedures, and document management system. The IOHA 2024 Annual Scientific Conference was held in the AVIVA Stadium in Dublin, Ireland, from 9 to 13 June 2024.

SAIOH Technical Committee feedback

SAIOH, in conjunction with Sedulitas, is organising a series of Noise Masterclasses. Internationally recognised noise specialists will present the Masterclasses.

The Department of Employment and Labour requested comments on the new Lead Regulations by the end of May 2024. Comments by SAIOH and other associations were submitted.

Note: There is no change to the occupational exposure limit (OEL) for lead. Risk assessments must now be conducted every 24 months. Exposure monitoring is more technical; exit medicals must be done, etc.

Annual SAIOH Scientific Conference

The Botswana branch will host the SAIOH-BAOH Annual 2024 Conference in Gaborone with the theme, *Sustainable occupational hygiene in changing work environments and emerging economies*. The dates for the conference have been finalised as 21–24 October 2024; the venue is Phakalane Golf Estate and Convention Centre, just outside Gaborone.

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

	Written assessments				Oral assessments			
Certification category	Assessed	Passed	Failed	Pass rate	Assessed	Passed	Failed	Pass rate
	n	n	n	%	n	n	n	%
OH assistant	41	41	0	100	0	0	0	-
OH technologist	31	24	7	77.4	31	17	14	54.8
Occupational hygienist	14	8	6	57.2	8	7	1	87.5
Total	**86**	**73**	**13**	**84.9**	**39**	**24**	**15**	**61.5**

Communications

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

FROM THE PROFESSIONAL CERTIFICATION COMMITTEE (PCC)

Lee Doolan: SAIOH PCC Administrator
e-mail: lee@saioh.co.za
Deon Jansen van Vuuren: SAIOH General Manager
e-mail: deon.jvvuuren@gmail.com
Corlia Peens: PCC Chairperson
e-mail: corlia.peens@sasol.com

Certification assessments

A summary of results for the written assessments that took place in March to May 2024 is provided in Table 1.

PCC assessment improvements

The PCC technical team have revised the skillset and is in the process of developing scenario questions in line with the requirements for oral assessments.

Occupational Hygiene Skills Forum (OHSF)

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

Dr Ivan Naranjan attended the annual Universities of Technologies' Curriculum workshop. This workshop falls within the scope of the OHSF, which noted that many tertiary qualifications were mentioned on application forms. With no understanding of the curricula covered by these qualifications, the alignment thereof with the required occupational hygiene-related content could not be accurately evaluated.

By recognising a programme, the SAIOH PCC declares that, to its knowledge, the programme contains at least 50% occupational hygiene-related content as defined by the IOHA National Accreditation Recognition (NAR) Committee, or includes the content covered in the OHTA modules, plus sufficient information regarding the skillsets defined in the SAIOH self-assessment tool. The objective is to ensure that a member applying to upgrade his/her occupational hygiene qualifications has completed an academic qualification that covered all topics that may be addressed in assessments, thereby improving knowledge and competency in the occupational hygiene field.

Asbestos Bulk Analysis training (SAIOH AP102), presented by Julie Hills, took place in Cape Town on 15 April 2024. The module comprises a practical and written examination, which include the introduction to types of asbestos, asbestos-containing materials and health effects, an overview of South African legal requirements, sample preparation, initial evaluation of sample type using stereo microscopy, set up and use of a polarised light microscope, quality control, and reporting and communication.

Finding missing TB cases post the COVID-19 epidemic at Doornkop operation, Harmony Gold Mine: lessons learnt

Tumi Legobye: Health and Wellness Executive, Harmony Gold Mining Company Limited; MMPA President
e-mail: Tumi.Legobye@Harmony.co.za

BACKGROUND

Tuberculosis (TB) is a preventable and, usually, curable disease. According to the World Health Organization (WHO), TB was the world's second leading cause of death from a single infectious agent in 2022, after coronavirus disease.[1] Tuberculosis was also reported to have caused almost twice as many deaths as HIV/AIDS.[1] Globally, more than 10 million people are infected with TB every year.[1] Country member states of the United Nations and the WHO are committed to ending the TB epidemic, globally, by 2030.[1,2]

The WHO has taken great strides to upscale TB case finding, globally, post-COVID-19 and has provided recommendations on measures that countries should take to find missing TB cases. This includes systematic screening for TB disease in the general population and among people at risk, household and close contacts, inmates, people living with HIV (PLHIV), and people exposed to silica in workplaces with a high TB prevalence.[1]

South Africa, with less than 0.8% of the global population, contributes 3.6% of all TB cases worldwide, making it one of the countries with the highest burdens of TB.[1] South Africa remains one of eight countries that collectively account for two-thirds of the world's TB burden.[3] The country also has the world's largest HIV epidemic, leading to a high TB/HIV co-infection rate of 54%.[1,4] People living with HIV are 18 times more likely to develop TB than HIV-negative individuals, particularly when not on antiretroviral therapy (ART).[5] In South Africa, TB remains a leading cause of death among PLHIV.[5,6] Stigma and socio-economic factors contribute to poor treatment adherence and outcomes, including high mortality, among TB/HIV co-infected individuals.[7] Poor nutritional status also increases the risk of mortality in people with HIV/TB co-infection.[6]

South Africa adopted the WHO recommendations for finding missing TB cases and, thus, developed a TB recovery plan, comprising four critical pillars: [8]

1. Find people with undiagnosed TB
2. Strengthen linkage of people diagnosed with TB to treatment
3. Strengthen retention in TB care
4. Strengthen TB prevention

The emphasis is on finding missing TB cases in high-risk populations, including PLHIV. It is through this recovery plan that the country developed a TB screening standard operational procedure (SOP) in 2022.[3] The purpose of this SOP is to scale up TB case finding at health facility level and community level, using evidence-based scientific tools such as Xpert MTB/RIF (GXP-TB), one of the WHO-recommended molecular rapid diagnostic tests, digital X-rays, and lateral flow urine lipoarabinomannan (LF lam).

Harmony Gold

Harmony is a global, sustainable gold mining and exploration company. It is also the largest producer of gold from the retreatment of old tailings dams, making it a major player in the circular economy of gold.[8]

Harmony operates in three provinces in South Africa:
1) Gauteng, where it has three operations (Doornkop, Kusasalethu, and Mponeng mines); North West (Moab Khotsong operation); and 3) Free State (Masimong, Joel, Target, Tshepong, Target 1, and Joel mines).

Doornkop is one of the deep-level single-shaft operations in Gauteng province, about 30 km west of Johannesburg, on the northern rim of the Witwatersrand basin. While it is a mature operation, it still has 15 remaining 'life-of-mine' years.[9] In 2022 and 2023, the size of the workforce at Doornkop operation was 4 444 and 4 543, respectively.[9]

In 2022, Doornkop reported 28 new cases of TB to both the Department of Health and the Department of Mineral Resources and Energy (DMRE), compared to 33 cases in 2023; incidence rates were approximately 630/100 000 and 726/100 000 in 2022 and 2023, respectively.

TB CASE-FINDING PROJECT

In March 2022, during TB awareness month, Harmony embarked on a project to strengthen TB case-finding in high-risk populations at Doornkop mine to: 1) find missing TB cases in high-risk populations, using the health facility TB screening algorithm at Doornkop medical hub; 2) scale up dust control measures/controls to prevent the spread of TB in high-risk populations; and 3) scale up TB prevention therapy to all identified high-risk groups at the Doornkop operation.

A desktop review was conducted at Doornkop medical hub. Tuberculosis data were collated for the period 2022–2023, post COVID-19. The following TB cascade indicators were reviewed for all reported TB cases:

1. TB screening
2. Suspect TB cases identified
3. Mode of TB diagnosis and TB/HIV integration component by looking at TB/HIV co-infection rate
4. Contact tracing of index TB cases was reviewed to assess TB cases identified using the TB screening tool

Socio–demographic data such as age, sex, occupation, record of service at Harmony Gold mine, and living occupancy were also collected.

Results

TB case finding cascade

More than 4 000 employees were screened for TB in both 2022 and in 2023 (Figure 1). Twice the number of presumptive TB cases were identified in 2023 than in 2022, viz. 390 (8.6%) and 196 (4.5%), respectively. Of these, 28 (14.3%) were diagnosed with TB disease in 2022, and 33 (8.5%) in 2023. All were male employees.

Mode of TB diagnosis

Seventeen of the cases were diagnosed in 2022 using the GXP-TB sputum test (60.7%) and nine (32.1%) were diagnosed on chest X-ray.

Table 1. Socio-demographic characteristics of employees diagnosed with TB, 2022 and 2023

Year of diagnosis	n	No. HIV-positive	Age range (years)	Work area	Place of residence		
					Within mine premises	Outside mine premises	Unknown
2022	28	20	25–59	Underground	12	16	0
2023	33	24	29–59	Surface/ underground	10	20	3

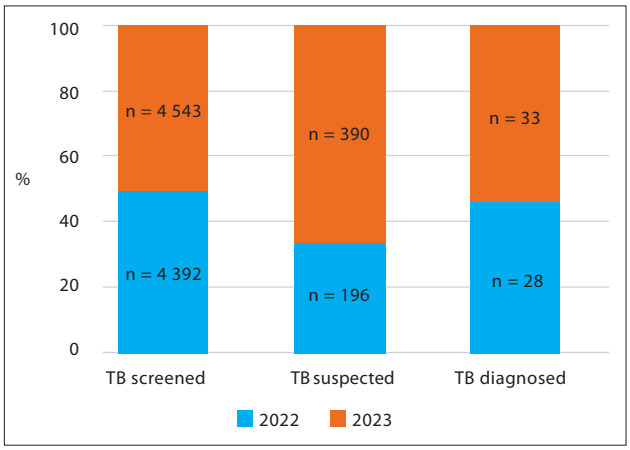


Figure 1. TB case-finding cascade

In 2023, 17 cases (51.5%) were diagnosed using the GXP-TB sputum test, 13 (39.4%) were diagnosed on chest X ray, and three (9.1%) were diagnosed using LF lam.

Demographic characteristics

Employees diagnosed with TB were aged from 25 to 59 years and worked both on-surface and underground (Table 1). More (almost 60%) lived outside the mining premises than within. Twenty (71.4%) and 24 (72.7%) of the TB cases were HIV-positive in 2022 and 2023, respectively.

The occupation of TB cases diagnosed in 2022 and 2023 varied widely. Those who worked underground were mainly from the production workforce.

Exposure to dust

In 2022, 17 of the TB cases were in homogeneous exposure group (HEG) A dust exposure category, four were in HEG B and seven were in HEG C. In 2023, only one case was in HEG A, while 24 and seven were in HEGs B and C, respectively (Table 2).

Table 2. TB cases by exposure category, 2022 and 2023

Exposure category/ HEG	RCS dust concentration (mg/m^3)	No. TB cases		
		2022	2023	All
C	< 0.05	7	7	14
B	0.05–0.1	4	24	24
A	> 0.1	17	1	18

Conclusion

The WHO continues to support countries with high TB burdens in their efforts to find missing TB cases, as a commitment to the goal of ending TB by 2030. South Africa is one of the countries with a high proportion of undiagnosed TB cases, and it has made great strides in its endeavours to find missing cases. The SOP for screening and testing for TB was implemented at Doornkop operations in 2022 and provides evidence that this is an effective strategy to find TB cases.

REFERENCES

1. Global tuberculosis report 2023. Geneva; World Health Organization; 2023. Available from http://www.who.int/publications/i/item/9789240083851 (accessed 19 June 2024).

2. Millington KA, White RG, Lipman M, McQuaid CF, Hauser J, Wooding V, et al. The 2023 UN high-level meeting on tuberculosis: renewing hope, momentum, and commitment to end tuberculosis. Lancet Respir Med. 2024; 12(1):10-13. doi: 10.1016/S2213-2600(23)00409-5.

3. South Africa. TB screening and testing. Standard operating procedure. Pretoria: Department of Health; 2022. Available from: https://www.westerncape.gov.za/assets/departments/health/FP/tutt_circular_annexure_1_-_screening_testing_sop.pdf (accessed 19 June 2024).

4. Churchyard G, Kim P, Shah NS, Rustomjee R, Gandhi N, Mathema B, et al. What we know about tuberculosis transmission: an overview. J Infect Dis. 2017; 216(suppl_6):S629-S635. doi: 10.1093/infdis/jix362.

5. Bell LCK, Noursadeghi M. Pathogenesis of HIV-1 and Mycobacterium tuberculosis co-infection. Nat Rev Microbiol. 2018; 16(2):80-90. doi: 10.1038/nrmicro.2017.128.

6. Duarte R, Lönnroth K, Carvalho C, Lima F, Carvalho ACC, Muñoz-Torrico M, et al. Tuberculosis, social determinants and co-morbidities (including HIV). Pulmonology. 2018; 24(2):115-119. doi: 10.1016/j.rppnen.2017.11.003.

7. WHO operational handbook on tuberculosis. Module 6: tuberculosis and comorbidities: mental health conditions. Geneva: World Health Organization; 2023. Available from: https://iris.who.int/bitstream/handle/10665/373829/9789240082557-eng.pdf?sequence=1 (accessed 19 June 2024).

8. Department of Health. Knowledge huby. TB national recovery plan. Available from: https://knowledgehub.health.gov.za/system/files/2024-03/updated%20TB%20Cluster_Webinar%201_TB%20Recovery%20Plan.pdf (accessed 20 June 2024).

9. Integrated Annual Report 2023. Harmony Gold Mining Company Limited; 2023. Available from: https://www.har.co.za/23/download/HAR-IR23-about-report.pdf (accessed 19 June 2024).