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Division of the National Health Laboratory Service

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MESSAGE FROM THE CHIEF EDITOR

Seasons' greetings and best wishes for 2021. May it be a safe, healthy and wonderfully uplifting year, one in which we find purpose and meaning and delight in productivity. Over the past few months, many people have been deeply affected by grief, loss and illness and we think of them at this time. As CO-VID-19 infection numbers are increasing at an alarming rate daily, let us all take heed and respond positively to our President's call to be safe and follow all health and safety protocols in place to minimize the spread of the virus. The current situation demands of us to pay attention to the ongoing and menacing health and safety threats associated with the pandemic and to observe health and safety protocols.

The year ahead promises to be another busy one at the NIOH, with so much that we hope to offer to ensure that workers and workplaces are well prepared in keeping healthy and safe. As we continue to work together to address the various occupational health challenges, we share with you the various activities the institute carried out in the previous quarter, some of which were collaborative efforts with various stakeholders. In this edition we recount our research activities with a special focus on the Institute's biennial Research Day hosted in November 2020 and showcase the scientific publications produced by our researchers during this period. We also profile one of our emerging researchers, a Medical Scientist at the NIOH's Pathology Division.

As part of surveillance of occupational exposures and health outcomes which is an essential function of the NIOH, this edition looks at the impact of COVID-19 lockdown measures on the informal economy. In addition, we highlight some of the highly specialized occupational health and safety services that the NIOH offers. Lastly, we showcase the numerous COVID-19 themed training sessions conducted for various industries in both formal and informal economies.

With so much uncertainty still impacting our lives, we can take some comfort from the fact that we are in control of our thoughts and how best to manage our thinking in ways that will prepare, strengthen, uplift and empower us each day and for what lies ahead. As our President said "We need to act with a common purpose, understanding that what we each do is important for ourselves, our families, our communities and our society". Importantly, stay safe and take care of yourselves and those around you.

Thank you for your continued support and to all who contributed to this edition and best wishes for 2021.

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Editor in Chief Angel Mzoneli

Message from the Research Committee Chair

As you begin your journey for 2021, the research team at NIOH wishes you a safe and productive year. May you continue to defy all odds, take advantage of the innumerable opportunities and champion ahead so that your efforts turn into great achievements. The world will continue to leach the knowledge and experience that you bring as it adapts and improves from lessons learned to ensure workplaces are healthier and safer for all. The new year has brought us another opportunity to set things right and get things done. Be it the proposal that needs to be finalised, the manuscript that needs to be submitted, or the policy that needs to be signed off. Procrastination is not just the thief of time but that of opportunities. So do not let a minute slip by; seize the moment and get it done.

Occupational diseases have a significant impact on the economy and sustainability of many businesses, and COVID-19 is a typical example globally. Worldwide the costs of work-related health issues are an estimated 4% of global GDP, and the burden is likely to be considerably higher as we know that many diseases are under-recognised, under-diagnosed and under-reported. Furthermore, the numbers are mostly unknown in the informal economy, which is essentially the forgotten majority. Therefore, it is evident that we cannot continue to do the same things if we wish for different results. Thus, we need to rethink our research strategy with the end goal in mind. There is also a need to develop systems that can collect and integrate occupational health data as it is not included in routine data collection, thus inhibits necessary research and prevents investigation of potentially important occupational risks. While new opportunities present itself by the rapid developments in science, the challenge is to use such innovations to effectively improve worker health.

While self-initiated projects are great and add value, we certainly need to promote bigger umbrella projects to identify the gaps and trends at a larger scale to have a more significant impact. However, a grave issue facing occupational health research is the lack of funding; hence a collective and strategic approach is critical for future research endeavours. The NIOH will be exploring new initiatives to better understand the country's occupational health research needs and challenges, with a view of reducing the burden of occupational diseases. The first of these activities for 2021 is an online survey to gather information of current occupational health research and new research topics that require investigation. However, we will need your help to achieve this and thus will be sharing the survey link in due course. We really value your inputs and do hope you give this some thought and find some time to complete the survey. The results of the survey will be communicated in a subsequent edition. Once again, thank you for your ardent support, and we're excited in anticipation of the new opportunities, and we wish you every success for 2021.

Dr Tanusha Singh

RESEARCH FOCUS

This edition provides a synopsis of the Institute's biennial Research Day hosted on the 19th November 2020 via the Zoom platform, which attracted 193 participants. NIOH's research covers a range of study areas, including exposure assessments, workplace interventions and occupational epidemiology spanning both the formal and informal economy and across many sectors and industries. However, the event was an opportunity for some researchers to present their current research and share new knowledge that could improve workers' health. A few abstracts were selected of the many research studies to profile our researchers and showcase what we do as a multidisciplinary institute and provide complementary insights to the evidence-base, and its application to practice and policy and is also an opportunity to foster further collaborations.

We were fortunate to have four distinguished keynote speakers that shared expertise and experience of key research issues. Mr Ben Durham from the Department of Science and Innovation (DSI) spoke about "Innovation and the National System", whilst emphasising the importance of collaboration and partnership in innovation. Mr Ehi Iden, president of the Occupational Safety and Health Africa (OS-HAfrica) Foundation, spoke on the challenges and opportunities for occupational health research in Africa, highlighting the importance of collaboration and coordination on the continent. Lastly, Prof Richard Gordon from the South African Medical Research Council (SAMRC) presented the SAMRC grant funding scope, processes, and possible occupational health research opportunities, which could be strengthened by lobbying interest groups. Oral and poster presentations by NIOH researchers gave an opportunity to showcase their work and answer questions posed by participants. The day concluded with the final keynote presentation by Prof Emeritus David Rees, who presented a systematic review of evidence on the association between silica exposure, silicosis and tuberculosis. We trust that the new knowledge shared will stimulate discussions and provide opportunities for future collaborations in Occupational Health research – ultimately to improve and protect workers' health and safety.

Oral Presentations

Nonhlanhla Tlotleng presented the association between bone lead levels and aggression in the Birth to Twenty Plus Cohort and showed that the bone lead levels were associated with the aggression score for anger. This information may help draft policies designed to combat crime associated with youth aggression in South Africa. **//Millicent Magogotya's** presentation was on the intracellular uptake and toxicity of gold nanoparticles (AuNPs) in representative cell lines. Her study showed that non-PEGylated AuNPs enter the cells better than their PEGylated counterparts; and that cytotoxic and non-cytotoxic AuNPs were genotoxic to the Caco-2 and HaCaT cells. / Thabang Duba presented on the validation of three decontamination methods for respirators used in South Africa to address stock shortages during the COVID-19 pandemic. His study's preliminary findings show that vapourised hydrogen peroxide (VHP) and ultraviolet germicidal irradiation (UVGI) do not appear to affect fit testing as nine of 19 participants for VHP and eight of 18 participants completed 30 cycles for UVGI. Instead, the donning and doffing of FFRs may contribute to fit failure. A study entitled 'male and female waste pickers on landfills in Johannesburg, South Africa: Divergence in health, socioeconomic status and chronic diseases' was presented by Kerry Wilson. Her study concluded that women waste pickers suffer worse health outcomes than male waste pickers for lifestyle diseases and HIV infection. However, further research is needed to confirm this and identify the factors involved. Responsive programmes supporting health care, improved working conditions and income for waste pickers may also improve their health. **Zethembiso Ngcobo** presented on the status of infection control measures in healthcare facilities in South Africa. Based on the evidence gathered from this study, 100% compliance with infection prevention and control measures has not been achieved across all four infection control measures. **Natasha Sanabria** presented on the Molecular Dynamic (MD) simulations of G6PD and potential risks using chloroquine (CQ)/hydroxychloroquine (HCQ)-based treatments. The results obtained in this study are important because CQ/HCQ have been proposed as potential treatments for COVID-19, where physicians should be alerted to a possible correlation between infection and countries with a high prevalence of G6PD deficiency.

The findings recently reported by previous research showed significant G6PD sequence variation in sub-Saharan Africa, with large allele frequency differences between sub-populations in South Africa. It suggested that G6PD gene variations could affect the risk of adverse effects of CQ/HCQ based treatments and be a significant interaction factor for COVID-19 clinical trials in Africans.

/Simbulele Mdleleni presented a study on the risk factors for problematic alcohol use among male waste pickers and caddies in Johannesburg, South Africa (a cross-sectional study). The study found that problematic alcohol use was associated with caddying, mental distress, age and smoking. Providing counseling services to informal workers and improving working conditions may help change these vulnerable groups' behaviors. **/Puleng Matatiele** presented a study entitled "Do the various hand sanitizers used in the Johannesburg area, during the COVID-19 pandemic contain the recommended concentration and quality of alcohol?" While many (56%) brands of hand sanitizer found around Johannesburg contain the recommended alcohol concentration, there are also many (44%) substandard preparations. Some sanitizers contain toxic ingredients; hence, it is recommended that all consumers be aware of untrustworthy brands of hand sanitizer. The use of hand sanitizer with no virucidal activity may give a false sense of security, while people using sanitizers containing toxic ingredients will likely suffer from the associated risks.

Poster Presentations

/Don Jambo's presentation was on assessing the presence SARS-CoV-2 in wastewater and potential health risks to wastewater workers. Although no definite conclusions can be drawn yet, other studies have reported similar untreated wastewater results but not in treated effluents. Important to note is that RNA detection does not imply infectivity. Infectivity is yet to be determined as part of this project. SARS-CoV-2 RNA was easier to detect from the solid portion than the aqueous portion of the primary and activated sludge samples clarified through centrifugation. Going forward, it is recommended to test for the viral signal both in the solid and aqueous portions of the wastewater samples to avoid under-or over-estimation of risks. **/Lerato Manamela** presented on the Analytical Services external quality assurance assessment. From this assessment, she concluded that the AS laboratory has an overall satisfactory performance and maintains accreditation under ISO 15189:2012.

/Larissa Singh presented a proposal on the health risk assessment in occupational settings during non-potable harvested rainwater use. Studies in South Africa have looked at the pathogens present in HRW, but there are no studies on RW's health risks during non-potable use in occupational settings. With the increasing demand for alternative water sources, research focusing on the human health risks of RW is critical to ensure the safe use of water for non-potable purposes in occupational settings. A better understanding and increased awareness of occupational health risks can help management minimise exposure and protect workers' health. Her findings will inform policy and decision making on the appropriate PPE for workers conducting various activities at RW use sites. Another water-related study was presented by **Talulani Marageni** and is entitled "Method for the detection of trichloroacetic acid (TCA) in urine using UV-VIS spectrophotometer". Based on the acceptable R values, SDI, excellent precision, and average recovery, this method is deemed suitable for TCA's routine analysis.

/Lufuno Muleba presented on an assessment of anti-bacterial effectiveness of hand sanitisers commonly used in South Africa. This study showed that only a fifth of hand sanitisers were effective against selected microorganisms. Further investigations into labelling claims are warranted as those claiming 99.9% effectiveness only inactivated one of the five microorganisms commonly reported in HAIs. Lastly, Mandile Thobela presented a study of the stability of the Human Carbohydrate Antigen 19-9 stored at predefined storage conditions in the NHLS Biobank, using molecular techniques. The establishment of sound QC procedures will be instrumental in providing samples and data that are of high quality and fit for purpose. Adherence to international best practices and internationally accepted procedures, standardisation and quality control, will enable the NHLS biobank to exchange biological samples and associated data between or among institutes, thereby building research capacity.

If you've missed the presentations they can be accessed and viewed at the following link: https://www.nioh.ac.za/research-day-poster-session/.

NB: Whilst permission was obtained from most presenters, unfortunately, some declined to share due to preliminary data and their results not having been published as yet.

PUBLICATIONS

Title: Intracellular and extracellular targets as mechanisms of cancer therapy by nanomaterials in relation to their physicochemical properties Author(s): C Andraos and M Gulumian Source: Nanomed Nanobiotechnol. 2020; e1680

Summary: Cancer nanomedicine has evolved in recent years and is only expected to increase due to the ease with which nanomaterials (NMs) may be manipulated to the advantage of the cancer patient. The success of nanomedicine is dependent on the cell death mechanism, which in turn is dependent on the organelle initially targeted. The success of cancer nanomedicine is also dependent on other cellular mechanisms such as the induction of autophagy dysfunction, manipulation of the

tumor microenvironment (TME) and secretome or induction of host immune responses. Current cancer phototherapies for example, photothermal- or photodynamic therapies as well as radio enhancement also form a major part of cancer nanomedicine. In general, cancer nanomedicine may be grouped into those NMs exhibiting inherent anti-cancer properties that is, self-therapeutic NMs (Group 1), NMs leading to localization of phototherapies or radio-enhancement (Group 2), and NMs as nanocarriers in the absence or presence of external radiation (Group 3). The recent advances of these three groups, together with their advantages and disadvantages as well as their cellular mechanisms and ultimate outcomes are summarized in this review. By exploiting these different intracellular mechanisms involved in initiating cell death pathways, it is possible to synthesize NMs that may have the desirable characteristics to maximize their efficacy in cancer therapy. Therefore, a summary of these important physicochemical characteristics is also presented that need to be considered for optimal cancer cell targeting and initiation of mechanisms that will lead to cancerous cell death.

Title: Treatment outcomes and costs of a simplified antiviral treatment strategy for hepatitis C among monoinfected and HIV and/or hepatitis B virus-co-infected patients in Myanmar

Author(s): YM Thaung, CS Chasela, KW Chew, T Minior, AA Lwin, YY Sein, N. Drame, F Marange, C van der Horst, HT Thwin, MJ Freiman, MM Gandhi, M Bijl, CW Kinge, S Rosen, S Thura, S Mohamed, T Xulu, AY Naing, M Barralon, C Cavenaugh, KP Kyi, I Sanne Source: Journal of Viral Hepatitis, 2020: 1–12.

Summary: Access to hepatitis C virus (HCV) testing and treatment is limited in Myanmar. We assessed an integrated HIV and viral hepatitis testing and HCV treatment strategy. Sofosbuvir/velpatasvir (SOF/VEL) ± weight-based ribavirin for

12 weeks was provided at three treatment sites in Myanmar and sustained virologic response (SVR) assessed at 12 weeks after treatment. Participants co-infected with HBV were treated concurrently with tenofovir. Cost estimates in 2018 USD were made at Yangon and Mandalay using standard microcosting methods. 803 participants initiated SOF/VEL; 4.8% were lost to follow-up. SVR was achieved in 680/803 (84.6%) by intention-t-treat analysis. SVR amongst people who inject drugs (PWID) was 79.7% (381/497), but 92.5% among PWID on opioid substitution therapy (OST) (74/80), and 97.4% among non-PWID (298/306). Utilizing data from 492 participants, of whom 93% achieved SVR, the estimated average cost of treatment per patient initiated was \$1030 (of which 54% were medication costs), with a production cost per successful outcome (SVR) of \$1109 and real-world estimate of \$1250. High SVR rates were achieved for non-PWID and PWID on OST. However, the estimated average cost of the intervention (under the assumption of no genotype testing and reduced real-world effectiveness) of \$1250/patient is unaffordable for a national elimination strategy. Reductions in the cost of antivirals and linkage to social and behavioural health services including substance use disorder treatment to increase retention and adherence to treatment are critical to HCV elimination in this population.



Title: Even lobar deposition of poorly soluble gold nanoparticles (AuNPs) is similar to that of soluble silver nanoparticles (AgNPs)

Author(s): HP Kim, J Kwon Kim, MS Jo, JD Park, K. Ahn, **M Gulumian**, G Oberdörster and IJ Yu Source: Particle and Fibre Toxicology, 2020, 17: 54

Summary: Information on particle deposition, retention, and clearance is important when evaluating the risk of inhaled nanomaterials to human health. The revised Organization Economic Cooperation and Development (OECD) inhalation toxicity test guidelines now require lung burden measurements of nanomaterials after rodent subacute and sub-chronic inhalation exposure (OECD 412, OECD 413) to inform on lung clearance behavior and translocation after exposure and

during post-exposure observation (PEO). Lung burden measurements are particularly relevant when the testing chemical is a solid poorly soluble nanomaterial. Previously, the current authors showed that total retained lung burden of inhaled soluble silver nanoparticles (AgNPs) could be effectively measured using any individual lung lobe. Accordingly, the current study investigated the evenness of deposition/retention of poorly soluble gold nanoparticles (AuNPs) after 1 and 5days of inhalation exposure. Rats were exposed nose-only for 1 or 5days (6h/day) to an aerosol of 11nm well-dispersed AuNPs. Thereafter, the five lung lobes were separated and the gold concentrations measured using an inductively coupled plasma-mass spectrophotometer (ICP-MS). The results showed no statistically significant difference in the AuNP deposition/retention among the different lung lobes in terms of the gold mass per gram of lung tissue. Thus, it would seem that any rat lung lobe can be used for the lung burden analysis after short or long-term NP inhalation, while the other lobes can be used for collecting and analyzing the bronchoalveolar lavage fluid (BALF) and for the histopathological analysis. Therefore, combining the lung burden measurement, histopathological tissue preparation, and BALF assay from one rat can minimize the number of animals used and maximize the number of endpoints measured.

Title: Usefulness of component-resolved diagnosis in a suspected occupational allergy case

Author(s): N Ndaba, O Volmink, M Muvhali, E Ratshikhopha, T Singh Source: Current Allergy & Clinical Immunology, 2020, 33(3)

Summary: A 37-year-old woman with suspected occupational allergies was referred to the National Institute for Occupational Health with results from an array of tests performed using the IgE ImmunoCAP and ISAC tests. Component-resolved diagnosis testing showed a combination of species-specific and cross-reacting sensitisation. Analyses of these results showed that she was sensitised to common environmental allergens; occupational allergies could not be diagnosed.



Title: The toxicity of respirable South African mine tailings dust in relation to their physicochemical properties Author(s): C Andraos and M Gulumian

Source: Inhalation Toxicology, DOI: 10.1080/08958378.2020.1836092

Summary: Decades of mining in South Africa has given rise to hundreds of tailings storage facilities (TSFs) and several tonnes of waste. These TSFs have contributed to air pollution due to the lack of proper rehabilitation measures. Currently, it is not known whether tailings emissions could be the cause of respiratory-related ill effects. In addition, the physicochemical properties that may govern their toxicity have not yet been identified. The aim of this research was to determine the toxicity

of tailings dust and identify the physicochemical properties likely to govern toxicity. Dust samples were collected from five TSFs in the Gauteng and North West Provinces of South Africa and sieved to enrich the airborne particle fraction more likely to be inhaled. Thereafter, their physicochemical characteristics were assessed i.e. size distribution, specific surface area, shape, surface elemental composition, mineral composition, total elemental composition and surface activity. In addition, the toxicity and cellular internalization of the particles were assessed using the BEAS-2B epithelial and U937 monocytic-macrophage cell lines. The results showed that all tailings dusts showed toxicity, particularly in the BEAS-2B cell line. This toxicity could have been governed by either their elemental composition, e.g. high transition elements e.g. Fe, Cu, Cr and V in the dusts from TSF 4, or a combination of other physicochemical properties, e.g. higher quartz content, lower size and higher surface area in the dusts from TSF 1. These results provide mechanistic evidence to support future epidemiological studies attempting to link tailings dust exposure to adverse health effects.

Title: An investigation of maternal anaemia among HIV infected pregnant women on antiretroviral treatment in Johannesburg, South Africa Author(s): J. Methazia, EL Ngamasana, W. Utembe, M. Ogunrombi, P. Nyasulu Source: Pan African Medical Journal. 2020; 37(93). 10.11604/pamj.2020.37.93.22244

Summary: Maternal anaemia is a major public health problem in developing countries. Data suggests that anaemia contributes to the progression of Human Immunodeficiency Virus (HIV)-infection. The aim of this study was to investigate if pregnancy was an aggravating factor for anaemia among HIV-positive women on antiretroviral treatment (ART).

Methods: *W*e analyzed data of all HIV-positive women aged 18-49 years receiving ART at Themba Lethu Clinic, Helen Joseph Hospital, Johannesburg, South Africa, from 1st April 2004-30t hApril 2011. HIV-positive pregnant women were matched with non-pregnant women using the year of initiation of treatment. The outcome of interest 'anaemia' was defined as "no anaemia", "anaemia" and "moderate/severe anaemia". We fitted an ordered logistic regression model to predict the likelihood of having severe/moderate anaemia versus no anaemia. We included pregnancy status as a predictor of the outcome and controlled the effect of other covariates in the analysis.

Results: The study included 236 HIV positive patients, of which half (n=118, 50%) were pregnant. At baseline, about (n=143, 60%) of patients were anaemic. The proportion of pregnant women classified as anaemic (anaemia, moderate/severe) differed significantly (p=0.02) from that of non-pregnant women. The following characteristics were significantly associated with anaemia at baseline: Body mass index (BMI) category (p=0.01); World Health Organization (WHO) stage (p=0.001) and CD4 count (p=0.001). Seven months after initiation of treatment, the proportion of HIV positive women with anaemia decreased significantly.

Conclusion: Anaemia is a significant risk factor for untoward health outcomes, especially among HIVpositive pregnant women. Early ART access might result in a significant decrease in anaemia in pregnancy.

Keywords: Anaemia, HIV, pregnancy, ART, Themba Lethu Clinic, Johannesburg

Title: Can an InChI for Nano Address the Need for a Simplified Representation of Complex Nanomaterials across Experimental and Nanoinformatics Studies?

Author(s): I. Lynch, A. Afantitis, T. Exner, M. Himly, V. Lobaskin, P. Doganis, D. Maier, N. Sanabria et al. Source: Nanomaterials 2020, 10, 2493; doi:10.3390/nano10122493

Summary: Chemoinformatics has developed efficient ways of representing chemical structures for small molecules as simple text strings, simplified molecular-input line entry system (SMILES) and the IUPAC International Chemical Identifier (InChI), which are machine-readable. In particular, InChIs have been extended to encode formalized representations of mixtures and reactions, and work is ongoing

to represent polymers and other macromolecules in this way. The next frontier is encoding the multicomponent structures of nanomaterials (NMs) in a machine readable format to enable linking of databases for nanoinformatics and regulatory applications.

A workshop organised by the H2020 research infrastructure NanoCommons and the nanoinformatics project NanoSolveIT analysed issues involved in developing InChI for NMS (NInChI).

The layers needed to capture NM structures unbclude but are not limited to: core composition (possibly multi-layered); surface topography; surface coatings or finctionalization; doping with other chemicals; and representation of impurities.

NM distributions (size, shape, composition, surface properties, etc.), types of chemical linkages connecting surface functionalization and coating molecules to the core, and various crystallographic forms exhibited by NMs also need to be considered. Six case studies were conducted to elucidate requirements for unambiguous description of NMs. The suggested NInChI layers are intended to stimulate further analysis that will lead to the first version of a "nano" extension to the InChI standard. **Keywords:** molecular structure; machine-readable; nanomaterials descriptors; core; surface; surface functionalization; complex nanostructures



IN THE SPOTLIGHT

Ntebogeng Kgokong, Medical Scientist in the Pathology Section

Why did you choose this career and research path?

I think the career chose me. My entire family are all health workers, so I have always known I'd be in the medical/health fraternity. I also enjoyed doing research in my undergrad, so being a medical scientist just seemed the natural route to go.

What training and qualifications did you undergo and where?

I have a BSc. Hons degree from the University of the Witwatersrand and am in the process of submitting my MSc(Med) also at the University of the Witwatersrand.

What are the most enjoyable aspects of doing research?

The most enjoyable aspects of doing research are discovering new information and the contribution of learning new things and finding new information that you had not thought about. Gaining a new perspective on your job is always refreshing. I chose this field of research as it has not been explored as much as miners in the gold mining industry within the department. It has been seen as one of the smaller commodities, but researching all aspects helps to give more insight into things you have not thought about or realized. To me, the miners are not just numbers in my Pathaut reports; they are people who lived, people who had families that loved and depended on them.

What are your research highlights to date?

Being an entry scientist, I have presented at multiple fora in my career and have two published articles (third one in press); I also author the annual surveillance Pathaut report.

What are your career goals?

I'd love to see myself making positive contributions to the scientific community. To become a rated researcher within my field and assisting miners' families in the small way I can.

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Surveillance



Occupational health surveillance data provides vital information on the prevalence of occupationally related diseases and injuries. It allows trends to be determined and prevention programmes to be monitored and evaluated. Thus surveillance of occupational exposures and health outcomes is an essential function of the NIOH. In this issue we look at the impact lockdown measures had on informal employment.

COVID-19, LOCKDOWN MEASURES AND INFORMAL EMPLOYMENT IN SOUTH AFRICA

Tahira Kootbodien, Nonhlanhla Tlotleng, Nisha Naicker

Introduction

At the end of November 2020, the number of COVID-19 infections had exceeded 790,000 cases in South Africa, with the death toll nearing 22,000 deaths (1). Across the globe, full or partial lockdown measures implemented to prevent the spread of the virus, have impacted low-wage and informal workers, with women disproportionately affected (2). With rising unemployment and poverty, increasing numbers of women look to the informal economy to sustain their families and households (3). Due to the precarious nature of informal work, individuals earn less, have less savings and are vulnerable because of inadequate access to health care services, social protection and infrastructure (4). In addition, disparities exist between men and women doing the same job within the informal sector - with men earning more than women (5).

Interviews conducted by WIEGO across Africa, Asia and North America between 23 March and 8 April 2020 revealed that several groups of informal workers, including domestic workers, street vendors, market traders and waste pickers have been affected by the pandemic (6). The first impact of the pandemic felt by informal workers during the lockdown period were through public health measures that prevented them from working. Informal workers noted substantial income loss compared to other workers. Most were also not provided with compensation like formal workers. Restriction of movement and social isolation measures have also increased the threat of violence on women increasing their vulnerability (2). In this brief report we aimed to describe changes in the labour market focusing on informal economy due to lockdown measures from July 2019 to September 2020.

Methods

The Quarterly Labour Force Survey (QLFS) is a household-based survey, conducted by Statistics South Africa, that collects information on labour market activities of individuals aged 15 years and older (7). Computer Assisted Telephone Interviewing (CATI) was used instead of face-to-face interviews to conduct the survey during the 1st quarter (April to June 2020) and 2nd quarter (July to September 2020) data collection because of the COVID-19 pandemic. Informal employment is defined as all persons who are in precarious employment situations.

It includes all persons in the informal sector, and employees in the formal sector and employed in private households who are not entitled to basic benefits such as pension or medical aid and who do not have a written contract of employment. Unemployment rate is defined as the proportion of the labour force that is unemployed. We analysed data of all persons of working age, 15 to 64 years.

Results

Approximately 2.5 million people in South Africa work informally, which is approximately 18% of all those employed. The current unemployment rate is 30.8%, an increase of 7.5% from 23.3% in the previous quarter (2nd quarter - April to June 2020). Informal employment decreased from the 1st quarter (January to March 2020) to the 2nd quarter of this year as lockdown was implemented and then increased by 7.6% in the 3rd quarter (July to September 2020) as some restrictions lifted. However, unemployment rate remained higher for women than men.



*Figure 1 Unemployment rate, formal and informal employment from July 2019 to September 2020. Source: Quarterly Labour Force Surveys (Q3 2019 – Q3 2020), Statistics South Africa. * Other includes private households.*



Figure 3 Unemployment rate and number of informal workers by sex from July 2019 to September 2020. Source: Quarterly Labour Force Surveys (Q3 2019 – Q3 2020), Statistics South Africa.

Compared to formal workers, informal workers have lower levels of education and informal occupations include elementary occupations (31%), domestic work (17%), craft (17%) and service and sales work (16%).



Figure 3 Education status by formal and informal employment. Source: Quarterly Labour Force Surveys (Q3 2020), Statistics South Africa.



Figure 4 Main occupation groups by formal and informal employment.

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Summary

The adverse economic impact of the COVID-19 pandemic has had a wide-reaching effect on all South Africans, but especially women working in the informal economy. The Poverty and Shared Prosperity Report 2020 have estimated that COVID-19 is expected to push between 88 and 115 million people globally into extreme poverty (living below \$1.90 day or R29.14 a day) (8). Job losses and the high unemployment rate, are likely to push vulnerable South Africans below the food poverty line or extreme poverty (an individual living in South Africa on less than R585 per month).

The informal economy is expanding due to job losses related to the COVID-19 pandemic. Women working in the informal economy and their families, already living in poverty, remain the most vulnerable, and economically marginalised (9). As women take on greater unpaid care demands at home, women informal workers will find it more difficult to work. There is high uncertainty about the future regarding the pandemic. Workers in the informal economy are vulnerable to economic stress and are likely to suffer from the effects of COVID-19 pandemic unless inequalities can be addressed; in particular, gender impacts of the pandemic. With economic recovery expected to be slow and resurgence waves of COVID-19 already in the Eastern and Western Cape, the pandemic highlights the need to protect informal workers and target policies to safe guard their livelihoods.

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Specialized Service Delivery

The NIOH provides specialised, cost effective occupational health and safety services to national and provincial government departments, various industries and trade unions as well as support for occupational health and safety within the NHLS. In this issue we showcase some of the highly speciliased occupational health and safety service offerings available from the institute.

RESPIRATOR FIT TESTING - A SPECIALIZED OCCUPATIONAL HYGIENE SERVICE

Workers often use tight fitting respirators or masks to protect themselves from exposure to workplace inhalable hazards. Currently employees are issued with respirators, which are correct for the type of the hazard but not always fit tested to confirm proper face seal. It is important to conduct respirator fit testing in order to match users according to their facial characteristics with the correct size and style of a respirator. The NIOH Occupational Hygiene Section provides this specialized service in accordance with international best practice. The section also provides training on conducting respirator fit testing to workplace staff as part of capacity building ensuring continuity of this service in-house if a company wishes. For more information regarding respirator fit testing services, please contact Mrs Jeanneth Manganyi:

JeannethM@nioh.ac.za | 011 712 6406



ASPIRE LABORATORY (AEROGEN SCIENCE PROMOTING INNOVATIVE RESEARCH)

The ASPIRE Laboratory is the only lab in South Africa that provides microbial efficiency testing to achieve clean air changes in accordance with international standards. Airborne infections like tuberculosis (TB) is a public health problem that pose substantial risks to health workers and workers in other settings. Workplaces often use portable air cleaning devices as well as wall and ceilingmounted UVGI devices to clean or disinfect the air. Testing devices help test the proof of concept as well as determine the effectiveness of the technology. The performance of air cleaning device's capability of inactivating microorganisms is tested at the NIOH. For more information regarding this service contact the Bioaerosol Unit:

Dr Tanusha Singh TanushaS@nioh.ac.za | 011-712-6475

Ms D Matuka/Mr T Duba DikelediM@nioh.ac.za | 011-712-6459



ADVANCES AND INNOVATIONS IN ANALYTICAL SERVICES - KIT TECHNOLOGY

Analytical Services has introduced new methods for the detection of harmful solvents including benzene, toluene, ethyl benzene and xylene (BTEX), which are the most common solvents used in occupational settings. These chemicals are used in various industries such as mining, petro-chemical, glue, rubber, plastic, pathology services and others. The Kit Technology methods have been accredited by the South African National Accreditation System (SANAS) according to ISO 15189:2012. The methods have been deemed fit for purpose and routine use. The methods simultaneously detect the metabolites of the BTEX solvents resulting in a significant reduction of TATs and cost. The NIOH Analytical Services Section now offers a TAT of 5-7 working days on these analyses as compared to conventional methods that have TAT of up to 20 days. The innovative power of these kit methods lie in the ability to do multi-compound analyses with high sensitivity and selectivity.

For more information regarding Analytical Services, please contact Dr Boitumelo Kgarebe: BoitumeloK@nioh.ac.za | 011 712 6410



COMPLEXITIES AROUND OCCUPATIONAL ALLERGIES (OA)

Occupational exposures are responsible for approximately 9-25% of all adult onset asthma cases and allergic contact dermatitis (ACD) and represents approximately 20% of all work-related skin disorders. Many workers across almost every industrial sector are potentially exposed to agents that can cause allergic diseases such as asthma, ACD, urticarial, allergic rhinitis, hypersensitivity pneumonitis and folliculitis. The NIOH Immunology & Microbiology Section offers testing for both respiratory and skin allergens and many other commercial agents. The laboratory also tests certain workplace specific agents that the worker may be exposed to. Workers can develop different allergic reactions to different substances in the workplace. It is therefore important to ensure that possible mechanisms of action are identified and tested.

For more information regarding the services that the Occupational Allergy Unit provides, please contact:

Ms Anna Fourie (Occupational Allergy): 011 712 6424

Ms Edith Ratshikhopha (Respiratory Allergy): info@nioh.ac.za | 011 712 6538



OCCUPATIONAL HYGIENE EXPOSURE ASSESSMENT: ASSESSING OCCUPATIONAL HEALTH RISKS IN CORRECTIONAL CENTRES AND OTHER WORKPLACES

Some correctional officials and offenders at South Africa's 240 correctional centres are involved in performing various tasks that could expose them to occupational health hazards including physical, chemical, ergonomic and biological hazards. The Occupational Hygiene Section of the NIOH conducts qualitative risk assessment and quantitative exposure assessment in correctional centres and other workplaces such as laboratories, office environments and industrial manufacturing or production facilities. They focus on assessing risk and quantifying occupational exposure to health hazards associated with production activities, routine tasks and maintenance activities. This service also includes results interpretation and reporting for compliance purposes. The NIOH Occupational Hygiene Section is registered with the Department of Employment and Labour (AIA Certificate No. OH0079 - CI 042) and accredited by SANAS in accordance with ISO/IEC 17020.

For more information regarding occupational hygiene services, please contact Mrs Jeanneth Manganyi:

JeannethM@nioh.ac.za | 011 712 6406



THE IMPORTANCE OF THE BIOBANK IN HEALTHCARE ADVANCEMENT IN SOUTH AFRICA

The NHLS Biobank is the only one of its kind in South Africa and Africa that has a ISO9001 Certification. Internationally, there are less than 10 Biobanks that have this crucial certification.

This Biobank was established to mitigate the growing burden of communicable and non-communicable diseases in South Africa and across the world.

Its main purpose is to manage, store and secure biomaterial collections and data for research purposes. It is unique because it constitutes multiple components of biobanking including cancer, cell culture, genetics, molecular biology and nucleic acid storage histology and cytology. Its objective is to enable research studies with significant sample sizes and to enhance preservation and innovation. Currently, the biobank has over 1, 2 million samples and a capacity of 4 million samples. This Biobank has partnered with different universities in conducting research projects. It is a member of different international Biobanking Societies (IS-BER, ESBB and BCNET) and participates in creating standards, ethics and processes for biobanks globally.

You can view the NHLS Biobank website here: www.nationalbiobank.nhls.ac.za

For more information regarding occupational hygiene services, please contact Mr Bonginkosi Duma: BonginkosiD@nioh.ac.za | 011 712 6521



LUNG AUTOPSY EXAMINATION SERVICE

There is a heavy burden of occupational lung disease among miners and ex-miners in South Africa and neighbouring countries, and the NIOH lung autopsy examination service plays an important role in identifying disease. This autopsy service performed by the Pathology Division of the NIOH is a statutory requirement for deceased miners, in line with the Occupational Diseases in Mines & Works Act 78 of 1973 (ODMWA). The Division examines the cardio-respiratory organs of miners, regardless of the clinical cause of death, and such autopsies can only be done with the written consent of the deceased's next of kin. Under ODMWA, only certain occupational diseases are compensable including; silicosis, asbestosis, pneumoconiosis, tuberculosis, lung cancer, and others. If any of these diseases are found during the autopsy, the severity of it will also be determined. The Pathology team then submits its autopsy report and findings electronically to the Certification Committee at the Medical Bureau for Occupational Disease (MBOD). The MBOD then reviews it and determines if the case is compensable.

For more information related to this service contact Dr Delerise Fassom

DeleriseF@nioh.ac.za | 011 712 6519

To download the procedures booklet or consent forms visit the website at:

www. http://www.nioh.ac.za/specialised-services/lung-autopsy-examination-services/

To view the Pathology Disease Surveillance Reports visit:

http://www.nioh.ac.za/pathology-disease-sur-veillance-reports/



AGILENT'S CARY ECLIPSE FLUORESCENCE SPECTROPHOTOMETER WITH MICROPLATE READER

In an attempt to improve laboratory analysis capabilities, the NIOH Analytical Services has acquired cutting-edge instruments in the form of the Agilent's Cary Eclipse Fluorescence Spectrophotometer with Microplate Reader. This is highly-innovative throughput instrument provides full wavelength scanning (fluorescence, phosphorescence, bio-/chemi-luminescence and time resolved delayed fluorescence modes) with excellent sensitivity and selectivity. This spectrophotometer offers powerful and reliable solutions for a diverse range of molecular applications spanning the ultra violet to the visible light spectral range. So whether the scientist is undertaking research, performing routine analysis, or needs fast accurate on-the-spot measurements, this will greatly assist in increasing the scope of tests offered by the laboratory. The test that will currently be offered is trichloroacetic acid in urine, which is the biomarker for trichloroethylene exposure.For

more information regarding this service contact the Bioaerosol Unit:

For more information, please contact Dr Puleng Matatiele:

PulengM@nioh.ac.za | 011 712 6577



TRANSLATING EXPOSURE ASSESSMENT AND HAZARD IDENTIFICATION OF NANOMATERIAL RESEARCH IN INDUSTRIAL SETTINGS INTO SERVICE DELIVERY

The Department of Science and Innovation (DSI) has established the Nanotechnology Health, Safety and Environmental (HSE) Risk Research platform to investigate exposure levels in research and industrial settings across South Africa. The Toxicology and Biochemistry Section, under the leadership of Prof. Mary Gulumian at NIOH, has been tasked to lead this objective and conducted a baseline study to identify research laboratories and industries within the Gauteng, Western Cape and KwaZulu-Natal that synthesize nanomaterials for various applications. This department is the only laboratory able to conduct the combined toxicity and exposure assessments for nanomaterials in South Africa.

Hazard identification of nanomaterials is challenging due to their complex and diverse physicochemical characteristics. This has resulted in inconsistent inter-laboratory toxicological findings. Moreover, their complex characteristics have made the assessment of exposure to nanomaterial in the workplace challenging. Occupational exposure assessments are central in occupational exposure limits (OEL) derivations. South Africa, through NIOH, has contributed in generating OEL data for the Organization for Economic Co-operation and Development (OECD) for gold nanoparticles.

For more information regarding this service contact Dr Natasha Sanabria: NatashaS@nioh.ac.za | 011 712 6471



NIOH OCCUPATIONAL MEDICINE COVID-19 HOTLINE

The NIOH introduced a hotline advisory service in April 2020, to provide a real time advisory support for workplaces in line with COVID-19. The hotline provides a connection between the callers from workplaces to an occupational medicine specialist based at the NIOH for immediate advice, service or consultation, seeking clarity on COVID-19 related issues encountered in workplaces.

The hotline is a toll free service, channeled through a dedicated line in the Occupational Medicine Section to one of the four dedicated cellular phones. Each cell phone handset is allocated to a specialist doctor, according to a roster system. Experts include pathologists, public health medicine specialists and registrars and occupational medicine specialists. The receiving doctor would take the enquiry, synthesize the nature of the call and respond accordingly. The response would be in the form of providing immediate advice, or taking down contact details to provide feedback after further consultation and discussion with other team members and specialists within and beyond the NIOH. This service was initially 24-hours a day but later limited to office hours from 8am to 5pm. The Occupational Medicine Section is considering taking on this service, beyond COVID-19, as means to engage with stakeholders in different workplaces and provide workplaces with ongoing support for clinical and workplace occupational health issues. After the implementation of the OHSS system, there was a high demand for technical assistance with uploading the relevant data required. In response to this, a dedicated call line was provided by the epidemiology section to provide employers and OHS staff with real-time assistance.

Contact the NIOH Occupational Medicine Workplace COVID-19 Hotline: 0800 2121 75





ADAPTING AN ONLINE HEALTH AND SAFETY INFORMATION SYSTEM FOR THE NEW COVID-19 CHALLENGE

The NHLS OHASIS system has been significantly improved, since the outbreak of Covid -19 in South Africa.

OHASIS is a comprehensive online health and safety information system that has been piloted in various parts of the world. The NHLS - through the NIOH – customised this OAHSIS system to ensure its suitability for local requirements. The new version aims to improve personal information security and improvements include:

- Daily screening tool for COVID-19 that complies with the requirements of local legislation.
- COVID-19 Incident Module to enable immediate response to notifications
- Automated emails sent to designated medical experts should any worker indicate a yes to the Covid screening tool or a positive outcome

- Easy referencing and reporting of people who are contacts of a positive case but who did not get sick.
- A Sub-Module where all the screening information is stored against the relevant employee's profile
 - COVID-specific reports
 - All incident reporting and investigation data put into an Excel spreadsheet

HASIS

Should you wish to learn more about OHASIS please visit:

www.ohasis.co.za or ohasis.support@nhls.ac.za

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Teaching & Training

The NIOH has continued to carry out numerous COVID-19 themed training sessions for various industries in both the formal and informal sectors. These training sessions were developed in modules based on topics and specific to sectors. In keeping with social distancing, these interactive training sessions were held online via Zoom conferencing, where stakeholders across the country could log in and watch. Videos, audio and presentations for these sessions were subsequently uploaded onto the NIOH web-site and sent out to all relevant stakeholders. In terms of CPD accreditation, the following professional bodies have approved our training sessions for COVID19:

- HPCSA medical and dental board approved
- SADA approved
- SAIOH approved
- SAIOSH approved
- StellMed/SANC approved (Occupational Nurse Practitioners)

TRAINING CONDUCTED

Fitness for work post COVID -19 infection

The NIOH conducted the 53^{rd} COVID-19 online webinar on 1^{st} October. The programme covered the long-term cardio-respiratory sequelae of COVID-19; the neuropsychiatric sequelae and considerations post COVID-19 illness; principles of fitness for work and how it relates to COVID-19; work capacity, rehabilitation and functional assessments for COVID-19; disability assessment in the insurance industry and COVID-19; and medical assessment of an employee returning to work post COVID. 726 of the NIOH's stakeholder groups attended the 2.5-hour webinar. The external presenters included Prof Guy Richards, Dr Sandra Fernandes; Dr Greg Kew, Ms Tia-Mari Hofmann, Dr Jack van Zyl and Dr Mmuso Ramantsi.

Watch it here: https://youtu.be/kd0ZV6Ftfvw



COVID-19 and the built environment

Institute for Occupational Hygiene (SAIOH) to deliver the 2-hour webinar on 6th October. Dr Tanusha Singh, the chairperson of the NIOH's COVID-19 Outbreak Response Team (OHORT) started the proceedings. The programme included an overview of the role of ventilation, ventilation as a key control for CPVID-19; and the limits of ventilation for airborne infection control in high risk settings. The webinar concluded with panel of experts, including occupational hygienists, a ventilation engineer and an occupational medical practitioner, in the question-and-answer session, including Mr Norman Khoza (SAIOH), Mr Garth Hunter (SAIOH) and Mr Tobias van Reenen (CSIR). 521 participants attended the 54th NIOH webinar.

Watch it here: https://youtu.be/iR4TrKBnwD0

Legionella and COVID-19: Building water safety during pandemics and beyond

The NIOH delivered its 55th COVID-19 webinar on 8th October. The programme covered Legionella and COVID-19 overview; Legionella risk in premise plumbing during and post COVID-19 lockdown; disinfection solutions for Legionella control; and concluded with the panel of experts. The presenters included Dr Noncy Gomba (NIOH), Dr Susanne Surnam-Lee (UK), Mr Tom Homan (SA). Dr Noncy Gomba led the question-and-answer session. 447 webinar attendees attended the 2.5-hour webinar.



6 Watch it here: https://youtu.be/aMwd421zCnA



Working from home during COVID-19 and beyond: An Ergonomics perspective

The NIOH convened the 2-hour online session on 15th October 2020 addressing the ergonomic risks that should be prevented for employees working from home within the context of COVID-19. Dr Tanusha Singh, the chairperson of the NIOH's COVID-19 Outbreak Response Team (OHORT) started the proceedings. The 461 attendees benefitted from the presentations contributed by Dr Jessica Hutchings (Transnet), Mr Warren Mallon (DoEL), Dr Busisiwe Nyantumbu-Mkhize (NIOH), Mr Hamid Jalal (UJ) and Prof Andrew Thatcher (WITS).

Watch it here: https://youtu.be/hkkjAA-k6ns

Medical screening and testing for COVID-19 in different workplaces (30 July & 6 August)

This important webinar covered topics related to the rationale and process for medical screening and testing for COVID-19. It included topics related to contact tracing, reporting and notification; quarantine and isolation; business continuity plans; as well as discussions around remuneration for COVID-19 related employee absence from work. Two sessions were held on this topic on 30 July and 06 August, and hosted in collaboration with WHC.

Watch it here: https://youtu.be/NUVXSyDrvWc

Occupational Health Surveillance of COVID-19 in South African Workplaces

The NIOH webinar focussed on the Occupational Health Surveillance System (OHSS) which the NIOH was mandated to lead the development. The 57th webinar in the COVID-19 workplace preparedness and prevention programme was convened on the 20th October. Dr Spo Kgalamono welcomed the attendees and the programme consisted of an overview of the OHSS; what data employers are required to submit and when; legal and ethical aspects; the submission process; how to submit via the CSV, the API and the Cmore process step by step; and what happens to the data with the OHSS Dashboard demonstration. The presenters were Prof Nisha Naicker (NIOH), Prof Mohamed Jeebhay (UCT), Prof Rajen Naidoo (UKZN), Dr Jabu Mtsweni (CSIR), Mr Fazil McKenna (NICD), Mr Monty Rambua (NIOH), Mr Herman le Roux (CSIR) and Mr Rethabile Khutlang (CSIR). 1025 attendees joined this online session.

The triple burden of COVID-19, HIV and TB in the workplace

The 58th NIOH COVID-19 webinar, convened on 29th October, focussed on the promoted the management of the "triple epidemic". The presentations covered the impact of COVID-19 on HIV TB in the workplace – looking at global and regional aspects (presented by Mr Simphiwe Mabhele); the impact of COVID-19 on HIV and TB – addressing clinical aspects (presented by Dr Irene Mampa); Occupational Health Services for COVID-19, HIV and TB - the South African Experience (presented by Dr Muzinkhulu Zungu); and was concluded with the question-and-answer session by Mr Ashraf Ryklief (National OHS Training Manager).

Watch it here: https://youtu.be/v_A_t2lc0ZQ



Risk Assessment training for GPG Employees

The Office of the Premier - Gauteng partnered with the NIOH to provide risk assessment training for employees of the Gauteng Provincial Government (GPG). The GPG webinar convened on 2nd December 2020 was opened by Dr Tanusha Singh, the chairperson of the NIOH's COVID-19 Outbreak Response Team (OHORT). Ms Mandu Madyibi-Menze represented the GPG Employee Health and Wellness office. Dr Juda Mokoena (COGTA) emphasised the relationship with local government authorities in the containment of SARS-CoV-2 epidemic. The main presentations covered the principles of health risk assessment and the risk assessment tools, presented by Mr Gabriel Mizan (NIOH) and Ms Dikeledi Matuka (NIOH). The webinar and the question-and answer session was facilitated by the NIOH's National OHS Training Manager, Mr Ashraf Ryklief. 109 GPG employees attended.

Compensation for workplace acquired COVID-19: A practical approach

The National Department of Health (NDoH) convened a 2-day "PPE Quality Assurance Management Workshop" on the 9th and 10th December 2020. The NIOH contributed to the second day. Ms Jeanneth Manganyi (Head of Occupational Hygiene Section) led the NIOH team who included the occupational hygienists Mr David Rangongo and Mr Tebogo Nthoke. The presentations covered an overview of respiratory protective equipment and qualitative fit testing of respirators. The workshop used a hybrid training approach that integrated "face-to-face" with the online Zoom delivery platform.



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Awards & Recognition

RECOGNITION

Dr Spo Kgalamono was appointed as the Executive Director for NIOH as well as the Occupational Health Chair at the University of the Witwatersrand, within the School of Public Health, in December 2020.

Dr Muzimkhulu Zungu was promoted and appointed as an Adjunct Professor at the University of Pretoria, within the School of Health Systems & Public Health (SHSPH) in the Faculty of Health Sciences in December 2020.



COVID-19 RELATED INFORMATION & EDUCATION MATERIALS

The National Institute of Occupational Health (NIOH) and its Outbreak Response Task Team has been actively involved in COVID-19 training sessions and public dissemination of information and educational material since early March, when news of the first Coronavirus case was announced.

The NIOH has been utilising several platforms to reach South Africans including Twitter, YouTube and its website (which has been zero-rated*) to raise awareness on its training sessions, educational videos and audio, as well as presentations and posters.

*The NIOH website is zero-rated by Vodacom, Telkom, MTN, Rain, MWeb & Internet Solutions. No data charges will therefore apply for users of these mobile network providers. All content and resources on this website can be downloaded and browsed for free, excluding YouTube viewing and downloading.

This has so far been a resounding success and as Occupational Health and safety champions and ambassadors, we should all be utilising these training sessions and minute-long videos for our own health and safety and that of our colleagues, families and friends.

PLEASE SEE BELOW LINKS TO THE TWITTER VIDEOS ONLINE THUS FAR:

- 1. COVID-19: What employers need to consider for vulnerable workers https://twitter.com/i/status/1291267764536082432
- 2. Steps employers can take when a worker is symptomatic or tests positive for Covid-19 at work https://twitter.com/i/status/1284069083156287489
- 3. The importance of Medical Screening https://twitter.com/i/status/1300463361826721792
- 4. The steps you need to know when donning gloves https://twitter.com/nioh_sa/status/1270640765467754497
- 5. Doffing of gloves is crucial in safeguarding yourself and these are some simple steps you can follow https://twitter.com/i/status/1272567041736626176
- 6. What employers need to know about risk assessment https://twitter.com/nioh_sa/status/1267350168006877185
- 7. This is how to doff gloves correctly using the Beak method https://twitter.com/i/status/1276140184753627138
- 8. Who should be wearing medical N95 respirators during the Covid-19 pandemic https://twitter.com/nioh_sa/status/1253266050264809472
- 9. What you need to know about surgical masks to promote health and safety in the workplace https://twitter.com/nioh_sa/status/1263741273359421440
- 10. As employers welcome staff back at work, follow these simple guidelines to ensure health and safety in the workplace

http://www.nioh.ac.za/covid-19

11. Are you working during lockdown? This is how you can stay safe https://twitter.com/nioh_sa/status/1247774605990752256







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Below is a link to posters as well as various factsheets that have been developed. These can be utilised in your respective workplaces and are print-ready (A3 size).

NIOH Factsheets & Posters http://www.nioh.ac.za/covid-19/

Please see below links to more useful training material and information resources:

- NIOH Training (Audio and Presentations) http://www.nioh.ac.za/covid-19-presentations/
- NIOH Training (Video recordings of the webinar) https://www.nioh.ac.za/covid-19-presentations/video-training/
- NIOH Training per presenter videos (compressed for mobile use) http://www.nioh.ac.za/covid-19/covid-19-training-per presenter/
- COVID-19 National Resources: Directives and guidelines https://www.nioh.ac.za/home/national-resources-directives-guidelines/
- Ethics Guidance for Occupational Health Practice https://www.nioh.ac.za/covid-19-presentations/ethics-in-occupational-health-safety/
- OHSS Business Portal COVID-19 Workplace Surveillance https://www.nioh.ac.za/covid-19/occupational-health-surveillance-system-ohss-business-portal/
- Occupational Health Surveillance https://www.nioh.ac.za/covid-19-occupational-health-surveillance/
- Educational Video Resources https://www.nioh.ac.za/educational-video-resources/
- **COVID-19 Frequently Asked Questions** https://www.nioh.ac.za/covid-19-faqs/









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