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NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

Division of the National Health Laboratory Service

OccuZone

25 Hospital Street, Constitution Hill
Johannesburg, 2000
Tel: +27 (0) 11 712 6400

www.nioh.ac.za

IN THIS ISSUE

MESSAGE FROM THE CHIEF EDITOR

Happy New Year to all! May 2020 be a year of success and accomplishment. Every new year brings a time of reflection of what we've accomplished, what our new goals will be and what we are grateful for. At the NIOH, we are proud to have brought you this newsletter, aiming to continue being a platform for disseminating and sharing information about the institute's activities, events and accomplishments. We are also grateful for the motivation and support of our readers.

January always starts with great expectations and a sense of new beginning, fresh ideas and initiatives. Everyone has resolved to make the year different and we are all recharged and set for race. In this 3rd issue of OccuZone, we report on the the numerous projects and activities in which NIOH staff were actively involved in the third quarter of this financial year. We highlight our research activities with a special focus on gold mine dust tailing emissions and the health implications on nearby communities. The scientific publications produced by our researchers are also highlighted as it contributes significantly to the wealth of knowledge in OHS. The edition also profiles one of our emerging researchers, and features an essential function of the NIOH - surveillance of occupational exposures and health outcomes. Details of the PATHAUT database is also in sharp focus with analysis that shows the trends of silicosis and TB in South African miners. This edition also features autopsy - one of the institute's specialized services – and the compensation process by the Pathology Division. Lastly, we share our upcoming teaching and training events in the third quarter.

In concluding, I would like to thank our newsletter editorial team for their valuable time and expertise in producing and maintaining this high quality publication. I would also like to thank the authors for their valuable contribution to the newsletter.

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Thanks for reading the NIOH OccuZone newsletter, and best wishes for a healthy and happy New Year!

Editor in Chief
Angel Mzoneli

Research

Message from the Research Committee Chair

Season's greetings and best wishes for 2020. May it be a year of formalised curiosity, intense exploration and infinite solutions to addressing the many challenges that face workers across many industries. We start the year with the 3rd edition which focuses on gold mine dust tailings emissions and the health implication on nearby communities. Johannesburg, known as the city of gold, dates back to the Witwatersrand Gold Rush of 1886, which brought many fortunes to the city and the country. However, the inadequate waste disposal of some gold mines results in significant air, soil and water pollution. This is very evident on a windy day as the 'golden' dust plumes hover over nearby communities. The dust particles or particulate matter (PM) from the tailings is transmitted to nearby communities raising the question of the health risk of people living there. This is not unique to South Africa, a Mexican study showed a high body burden of toxic metals among children living in the vicinity of the mine dump. The NIOH was afforded an opportunity to investigate the toxicological properties of gold mine tailings storage facilities and its association with adverse health effects in communities that are exposed to the tailings. We present here the findings of the study and trust you'd find it an informative read.

Dr Tanusha Singh

RESEARCH FOCUS

Decades of mining in South Africa have produced waste material, which have been deposited in numerous gold mine tailings storage facilities (TSFs). These TSFs contribute to air pollution due to the lack of proper rehabilitation measures needed to mitigate erosion. Indeed, human populations residing in close proximity to these TSFs have raised concern regarding high dust levels and the onset of respiratory-related symptoms. Currently, it is not known whether tailings emissions could be the cause of such ill effects and the physicochemical properties that may govern their toxicity have not yet been identified. In addition, South Africa currently does not have an efficient routine air monitoring system in residential areas of surrounding communities to determine the extent of air pollution caused by tailings emissions. The aim of this research was to determine the possible risk of tailings particles to surrounding communities by conducting a human health risk assessment consisting of hazard identification, exposure assessment and risk characterisation.

In Vitro Toxicity Assessment of Dust Emissions from South African Gold Mine Tailings Sites

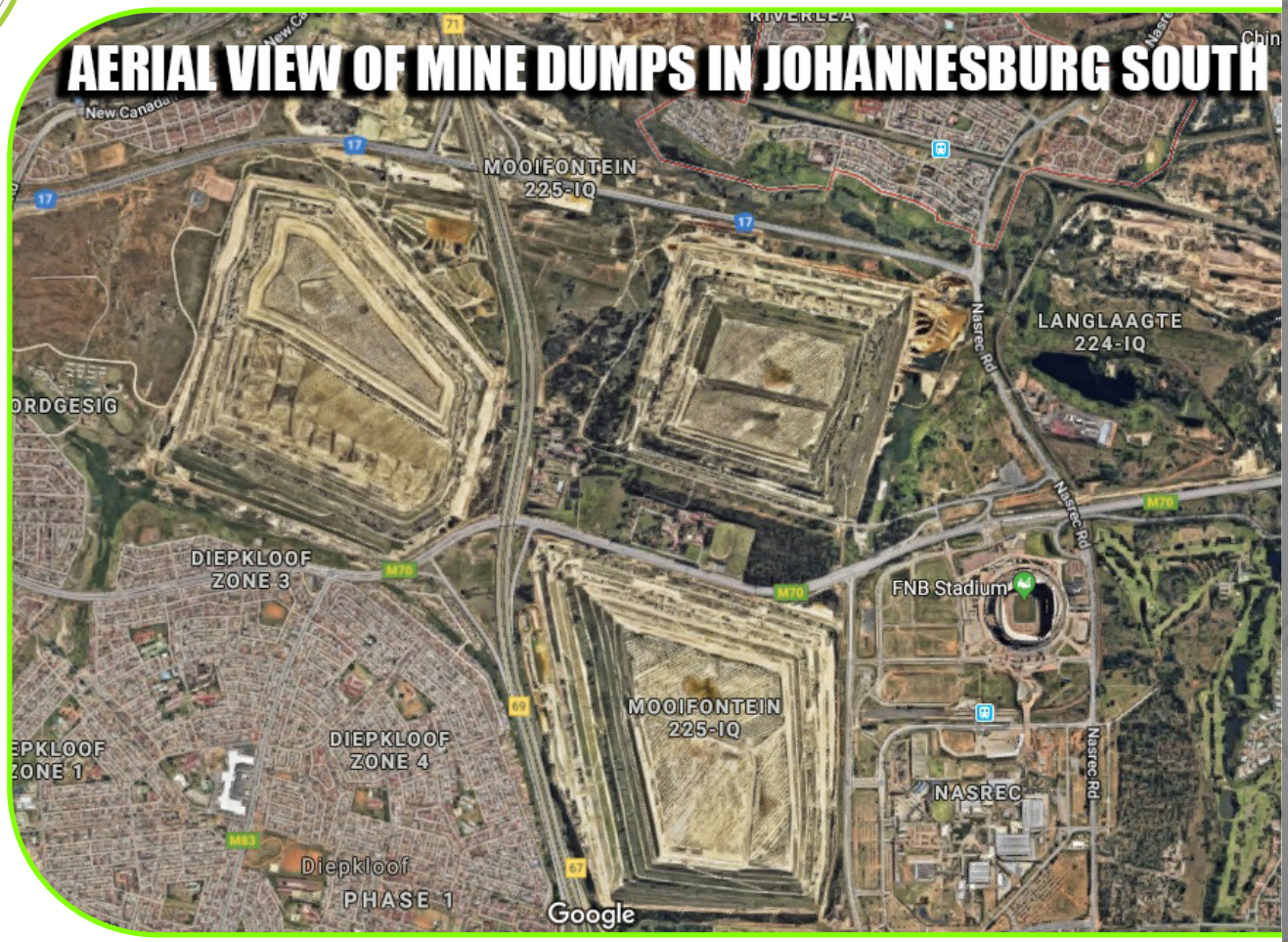
Charlene Andraos[1,2] and Mary Gulumian[1,2]
[1]Toxicology and Biochemistry Department, National Institute for Occupational Health, PO Box 4788, Johannesburg, 2000, South Africa.
[2]Haematology and Molecular Medicine Department, School of Pathology, Faculty of Health Sciences, University of the Witwatersrand, Private Bag 3, Wits 2050, Johannesburg, South Africa.
Corresponding Author: CharleneA@nioh.ac.za

Note: This research has been submitted as Ms Andraos' PhD thesis for external examination (i.e. two national reviewers and one international reviewer) and has been accepted by all three reviewers. In addition, Ms Andraos has published two articles on this research in two international, peer-reviewed journals:

- Andraos, C., Dekker, K. and Gulumian, M. (2019). Ambient PM_{10} and respirable dust levels near gold mine tailings storage facilities in South Africa. CLEAN–Soil, Air, Water, 47(2), 1800103.
- Andraos, C., Utembe, W. and Gulumian, M. (2018). Exceedance of environmental exposure limits to crystalline silica in communities surrounding gold mine tailings storage facilities in South Africa. Science of the Total Environment, 619, 504-516.

In this study, bulk dust samples were collected from TSFs situated in the Gauteng and North West Provinces of South Africa for physicochemical analyses i.e. size distribution, specific surface area, shape and surface elemental composition, mineral composition, total elemental composition and surface activity. In addition, the potential toxicity of the particles was assessed in vitro using two human lung-derived cell lines. Toxicity assessment included label-free, impedance-based toxicity analysis as well as assessment of the degree of cellular internalisation. Continuous real-time ambient PM_{10} levels at surrounding residential areas were also recorded and ambient PM_{10} were collected on filters for crystalline silica content analysis. Thereafter, PM_4 was collected from personal samplers attached to school children in schools located at various distances from the TSFs. The crystalline silica content in these personal filters were also assessed to calculate the respirable crystalline silica (RCS) levels. The potential cancer and non-cancer inhalational risk endpoints of surrounding communities, based on the lifetime exposure to RCS levels obtained from the personal filters, were calculated.

The results showed that all tailings dusts exhibited in vitro toxicity. This toxicity was shown to be governed either by their transitional elemental composition or a combination of different physicochemical properties such as size, quartz content and elemental composition. The ambient PM_{10} levels in surrounding populations exceeded by several fold (i.e. three to four times) the current South African limit of 75 µg/m^3. Furthermore, the RCS levels collected from PM_4 from surrounding communities exceeded the current international interim RCS limit of 3 µg/m^3. Finally, the risk characterisation revealed surrounding communities to possibly develop non-cancer adverse health effects as hazard quotients (HQ) higher than 1 was calculated. Moreover, calculations of cancer adverse health effects also showed possible risk of regulatory concern as more than 1 individual per 1000 could potentially develop cancer when exposed to RCS levels recorded in this study. One site in particular showed an HQ of 11.6 (non-cancer) and the possibility of more than 2 individuals per 1000 to possibly develop cancer. This study could therefore provide mechanistic evidence to support future epidemiological studies attempting to link tailings dust exposure to adverse health effects. It could also serve as a starting point for future ambient and personal sampling campaigns and suggests that a RCS interim exposure limit, particularly for South Africa, be established.



PUBLICATIONS

Title: Determinants of international variation in the prevalence of disabling wrist and hand pain

Author(s): Coggon D, Ntani G, Walker-Bone K, Felli VE, Harari F, Barrero LH, Felknor SA, Rojas M, Cattrell A, Serra C, Borchini R, Solidaki E, Merisalu E, Habib RR, Sadeghian F, Kadir MM, Peiris-John RJ, Matsudaira K, **Nyantumbu-Mkhize B**, Kelsall HL and Harcombe H

Source: BMC Musculoskeletal Disorders (2019) 20:436 https://doi.org/10.1186/s12891-019-2791-x

Abstract: Previous research has indicated that wide international variation in the prevalence of disabling low back pain among working populations is largely driven by factors predisposing to musculoskeletal pain more generally. This paper explores whether the same applies to disabling wrist/hand pain (WHP). Using data from the Cultural and Psychosocial Influences on Disability (CUPID) study, we focused on workers from 45 occupational groups (office workers, nurses and other workers) in 18 countries. Among 11,740 participants who completed a baseline questionnaire about musculoskeletal pain and potential risk factors, 9082 (77%) answered a further questionnaire after a mean interval of 14 months, including 1373 (15%) who reported disabling WHP in the month before follow-up. Poisson regression was used to assess associations of this outcome with baseline risk factors, including the number of anatomical sites other than wrist/hand that had been painful in the 12 months before baseline (taken as an index of general propensity to pain). After allowance for other risk factors, the strongest associations were with general pain propensity (prevalence rate ratio for an index ≥6 vs. 0: 3.6, 95% confidence interval 2.9–4.4), and risk rose progressively as the index increased. The population attributable fraction for a pain propensity index > 0 was 49.4%. The prevalence of disabling WHP by occupational group ranged from 0.3 to 36.2%, and correlated strongly with mean pain propensity index (correlation coefficient 0.86). Strategies to prevent disability from WHP among working populations should explore ways of reducing general propensity to pain, as well as improving the ergonomics of occupational tasks.

Keywords: Wrist/hand pain, Geographical variation, Pain propensity, Risk factors

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Title: Statistical analysis methods used to assess data below the limit of detection in the SA Literature, 2010-2017

Author(s): **Made F** and Utembe W

Source: Occupational Health Southern Africa, Volume 25 Number 5, Sep / Oct 2019, p. 160 – 164

Abstract: The statistical methods used to analyse data below the limit of detection (LOD), otherwise known as non-detect (ND) data, may result in under- or over-estimation of exposure, leading to inaccurate decision making in occupational health risk assessment. The objective of this study was to describe the statistical methods commonly used to analyse ND data in the South African scientific literature. Studies that used statistical methods for the analysis of ND data, published in South African journals from 2010 to 2017, were identified through an electronic search of the South African Bibliographic and Information Network (Sabinet) database, and snowballing. The selected manuscripts were reviewed and the methods used for dealing with ND data were described. Fifteen manuscripts that statistically analysed ND data were identified. Most used substitution (60.0%) and exclusion (20.0%) methods. Robust methods, including multiple imputation, regression on order statistics and β-substitution, were used in only 20.0% of the studies. Robust approaches for analysing ND data in occupational health are seldom used in South Africa. Occupational hygienists should consider using the Bayesian toolkit, Expostats, which is freely available software for the analysis of ND data.

Title: Prevalence of Respiratory Health Symptoms among Landfill Waste Recyclers in the City of Johannesburg, South Africa

Author(s): Tlotleng N, Kootbodien T, Wilson K, Made F, Mathee A, Ntlebi V, Kgalamono S, Mokone M, Du Preez K and Naicker N

Source: Int. J. Environ. Res. Public Health 2019, 16(21), 4277; https://doi.org/10.3390/ijerph16214277

Abstract: In developing countries, waste sorting and recycling have become a source of income for poorer communities. However, it can potentially pose significant health risks. This study aimed to determine the prevalence of acute respiratory symptoms and associated risk factors for respiratory health outcomes among waste recyclers. A cross-sectional study was conducted among 361 waste recyclers at two randomly selected landfill sites in Johannesburg. Convenience sampling was used to sample the waste recyclers. The prevalence of respiratory symptoms in the population was 58.5%. A persistent cough was the most common symptom reported (46.8%), followed by breathlessness (19.6%) and rapid breathing (15.8%). Approximately 66.4% of waste recyclers reported exposure to chemicals and 96.6% reported exposure to airborne dust. A multivariable logistic regression analysis showed that exposure to waste containing chemical residues (OR 1.80, 95% CI 1.01–3.22 p = 0.044) increased the odds of respiratory symptoms. There was a significant difference in respiratory symptoms in landfill sites 1 and 2 (OR 2.77, 95% CI 1.03–7.42 p = 0.042). Occupational health and safety awareness is important to minimize hazards faced by informal workers. In addition, providing waste recyclers with the correct protective clothing, such as respiratory protective equipment, and training on basic hygiene practices, could reduce the risks associated with waste sorting.

Title: Workplace-Based Organizational Interventions Promoting Mental Health and Happiness among Healthcare Workers: A Realist Review.

Author(s): Gray P, Senabe S, **Naicker N,** Kgalamono S, Yassi A and Spiegel JM

Source: Int. J. Environ. Res. Public Health 2019, 16(22), 4396; https://doi.org/10.3390/ijerph16224396

Abstract: Mental illness, deemed globally to account for 32% of years lived with a disability, generates significant impacts on workplaces. In particular, healthcare workers experience high rates of mental ill health such as burnout, stress, and depression due to workplace conditions including excessive workloads, workplace violence and bullying, which also produces negative effects on patients as well as on the happiness and wellbeing of those who remain at work. This review was undertaken to synthesize the evidence on workplace-based interventions at the organizational level promoting mental health and wellbeing among healthcare workers, to identify what has been receiving attention in this area and why, especially considering how such positive effects are produced. A search of three premier health-related databases identified 1290 articles that discussed healthcare workers, workplace interventions, and mental health. Following further examination, 46 articles were ultimately selected as meeting the criteria specifying interventions at the organizational level and combined with similar studies included in a relevant Cochrane review. The 60 chosen articles were then analyzed following a realist framework analyzing context, mechanism, and outcome. Most of the studies included in the realist review were conducted in high-income countries, and the types of organizational-level interventions studied included skills and knowledge development, leadership development, communication and team building, stress management as well as workload and time management. Common themes from the realist review highlight the importance of employee engagement in the intervention development and implementation process. The literature review also supports the recognized need for more research on mental health and happiness in low- and middle-income countries, and for studies evaluating the longer-term effects of workplace mental health promotion.

Title: An occupational health service intervention to improve TB infection prevention and control among South African health workers - research

Author(s): Zungu M, Yassi A, Malotle M, O'Hara L, Bryce E and Mlangeni N

Source: Occupational Health Southern Africa, Volume 25 Number 5, Sep / Oct 2019, p. 148 - 154

Abstract: South Africa has adopted strategies to prevent workplace transmission of diseases, including tuberculosis (TB). Occupational health and safety (OHS), and infection prevention and control (IPC), are essential in combatting human immunodeficiency virus (HIV) and TB in the workplace. We evaluated the effect of a multi-faceted policy, practice and education intervention on OHS and TBIPC at a provincial teaching hospital in South Africa. A quasi-experimental study was conducted in 2014-2017 in an 800-bed hospital in Tshwane, South Africa, as part of a larger research collaboration. A multi-faceted intervention (including elements focused on primary, secondary and tertiary prevention) to improve OHS and TB IPC in the hospital was implemented. Observational walkthrough surveys were conducted and an infection control practices assessment tool was completed pre- and post-intervention to evaluate the impact of the intervention. Total TB IPC scores were calculated and diff erences in scores between preand post-intervention were compared, using t-tests. While there was substantial strengthening in the hospital's OHS systems, including HIV and TB services, resources and infrastructure, little improvement in IPC occurred and administrative controls did not improve at all, despite the interventions and support provided. The total TB IC score decreased from 12.5/37 to 11.0/37 ($p = 0.0363$). Strengthened workplace programmes for health workers in low- and middle-income countries, including those targeting HIV and TB, are possible with political will and involvement of management and workers. However, a monitoring and evaluation system, supported by top management, is essential to ensure implementation by frontline health workers, and to guard against complacency.

Title: Interference of Gold Nanoparticles with In vitro Endotoxin detection assays

Author(s): Vetten MA and Gulumian M

Source: Current Nanoscience, 2020, 16, 1-9, DOI:10.2174/1573413715666181212120013

Abstract: Endotoxin-free engineered nanoparticle suspensions are imperative for their successful applications in the field of nanomedicine as well as in the investigations in their toxicity. Gold nanoparticles are known to interfere with various in vitro assays due to their optical properties and potential for surface reactivity. In vitro endotoxin testing assays are known to be susceptible to interference caused by the sample being tested. This study aimed to identify a preferred assay for the testing of endotoxin contamination in gold nanoparticle suspensions. The interference by gold nanoparticles on three assays namely, the commonly used limulus amebocyte lysate chromogenic assay, the limulus amebocyte lysate gel-clot method, and the less common recombinant Factor C (rFC) assay, was tested.

Possible interference could be observed with all three assays. The interference with the absorbance-based chromogenic assay could not be overcome by dilution; whilst the qualitative nature of the gel-clot assay excluded the possibility of distinguishing between a false positive result due to enhancement of the sensitivity of the assay, and genuine endotoxin contamination. However, interference with the rFC assay was easily overcome through dilution. The rFC assay is recommended as an option for endotoxin contamination detection in gold nanoparticle suspensions.

Keywords: Endotoxins, Contamination, Gold nanoparticles, in vitro, Interference, LAL assay.

Title: Effect of a simple intervention on hand hygiene related diseases in preschools in South Africa research protocol for an intervention study

Author(s): Lange SL, Barnard TG and **Naicker N.**

Source: BMJ Open 2019;9:e030656. doi:10.1136/bmjopen-2019-030656

Abstract:

Introduction

Hand hygiene (HH) 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 5 years in South Africa. Children attending preschools are more susceptible to these infections due to the higher number of children in preschools. HH interventions have shown to reduce HH- related diseases by improving HH practices. In South Africa, there are no documented HH interventions or studies in children under 5 years. The purpose of the study is to determine whether an HH intervention can reduce HH- related diseases among 4–5- year- old preschool children and to improve HH practices in these children, their caregivers and their parents.

Methodology and analysis

This is a protocol for a controlled intervention study to be conducted at preschools in Kempton Park, City of Ekurhuleni, Gauteng, South Africa. Preschools will be randomly distributed into control and experimental groups (n=70). The intervention includes interactive simulation learning, educational emails and education and poster reminders obtained from the WHO and the Global Handwashing Day website. Data collection, including the intervention, will take place during the calendar year as this coincides with the school year. Data will be analysed both preintervention and postintervention in the experimental group as well as between the experimental and control group. Data collected by means of questionnaires, observations, disease registers, hygiene inspections, semi- structured interviews and hand swabs will be analysed to determine these outcomes.

Ethics and dissemination

Permission has been obtained from the University of Johannesburg Ethics Committee and Ministerial Consent for Non- Therapeutic Research on Minors from the Department of Health National Ethics Research Council. Permissions for use of copyright protected materials has been obtained. Results of the study will be disseminated through peer- reviewed publications, and feedback within relevant structures through conference proceedings.

Title: The role of the South African Medical Research Council in reducing lead exposure and preventing lead poisoning in South Africa

Author(s): Mathee A, **Naicker N** and von Schirnding Y

Source: S Afr Med J 2019;109 (11 Suppl 1): S25-S29. https://doi.org/10.7196/SAMJ.2019.v109i11b.14271

Abstract: Even at low levels in blood, lead has been associated with reduced IQ scores, behavioural problems, learning impediments, aggression and violent behaviour. Since the 1980s, the South African Medical Research Council (SAMRC) has been investigating the sources of exposure to lead in South Africa (SA), the groups at highest risk of lead poisoning and a selection of the myriad associated health and social consequences. SAMRC research evidence contributed to the phasng out of leaded petrol, restrictions on lead in paint and other interventions. Subsequently, childhood blood lead levels in SA declined significantly. More recent studies have revealed elevated risks of lead exposure in subsistence fishing and mining communities, users of arms and ammunition, those ingesting certain traditional medicines, and users of certain ceramicware and artisanal cooking pots. Lead-related cognitive damage costs the SA economy ~USD17.7 (ZAR261.3) billion annually, justifying further SAMRC investment in lead exposure research in the country.

Title: Is one man's garbage another's toxic treasure? a brief look into the informal recycling of waste on landfills and associated health challenges in South Africa

Author(s): **Maeteletja T ,** Manganyi J and Wichmann J

Source: Occupational Health Southern Africa, Volume 25 Number 5, Sep / Oct 2019, p. 155 – 159

Abstract: As South African consumerism has risen, the waste being generated has increased. Poor accessibility to recycling infrastructures in communities has resulted in a high influx of reusable waste at landfills. Waste disposal through landfills is the primary form of disposal worldwide. According to the World Bank (2018), South Africans produce 0.50-0.99 kg of waste per capital per day. In 2017, the Department of Environment, Forestry and Fisheries (DEFF), formerly the Department of Environmental Affairs, reported that 75% of this waste is disposed of in landfills across the country. This has, to some degree, created a 'gold rush' to landfills as underprivileged and unemployed men and women in urban communities turn to waste recycling as a form of income generation.

Title: Overcrowding and health in two impoverished suburbs of Johannesburg, South Africa

Author(s): Nkosi V, Haman T, **Naicker N** & Mathee A

Source: BMC Public Health (2019) 19:1358 https://doi.org/10.1186/s12889-019-7665-5

Abstract: Rapid urbanization, unmatched by an associated supply of housing, has resulted in overcrowding in the cities of many developing countries, including in Johannesburg, South Africa. Household overcrowding has been associated with a range of ill-health outcomes, including acute respiratory infections and diarrhoeal diseases. The aim of this study was to describe the levels of household crowding, and examine associations with respiratory and gastrointestinal symptoms in selected two low-income neighbourhoods in Johannesburg. Questionnaire data from a panel study conducted over an 11-year period between 2006 and 2016 were extracted to conduct the analyses. Structured questionnaires, designed to collect information on housing conditions, socio-economic and health status were administered to adult representatives of households occupying the primary dwelling on pre-selected study sites. Over the 11-year study period, levels of overcrowding remained unchanged. Around 57.6% of dwellings in the study neighbourhoods were determined to be overcrowded in relation to international guidelines. Results from the multiple logistic regression analyses indicated that crowded dwellings were associated with elevated levels of acute respiratory and gastrointestinal symptoms, as well as fever/chills. Respondent perceptions varied from objective measures of overcrowding. Crowded dwellings were associated with elevated reports of acute respiratory and gastrointestinal symptoms, as well as fever/chills.

Keywords: Overcrowding, Health, South Africa, Housing, Environmental health

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Corrigendum

In the abstract "Chirality, a neglected physico-chemical property of nanomaterial? A mini-review on the occurrence and importance chirality on their toxicity" which appeared in OccuZone Issue 1, the name of an author that made substantial contribution was inadvertently omitted. The authors regret any inconvenience the omission may have caused. The correct citation for the article in Utembe W and M Gulumian. 2019, and can be found at the journals website, https://www.sciencedirect.com/science/article/pii/S0378427419301225.

IN THE SPOTLIGHT

Charlene Andraos
Medical Scientist in Toxicology

Why did you choose this career and research path?
I enjoyed science and biology at school and my interests have always been human health, the causes leading to ill health and related treatments. I could not envision myself studying anything other than science.

What training and qualifications did you undergo and where?
I have completed my BSc, BSc (Hons) and MSc degree in Biochemistry and Human Physiology at the University of Johannesburg. My MSc project involved studying the methylation status of the Vitamin D Receptor (VDR) gene as a possible factor contributing to inconsistent associations between VDR single nucleotide polymorphisms (SNPs) and tuberculosis (TB). I have also recently completed my PhD at the University of Witwatersrand, which involved assessing the in vitro toxicity of dust emissions from gold mine tailings sites in South Africa.

What are the most enjoyable aspects of doing research and why did you choose Toxicology?
I enjoy the level of freedom that is involved in conducting research. The fact that you are in a position of answering scientific hypotheses based on objectives that you yourself have set. Research is also not repetitive in nature therefore each day in the lab is different from the next. In addition, being involved in a project from start to finish is truly gratifying. I chose Toxicology as my research field as it is a broad field of science and requires the understanding of many disciplines from molecular biology to chemistry to epidemiology and even computer science. Hence, the opportunities for cutting-edge research and collaboration with various other scientific organisations are endless. For example, nanotechnology in particular is currently a topic of interest and the Toxicology Department have been involved in several projects over the years from assessing the toxicity of nanoparticles to currently being involved in the development of an effective risk governance model for nanotechnology. In addition, we have recently embarked on a project looking at various nanomedicines for the effective treatment of cancer.

What are your research highlights to date?
One of my research highlights is the successful completion of the project funded by the Mine Health and Safety Council entitled "Adverse Health Impacts associated with Dust Emissions from Gold Mine Tailings storage facilities in South Africa". This project was a collaborative study between three universities and involved meticulous planning, organization and cooperation. I was involved in all stages of this project from writing yearly scientific and financial proposals and reports to conducting my own experiments and analyzing data under the supervision of Prof Mary Gulumian. This project has taught me so much, but most importantly are the results that stemmed from this research. For example, the recommendations that we have suggested in mitigating exposure of mine dump dust to surrounding communities was escalated to the Department of Mineral Resources thereby indicating the significance of this project to the health of these communities.

What are your career goals?
I aspire to one day head my own research projects in the fields of Toxicology and Biochemistry. I would love to integrate my love for genetics and epigenetics with particle or chemical toxicology. As mentioned earlier, Toxicology is such a broad scientific field covering many topics, therefore the opportunities are endless.

Surveillance

Occupational health surveillance data provides vital information on the prevalence of occupational 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 the PATHAUT database was analysed to produce trends of silicosis and TB in South African miners.

TRENDS OF SILICOSIS AND TB FROM AUTOPSY DATA IN SOUTH AFRICAN MINERS: 1975 TO 2017

Gold mines have been identified as the main source of silicosis in the SADC region1 due to the high crystalline silica content found in gold ore. Exposure to crystalline silica can result in a predisposition to silicosis but even in the absence of silicosis, silica dust exposure can cause a lifetime predisposition to tuberculosis[2]. Thus, in 2012, the ministers of health of the SADC member countries signed a declaration committing their countries to the reduction in the burden of lung disease in the mining industry. This then required augmented efforts in the surveillance of silicosis and tuberculosis due to their association with crystalline silica dust exposure[1].

The number of PTB cases at autopsy has been declining since 2007. This is encouraging and reflects the decrease in the total number of TB cases notified nationally according to annual WHO Global TB reports (1.6% decline in incidence rates globally between 2000-2018[5]). This reflects the deployment of anti-tuberculous and anti-retroviral treatment programmes nationally and by the mining industry. Nevertheless, the current overall rate of 155 cases (a slight increase from 152/1000 in 2016) of PTB per 1000 autopsies remains high. Most cases of active PTB (55.6%) were from the gold and platinum (23.9%) mining industries in 2017.

The Pathology Division of the NIOH conducts, as a part of a statutory requirement in terms of ODMWA, autopsy examinations of their cardio-respiratory organs of mine workers. Details of the macroscopic and microscopic autopsy examination of the heart and lungs, together with demographic data and occupational histories, are entered into a database known as PATHAUT. The database has been maintained by the Pathology Division at the NIOH since 1975 and currently (as of December 2017) contains the records of 112 702 deceased mine workers[3].

There has been a decline in the number of cardio-respiratory organs submitted to the NIOH for autopsy which could be a reflection of the declining number of miners employed in the industry. In 1994, there were around 344 000 people employed in the gold mining industry .

The trends for silicosis amongst black miners are of particular concern, this is because there has been an upward trend in the rate of silicosis from 1975 and this has been particularly marked from 2000 (Figure 1). In 2017, silicotic nodules were found in the lungs of 150 deceased miners (18.7% of all autopsies). Occasional silicotic nodules were found in 42.7% (n=64) of these cases, a few nodules in 24% (n=36), a moderate number in 26% (n=39), and a large number in 7.3% (n=11). The majority of these cases (80%) had been employed in the gold mining industry. In an attempt to reduce the rates of silicosis, the mining industry, as required by the National Environmental Management: Air Quality Act, 2004 (Act number 39 of 2004[4]), pledged to control and supress dust levels, however, the expected impact of these dust control measures has not been reflected in the results.

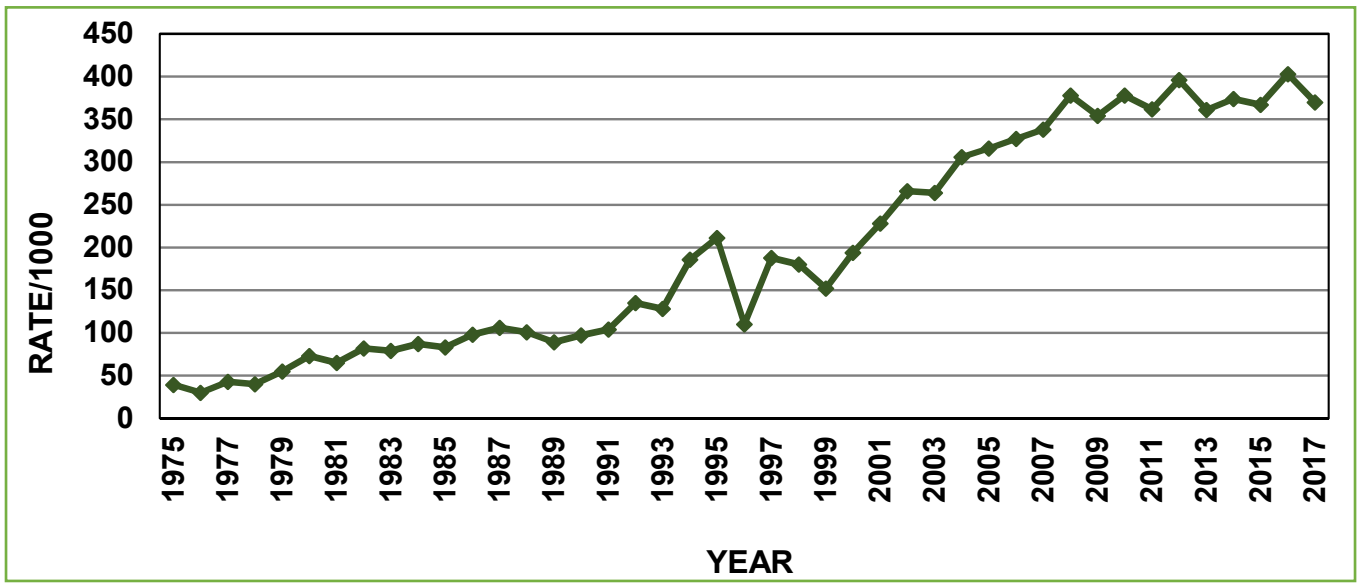

Figure 1. The rate of silicosis in black gold miners (1975-2017)

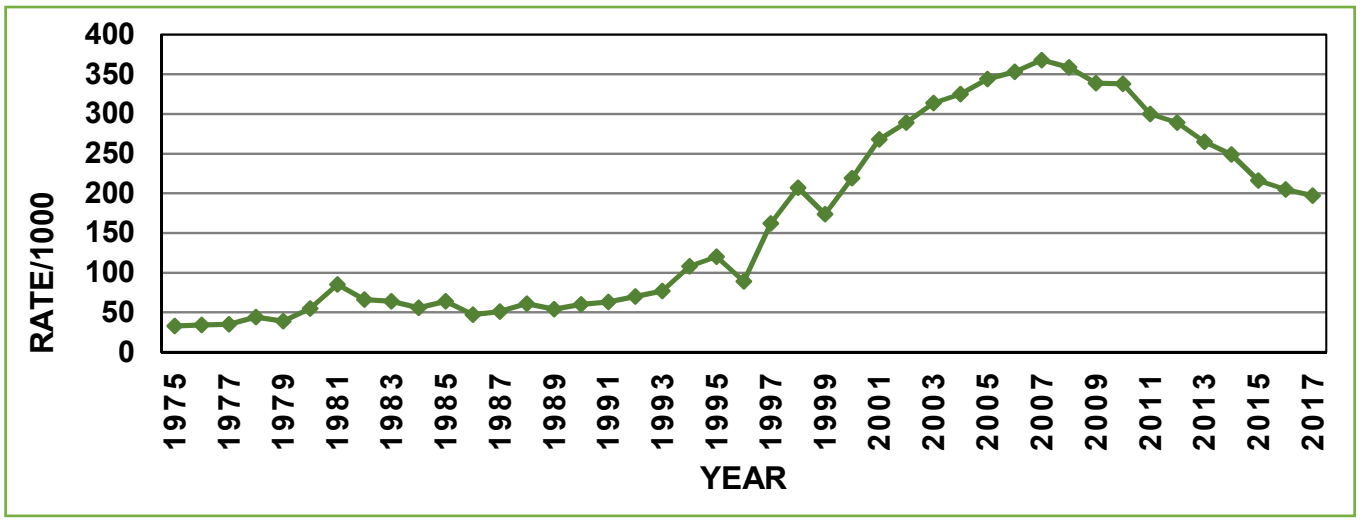

Figure 2. The rate of tuberculosis in black gold miners (1975-2017)

Mining remains an important contributor to the economy of South Africa. However, the data from the PATHAUT report reflects high rates of disease and emphasizes the urgent need to prevent exposure in mine workers.

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Contributors: Kgokong N[1,2], McCabe M[1,3] Mhlongo L[1], Vorajee N[1,3], Linden L[1,3], Lakhoo D[1,3]

[1]Pathology Division, National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa
[2]School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa
[3]School of Pathology, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

Interested investigators will be able to access PATHAUT reports at http://www.nioh.ac.za

For further information regarding the PATHAUT Database please contact Ntebogeng Kgokong at ntebogengk@nioh.ac.za

For more information on Occupational Health Surveillance at the NIOH please contact the Epidemiology and Surveillance Section at 011 712 6472 or NishaN@nioh.ac.za

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, our service delivery highlights focus on the statutory autopsy service of the Pathology Division, which forms part of the compensation process.

LUNG AUTOPSY EXAMINATION SERVICE

There is a heavy burden of occupational lung disease among miners and ex-miners in South Africa, and the NIOH autopsy service plays an important role in identifying disease. It is a service that is under-utilized by the mining industry and ex-miners. In 2010, there were 1,500 autopsies carried out by the NIOH and in 2016, it dropped to 850. In 2018, it continued to decline further. While this may reflect the decreasing number of miners working in the industry, there is a recognised need to facilitate access to the compensation system, particularly for ex-miners who die at home in the labour sending areas of the Eastern Cape and neighbouring Southern African Development Community (SADC).

The 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.

The lungs are placed in formalin and into a red box, and must be accompanied with a completed P form from the sender. This is then couriered or delivered to the NIOH, where it is verified upon receipt. The Pathology team examines the organs for the presence of certain compensable lung diseases, which are caused by working in a mine. Only if the deceased had a compensable lung disease will his/her family receive compensation. Under ODMWA, only certain occupational diseases are compensable including; silicosis, asbestosis, coal workers pneumoconiosis, mixed dust fibrosis, tuberculosis, obstructive lung disease (emphysema), asbestos related diseases, cancer of the lung in asbestos exposed cases, and mesothelioma.

If any of these diseases are found during the autopsy, the severity of it will also be determined. Compensation will differ according to the severity of each case.

The Pathology team captures the particulars of the deceased, their labour history and the autopsy report findings on computerized databases. The information is sent electronically to the Certification Committee at the Medical Bureau for Occupational Disease (MBOD).

The MBOD then reviews the mining service, previous submissions and determines if the case is compensable in the 1st or 2nd degree. A certificate will subsequently be issued to the deceased's family and the Compensation Commissioner. At this time, the Commissioner authenticates the beneficiaries and calculates the amount of compensation, which is then paid to the family.

What is important to note is that only certain individuals can give consent for an autopsy including the surviving spouse or next of kin, a legal guardian, or an individual authorised to dispose of the remains.

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-

Teaching & Training

The training offered by the NIOH strives to promote development of the work environment, work communities and organizations, to enhance management of changes, and to further occupational health and expertise in these issues at workplaces. In the training sector, our goals with regard to impact are: a healthy and safe work environment; a healthy worker whose work ability is good; a work community that supports health and well-being. In this issue we look at the knowledge exchange and capacity building activities and initiatives undertaken by NIOH together with stakeholders and partners during the third quarter.

INTERNATIONAL OHTA TRAINING PROVIDER STATUS AWARDED TO NIOH

The NIOH Occupational Hygiene Section was awarded approved training provider (ATP) status by the Occupational Hygiene Training Association (OHTA) with effect from 30 September 2019. Approval was granted to facilitate the W201 foundation level module as well as the seven intermediate level W500 series modules, in the SADC countries including South Africa, Botswana, Namibia, Lesotho, Swaziland, Angola, DRC, Madagascar, Malawi, Mauritius, Mozambique, Seychelles, Tanzania, Zambia and Zimbabwe.

OHTA promotes an international framework for occupational hygiene training, supported by the national occupational hygiene organisations of many countries, as well as the International Occupational Hygiene Association (IOHA). OHTA develop training material for the approved modules, and award approval to training providers to facilitate the modules. The OHTA modules are formally recognised and accepted internationally, and cover the core science and practice of occupational hygiene.

All modules are offered as five-day taught training programmes, with a written exam on the last day. Candidates who successfully complete a module are awarded a certificate. Successful completion of the required intermediate modules forms the basis to obtain an internationally accepted qualification, the International Certificate in Occupational Hygiene (ICertOH). Please visit the OHTA website at http://www.ohlearning.com for further information on OHTA and the approved training modules.

As the major centre for occupational health development, training, service support and research in South Africa, the NIOH will primarily provide training on request to organisations who enter into agreement (MoA) with the NIOH, but invitation to attend training may also be extended to external candidates. Details of the NIOH's approval status may be viewed at http://www.ohlearning.com/training/training-providers/national-institute-for-occupational-health-(nioh).aspx

For more information on training programmes and schedules, please contact:
Karen du Preez (Registered Occupational Hygienist)
011 712 6435 | KarenD@nioh.ac.za

Jeanneth Manganyi (Head of Section: Occupational Hygiene)
011 712 6406 | JeannethM@nioh.ac.za

TRAINING CONDUCTED

Workplace Biorisk Management Training Course

The Immunology & Microbiology Section hosted a Biorisk Management in the Workplace 5-day course from the 7 – 11 October 2019. This marked the third annual Biorisk course and was attended by 42 occupational health professionals including occupational health nurses, doctors, labour inspectors, occupational hygienists and environmental health practitioners. This course is intended to close the existing knowledge gaps in biorisks and empower attendees with the needed skills through lectures, demonstrations, case studies, problem solving, current best practices, cutting-edge science to prevent & control biological exposure.

Delegates also get to perform risk assessments in actual work settings for a more practical approach. The course can be tailored to specific industries and their needs.

Delegates at the BioRisk Management Course, 7 - 11 October 2019

Delegates at the Global Handwash Day, 15 October 2019

Hand Hygiene mini-workshop

The Immunology & Microbiology Section also co-hosted hand hygiene mini-workshop at the Rahima Moosa Mother and Child hospital on the 15th October to commemorate Global Hand Wash Day. Hand hygiene is a basic preventive measure which contributes significantly to reducing infections across workplace settings and thus is a simple and cost effective measure that can enhance the protection of workers' health.

National Union of Mineworkers (NUM) Training

The National Institute for Occupational Health (NIOH) conducted a week long national Occupational Health and Safety (OHS) workshop for the National Union of Mineworkers (NUM) representatives at Elijah Barayi Memorial Training Centre in Midrand, Gauteng from the 28 October to 1 November 2019. The programme comprised of inputs from the NIOH's multi-disciplinary OHS team drawing on NIOH's various Sections. The team included Occupational Medical Practitioners specialising in occupational lung diseases, and Ergonomics; Occupational Hygiene; HIV and TB in the Workplace; Epidemiology and Surveillance; Occupational Skin Diseases; Toxicology and Biochemistry; and other specialists. Additional input was provided by the presenters from the NDoH's Medical Bureau for Occupational Disease (MBOD), Department of Mineral Resources (DMR) Medical Inspector, Rand Mutual Assurance (RMA) and the National Council Against Smoking (NCAS). The NIOH training was coordinated by the National OHS Training Manager. The 2019 workshop introduced the union's OHS leadership in mining, energy and construction to a range of key occupational health topics. The 23 participants represented the union's OHS structures at branch, regional and national levels. Approximately a third were from the union's Women's' structures. The trade union representatives included full-time OHS shop stewards. The NUM has requested that OHS capacity-building event be convened annually.

Participants at the NUM National OHS Workshop, 28 Oct - 1 Nov 2019, Midrand

NIOH Webster Day

On 7 November the NIOH held its annual Webster Day. This event serves as a platform to discuss current topics related to occupational health and safety; and to profile relevant innovative research in South Africa. This year, the theme addressed the Changing World of Work and some of the new challenges that employees and employers face in the 21st century, and the role of the NIOH in this changing landscape. The focus of the day was on workplace mental health and our guest speakers included: Dr Sumaya Mall (Epidemiology and Biostatistics division at Wits University's School Public Health), Dr Thabiso Mokola (Public Health Medicine Specialist) and Dr Colleen Bernstein (Psychology division, Wits University). The speakers provided enlightened inputs and perspectives on the topic based on their various fields of expertise. Dr Mall outlined occupational mental health including studies related to the causality of mental disorders and the possibility that the occupational environment and mental disorders may have a bi-directional relationship; Dr Makola spoke about the importance of diversity in the workplace, specifically due to shifting paradigms, changing demographics, globalisation, generational gaps, and religious/ spiritual diversity; an Dr Bernstein provided an interactive session on the issue of bullying and emotional abuse in the workplace including the toxic effect it has on health. The event was well attended and mental health in the workplace was highlighted as a crucial topic needing more attention in South Africa. The NIOH looks forward to continuing discussions around this topic and seeking areas of collaboration with stakeholders.

For more information on the event visit the website at: http://www.nioh.ac.za/nioh-hosts-successful-webster-day-2019/

NIOH Webster Day 7 November 2019

Southern Africa Tuberculosis and Health Systems (SATBHSS) Training - Malawi

The NIOH Occupational Hygiene Section (OHyS) took part in a Southern Africa Tuberculosis and Health Systems (SATBHSS) training organized by the New Partnership for Africa's Development (NEPAD), an African Union Development Agency. The training was conducted by Mr Moses Mokone of the NIOH OHyS, together with other external specialists in the field of occupational health and safety, over a period of one-week (11-15 Nov 2019) and was hosted in Malawi. The focus was on capacity building related to occupational health risk assessment, workplace controls and the use of occupational hygiene monitoring equipment among public sector agencies such as ministries of labour, health and mines responsible for occupational health and safety (OHS) inspections in mines and non-mining sectors in Malawi. The training was attended by 32 delegates from the three ministries and included topics such as: principles of occupational health risk assessment, practical demonstration on the use of occupational hygiene instruments, the role of Occupational Hygienists in mining regulatory framework, inspectors' code of ethical behavior, legal framework and dealing with vulnerable workers. The programme also included a day visit to a nearby quarry to observe OHS practices and to assist OHS inspectors in learning how to apply health risk assessment principles using some of the monitoring equipment in the field. The feedback received from the 32 delegates indicated that the training was very beneficial and many participants expressed the need for additional training on specific topics in the field of occupational hygiene.

Site visit to Mater Stone Breakers Quarry during the SATBHSS Training in Malawi.

Participants at the Southern Africa Tuberculosis and Health Systems (SATBHSS) Training – Malawi.

Technical support to the Mozambique Ministry of Labour and Social Security

The NIOH was requested by the New Partnership for Africa's Development (NEPAD) to provide technical guidance to the Mozambique Ministry of Labour and Social Security in Maputo. This request forms part of the activities included in the memorandum of agreement (MOA) between the NIOH and NEPAD. This request was due to the launch of an occupational hygiene laboratory by the Ministry of Labour. The NIOH (as represented by Jeanneth Manganyi) visited the laboratory on 28 November 2019 and participated in a meeting with three representatives /laboratory staff members of the Ministry. A presentation was given, which facilitated some informal discussion. The presentation covered the basic requirements of setting up an occupational hygiene laboratory, which included trained personnel, facility and equipment, operating procedures, legislation and methods. A walkthrough in a laboratory was conducted where laboratory representatives demonstrated some of the equipment available. The meeting was well received and NIOH has provided a set of recommendations, including ongoing collaboration to address gaps in occupational hygiene and the necessary knowledge transfer through capacity building.

Participants including Ministry of Labour representatives and the Interpreter

During the demonstration of the equipment

Lung Function Interpretation Workshop

The NIOH hosted two one-day training workshops for Occupational Medical Practitioners (OMPs) on lung function interpretation on 26 and 28 November 2019 at the School of Public Health, University of the Witwatersrand. The workshop was developed based on common enquiries and discussions with the OMPS on patients referred to the NIOH Occupational Medicine Section. This workshop provided an opportunity for the OMPs to hone their skills of interpretation and decision making based on lung function tests. Participants benefitted also from gaining skills to independently identify features of asthma from lung function tests, and better understood use and interpretation methacholine challenge tests as a diagnostic specialised test. The intention is to host more of these trainings in 2020.

Participants at the Lung Function Interpretation Workshop for OMPs – 26 November 2019

Participants at the Lung Function Interpretation Workshop for OMPs – 28 November 2019

UPCOMING EVENTS

NIOH RESEARCH FORUM

The NIOH Research Forum is held monthly and is to promote the research of the Institute. The event is an hour long, showcasing two research projects. The upcoming meetings will be on 19 February, 18 March and 15 April 2020 from 10:00– 11:00.

If you would like to attend kindly RSVP to:
NtebogengK@nioh.ac.za

ANALYSIS AND INTERPRETATION OF ROUTINE SURVEILLANCE DATA TO IMPROVE OCCUPATIONAL HEALTH AND SAFETY

The NIOH will be hosting a three-day workshop on the basic analysis of routine surveillance data in Occupational Health and Safety from 25-27 February 2020. This surveillance data analysis workshop will provide practical training in the analysis, evaluation and interpretation of surveillance data and will allow all health and safety professionals along with HR practitioners to analyse and produce meaningful reports using routine data collected in their workplaces to the fullest. The workshop aims to provide the necessary skills to all to allow all health and safety professionals and HR practitioners to make the best use of routinely collected occupational health data for improved occupational health and safety and productivity in the workplace. Topics that will be covered include: surveillance systems, basic epidemiology, basic statistics, trend analysis, databases, occupational health ethics.

For more information, contact the Epidemiology & Surveillance Section:
Dr Kerry Wilson | KerryW@nioh.ac.za | 011 712 6422
Ms Asanda Jekwa | AsandaJ@nioh.ac.za | 011 712 6427

More info regarding the above-mentioned upcoming events will be posted on our website: www.nioh.ac.za/events

Awards & Recognition

ACHIEVEMENTS

- Ms Zubaydah Kirsten completed and was awarded a post graduate diploma in higher education from the University of the Johannesburg.
- Ms Charlene Andraos completed and was awarded a PhD from the Faculty of Health Sciences, in the Department of Haematology & Molecular Medicine at the University of the Witwatersrand.
- Ms Melissa Vetten completed and was awarded a PhD from the Faculty of Health Sciences, in the Department of Haematology & Molecular Medicine at the University of the Witwatersrand.
- Ms Sibongile Muthabeni has completed a B-Tech in Biomedical Technology.
- Ms Kedibonye Tumisi passed board exams, and is now a qualified Medical Technologist.
- Ms Mosidi Shabangu passed board exams and is now a qualified Medical Technician.
- Mr Moses Mokone has been appointed as a SAIOH Council Member.
- Sr Goitsimang Buffel completed and achieved a BTech in Occupational health from Tshwane University of Technology as well as a Diploma in Nursing Administration from Tshwane University of Technology.
- Dr Mollen Magombo completed specialist examinations and was awarded an MMed by the University of the Witwatersrand.
- Dr Sam Iyaloo completed specialist examinations and was awarded an MMed by the University of the Witwatersrand.
- Ms Angela Mawela completed The Society of Medical Laboratory Technology/ Technicians of South Africa (SMLTSA) board exams, and has qualified as a Medical Technician in Clinical Chemistry (Chem Path).
- Ms Avhadipfi Mulaudzi completed the SMLTSA board exams and has qualified as a Medical Technician in Clinical Chemistry (Chem Path).
- Ms Sesitjie Moremi completed the SMLTSA board exams and has qualified as a Medical Technician in Clinical Chemistry (Chem Path).
- Dr N Naicker accepted as a member of ICOH (International Commission on Occupational Health).
- Prof Mary Gulumian was selected as a Class of 2019 fellow for her substantial achievements in science or public policy relating to risk analysis and substantial service to the Society for Risk Analysis (SRA).

NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH

Division of the National Health Laboratory Service

Editorial and Production Team:
Ms Angel Mzoneli
Ms Shanaz Hampson
Dr Tanusha Singh
Dr Nisha Naicker
Ms Jeanneth Manganyi
Ms Miranda Raaff
Ms Babalwa Jekwa

To subscribe to this quarterly publication please send an email to:
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