



NATIONAL INSTITUTE FOR  
OCCUPATIONAL HEALTH

Division of the National Health Laboratory Service

Occupational  
Zone



**ANTIMICROBIAL RESISTANCE ISSUE**

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# Vuyo Sabani

## MESSAGE FROM THE EDITOR

Following to the growing concerns around Antimicrobial Resistance (AMR) and its implications for public healthcare, we have decided to put the spotlight on AMR in this issue. According to the World Health Organization, AMR occurs when bacteria, viruses, fungi and parasites change over time and no longer respond to medicines, making infections harder to treat and increasing the risk of disease spread, severe illness and death. The US Centers for Disease Control says AMR is an urgent global public health threat, killing millions of people worldwide. For more on AMR and why we should be concerned about it, please read the research focus, where Prof. Nisha Naicker unpacks the issue.

October is Mental Health Month, and this year, the day was commemorated under the theme: "Time to Prioritise Mental Health in the Workplace". The NIOH Executive Director, Prof. Spo Kgalamono, shares some insights on what workplaces can do to create safer workplaces where mental care users can thrive. In the publication section, we publish translated research articles the NIOH researchers were part of in the last quarter. An article titled "Unintended consequences of urban expansion and gold mining: Elevated indoor radon levels in Gauteng communities neighbouring gold mine tailings" highlight a concerning association between proximity to gold mine tailings and elevated indoor

radon levels. The rate of radioactive decay of radon was measured inside residential dwellings located nearer and farther from the gold mine tailings.

The study titled "Prevalence of needle stick and sharps injuries and associated factors among nursing students in Gauteng province, South Africa", discovered that 43% of students experienced needle stick and sharp injuries. Despite 82% of students receiving training on handling needles, nearly half of them still experienced injuries. For these and other research articles, see page 9.

**This study highlighted a concerning association between proximity to gold mine tailings and elevated indoor radon levels.**

In the features section, Dr Kerry Wilson shares insights on how to protect your hands against hand dermatitis. Hand dermatitis is a common disease and one of the most commonly notified and recognised occupational diseases. In the same section, Dr Wilson, in the article titled "Common infections in medical and research laboratory settings," emphasises that recognition and communication of laboratory-acquired infections

and root cause analysis is important in maintaining a high level of risk perception. For the NIOH upcoming training programme, please see our teaching and training section on page 24.

On behalf of the editorial team, I wish to thank all the contributors, and if you want to contribute to our upcoming issue, please drop us an email.

*until the next issue, Cheers!*



# Prof. Spo Kgalamono

## TIME TO PRIORITISE MENTAL HEALTH IN THE WORKPLACE

**T**his year's World Mental Health Day (10 October) was commemorated under the theme: "It is Time to Prioritise Mental Health in the Workplace." This theme emphasises the connection between mental health and work. Unhealthy workplaces can have serious consequences, impacting mental health, general quality of life, and productivity at work.

### Challenges in the workplace

Various factors lead to the perpetuation of mental health in the workplace. These include stigma and cultural barriers. Often, mental health is still stigmatised in many workplaces. This may lead to fear of discrimination or judgment if an employee discloses mental health issues, which discourages open discussions about mental well-being. Cultural attitudes, on the other hand, may influence the perception of mental health, with some cultures or environments viewing it as a personal weakness rather than a legitimate health concern. Additionally, many employers and employees lack awareness of the importance of mental health, how to recognise mental health issues, and what support systems are available. This is compounded by a lack of training and understanding of mental health management, which can prevent effective interventions.

With the current state of the economy, many organisations, especially smaller businesses, don't have the resources or budget to provide adequate mental health services, such as employee assistance programmes (EAPs) or stress management initiatives. Moreover, workplaces often prioritise productivity and performance, which can conflict with mental health initiatives. Employees may face pressures to meet deadlines and performance

metrics, discouraging them from taking time off for mental health needs.

### Benefits of prioritising mental health in the workplace

Increasing mental health advocacy and education offers opportunities for more open conversations, reducing stigma over time. Furthermore, organisations prioritising psychological safety and creating a culture of inclusion and empathy tend to experience higher employee satisfaction, loyalty, and reduced turnover. This can be an opportunity to foster stronger workplace relationships.

Mental health champions and peer support groups within the workplace can create a community that encourages mutual support and open discussions. Prioritising mental health can enhance employee productivity, creativity, and engagement. Organisations that actively support mental health tend to attract and retain top talent, giving them a competitive edge. These are some of the benefits of prioritising mental health in the workplace.

### Solutions and way forward

There is a need to review leadership and organisational culture to improve and prioritise mental health in the workplace. A lack of leadership support for mental health initiatives can be a barrier. Employees may feel unsupported if leaders do not champion mental health programmes or demonstrate empathy. We need to change organisational culture. If an organisation is overly competitive or employees work in a high-pressure environment, that can undermine mental health efforts.

Employers should invest in mental health training for managers and employees to improve understanding and the ability to identify and respond to mental health issues early. Training programmes can build resilience, coping strategies, and skills to manage stress, creating a healthier work environment. The COVID-19 pandemic has demonstrated the benefits of flexible work arrangements, reducing stress and improving work-life balance. Organisations that offer remote work options (where possible) or flexible hours create a more supportive environment for mental health.

Let us begin the conversation and work through solutions. Together we can make a difference.



# PRIORITISE YOUR MENTAL HEALTH AT WORK

We spend a large proportion of our time at work, thus our workplace plays a significant role in our overall wellbeing.

## Did you know?

- Mental health in the working population is a growing concern.
- Mental health issues impact productivity, attendance and overall performance.
- Mental health in the workplace includes mental health disorders, mental health problems and mental well being.
- Some of the commonly encountered issues in the workplace includes: daily worries, stress, burnout, poor wellbeing and depression or anxiety.



## Talk about your feelings

It is important to open up and share your challenges and emotions with colleagues, and obtain professional assistance via the Employee Assistance Program/ Psychologist.



## Set healthy boundaries

If work is outside your scope of work – learn to communicate and say no. Setting boundaries helps us take care of ourselves and avoid overcommitting.



## Keep active

Engaging in physical activity can help boost self-esteem, concentration, sleep and general wellbeing.



## Be kind to yourself

Work targets are set in alignment with the Supervisor and should be realistic and within the scope of work. Where one is failing to meet work demands – seek assistance and job upskilling.



# Prof. Nisha Naicker

## RESEARCH FOCUS

### RESEARCH FOCUSES ON ANTIMICROBIAL RESISTANCE

**A**ntimicrobial resistance (AMR) occurs when microorganisms (bacteria, viruses, fungi and parasites) resist the effects of medications that once killed them or stopped their growth. It is one of the top 10 global public health and environmental threats. In 2022, it was estimated that bacterial AMR was responsible for over 1.2 million deaths globally in 2019 and contributed to approximately 4.9 million deaths.<sup>1</sup>

Health Workers, including Occupational Health Practitioners, play an important role in combatting AMR. There are multiple ways in which a Health Worker can contribute, some examples include:

1. Prescribe and dispense antibiotics only when necessary and ensure that the appropriate type, dosage and duration are followed.
2. Hand hygiene is one of the simplest and most effective methods to prevent the spread of infections, including resistant bacteria.
3. Use appropriate Personal Protective Equipment (PPE) such as gloves, gowns and masks in clinics and hospitals to prevent cross-contamination and the spread of resistant pathogens.
4. Educating patients about when an antibiotic is not required, such as during viral infections like a common cold or flu. Educate the broader community using public health campaigns or workshops to raise awareness.
5. Training of Health Workers to stay up-to-date on the latest guidelines for infection prevention,

antimicrobial use and management of resistant infections.

6. Monitoring antibiotic use helps reduce misuse.

The NIOH has published several interesting papers on this topic (listed below).<sup>2-7</sup> Other resources such as the WHO fact sheets and training manuals or the CDC website provide valuable information that could help you tackle this challenge.

1. Antimicrobial Resistance Collaborators. (2022). Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *The Lancet*; 399(10325): P629-655. DOI: [https://doi.org/10.1016/S0140-6736\(21\)02724-0](https://doi.org/10.1016/S0140-6736(21)02724-0)
2. Sambaza, S.S., Naicker, N. Contribution of wastewater to antimicrobial resistance: A review article. *Journal of Global Antimicrobial Resistance* 34 (2023) 23–29.
3. Tlotleng, N., John, JM., Nyembe, DW., and Utembe, W. Green synthesis of nanoparticles and their antimicrobial efficacy against drug-resistant *Staphylococcus aureus*. in Glover RL, Nyanganyura D, Mufamadi MS, Mulaudzi RB, Eds. *Green Synthesis in Nanomedicine and Human Health*. CRC Press, CRC press, ISBN 9780367710811
4. Seetswane, E., Loeto, D., Muzila, M., Tshkiso, K., Gomba, A., et al. Phenotypic and genotypic profiling reveals a high prevalence of methicillin-resistant *Staphylococcus aureus* isolated from hospitals, houseflies and adjacent informal food retailers in Botswana. *Microbiology* 2022;168:001213 DOI 10.1099/mic.0.001213.

5. Matuka, DO., Carman, HA., Singh, T. Staphylococcus aureus and Escherichia coli levels on the hands of the theatre staff in three hospitals in Johannesburg, South Africa, before and after handwashing. S Afr Med J 2018; 108(6)

7. Nyasulu P, Mabula K, Boniface R, Murray, J. Understanding laboratory methods and their impact on antimicrobial resistance surveillance, at Muhimbili National Hospital, Dar es Salaam, Tanzania. Advances in Microbiology, 2014, 4, 33-38

6. Nyasulu, P., Murray, J., Perovic, O., Koornhof, H. Antimicrobial resistance surveillance among nosocomial pathogens in South Africa: Systematic Review of Published Literature. J Exp Clin Med 2012; 4(1):8-13





# RESEARCH PUBLICATIONS



## Unintended consequences of urban expansion and gold mining: Elevated indoor radon levels in Gauteng communities neighboring gold mine tailings

**Author(s):** Mphaga, K.V.; Utembe, W.; Shezi, B.; Mbonane, T.P.; Rathebe, P.C.

**Source:** Atmosphere 2024, 15, 881. <https://doi.org/10.3390/atmos1508088>

**Summary:** The province of Gauteng in South Africa has a rich history of gold mining, which has unfortunately created over 270 gold mine tailings (GMTs). These GMTs, which are often surrounded by human settlements, pose a health risk as they harbour elevated amounts of toxic substances such as uranium, which over time undergoes radioactive decay to produce radon, a known lung carcinogen. This study aimed to investigate the potential correlation between the proximity to GMTs and indoor radon concentrations in Gauteng's residential dwellings. The rate of radioactive decay of radon was measured inside 330 residential dwellings located nearer (<2 km) and farther (>2 km) from the GMTs. Furthermore, questionnaires were used to obtain data on factors that may influence indoor radon radioactive decay. Descriptive statistics and bivariate logistic regression analyzed the influence of proximity to GMTs and dwelling characteristics on the rate of radioactive decay. Furthermore, the

levels of radioactive decay was compared to the World Health Organization (WHO) radon reference level of 100 Bq/m<sup>3</sup>. Residential dwellings near GMTs had significantly higher average indoor radon concentrations (103.30 Bq/m<sup>3</sup>) compared to the control group (65.19 Bq/m<sup>3</sup>). Residential dwellings nearer the GMTs were three times more likely to have radioactive decay beyond the WHO reference level of 100 Bq/m<sup>3</sup>. Furthermore, they had estimated annual radioactive effective doses of 2.60 mSv/y compared to 1.64 mSv/y for the control group. This study highlighted a concerning association between proximity to GMTs and elevated indoor radon levels. Therefore, it is important to conduct public health interventions that prioritize residential dwellings near GMTs. Residents near GMTs are encouraged to ensure continuous natural ventilation through frequent opening of windows and doors. Furthermore, educational campaigns and financial assistance for radon mitigation systems in high-risk dwellings are recommended.



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

**Author(s):** Manenzhe, G.I., Singh, T.

**Source:** *Occup Health Southern Afr.* 2024; 30(2):56-62. doi: 10.62380/ohsa.2024.30.2.1

**Summary:** Needle stick and sharps injuries (NSSIs) are a significant risk for nursing students due to their limited clinical experience. This study aimed to estimate the prevalence of NSSIs and identify related risk factors among 142 nursing students in two hospitals in Gauteng, South Africa. Data were gathered using a structured questionnaire, and statistical analyses explored associations between NSSIs and various factors. The findings revealed that 43% of students experienced an NSSI. Despite 82% of students receiving training on handling needles, nearly half of them still experienced injuries. Needles were the primary cause (75%), followed by medication vials (16%) and surgical tools (8%). NSSIs mostly occurred during injection procedures and were common in surgical, medical, and maternity wards. Most injuries were minor, but 47.5% of affected students received post-exposure treatment. Students working 40 hours or more per week were significantly more likely to suffer NSSIs than those working fewer hours. The study suggests that existing training on handling needles may be insufficient, highlighting the need for improved training programs to reduce NSSI risks for nursing students.



### Short-term vs. long-term: A critical review of indoor radon measurement technique

**Author(s):** Mphaga, K.V.; Thokozani, M.; Utembe, W.; Rathebe, P.C.

**Source:** *Sensors* 2024, 24, 4575. <https://doi.org/10.3390/s24144575>

**Summary:** Accurate assessment of indoor levels of Radon (Rn), a well-known cancer-causing agent, is essential for effective mitigation strategies. While long-term testing provides the most reliable data, short-term testing (STT) offers a quicker and more cost-effective alternative. This review evaluated the accuracy of STT in predicting annual radon averages and compared testing strategies in Europe (where long-term measurements are common) and the United States (where STT is prevalent). Twenty (20) studies were systematically identified through searches in scientific databases and the grey literature, focusing on STT accuracy and radon management. This review revealed several factors that influence the accuracy of STT. Most studies recommended a minimum four-day test for initial screening, but accuracy varied with radon levels. For low levels (<75 Bq/m<sup>3</sup>), a one-week STT achieved high confidence (>95%) in predicting annual averages. However, accuracy decreased for moderate levels (approximately 50% success rate), necessitating confirmation with longer testing periods (3 months). High radon levels made STT unsuitable due to significant fluctuations. Seasonality also played a role, with winter months providing a more representative picture of annual radon averages. STT was found to be a useful method for screening low-risk areas with low radon concentrations. However, its limitations were evident in moderate- and high-level scenarios. While a minimum of four days was recommended, longer testing periods (3 months or more) were crucial for achieving reliable results, particularly in areas with potential for elevated radon exposure. This review suggests the need for further research to explore the possibility of harmonizing radon testing protocols between Europe and the United States.



## Unravelling the toxicity of carbon nanomaterials- From cellular interactions to mechanistic understanding

**Author(s):** Makhado, B.P.; Oladipo, A.O.; Gumbi, A.A.; De Kock, L.A.; **Andraos, C.**; Gulumian, M.; Nxumalo, N.N.

**Source:** Toxicology in Vitro (2024), <https://doi.org/10.1016/j.tiv.2024.105898>

**Summary:** The review by Makhado et al. (2024) examines the toxicity of carbon nanomaterials (CNMs), focusing on their interactions with cellular systems and the underlying mechanisms of their toxicity. CNMs, including carbon nanotubes, graphene, and nanodiamonds, have widespread applications due to their unique properties. However, their extensive use raises significant health and environmental concerns. This review emphasizes the need to balance the benefits of CNMs with their potential harmful impacts, particularly in biological applications. It highlights that while many studies report minimal toxicity at certain dosages, there is still a lack of understanding regarding the dynamic cellular interactions and property-driven behaviours of these materials. The review provides an in-depth analysis of how physicochemical properties like size, shape, surface charge, and functionalization influence CNM toxicity.

The review addresses the various routes through which CNMs can enter the human body, such as inhalation, ingestion, and skin contact, and their potential to cause cytotoxicity, genotoxicity, and inflammation. It also addresses the environmental risks posed by CNMs, which can contaminate air, water, and soil, affecting both human health and ecosystems. The review concludes by calling for more comprehensive studies to better understand the mechanistic aspects of CNM toxicity and to develop safer nanomaterials.



## Is “small” safe? Exploring the good and bad of nanomaterials

**Author(s):** **Andraos, C.**, Boodhia, K., and Botha, T.L.

**Source:** Frontiers for Young Minds. August 2024 | Volume 12 | Article 1356375

**Summary:** “Small” does not necessarily have a clear meaning... is a ball big or small? A ball might be small compared to the entire planet, but it is absolutely huge compared to tiny “nano” particles! If you look at 1 mm on a ruler, one million nanometers can fit into that millimeter. Nanomaterials—the general name for materials made from tiny particles in the nanometer range—are so small that they have properties that can be quite different from “normal” materials. Nanomaterials may have a number of helpful functions. For example, they can be useful in medicine, helping our bodies to fight infections from bacteria and viruses. Nanomaterials can also be included in some products, to make them stronger or longer lasting. However, despite their advantages, we must be cautious with nanomaterials because they can sometimes get past the barriers in the human body that protect us from foreign invaders, causing damage to cells and potentially making people sick. Let us see how their size changes where they go and what they can do.

# FEATURES AND NEWS



## Guard your skin – hand care and contact dermatitis awareness

By Dr Kerry Wilson

**P**roper hand hygiene benefits everyone's health, and it is one of the easiest ways to prevent the spread of infectious agents and chemicals to others in the workplace, thereby possibly reducing illness among the workforce. In addition, it also prevents exposing family members at home to infectious agents/toxic substances from the workplace. Awareness of the importance of hand hygiene was increased during the COVID-19 pandemic. This made people "use soap, water and alcohol-based sanitisers more enthusiastically than was actually required, making them prone to develop hand eczema because of the loss of the protective top layer on the skin".<sup>1</sup>

### Your Hands = Your livelihood

Our hands can also suffer damage from workplace exposures. There is an almost limitless list of substances/situations that cause damage to the skin of our hands, and a few of the more common ones are overexposure to water, too much dry air, soaps, detergents, solvents, cleaning agents, rubber gloves or even ingredients in skin and personal care products. Once the skin becomes red and dry, even so-called "harmless" things like water and even baby products can irritate the skin further.

### Hand dermatitis

Hand dermatitis is a very common disease, with the pooled estimates for lifetime prevalence by Quaade A et al. (2021) at 14.5% (95% confidence interval [CI]: 12.6–16.5), with more than one-third of those affected suffering from moderate or severe disease.<sup>2</sup> Another study among 981 adult patients with hand dermatitis, hand dermatitis was chronic in 83.5% of patients; 21.3% had severe dermatitis, and 62.0% of these patients were non-responsive to standard therapy.<sup>3</sup> In a third study, hand dermatitis was shown

to be a common skin disease with an estimated prevalence of 9.1% in the general population. Moreover, it constituted one of the most commonly notified and recognized occupational diseases.<sup>4</sup> These studies further strengthen the need for proper hand hygiene protocols and products to limit the effects of exposures in the workplace on our hands and prevent transmission of contaminants to others.

### Hand hygiene protocols

You should be aware that if their hands are visibly dirty, you should use soap and water instead of hand sanitiser.

#### 1. Key times to clean your hands include:

- ⦿ Before and after work
- ⦿ Before and after breaks
- ⦿ After blowing your nose, coughing, or sneezing
- ⦿ After using the restroom
- ⦿ Before eating or preparing food
- ⦿ After working with toxic chemicals which could penetrate through the skin into the body or accidentally be ingested

#### 2. Use of hand sanitisers

If not visibly soiled, hand sanitisers are most useful, especially in the healthcare environment. Although these were much maligned during the COVID-19 pandemic, there are many reasons for them to be used in the workplace:

- ⦿ Alcohol-based hand rubs are superior to conventional hand washing with water and soap
- ⦿ They reduce the transmission of infections in hospitals and healthcare facilities
- ⦿ They are less irritating than soap and water



- ⦿ Washing one's hands should be the exception, to be performed only when they are visibly soiled or contaminated
- ⦿ Ideally, a colourless, fragrance or perfume-free alcohol-based waterless hand sanitiser should be used before the expiry date

### 3. Other important prevention factors to be considered when washing/sanitising are:

- ⦿ Removing rings so as not to trap soap and water next to the skin
- ⦿ Use of lukewarm water
- ⦿ Thorough rinsing after washing with soap
- ⦿ Skin should be blotted dry, gently
- ⦿ Moisturiser should be applied while the skin is still damp
- ⦿ Soap should be used sparingly - as it strips oil from your skin
- ⦿ Detergents and perfumed soaps should be avoided as they can intensify drying

- ⦿ Instead, soap substitutes or soaps that contain moisturisers should be used

### 4. Correct and regular use of hand creams:

- ⦿ Use hand creams daily, as this maintains a stable and healthy barrier layer which can reduce the penetration of harmful substances through the skin
- ⦿ Use water-based creams when using gloves frequently or for more than 20 minutes at a time
- ⦿ Oil-based emollients can increase the absorption of the proteins from the gloves into the skin and can also cause glove deterioration
- ⦿ Before and after work, it's important to use oil-based creams which will:
  - Moisturise, lubricate and soothe dry skin
  - Provide a lipid film on the surface of the skin, thereby reducing water loss and preventing the skin from drying
  - Replace the natural oils which have been removed by soap, water or other irritants

Hand hygiene is of importance, both in the workplace and in everyday life in order to protect from potentially harmful substances which can damage them and to prevent the transmission of infectious agents/workplace contaminants to unexposed individuals such as family. "Make hand care a priority in your daily life to protect your health and well-being."

**References:**

1. Debjit K, Anupam D, Abheek S. An Upsurge of Hand Dermatitis Cases Amidst COVID-19 Pandemic. Indian J Dermatol. 2021;66(1998-3611).
2. Quaade AS, Simonsen AB, Halling AS, Thyssen JP, Johansen JD. Prevalence, incidence, and severity of hand eczema in the general population - A systematic review and meta-analysis. Contact dermatitis. 2021;84(6):361-74.

3. Scalone L, Cortesi PA, Mantovani LG, Belisari A, Ayala F, Fortina AB, et al. Clinical epidemiology of hand eczema in patients accessing dermatological reference centres: results from Italy. The British journal of dermatology. 2015;172(1):187-95.

4. Yüksel YT, Symanzik C, Christensen MO, Olesen CM, Thyssen JP, Skudlik C, et al. Prevalence and incidence of hand eczema in healthcare workers: A systematic review and meta-analysis. Contact dermatitis. 2024;90(4):331-42.



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# OCCUPATIONAL SKIN DISEASES

OCCUPATIONAL SKIN DISEASES are among the most common work-related diseases in industrialised countries. They are under-diagnosed, under-reported and under-compensated and thus considered a "Hidden Epidemic". **EARLY DETECTION, CORRECT DIAGNOSIS** and appropriate **TREATMENT** can reduce sick leave, loss of skills and distress to the workers. Common occupational skin diseases include allergic and irritant contact dermatitis (80-90%), infections (bacterial, viral, fungal), urticaria, folliculitis/acne and cancers.

Allergic Contact Dermatitis	Irritant Contact Dermatitis	Other occupational skin diseases
 Allergy to rubber in gloves  Allergy to rubber in a respirator  Allergy to nickel	 Chronic irritant dermatitis with hypopigmentation  Chronic dermatitis resistant to treatment	 Allergic dermatitis & bacterial infection  Fungal Sporotrichosis  Candida infection
 Chronic allergy to epoxy resins  Allergy & pigmentation to TiC in powder paint  Chronic allergy to methacrylates coupled with an infection  Acute allergy to preservative in cooling water	 Irritant shoe dermatitis  Acute dermatitis with abrasion from sandpaper  Irritant contact dermatitis in a chef	<p style="text-align: center;">Occupational skin infections</p>  Contact Urticaria  Cancer  Folliculitis/Acne

Examples of occupations and substances causing occupational skin diseases		NIOH Occupational Skin Diseases Clinic
Occupation	Substances which can cause OSD	<ul style="list-style-type: none"> <li>Consultation with a dermatologist with experience in occupational skin diseases</li> <li>Patch testing for allergic contact dermatitis (specific series for different exposures)</li> <li>Specialised testing with workplace substances</li> <li>Comprehensive report with recommendations</li> </ul>
Construction workers	Cement, chromates, epoxy resins, wood dust, paints, varnishes, nickel, rubber, fiberglass, solvents, paint	
Cleaners	Detergents, soaps, rubber gloves, polishes, fragrances, disinfectants	
Health care workers	Anaesthetics, antibiotics, antiseptics, rubber gloves, preservatives, acrylate, detergents, disinfectants, water, soap	
Hairdressers	Hair dyes, persulphate, nickel, fragrances, rubber gloves, permanent wave solutions, shampoos, bleaching agents, water	

# COMMON INFECTIONS IN MEDICAL AND RESEARCH LABORATORY SETTINGS

By Dr Kerry Wilson



Medical laboratory workers work in clinical laboratories analysing various biological samples to provide doctors with information for detecting, diagnosing and treating disease. Research and teaching laboratory workers often work with biological samples to isolate and propagate microbiological organisms for further research. Through the samples they work with, these workers may be exposed to a range of infectious organisms, among other work hazards. Literature has identified bacteria, viruses, fungi and parasites as responsible for causing infections in laboratory workers.<sup>1</sup>

## Common routes of laboratory transmission

- ⦿ Spills, sprays, and splashes into eyes, mouth or nose
- ⦿ Spill, sprays, and splashes onto broken skin, including dry cracked skin
- ⦿ Hand to face actions
- ⦿ Inhalation of aerosols due to laboratory activities
- ⦿ Contaminated equipment and surfaces
- ⦿ Consumption of food in the laboratory

Table 1. Recent descriptions of laboratory-acquired infections globally

Author (s)	Country	Report to	Number of LAI cases	Agents	Time Period
Jaouhari ME., 2022 (2)	Canada	Laboratory incident Notification Canada	9	4 Salmonella spp 2 E coli 1 Brucella 1 Staph aureus 1 Vaccina virus	2016 - 2021
Blacksell et al 2024 (3)	USA	Various surveys and case reports	238	174 Salmonella spp 16 cryptosporidium 9 Vaccina virus 6 Ecoli 4 Brucella 4 Francisella tularensis 4 Neiseria meningitides 4 Zika virus 3 Brucella 2 Dengue 2 Yersinia 10 others	2000-2021
	Mexico		2	2 Sporothrix schenckii	
	Brazil		4	1 Brucella 1 Vaccina virus 1 Zika virus 1 leishmania (Viannia)	
	Argentina		1	1 Brucella	
	South Africa		5	2 Vaccina virus 2 Brucella 1 HIV	
	Turkiye		7	4 Brucella 2 CCHF virus 1 Staph aureus	
	Germany		5	2 Vaccina virus 2 Brucella 1 HIV	
	France		4	2 Neiseria meningitides 1 BSE 1 Mimivirus	
	Italy		2	1 Brucella 1 HIV	



Author (s)	Country	Report to	Number of LAI cases	Agents	Time Period
Blacksell et al 2024 (3)	Italy		2	1 Brucella 1 HIV	
	Sweden		2	1 Brucella 1 Neiseria meningitides	
	China		11	9 Brucella 2 SARS-CoV 2	
	Taiwan		3	1 SARS CoV 1 1 SARS CoV 2 1 Shigella spp	
	Australia		4	2 Toxoplasma gondi 1 Staph aureas 1 Dengue virus	
Peng et al 2018	PR China	American Biological Safety Association data	16	8 Seoul virus and Hanta v 8 SARS CoV 2	1982 -2016
	Malaysia		2	Brucella melitensis Salmonella typhi	
	Taiwan		6	1 Ralstonia Pickettii 1 Shigella spp 1 Dengue virus 1 SARS CoV 1 1 Arthroderma benhamiae Vibrio paraheamolyticus	
	South Korea		4	Dengue virus 1 Orientia tsutsugamushi 2 Rickettsia typhi	
	India		2	1 Buffalopox virus 1 Mycobacterium leprae	
	Australia		9	1 Dengue virus Staph Aureus, MRSA, EMRSA Brucella suis 3 Pseudomonas pseudomallei Newcastle disease virus 1 Brucella melitensis Shigella flexneri	

Overall the top five most commonly reported pathogens causing laboratory infections in the review by Blacksell et al., 2024 were *Salmonella spp*, *Brucella spp*, *Cryptosporidium spp*, *Vaccinia Virus*, and *Neisseria meningitides*. Only one prion (BSE) infection was reported, followed by five fungal infections. The infections were mainly from risk group (RG) 2 pathogens rather than the more dangerous RG 3 and 4 suggesting stricter practices and awareness around RG 3 and 4 pathogens<sup>3</sup>. Thus, risk tolerance and risk perception may complicate biosafety management.

The review by Blacksell et al., 2024 reports that procedural errors accounted for 69% of the incident causes, followed by unknown (9%), needlesticks (7%) and spills (7%). The review of accidental pathogen escape from laboratory settings (APELS) highlighted human errors, engineering problems and system errors as problems. With examples of poor inventory management, expired disinfectants and leaking old pipes in reports of APELS.

The numbers reported are low due to bias in voluntary reporting and difficulty in separating laboratory-acquired infections from community-acquired ones. Reporting of laboratory-acquired infections must be encouraged and needs to be no fault as it is important to allow root cause analysis to be conducted and lessons to be communicated widely to protect workers and students from harm. Integrated biosafety and biorisk management approaches are needed, along with leadership support investment in infrastructure.<sup>3</sup> Biosafety and laboratory biosecurity are complementary. Implementation of specific biosafety activities already covers some biosecurity aspects.

In the laboratories, both commercial and academic, there is a lack of reporting of infections; thus, the risk of infection in workers is still unclear. The various routes of exposure are likely to result in different infection risks, and often, the route of exposure may be unknown. Training and maintenance of equipment, including PPE, are necessary in preventing laboratory-acquired infections. Recognition of exposure at the time of the event is also key to the implementation of recommended procedures and reduction of risk.<sup>2</sup> Communication of laboratory-acquired infections and root cause analysis is important in maintaining a high level of risk perception.

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# SERVICE DELIVERY

By Karen du Preez

## IMMUNOLOGY AND MICROBIOLOGY SECTION

The NIOH fields a multidisciplinary team of experts dedicated to promoting healthy and safe working environments in the workplace in South Africa, the African region and globally. With specialities ranging from occupational medicine and epidemiology to workplace policies and programs, NIOH's staff provide a comprehensive suite of services to employers, workers, government agencies and other stakeholders. In this issue, Ms Karen du Preez puts the spotlight on the Immunology and Microbiology Section.

### Introduction

The Immunology and Microbiology (IM) section provides diagnostic services, teaching and training, research, and advisory services aligned with the NIOH's objectives. It consists of three units: Bioaerosol, Waterborne Pathogens, and Occupational Allergy. The IM Section offers specialised, cost-effective occupational diagnostic services to both national and provincial government departments, as well as various industries in the private sector. The diagnostic laboratories are accredited with the South African National Accreditation System (SANAS) under ISO 15189 and ISO/IEC 17025 standards for specific tests.

### Diagnosis and consultation services

**The Bioaerosol Unit** conducts risk assessments for Hazardous Biological Agents (HBAs), tests the effectiveness of Ultraviolet Germicidal Irradiation (UVGI) air disinfection devices, and assesses the sterility of specific samples. UVGI devices are used in workplaces to reduce airborne infectious organisms including bacteria, viruses, and fungi. The efficient testing of UVGI devices is conducted in the Aerogen Science – Promoting Innovative Research (ASPIRE) laboratory, which is a state-of-the-art biosafety level 3 laboratory facility. This laboratory is the only one of its kind in South Africa. Currently, the laboratory is testing devices from different manufacturers. Installing devices that meet the efficacy standard will

help reduce the spread of HBA infections, especially in high-risk settings, such as hospitals and other workplaces. Conducting comprehensive workplace HBA assessments helps identify previously unknown risk settings and evaluate the effectiveness of control interventions for reducing airborne exposure. This assessment involves environmental sampling in the workplace (air, surface, bulk, or dust) and identifying bacteria and fungi from these samples.



NIOH staff working inside the ASPIRE laboratory



Member of the WPU collecting water samples for testing.

**The Waterborne Pathogens Unit (WPU)** is dedicated to advancing our knowledge on waterborne pathogens in the world of work, with the overarching objective of safeguarding workers' health, productivity, and well-being. The unit is involved in water quality testing for potability (drinking water e.g. tap and borehole water) as per the SANS 241 standard for drinking water as well as non-potable water (municipal wastewater and their treated effluents) quality testing for fitness of use, according to the client's request. Furthermore, the WPU endeavours to inform workplace policies through the dissemination of research findings and other awareness material on various aspects related to waterborne pathogen exposure and the associated health risks in occupational settings.

The Unit is SANAS accredited for the Colilert-18 Quanti-tray/2000 method for total coliforms and *Escherichia coli* detection and enumeration. Other tests scheduled for accreditation include the Legiolert and Enterolert methods for *Legionella pneumophila* and *Enterococcus* spp., respectively. The unit also conducts high-impact collaborative research thus contributing to human capacity development in the South African water sector and the region, in general. It also provides risk assessment and consultation services on water-related health risks in different settings. This is crucial for determining water quality, monitoring water treatment effectiveness, and preventing waterborne infections in workers and the general public, as well as developing mitigation strategies.

**The Occupational Allergy Unit** provides diagnostic tests for respiratory and skin diseases related to occupational exposures. These tests help in identifying agents causing allergies and assist in managing cases and prevention strategies in industries. The Unit tests for allergies using commercially supplied allergens as well as allergens prepared using materials that workers are exposed to in the workplace. Clients include the mining, manufacturing, healthcare, pharmaceutical, food, construction, and beauty industries.

The Respiratory Allergy Laboratory offers Skin Prick Tests (SPT) and sIgE tests to patients with suspected IgE-mediated allergy symptoms, as well as measurements of specific IgG (sIgG) for patients with suspected hypersensitivity pneumonitis. This laboratory also screens asymptomatic workers for sensitisation to platinum group metals (PGM) to facilitate the early detection of workers who are sensitised to metal salts before symptoms develop.

The Skin Diseases Clinic offers services for Occupational Skin Disease (OSD) consultations with a dermatologist experienced in OSD. Patch testing is used to identify allergic causes of contact dermatitis, with specific patch series available for different exposures such as rubber chemicals, metalworking/cooling fluids, and epoxy series. A comprehensive report with recommendations is provided to assist in preventing skin diseases.



NIOH staff member demonstrating SPT to occupational allergy workshop delegates

The IM section is also involved in supervising post-graduate students from different institutions and those undertaking the Health Professions Council of South Africa (HPCSA) medical scientist internship in Clinical Microbiology. The section engages in outreach activities, information dissemination, and

workshops. It is actively involved in research related to workplace allergy and exposure to infectious microorganisms, which enhances understanding of their role in causing and transmitting diseases in workplaces. This research contributes to better management of cases and the development of evidence based mitigation strategies. The research

is conducted in both formal and informal economic sectors, including training street reclaimers on the health and safety aspects of their job. This training helps raise awareness of hazards in their work environments and teaches them how to protect themselves from these hazards.



NIOH staff member with street reclaimers

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# TEACHING AND TRAINING

## NIOH Biennial Research Day 2024

The National Institute for Occupational Health's Research Committee will host the Biennial Research Day 2024.

<b>Theme</b>	:	The Future of Work
<b>Date</b>	:	28 November 2024
<b>Time</b>	:	09h00 – 15h30
<b>Venue</b>	:	Zoom
<b>CPD Status</b>	:	4 CPD and 1 ethics points

For enquiries e-mail: [research.relations@nioh.ac.za](mailto:research.relations@nioh.ac.za)

### Link to register:

[https://zoom.us/webinar/register/WN\\_GQ2ZVHqSeCmXadXW0xhcw#/registration](https://zoom.us/webinar/register/WN_GQ2ZVHqSeCmXadXW0xhcw#/registration)

Alternatively click on the poster below.



**National Institute for Occupational Health Biennial Research Day 2024**

**Date** : 28 November 2024  
**Time** : 8:30 to 15:30  
**Venue** : Virtual Zoom

CPD ACCREDITED

**Enquiries:** [Research.relations@nioh.ac.za](mailto:Research.relations@nioh.ac.za)

 NATIONAL HEALTH LABORATORY SERVICE

 NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH  
Division of the National Health Laboratory Service

# ERGONOMICS AWARENESS

## What is Ergonomics?

**The science of designing workspaces and tasks to fit the people who use them, ensuring comfort, efficiency and safety.**

## Legislation Governing Ergonomics in the Workplace - Ergonomics Regulation, 2019,

Its aim is:

- Lessen discomfort and risk of workplace injuries
- Improve efficiency and productivity
- Develop employee engagement
- Promote a proactive health and safety culture
- Reduce the cost of musculoskeletal injuries in the workplace

## Tips to manage ergonomics in the workplace:

- Comfortable workstation setup
- Balance tasks & responsibilities
- Staff participation
- Training & Awareness
- Safe workplace conditions
- Reduce tiredness
- Track & share information

## How Does it Help You?

- Improves posture
- Reduces discomfort & pain
- Boosts productivity
- Prevents workplace injuries

## Based on the Ergonomics Regulations, the Employer should:

1. Implement an Ergonomics Programme
2. Educate and train employees on ergonomic principles, risks, and mitigation procedures.
3. Utilise ergonomics in design of machinery work stations
4. Identify ergonomic risks and apply reasonable measures to eliminate or reduce exposure, following the hierarchy of controls.
5. Establish Medical Surveillance programme and monitor ergonomic-related injuries.
6. Recognize Ergonomic Risk Factors and tasks that may contribute to strain and injury, such as repetitive motions and awkward postures.



**Invest in ergonomics today for a healthier, more productive work environment!**  
**#Ergonomics #WorkplaceWellness**

# NIOH SERVICES

Section	Services	Contact person
<b>Analytical Services</b>	Analytical Services makes available to a wide range of users analytical services in occupational hygiene, biological monitoring, and some clinical laboratory tests.	Head of Section Dr Boitumelo Kgarebe Tel: +27(0)11-712-6410 E-mail: boitumelok@nioh.ac.za
<b>Immunology &amp; Microbiology</b>	<b>Bioaerosols laboratory</b> Bio-risk management workshop to different professionals in the workplaces	Ms Onnicah Matuka Tel: 011 712 6487 Email: dikeledim@nioh.ac.za
<b>Information Services and Training</b>	<b>Archive</b> Documenting and preserving the institutional memory and create access points to the rare and unique information resources showcasing how the institute has evolved over time. These records stretch as far as 1912, they include personal papers, conference papers, registers, obsolete instruments, photographs etc.	Mr Simphiwe Yako Tel: 011 712 6518 Email: simphiwey@nioh.ac.za
<b>Pathology Division</b>	<b>Training laboratory technical staff:</b> The laboratory performs practical training of technical laboratory staff enrolled as medical laboratory scientists, and laboratory technologists in the histopathology discipline.	Ms Sharlene Naidoo Tel: 011 712 6595 Email: sharlenen@nioh.ac.za
<b>Toxicology and Biochemistry</b>	<b>United Nations Globally Harmonised System of Classification and Labelling of Chemicals (UNGHS)</b>  The Toxicology Department facilitates the UNGHS workshop to train individuals who handle hazardous chemicals in their workplaces in the identification and management of chemical hazards according to GHS classification criteria.	Dr Wells Utembe Tel 0117126741 Email: wellsu@nioh.ac.za
<b>Occupational Medicine</b>	<b>Advisory services</b> Advisory services on the prevention and management of occupational diseases and disorders offered to organizations within the SADC region.	<b>Occupational Medicine Specialist referral clinic:</b> Mr Jacob Senamolela Tel: 011 712 6462 Email: JacobSe@nioh.ac.za



Section	Services	Contact person
<p><b>Occupational Hygiene</b></p>	<p><b>Occupational Hygiene Training Association (OHTA) Modules</b></p> <p>The Occupational Hygiene Section is an approved OHTA trainer, and provide training on the following modules:</p> <p>Foundation level:</p> <ul style="list-style-type: none"> <li>• OHTA201 Basic principles in Occupational Hygiene</li> </ul> <p>Intermediate level – core modules:</p> <ul style="list-style-type: none"> <li>• OHTA501 Measurement of Hazardous Substances</li> <li>• OHTA503 Noise – Measurement and its effects</li> <li>• OHTA505 Control of Hazardous Substances</li> <li>• OHTA507 Health effects of Hazardous Substances</li> </ul> <p>Intermediate level – optional modules:</p> <ul style="list-style-type: none"> <li>• OHTA502 Thermal Environment.</li> <li>• OHTA504 Asbestos and other fibres.</li> <li>• OHTA506 Ergonomics Essentials.</li> </ul>	<p>Dr Jeanneth Manganyi Tel: 011 712 6406 Email: JeannethM@nioh.ac.za</p>
<p><b>Epidemiology &amp; Surveillance</b></p>	<p><b>Training:</b></p> <p>Epidemiology and Biostatistics Training:</p> <ul style="list-style-type: none"> <li>• Basic and Advanced courses.</li> <li>• How to use routine surveillance data to improve the health of workers.</li> <li>• How to use REDCap Protocol development for research on Occupational exposures and Health outcomes.</li> <li>• Development of REDCap tools and other data collection tools.</li> <li>• Research on work exposures and health outcomes in the workplace.</li> <li>• Analyses of routine medical surveillance data.</li> <li>• Developing analysis plans for surveillance data.</li> <li>• Literature Reviews on occupational health topics.</li> <li>• Evaluation of Surveillance systems.</li> <li>• Advice and guidance around developing a surveillance system or advice for selecting a service provider for surveillance tools.</li> <li>• Designing or conducting occupational health screening surveys along with staff satisfaction and mental health surveys in your workplace.</li> <li>• Evaluation of training programs in occupational hazards, health and safety.</li> </ul>	<p>Asanda Jekwa Email: AsandaJ@nioh.ac.za</p>



NATIONAL INSTITUTE FOR  
OCCUPATIONAL HEALTH

Division of the National Health Laboratory Service



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