

Division of the National Health Laboratory Service



NIOH ANNUAL REVIEW 2020/2021

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LIST OF ABBREVIATIONS

| AFRICA | Asbestos Fibre Regular Informal Counting Arrangement |
|----------|---|
| AOP | Adverse Outcomes Pathway |
| ARAOH | African Regional Association for Occupational Health |
| AUDA | African Union Development Agency |
| BRICS | Brazil, Russia, India, China and South Africa |
| ССМА | Commission for Conciliation, Mediation and Arbitration |
| CDC | Centers for Disease Control and Prevention, US |
| CEFT | Committee for Evaluations and Technical Function |
| CEO | Chief Executive Officer |
| COIDA | Compensation for Occupational Injuries and Diseases Act |
| COSATU | Congress of South African Trade Unions |
| COVID-19 | Coronavirus Disease |
| CPD | Continuing Professional Development |
| CSIR | Council for Scientific and Industrial Research |
| CTDC | Counter Trafficking Data Collaborative |
| DMRE | Department of Mineral Resources and Energy |
| DoEL | Department of Employment and Labour |
| DoH | Department of Health |
| DPSA | Department of Public Service and Administration |
| DSI | Department of Science and Innovation |
| ESBB | European, Middle Eastern and African Society for Biopreservation and Biobanking |
| EU | European Union |
| FFR | Filtering Facepiece Respirator |
| FIOH | Finnish Institute for Occupational Health |
| FTIR | Fourier Transmission Infrared Spectroscopy |
| GEMP | Graduate Entry Medical Programme |
| GLP | Good Laboratory Practice |
| GPG | Gauteng Provincial Government |
| HIV | Human Immunodeficiency Virus |
| HPCSA | Health Professions Council of South Africa |
| HRA | Health Risk Assessment |
| HSE | Health, Safety and Environment |
| HSL | Health and Safety Laboratory, UK |
| HWSETA | Health and Welfare Sector Education Training Authority |
| ІСОН | International Commission on Occupational Health |
| IEC | International Electrotechnical Commission |
| ILO | International Labour Organization |
| ISBER | International Society for Biological and Environmental Repositories |
| ISO | International Organization for Standardization |
| IT | Information Technology |
| МВА | Master of Business Administration |
| MBOD | Medical Bureau for Occupational Diseases |
| MCSA | Minerals Council South Africa |
| MHI | Moist Heat Incubation |
| MHSC | Mine Health and Safety Council |
| MMPA | Mine Medical Professionals Association |
| MoU | Memorandum of Understanding |
| MPH | Iviaster of Public Health |
| MRC | |
| NRD | Ividster of Science |
| Nedles | National Economic Development and Labour Coursel |
| | National economic Development and Labour Council |
| | New Partnership for Africas Development |
| | National Institute for Communicable Diseases |
| | National Institute for Occupational Health |
| NICH | המנוסחמו חוזגונעני וסרטכנעףמנוסחמו חיפונו ו |

| NIOSH | National Institute for Occupational Safety and Health (US) |
|-----------------|---|
| NMBP | Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing |
| NMISA | National Metrology Institute of South Africa |
| NOMS-SA | National Occupational Mortality Surveillance South Africa |
| NRF | National Research Foundation |
| NRGC | Nano Risk Governance Council |
| NUM | National Union of Mineworkers |
| OECD | Organization for Economic Cooperation and Development |
| OEHS | Occupational and Environmental Health and Safety |
| OHASIS | Occupational Health and Safety Information System |
| OHORT | Occupational Health Outbreak Response Team |
| OHS | Occupational Health and Safety |
| OHSS | Occupational Health Surveillance System |
| OMP | Occupational Medicine Practitioner |
| PACC | Premier's Advisory Committee on COVID-19 |
| PATHAUT | Pathology Disease Surveillance Database |
| PathReD | Pathology Research and Development Congress |
| РСМ | Phase Contrast Microscopy |
| PCR | Polymerase Chain Reaction |
| PhD | Doctor in Philosophy |
| PMR | Proportional Mortality Ratio |
| PPE | Personal Protective Equipment |
| QCTO | Quality Council for Trades and Occupations |
| QMIS | Quality Management System |
| ЧРСК | Quantitative Polymerase Chain Reaction |
| кеасар | Research Electronic Data Capitries on Llockh and Aide |
| | South African Business Coalition on Health and Alds |
| SACCESS | South African Gallaharative COVID 10 Environmental Surveillance System |
| | South African Council for Natural Scientific Professions |
| SADC | South Anican Council for Natural Scientific Professions |
| SAEETD | South African Field Enidemiology Training Programme |
| SAIMR | South African Institute for Medical Research |
| SAIOH | South And Institute for Occupational Hydiene |
| SANAS | South African National Accreditation System |
| SARS | Severe Acute Respiratory Syndrome |
| SASOHN | South African Society of Occupational Health Nursing Practitioners |
| SASOM | South African Society of Occupational Medicine |
| SETA | Sector Education Training Authority |
| SHE | Safety, Health and Environment |
| SOP | Standard Operating Procedures |
| тв | Tuberculosis |
| UK | United Kingdom |
| UNAIDS | Joint United Nations Programme on HIV/AIDS |
| Unisa | University of South Africa |
| URL | Uniform Resource Locator |
| USA | United States of America |
| UVGI | Ultraviolet Germicidal Irradiation |
| VHP | Vapourised Hydrogen Peroxide |
| WHO | World Health Organization |
| WHWB | Workplace Health Without Borders |
| Wits University | University of the Witwatersrand |
| WPMN | Working Party on Manufactured Nanomaterials |
| WRC | Water Research Commission |
| WWTP | Wastewater Treatment Plant |
| XRD | X-ray Diffraction |
| XRF | X-ray Fluorescence |

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EXECUTIVE DIRECTOR'S OVERVIEW

Executive Director: Dr Spo Kgalamono

The National Institute for Occupational Health (NIOH) plays an important role in supporting government's occupational health efforts. It is recognised as a centre of excellence for occupational health, and functions as a national and regional source of knowledge and expertise to the South African government, industry and labour, the Southern African Development Community (SADC) countries and the African region. It provides advice and assistance, conducts research and develops capacity through teaching and training for the purpose of promoting healthy conditions in workplaces and improving the health of workers.

Under the leadership of the National Health Laboratory Service (NHLS), the NIOH had numerous highlights in the area of occupational health and safety (OHS) during the period under review. The Institute's multidisciplinary teams participated in a significant number of OHS engagements in both the public and private sectors, ranging from partaking in cutting-edge research at a national and global level to supporting innovative programmes to assist vulnerable workers. In the process, the NIOH collaborated with a significant number of key workplace role players locally, nationally and internationally. This, in turn, contributed to the Institute gaining a new body of knowledge that will enhance and supplement its future efforts to help ensure good occupational health and safety in all workplaces.

The NIOH implemented several targeted programmes and training initiatives for its key partners, local societies and stakeholders during the period under review. In addition to academia, trade union representatives, employees, employees, and public and private sector groups, these included collaborations and partnerships with the following:

- The national and provincial departments of health
- The Department of Employment and Labour (DoEL) and the Department of Mineral Resources and Energy (DMRE)
- The South African Society of Occupational Medicine (SASOM)
- The African Regional Association for Occupational Health (ARAOH)
- The South African Society of Occupational Health Nursing Practitioners (SASOHN)
- The Southern African Institute for Occupational Hygiene (SAIOH)
- The Mine Medical Professionals Association (MMPA)
- The African Union Development Agency-New Partnership for Africa's Development (AUDA-NEPAD)

Highlights

The NIOH played a significant role in some notable developments in OHS in South Africa. A number of staff members represented the NIOH at key high-level decision-making technical committees, including the National Economic Development and Labour Council (Nedlac), the national Department of Health (DoH) and the Department of Employment and Labour. This entailed drafting and revising specific occupational health legislation and guidelines in both the formal and informal economy.



In the last quarter of the period under review, organised labour and the national DoH commissioned the NIOH to conduct a nationwide evaluation of occupational health services, focusing on the functioning of OHS committees in the health sector to ensure that OHS services in the sector are in line with the DoEL's Direction on COVID-19.

The Occupational Health and Safety Information System (OHASIS) supports surveillance and compliance with Occupational and Environmental Health and Safety (OEHS) legislation, and provides information for research. During the period under review, the OHASIS has been extensively adapted to cater for new challenges posed by COVID-19, and further enhancements were made to cater for the unique needs posed by the NHLS' laboratory environment.

The improved system included adaptations to incorporate COVID-19 as a specific disease in the reporting section, the provision of an online screening platform for self-reporting by employees of COVID-19 symptoms and automatic email notifications to an identified health worker, the presentation of all COVID-19-related information in dashboards, a facility to record all COVID-19 vaccinations, tests and results, as well as the capability to capture COVID-19 healthcare waste. Beyond the NHLS, a number of local and international organisations have shown a keen interest in system rollouts.

The NIOH's specialised laboratories continue to maintain quality management system accreditation year on year. The Institute is the only entity in South Africa that has obtained accreditation on four different quality management systems: ISO 15189 (medical laboratories), ISO 17025 (testing and calibration laboratories), ISO 17020 (conformity assessment for inspection bodies) and ISO 9001. It has also been able to provide pre-South African National Accreditation System (SANAS) internal audits, training and support to NHLS laboratories, including proficiency testing scheme guidance to staff.

The NIOH's newsletter, *NIOH OccuZone*, continued to be used as a medium to share information on the Institute's activities. This publication, which is disseminated quarterly, details current research underway, specialised service delivery and the Institute's teaching and training activities. In addition, the NIOH has increased its digital footprint through the effective utilisation of the social media platforms Twitter and YouTube. These communication channels provided the opportunity to network on a global scale. They assisted the Institute to target specific stakeholders through tailored communication, and provided a diverse public relations platform to share information.

COVID-19 activities

The year 2020 was dominated by the COVID-19 pandemic, which impacted on workplaces across the globe. While the arrival of the pandemic crippled some of the services provided by the NIOH, it created numerous opportunities that emphasised the value of the Institute well beyond the occupational health space. As employers were legally obligated to conduct COVID-19 risk assessments, the NIOH played a significant role in designing tools to assist workplaces to conduct these assessments and adapted some tools for specific sectors and unique workplaces. These workplace risk assessments highlighted the importance of psychosocial and ergonomic hazards. The majority of stakeholders were capacitated to identify risks and implement the requisite control measures to prevent and curb the spread of COVID-19 in workplaces.

The NIOH also responded to the pandemic by establishing a dedicated workplace advisory hotline, specifically for occupational health professionals, employees and employers. The hotline has been expanded to address general workplace queries beyond COVID-19. Queries from the hotline formed the basis for some of the webinars that were held to cater for various occupational groups across different sectors. Webinars and other training events equipped industry with the tools required to protect and promote workers' health and safety, including the safe return to work during the pandemic.

To date, 57 webinars have been conducted, with over 40 000 participants being trained on COVID-19-related topics. Several posters and fact sheets were also developed and translated into local languages. In collaboration with academia and experts from the national DoH, the NIOH contributed to COVID-19 regulations, directions and guidelines related to workers and workplaces. All these materials are accessible via the NIOH's zero-rated website. Towards the end of the financial year, the Quality Council for Trades and Occupations (QCTO) accredited the NIOH as a skills development provider to offer two qualifications/programmes on Workplace Preparedness and Risk Control for a period of five years commencing in March 2021.



Although COVID-19 affected many organisations negatively, the NIOH was able to repurpose its staff members to respond to the need to empower workplaces and, in so doing, raised the NIOH's profile as an occupational health knowledge hub for employers, employees and professionals within and outside South Africa. More details related to the COVID-19 activities conducted by the Institute are listed elsewhere in this annual review.¹

RESEARCH

A fundamental task of national institutes for occupational health is to produce new knowledge in an effort to prevent ill health and injury, and to promote good health. Taken together, the section reports that follow describe a large and varied interdisciplinary research programme that covers many issues that are important to the improvement of workers' health and the health of communities living around workplaces. The topics of the scientific articles published over the year reveal the large variety of research needs in OHS in the country.

Research remained a priority for the Institute and focused on the prevention of workplace exposure, with specific reference to hazardous biological agents. In total, the few researchers at the NIOH managed to publish 43 articles in peer-reviewed journals, an increase on the previous year.

Surveillance

The surveillance of occupational health, morbidity, injury and mortality is inadequate in South Africa. Contributing to improved surveillance is a long-standing, but increasingly important part of the work of the NIOH. The surveillance of occupational diseases was prioritised as a new strategic thrust during the period under review. Concerted efforts are being made to also increase the publication of surveillance reports.

A national Occupational Health Surveillance System (OHSS) was established in October 2020 to cater for the submission of workplace COVID-19 infections, in line with government regulations and directives legislating the collection of data on COVID-19positive employees.

The OHSS provides an overview of the COVID-19 infection spectrum in the South African workforce with the early identification of industries and occupational groups at high risk of infection so as to inform appropriate interventions (e.g. policy, programmatic and resource interventions). The surveillance of all occupational diseases and injuries will be based on this system.

In addition, several other surveillance initiatives continue within the Institute. As per statutory obligation, the Pathology Disease Surveillance Database (PATHAUT) report was completed and is accessible on the NIOH's website. The Institute also provided the COVID-19 Weekly Sentinel Hospital Admissions Surveillance for Healthcare Workers.

International liaison

The NIOH maintained its World Health Organization (WHO) collaborating centre status. This is an affirmation and a recognition of the NIOH's achievements in supporting the WHO's occupational health programmes, and the continuation of opportunities for partnerships and projects with the network of collaborating centres around the world. The NIOH played a prominent role in the WHO's programme on vulnerable workers, such as those in the informal economy.

The NIOH fostered strong international relationships through dedicated collaboration and networking efforts with key international agencies, such as the WHO, the International Labour Organization (ILO), AUDA-NEPAD, the International Commission on Occupational Health (ICOH), the National Institute for Occupational Safety and Health of the Centres for Disease Control and Prevention (NIOSH-CDC), USA, the Finnish Institute for Occupational Health (FIOH), the Health and Safety Laboratory (HSL) of the UK, Workplace Health Without Borders (WHWB) and the Organization for Economic Cooperation and Development (OECD).



See the information on research- and teaching and training- activities related to COVID-19 in the reports of the different departments and sections, as well as under Section 12 (COVID-19 Occupational Health Outbreak Response Team) and Section 13 (Occupational Health Surveillance System)

Moving to the new financial year – COVID-19 and a changing world of work

It is expected that COVID-19 and the consequent changing world of work will occupy much of the NIOH's planning, reorganisation and work for the near future. Many technical questions on protecting employees and employers from occupational hazards and their consequences need to be answered. The research projects listed in the body of this review are illustrative of them. All of working life may be altered to some extent: the way we work at home, in the informal economy, at businesses of all sizes, factories and mines will change in unpredictable ways, and the work-related health effects that accompany these changes - some bad and some good - will need to be assessed and managed. South Africa is, unfortunately, all too familiar with unemployment and under-employment. The expected increase in unemployment will have many negative consequences for workers. Although new to the NIOH, the Institute may need to consider aspects of unemployment and worker health, in collaboration with other partners. The informal economy, which is already large, will probably expand rapidly, and the NIOH's programmes in this economic sector will need to be geared to respond to its growing needs.

Appreciation

I wish to thank the NHLS and the NIOH's management team for the strategic leadership that enabled the NIOH to deliver excellent results under resource-constrained circumstances. Staff at the NIOH continue to strive for excellence in their work. I appreciate their contribution and thank them for their hard work towards ensuring healthy, safe and - ultimately - sustainable workplaces. Our partners, collaborators and stakeholders are acknowledged for contributing to the successes of the NIOH during the period under review.





PATHOLOGY DIVISION

1. PATHOLOGY DIVISION

Head: Dr Anita Gildenhuys

The origins of the Pathology Division lie in the Pneumoconiosis Research Unit that was founded in 1953 to conduct research into dust-induced lung disease in mine workers. While working at this unit, Dr JC Wagner discovered the causal link between crocidolite asbestos and malignant mesothelioma of the pleura. The work of the Pathology Division has traditionally focused on occupational lung disease and continues to provide an autopsy service to assist with the compensation of the families of deceased mine workers. Through expertise gained in lung pathology, the Division has become a referral centre for lung biopsies obtained at surgery. In 2017, the Pathology Division was appointed as a provider of pathology services to the Centre of Pulmonary Excellence (Lung Laboratory Research and Intervention Centre). The Division has been assisting with diagnostic surgical pathology services for Limpopo. In addition to these pathology services, the Division offers analytical electron microscopy services.

The service work of the Pathology Division provides data and material for teaching, research and surveillance purposes. The quality of the work in its laboratories is maintained through participation in external quality assurance schemes and accreditation with SANAS, in accordance with the recognised International Standard, ISO 15189:2007.

DIAGNOSTIC SERVICES

Autopsies

In terms of the Occupational Diseases in Mines and Works Act, Act No. 78 of 1973, the Pathology Division continues to carry out the statutory requirement of examining the cardio-respiratory organs of deceased miners. A pathology report of this examination is sent to the Mines Medical Bureau for Occupational Diseases to assist with the compensation process for families of deceased mine workers.

In this financial year, the COVID-19 pandemic impacted materially on the ability of the NIOH to offer presentations and workshops to promote the autopsy service to stakeholders. Considerable uncertainty was encountered regarding the safety of performing autopsies during the pandemic, particularly during the first wave of the pandemic when testing was not always readily available. The risks facing prosectors was also not well known. In order to assist service providers nationwide, the NIOH's Pathology Division published guidelines titled "Guidelines for removal of heart and lungs for prosectors and doctors during the 2020 COVID-19 pandemic". It received the organs of 535 former miners in 2020, compared to 759 in 2019.

While the pandemic further impacted on the declining autopsy numbers during the year under review, the steady decrease in numbers over the years likely also reflects the lower number of miners working in the industry. There is, nonetheless, a recognised need to facilitate access to the compensation system.



The autopsy service generates a great deal of information about the lungs that are examined. The examining pathologists carefully recorded approximately 200 items of information. This information is entered into the Pathology Division's Pathology Disease Surveillance Database. The PATHAUT is a national resource and contains unique information about diseases in the mining industry. The database has been and continues to be used extensively for research in collaboration with local and international collaborators, and over 150 peer-reviewed publications have been produced using the data. The database has been maintained since 1975 and has been used to show disease trends in the mining industry. It is also an important tool for disease surveillance. Detailed disease surveillance reports compiled from PATHAUT data, giving demographic data and disease rates, are produced annually. These have been made available in the public domain through the NIOH's website. The URL for the reports is:

http://www.nioh.ac.za/?page=pathology_disease_surveillance_reports&id=162

Surgical pathology

The Division has vast experience in lung pathology and is recognised as a Centre of Excellence. A diagnostic service is offered to satisfy the demand for opinions on lung biopsies, fine needle aspirates and bronchial washings. During 2017, the Centre of Pulmonary Excellence requested that NIOH's Pathology Division to provide pathology expertise and services for the newly created centre, which officially opened in April 2018. In 2020, Dr A Gildenhuys and Dr DG Lakhoo co-authored the pathology section of a document written for the Department of Health as part of an appointed Lung Cancer Expert Writing Group. The document is titled "Guidelines for the continuum of care in lung cancer". The draft document is currently with the WHO for comment.

Due to a lack of capacity at the NHLS' laboratories, the NIOH's Pathology Division accepted a request in October 2017 to be the service provider for general surgical pathology to Limpopo. This has resulted in an improved pathology service to the province. The general surgical pathology specimens received from Limpopo affords an opportunity for pathologists at the NIOH to examine a broad range of general pathology.

Electron microscopy

The Electron Microscopy Section functions within the Division and supplements the service work of the Division by determining the type of asbestos fibre and asbestos fibre concentration in the lung tissue of former miners to assist with the diagnoses of asbestos-related diseases.

Asbestos fibre analyses are also conducted on bulk materials and air samples, which are obtained on filters. These analyses are performed for other sections of the NIOH and external clients including national, provincial and local government, nongovernmental organisations, universities and private businesses. The Electron Microscopy Section participates in an external quality assurance scheme and has maintained its satisfactory rating in the Asbestos in Materials international quality assurance scheme that is coordinated by the Health and Safety Laboratory, UK.

Asbestos fibre analysis was first offered in 2003. Since then, data generated from the samples submitted for analysis has been stored and entered into a database. This database is unique in South Africa and its interrogation provides information about the legacy of asbestos in the country. To date, the database contains over 3 000 entries with information regarding the type of sample, its origin, the type of industrial sector, and the activity being performed, such as the renovation of an asbestoscontaining structure. This information has been used to produce an annual surveillance report, which is available in the public domain through the NIOH's website. The URL for the report is:

http://www.nioh.ac.za/?page=asbestos_surveillance_reports&id=191





Figure 4: A scanning electron micrograph of crocidolite asbestos.

RESEARCH AND EDUCATION

Research relevant to the health of South African workers is conducted by staff members of the Pathology Division. Material and data from the service work of the Division provides information for research projects. Current areas of interest centre on lung diseases in mine workers, which is caused by exposure to silica dust or asbestos fibres, as well as some aspects of the surgical pathology cases received from Limpopo.

Ms Z Maseko, an Intern Medical Scientist in the Division, has completed her research on the correlation between asbestos bodies on histology and asbestos fibre on electron microscopy in individuals occupationally exposed to asbestos. She plans to submit the research for publication shortly. Her supervisors are Dr J Linden, Dr DG Lakhoo and Prof N Naicker.

Ms N Kgokong, a Medical Scientist in the Division, completed her master's dissertation and is in the process of submitting corrections. The dissertation is titled "Patterns of tissue damage caused by insect activity using pig carcasses as human analogies. A macroscopic and microscopic analysis".

Ms L Mhlongo, a Medical Scientist in the Division, is currently working on a research project titled "Association between asbestos fibre type and asbestos-related disease in ex-miners". She is supervised by Dr J Linden and Dr C McCusker.

Dr C McCusker, a Pathologist in the Division, is working with Prof J Murray on a research project titled "Silica-associated lung cancer in gold miners".

Dr DG Lakhoo, a Pathologist in the Division, is working on a project titled "The value of the Mycobacterium PCR assay in formalin-fixed paraffin-embedded tissue from extrapulmonary sites".

Mr R Manenzhe, a Prosector in the Division, is registered for a Master of Science (MSc) (Anatomical Pathology) at the University of the Witwatersrand. His research topic is "Minimally invasive post-mortem tissue sampling for diagnosis of occupational lung diseases". He is supervised by Dr A Gildenhuys. He is also working on a project titled "Basal cell carcinoma in Limpopo Province of South Africa: A retrospective study" with Dr C McCusker and Ms L Mhlongo.

Ms T Mashele, an intern Scientist in the Division, is working on a research project titled "Morphologic subtypes of cervical carcinoma in Limpopo Province of South Africa" with Dr J Linden. Ms T Mashele is also registered for an MSc (Anatomical Pathology) at the University of the Witwatersrand. Her research project is titled "Investigation of immunophenotypic and molecular features of aggressive B-cell; non-Hodgkin lymphomas that were documented in patients at Chris Hani Baragwanath Academic Hospital".

Ms N Ndawo, a Medical Technologist in the Division, is registered for a Bachelor of Health Sciences (Honours) at the University of the Witwatersrand. Her research topic is "The positive and negative contribution of standardised cytology reporting systems", supervised by Prof P Michelow and Dr C McCusker.

Dr D Fassom, a Medical Officer in the Division, is registered for a Diploma in Occupational Medicine and Health at the University of Pretoria. She is currently in her first year of study.



The Division collaborates with other sections within the NIOH and assists with projects that involve the enumeration and identification of asbestos. Relationships are fostered with local and international institutions. These currently include the Council for Scientific and Industrial Research (CSIR), the University of the Witwatersrand: Schools of Pathology, Public Health, Clinical Medicine and Archaeology, the University of Johannesburg: Faculty of Health Sciences, the Health and Safety Laboratory, UK, the Occupational and Environmental Lung Injury Centre, Sheffield University, UK, the University of Wales, UK, Harlan Laboratories, Switzerland, Dokkyo University School of Medicine, Japan, London School of Hygiene and Tropical Medicine, University College, London, UK, Brooklyn College, City University of New York, USA, Sciences Po University, Paris, France, and Environmental and Occupational Health Sciences, School of Public Health, Chicago, Illinois. The Division also receives visitors from these local and international institutions.

TEACHING AND TRAINING

The Division plays a role in teaching and training through workshops, presentations and formal lecturing to professional bodies, universities and teaching hospitals. Prof J Murray is an associate professor in the School of Public Health at the University of the Witwatersrand (Wits University).

Staff members participate in the mentoring, teaching and supervision of master's students at Wits University. The pathologists are actively involved in the undergraduate teaching of medical students and in anatomical pathology registrar training. Registers from Wits University rotate through the NIOH for three to four months during their training for exposure to pulmonary pathology and for general pathology training. Dr A Gildenhuys is an examiner for the national FCPath(SA) Anatomical Pathology specialist exit examination. The pathologists actively participate in and present cases at regular clinical pathology meetings with doctors from the Johannesburg teaching hospitals.

PROFESSIONAL DEVELOPMENT

Two postgraduates were enrolled: A Post Graduate Diploma in Occupational Medicine and Health student at the University of Pretoria and a MSc Anatomical Pathology student at Wits University.

Three undergraduates were enrolled: A National Diploma in Biomedical Technology student at the Vaal University of Technology, a BSc Honours in Health Sciences, Anatomical Pathology student at Wits University and a Diploma in Business Management student at Damelin.



Image 2A and B: Lung sections indicating disease from Silicosis and Mesothelioma.



OCCUPATIONAL MEDICINE AND EPIDEMIOLOGY DIVISION

2. OCCUPATIONAL MEDICINE AND EPIDEMIOLOGY DIVISION

Head: Prof David Rees

The Division comprises three sections: Occupational Medicine, Immunology and Microbiology, and Epidemiology and Surveillance. The reports of the individual sections follow a brief introduction, which focuses on some notable aspects of the sections' work during the period under review. Prof David Rees retired at the end of 2019, but remained on as Head of the Division until October 2020. All sections made important contributions to the NIOH's substantial COVID-19 programme.

Occupational Medicine

For much of the period under review, Dr Nompumelelo Ndaba was the Acting Head: Occupational Medicine while Dr Spo Kgalamono continued her role as Interim Executive Director of the NIOH.

The Occupational Medicine Section redirected much of its energy and resources towards COVID-19 and the workplace. Its report lists a large number of key services, advisory activities, training and information tasks, and support to government departments, organised labour and business, and individuals. Many of the activities were novel and developed in a context of evolving knowledge and conflicting approaches. Noteworthy undertakings included the establishment of the COVID-19 hotline for workplaces, the development of guidelines for workplaces, and preparing, coordinating and delivering presentations at various webinars and information sessions held on COVID-19 awareness for various workplaces. As can be seen from its report, the Section was heavily involved in these tasks, but nevertheless continued with its long-standing obligations. Occupational medicine registrar training was maintained with the recruitment of two new registrars. The Section continued to support postgraduate occupational medicine courses such as the Diploma in Occupational Health. The Section contributed to a major project of the Department of Employment and Labour on silicosis elimination in South Africa.

The report of the Ergonomics Unit, within the Occupational Medicine Section, by Dr Busisiwe Nyantumbu-Mkhize highlights its many COVID-19 contributions during the period under review, but also its ongoing service, research, and teaching and training activities in other fields. The COVID-19 epidemic relegated significant OHS initiatives to relative unimportance. The new Ergonomics Regulations is among them. These Regulations were expected to be a prominent initiative for the Unit in 2020/21. Hopefully this initiative can be resumed in the years to come.

Immunology and Microbiology

As in previous years, an impressive programme of workshops, as well as teaching and training initiatives, formed a prominent part of the Immunology and Microbiology Section's activities for 2020/21. Dr Tanusha Singh, the Section's head, noted that the demand for credible information on COVID-19 shifted the Section's training initiatives mostly to workplace preparedness and readiness during outbreaks and emergencies. Its research programme was re-shaped to contribute to answering some key COVID-19 questions. The validation of three decontamination methods for respirators used in South Africa to address stock shortages during the COVID-19 pandemic, and an assessment of the anti-bacterial efficacy of hand sanitisers commonly used in South Africa are two noteworthy projects in this context. The responsiveness of the Section to the country's COVID-19 needs is laudable.



Dr Singh continued to serve as the Chair of the NIOH's Research Committee and was material to a highly successful NIOH Research Day.

Epidemiology and Surveillance

Prof Nisha Naicker, Head of Epidemiology and Surveillance, left the NIOH during the period under review. Prof Naicker led the Section most effectively and many valuable projects were initiated and successfully completed during her tenure. The Section's outputs, publications and surveillance reports, notably, increased markedly over the years Prof Naicker spent at the institution. As reported in the 2019/20 NIOH Annual Report, the Epidemiology and Surveillance Section produced 19 publications, a substantial increase on previous years. This productivity was maintained in 2020/21, as shown in the Section's report. The scope of the Section's research programme is exceptional for a relatively small unit.

Surveillance of occupational health, morbidity, injury and mortality is inadequate in South Africa. Contributing to improved surveillance is a long-standing, but increasingly important part of the work of the Section. The Surveillance and Services subheading of the Section's report shows a significant contribution by Epidemiology and Surveillance to improve surveillance in the country. COVID-19 surveillance programmes were particularly notable during 2020/21. The National Occupational Mortality Surveillance South Africa (NOMS-SA) Programme continued, as did the analysis of OHASIS data. The Section issues reports and formal peer-reviewed publications. They can be found on the NIOH's website:

https://www.nioh.ac.za/national-occupational-mortality-surveillance-south-africa-noms-sa/





OCCUPATIONAL MEDICINE SECTION

2.1 OCCUPATIONAL MEDICINE SECTION

Acting Head: Dr Nompumelelo Ndaba

The Occupational Medicine Section provides an expert clinical occupational medicine service to stakeholders through a specialist Occupational Medicine Clinic. The Clinic serves as a referral clinic for occupational health practitioners seeking a second opinion and the expert clinical assessment of cases seen in their various enterprise levels. The Clinic also serves as a teaching platform for occupational medicine registrars training to be specialists, working under occupational medicine specialists. For the first half of the period under review, there were four occupational medicine specialists in the section (as the previous registrars had qualified to become consultants as well), two clinic support staff and two staff within the Ergonomics Unit. The activities and outputs of the Ergonomics Unit are provided as a separate report within this Section.

SURVEILLANCE/DIAGNOSTIC SERVICES

Service delivery and advisory support in key strategic stakeholder occupational health meetings

The Section traditionally offers a considerable amount of service delivery through the clinical diagnostic service. However, during 2020/21, the resources and activities were diverted towards COVID-19 and the workplace as a major service delivery output, as well as representation in other advisory and support services in key strategic stakeholder fora.

COVID-19 and the workplace

COVID-19, as a novel disease in the world, required dedicated effort from all angles in public health, including occupational health. In March 2020, following the first cases being diagnosed in South Africa and the subsequent lockdown announced, it was inevitable that healthcare workers, essential workers and all workplaces were empowered to develop strategies to deal with COVID-19 in the workplace.

This Section, like all occupational health settings in the country, was faced with developing new responses to the pandemic, which were novel at the time. The clinical activities were therefore put on hold for the entire financial year as the resources were redeployed to COVID-19 responses and activities – not only from within the NIOH, but also as requested by different industries. These services are explained under the Teaching and Training heading of this Section's report.

The high influx of clinical and general enquiries around COVID-19 and the workplace led to the various activities and means to address the new information gaps and policy-related enquiries brought to the Section and the NIOH at large. The Section responded by participating in and spearheading various service delivery mechanisms, including the establishment of the COVID-19 hotline for workplaces, the development of guidelines for workplaces, and preparing, coordinating and delivering presentations at various webinars and information sessions on COVID-19 awareness in various workplaces.

The NIOH developed a number of interventions. A few of these were led by the Section's occupational medicine specialists and subsequently involved the Section's registrars. Some key interventions included the introduction of a new advisory platform



for workplaces in the form of a hotline service, participation in the Occupational Health Outbreak Response Team (OHORT) for coordinated responses to various needs in different workplaces, and human resources support to the Epidemiology and Surveilance Section's OHSS.

Occupational Health Outbreak Response Team

The Occupational Medicine Specialists, Drs O Volmink, S Iyaloo and N Ndaba, attended COVID-19 task team meetings to represent the Occupational Medicine Section throughout the period under review. Some of the activities specifically allocated to the Section included presentations to various stakeholder platforms on preparedness, and roles and responses to COVID-19 in the workplace. Significant focus was therefore put on developing material in the form of posters and pamphlets, assisting in developing short educational video messages, and providing a real-time hotline service. In addition, the Section attended to media enquiries and requests for interviews, and participated in the authoring of thought leadership editorials in non-peerreviewed industry-specific publications.

COVID-19 hotline and query information email service

A COVID-19 hotline service was an initiative of the OHORT and delegated to the occupational medicine service to gather and respond to various enquiries from anywhere in the country regarding COVID-19 in the workplace. The Occupational Medicine Section managed this service and provided ongoing account and feedback to OHORT meetings.

This service was introduced in April 2020 to provide real-time advisory support for workplaces in line with COVID-19. The hotline was initially manned by all the medical practitioners employed at the NIOH, including pathologists, public health medicine specialists and registrars over a 24-hour period. From July 2020, the service was provided by the four occupational medicine specialists and registrars in the Section, limited to office hours from 08:00 to 17:00.

The Section received a considerable number of enquiries every day on different aspects of COVID-19 in the workplace. These are grouped into thematic areas, as shown in Figure 1. The hotline service provided a synchronised, verifiable manner of generating advice from practitioners on time and ensuring that responses were provided within the stipulated turnaround time (24 hours), based on the latest reputable scientific sources. Monthly reports were provided to the OHORT on key thematic areas to ensure that there was an appropriate response, and prioritising areas of concern by commissioning new topics for training sessions, developing posters, and sourcing relevant guidelines for uploading onto the NIOH's website, as well as other platforms.

The volume of hotline calls declined from August 2020 with new emerging themes in line with the phases of the pandemic in South Africa. Some of the themes remained dominant throughout the period under review, e.g. surveillance data submission.



Figure 1: The hotline enquiries received from May 2020 to March 2021 according to themes.



Occupational health surveillance system hotline and query service

The Occupational Medicine Section, through Sr G Buffel, provided support to the Occupational Health Surveillance System hotline guery service in December 2020 by attending to calls from different employers for guidance on the submission of COVID-19-related health data from workplaces. In January 2021, one medical practitioner was allocated, together with Sr Buffel, to provide services to the OHSS hotline and query service, as well as attending to other related queries not directly related to the OHSS, but on COVID-19 in the workplace. Services rendered included assisting employers to register on the platform, providing clinical advisory support, and responding to emails relating to reporting, and statistical and infrastructure requirements for ongoing submissions.

Later during the year, Sr Buffel provided support to the Epidemiology and Surveillance Section's newly developed surveillance system, and Dr H Maso joined the Section to assist with the OHSS.

Participation and representation in key fora/stakeholder meetings in occupational health

The Occupational Medicine Section provided advisory support and representation in key committees for decision making in occupational health, such as the Department of Employment and Labour's Technical Committee (TC7), the NIOH's Occupational Health Outbreak Response Team, Wits University's School of Public Health, Occupational Health Division meetings and the Department of Health's Medical Bureau for Occupational Diseases' Reviewing and Joint Committee meetings.

NHLS support during COVID-19

Dr O Volmink prepared a document during April 2020 titled "NHLS visitors' procedure for gaining access to NHLS offices". The document was meant for use by security personnel to assist with decision-making algorithm and screening tools to be completed by visitors upon arrival at the NIOH's access points and premises.

The Occupational Medicine team conducted training for the NIOH's security personnel during June 2021 on the temperature screening of staff and visitors accessing the premises during the COVID-19 era.

SUPPORT TO GOVERNMENT DEPARTMENTS AND OTHER ENTITIES

Department of Employment and Labour

Dr O Volmink worked with the Department of Employment and Labour in March 2021, together with other stakeholders (the South African Society of Occupational Medicine and the South African Society of Occupational Health Nursing Practitioners) to draft a consent form for inspectors to use to review medical surveillance records.

The Occupational Medicine Section provided panellist support to the DoEL's Training on the Asbestos Abatement Regulations webinar on 27 November 2020. The Section also provided training to the DoEL's inspectors on audiometry and noise-induced hearing loss during November 2020.

National Department of Health: Medical Bureau for Occupational Diseases

The Minister of Health appoints occupational medicine specialists to provide Reviewing Authority Committee functions to the Medical Bureau for Occupational Diseases (MBOD), as stipulated under the Occupational Diseases in Mines and Works Act of 1973, as amended. The Reviewing Committee evaluates appeals received on the outcomes of the MBOD's certification committees. The year under review was affected by the COVID-19 changes, and thus the Reviewing Authority only held a few meetings. The clinical support team coordinator in the Occupational Medicine Section was allocated to provide administrative and logistical support to the Reviewing Authority meetings.

Four meetings were held: two in November 2020 and two in March 2021. Each Reviewing Authority meeting was followed by a Joint Committee meeting, where the Certification and Reviewing committees convene to discuss specific cases for joint insight and outcome decision. The meetings were attended by drs S Kgalamono, O Volmink and N Ndaba, and were chaired by Prof D Rees. Three cases were discussed and finalised in March 2021.



National Department of Health Workplace COVID-19 Vaccination Planning Programme

Dr H Maso represented the Occupational Medicine Section of the NIOH in the national DoH's Workplace COVID-19 Vaccination Planning Programme workstream meetings during March 2021 (meetings were held on 16, 23 and 30 March 2021).

Advisory service and support to trade unions and employer organisations

Dr N Ndaba, on behalf of the Occupational Medicine Section, attended meetings convened by the Commission for Conciliation, Mediation and Arbitration (CCMA) with employer organisations and the National Union of Mineworkers (NUM), a registered trade union, to revive a project from 2019 with the revision of the original concept notes. Meetings were held on 4 and 25 February 2021, where approval was granted for the NIOH to commence the project after a Memorandum of Understanding (MoU) had been prepared and signed by all parties. The MoU was developed by the Occupational Medicine and the Epidemiology and Surveillance sections, and submitted to the NHLS' Legal Section for ratification and eventual submission for approval by the Chief Executive Officer (CEO). The documents were shared with all parties for signing, with finalisation commencing in the 2021/22 financial year. The project is planned to yield several output reports, as well as research reports after the appropriate ethical approval processes have been concluded.

Gauteng Provincial Government baseline survey of OHS systems

The Office of the Premier of the Gauteng Provincial Government (GPG) requested the Occupational Medicine Section to provide support on OHS services within the province. The request followed training interventions on systems that should be in place for the provincial government departments to be able to implement OHS services for their workers. The departments in the GPG, following the model of the Department of Public Service and Administration (DPSA), had a fully functional wellness structure and strategy. This strategy was to be enhanced and augmented with appropriate OHS services.

Dr N Ndaba held meetings with the Wellness Task Team to finalise this support, which would include the provision of an oversight role to its existing occupational medical practitioner and conducting a baseline survey among its provincial departments.

The project was conceptualised during November 2020 for rollout to all 18 departments. Data collection tools were developed and circulated through the Premier's Office's wellness champion. By 31 March 2021, the occupational medicine team had interviewed 10 departments as part of data collection. Drs N Ndaba, M Mberi and E Sepirwa coordinated and conducted the interviews and were to start with the report writing in the new financial year. The move from traditional physical data collection interviews to virtual data collection delayed the project as both sides experienced several information service platform challenges with other key staff members working away from the office with limited access to the data.

Elimination of silicosis in the non-mining industry

The NIOH collaborated with several stakeholders to execute a project for the DoEL on the elimination of silicosis in the nonmining industry. The Occupational Medicine Section is involved in Work Package 1 and Work Package 3, which are involved with estimating the prevalence of silicosis in the non-mining industries, based on international literature, and eventually conducting field surveys. The project is currently at the desktop phase, including the review of the project plan timelines and obtaining ethical clearance and approval.

University of Witwatersrand, School of Public Health, Occupational Health Division

Dr N Ndaba attended meetings with the Occupational Health Division at Wits University's School of Public Health for curriculum review and rearrangement in preparation for the second-year of the Postgraduate Diploma in Occupational Health programme offered by the School of Public Health. The meetings were attended monthly in 2021 as part of ongoing progress review and support to the Postgraduate Diploma in Occupational Health programme.



RESEARCH

No research projects were completed during the period under review, but new projects were conceptualised around the health effects and diseases from ergonomic hazards in a group of miners, and the evaluation of those health effects for possible incorporation into the list of occupational diseases of the Compensation for Occupational Injuries and Diseases Act, Act No. 103 of 1993 (COIDA) for this special occupational group

TEACHING AND TRAINING

The Occupational Medicine Section delivered a number of teaching and training interventions during the period under review. These included both formal academic and non-academic interventions.

For the purposes of this report, a training intervention of the Section is referred to as a training-related activity, which may be performed or require at least one hour to execute. This may be in the form of lectures, presentations, the coordination of training, panellist support for a presentation or webinar, and non-academic training interventions provided for stakeholders and professionals in occupational health.

Formal academic interventions include the coordination of academic blocks, preparing academic lectures, delivering presentations, facilitating a day in an academic programme, lecture presentation sessions with postgraduate students and registrars in the Section, academic supervisory sessions and the review of concept notes and chapters on academic write-ups, including feedback meetings with supervised students.

Postgraduate Master of Medicine registrar training

In January 2021, the Occupational Medicine Section received two registrars to start their registrar training programme in the NHLS for a minimum of four years to eventually become occupational medicine specialists.

The Occupational Medicine Section provided a six-month training rotation platform and signed off one public health medicine registrar in December 2020 as part of the requirements of the Public Health Medicine College. This training involved a series of training presentations and workplace-based activities in occupational health.

One new public health medicine registrar joined the section in January 2021 for a six-month period.

Formal lecture-based academic training interventions for various academic programmes

The Section provided a number of training interventions aimed at postgraduate occupational health programmes at tertiary academic institutions such as Wits University's Postgraduate Diploma in Occupational Health and Master of Science in Exposure Science, and the University of Pretoria's Postgraduate Diploma in Occupational Health.

Teaching and training activities mainly include the preparation and delivery of lectures, but also the coordination of specific themes. In 2020, the Occupational Medicine Section was involved in planning and coordinating the Epidemiology block for Wits University's Postgraduate Diploma. This involved presenting lectures, developing a timetable, inviting lecturers and keynote guest lecturers, as well as setting group assignments for the same block. The occupational medicine specialists assessed the group presentations for group marks, and set and marked the end-of-year Epidemiology examination for first-year diploma students.

Formal training activities not for academic qualification purposes

Training activities conducted by the Section were also in the form of presentations and webinars for professionals and key occupational health and safety stakeholders in various settings, including organised labour, employers, wellness coordinators and industry champions. Most of the training conducted during this period was through the NIOH's OHORT coordination, which was primarily targeted at COVID-19 in the workplace. However, some of the training outputs conducted were not limited to COVID-19, but also addressed other OHS topics required by various stakeholders. More training interventions were delivered during this



period that were not for academic qualification purposes, as shown in Figure 2.



Figure 2: Training interventions delivered by the Occupational Medicine Section from April 2020 to March 2021.

Undergraduate programmes

No teaching and training activities were conducted for undergraduate programmes during this period. The Section conducted extensive teaching and training interventions that were not for academic purposes, but instead for the professional development of occupational health stakeholders.

PROFESSIONAL DEVELOPMENT

Two occupational medicine doctors, Drs H Maso and E Sepirwa, were recruited and joined the Section in January 2021 to commence the first year of their four-year MMed in Occupational Medicine programme at the University of the Witwatersrand. The registrars started with the formal programme at Wits University within the NIOH, and have joined the ongoing activities of the Section, including clinical case assessments, clinical discussion meetings, MBOD Reviewing Authority and Joint Committee meetings, as well as the Section's Journal Club activities.

No new students in the Section graduated during 2020/21.



ERGONOMICS UNIT

The Ergonomics Unit, headed by Dr Busisiwe Nyantumbu-Mkhize, is part of the Occupational Medicine Section. Its functions are to provide ergonomic services to South African workplaces, conduct research related to ergonomics and build the capacity of occupational health professionals and workers in ergonomics through teaching and training. The year under review has been unprecedented due to the advent of the Severe Acute Respiratory Syndrome (SARS)-CoV-2 virus responsible for the COVID-19 pandemic in that it necessitated a concerted effort to assist workplaces to fight against and contain the virus in order to protect workers from contracting COVID-19. As such, the work activities performed in the Unit covered services, research, teaching and training, as well as supporting the activities of the Occupational Medicine Section related to COVID-19.

The services provided were advisory in nature. Research activities mainly encompassed reviewing research documents, while teaching and training covered postgraduate students, occupational health professionals and workers. The involvement of the Unit in COVID-19-related activities included participation in research, the development and review of information material, and teaching and training.

An analysis of the Unit's activities in the year under review, revealed that teaching and training activities comprised close to twothirds of its work, compared to services and research activities, which, combined, comprised a third of its work, as illustrated in Figure 3.



Figure 3: Activities performed in the Ergonomics Unit in 2020/21.

Services

The services offered by the Ergonomics Unit comprised giving ergonomics-related advice to workplaces and contributing to the efforts of making the Occupational Medicine Section COVID-19 compliant. The nature of advice sought by workplaces was about suitable furniture, legislative requirements for ergonomics training in the workplace, measurement tools for assessing ergonomic hazards in the workplace, preventing adverse health effects when using computers and human vibration occupational exposure limits.



In the Section, occupational health systems were strengthened in light of the COVID-19 pandemic. Risk assessment was amended to include COVID-19 control measures. A new work plan and protocols were developed to incorporate COVID-19 measures to ensure COVID-19 preparedness.

RESEARCH

In pursuit of generating new knowledge, the Unit performed reviews of research documents, which included abstracts, a research proposal, a report and a journal article. Research activities related to COVID-19 were also conducted. Two abstracts, "Validation of three decontamination methods for respirators used in South Africa to address stock shortages during the COVID-19 pandemic" and "Risk factors for problematic alcohol use among male waste pickers and caddies in Johannesburg" were reviewed for oral presentations at the 2020 NIOH Research Day. A proposal from the NIOH Research Committee titled "Do the various alcohol-based hand sanitisers used in Johannesburg, South Africa, during the COVID-19 pandemic contain the recommended concentration and quality of alcohol?" and an MPH research report titled "Prevalence of musculoskeletal disorder pain among computer users in offices" from Wits University were also reviewed. Finally, a paper titled "Occupationalrelated low back pain in truck drivers" was reviewed for publication in the Occupational Health Southern Africa Journal.

COVID-19 research-related activities

The Unit participated in the fieldwork of a taxi COVID-19 transmissibility study. The study was commissioned by the national DoH to assess the effectiveness of disinfection practices currently implemented in the taxi industry. In the early stages of the COVID-19 pandemic, there had been uncertainty about the effectiveness of temperature-measuring devices. Thus, the Unit contributed by producing a literature review document on the use of temperature-screening and appropriate measurement devices for COVID-19. The Unit also assisted in determining appropriate topics to be covered in the NIOH training offered to workplaces on COVID-19 by producing a document titled "Outcome of the analysis of occupational medicine queries relating to COVID-19". These queries came through the NIOH's query ticket system.

TEACHING AND TRAINING

In South Africa, there is a shortage of occupational health professionals with ergonomics skills. Therefore, in the year under review, the Unit provided ergonomics teaching and training through formal and informal methods. As part of the COVID-19related activities, the Unit was involved in the development of information material.

The topics covered in teaching and training activities were ergonomics and musculoskeletal disorders, hand-arm vibration syndrome, ergonomic risk assessment, working from home during COVID-19 and beyond: an ergonomics perspective, office ergonomics and work station design. The recipients of the training included Wits University's Masters in Exposure Science students and the University of Pretoria's Diploma in Occupational Health students, as well as various occupational health professionals, including doctors, hygienists and nurses, and workers.

COVID-19 teaching and training-related activities

Information material such as posters and fact sheets were produced on COVID-19-related topics and posted on the NIOH's website for the occupational health fraternity and South African public to access. The Unit produced a poster titled "Work comfortably and safely on your computer at home during COVID-19". Fact sheets were reviewed, including questions that emanated during training, with corresponding answers for the participants to access.



IMMUNOLOGY AND MICROBIOLOGY SECTION

2.2 IMMUNOLOGY AND **MICROBIOLOGY SECTION**

Head: Dr Tanusha Singh

The Immunology and Microbiology Section plays a pivotal role in preventing occupational allergies and infectious diseases, which remains a challenge in many workplaces, particularly healthcare facilities, agriculture and wastewater treatment plants. The Section contributes to the implementation of effective and sustainable mitigation strategies, particularly in airborne infection control. The Section also provides tailored occupational allergy diagnostics to clinically manage workers' allergies. One of the main thrusts for the year was the promotion and awareness of COVID-19 and its impact on occupational allergies and infectious diseases. The Section participated in various stakeholder forums such as the national DoH, the DoEL, the Africa CDC, NEPAD, the CSIR and academia, in support of accelerating the implementation of occupational health matters. COVID-19 has greatly impacted on business continuity. However, the Section remained steadfast in adapting to new ways of operating during these unprecedented times. The Section's deliverables were aligned to teaching and training, consultations, allergy testing and the efficacy testing of devices purported to reduce microbial transmission.

DIAGNOSTIC SERVICES

The Section continued to provide a worker-centered approach to tailored testing for occupationally related allergic diseases. This specialised service provides a confirmatory diagnosis of specific occupational allergies to better manage workers' exposure. Through this service, the NIOH can identify occupations at risk and recommended measures to control exposure in the workplace. The service has also contributed to the prevention of job loss as a result of a wrongful diagnosis. Sterility testing of nanoparticle samples was conducted, which is important as it contributes to toxicological testing towards research.

The SANAS surveillance assessment for the International Standard ISO 15189 was postponed due to restrictions associated with the COVID-19 pandemic and lockdown regulations. Nonetheless, the Section continued to maintain and strengthen the quality management system. The heightened awareness of infection prevention and control led to increased gueries related to device testing for Mycobacterium tuberculosis and other indicator organisms.

RESEARCH

The Section actively contributed to strengthening research and development within the NIOH by providing leadership to the Research Committee with Dr T Singh as Chair. The NIOH hosted a virtual Research Day in November 2020.

The event was an opportunity for NIOH researchers, including the Section's researchers, to share new research knowledge to improve and promote workers' health. Keynote presentations were delivered by Mr Ben Durham (Department of Science and Innovation), who spoke on the national system of innovation, Mr Ehi Iden (OSHAfrica), whose talk detailed challenges and opportunities for occupational health research in South Africa, Prof Richard Gordon (South African Medical Research Council (MRC)), who spoke about innovation and funding opportunities available at the MRC, and Prof Emeritus David Rees, whose presentation was on the association between silica exposure, silicosis and tuberculosis: a systematic review. The Section gave two oral and one poster presentation.



The day was well attended by 193 participants. In addition, the Section's research priorities focused on identifying workplace exposure, with specific reference to waterborne pathogens and the decontamination of personal protective respirators for reuse during stock shortages. The research conducted involved projects supported by the Section and collaborative projects with multiple stakeholders across various disciplines, including infection control and engineering. The ongoing projects in which the Section is involved were delayed to prioritise COVID-19 research activities.

The new research projects included the following:

Validation of three decontamination methods for respirators used in South Africa to address stock shortages during the COVID-19 pandemic

Collaborative study team: Tanusha Singh¹²³, Thabang Duba¹, Lufuno Muleba¹, Onnicah Matuka¹, Daniel Glaser⁴, Zethembiso Ngcobo¹, Nisha Naicker³, Edith Ratshikhopha', Tobias van Reenen⁴, Zubaydah Kirsten¹, Zibusiso Masuku⁵, Dikeledi Singo', Lebogang Ntlailane¹, Tebogo Nthoke¹, David Jones¹, Mary Ross¹, Pieter du Toit⁷.

National Institute for Occupational Health - a Division of the NHLS¹, Department of Clinical Microbiology and Infectious Diseases, Wits University², Department of Environmental Health, University of Johannesburg³, Council for Scientific and Industrial Research⁴, National Institute for Communicable Diseases⁵, School of Public Health, Wits University⁶, National Metrology Institute of South Africa (NMISA)⁷.

This study aimed to demonstrate the effectiveness of low-cost and scalable decontamination methods for SARS-CoV-2 and the effect on fit testing using people instead of manikins. The results suggest that ultraviolet germicidal irradiation (UVGI) decontamination performed better compared to vapourised hydrogen peroxide (VHP) and moist heat incubation (MHI) methods.

The UVGI was a low-cost prototype and can be used in smaller healthcare facilities such as public healthcare clinics, while the VHP method can be adopted for larger facilities with higher throughput. These methods did not impact on the respirators' filtration. However, donning and doffing may be the significant contributor to fit failure. In addition, a handful of studies showed that UVGI and VHP are effective at inactivating SARS-CoV-2 by three logs from new respirators or respirator swatches. The research team demonstrated a similar log reduction on worn-in respirators using UVGI and VHP; however, only for certain types of respirators. It is recognised that extensive experimental evidence for the reuse of decontaminated filtering facepiece respirators is lacking. Thus, this study would be relevant and of interest in crisis-capacity settings, particularly in low-resourced facilities. The study also highlighted the importance of validating the decontamination method at facility level.

Potential occupational exposure to enteric and respiratory bacterial pathogens at wastewater treatment plants: A preliminary study

Collaborative study team: Poopedi Evida^{1,2}, Kwenda Stanford³, Gomba Noncy¹, and Singh Tanusha^{1,2,4}. National Institute for Occupational Health - a Division of the NHLS¹, Clinical Microbiology and Infectious Diseases, Wits University², Core Sequencing Facility, National Institute for Communicable Diseases³, Department of Environmental Health, University of Johannesburg⁴.

Workers at wastewater treatment plants (WWTPs) provide an invaluable public service, while also being at constant risk of exposure to microbiological contaminants. However, there is a paucity of data on the precise cause of symptoms and illnesses reported among workers at WWTPs. The current study aimed to provide a qualitative profile of human pathogenic bacteria present in untreated municipal wastewater (sewage) that could pose an occupational health risk to WWTP workers if ingested or inhaled. Untreated grab wastewater samples were collected from five WWTPs in Pretoria and analysed for bacterial community composition, including potentially pathogenic bacteria using Illumina Miseq 16S rRNA gene amplicon sequencing. The most predominant phyla identified were Bacteroidota, Campilobacterota, Proteobacteria, Firmicutes and Desulfobacterota, accounting for 85.9% of the total bacterial community. A comparison of bacterial profiles across the five WWTPs revealed that, while some WWTPs contained exclusive genera, the predominant genera in untreated wastewater did not differ considerably, irrespective of plant location and size. A total of 23 genera known to contain bacterial species of medical importance to human health, including Mycobacterium, Coxiella, Escherichia, Shigella, Arcobacter, Klebsiella, Erysipelothrix, Laribacter, Citrobacter, Actinomyces, Treponema and Aeromonas, were identified in this study.



Furthermore, WHO-listed inherently antibiotic-resistant opportunistic bacterial genera such as Pseudomonas, Acinetobacter and Streptococcus were identified. Overall, the assigned genera can cause airway obstruction and gastrointestinal problems, and are classified in Risk Group 2/3 according to the British Health and Safety system and Technical Rules for Biological Agents 466. In conclusion, this study confirms that WWTP workers are occupationally exposed to several bacterial genera classified as hazardous biological agents for humans. This study also highlights the relevance of the metagenomics approach in characterising wastewater bacterial signatures circulating at WWTPs with the potential to cause complicated health issues to exposed workers.

Assessment of anti-bacterial efficacy of hand sanitisers commonly used in South Africa

Collaborative study team: Lufuno Muleba¹, Renay Van-Wyk², Jennifer Pienaar³, Edith Ratshikhopha¹, Tanusha Singh^{1,2,4}. National Institute for Occupational Health - a Division of the NHLS¹, Department of Environmental Health, University of Johannesburg², Biomedical Technology, University of Johannesburg³, Clinical Microbiology and Infectious Diseases, School of Pathology, Wits University⁴.

Hand hygiene plays a vital role in reducing infections in various settings, particularly in healthcare. Hand sanitisers are used as an alternative to hand washing in reducing the number of viable microorganisms when soap and water are not readily available. However, they are only effective if quality products are used and only effective if hands are not heavily soiled or greasy. This study aimed to investigate the antibacterial effectiveness of commercially available hand sanitisers and those commonly used in healthcare facilities.

A mapping exercise was done to select and procure 18 different hand sanitisers sold at retailers, including pharmaceuticals and those available from healthcare facilities. Five microorganisms implicated in hospital-acquired infections were selected and tested against each hand sanitiser: Escherichia coli, Enterococcus faecalis, Klebsiella pneumoniae, Pseudomonas aeruginosa and Staphylococcus aureus. Twenty volunteers were recruited to do a handprint before and after the application of the hand sanitiser. Four of the 18 hand sanitisers (22%) were most effective against all tested bacterial species, and another four (22%) were ineffective. Seven hand sanitisers with a label claim of 99.99% were only effective against E. coli. Only five hand sanitisers (27%) were effective in the bacterial reduction of participant handprints. One hand sanitiser had a label claim of 100% and was 99.9% effective in bacterial reduction on the participants' hands. This study showed that only a fifth of hand sanitisers was effective against selected microorganisms. The hand sanitisers were also only effective against one of the five microorganisms tested. The findings raise concern about the efficacy of hand sanitisers and its role as a preventive measure in reducing microbial transmission.

SURVEILLANCE

The Section conducts surveillance on occupational respiratory allergy and skin disease and publishes an annual report on these. The Waterborne Pathogen Laboratory participated in a project titled "Establishment of a national COVID-19 wastewater surveillance pilot" in collaboration with the National Institute for Communicable Diseases (NICD)'s partnership with the Water Research Commission (WRC). The project is an initiative of the South African Collaborative COVID-19 Environmental Surveillance System (SACCESS) Network, which involves other public and private institutions in the country, and will run from 1 February 2021 to 31 August 2021. Under this project, the Section will collect untreated wastewater samples from three wastewater treatment plants managed by the City of Tshwane Municipality. The samples will be analysed for the presence or absence of SARS-CoV-2. Findings from this project will be used to detect and track COVID-19 trends in communities serviced by sampled WWTPs as a low-cost surveillance and early-warning tool to help public health officials better understand the extent of COVID-19 infections in specific communities.



TEACHING AND TRAINING

The demand for credible information on COVID-19 shifted the Section's training initiatives mostly to workplace preparedness and readiness during outbreaks and emergencies, although some training on water reuse and interventions for infection control continued. Various occupational health professionals, employers and employees were trained across several sectors, as well as persons outside the occupational health sector. The training of Intern Medical Scientists, who are accredited with the Health Professions Council of South Africa (HPCSA), continued, and support was provided to the NHLS' medical technologist training function. The training prepares this cadre for employment in medical laboratories. The Section also supported occupational health curricula for various universities (e.g. the Diploma in Occupational Health for the universities of KwaZulu-Natal, Pretoria and the Witwatersrand) and the Southern African Institute for Occupational Hygienists.

Information sheets

The Section contributed to the development of occupational health awareness material related to infectious disease transmission in various workplaces, including a TB awareness video highlighting the value of the ASPIRE Laboratory for World TB Day and a wastewater treatment poster to commemorate Water Month.

HONOURS

Ms L Singh completed her postgraduate studies in public health in December 2020.

PROFESSIONAL DEVELOPMENT

Eight postgraduates were enrolled: A PhD and two Master's in Occupational Hygiene degree students at Wits University, an MPH student at the University of Cape Town, and a Master in Technology and three MPH students at the University of Johannesburg.



EPIDEMIOLOGY AND SURVEILLANCE SECTION

2.3 EPIDEMIOLOGY AND SURVEILLANCE SECTION

Head: Dr Nisha Naicker

The Epidemiology and Surveillance Section studies and analyses the patterns, causes and effects of exposure on health, morbidity and mortality in occupational settings. This is important in establishing the burden of occupationally related diseases over time and allows for the appropriate allocation of funds for preventative measures and interventions. During the year under review, many of the planned activities were halted due to COVID-19. However, work in other areas, such as occupational health surveillance, increased, as well as research focused on COVID-19 in healthcare workers.

SURVEILLANCE AND SERVICES

South Africa does not have an optimally functioning national occupational health surveillance programme. Since 2018, the Section has expanded this programme to include various internal and external surveillance outputs to assist in the development of a more comprehensive occupational health profile for South Africa.

Internal surveillance

The Section compiles or checks the reports of the Respiratory Allergy Clinic, Skin Allergy Clinic and PATHAUT. Descriptions of these reports can be found under the profiles of the Immunology and Microbiology Section and the Pathology Division.

External surveillance

National Occupational Mortality Surveillance of South Africa (NOMS-SA)

The NOMS-SA describes the relationship between work and wellbeing in order to inform policy development to improve worker safety and health, enable research and improve prevention strategies. The NOMS-SA uses mortality data with occupation information from Statistics South Africa, the national statistics entity responsible for recording vital events annually.

Coding used for the underlying cause of death was provided by the South African National Burden of Disease (NBD) study. This year, disease-specific reports were published highlighting proportional mortality ratios (PMRs) per industry, major and suboccupational groups for TB, renal disease, ischaemic heart disease, hypertension, HIV and diabetes. The PMR is a simple and potentially useful way of portraying the burden of a specific disease within a population. These ratios were calculated to estimate where excess mortality by occupation is found. The PMR also provides a way to compare occupations.

Continuous surveillance of mortality by occupation is a low-cost method that provides a more comprehensive picture of the burden and distribution of potentially work-related illnesses. Reports can be accessed from the website: http://www.nioh.ac.za/ national-occupational-mortality-surveillance-south-africa-noms-sa/



Occupational Health and Safety Information System

The OHASIS is an online reporting tool for all NHLS incidents, injuries and diseases related to the work environment. For the 2020-2021 period, surveillance focused on COVID-19 exposure and positive cases among NHLS employees. Reports were produced weekly and were used to monitor the infection trends according to region, business unit, job type, type of exposure and disease outcomes in COVID-19-positive employees.

COVID-19 healthcare worker admission reports

The Section analyses secondary data from the DATCOV hospital surveillance for COVID-19 admissions, which was initiated by the NICD on 1 April 2020. Data is submitted by public and private hospitals that have agreed to report COVID-19 admissions through DATCOV in all nine provinces. Healthcare worker data is extracted and analysed, and trends in admissions, demographic profiles, health outcomes and severity of disease are reported. Reports can be downloaded from https://www. nioh.ac.za/covid-19-occupational-health-surveillance/



Figure 4: Number of reported COVID-19 admissions among healthcare workers by epidemiologic week of diagnosis and provinces, South Africa, 5 March 2020 to 10 April 2021 (n = 6 877).

Occupational Health Surveillance System (OHSS)

The OHSS is a national surveillance system that is supported by the national DoH, the NIOH, the NICD, the CSIR, the DoEL, occupational medicine specialists and the private sector. The Directive of the DoEL, released on 28 September 2020, makes reporting by employers' mandatory. The OHSS requires employers to submit information on their employees' vulnerability status, symptomatic employees and COVID-19-positive employees, including contacts and return to work. A full description is provided under Section 13 of this report (Occupational Health Surveillance System).

Research support services

The Section provides epidemiological and biostatistical support to sections within the NIOH, various government entities, parastatals and private organisations. Assistance was provided with study design, sample size determination, project management, data collection, data entry, data analyses and scientific writing.

Within the NIOH, the Epidemiology and Surveillance Section has provided support to the following sections over the past year: Occupational Medicine, Occupational Hygiene, Immunology and Microbiology. It also provided support to the Safety, Health and



Environment Department, HIV and TB in the Workplace Unit and the Pathology Division. This includes analysing clinic data for annual occupational and health surveillance reports.

In 2020/21, the Section assisted the Gauteng DoH with the Gauteng staff satisfaction survey, an annual survey conducted by the DoH's Employee Health and Wellness Programme Directorate. Dr Kerry Wilson developed a standardised, validated staff satisfaction questionnaire. Staff from the directorate were trained on how to enter data into the Research Electronic Data Capture (RedCap) system. The entered data was then analysed and a report indicating overall satisfaction with the Gauteng DoH produced for the Directorate. Individual facility and district reports would be completed by May 2021.

In addition, members of the Section played an advisory role for several committees in the DoEL, Nedlac and the DoH's OHS workstream.

RESEARCH

The Section conducts primary research, commissioned by governmental, parastatal and private organisations, as well as secondary data analyses. Research conducted during the period under review included the following:

The knowledge, awareness and perceptions of occupational health and safety in a medical laboratory following the introduction of the online OHS information system (OHASIS)

Study team: Dr N Tlotleng¹, Prof N Naicker,¹, Mr D Jones², Dr G Chin². Epidemiology and Surveillance Section, NIOH¹, SHE Section, NIOH².

The aim of this repeat 2019/20 survey was to describe OHS in the NHLS in terms of perceptions, experiences, training and reporting behaviour within NHLS staff. The results indicated the following:

- Seven percent (41/625) of employees had a work-related injury or illness in the last year.
- With regards to training, an increase in the proportion of employees who received training for TB infection control was reported from 34% in the 2015 survey to 379/593 (64%) in 2019.
- A decline in compliance with health and safety measures was reported among employees from 2015 to 2019.

Thus, the development of additional measures to improve compliance to occupational health and safety was recommended, as well as increased access to the internet and email for all employees. This will enable employees to regularly access online OHS training tools.

A systematic review of the health outcomes and health care utilisation of the informal economy workers

Study team: Prof N Naicker¹, Dr F Pega², Prof D Rees¹, Dr S Kgalamono¹, Dr T Singh¹.

National Institute for Occupational Health - a Division of the NHLS¹, Department of Public Health, Environmental and Social Determinants of Health, WHO².

This is a joint project between the NIOH and the WHO. The aim is to systematically review and meta-analyse evidence from quantitative studies on health services use and health outcomes among informal economy workers, compared with formal economy workers, published between 1999 and 2020. The findings from the review indicated that informal economy workers may be less likely to use any health services and more likely to have depression than formal economy workers. The evidence is uncertain for relative differences in the other eligible outcomes. Further research is warranted to strengthen the current body of evidence and needed to improve population health and reduce health inequalities among workers. The findings were



The sources of asbestos exposure in patients with malignant mesothelioma in South Africa

Study team: Dr N Tlotleng¹, Dr KS Wilson¹, Prof N Naicker¹, Prof CFN Koegelenberg², Prof D Rees¹, Prof JI Phillips¹, Dr M Wong³,

National Institute for Occupational Health - a Division of the NHLS¹, Department of Medicine, Faculty of Medicine and Health Sciences, Stellenbosch University², Department of Medicine, Faculty of Health Sciences, Chris Hani Baragwanath Hospital, Wits University³.

This was a two-year national study involving tertiary and academic hospitals in South Africa and was concluded on 31 December 2019. The study described occupational and non-occupational asbestos exposure in patients diagnosed with malignant mesothelioma. Seventeen mesothelioma patients were interviewed during the study. Of the patients that were interviewed, nine were female and eight were male, with a median age of 68 years (interquartile range: 58-80). Overall, the number of patients who reported physically working with asbestos worked in a place where asbestos was used, and those who lived and worked in an asbestos mine was the same. Living in a house with an asbestos roof accounted for most cases of non-occupational exposure (n = 8; 47.1%), with an almost equal proportion in male (37.5%) and female (55.6%) respondents. Exclusive asbestos exposure was reported in one patient in Johannesburg. In conclusion, females who were interviewed reported non-occupational asbestos exposure, whereas males were mainly exposed to asbestos from their occupations.

Occupational health and safety of female miners

Study team: Dr KS Wilson¹, Prof N Naicker¹.

Epidemiology and Surveillance Section, National Institute for Occupational Health - a Division of the NHLS¹.

Based on the dearth of data on mortality and morbidity affecting female miners, the Minerals Council South Africa (MCSA) commissioned a study to assess health outcomes in female mine workers over the past 13 years. The Epidemiology and Surveillance Section is currently conducting a study with the following objectives: to determine the nature and prevalence of fatal injuries in a sample of female and male miners from 2005 to 2017; to determine the underlying risk factors for fatal injuries and disease in the sample of female and male miners; to assess the differences in health outcomes between male and female miners; and to assess the types of health outcomes processed for compensation in female compared to male mine workers. This is a mixed method study involving four mining houses from the four largest commodities in South Africa (gold, platinum group metals, coal and diamonds). During 2020, the study was put on hold for several months following the COVID-19 Level 5 lockdown. The study recommenced in February 2021.

Working conditions and self-reported illnesses among waste recyclers at waste recycling buyback centres, Johannesburg, South Africa

Study team: Mr R Gumede¹, Prof N Naicker^{2,3}, Ms G Keretetse¹. School of Public Health, Wits University, Johannesburg, South Africa¹, National Institute for Occupational Health - a Division of the NHLS¹, Department of Environmental Health, University of Johannesburg, South Africa³.

There were no known studies assessing the working conditions and potential health outcomes at recycling centres. Therefore, more research is needed on the recycling industry in South Africa to better understand the industry and its operations and to address this gap in the literature. This study is a follow-up study assessing formal workers in the waste management industry. Previously, a study was conducted on informal waste pickers/reclaimers in Johannesburg. The aim of the study is to assess the working conditions and self-reported health status among waste handlers at recycling buy-back centres in Johannesburg, South Africa. Fieldwork commenced in May 2021. The data obtained will be used for Mr Gumede's MPH research report.



Lead exposure and cognitive impairment in older people living in communities located near mine tailings in Johannesburg project

Study team: Prof N Naicker^{1,2}, Dr V Nkosi³, Prof A Mathee³, Prof A Todd⁴.

National Institute for Occupational Health - a Division of the NHLS1¹, Department of Environmental Health, University of Johannesburg, South Africa², Environment and Health Research Unit, South African Medical Research Council Johannesburg, South Africa³, Mount Sinai University, New York, USA⁴.

Collaborators on this project include the South African MRC, the Environmental and Health Research Unit and Mount Sinai University, New York, USA. Exposure from mining activities and mine tailings dumps may result in the poor health outcomes of people within the communities surrounding the mines. Lead is one of the contaminants that have serious, but preventable neurological effects. Data collection for this study has been completed, and analyses of the data are in progress.

Risk factors associated with noise exposure among drill operators and assistants in an opencast mine in South Africa

Study team: Ms T Zamisa¹, Mr F Made^{1,2}, Prof G Nelson¹.

Division of Occupational Health, Wits School of Public Health, Wits University¹, National Institute for Occupational Health² - a Division of the NHLS.

The study aimed to assess the noise levels to which drill operators and assistants are exposed and to identify the risk factors associated with exposure to noise in order to guide policies in exposure reduction strategies. The study will be conducted by measuring noise exposure using a personal noise dosimeter for the drill operators and assistants. The personal noise dosimeter will be attached to the employee as close as possible to the ear (usually the shirt/overall collar) for at least nine hours of the 12-hour shift. The employee will be monitored by the researcher twice during the shift for 10 to 15 minutes at a time to record the activities that they perform during the shift, which contribute to noise exposure. The drilling machine noise will also be measured using a sound level meter. Noise readings will be measured at the drilling machine.

Mental health in healthcare workers

Study team: Dr K Wilson¹, Prof N Naicker¹, Dr S Kgalamono¹, Dr A Yassi², Dr Spiega¹², Dr S Senabe³, Ms N Mdumbe³, Mrs G Gemell³.

Epidemiology and Surveillance Section, National Institute for Occupational Health - a Division of the NHLS1¹, University of British Columbia, Canada², Gauteng Department of Health³.

Healthcare workers who are exposed to the public and to Coronavirus cases are vulnerable to a high risk of infection and mental health problems. How healthcare workers cope with the threat of infection, losing patients and a high workload, along with other psychological factors, will play an important role in their long-term mental health. Issues such as an inability to adapt to the new environment, negative emotional reactions and defensive behaviour may arise. Supporting mental health in healthcare workers during this pandemic is key to maintaining a healthy, productive workforce. This longitudinal study in Gauteng, South Africa, aims to describe the mental health of healthcare workers during the COVID-19 pandemic and to identify areas for intervention. Data collection is currently in progress. Funding has been obtained from the Canadian Institutes of Health Research and the International Development Research Centre. This study is being conducted in collaboration with the Gauteng DoH and the University of British Columbia.

Staff satisfaction in Gauteng Department of Health workers

Study team: Dr K Wilson¹, Ms N Mdumbe², Mrs G Gemell².

Epidemiology and Surveillance Section, National Institute for Occupational Health - a Division of the NHLS¹, Gauteng Department of Health².

Staff satisfaction is an important factor in an effort to continually maintain and improve the quality and efficiency of healthcare provided in healthcare facilities. Job satisfaction is also a measure of the success of reward mechanisms provided in the workplace and the ability of the workplace to change. Literature has associated high staff satisfaction levels with a higher quality of healthcare services, resulting in better patient outcomes and satisfaction. It is also associated with a better retention of staff. The relationship between work and stress can be moderated by job satisfaction and meaningful work. Poor job satisfaction has been associated with increased turnover of employees, tardiness, absenteeism, presenteeism, complaints and making the healthcare delivery system weak and costly.
This annual survey was redesigned and distributed to all Gauteng public health facilities. An overall report has been submitted to the DoH, along with key recommendations. Individual facility-focused reports were to be delivered in May 2021.

The relationship between asbestos bodies on histology and asbestos fibres on electron microscopy in individuals occupationally exposed to asbestos

Study team: Ms Z Maseko¹, Dr D Govind Lakhoo¹, Dr J Linden¹, Prof N Naicker². Pathology Division, NIOH¹, Epidemiology and Surveillance Section, NIOH².

Exposure to asbestos is known to cause pathology in the form of asbestosis, mesothelioma, carcinoma, asbestos plagues and diffuse pleural fibrosis. Asbestos bodies, which are the hallmark of asbestos exposure, occur at increased levels within the lungs of individuals with asbestos-related diseases. Studies have examined the correlation of asbestos concentration in lung tissue from individuals with asbestos-related diseases in an attempt to correlate lung asbestos burden with specific pathologic changes. However, the relationship between the quantity of asbestos fibres and the formation of asbestos bodies has not been determined. A retrospective cohort study was conducted among individuals who were exposed to asbestos. The study utilised data from 2006 to 2016, taken from the NIOH's PATHAUT. This is the first study to take into account all the different factors that contribute to the fibre burden and analyse each one against each other. It provides evidence of the association between asbestos exposure, and the concentration threshold of asbestos fibres in scanning electron microscopy that would result in asbestos bodies being identified in light microscopy.

The effect of a simple intervention on hand hygiene-related diseases in preschools in South Africa

Study team: Ms S Lange¹, Prof TG Barnard¹, Prof N Naicker².

Water and Health Research Unit, University of Johannesburg, South Africa¹, Epidemiology and Surveillance Section, National Institute for Occupational Health - a Division of the NHLS².

Hand hygiene-related illnesses such as diarrhoea and respiratory diseases contribute to the burden of disease and are included in the top five causes of mortality in children under five in South Africa. Children attending preschools are more susceptible to these infections due to the higher concentration of children in preschools. Hand hygiene interventions have shown to reduce hand hygiene-related diseases by improving hand hygiene practices.

In South Africa, there are no documented hand hygiene interventions or studies in children under five. The purpose of the study is to determine whether a hand hygiene intervention can reduce hand hygiene-related diseases among four- to five-year old preschool children and to improve hand hygiene practices in these children, their teachers and their parents. This research study was submitted for a PhD.

Blood lead levels and violent criminal behaviour in young males in conflict with the law

Study team: Mr T Mbonane¹, Prof A Mathee², Prof A Swart¹, Prof N Naicker³.

Department of Environmental Health, Faculty of Health Sciences, University of Johannesburg¹, South African Medical Research Council², Epidemiology and Surveillance Section, National Institute for Occupational Health - a Division of the NHLS³.

Recent studies have shown a link between lead exposure during childhood and the development of aggressive or violent behaviour during early adulthood.

A cross-sectional study will be conducted to determine the association between childhood lead exposure and violent criminal behaviour among young males in conflict with the law housed at four Gauteng child and youth development centres. There is a paucity of information on lead exposure and its effects on behaviour in young adult males in South Africa. This study will contribute to narrowing or closing this information gap and will help lay the foundation for future policies aimed at the prevention of violent behaviour associated with lead exposure, and its societal consequences. This research study was submitted for a PhD.



Association between bone lead levels and aggression in the birth-to-20+ cohort

Study team: Dr N Tlotleng¹, Dr N Naicker¹, Prof A Mathee², Prof S Norris³, Prof A Todd⁴.

Epidemiology and Surveillance Section, National Institute for Occupational Health - a Division of the NHLS¹, Environment and Health Research Unit, South African Medical Research Council², Developmental Pathways for Health Research Unit, Wits University, Johannesburg, South Africa³, Mount Sinai University, New York, USA⁴.

The study seeks to investigate the association between bone lead levels and aggression among young males and females in Johannesburg, South Africa. This was a quantitative study that conducted bone lead X-ray fluorescence (XRF) measurements on 21-year-old participants to determine cumulative lead levels, and used a validated, structured questionnaire to assess for aggressive behaviour and confounding factors. The results indicate that bone lead levels were associated with an aggression score for anger. While a larger sample size may be necessary to further investigate the association between bone lead levels and aggression, the findings from this study provide a preliminary overview in the relationship between these important public health factors. This information may be crucial in the drafting of policies designed to combat crime associated with youth aggression in South Africa.

Occupational exposure risk to airborne Mycobacterium Tuberculosis in a three-tier public healthcare system in South Africa

Study team: Matuka Dikeledi (MScMed)¹, Duba Thabang¹, Ngcobo Zethembiso (MScMed)¹, Muleba Lufuno¹, Made Felix¹, Nthoke Tebogo¹, Singh Tanusha (PhD)¹²³.

National Institute for Occupational Health - a Division of the NHLS¹, Department of Clinical Microbiology and Infectious Disease, School of Pathology, Wits University², Department of Health, School of Health Sciences, University of Johannesburg³.

Healthcare settings pose a serious risk of TB infection to healthcare workers. Therefore, the presence of airborne TB bacilli probe the need to initiate additional mitigation strategies for TB transmission. The aim of the study was to detect airborne TB in three types of South African healthcare facilities, to identify possible high-risk areas, and to determine possible risk factors that may contribute to airborne transmission.

Validation of three decontamination methods for respirators used in South Africa to address stock shortages during the COVID-19 pandemic

Study team: Tanusha Singh¹, Tobias van Reenen², Jeanneth Manganyi³, David Jones⁴, Nisha Naicker⁵, Felix Made⁵.

Immunology and Microbiology Section, NIOH¹, The Built Environment, CSIR², Occupational Hygiene Section, NIOH³, Safety, Health and Environment Department, NIOH⁴, Epidemiology and Surveillance Section, NIOH⁵.

Filtering facepiece respirators (FFRs) such as N95, FFP2 and KN95 are designed to meet the filtration efficiency requirements and are used to help provide respiratory protection in a variety of workplaces, including healthcare settings, where other higher hierarchy controls are ineffective. With the global shortage of personal protective equipment (PPE) due to several reasons, including supply chain constraints, the need for the reuse of equipment is vitally important and lifesaving. The research therefore aimed to validate methods used to extend the life of FFRs after decontamination, thus preserving stock levels and ensuring availability and access to much-needed respirators for frontline workers.

TEACHING AND TRAINING

The Section continues its teaching and training in undergraduate and postgraduate academic programmes within the NIOH and at Wits University, the University of Johannesburg and the University of Pretoria's Field Epidemiology Training Programme (SAFETP). Assistance is provided to the School of Public Health (Wits University) in facilitating lectures in the Graduate Entry Medical Programme (GEMP) and Diploma in Occupational Health, as well as participating in the postgraduate assessors' committees. Staff supported academic institutions as examiners for master's and PhD theses. Lectures are also provided for the SAFETP run by the University of Pretoria. Staff currently supervise 11 PhD and master's students from Wits University,



the University of Pretoria and the University of Johannesburg. The Section has two National Research Foundation (NRF) interns that started in April 2019 and will complete the year-long programme on 31 March 2021. Staff also support students from the NIOH with their project development and data analysis.

The staff of the Section review journal articles for international and national journals such as the Journal of Respiratory Diseases and Medicine, Science of the Total Environment, International Journal of Environmental Research and Public Health, Diagnostics, Clinical Medicine Insights: Psychiatry, BMC Public Health, South African Medical Journal and Occupational Health Southern Africa. Prof Naicker serves as an assistant editor for PLOS One and BMC Public Health.

In addition to the above, three COVID-19 training webinars were held for employers and occupational health practitioners on the OHSS.

PROFESSIONAL DEVELOPMENT

Dr T Kootbodien is completing her PhD on genetic risk factors and epidemiology of suicidal behaviour in South Africa. She received a scholarship from the South African Medical Research Council.

Mr F Made is in the fourth year of his PhD. His research is on preventing coal mine dust lung disease through the use of the Bayesian hierarchical framework for occupational exposure assessment in the South African coal mining industry. He also attended the Summer School on Spatial Statistics and Casual Inference Models. This was an online programme presented by the University of Washington, USA, in July 2020.

Dr N Tlotleng completed her MSc in Epidemiology and Biostatistics at the Wits School of Public Health. She graduated in December 2020

Ms S Mdleleni (NRF intern) completed her MSc in Field Epidemiology at the Wits School of Public Health and graduated in 2020.

Five PhD and five master's students were supervised in the Section. Two master's students graduated in 2020.

Ten postgraduates were enrolled: two completing their PhDs at Wits University and three completing their PhDs at the University of Johannesburg, four completing their master's degrees at Wits University, and one completing an MPH at the University of Johannesburg.



OCCUPATIONAL HYGIENE SECTION

3. OCCUPATIONAL **HYGIENE SECTION**

Head: Mrs Jeanneth Manganyi

The Occupational Hygiene Section continues to address occupational hazards, and promote the health and wellbeing of employees. Its aim is to protect workers and their communities from occupational disease, injury and illness. This mandate is made possible through continuous effort to retain experienced professional staff to enable a high-quality output for tasks performed. The functions of the Section include hazard identification, the evaluation of exposure hazards and making recommendations of cost-effective and practical control measures that aim to mitigate potential exposure. Additional functions that contribute to the mandate of the NIOH are research, training and teaching, non-medical sample analyses, as well as advisory support to employees, employers and other relevant stakeholders.

SERVICES

The Occupational Hygiene Section participated in a remote SANAS first surveillance assessment, and was recommended for continued accreditation and registration with the DoEL.

The Section has two laboratories: the Asbestos Laboratory (managed by Mr Gabriel Mizan) and the X-ray diffraction (XRD)/ Fourier Transmission Infrared Spectroscopy (FTIR) Laboratory (managed by Mr Jonas Shai). They operate under the direct supervision of the Head of the Section.

The Asbestos Laboratory continued to participate in the Asbestos Fibre Regular Informal Counting Arrangement (AFRICA) asbestos proficiency testing scheme run by the Institute for Occupational Medicine in Edinburgh, UK. The Asbestos Laboratory maintained a good performance with a "1" rating in both rounds of proficiency testing participation.

The XRD/FTIR Laboratory continued to participate in the Air and Stack Emissions Proficiency Testing Scheme run by the Health and Safety Laboratory in the UK, and administered by the LGC Group. The laboratory has maintained a Z-score of ±1 for all three methods, which is regarded as a satisfactory performance.

Exposure assessments

The Section has produced 11 exposure assessment reports, which contributed significantly to the 15 reported assessments for the NIOH's Annual Performance Plan. The majority of these assessments were performed for the Department of Correctional Services as part of the existing service-level agreement. The Section, being a Type C inspection body, also provided occupational hygiene services to the private sector. The Immunology and Microbiology Section, as one of the contributors to the Annual Performance Plan, reported four additional exposure assessments, bringing the total to 15 assessments produced during the period under review.





Image 1: Calibration of pumps prior to conducting air monitoring.

Image 2: An example of a sampling train for conducting environmental asbestos monitoring.

Sample analyses

The XRD/FTIR and Asbestos laboratories analysed non-medical samples, which aimed to estimate potential exposure to hazardous substances in the air. These analytical services complement the function of the accredited scope of work in exposure assessment. The XRD/FTIR Laboratory conducted the gravimetric sampling analysis for 20 samples as part of service delivery to private clients. A total of 420 samples, which included 144 gravimetric weighing and 276 respirable crystalline silica by FTIR and XRD equipment, was analysed to form part of the method validations in preparation of the SANAS assessment. The XRD/FTIR Laboratory also analysed 20 samples for all three methods as part of participation in the proficiency testing scheme.

The Asbestos Laboratory analysed 34 air samples using phase contrast microscopy (PCM). These included two rounds of proficiency testing participation (20 sample slides) and service work (14 samples) that contributed to analysis for exposure assessments.



Image 3: Gravimetric filter weighing in the balance room.

Image 4: Clearing of asbestos filters prior to counting and sizing the fibres.

Respirator fit testing

The Section continued its efforts to promote awareness and provide capacity building on respirator fit testing. The Section provided a respirator fit testing service to 120 employees during 2020/21. The service was provided to support research and as part of the NIOH's respiratory protective programmes.



Advisory support

Staff participated at strategic meetings and served on various committees, including the SAIOH, DoEL, SANAS, NIOH OHORT, NEPAD and the national OHS work stream and Nedlac. Staff continued to conduct SANAS technical assessment as part of International Standard ISO/IEC 17020 requirements, as well as DoEL requirements for approved inspection authorities. The Section reviewed legislation and guidance documents in support of the DoEL.

RESEARCH

Staff of the Section continued with research projects that form part of academic studies or are carried out in collaboration with other sections or stakeholders. The majority of the projects that were reported previously are ongoing with protocol development underway. However, data collection was put on hold due to the restrictions as a result of the COVID-19 pandemic. The Section continued to supervise postgraduate students at various universities. The following research study was initiated during the period under review.

Qualitative health risk assessment conducted on COVID-19 mobile screening and testing laboratories

This study aims to conduct a health risk assessment in two types of NHLS mobile laboratories: a screening only unit and a screening and testing unit, using a specialised COVID-19 risk assessment tool. Based on the results of the risk assessment, the study aims to determine the need for residual risk control measures. An application for ethics approval was submitted to the Wits Health Research Ethics Committee.



Image 5: NHLS mobile laboratory for COVID-19 screening.



TEACHING AND TRAINING

The Section contributed to the OHORT by coordinating, planning and delivering training webinars on COVID-19-related topics. The Section generated information fact sheets and posters, which addressed COVID-19- and OHS-related issues, and produced translated versions for some of the content. The Section also contributed to the development of COVID-19 skills programmes, for which the QCTO accredited the NIOH for the training roll-out for a period of five years.

In addition, the Occupational Hygiene Section, as an approved training provider, hosted two week-long training sessions as part of the contract for training mainly inspectors from the DoEL. The modules presented were Interpretation of Occupational Hygiene Reports, which was developed in-house, and Noise Measurement and its Effects.

The Section facilitated online training on Health and Safety Risk Assessment to employees of the Department of Correctional Services, including OHS coordinators, OHS representatives and union representatives from various provinces as part of the service-level agreement. The Section supported the roll-out of respirator fit testing initiatives at the DoH through training that took place over two days for Gauteng DoH employees as part of capacity building and delivered presentations on quantitative respirator fit testing at the PPE Quality Assurance Training Workshop to PPE coordinators. Other support included academic teaching and support to the MPH/Medicine and Postgraduate Diploma in Occupational Health at Wits University and the University of Pretoria. The SAIOH granted the Section recognised training provider status for the Asbestos AP101 module.



Image 6: Participants during the training of inspectors at the NIOH.

PROFESSIONAL DEVELOPMENT

Six postgraduates were enrolled: two PhD candidates in Public Health at Wits University, one MPH student in Environmental and Occupational Health at the University of Pretoria, and two MPH students in Occupational Hygiene and one MMed student at Wits University.

HONOURS

Mrs Karen du Preez has been appointed as Chairperson of the SAIOH Professional Certification Committee for a period of two years, following the resignation of the previous Chairperson in 2020.



QUALITY ASSURANCE DEPARTMENT







4. QUALITY ASSURANCE DEPARTMENT

Head: Mr Bonginkosi Duma

Quality Assurance continued to maintain its accreditation in all four standards: ISO 15189 (medical laboratories), ISO 17025 (testing laboratory), ISO 17020 (inspection body) and ISO 9001:2015 (guality management). The Department is planning to increase the number the accreditation systems to five by the next financial year. This will include Good Laboratory Practice (GLP) for the Toxicology and Biochemistry Section. The GLP accreditation is based on the OECD's principles for laboratories that only conduct research on non-medical samples. The NIOH remains the only institute in South Africa and in Africa to hold an unprecedented four different accreditation standards.

SERVICES

The NIOH uses a quality improvement process to maintain its different International Organization for Standardization (ISO) systems that involve resource, process and improvement processes. During the period under review, the Department continued with internal audits as part of the systems to keep the quality management systems intact. In addition, monthly accreditation meetings were held for each NIOH department, section and unit.

New NIOH staff undergo induction, which includes quality-related talks and guidelines. The Quality Assurance Department also coordinates external SANAS audits for other NHLS laboratories, e.g. the KwaZulu-Natal Public Health Laboratory. The Department handles customer complaints, both internally within NIOH and externally. The complaints are analysed and customers are provided with feedback on the outcomes of their complaints.

Due to COVID-19 regulations, most of the quality assurance services were conducted under very strict conditions during the period under review using online platforms. The Section's staff also assisted with the COVID-19 Surveillance Audit that the NIOH conducted on behalf of the DoH.

The NIOH's current test accreditation

| The NIOH's current test accreditation | | | | |
|---------------------------------------|-----------|---------------|-------------------------|----------------------------|
| Accreditation | Region | Laboratory No | Laboratory name | Discipline/Scope |
| | | | | |
| ISO 15189 | NIOH | M0276 | Analytical Services | Organic chemistry |
| | | M0276 | Analytical Services | Inorganic chemistry |
| | | M0276 | Immunology/Microbiology | Immunology |
| | | M0276 | Pathology | Histology |
| | | M0276 | Pathology | Cytology |
| | | | | |
| ISO 17025 | NIOH | T0660 | Analytical Services | Water testing: mercury |
| | | T0660 | Analytical Services | Water testing: aluminium |
| | | | | |
| ISO 17020 | NIOH | OH0079 | Occupational Hygiene | Asbestos |
| | | OH0079 | Occupational Hygiene | Lead |
| | | OH0079 | Occupational Hygiene | Noise-Induced Hearing Loss |
| | | OH0079 | Occupational Hygiene | Hazardous Chemical Agents |
| ISO 9001 | NHLS-NIOH | Z19/210217 | National Biobank | Storage of biomaterial |

ISO 9001 implementation progress

The Quality Assurance Department ensures that other non-technical areas receive the necessary attention to ensure that quality management systems are implemented within the NIOH. The benefits of ISO 9001 implementation within the NIOH to non-technical departments include the following:

- A display of commitment to quality and a willingness to work towards improving service efficiency in both the core and non-laboratory processes
- Improving the credibility of the organisation (ISO 9001 QMS is an internationally recognised standard)
- Assisting in the improvement of consistency of operations throughout the NIOH •
- Enhancing the company's image as viewed by customers, shareholders and employees

Departments and sections that have committed to implementing ISO 9001 for the next financial year are Occupational Medicine (including the clinic), Epidemiology and Surveillance, Procurement, Information Services, General Services and Logistics.



It must be noted that the Epidemiology and Surveillance Section is awaiting a new Head of Section, and the Procurement Department is committed to taking ownership of writing the manual.



Service to other NHLS entities

The NHLS continually requests the expertise of the NIOH's Quality Assurance Department to assist with preparing other laboratories for accreditation. These laboratories, which are based in other provinces, are assisted with pre-assessments for SANAS audits, gap analyses, internal audits, Committee for Evaluations and Technical Function (CEFT) evaluations and quality assurance training. During the period under review, these services were provided to NHLS laboratories in the Free State (Genetics), as well as the Eastern Cape, Limpopo and KwaZulu-Natal medical laboratories under ISO 15189. The NIOH continued the provision of support for internal audits and the equipment tender process for the KwaZulu-Natal Public Health Laboratory, as well as assistance to the NICD for ISO 17025 and ISO 9001 implementation, respectively.



Image 1(A-B): COVID-19 screening at the entrance to the Kynsna Hospital, Western Cape, where COVID-19 surveillance audits were conducted by NIOH staff.

TRAINING

The Department conducts internal training to strengthen the quality management systems in place. Training conducted during the period under review included the following:

- Risk management
- Non-conforming events
- Root cause analysis
- How to handle and use spill kits
- Use of PPE
- TR28
- Monitoring quality indicators
- Validations

PROFESSIONAL DEVELOPMENT

Courses that staff of the Quality Assurance Department attended as part of their development included the following:

- Project Management
- ISO9001 QMS auditing
- Advanced Excel training
- Q-Pulse orientation
- Data analysis course using Stata
- Scientific writing course
- Office administration
- Procurement and finance

Mr Bonginkosi Duma completed a Master of Business Administration (MBA) from Regent Business School, and graduated in April 2020.

Ms Kebareileng Mogari completed a Certificate in Management Advanced Programme from Wits University.



HIV AND TB IN THE WORKPLACE UNIT



5. HIV AND TB IN THE WORKPLACE UNIT

Head: Dr Muzimkhulu Zungu

The HIV and TB in the Workplace Unit is one of the strategically placed units within the Intitute. The Unit applies the basic principles of public health to promote, maintain and improve the health and wellbeing of workers. The Unit was initially established to provide scientific approaches to the management of HIV and TB in workplaces.

The Unit has since grown from utilising lessons learnt from HIV and TB in the workplace to providing occupational health policy, systems and programmes. This approach has been key to addressing COVID-19 in the workplace during the pandemic. The Unit works in both the formal and the informal economy. Although all industries are targets of the Unit, it mostly has projects with the construction, health, mining and municipal services industries, as well as the informal economy.

SERVICE DELIVERY

COVID-19 in the workplace

The year under review was an unprecedented year for the world of work following the ongoing COVID-19 pandemic. Like most, if not all units of the NIOH, the Unit had to channel most of its resources to the fight against the COVID-19 pandemic in workplaces. The services it rendered included conducting COVID-19 workplace readiness assessments, drafting national COVID-19 guidelines, reviewing guidelines and/or directions, providing workplace teaching and training, and imparting COVID-19 advisory technical expertise to the following organisations, among others:

- The WHO Ad-Hoc Study Group on Occupational Health for Healthcare Workers in COVID-19
- AUDA-NEPAD
- The National DoH's Occupational Health Workstream on COVID-19
- Nedlac
- The NIOH's OHORT
- The Gauteng Premier's Advisory Committee on COVID-19 (PACC)
- The Gauteng, Limpopo, Mpumalanga and North West provincial DoH

Occupational health policy, systems and programmes, including HIV and TB in the workplace

The Unit provides advisory occupational medical expertise to the Gauteng and Mpumalanga DoH on an ongoing basis.

In the Gauteng DoH, supervisory and ad hoc occupational medicine practitioner (OMP) support was provided at the Dr George Mukhari and Chris Hani Baragwanath academic hospitals. The support entailed working with the provincial DoH and the hospital OHS teams in planning and implementing OHS services for the hospitals.

In both the Gauteng and Mpumalanga DoH, the Unit supported the implementation of the WHO and ILO's HealthWISE Tool.

The Unit is supporting the introduction, implementation and utilisation of the OHASIS at the two provincial departments of health.



Mining occupational health

The Unit acts as one of several technical advisors to the Masoyise Health Programme, whose goal is to reduce the impact of TB, HIV, occupational lung diseases and non-communicable diseases as occupational health threats in the mining sector.

The Masoyise Health Programme is a multi-stakeholder initiative with representatives of MCSA member companies, trade unions (NUM, Solidarity, the Association of Mineworkers and Construction Union and UASA), government (the DoH, the DMRE, the Mine Health and Safety Council, the NHLS and the NIOH), the South African Business Coalition on Health and Aids (SABCOHA) and multilateral organisations, including the Joint United Nations Programme on HIV/AIDS (UNAIDS), the ILO and the WHO. The precursor to the Masoyise Health Programme was Masoyise iTB ("Lets Beat TB"), whose aim was to increase counselling for HIV and screening for TB in the industry.

Ad-hoc workplace HIV, TB and OHS policy, systems and programmes support

The Unit provides ongoing and ad hoc advisory support on HIV and TB for the national DoH, the DoEL, the provincial departments of health, the trade unions and employers. The Unit continues to serve on an advisory basis in the OHS meetings of the construction industry for the Master Builders Association North. Its role in these guarterly meetings is to provide support on occupational health issues pertinent to the industry, and where appropriate, advise on new developments related to occupational health in the sector.

Management and strategic support to the NHLS

The Unit provided management and strategic support to the NIOH/NHLS through its members working as Acting Executive Director and participating in the NHLS' executive meetings.

RESEARCH AND/OR SPECIAL PROJECTS

The Unit has several completed and ongoing research projects.

A rapid appraisal of the COVID-19 OHS response by four provinces in South Africa

Zungu, M, Voyi, K, Mlangeni, N, Moodley, S, Ramodike, J, Claassen, N, Wilcox, E, Thunzi, N, Yassi, A, Spiegel, J and Malotle, M

This study aims to conduct a rapid appraisal in health facilities of the Gauteng, Limpopo, Mpumalanga and North West provincial departments of health in order to inform the COVID-19 OHS outbreak response teams at provincial, national and global level. It is funded by the University of Pretoria, the NIOH/NHLS and the Canadian Institute of Health Research/University of British Columbia.

Strengthening occupational health systems and services for health workers during the COVID-19 pandemic and beyond: The role of occupational health and safety information systems

Zungu, M, Voyi, K, Yassi, A and Spiegel, J

This study aims to assess the conditions and extent to which the introduction and implementation of occupational health and safety information systems and the joint ILO-WHO-developed HealthWISE interventions will strengthen the occupational health system and/or services in South African health settings. It is funded by the Canadian Institute of Health Research/University of British Columbia.



HealthWISE and the working environment of health workers

Zungu, M, Yassi, A, Seabelo, L, Spiegel, J, Mabhele, S and Wilcox, E

This is a collaborative project, with multiple subprojects, studying HealthWISE in different environments. The aim is to determine the factors associated with the successful implementation of HealthWISE and the role of HealthWISE in different resource settings, as well as its effectiveness. The collaborators are the ILO, the University of British Columbia and the University of Pretoria. The project is funded by the University of British Columbia.

The national verification (audit) of occupational health services and health and safety committees in public and private health facilities in South Africa

Zungu, M, Ramodike, J, Wilson, K, Thunzi, N, Mlangeni, N and Malotle, M

The aim of this project was to conduct an audit of OHS in the health sector (public and private) with a particular emphasis on compliance with the DoEL's COVID-19 consolidated directions on OHS measures in certain workplaces, and the functioning of health and safety committees at such workplaces. It is funded by the national DoH.

Research Output

Preventing occupational tuberculosis in health workers: An analysis of state responsibilities and worker rights in Mozambique.

Garcia, R, Spiegel, JM, Yassi, A, Ehrlich, R, Romão, P, Nunes, E, Zungu, M, Mabhele, S

The aim of this research paper was to examine legislative barriers to and enablers of the implementation of TB-related laws in healthcare facilities. This was done in order to answer two questions: (1) What are the existing laws, regulations and policy frameworks that provide for rights and obligations related to occupational TB in health workers in Mozambique? (2) What do key informants perceive as legislative barriers impeding the implementation of TB-related laws in Mozambique healthcare facilities?

International Journal of Environmental Research and Public Health. 2020; 17(20): 7546. DOI: 10.3390/ijerph17207546.

TEACHING AND TRAINING

Academic qualifications in public and/or occupational health

The Unit coordinates the Diploma in Occupational Health and Medicine, and teaches Occupational Health to undergraduate and postgraduate students on behalf of the School of Health Systems and Public Health at the University of Pretoria. The Unit was a rotation site for the practical training of public health medicine registrars from the University of Pretoria. The Unit contributes to the ongoing training of public health medicine registrars from the Sefako Makgatho Health Sciences University.

Public health postgraduate research supervision

The Unit graduated one MSc student in Clinical Epidemiology and 22 Diploma in Occupational Medicine and Health students from the School of Health Systems and Public Health at the University of Pretoria. It is currently supervising three MPH students and one MMed in Public Health student in their postgraduate research projects, as well as two Diploma in Occupational Medicine and Health research projects.

Training of workers and management in OHS short courses

The Unit provided six training workshops on COVID-19 preparedness in the workplace for the OHORT's online training, the Limpopo and Mpumalanga DoH, the Public Service Coordinating Bargaining Council, the Public Health and Social Development Sector Bargaining Council and the Congress of South African Trade Unions (COSATU).

The Unit, as Chair of the Training Subcommittee for the AUDA-NEPAD COVID-19 OHS Expert Committee, led the AUDA-NEPAD training curriculum development and implementation. Overall, through this platform, it managed to train 1 807 OHS professionals from 33 African countries over 12 separate two-hour online sessions.



The Unit, as a member of the OHORT, participated in the development of the curriculum for the COVID-19 collaboration training with the Wits Health Consortium through funding by the Health and Welfare Sector Education and Training Authority (HWSETA).

PROFESSIONAL DEVELOPMENT

Four postgraduates were enrolled: one MPH student from the University of Pretoria, one MMed in Public Health Medicine student from the Sefako Makgatho Health Science University and two PhD candidates in Public Health from Stellenbosch University and the University of Pretoria, respectively.

HONOURS

Dr Muzimkhulu Zungu was promoted to Adjunct Professor in the Faculty of Health Sciences at the University of Pretoria.



SAFETY, HEALTH AND ENVIRONMENT DEPARTMENT

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6. SAFETY, HEALTH AND **ENVIRONMENT DEPARTMENT**

Head: Mr David Jones

The year under review has been most unusual. This is due, primarily, to the COVID-19 pandemic and the pressures put on the healthcare industry, including the NHLS and the Safety, Health and Environment (SHE) Department. The SHE Department was declared an essential service and continued to provide services throughout the period under review.

Staffing

The past financial year saw the filling of both permanent and COVID-19 short-term contract posts. The permanent posts that were filled were the members of the SHE team that service the Free State/North West region. Both an Occupational Health Nurse Manager and an SHE Officer were appointed. A Waste Assurance Officer was also appointed, who is based in Cape Town and provides services to the southern part of the country.

The onset of the COVD-19 pandemic also brought about the need to monitor screening done by NHLS employees, as well as respond to positive cases. In order to meet this obligation, an additional two occupational medicine practitioners were appointed: one in the Western Cape and one in Johannesburg. An additional six occupational health practitioners (nurses) were also appointed.

CLINICAL

Occupational health

The start of this financial year coincided closely with the start and rise of COVID-19 infections in South Africa. With various legislative requirements issued through the DoEL, as well as guidelines and legislation issued by the national DoH, the SHE Department embarked on a massive undertaking to develop and realign various occupational health and safety policies and procedures to ensure that COVID-19 was addressed and managed within the NHLS.

Risk assessment guidelines were adapted to accommodate COVID-19, which included addressing emerging services at the time in the NHLS, such as mobile testing units. Staff screening programmes were implemented, and COVID-19 case management protocols were designed to address transmission risks in the workplace.

The NHLS, as an organisation, was not spared from COVID-19, and confirmed cases occurred which reflected many of the case load trends nationally. The SHE Department's occupational health staff continued to provide the necessary support services to manage affected employees, often working over weekends and on public holidays to ensure laboratory operational continuity, which was required to support the national health response to COVID-19. In addition, occupational health staff supported the NHLS' Human Resources Department to facilitate the reporting of work-related COVID-19 cases to the Compensation Commissioner. This remains an ongoing process.

Although much of the focus of the Department has been on COVID-19, other occupational health services, including the management of TB, hepatitis, brucella and ergonomic-related cases, have continued.



Special investigations and NIOH support

The planned project to examine the exposure levels of employees to formaldehyde and xylene had to be put on hold due to travel restrictions. It is planned to recommence the project in the new financial year, subject to travel being permitted.

There was continued expert support from the various departments and sections in the NIOH, including Occupational Hygiene, Occupational Medicine, Immunology and Microbiology, Information Technology (IT) and Finance. Examples of expert opinion and guidance provided related to the following:

- · Case management for occupational incidents and disease investigations
- Compliance with legal requirements regarding medical surveillance
- · Consulting with employees and their treating health care professionals who have specific occupational medical concerns
- Ergonomic assessments
- Immunology advice
- Ongoing development of the OHASIS

OCCUPATIONAL HEALTH AND SAFETY INFORMATION SYSTEM

OHASIS in the NHLS

The OHASIS has proved itself to be an agile and valuable health information system. It is agile in that the NIOH's IT Department has taken the software and adapted it to cater for COVID-19, and valuable in that the OHASIS provides weekly live statistics for the NHLS' EXCO and COVID-19 officers so that ongoing monitoring and management decisions can be taken.

The following updates have been done to OHASIS, specifically to cater for COVID-19:

- The inclusion of COVID-19 as a specific disease in the reporting section
- The provision of a platform for employees to screen for COVID-19 symptoms online
- Provision for the notification to an occupational health practitioner of any person who screens positive for any COVID-19 symptoms
- The presentation of a summary of COVID-19-related information in dashboards
- Provision for the recording of COVID-19 vaccinations
- Provision for the recording of COVID-19 tests and results
- Provision for the capturing of COVID-19 healthcare risk waste (as required by legislation)

The year under review saw a considerable increase in the number of incidents reported on the OHASIS because of the COVID-19 pandemic.



Figure 5: Year-on-year reporting of all incidents in OHASIS for the 2011/12 to 2020/21 financial years.



Employees are encouraged to report every incident no matter how small or insignificant they may think it is. The rationale for this approach is to encourage a culture of reporting and correction rather than hiding and punishment.

Of the 3 607 incidents reported on the OHASIS, 3 339 were COVID-19 related (cases and potential exposures) and only 268 were not. This equates to just over 93% of incidents reported being COVID-19 related. Of the reported incidents, 2 093 were cases of COVD-19 and 1 514 were incidents reporting potential exposure to the disease.



Figure 6: Breakdown of incidents captured on the OHASIS for the 2020/21 financial year indicating COVID-19-related as opposed to non-COVID-19-related incidents.



The 2 093 cases of COVID-19 were spread throughout all regions, as can be seen in Figure 7.

Figure 7: COVID-19 cases by region from 1 April 2020 to 31 March 2021.



Figure 8: COVID-19 cases in the NHLS by gender from 1 April 2020 to 31 March 2021.

Of the reported COVID-19 cases, 47%, which reflects the NHLS' gender breakdown, which is 45% male.



OHASIS beyond the NHLS

Interest in the roll-out of the OHASIS in a number of areas, including the Western Cape, North West and Mpumalanga DoH, and the Office of the Premier of Gauteng, remains strong. On the international front, through the AUDA, negotiations for the rollout of the OHASIS in Mozambique, Lesotho and Malawi are continuing. An agreement has been signed for the roll-out of the OHASIS in the Western Cape DoH. The design of the architecture for the roll-out of the OHASIS in Zambia is underway.

SAFETY, HEALTH AND ENVIRONMENT AUDITS

Due to the COVID-19 pandemic and lockdown restrictions, the audit process was significantly different from previous years. All SHE audits were conducted remotely, and only laboratories that scored less than 95% in the previous year's audit were audited. The checklist was also revised and condensed to cater for the new format and reduced to 48 questions compared to the original checklist contained in GPS0048, which comprised 232 questions.

| HLS regions | Number of audits completed | Number of non-compliances | Number of non-compliances closed | Number of non-compliances still open |
|---------------------------|-------------------------------|------------------------------|--|--|
| Eastern Cape | 9 | 18 | 12 | 6 |
| Free State and North West | 7 | 17 | 13 | 4 |
| Gauteng | 9 | 35 | 32 | 3 |
| Institutes and corporate | 13 | 44 | 7 | 37 |
| KwaZulu-Natal | 16 | 15 | 2 | 13 |
| Limpopo | 24 | 68 | 30 | 38 |
| Western Cape | 11 | 25 | 25 | 0 |
| and Northern Cape | | | | |
| Total | 89 | 222 | 121 | 101 |

Table 1: Summary of SHE audit results.

Of the 101 non-compliances still open, it is noted that most of these cases are due to structural issues that require construction/ renovation to be closed and the absence of electrical compliance certificates in many facilities.

RISK ASSESSMENTS

The onset of COVID-19 brought about the need for updated health and safety risk assessments for all workplaces. The SHE Department produced a guidance document to this end. Regional SHE teams also monitored and facilitated the process. By the end of the financial year, 447 of the 450 facilities had approved health and safety risk assessments that included COVID-19.

HEALTH AND SAFETY COMMITTEE MEETINGS

In order to ensure compliance with the relevant legislation, the Department's regional SHE officers coordinated and monitored the appointment and training of health and safety representatives. Regional SHE teams, comprising SHE Officers and Occupational Health Nurse Managers, attend health and safety committee meetings in an advisory capacity. Where they are unable to attend, they send input in writing to the Committee. The NHLS has 429 active health and safety representatives, of which 417 are trained and serving in the 36 health and safety committees, all of which are active. As per the legal requirement, all health and safety committees meet at least once every three months. Of the 192 health and safety committee meetings held, labour was invited to attend 118. They attended 88.

HAZARDOUS WASTE

The Waste Assurance Manager is continuously reviewing the NHLS' waste policy, audit checklist and the online training course on waste management. This is to ensure that practices are in line with the provisions of legislation and the policy framework on the management of waste, and to improve the NHLS' waste management standards.



Each of the facilities are continuing to capture details of generated hazardous waste on OHASIS. Table 2 provides information on the quantities of health care risk waste generated by the NHLS by waste category over the previous three years.

| Category of health care risk waste | Quantities of health care risk waste reported on OHASIS from 1 April 2018 to 31 March 2019 | Quantities of health care risk waste reported on OHASIS from 1 April 2019 to 31 March 2020 | Quantities of health care risk waste reported on OHASIS from 1 April 2020 to 31 March 2021 |
|---------------------------------------|---|---|---|
| Anatomical waste | 185 985,15 kg | 241 339,96 kg | 223 935,00 kg |
| COVID-19 waste | N/A | 2 612,51 kg | 128 285,54 kg |
| Chemical waste | 121 742.54 kg | 106 868,95 kg | 100 976,81 kg |
| Infectious waste | 1 036 773,21 kg | 1 170 613,84 kg | 1 132 599,50 kg |
| Pharmaceutical waste | 8 467,06 kg | 12 409,15 kg | 10 311,85 kg |
| Sharps waste | 354 984,94 kg | 388 951,75 kg | 343 191,00 kg |

Table 2: Comparison of quantities of health care risk waste captured on the OHASIS over the past three financial years.

Table 3: Quantities of hazardous waste generated by the NHLS by region over the past three financial years.

| Area | Quantities of health care risk waste reported on OHASIS from 1 April 2018 to 31 March 2019 per area | Quantities of health care risk waste reported on OHASIS from 1 April 2019 to 31 March 2020 per area | Quantities of health care risk waste reported on OHASIS from 1 April 2020 to 31 March 2021 per area |
|---------------------------|--|--|--|
| Eastern Cape | 215 692,18 kg | 260 128,15 kg | 246 336,83 kg |
| Free State and North West | 151 933,13 kg | 179 257,55 kg | 182 828,31 kg |
| Gauteng | 523 542,25 kg | 532 336,02 kg | 516 184,54 kg |
| Institutes and corporate | 71 098,25 kg | 64 117,97 kg | 59 060,13 kg |
| KwaZulu- Natal | 402 715,77 kg | 499 522,47 kg | 497 144,16 kg |
| Limpopo and Mpumalanga | 121 517,34 kg | 117 976,41 kg | 144 646,15 kg |
| Western and Northern Cape | 254 372,01 kg | 279 766,53 kg | 293 581,19 kg |
| Total | 1 740 870,93 kg | 1 933 105,10 kg | 1 939 781,31 kg |

The Waste Assurance Section continues to engage with the relevant authorities and service providers to ensure that the facilities comply with the provisions of legislation and keep up-to-date with the developments in the waste management sector.

CONFERENCES AND TRAINING

Training within the NHLS

The SHE Department continued to coordinate the online training of health and safety representatives and managers during the period under review. A total of 208 employees did the online training course that was developed and assessed by the SHE Officers, which is available on the NHLS' intranet. A further 87 employees did the online health care risk waste training that is also coordinated by the SHE Department.

| NHLS regions | Training | Number of staff trained |
|--------------------------------|--|----------------------------|
| Institutes and corporate | Health and safety induction training of new staff | 125 |
| KwaZulu-Natal | New employee' SHE training (COVID-19 temps) | 110 |
| Limpopo | Introduction and orientation of COVID-19 phlebotomists and drivers | 46 |
| Western Cape and Northern Cape | COVID-19 and other training | 986 |
| Total | | 1 267 |

Table 4: Other training of the SHE Department within the NHLS.



Training events through the OHORT

Some members of the SHE Department actively participated in the activities of the NIOH's COVID-19 OHORT, which was constituted in 2020 at the start of the COVID-19 pandemic. Some of the training activities in which the Department was involved included coordination and training for both the NHLS and beyond. Some of these training sessions are listed in Table 5, noting that more detail related to all the OHORT activities is included in Section 12 (COVID-19 Occupational Health Outbreak Response Team).

| Date | Training programme | Trained |
|-------------------|---|-----------------------------|
| 19 March 2020 | COVID-19 training for the NHLS | NHLS staff |
| 26 March 2020 | COVID-19 training for the NHLS | NHLS staff |
| 9 April 2020 | COVID-19 management roles and responsibilities | NIOH staff |
| 9 June 2020 | Legislated roles and responsibilities of employers | WHC staff |
| 10 June 2020 | COVID-19: What every manager should know and do | GPG staff |
| 12 June 2020 | Legislated roles and responsibilities of employers | WHC staff |
| 20 August 2020 | Employers' responsibility around incident reporting and investigation | WHC staff |
| 25 September 2020 | COVID-19 OHS auditor training workshop | DoH-appointed auditors |
| 27 January 2020 | NHLS information session on COVID-19 | NHLS staff |
| 9 March 2021 | General OHS and COVID-19 training for health and safety representatives | DoH health and safety staff |

Table 5: Training events completed through OHORT.

During the period under review, the Waste Assurance Manager delivered a presentation to the National Health Care Risk Waste Forum meeting, held online, on the topic of the management of COVID-19 waste: the NHLS' experience.

The SHE Department also continued to contribute to the South African Bureau of Standards (SABS) Technical Committee TC48.



ANALYTICAL SERVICES SECTION

7. ANALYTICAL SERVICES **SECTION**

Head: Dr Boitumelo Kgarebe

The Analytical Services Section continues with its mandate to focus on the analysis of hazardous substances in biological and environmental media as a way of strengthening the assessment of workplace exposure to comply with the Regulations of Hazardous Chemical Substances. The period under review witnessed the arrival of COVID-19, which impacted on several areas in the functions and outputs of the Analytical Services Section. That notwithstanding, the Section continued to respond to requests for the provision of specialised laboratory tests, advisory services and the support of private industries, government departments and academic institutions in occupational and environmental health. Key in monitoring analytical performance and competence in analysing and quantifying biomarkers in specimens, the laboratories continued to participate in proficiency testing schemes (external quality assurance).

DIAGNOSTIC SERVICES

A total of 1 528 tests for diagnostic, surveillance and research purposes were completed during the period under review.

Specialised laboratory testing

In the provision of laboratory testing services, the Analytical Services Section achieved an overall average turnaround time of 91% for the 1 529 routine special tests conducted in specified turnaround times for the period under review. The slightly higher achievements compared to previous years were largely due to reduced sample volumes during COVID-19.

Advisory services

Over and above the routine specialised tests conducted, the Section received numerous requests to render advice and testing services to the private and public sectors. These requests increased during COVID-19, particularly in the area of attempted suicides.

In the period under review, engagement with the national DoH on the National Regulations Relating to Lead in Paint was reported. This has since been followed up with a formal request from the national DoH to render testing services, Currently, the Section provides updates on the progress of planned activities towards the implementation of the paint analysis service plan.

RESEARCH AND SPECIAL PROJECTS

Dr Kgarebe collaborated with Microsep (Pty) Ltd South Africa for the provision of research facilities and instrumentation for a project by Gareth Riley. In response to a request from the Tshwane Academic Core Laboratory at Steve Biko Academic Hospital, the Section provided urgent analyses and reports on patient poisoning samples.

The major international collaboration with Mbuyisa Moleele Attorneys (SA) and Leigh Day Solicitors (UK), which was reported in the previous year was completed in December 2020. It related to testing and analysis services for a class action suit involving blood-lead measurements in residents, especially children, in and around the town of Kabwe in Zambia.



ACCREDITATION AND QUALITY ASSURANCE

The Metals and Organic units maintained their annual ISO 15189 accreditation status. The Section was also audited by SANAS and maintained its ISO/IEC 17025:2005 accreditation status for testing aluminium and mercury in water.

Regular internal audits were conducted throughout the year to maintain safety, guality and competence in the laboratory. In line with COVID-19 protocols, the laboratories were not assessed in the year under review. However, SANAS assessed activities from the last assessment done in 2019

In terms of proficiency testing schemes for monitoring laboratory analytical performance and competence in analysing and quantifying biomarkers in specimens, the Section continued with its participation in the following external quality assurance programmes:

- i. New York State Department of Health for arsenic, cadmium, chromium, lead, manganese and mercury in blood and urine, and aluminium in serum and water;
- ii. The German external quality assurance programme for mandelic acid, phenol, o-cresol, hexanedione, 1-hydroxypyrene and methyl hippuric acid in urine;
- iii. The SABS Water Check Scheme; and
- iv. The NMISA's proficiency testing scheme for the analysis of ethanol (alcohol).



Image 1: Mr Frans Sethosa in the ICP-MS laboratory.

TEACHING AND TRAINING

The Section met its usual teaching and training obligations in the period under review. The annual training of postgraduate students on GLP, risk assessment, analytical techniques and research methodology, as applied in chemical contaminant detection in the workplace and for biological monitoring, was provided. The Section has continued to host students to familiarise them with the various practical aspects of an accredited laboratory. The Section responded to a request by Khanyisa, a non-governmental educational and development trust based in Gqeberha, Eastern Cape, for training in the safe handling of pesticides. The training programme was designed to appropriately reflect the inadequate information workers currently have



about pesticide hazards, and in a language and form that farmworkers can understand. To achieve this, the Section produced two illustrated brochures.

The delivery of the fourth edition of the Introduction to Applied Chemistry in Occupational and Environmental Health course for second-year undergraduate students in Applied Chemistry at Wits University was adapted for virtual delivery, including practical sessions, in line with COVID-19 protocols.

HONOURS

In January 2021, the Organics Unit of the Analytical Services Section successfully passed the 64th Inter-comparison Programme 2020 as a reference laboratory for toxicological analyses in biological materials. The programme is conducted by the German Institute and Outpatient Clinic for Occupational, Social and Environmental Medicine. This marks the ninth consecutive year that Analytical Services has maintained its status as a reference laboratory for the analysis of urine for exposure to hexane.

PROFESSIONAL DEVELOPMENT

Mr Lesiba Frans Sethosa obtained his Society of Medical Laboratory Technology of South Africa qualification for the HPCSA technicians board exam. This brings the number of qualified medical technicians in the Section to four.

Mr Gareth Riley completed his MSc Med: Forensic Medicine and Pathology on the topic of the determination of ethyl glucuronide and ethyl sulphate in vitreous humour as biomarkers of recent alcohol use in post-mortem forensic cases using UPLC-MS/MS. The research, the first of its kind in South Africa, was supervised by Dr Kgarebe (NIOH) and co-supervised by Ms Ildiko Wainer (Wits University). The degree was awarded with distinction.

In addition to the NIOH/NHLS, financial assistance for the master's programme was provided by HWSETA and Microsep (Pty) Ltd, South Africa, which provided the use of its facilities and instrumentation.



Image 2: Mr Gareth Riley graduating with his MSc Med: Forensic Medicine and Pathology degree.



TOXICOLOGY AND BIOCHEMISTRY SECTION

6



8. TOXICOLOGY AND BIOCHEMISTRY SECTION

Head: Dr Natasha Sanabria

The global COVID-19 pandemic impacted on activities related to research, teaching and training, consultation to a number of governmental departments and industry stakeholders, as well as specialised service delivery. In spite of this, the Section outperformed set targets compared to previous outputs in the past few years, e.g. published articles increased from 30 to 50% of the total number of articles produced by the NIOH. In addition, the role of biochemistry-related applications and toxicology in public health was emphasised via support of the NIOH's public engagement and training outreach programmes.

New activities associated with COVID-19 were focused on guidance related to toxic exposures and associated risks, such as working with the national DoH, the DoEL, the Department of Basic Education, the DPSA, the NICD, as well as the NHLS' SHE and Labour departments regarding cleaning and disinfection guidance documents and fact sheets. These were posted on the NIOH's website and routinely updated as new information became available. Specific presentations for cleaning workplaces during COVID-19, cleaning post-COVID-19 in the workplace, the responsibilities of employers during COVID-19, guidance on routine and deep cleaning of workplaces when COVID-19-positive cases have been identified, ethical considerations of health and safety personnel in the workplace around COVID-19, as well as cleaning and disinfection guidelines during COVID-19 at schools were provided to various national stakeholders throughout the year. Some of these presentations were by co-hosted by AUDA-NEPAD and the Wits Health Consortium.

The Section also committed to taking a more active role in healthcare surveillance and the translation of OHASIS data into usable formats for OHS support and services via regular meetings with the NIOH's SHE Department, and Epidemiology and Surveillance Section. However, during the nationwide lockdown, a rotational shift programme was implemented to maintain the existing work conducted through the following specialised units in the Section:

- The Genotoxicity Unit
- The Health Risk Assessment (HRA) Unit
- The Nano- and Microparticle Toxicity Unit
- The Toxicogenomics Unit

Similarly, established collaborations were maintained with local and international institutions, which allowed for remote, off-site training and blended learning activities for staff and postgraduate students in the field of general occupational toxicology and nanotoxicology. The shift to more digital platforms was not only implemented for continued business practices or academic training, but also to develop the implementation of computational toxicology studies, i.e. where predictive tools are used to prevent disease. This was supported by the International NanoSolveIT consortium H2020 EU project, i.e. for the implementation of computational models based on measurements from the various research projects.

Collaboration extended to the xCELLigence in Toxicology practical workshop, with hands-on cell-culture sterile technique training, as well as GraphPad Prism software analyses, which were conducted at the University of South Africa for research scientists to promote development. Lastly, the Section focused on SANAS accreditation activities for GLP based on OECD principles, as well as ISO 15189.

SERVICE DELIVERY

Lung Cancer Research Unit (Helen Joseph Hospital)

Dr N Sanabria continued to develop the collaboration between the Pathology Division and the Toxicology and Biochemistry Section at the NIOH. Senior management was engaged. The legal and financial implications relating to the four new proposed tests were discussed, i.e. multiplexed probe-based quantitative polymerase chain reaction (qPCR) for the qualitative detection of somatic mutations within non-small cell lung carcinomas (NSCLC). In addition, steps were taken to initiate ISO 15189 SANAS accreditation. These new qPCR tests will form part of the services provided to government hospitals that are serviced by the NHLS. It is part of the current work performed in the Pathology Division, which is in collaboration with the Lung Cancer Research Unit. This may also benefit the current Brazil, Russia, India, China and South Africa (BRICS) research collaboration (see below).

Mine Health and Safety Council

Dr M Vetten and Dr N Sanabria liaised with the MHSC regarding quarterly reporting for the CytoViva 3D upgrade throughout the year. In addition, Dr M Vetten met with the new MHSC delivery specialist and Centre of Excellence Manager in 2021. The services that the NIOH will offer to industry are aimed at occupational medical practitioners and occupational hygienists. However, additional services for Unisa have been completed. In addition, the validation of the use of specialised dyes for intracellular localisation analyses has been initiated. Dr M Vetten and Dr C Andraos also drafted a summary for the MHSC on a proposed project for the development of a test for the measurement of internal doses using CytoViva. Dr M Vetten also completed the training and competency assessments of postgraduate students related to the use of the equipment.

National Research Foundation

Dr J Joseph served as a reviewer for the NRF regarding competitive support for unrated researchers and Thutuka grant applications for 2021.

South African Water Research Commission

Dr N Sanabria and Dr M Vetten served as reviewers for the South African WRC regarding numerous proposals submitted during the current funding period.

RESEARCH

The collaborative efforts between Prof M Gulumian and Dr N Sanabria created a highly productive section that produced 21 publications in scientific journals and one peer-reviewed book chapter, which constitutes approximately 50% of the Institute's research output during the period under review. Our staff also supported public engagement, served as reviewers for international journals, served as reviewers for national research grant funding bodies, and presented their research findings at international and national conferences, as well as local research days and workshops.

INTERNATIONAL COLLABORATION

BRICS multilateral project

Dr C Andraos and Prof M Gulumian submitted the annual progress report for the BRICS multilateral project, which is funded by the NRF. Prof M Gulumian, Dr C Andraos, Dr M Vetten and Dr N Sanabria continued to contribute to a collaborative nano-hybrid



project related to nanotechnologies, which speaks to new core-shell hybrid nanostructures: the evaluation of surface coating impact to biosafety and potential therapeutic applications. The research outputs are being developed for implementation in the Section's service delivery quota.

Encyclopaedia of Toxicology

Prof M Gulumian is the section editor of the fourth edition of the Encyclopedia of Toxicology (Elsevier) and attended numerous meetings to report on progress on the invitation of authors for contributions.

European Union projects

European Union (EU) Horizon 2020 research grants were awarded for two projects related to the study of the toxicity and the risk assessment of engineered nanoparticles and nanotechnologies. Consequently, Prof M Gulumian participated in a number of meetings with EU partners to discuss collaboration on current and new projects, i.e. Gov4Nano and NanoSolveIT (see below).

Gov4Nano

The Gov4Nano EU Horizon 2020 project established a Nano Risk Governance Council (NRGC). Prof M Gulumian is the principal investigator of the project and attended collaborators' meetings and workshops to discuss the new approach methodologies, the NRGC's mission and goals, as well as the current and near-future state-of-the-art and further requirements for the establishment of the regulatory aspects of the NRGC. Dr C Andraos and Prof M Gulumian submitted the financial report. Dr C Andraos attended the Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing (NMBP)-13 cross-consortia teleconference, during which four draft scenarios for the NRGC were discussed among the different representatives and stakeholders from the Horizon 2020 projects (NanoRigo, RiskGone and Gov4Nano).

Innovative nano-informatics models and tools: towards a solid, verified and integrated approach to predictive (eco) toxicology (NanoSolveIT)

Dr N Sanabria and Prof M Gulumian are participating members for the international NanoSolveIT consortium (an EU Horizon 2020 project). The general assembly and numerous specific work package meetings were conducted via virtual platforms on a regular basis each month to account for COVID-19 travel restrictions. Prof M Gulumian was given the task of assessing the quality of data available to be utilised for the predictive modelling of the toxicity of nanomaterials. All protocols and results were presented at the NanoSolveIT Work Package 2 Workshop.

International Organization for Standardization

As the head of the delegation of the ISO/Technical Committee 229 Working Group (WG3) (Health, Safety and Environmental Aspects of Nanotechnologies) Committee, Prof M Gulumian attended numerous WebEx and teleconference meetings throughout the year. She participated as an expert at these forums.

International Union of Toxicology

The Section liaised with IUTOX, which participated in the virtual workshop on Principles and Methods for the Risk Assessment of Chemicals in Food.

Organization for Economic Cooperation and Development

Prof M Gulumian is a participating member in the activities of the OECD Working Party on Manufactured Nanomaterials (WPMN). This required attendance of many meetings throughout the year. These meetings are important for the approval of nanomaterials that are intended for export to the EU, as well as other OECD countries, including South Africa. Prof M Gulumian attended an OECD web-based conference on advanced materials to discuss possibilities to structure the field and to identify types of advanced materials of relevance with regard to chemical safety, as well as the OECD National Nanotechnology Initiative on Human Exposure. Through the NIOH, South Africa will continue to contribute to the collection of data for exposure modelling projects (e.g. the NanoReg2 and Gracious 2020 projects).



Society of Environmental Toxicology and Chemistry

The Section liaised with the Society of Environmental Toxicology and Chemistry, which participated in the virtual workshop on principles and methods for the risk assessment of chemicals in food.

Society of Toxicology

Prof M Gulumian attended the international Society of Toxicology's virtual conference.

World Health Organization

The NIOH reviewed documents, compiled progress reports and attended webinars for the WHO's collaborating centre projects, where Prof M Gulumian is a member of the WHO Chemical Risk Assessment Network. Prof M Gulumian attended the Promoting Transdisciplinary Approaches for Identifying and Assessing Chemical Hazards and Risks to Protect Public Health workshop. Prof M Gulumian is also the co-organiser of the continuing education course on risk assessment and computational toxicology to be presented at the Congress of Toxicology in Developing Countries (CTDC) 11. The WHO supported and participated in the virtual workshop on Principles and Methods for the Risk Assessment of Chemicals in Food.

NATIONAL COLLABORATION

Department of Science and Innovation

In collaboration with Mintek, NWU, the CSIR and UP, the Section continued to execute work for two projects funded by the DSI:

- Risk assessment of gold nanomaterials: an OECD sponsorship programme
- Nanotechnology Health, Safety and Environment (HSE) risk research platform

Dr C Andraos and Prof M Gulumian prepared and submitted technical, as well as progress reports to the DSI. Prof M Gulumian and Dr C Andraos arranged and attended the annual virtual DSI health, safety and environment progress workshop.

Council for Scientific and Industrial Research

The Section liaised with the CSIR regarding collaborative work related to analysing the (toxic) gas emissions from synthetic products exposed to harsh outdoor conditions.

Society of Risk Analysis Africa

The Section liaised with the Society of Risk Analysis Africa, which participated in the virtual workshop on Principles and Methods for the Risk Assessment of Chemicals in Food.

South African Council for Natural Scientific Professions

The Section contributed to the strategic meetings of the South African Council for Natural Scientific Professions (SACNSP), where Prof M Gulumian served as a member and provided expert knowledge. Prof M Gulumian attended meetings for the Registration Committee and as a Council Member of the Advisory Task Team. Dr N Sanabria served as a reviewer.

Toxicology Society of South Africa

The Section liaised with the Toxicology Society of South Africa, which participated in the virtual workshop on principles and methods for the risk assessment of chemicals in food. Prof M Gulumian and Dr M Vetten attended a Toxicology Society of South Africa meeting for the New Critical Skills list from the DSI and Department of Home Affairs.

Pathology Research and Development Congress

Prof M Gulumian attended meetings for the Pathology Research and Development Congress (PathReD), as a member of the Scientific Committee, to discuss the Programme and the Organising Committee Updates. In addition, Dr M Vetten participated in a PathReD joint NIOH-NICD Discipline-specific Advisory Committee meeting regarding proposals on topics and presenters.



TEACHING AND TRAINING

Postgraduate students

- Dr C Andraos and Prof M Gulumian contributed towards a virtual workshop organised by North-West University (principles and methods for the risk assessment of chemicals in food).
- Prof M Gulumian delivered a presentation at the Tygerberg Poisons Information Centre Postgraduate Diploma in Medical Toxicology on the following topics: general principles of toxicology, health risk assessment, occupational toxicology, and risk assessment and nanotechnology.
- Dr J Joseph organised and conducted the Toxicology Workshop on xCELLigence and GraphPad Prism software analyses at Unisa.
- Mrs M Magogotya provided training and completed the competency assessments of two staff members for Mycoplasma contamination detection and the contamination test procedure.
- Dr W Utembe presented three Pesticide Risk Assessment modules for the Postgraduate Diploma students at the University of Cape Town.
- Dr W Utembe participated as an external examiner for MPH projects at the University of Johannesburg.
- Dr W Utembe also presented courses to Master's in Occupational Safety and Health degree students at the University of Malawi on the following topics: general concepts and approaches in toxicological risk assessment, toxicokinetics and toxicodynamics, occupational exposure limits and standards for air contaminants: derivation and use, and environmental and biological monitoring.
- Dr M Vetten provided training and completed the competency assessments of two staff members for the maintenance of adherent cell cultures.
- Dr M Vetten also trained a student from the University of Pretoria on the CytoViva hyperspectral imaging system.
- Dr M Vetten delivered a presentation at the Wits MSc in Medicine (Exposure Science) course, COMH7297A.
- Dr N Sanabria provided postgraduate training and competency assessments to students and staff members on nucleic acid isolation, quantification and amplification.
- Dr N Sanabria also delivered presenations at the Wits MSc in Medicine (Exposure Science) courses, COMH7297A and COMH7104A.

Undergraduate students and visitors

Due to the nationwide lockdown, no on-site visits were allowed. However, training continued via various digital platforms as listed (above and below) in the other training activities.

PROFESSIONAL DEVELOPMENT

The Section invested substantial effort into professional development and skills transfer to promote succession planning.

Postgraduate students were hosted on-site. These students are enrolled for the following degrees: two PhDs (one at Wits University and one at the University of Johannesburg), five MSc degrees (four at the University of Johannesburg and one at the University of Pretoria), and one MTech degree at the Tshwane University of Technology. Prof M Gulumian continued to supervise 11 postgraduate students at North-West University, the University of Pretoria and the University of the Free State.

Staff also attended the following training activities:

- The Society of Risk Analysis Webinar: COVID-19 conversations on risk, with presentations by Prof Jade Mitchell and Prof Felicia Wu of Michigan State University, USA, 23 April 2020.
- The South African Institute for Occupational Safety and Health Webinar: Unpacking the new DoEL OHS Direction with the Chief Inspector, 17 June 2020.
- The virtual Summer School on Innovative Approaches in Science, which addressed new approaches to *in vitro* and *in silico* toxicity assessments in place of animal studies, 22 to 26 June 2020.
- Workshop series on machine learning using Galaxy, 22 to 26 June 2020.



- The SmartNanoTox conference on the grouping of nanomaterials, development of adverse outcomes pathways (AOPs) and the identification of key events, in vivo-in vitro mapping, databases/data management, 24 June 2020.
- The South African Immunology Society's Immunopoedia COVID-19 Webinar,
 4 August 2020.
- The WHO Characterising Hazard and Risk in Mechanism-based Toxicology Webinar, 12 August 2020.
- The NIOH webinar: Impact of COVID-19 on mental health, 13 August 2020.
- The NIOH webinar: Compensation for workplace-acquired COVID-19: A practical approach, 20 August 2020.
- The COVID-19 diagnosis: Fundamentals, current diagnostic techniques and future directions, conducted by Mahatma Gandhi University, Nirmala College, Chemistry Department, 22 August 2020.
- The WHO webinar: The many faces of stigma during COVID-19, 16 September 2020.
- The pathway to test guidelines: From science to standards for nanomaterials, a presentation by Prof T Kuhlbusch and M Gonzalez of the EU-funded projects NanoHarmony and NANOMET/OECD, 21 September 2020.
- The Health and Welfare Sector Education and Training Authority (HWSETA) assessor course, 5 to 9 October 2020.
- The WHO network training webinars: Rapid public health risk assessment to inform chemical incident response action: An introductory training session, and Toxicology, risk assessment in food safety and exposure assessment, 14, 16, 20 and 23 October 2020.
- The second REFINE knowledge exchange conference, 2 and 3 November 2020.
- The NanoHarmony international virtual workshop, 5 November 2020.
- The NanoSafe digital workshop, organised by the Nanosafety Cluster, 16 November 2020.
- Prioritisation of Chemicals for Risk Assessment, hosted by the WHO, Department of Environment, Climate Change and Health, 12 November 2020.
- The Nano Safety Cluster digital training day, hosted by NanoSAFE 2020, 23 November 2020.
- Basic life support and emergency first aid training, 23 and 24 November 2020.
- Emergency preparedness and response procedures, 23, 25 and 27 November 2020.
- Institute of Emergency First Aiders (IEFA) fire marshal training, 25 and 27 November 2020.
- The Oncomine virtual meeting, presented by ThermoFisher, 10 December 2020.
- The Nano Risk Governance Framework, tools and portal stakeholder workshop, 26 and 27 January 2021.
- The Principles and Methods for the Risk Assessment of Chemicals in Food Workshop, 26 to 29 January 2021.
- NHLS information session: COVID-19 update, 27 January 2021.
- The ECHO presentation, high-depth African genomes inform human migration and health, 10 February 2021.
- Quality Management System (QMS) training, provided by NIOH's Quality Assurance Department, Mrs K Mogari, 8 to 12 February 2021.
- The ECHO presentation, NHLS research protocols by Prof Crowther, 12 March 2021.
- The Bioinformatics and Genomics Careers Spotlight webinar series, 29 January 2021.
- Numerous presentations at the NIOH's monthly research forum and weekly Departmental Journal clubs, where skills are developed, such as public speaking, information dissemination, analyses of data and critical review.

HONOURS

Two staff members were recognised for their achievements. Prof M Gulumian was appointed as an extraordinary professor in the Research Unit for Environmental Sciences and Management at North-West University (Potchefstroom Campus). Dr W Utembe published an article in *Environmental Toxicology and Chemistry*, which was among the top 10% of most downloaded papers of the work published at the time.





Image 1A: Dr J Joseph (right) presenting the xCELLigence in Toxicology practical workshop, with hands-on training, conducted at Unisa for research scientists to promote development.

Image 1B: Dr J Joseph presenting GraphPad Prism software analyses, which was conducted at Unisa for research scientists to promote development.



Image 2: Mrs M Magogotya (centre) presenting the cell-culture sterile technique, which was conducted at Unisa for research scientists to promote development.




9. NATIONAL BIOBANK

Manager: Mr Bonginkosi Duma

SERVICES

The NHLS' Biobank was established as support infrastructure for internal and external clients both locally and internationally to conduct innovative and relevant research with a focus on patient care. The NHLS' Biobank continues to collect and store samples for short- and long-term research and preservation purposes, and operates as a non-profit organisation, utilising a cost-recovery model. To date, the National Biobank has approximately 1.4 million samples securely stored, with the capacity to store four million samples.



Image 1: The services provided by the National Biobank.

The services provided by the National Biobank include the following:

- Sample collection, processing and short-term or long-term storage
- Material transfer agreements that comply with ethical and legal requirements
- The provision of a wide variety of samples
- Sample logistics and preparation
- Research activities and collaboration

Repurposing the Biobank facility for COVID-19 samples

COVID-19 has prompted laboratories to seek space to store COVID-19 samples prior to analysis. Some samples were stored for the short term to the long term. The analysis within the NHLS still continues with COVID-19 showing different strains during analysis.

Biobank tracking system

The NHLS' Biobank implemented a system that allows for the coding and tracking of samples. This is a two-dimensional barcoded system and will assist with the storage of samples using the ability to track the biospecimen's whereabouts. It also assists with the easy retrieval of specimens from ultra-freezers, as well as location tracking if the sample is still located in the Biobank.



Biobank quality management system

It is important for biorepositories to have quality management systems and adhere to a set of standard operating procedures (SOP), as well as ethical and legal considerations. A quality management system enables the long-term preservation of specimens, stability, quality and confidence in the data of the stored specimens.

The WHO recognises the pivotal role that biobanking plays in society and has proposed a global governance framework for biobanks. The framework encompasses elements of participant confidentiality, ethics, safety, sample and data quality for biobanks.

The biobank still maintained its ISO 9001:2015 accreditation during the period under review. This makes it the only biobank in Africa that is accredited with that standard.

Benefits of the quality processes at the Biobank include the following:

- Saving time and money
- · Maintaining high-quality samples and adding value
- Ensuring the necessary biosafety and biosecurity standards
- The ability to map population flows, evolution of disease and sources of epidemics •
- Promoting the early development of prevention and treatment strategies through the application of modern technology
- · Accelerating opportunities for global collaboration and the secondary use of samples to increase statistical confidence



Image 2(A-B): Minus 80 ultra-freezers used for storing samples and COVID-19 vaccines for long-term storage; Minus 20 freezer used for storing vaccines and samples waiting for analysis by the laboratories.



Image 3(A-B): Liquid nitrogen used to store live cells at minus 156 °C.



Biobank membership

To ensure that its operations are aligned with international standards, the NHLS' Biobank continues to maintain its membership of the International Society for Biobanking (ISBER) and the European, Middle Eastern and African Society for Biopreservation and Biobanking (ESBB). Mr B Duma continues to participate as a member of the ISBER Standards Committee, which recently developed a new biobanking standard, ISO 20387. This standard will help international biobanks to be audited and get accreditation. The Biobank's website can be accessed at: <u>www.nationalbiobank.nhls.ac.za</u>

PROFESSIONAL DEVELOPMENT

Ms Mantombi Maseme completed her MSc in Ethics at Wits University in December 2020.

Mr B Duma is currently enrolled for his second MMed degree at the University of Graz in Austria on biobanking.



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10. INFORMATION SERVICES AND TRAINING SECTION

Head: Ms Angel Mzoneli

Information Services and Training serves as an enabling partner that provides support to the NIOH and the NHLS, and acts as a gateway to occupational health information, not only for the organisation, but also for external clients.

The Section provides support through the following:

- South Africa's national reference library for occupational health (AJ Orenstein Memorial Library), the only specialist reference library in Southern Africa dealing exclusively with occupational health topics, housing an extensive collection of information resources in occupational health in both print and electronic formats
- A query-handling service, which is aimed at responding to and facilitating access to technical and scientific occupational health information, guidance and expert advisory services offered within the Institute
- An archive, aimed at comprehensively collecting, documenting and preserving the character and identity of the organisation and providing evidence of the historical development and changes of the Institute over time
- An institutional repository, which is a digital collection of the organisation's intellectual output
- A training unit, which provides technical OHS training to NIOH stakeholders, as an integral function of an occupational health institute.

In addition, the Section provides seamless and consistent access to information resources (electronic and print) throughout the NHLS to support and enable researchers to conduct world-class and innovative research.

Information Services expands its offerings to include access to the library collections of the NHLS (formally known as the South African Institute of Medical Research (SAIMR) Library), located in Braamfontein.

The Section serves the needs of all the NHLS' staff, including those located in laboratories, and the eight medical schools throughout South Africa, as well as the NICD. The NICD's library collections are housed at the NIOH's resource centre, and provide an extensive remote information service to the NICD community.

SERVICES

Information Services and Training offers its knowledge and information to all stakeholders, both internal and external, to support the promotion of good occupational health practice. The Section ensures the provision of comprehensive resources and services in support of the Institute's research, teaching and training activities, and is a national resource and service dedicated to the collection, access and dissemination of information on the prevention of occupational diseases and accidents in workplaces. The primary objective of the service is therefore to collect, access and disseminate information in support of occupational health services and activities throughout South Africa and the SADC region.



In realising this, a wide variety of information resources is provided. These include electronic databases and scientific periodicals and monographs, both in print and electronic formats. The NIOH Library, which deals exclusively with occupational health topics and is the only specialist occupational health reference library in South Africa, continued its principal function of searching, retrieving and disseminating information in support of occupational health services throughout South Africa and the SADC region. Through various library interventions, the skills needed to source information in occupational health were shared with occupational health professionals, university students, workers, management, health and safety representatives, and labour union officials.

Information Services and Training continued to receive and respond to requests for technical and scientific information on occupational health issues through its query-handling service. In the year under review, the query handling service had an unusually high number of queries due to the COVID-19 pandemic. The numbers jumped from 117 queries in 2019/20 to 1 174 queries in 2020/21. As can be expected, the queries were mostly around COVID-19, coming from both employers and employees, occupational health practitioners, health and safety representatives and the general public. All these were in addition to its usual queries, which included requests for occupational hygiene surveys, requests for training on the handling of asbestos or advice on how to best handle asbestos-containing material in homes and workplaces, or risks related to asbestos-containing materials in homes, referrals to the NIOH's clinic, requests for information about the Diploma in Occupational Health and the MPH, requests for advice from employers and employees on occupational health-related issues in the workplace, and requests for training interventions. It is also worth noting that gueries came from all South Africa's provinces, other African countries and from countries outside South Africa's borders.

A total of 1 581 gueries were handled for the period under review. Of these, 1 576 were fulfilled. The gueries included gueries that came through the NIOH's Library and those that came through the query handling service.

In support of research activities, the Section maintained its library collections and enabled ease of access to full-text scientific journal articles through its subscription to the Science Direct and the American Society for Microbiology databases.

These databases provided access to full-text articles from various medical journal titles. Open-access electronic resources and databases and a few trial databases were also added to the library collection that is accessible to researchers via the library page on the intranet. The Section continued to provide researchers with the necessary literature to carry out their research projects.

From the research projects conducted, the NIOH predicted an annual target of 27 publications for the period under review. This was over-achieved by 59%, resulting in a total of 43 publications produced in the period under review by the NIOH's researchers. All 43 publications were managed by the Section, uploaded onto the website for ease of access and disseminated to external stakeholders through the NIOH's newsletter, which reaches multiple stakeholders interested in or working in OHS.

In collaboration with members from other departments and sections, the Information Services and Training also continued to provide leadership and coordination in putting together and disseminating NIOH OccuZone, the Institute's official newsletter. Through the newsletter, the Institute successfully kept its target audience up to date with the latest developments around service delivery, teaching and training, and the Institute's research activities.

PROFESSIONAL DEVELOPMENT

Staff in the Section continue to develop academically, and a number of them are enrolled for university programmes. In the year under review, the Section saw three academic achievements: two staff members obtained their Master's in Information Science degree from Unisa and the University of Limpopo, and one staff member completed a programme in Archival Studies at Unisa.

Six postgraduates were enrolled. These included three master's degree students at Unisa, two at Wits University and one at the University of Limpopo.



TEACHING AND TRAINING

In its second year of existence, the Training Unit continued to provide technical OHS training to the NIOH's stakeholders. The Unit coordinated a number of training events during the period under review, including a large number of training sessions on COVID-19 preparedness and the prevention response in the workplace.

Training interventions

The year under review paid considerable attention to COVID-19 webinars. The COVID-19 training sessions were developed in modules covering a wide range of topics related to various aspects of the COVID-19 pandemic focused on workplace preparedness and disease prevention. These topics were tailored to specific sectors and the needs of the NIOH's stakeholders, which included occupational medicine practitioners, occupational health nursing practitioners, frontline health workers, employees (e.g. designated essential services workers), government officials, OHS professionals, advisors and practitioners, employers and management representatives, trade union representatives, SHE/health and safety representatives, health and wellness practitioners, and human resources practitioners.

In maintaining social distancing, these training sessions were conducted online using the Zoom platform. This enabled the Institute to reach thousands of employees and employers across various industries and professional categories. Video and audio recordings, as well as the presentations for these sessions, were uploaded onto the NIOH's website and YouTube channel and the URL links were sent to all relevant stakeholders. In terms of continuous professional development accreditation, the following professional bodies approved the NIOH's training sessions for COVID-19:

- The HPCSA Medical and Dental Board
- The South African Dental Association
- The South African Institute for Occupational Health
- The South African Institute of Occupational Safety and Health
- StellMed/the South African Nursing Council (occupational nurse practitioners)

With accreditation in place, attendees qualified for continuing professional development (CPD) points after the successful completion of an online CPD test. The CPD certificates were issued to successful candidates upon achieving a minimum of 70% in the online assessment.

A total of 57 COVID-19 webinars were conducted during the period under review, reaching 38 804 attendees, with an average of 680 attendees per webinar. The NIOH conducted 16 webinars (with a total of 16 906 attendees) for the partnership with the Wits Health Consortium from 26 May to 6 August 2020. These COVID-19 webinars were supported with funding from HWSETA.

The following COVID-19 webinars were conducted during the period under review.

- 1. COVID-19 workplace preparedness for national DoH Civitas employees
- 2. COVID-19: Biorisk assessments for frontline workers
- 3. Personal protective equipment (PPE) use and COVID-19
- 4. Looking after your emotional wellbeing during this time: thinking about health care workers
- 5. COVID-19 and management roles and responsibilities
- 6. COVID-19 post-lockdown return-to-work preparedness sessions
- 7. COVID-19 post-lockdown return-to-work preparedness sessions (repeat)
- 8. COVID-19 training for environmental health practitioners
- 9. COVID-19 training for NHLS shop stewards
- 10. COVID-19: Step-by-step risk assessment (and practical risk assessment tools)
- 11. Addressing questions on COVID-19 and return-to-work preparedness
- 12. COVID-19 training of employees in the food industry
- 13. Implications of COVID-19 in the workplace



- 14. Risk assessment for COVID-19
- 15. Implications of COVID-19 in the workplace (repeat)
- 16. Available control measures for COVID-19
- 17. COVID-19 training for employees in the construction industry
- 18. Return to work in the Gauteng Provincial Government
- 19. What are the responsibilities of employers during COVID-19?
- 20. Return to work in the Gauteng Provincial Government for senior managers
- 21. What are the responsibilities of employers during COVID-19?
- 22. Available control measures for COVID-19 in specific workplaces
- 23. What to do when an employee tests positive for COVID-19 at work
- 24. Available control measures for COVID-19 in specific workplaces (repeat)
- 25. What to do when an employee tests positive for COVID-19 at work (repeat)
- 26. Available COVID-19 OHS resources
- 27. COVID-19 vulnerable employees risk assessment
- 28. COVID-19 workplace health risk assessment
- 29. Return to work post-COVID-19 illness, lockdown, etc.
- 30. Discussion on COVID-19 health care worker surveillance
- 31. Managing of COVID-19 persons under investigation in different workplaces
- 32. Medical screening and testing for COVID-19 in different workplaces
- 33. Managing of COVID-19 persons under investigation in different workplaces (repeat)
- 34. Medical screening and testing for COVID-19 in different workplaces (repeat)
- 35. Impact of COVID-19 on mental health and risk communication
- 36. Compensation for workplace-acquired COVID-19: A practical approach
- 37. Occupational safety and health in urban public workplaces for workers in the informal economy
- 38. Workplace risk assessment, cleaning and decontamination
- 39. Ethical considerations of health and safety personnel in the workplace around COVID-19
- 40. Workplace risk assessment, cleaning and decontamination (repeat)
- 41. Ask the expert: The use of fabric masks and masks with vents
- 42. Fitness for work post-COVID -19 infection
- 43. COVID-19 and the built environment
- 44. Legionella and COVID-19: Building water safety during pandemics and beyond
- 45. Ergonomic risks that should be prevented during this time of COVID-19
- 46. Surveillance of COVID-19 in South African workplaces
- 47. Managing the triple epidemic in the workplace: COVID-19, TB and HIV
- 48. Gauteng Provincial Government risk assessment training
- 49. National DoH PPE quality assurance management workshop
- 50. NHLS staff information session COVID-19 update
- 51. Occupational health surveillance of COVID-19 in South African workplaces
- 52. Covid-19 risk assessment training
- 53. OHSS CMORE Creating your own reports, a hands-on workshop
- 54. COVID-19 vaccines in the workplace
- 55. COVID-19: Roles and responsibilities of health and safety representatives in the public sector
- 56. Travel medicine and Covid-19
- 57. COVID-19 vaccination webinar (repeat)



COVID-19 training webinars drew mainly on the NIOH's staff's expertise as presenters, and were increasingly augmented by external specialists and expertise. The internal presenters included representatives from the NHLS' divisions, including the NICD. Guest or external presenters came from the public sector, academia and the private sector. These included speakers from national professional bodies, national and provincial government departments or enforcement agencies, academic institutions, national medical, scientific and research bodies, and the national DoH's vaccine programme.

Comparison of time contributed by internal NIOH and external trainers/presenters (57 online webinars presented from: April 2020 to March 2021

| No. | Webinar trainers/presenter categories | Percentage | Online time contributed |
|---------|--|------------|-------------------------|
| 1. | Internal NIOH speakers | 51.4 | 43.5 hours |
| 2. | External speakers | 48.6 | 41.0 hours |
| Total o | online time contributed to COVID-19 webinars | 100.0 | 84.5 hours |

From available data of 19 webinars held, the following demographic data was extracted for the nine provinces.

| Provincial breakdown of webinar attendees for 19 webinars during the period under review (available data for 19 webinars presented from 26 May to 25 March 2021) | | | | | |
|--|---------------|---------------------|------------|--|--|
| No. | Province | Number of attendees | Percentage | | |
| 1. | Gauteng | 5 576 | 52.2 | | |
| 2. | Western Cape | 2 383 | 22.3 | | |
| 3. | KwaZulu-Natal | 1 734 | 16.2 | | |
| 4. | Eastern Cape | 993 | 9.3 | | |
| 5. | Mpumalanga | 802 | 7.5 | | |
| 6. | North West | 421 | 3.9 | | |
| 7. | Free State | 411 | 3.8 | | |
| 8. | Limpopo | 392 | 3.7 | | |
| 9. | Northern Cape | 349 | 3.3 | | |
| Total attendees | | 13 061 | 100.0 | | |

Figure 9: The number of attendees per province for 19 webinars during the period under review (with available data). Gauteng led with the highest portion of attendees of 52.2%.

A total of 10 689 workplaces were reached in the 19 webinars. This involved an average of 562.6 workplaces per webinar. Given that a total of 57 webinars were conducted during the period under review, it could be stated that the estimated total number of workplaces reached for the 57 webinars could be 32 067 workplaces.

| Average number of workplaces per webinar (national and per province) (available data during the period: 26 May 2020 to 25 March 2021) | | | | | | | | | | |
|--|--------|--------------|------------|---------|---------------|---------|------------|------------|---------------|--------------|
| | Total | Eastern Cape | Free State | Gauteng | KwaZulu-Natal | Limpopo | Mpumalanga | North West | Northern Cape | Western Cape |
| Number of workplaces | 10 689 | 993 | 411 | 5 576 | 1 734 | 392 | 802 | 421 | 349 | 2 383 |
| Number of webinars | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 19 |
| Average number of | 562.6 | 52.3 | 21.6 | 293.5 | 91.3 | 20.6 | 42.2 | 22.2 | 18.4 | 125.4 |

Figure 10: The average number of workplaces per webinar (national and provincial data).

COVID-19 training webinars were augmented with a variety of OHS information resources disseminated through a number of channels, e.g. the NIOH's website, the *OccuZone* newsletter, Twitter, the YouTube channel, the COVID-19 hotline and the NIOH's



info mailbox. These resources included government regulations and directions, posters and fact sheets, infographics, guidelines and videos. The online training was delivered free of charge to NIOH stakeholders. Additional value-adding post-webinar support services were also offered to webinar attendees.

The webinar presentation slides, information resources, and video and audio resources were made available on the NIOH's website, and the links to these resources were circulated to the registered attendees. A general certificate of attendance was provided to all attendees. In the latter part of the year under review, online post-webinar surveys were disseminated to secure attendees' feedback on the training interventions and suggestions for future and additional or new topics.

Capacity building in occupational health and safety

In addition to the COVID-19 training sessions, the Institute contributed to the delivery of the Diploma in Occupational Health programmes at Wits University and the University of Pretoria.

Similarly, an online training course on occupational hygiene report writing and interpretation was conducted during the fourth quarter. The training was conducted over a period of five days and drew participants from the DoEL. The objectives of this training included providing an overview of the purpose and legal requirements of report writing, exploring technical writing skills, and understanding the typical layout and content of occupational hygiene reports.

The Institute also offered an xCELLigence real-time cell analysis training workshop for master's degree students and PhD candidates in Unisa's Department of Life and Consumer Sciences. The workshop took place at the Florida Campus in Johannesburg from 15 to 17 March 2021, and consisted of theoretical, as well as practical components. The workshop focused on lectures and included cell culture, xCELLigence assay principles and its research applications, setting up experiments, seeding cells, the addition of drugs, xCELLigence data interpretation and analysis, and the statistical analysis of results using GraphPad Prism 5 software. The xCELLigence system is a new technological approach that allows the real-time cell analysis of adherent tumour cells that are beneficial in the field of cancer research (drug discovery).

ACCREDITATION

Skills development provider accreditation

The Quality Council for Trades & Occupations (QCTO) accredited the NIOH to offer the following COVID-19-related skills programmes for a period of five years starting on 17 March 2021, in accordance with the Skills Development Act and the Continuing Education and Training Act.

| Accreditation of the NIOH as a skills development provider | | | | | | |
|--|---|-----------|----------------|-----------------|--|--|
| No. | Qualification/programme title | NQF level | ID or OFO code | Minimum credits | | |
| 1 | Skills Programme Workplace Preparedness and Risk Control Officer: Communicable Disease and Occupational Diseases | 4 | SP-191224 | 5 | | |
| 2 | Skills Programme Workplace Preparedness and Risk Control Assistant: Communicable Disease and Occupational Diseases | 3 | SP-191223 | 3 | | |

The formal QCTO accreditation provides the NIOH the basis to apply its occupational health and general OHS capacity and skills base to reach the South African formal and informal sector workplaces through these registered and approved skills programmes. This strengthens the NIOH's ability to align its existing knowledge base and training materials to further its mandate to address strategic OHS training needs and capacity-building interventions through the registered and approved skills programmes.

Through all the abovementioned meaningful training interventions provided during the period under review, the Institute continues to promote healthy, safe and sustainable workplaces.



INTERNATIONAL LIAISON

11. INTERNATIONAL LIAISON

Manager: Dr Natasha Sanabria

WORLD HEALTH ORGANIZATION PROJECTS

The NIOH is a WHO collaborating centre in occupational health. The aim of the global network of WHO collaborating centres is to stimulate networking between participating institutions and international partners to make a substantial contribution to the WHO's goal of "occupational health and safety for all". The WHO estimates that only about 10 to 15% of workers worldwide have some kind of access to occupational health services, and extending coverage is a key challenge to overcome.

Dr N Sanabria attended the WHO Collaborating Centre Seminar for all managers of WHO collaborating centres, which was conducted by the WHO's Director-General and the Quality Assurance, Norms and Standards Department. The virtual seminar was opened by the WHO's Director-General, Dr Tedros Adhanom Ghebreyesus. Discussion topics included the current programme priorities of the organisation, the WHO's response to COVID-19 and the role collaborating centres have played, the latest news and vision regarding the work of the organisation with collaborating centres, case studies coming from the regions and headquarters of work conducted together with collaborating centres.

Each region gave an update on activities, where the African region was represented by Dr Joseph Caboré. He reported that there are 28 collaborating centres in Africa and that these collaborating centres are not evenly distributed, with 18 collaborating centres located in South Africa, i.e. there is an imbalance in regions and topic focus areas. Additional problems reported were the complex requirements to become a collaborating centre, and after becoming a collaborating centre, the fact that the organisation can no longer receive funding from the WHO, nor be eligible for other funding due to certain donor clause restrictions. Therefore, there is a need for clear terms of reference, which must be regularly updated. Our participation in the network is vital to ensuring decent work for all, and Dr N Sanabria compiled and submitted the annual report for the NIOH in this regard.

The projects listed below are currently in the second year of progress:

Lead: Dr Muzimkhulu Zungu (Project 28609)

In support of the WHO's work on the OHS of health workers, to identify and analyse lessons learnt from the development and implementation of the national programme for the occupational health of health workers in South Africa

While the SARS-Cov-2 pandemic has derailed most activities, work continued within the health sector to improve the occupational health of health workers through a national audit of the occupational health services, as well as health and safety committees in the health sector, with a specific emphasis on COVID-19. A technical report was prepared for the national DoH. This is still embargoed while the Ministry of Health is consulting stakeholders.



Lead: Dr Muzimkhulu Zungu (Project 28610)

Provision of technical inputs to support the WHO's work towards the development of the WHO/ILO global report on the occupational health of health workers

In 2019, the NIOH managed to reach an agreement with the Mpumalanga and Gauteng DoH for the training and implementation of HealthWISE. Future activities include producing manuscripts for sharing information related to protecting health workers from HIV, TB and HBV infections due to the COVID-19 pandemic. In addition, a guasi-experimental study utilising a mixed methodological approach, which compared changes in OHS systems (policy, leadership and coordination, financing, human resources, infrastructure, technology and medicines, information management and services) in health facilities, following the concurrent implementation of two interventions (the OHASIS and HealthWISE) was proposed and subsequently approved. Phase 1 was initiated for data collection in the Gauteng and Mpumalanga DoH.

Lead: Dr Tanusha Singh and Dr Nisha Naicker (Project 28614)

To provide technical inputs in support of the WHO's activities towards providing guidance and policy options for action by the health sector to improve the health and safety of poor informal economy workers

Monthly meetings were held with the core NIOH team and scheduled meetings with the WHO's technical officer. The systematic review paper on the health outcomes of informal vs formal sector workers has progressed, where the paper was submitted for publication and is awaiting the outcome.

Lead: Dr Nisha Naicker (Project 28612)

To support the WHO's work on the informal economy, focusing on research and policy development

Very few studies have compared health outcomes between the informal economy worker and the formal economy worker. Thus, the NIOH has developed projects to address this gap. The informal economy survey has been completed and the results published. The formal economy study was approved by the Ethics Committee and approval has been obtained by selected buy-back centres. However, due to COVID-19, data collection was put on hold. It will commence in March 2021, unless there is another lockdown due to COVID-19. The second phase of the project will assess formal workers at waste recycling buy-back centres in Johannesburg. Funding has been obtained to support the fieldwork, which will commence after the COVID-19 lockdown has been lifted. Other deliverables will follow the completion of data collection for the formal economy. The outcomes from this project will provide an evidence base for policy development relating to the provision of and access to occupational health services for the informal economy.

Lead: Prof Mary Gulumian (Project 22071)

WHO Risk Assessment Network

Prof M Gulumian is a member of the WHO's Risk Assessment Network, where she contributes to discussions on exposure assessment, biomonitoring, biomarkers, key needs and/or other strategic aspects for developing countries, as well as computational and experimental toxicology. She attended web-based training, where presentations were made about the network (Richard Brown, WHO), the Systematic Review Framework (Andrew Rooney, National Toxicology Programme), the Emerging Risks Task Group (Theo Vermeire, the Dutch National Institute for Public Health and the Environment), the Community of Trainers (Johanna Zilliacus, Karolinska Institutet) and the upcoming programme of webinars and online training events for 2020 (Richard Brown). Prof M Gulumian also liaised with the WHO to support and participate in the virtual workshop organised by North-West University on principles and methods for the risk assessment of chemicals in food.



ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT PROJECTS

Prof M Gulumian is a participating member in the activities of the OECD Working Party on Manufactured Nanomaterials. This required attendance of many meetings throughout the year.

These meetings are important for the approval of nanomaterials that are intended for export to the EU, as well as other OECD countries, including South Africa. Prof M Gulumian attended an OECD web-based conference on advanced materials to discuss possibilities to structure the field and to identify types of advanced materials of relevance with regard to chemical safety, as well as the OECD National Nanotechnology Initiative on human exposure. A technical report has been generated as an output of this work (see below).

INTERNATIONAL UNION OF TOXICOLOGY PROJECTS

Prof M Gulumian is an expert advisor and liaised with the International Union of Toxicology to participate in the virtual workshop on principles and methods for the risk assessment of chemicals in food.

EUROPEAN UNION PROJECTS

Innovative nano informatics models and tools: Towards a solid, verified and integrated approach to predictive (eco) toxicology

Dr N Sanabria and Prof M Gulumian are participating members for the international consortium NanoSolveIT (an EU Horizon 2020 project). The project has been divided into work packages, where Work Package 2 focuses on the design of experiments to fill data gaps to support the in silico model (i.e. the emphasis is on the collection of data from various sources to initiate the modelling work, which is needed to close gaps identified as roadblocks to modelling).

Prof M Gulumian was given the task of assessing the quality of data available to be utilised for the predictive modelling of the toxicity of nanomaterials. All collaborative meetings strengthen research activities by engaging in the discussion of data, sharing information for skills transfer and capacity building, and maintaining and increasing networks. For example, all protocols and results were presented at the NanoSolveIT Work Package 2 workshop, which was open to other EU groups (e.g. NanoCommons, RiskGone and Gov4Nano).

Gov4Nano

The Gov4Nano EU Horizon 2020 project established a Nano Risk Governance Council. Prof M Gulumian and Dr C Andraos are involved in this EU-funded project, which collaborates with the French Centre for Research and Teaching in Environmental Geoscience. Prof M Gulumian attended collaborators' meetings and workshops to discuss the new approach methodologies, the NRGC's mission and goals, as well as the current and near-future state-of-the-art and further requirements for establishing the regulatory aspects of the NRGC. Dr C Andraos attended the NMBP-13 cross-consortia teleconference, at which four draft scenarios for the NRGC were discussed among the different representatives and stakeholders from the Horizon 2020 projects, e.g. NanoRigo, RiskGone and Gov4Nano.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

Prof M Gulumian contributed to the ISO/TC229 Working Group (WG3) on Health, Safety and Environmental Aspects of Nanotechnologies Committee, attended numerous WebEx teleconference meetings throughout the year and participated as an expert at these forums. A technical report has been generated as an output of this work (see below).



TECHNICAL GUIDELINES AND REPORTS – INTERNATIONAL

OECD Technical Report

Prof M Gulumian compiled a report for the OECD that highlighted the suitability of a new assay developed by the NIOH's Toxicology and Biochemistry Section, i.e. the compilation of information on the ability of bio-persistent/bio-durable manufactured nanomaterials to induce lysosomal membrane permeabilisation to predict their long-term toxic effects.

ISO Technical Report

Prof M Gulumian compiled a report for the ISO that highlighted the applications of technology housed within the NIOH's Toxicology and Biochemistry Section, i.e. nanotechnologies: lung burden measurement of nanomaterials for inhalation toxicity studies.

ILO Technical Guidelines

Dr T Singh attended the second technical meeting on the formulation of the ILO's technical guidelines on occupational exposure to biological hazards from 21 to 22 November 2020 at the ILO in Geneva. The meeting was very productive and good progress was made by members on allocated chapters.



COVID-19 **OCCUPATIONAL** HEALTH OUTBREAK **RESPONSE TEAM**

NNN

12. COVID-19 OCCUPATIONAL HEALTH OUTBREAK RESPONSE TEAM

Chair: Dr Tanusha Singh

This report is based on feedback provided at the OHORT meetings. Some COVID-19 activities that were not reported at the meeting may form part of other reporting platforms.

The NIOH's OHORT was established to provide leadership in occupational health to both internal and external stakeholders and clients to ensure workplace preparedness and readiness. The members comprised experts from various disciplines within the NIOH. The key focus of the Committee was to develop, review and update technical documents, guidelines, procedures and processes related to COVID-19. Other functions were to develop occupation-specific prevention material, provide training on various COVID-19-related matters to different cadres of employees in various industries, and encourage research and contribute to new knowledge. All information is freely available and accessible on the NIOH's website (www.nioh.ac.za), which was zero-rated by the major data service providers in South Africa.

In addition, the Committee endeavoured to disseminate relevant and credible information and to provide an advisory service through its Occupational Health Hotline service. The team was instrumental in establishing the COVID-19 OHSS. Members of the team were actively involved in developing new modules on the existing OHASIS to enable the online COVID-19 screening of employees, reporting of NHLS COVID-19 cases, and recording of employee vaccinations.

On behalf of the Institute, the Committee is very grateful for the tremendous and overwhelming support it received and continues to receive from the occupational health fraternity and sundry in preventing COVID-19 among workers, which impacts on both workplaces and communities. The successes highlighted below and in the respective section reports are testament to many enduring hours of selfless commitment by many occupational health professionals and colleagues, for which I, as chair, am humbled and highly appreciate it.

RESEARCH

The Committee had supported several new research studies related to COVID-19 transmission in different work settings, including taxis, and its impact on workers' mental health. Research studies also included validating decontamination methods for filtering facepiece respirators as an alternative for stock shortages during emergencies and investigating skin disorders associated with PPE used during COVID-19. The Institute also participated in a study to detect COVID-19 in wastewater and its implications for workers' health at wastewater treatment plants in Gauteng. Research on the alcohol content of hand sanitisers was prioritised due to concerns about poor-quality hand sanitisers entering the market, putting many workers at risk. Another research study investigated the role of telecommuting during COVID-19, which highlighted occupational health and safety policies and reasonable accommodation for workers working from home. These studies are elaborated in the various departmental annual reports.



Occupational Health and Safety Audit

Members of the Committee led the occupational health and safety audit of health facilities in South Africa. The audit was completed, and the findings were presented to the Director-General and Executive Committee of the national DoH. Recommendations on strengthening OHS were made in the report.

SURVEILLANCE

Occupational health surveillance is generally lacking in the country, and the COVID-19 pandemic highlighted this glaring gap. Hence, members of the Committee collaborated with the national DoH, the NICD and the CSIR, and embarked on the establishment of an occupational health surveillance system. The system is managed by the NIOH. It has approximately 3 000 business registrations and just over a million employee records. Several initiatives were made to improve awareness, and these efforts will continue in the new financial year. However, funding remains a challenge to the sustainability of the programme. Statistical support was also given to the healthcare worker admissions weekly reports available on the NIOH's website.

FACT SHEETS

The fight against COVID-19 is also the fight against disinformation and misinformation; hence the Committee prioritised enhancing access to reliable information. This initiative resulted in the dissemination of 40 fact sheets relating to various COVID-19 and occupational health topics tailored to South African workplace settings and needs.

These are freely available on the NIOH's website. Some of the fact sheets were translated into isiZulu, Sesotho, Tsonga and Tshivenda. The COVID-19 fact sheet for general business was also translated into South African Sign Language and Braille. Some of these sheets were transformed into posters and infographics as well, and the content is periodically revised as new information becomes available.

COVID-19 TRAINING

The Committee accelerated its training efforts to raise awareness of COVID-19 in workplaces across various sectors (public and private), to promote workplace preparedness and prevention before, during and after the various stages of lockdown, and to capacitate participants with knowledge aligned with current challenges in the hope that workplaces will take the initiative to assess change from their employees after they have participated in the free webinars. The training took a hybrid form with some face-to-face sessions considering COVID-19 precautionary measures, but was mainly online training. Topics were amended from time to time in line with lockdown levels and requests from participants through email, the occupational health hotline and gaps raised on relevant OHS platforms. The webinars were presented by internal and external experts (who are authoritative in their respective fields), who dedicated several hours of free expert time.

On average, 10 689 different workplaces have attended the webinars, with 563 workplaces per webinar. Approximately 70 training sessions were conducted with an estimated 40 000 participants. The majority of the participants were from Gauteng, the Western Cape and KwaZulu-Natal. The training material is freely available on the NIOH's website. A training survey was conducted, which highlighted that the training offered empowered people to take action, improved their awareness and knowledge of occupational health matters, addressed their concerns and interests about COVID-19, and allowed more workplaces to become more aware of their duty as employers. Through the training, the Committee contributed to continuing professional development, where relevant topics are accredited with the HPCSA, the SAIOH, the South Africa Dental Association, the South Africa Institute for Occupational Safety and Health, and Stellmed. The NIOH was also accredited by the QCTO for two skills programmes: Workplace Preparedness and Risk Control Assistant, and Workplace Preparedness and Risk Control Officer.



COVID-19 Occupational Health Outbreak Response Task Team Committee



COVID-19 Occupational Health Outbreak Response Task Team members – from left to right:

Dr Tanusha Singh – Chair (Immunology & Microbiology), Dr Spo Kgalamono (Executive Director), Dr Muzimkhulu Zungu (Workplace HIV TB Unit), Mrs Jeanneth Manganyi (Occupational Hygiene), Dr Nisha Naicker (Epidemiology and Surveillance), Dr Odette Volmink (Occupational Medicine), Dr Nompumelelo Ndaba (Occupational Medicine), Dr Graham Chin (SHE Department), Mr David Jones (SHE Department), Mr Jay Hira (Finance), Dr Samantha Iyalloo (Occupational Medicine), Mrs Michelle Morgan (SHE Department), Mr Ashraf Ryklief (Information Services), Ms Angel Mzoneli (Information Services), Mrs Miranda Raaff (Communications and Marketing), Mr Thabane Zwane (Information Technology), Mr Vongani Mashele (Information Technology), Mr Monty Rambau (Information Technology), Mrs Zubaydah Kirsten (Immunology & Microbiology), Dr Nkululeko Thunzi (Workplace HIV TB Unit).



OCCUPATIONAL HEALTH SURVEILLANCE SYSTEM

13. OCCUPATIONAL HEALTH SURVEILLANCE SYSTEM

OHSS Manager: Dr Nisha Naicker

The OHSS was developed to collect occupational health data related to COVID-19 during the state of disaster. This project aims to design and implement digital COVID-19 surveillance platforms and/or tap into existing platforms (e.g. those already used by private sector employers) to collect screening, vulnerability testing, high-risk workplace contacts, health outcomes and return-to-work data for the surveillance system from the private and public working sector.

The specific objectives of data collection are as follows:

- Provide strategic insights through data analytics and visualisation into all phases (i.e. screening, testing, contact tracing within the workplace, vulnerable employees and return to work, including health outcomes) of the COVID-19 infection spectrum in the South African workforce.
- The early identification of industries, companies and occupational groups at high risk of infection so as to inform appropriate interventions (e.g. policy, programmatic and resource interventions).
- Understand the impact of COVID-19 interventions in workplaces.
- Develop a framework for a COVID-19 surveillance model for monitoring workers in general that includes both the public and private sectors.
- Determine the human resource and economic impact of COVID-19 on the various industrial sectors.
- Identify key scientific questions that require in-depth investigations.

The OHSS was initiated by the national DoH, the NIOH, the NICD, the CSIR, Business for South Africa and occupational medicine specialists from the University of Cape Town and the University of KwaZulu-Natal, together with several major private sector corporations. The OHSS was piloted in August to September 2020 and officially commenced on 1 October 2020, following the release of the DoEL's Consolidated COVID-19 Directive on Health and Safety in the Workplace – R639 on 28 September 2020.

GOVERNANCE

There is a legal framework guiding data acquisition, management and access. Within the context of the COVID-19 epidemic, the system is governed by the Disaster Management Act Regulations, broadly, and the subsequent directives have been issued by different government departments. In addition, several other Acts exist that provide guidance for data collection and protection for the general population, such as the Health Act. A summary table on specific data requirements and the legal framework governing the submission of de-identifiable and identifiable data can be found in the OHSS's charter document: https://www.nioh.ac.za/wp-content/uploads/2021/10/OHSS-CHARTER-DOCUMENT-version-10-Sept-2021.pdf

Specific governance structures within the OHSS ensure that all ethical requirements are met and that the quality of the data is maintained.





DATA COLLECTION

Data is collected from workplaces that employ over 50 employees on one of three online platforms (API, CSV via NEXTCLOUD or the CMORE application). Employers with fewer than 50 employees are still able to submit data voluntarily.

The following data is being collected:

- Vulnerability information on all employees, which is a once-off submission
- Symptoms from symptomatic employees, which are submitted on the OHSS weekly
- Data of COVID-19 positive employees on testing and high-risk contacts submitted weekly as required .
- Health outcomes and return to work of COVID-19 positive employees.

This is an evolving project as the government directives are updated. Data in the data lake are anonymised and any identifying information removed after a period of six weeks. All OHSS data collected by the NIOH is securely stored and processed in the NIOH's data centre. All systems used for data collection, storage and processes are assessed on a regular basis (every month) for any security vulnerabilities.

FUNDING

The CSIR and the NIOH have developed and maintained the system with the support of occupational medicine specialists, the national DoH and the private sector.

In March 2021, the OHSS received a donation of R2.5 million from the Ford Motor Company of South Africa. This has enabled the OHSS to obtain the necessary human and infrastructure resources required (see Figure 11)



Ford donates R2.5 million to the NIOH to bolster the COVID-19 surveillance system



Image 1-2: Dr Kgalamono (the NIOH's Executive Director) at the Ford Motor Company's media breakfast accepting the donation.





RESULTS FROM 1 OCTOBER 2020 TO 31 MARCH 2021

Business registrations

For the six-month period (1 October 2020 to 31 March 2021), 3 111 businesses had registered. During this period, 1 829 897 employees were recorded, representing 12.2% of formal sector employees (see figures 12 and 13). Most workplaces registered are located in Gauteng (46%), the Western Cape (22%) and KwaZulu-Natal (14%), which represent the provinces where industries are concentrated.



Figure 12: Industry distribution of registered businesses (59% of all registrations; the remaining industries not shown in the graph were less than 1% each).



Figure 13: Provinces where these businesses are located (NC: Northern Cape; NW: North West; FS: Free State; LP: Limpopo; MP: Mpumalanga: EC: Eastern Cape; KZN: KwaZulu-Natal; WC: Western Cape; GP: Gauteng).



Symptoms

Approximately 201 businesses (6.5%) submitted data on symptomatic employees during this period. The most common symptoms included a cough and sore throat (9% each), followed by anosmia and tiredness (7% each), see Figure 14 below.







Figure 15: Number of reported COVID-19-positive employees by epidemiological month in South Africa (1 October 2020 to 31 March 2021).

During the period under review, 3 704 COVID-19 positive cases were reported (see Figure 15), with the majority of cases from Gauteng (48.2%), followed by the Western Cape (18.6%) and KwaZulu-Natal (12.4%). Industrial sectors reporting the largest number of cases included the banking and insurance sector (57.0%) followed by the health and social sector (27.3%). The majority of COVID-19-positive workers were employed as clerical support workers (30%).

Among those with COVID-19, 2 617 (70.6%) had returned to work. Only 38 (1.5%) deaths were reported and 195 (7.5%) employees had been hospitalised. Further data from the OHSS is available on the dynamic online dashboard.

However, this data is dependent on employers reporting the legally required information. Failure of businesses to register and report their data, as well as the lack of denominator data for businesses and employees per sector, has resulted in reporting bias. The data presented does not represent the true disease burden experienced by workers in the country. However, it does



give some insight into patterns of distribution of the pandemic among industries affected since there are no studies reported for the country to date.

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NICD: Mr F Mckenna, Dr N Mayat

National DoH: Dr B Kistnasamy

DoEL: Dr L Magubane, Mr T Szana

Academic experts: Prof M Jeebhay (University of Cape Town) and Prof R Naidoo (University of KwaZulu-Natal)

Business partners: Business for South Africa, First National Bank, Ford Motor Company, Accenture, Weber Wentzel







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OTHER PUBLICATIONS (COVID-19 SCIENTIFIC REPORTS)

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Gulumian, M., Andraos, C. NIOH partner annual financial report for the EU-funded project, NanosolveIT (26 April 2020).

- Gulumian, M., Andraos, C. Gov4Nano NIOH partner technical report: "An 18-Months report on meeting the needs of nanotechnology" for the period 1 January 2019-30 June 2020 (which involves the implementation of risk governance for nanotechnology).
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- Gulumian, M., Andraos, C. OECD technical report: "Compilation of information on the ability of biopersistent/biodurable manufactured nanomaterials (MNs) to induce lysosomal membrane permeabilization (LMP) as a prediction of their long-term toxic effects".
- Gulumian, M., Andraos, C. ISO technical report: "Nanotechnologies: Lung burden measurement of nanomaterials for inhalation toxicity studies".
- Gulumian, M. OECD Review reports: Advancing adverse outcome pathway (AOP) development for nanomaterial risk assessment and categorisation Part 1 (Draft final report); Part 2 (Case study demonstration of nanomaterial key event investigation and literature review); Part 3 (Project advancing adverse outcome pathway (AOP) development for nanomaterial risk assessment and categorisation).

Gulumian, M., Andraos, C. Gov4Nano NIOH partner biannual progress report for the EU-funded project (30 January 2021).

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- Fourie, A., Muvhali, M., Singh, T., Willson, K., Kootbodien, T., Naicker, N. Annual occupational skin disease surveillance report: 2019. Report No. IM 011/20-21. Draft submitted.
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National COVID-19 wastewater surveillance pilot

The Waterborne Pathogen Laboratory participated in a project titled "Establishment of a national COVID-19 wastewater surveillance pilot" in collaboration with the NICD's partnership with the WRC of South Africa. The project is an initiative of the SACCESS Network, which involves other public and private institutions in the country and will run from 1 February 2021 until 31 August 2021. Under this project, the Immunology and Microbiology Section will collect untreated wastewater samples from three WWTPs managed by the City of Tshwane Municipality. The samples will be analysed for the presence or absence of SARS-CoV-2. Findings from this project will be used for detecting and tracking COVID-19 trends in communities serviced by sampled WWTPs as a low-cost surveillance and early-warning tool to help public health officials better understand the extent of COVID-19 infections in specific communities.



BOOK CHAPTERS

- Gulumian, M., Botha, T.L., Wepenar, V. 2020. Information Resources in Toxicology, Chapter 34, in Gilbert et al. (eds), Volume 2: The Global Arena. Elsevier Publishers. Pp 461-470.
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CONFERENCE PRESENTATIONS: ORAL PRESENTATIONS NATIONAL

- Duba T, L Muleba L, O Matuka O, D Glazer D, Z Ngcobo Z, E Ratshikhopha E, T van Reenen T, Z Masuku Z, Z Kirsten Z, D Singo D, L Ntlailane L, T Nthoke T, D Jones D, M Ross M, du Toit P. Validation of three decontamination methods for respirators used in South Africa to address stock shortages during the COVID-19 Pandemic. Biennial Research Day, National Institute for Occupational Health, 19 November, Online.
- Kootboodien, T. Health care access prior to suicidal behaviour in Cape Town, South Africa. 14th Annual SA MRC Early Career Scientist Convention, 28–29 October 2020.
- Magogotya, M. Intracellular uptake and toxicity of gold (AuNPs) in representative cell lines. Biennial Research Day, National Institute for Occupational Health, 19 November, Online.
- Matatiele, P., Dabula, B., Southon, B., Poongavanum, P., Kgarebe, B. Do the various hand sanitizers used in Johannesburg, South Africa, during the COVID-19 pandemic contain the recommended concentration and quality of alcohol? Biennial Research Day, National Institute for Occupational Health, 19 November, Online.
- Mdleleni, S., Wilson, K., Kootbodien, T., Ntlebi, V., Made, F., Tlotleng, N., Naicker, N. Risk factors for problematic alcohol use among male waste pickers and caddies in Johannesburg, South Africa: A cross-sectional study. Biennial Research Day, National Institute for Occupational Health, 19 November, Online.
- Mokone, M. Occupational hygiene within a government subsidiary. Occupational Health and Safety (Physical) II 2021 Miniconference, Tshwane University of Technology, 17 March 2021.
- Muleba, L., Van Wyk, R., Pienaar, J., Ratshikhopha, E., Singh, T. Assessment of anti-bacterial effectiveness of hand sanitisers commonly used in South Africa. Biennial Research Day, National Institute for Occupational Health, 19 November, Online.
- Ndaba, N. Principles of biological monitoring in the workplace. The South African Institute for Occupational Hygienist's Virtual Conference Webinar, South Africa, 10-24 November 2020.
- Ngcobo, Z., Matuka, D., Duba, T., Muleba, L., Nthoke, T., Made, F., Mazibuko, L., Singh, T. The status of infection control measures in healthcare facilities in South Africa. Biennial Research Day, National Institute for Occupational Health, 19 November, Online.
- Sanabria, N., Tastan-Bishop, O. MD simulations: Occupational relevance and COVID-19 precautions. Biennial Research Day, National Institute for Occupational Health, 19 November, Online.
- Tlotleng, N., Naicker, N. Association between bone lead levels and aggression in the birth to twenty plus cohort. Biennial Research Day, National Institute for Occupational Health, 19 November, Online.
- Wilson, K.S., Tlotleng, N., Made, F., Ntlebi, V., Kootbodien, T., Naicker, N. Male and female waste pickers on landfills in Johannesburg, South Africa: Divergence in health, socioeconomic status and chronic diseases. Biennial Research Day, National Institute for Occupational Health, 19 November, Online.



CONFERENCE PRESENTATIONS: POSTER PRESENTATIONS INTERNATIONAL

- Masekameni, D.M., Sethowa, J.T., Gulumian, M. Characterisation of particle size distribution and number concentration of nanoobjects generated during synthesis of silver and gold nanoparticles. SOT Virtual Meeting, 12-26 March 2021.
- Mbanga, O., Cukrowska, E., Gulumian, M. Dissolution of citrate stabilised, polyethylene glycol coated, carboxyl and amine functionalised gold nanoparticles in simulated biological fluids and environmental media. SOT Virtual Meeting, 12-26 March 2021.
- Sanabria, N.M., Tastan-Bishop, O. MD simulations and potential risks using chloroquine/ hydroxychloroquine-based treatments. LabRoots Clinical Diagnostics Research virtual conference, 12 November 2020.

CONFERENCE PRESENTATIONS: POSTER PRESENTATIONS NATIONAL

- Andraos, C. Basic methodologies for human health risk assessment based on data from the Phongolo case-study. Virtual Workshop on Principles and Methods for the Risk Assessment of Chemical in Food, 26-29 January 2021.
- Gulumian, M. The principles and methods of risk assessment. Virtual Workshop on Principles and Methods for the Risk Assessment of Chemical in Food, 26-29 January 2021.
- Jambo, D., Gomba, A., Singh, T. Assessing the presence of SARS-CoV-2 in wastewater and potential health risks to wastewater workers. Biennial Research Day, National Institute for Occupational Health, 19 November 2020, Online.
- Manamela, L., Moremi, S., Mawela, A., Mulaudzi, A., Sethosa, F., Poongavanum, P., Kgarebe, B. Analytical services external quality assurance assessment: A snap-shot of current performance. Biennial Research Day, National Institute for Occupational Health, 19 November 2020, Online.
- Marageni, T., Dabula, B., Southon, B., Matatiele, P., Poongavanum, P., Kgarebe, B. Method for the detection of trichloroacetic acid in urine using UV-VIS Spectrophotometery. Biennial Research Day, National Institute for Occupational Health, 19 November 2020, Online.
- Mdleleni, S., Page, N., Groome, M. Aetiology and pathogen-specific factors for diarrhoea among children <5 years old. Wits Faculty of Health Research Day, 15 October 2020.
- Muleba, L, Van Wyk, R., Pienaar, J., Ratshikhopha, E., Singh, T. Assessment of anti-bacterial effectiveness of hand sanitisers commonly used in South Africa. Biennial Research Day, National Institute for Occupational Health, 19 November 2020, Online.
- Singh, L., Gomba, A., Singh, T. Health risk assessment in occupational settings during non-potable use of harvested rainwater. Biennial Research Day, National Institute for Occupational Health, 19 November 2020, Online.
- Thobela, M., Duma, B. Study of the stability of the human carbohydrate antigen 19-9 stored at predefined storage conditions in the NHLS biobank using molecular techniques. Biennial Research Day, National Institute for Occupational Health, 19 November 2020, Online.



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NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

Division of the National Health Laboratory Servic



25 Hospital Street, Constitution Hill Johannesburg 2000, South Africa

PO Box 4788, Johannesburg, South Africa, 2000

Tel: (011) 712 6400

Fax: (011) 712 6523

www.nhls.ac.za

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