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Respiratory health

Evaluation of diesel particulate matter sampling methods

Material safety data sheets for man-made mineral fibres should include diameter distribution measurements

Do we know enough to prevent occupationally acquired tuberculosis in health care workers?

Managers' perspectives on accommodating deaf individuals within the automotive manufacturing industry: a qualitative study

Official Journal of *The SA Society of Occupational Health Nursing Practitioners, The SA Society of Occupational Medicine, The Southern African Institute for Occupational Hygiene* and *The Mine Medical Professionals' Association.*

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From the Editor . . .

Linda Grainger, Editor

The special theme for this issue is respiratory health in the occupational context. We have three papers relating to it, and expect to have a further two in the November/December 2011 issue. The first paper provides the results of an evaluation of different sampling methods for diesel particulate matter. Despite the ubiquitous presence of diesel in workplaces and the health hazards associated with exposure, an occupational exposure limit has yet to be published for South Africa. However, it is expected that this will be established in the near future. In addition, there is no standardised sampling method. Therefore, the study by Pretorius and Grove makes an important contribution to addressing this issue.

Rockwool, one of the man-made mineral fibres, is commonly used for insulation. Construction workers are frequently exposed to it and although it has been known to act as a respiratory irritant it is often perceived by workers as being of low health risk. Phillips, Davies, Pieterse and Murray present an interesting case study that indicates the need for a more cautious approach. They have demonstrated that these fibres may well be respirable, and long-term lung damage is possible.

South Africa has an extremely high prevalence of TB, and healthcare workers are regularly exposed to patients with active TB, including MDR and XDR-TB. HIV positive healthcare workers are even more susceptible to infection risk. Zungu and Malotle, in their review article, highlight the policies and guidelines to prevent occupationally acquired TB amongst healthcare workers. Despite the existence of good national and international frameworks and policies, their implementation is poor. Readers are urged to use the information to put measures in place at their own workplaces to protect themselves. In addition, our societies and their members can advocate for other healthcare workers who do not have a good understanding of statutory occupational health requirements.

Karen Michell, the current President of SASOHN, has long been concerned about the quality of spirometry testing. She and other like-minded experts were instrumental in the development of the national SANS 451 standard for testing and the unit standard for training in spirometry. At the behest of the Editorial Board, she has produced a report on these activities. The steps that still need to be achieved are highlighted and it is hoped that the information will encourage our members to support these efforts.

Changing the focus from respiratory health, Smit and Brand describe the results of their study on managers' perspectives on whether deaf people could work in the automotive industry. The article is useful as it provides practical information on how such individuals could be accommodated in this setting. It also shows that the possibility of their working in it may not have been considered by managers and it is important that deaf awareness training programmes be provided. Despite the fact that this was a qualitative study in one industry, empirical evidence suggests that such perspectives may be quite widely held.

Blignaut, Coombs and Schillack have provided an overview of women and work. Following a description of the historical trends in women's work, the health issues that women currently face in relation to work are outlined. Finally, chemical toxicity in relation to women and their foetuses is emphasised.

Elsabé Klinck has addressed a very topical subject in her page – National Health Insurance. She succinctly highlights how the NHI is a measure to provide access to healthcare – a human right in terms of our constitution. However, as many of you are well aware, there are challenges associated with the implementation of such a health system, particularly with respect to financing. Readers are urged to study the NHI Green Paper (see reference 5 on page 37) and provide input on how occupational health and work-based primary care can be effectively integrated into the system.

The Occupational Safety and Health Group of the Cochrane Collaboration recently published a review of the effectiveness of workplace interventions on the outcome of occupational asthma.[1] Low-quality evidence that symptoms and lung function improved after removal from exposure was found. However, they rightly warn that this carries the risk of unemployment. Better studies to identify which interventions give the most benefit are required.

A systematic review which evaluated the effectiveness of interventions to influence workers to wear hearing protection to decrease their exposure to noise has found that some interventions improve the mean use of hearing protection devices compared to non-intervention.[2] Tailored interventions, such as the use of communication or other types of interventions that are specific to an individual or a group and aim to change behaviour resulted in improved use. Individually tailored education was more effective than target education programmes which address shared worker characteristics. Of note, is that mixed interventions (education, mailing, distribution of HPDs, noise assessments and audiometric testing) were more effective than hearing testing alone.

News from our professional societies is that two of them have elected new Presidents. Charles Mbekeni is the incoming President of the MMPA and Johann Beukes is the President of SAIOH. On behalf of *Occupational Health Southern Africa*, I would like to congratulate them both and wish them a stimulating, productive and effective term of office. I also wish to draw the attention of readers to SAIOH's change of telephone and fax numbers – please see page 39 for details.

1. de Groene GJ, Pal TM, Beach J, Tarlo SM, Spreeuwers D, et al. Workplace interventions for treatment of occupational asthma. Cochrane Database of Systematic Reviews. 2011; Issue 5. Art. No.: CD006308. DOI: 10.1002/14651858.CD006308.pub3.
2. El Dib RP, Mathew JL, Martins RHG. Interventions to promote the wearing of hearing protection. Cochrane Database of Systematic Reviews. 2011; Issue 9. Art. No.: CD005234. DOI: 10.1002/14651858.CD005234.pub4.

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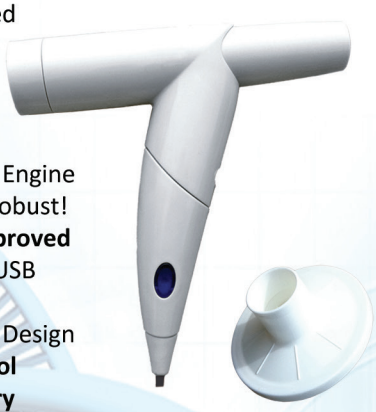

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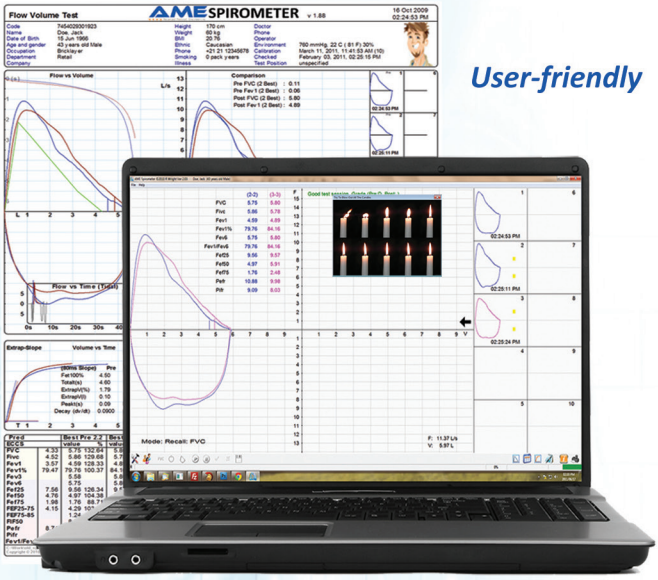

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Evaluation of diesel particulate matter sampling methods

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2. Member of the Southern African Institute for Occupational Hygiene

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ABSTRACT

The study evaluated diesel particulate matter (DPM) sampling methods used in the South African mining industry. The three-piece cassette respirable, open face and stopper sampling methods were compared with the SKC cassette method to find a comparable DPM sampling method for the non-coal mining industry. Controlled surface and underground static (i.e. area) and personal sampling studies were conducted. Triplicate analysis was carried out on each sampled filter using the NIOSH 5040 method to obtain elemental carbon, organic carbon and total carbon values. The results of the three-piece cassette sampling methods compared well with the SKC method and it is concluded that any of the three methods could be used to determine the DPM exposure of mineworkers in terms of the elemental carbon marker. In terms of standardising the DPM sampling methods for non-coal mining industries, the respirable method had certain advantages.

Key words: **diesel particulate matter, NIOSH 5040, SKC cassette, DPM sampling method**

INTRODUCTION

Diesel particulate matter (DPM) is an airborne pollutant generated by diesel-powered engines that causes respiratory diseases and that has been linked to lung cancer. Diesel engine exhaust is a highly complex and variable mixture of toxic chemicals that mainly consists of carbon dioxide, carbon monoxide, nitrogen oxides, hydrocarbons (including polycyclic aromatic hydrocarbons [PAHs]), sulphur oxides (depending on the fuel's sulphur content) and solid materials (fine particles). Diesel particulate matter is the visible emission in diesel exhaust that consists of liquid droplets and carbon particles or "soot".[1-3] The elemental carbon (EC) particles adsorb organic compounds, sulphates, metals and other trace elements.[1] The organic carbon (OC) fraction of diesel exhaust mainly consists of unburned fuel and oil. Compounds such as aldehydes and PAH are also contained in the organic fraction, which is of particular concern as many PAHs are known carcinogens.[1,3] The sum of EC and OC is total carbon (TC).

The health concern for DPM exposure lies in the fact that DPM is a sub-micron aerosol (mass median diameter of 0.2 µm) and 90% of the particles are smaller than 1 µm. They are therefore inhaled into the deepest part of the lungs (i.e. alveoli) and cause damage.[2,4-6]

With the acknowledged health risk associated with exposure to DPM an occupational exposure limit (OEL) for DPM exposure in South Africa is to be established soon. However, at present there no standardised sampling method for this particulate followed by the South African mining industry.

There are various methods used for sampling DPM in the South African mining industry. The most commonly used methods are the SKC DPM cassette and a three-piece cassette loaded with a 37 mm heat-treated quartz filter and support pad, with three different sampling configurations. The SKC DPM sampling method was originally designed for the coal mine industry to prevent carbon containing coal dust from collecting on the filter. Non-coal mining industries have been using both the SKC and the three-piece cassette methods when sampling for DPM. However, the various three-piece cassette methods have not been researched or compared with the SKC DPM method in the past.

The objective of this study was to evaluate the different

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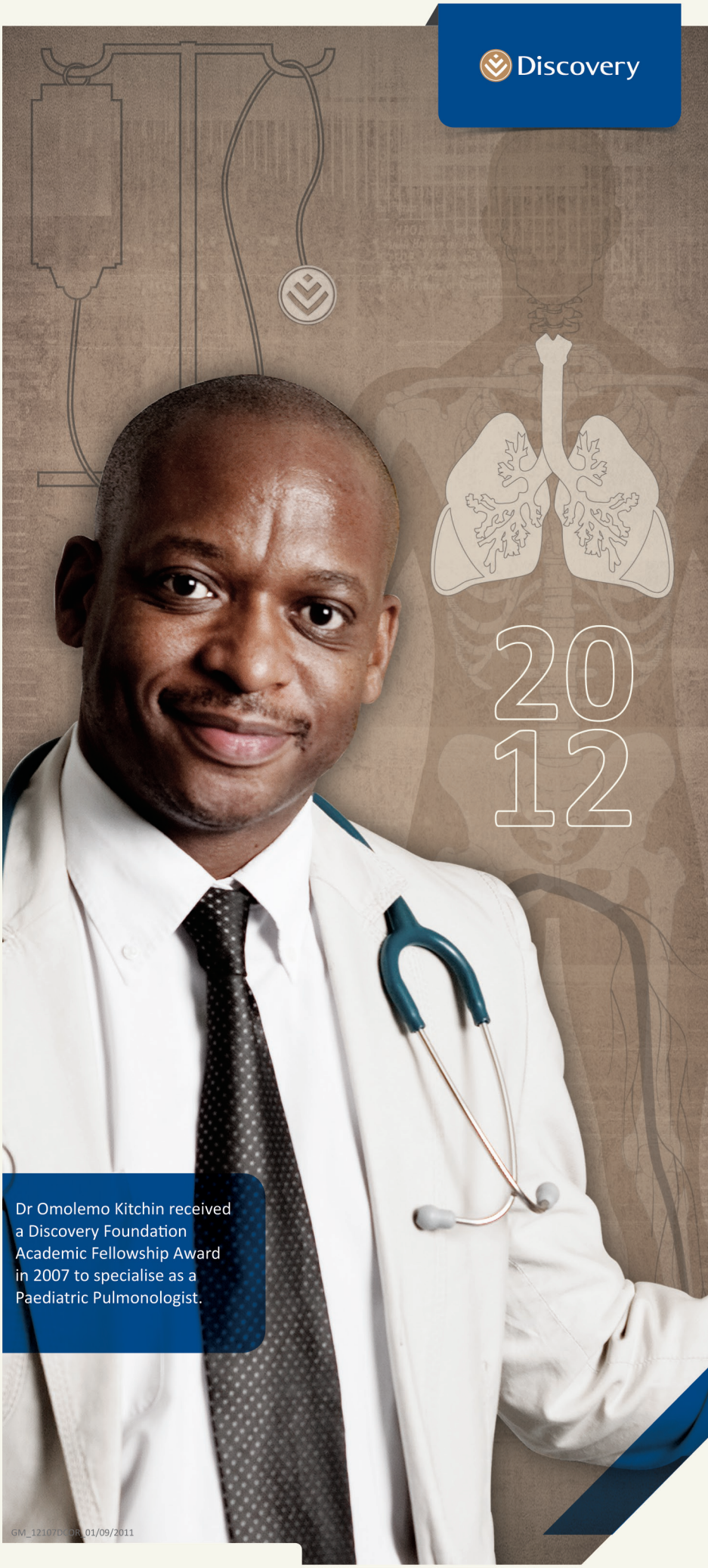

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DPM sampling methods used in the South African mining industry and compare them with the SKC method. The NIOSH 5040 analysis method for the measurement of DPM requires that three punches (i.e. specimens) be taken from a sampled filter. For this reason uniformity of the DPM deposition on the filter is essential. In order to compare the different DPM sampling methods used in the South African mining industry, the statistical analysis was based on the mass of DPM (in mg) on the sampled filter rather than the DPM concentration.

Research by NIOSH that validated the uniformity of DPM deposition on the filter with the SKC DPM cassette method, made this sampling method a suitable control in the current study.[8,10]

METHODOLOGY

The selection and execution of the four DPM sampling methods were based on information gained from a DPM questionnaire that was sent to 32 mines in the South African mining industry. No ethics clearance was required for the purpose of this study.

SKC DPM cassette method

The SKC DPM cassette and a GS-1 single-inlet cyclone were held together with a filter cassette/cyclone holder accessory for this configuration (see Figure 1). The filter media used in these cassettes were 37 mm heat-treated tissue quartz filters. The sampling head was attached to a Sensidyne Gillian air sampling pump (GilAir-3) by means of flexible tubing and the sampling pump was calibrated at a flow rate of 1.7 l/min for sampling according to the manufacturer's specifications.

Three-piece cassette methods

In the following three methods the sampling head consisted of a three-piece clear styrene cassette loaded with a 37 mm heat-treated quartz filter, a stainless steel ring which provided a filter deposition area of 8.04 cm^2 and a support pad. The sampling head was attached to a GilAir-3 with flexible tubing. The differences between the three-piece cassette sampling methods are described below.

Respirable method (i.e. configuration)

The bottom part of the three-piece cassette was removed and a non-corrosive size-selective cyclone was attached in its place. To prevent air leakages between the cyclone and the filter cassette, insulation tape was used to seal off the connection (see Figure 2). The sampling pump was calibrated at 2.2 l/min, matching the specification from the cyclone supplier.

Open face method

For this method the bottom or inlet part of the three-piece

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Figure 1. SKC DPM sampling method

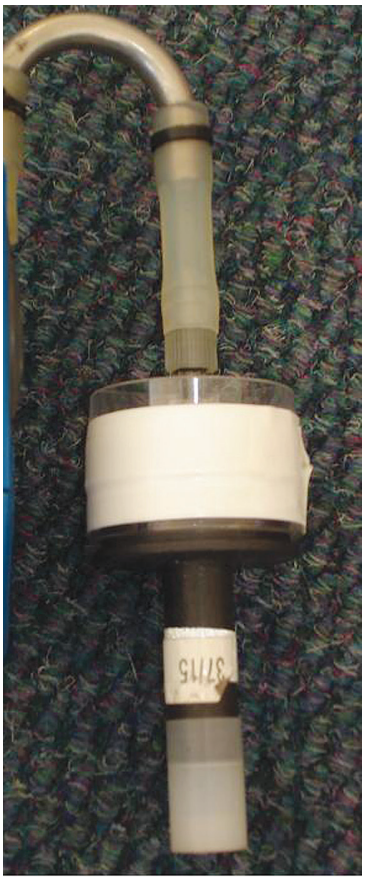

Figure 2. Respirable DPM sampling method

Figure 3. Open face DPM sampling method

Figure 4. Stopper DPM sampling method

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cassette was also removed, leaving the cassette "face" open for sampling directly onto the filter (see Figure 3). Sampling was conducted at 1.7 l/min for this method, based on information obtained from the users within the mining industry.

Stopper method

The three-piece cassette is protected from the environment with plastic stoppers (i.e. plugs) at the inlet and outlet of each cassette. The inlet stopper was removed with the stopper method, revealing only the inlet opening through which sampling took place (see Figure 4). The sampling pump was calibrated at 1.7 l/min, based on information obtained from users within the mining industry.

Sampling studies

Three different studies were conducted in which each of the above-mentioned sampling methods or configurations were used.

Controlled study

The controlled study was performed on surface in a diesel locomotive service shed. A locomotive with a 12-cylinder CAT diesel engine was pulled into the shed, started and performed under load (approximately 1800 rpm) for an hour while sampling was conducted. All the doors and possible entrances to the shed were closed off to minimise ventilation during sampling and to keep the environmental conditions constant.

Ten sampling pumps, consisting of four SKC DPM sampling trains and two of each of the three-piece cassette sampling trains, were assembled in a wooden box. The wooden box with the pumps was lifted to approximately 10 metres above the locomotive towards the middle of the shed with a crane, where it remained for the duration of the sampling period. The box was hoisted above the locomotive to sample the highest DPM concentration within the permissible time of one hour. The study was repeated three times on three consecutive days. The number of samples taken were SKC method (n=12), respiratory method (n=6), open face method (n=6) and stopper method (n=6).

Source: http://en.wikipedia.org/wiki/File:Automobile_exhaust_gas.jpg

Field study

A study under actual underground mining conditions was conducted to compare these results with the results obtained during the controlled study on surface. Static and personal sampling was repeated for four dayshifts over four consecutive days. The objective of the underground study was to determine if the trends found in the results from the different DPM sampling methods during the controlled study would be repeated under real mining conditions.

Static sampling (i.e. area sampling)

Area sampling was conducted in an underground trackless section of a platinum mine at a tipping area. The highest DPM exposure would be expected here where the load haul dump (LHD) would be working under load. Each one of the four different sampling methods (n=4 for each method; total n=16) was assembled and placed as static samplers at the tipping area for the duration of the shift, which lasted approximately eight hours. The pumps were placed approximately 1.2 m above ground level to be representative of the workers' inhalation of DPM.

Personal sampling

Personal sampling was conducted in the same section in which the static sampling took place. Four workers (n=4 for each method; total n=16) that worked in this area were each supplied with a sampling train with one of the DPM sampling methods. The occupations sampled were a utility vehicle operator, an LHD operator, a drill rig operator and a rock breaker operator (tip attendant). An individual worker did not receive the same DPM sampling method every day in order to establish a worst case scenario for personal sampling under real mining conditions.

ANALYTICAL PROCEDURES

Triplicate analysis was conducted on each sampled filter according to the NIOSH 5040 analytical method. The EC, OC and TC values were determined and converted to milligram (mg) by taking the filter deposition area of 8.04 cm^2 into account.

Statistical analysis

The mass of EC, OC and TC (in mg) was statistically analysed to determine if the triplicate results from the filters for

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Table 1. Summary of measurements for the controlled study (surface)

	Summary measure	SKC	Respirable	Open face	Stopper
Organic carbon	Average (mg)	0.362	0.677	0.523	0.436
	Standard deviation	0.371	0.619	0.646	0.398
	Average RSD%	2.9	2.3	14.4	8.2
Elemental carbon	Average (mg)	0.131	0.179	0.132	0.148
	Standard deviation	0.172	0.199	0.169	0.182
	Average RSD%	5.1	8.1	5.5	10.1
Total carbon	Average (mg)	0.494	0.856	0.655	0.584
	Standard deviation	0.540	0.810	0.812	0.568
	Average RSD%	2.2	1.2	10.8	6.0

Table 2. Summary of measurements for the underground (static) DPM sample

	Summary measure	SKC	Respirable	Open face	Stopper
Organic carbon	Average (mg)	0.070	0.100	0.095	0.102
	Standard deviation	0.030	0.038	0.039	0.033
	Average RSD%	2.6	10.0	10.2	17.1
Elemental carbon	Average (mg)	0.099	0.127	0.105	0.103
	Standard deviation	0.044	0.044	0.044	0.043
	Average RSD%	4.1	8.7	5.6	2.9
Total carbon	Average (mg)	0.169	0.227	0.200	0.204
	Standard deviation	0.073	0.082	0.080	0.073
	Average RSD%	3.4	8.0	7.0	9.7

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each three-piece cassette method compared with the triplicate results from the SKC method. In order to test whether the different types of filters showed differences in variability, as measured with the statistical measures of standard deviation or variance, Levene's test was used. Levene's test is applicable to a relatively small number of samples and when no assumption about the samples' underlying distribution can be made.[9]

The percentage relative standard deviation (RSD%) was calculated on the basis of the standard deviation of the triplicate results per filter divided by the average of the three results.

RESULTS

The distribution of EC, OC and TC values (in mg) for the controlled study are given in Figure 5. Under the controlled conditions there were no statistically significant differences between the EC values for the respirable, open face and stopper methods when compared to the EC values from the SKC method ($p > 0.05$). However, the variance among the OC and TC values for the three methods showed significant differences when compared to the SKC method.

The average EC values (mg) for the open face and stopper methods compared very well with the EC values of the SKC method in that their average values were within the NIOSH acceptance criterion range of ± 25% of the average

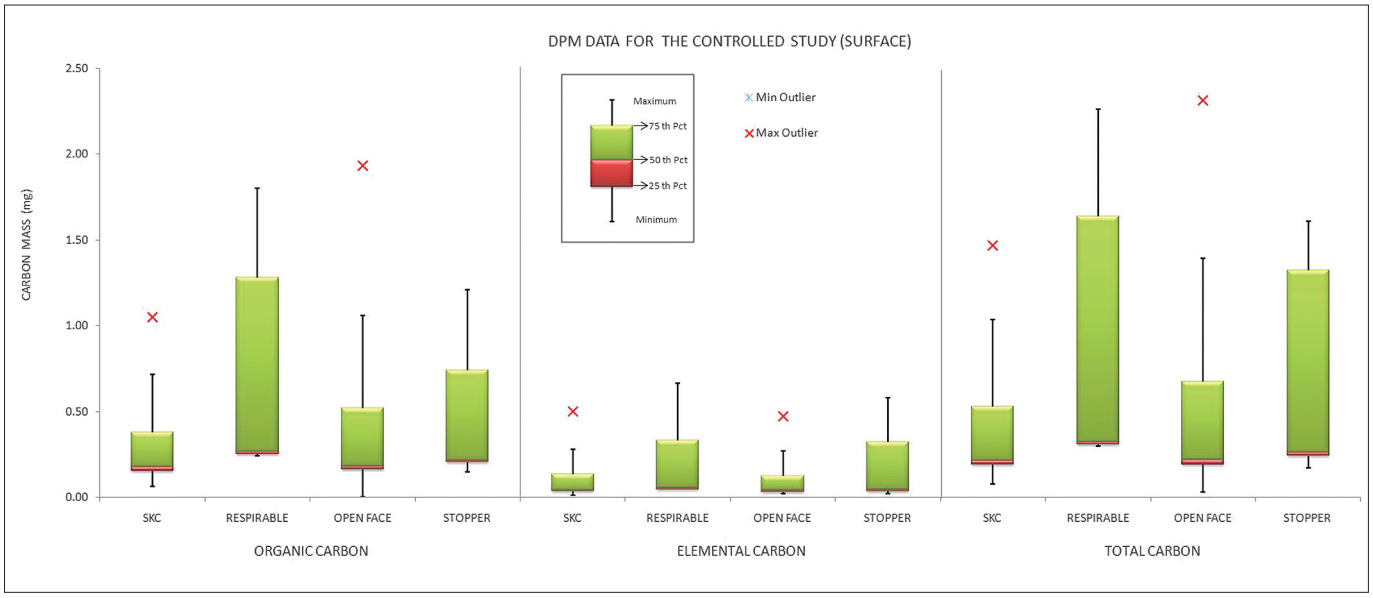

Figure 5. DPM data for the controlled study on surface showing the OC, EC and TC values

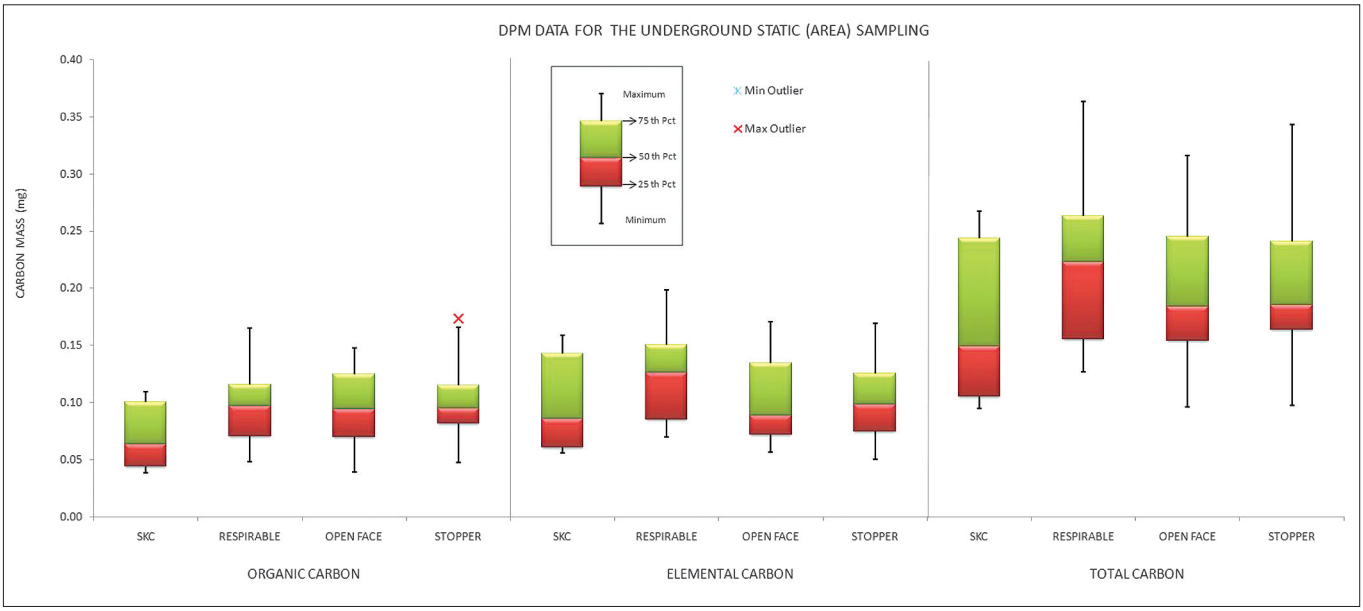

Figure 6. DPM data for the underground static (i.e. area) sampling showing the OC, EC and TC values

SKC value.[1] However, the average value for the respirable method was 35% higher than the SKC average. The difference in the respirable method could be related to the performance of the cyclone and/or the higher flow rate that was used compared to the other sampling methods.

The average relative standard deviation (RSD) for the EC values of the SKC method was 5.1%, which is similar to what was found by NIOSH. The RSDs for the EC values of the other methods were: respirable (8.1%), open face (5.5%) and stopper (10.1%). The average RSDs for the OC and TC values were higher than 5% for the open face and stopper methods and were below 5% for the respirable method. These values are summarised in Table 1.

The distribution of the results from the underground static (i.e. area) sampling is shown in Figure 6. The results from the underground, static (i.e. area) DPM measurements showed that the average EC values for the open face and stopper methods were within the NIOSH criterion range of 25%. The average EC values from the respirable method were just outside of this range (+28%). The RSD for the EC values for each method was: SKC 4.1%, respirable 8.7%, open face 5.6% and stopper 2.9%. Similar to the controlled study on surface, the RSDs for OC and TC values were higher than 5% for the three-piece cassette methods, apart from the SKC method. The values are summarised in Table 2.

Levene's test revealed no statistically significant differences among the variances associated with the respirable, open face or stopper methods when compared to the SKC method for the underground static sampling. All the p-values for the EC, OC and TC values were greater than 0.05 (average p = 0.67).

There was an initial concern that variations in measurements on the same filter (i.e. differences in triplicate measures) could influence the results of the Levene test. For this reason the values obtained from the triplicate measures were averaged per filter, and the Levene test was carried out again on these "averaged" values. The variance obtained from the "averaged" values differed slightly from that calculated on all data values. However, the significance patterns did not change.

The distribution of the underground personal sampling results is illustrated in Figure 7. For the underground personal sampling the average EC values of the respirable and open face methods were within 25% of the average SKC value. The average EC value for the stopper method was 54% higher than the SKC method.

The average RSDs for the EC values for all the sampling methods were below 5%. As with the controlled study on surface and the underground static sampling, the average RSDs for the OC and TC values were, in general, higher than 5%. These values are summarised in Table 3.

The Levene test showed that there were no statistically significant differences between the variances of the TC, OC or EC values of the respirable method when compared to the SKC method (p-values were greater than 0.4).

When the variances of the TC, OC and EC values of the open face method were compared to those of the SKC method, statistically significant differences could be found ($p < 0.05$). Only the EC values of the stopper method were not significantly different from the SKC method.

Given that NIOSH[1] recommends that the EC value be used as the marker for DPM exposure measurements, it was interesting to note that the respirable and stopper methods showed no significant differences in variances when compared to the SKC method for underground personal sampling. This finding confirmed the result obtained in the controlled study on surface. The open face method showed a statistically significant difference in variance compared to the SKC method, but this difference was no longer significant when tested on the "averaged" data.

DISCUSSION

The results obtained from this study indicate that any of the three-piece sampling methods can be used to determine the DPM exposure of mine workers in terms of the marker, EC. There are, however, a number of practical considerations to keep in mind:

- The open face sampling method lends itself to tampering, which could have a negative impact on the DPM exposure result;
- The open face and stopper sampling methods allow for the deposition of particles that are larger than ten micron (i.e. not respirable fraction); and
- The deposition of DPM on the filter is subject to the performance of the size-selective cyclone when using the respirable sampling method.

CONCLUSIONS AND RECOMMENDATIONS

The study showed that any of the three-piece cassette methods can be used to determine the DPM exposure of mine workers in terms of the EC marker, with values that should compare very well if the SKC method is used under the same conditions.

In order to standardise the DPM sampling methods for non-coal mining industries, it is recommended that the respirable method be used for DPM exposure measurements. The respirable method allows for the sampling of the respirable fraction of airborne dust of which DPM forms a part and the filter is protected against tampering. This method can be used on surface or underground, for personal or static sampling and should give comparable results to the SKC method. This method also provides a cost-effective alternative for DPM sampling in non-coal mining industries when compared to the SKC cassette.

A larger underground study is recommended to determine how the EC concentrations obtained from the respirable DPM sampling method compare with those of

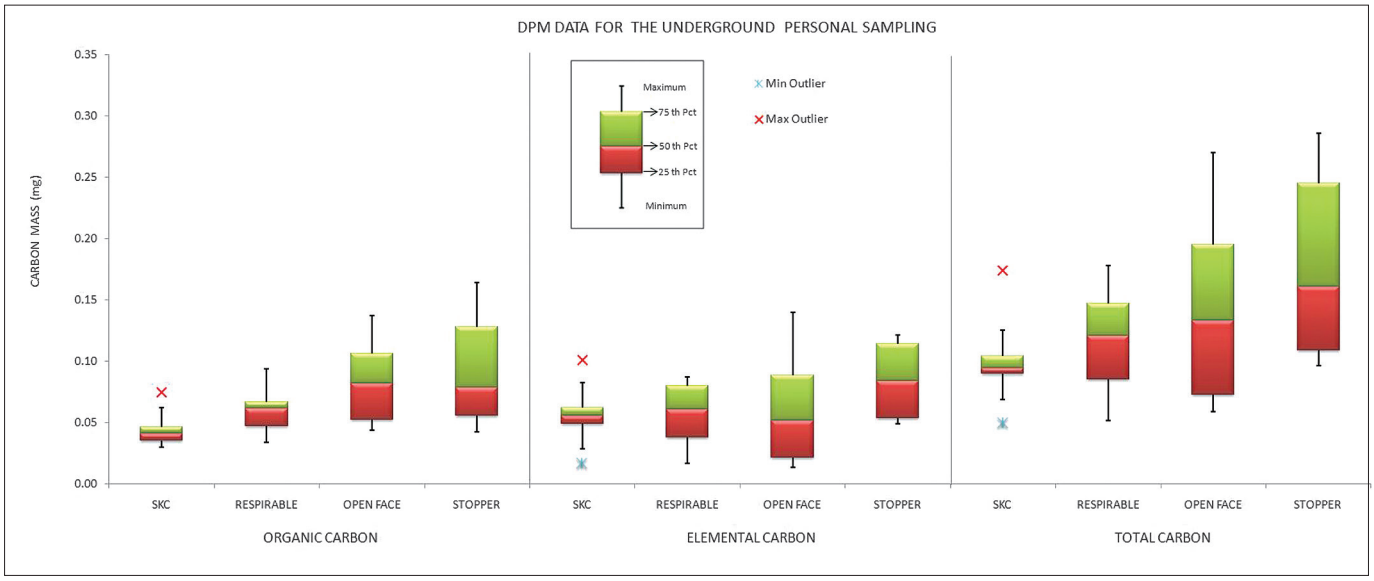

Figure 7. DPM data for the underground personal sampling showing the OC, EC and TC values

Table 3. Summary of measurements for the underground personal DPM sample

	Summary measure	SKC	Respirable	Open face	Stopper
Organic carbon	Average (mg)	0.046	0.060	0.083	0.091
	Standard deviation	0.015	0.019	0.034	0.043
	Average RSD%	6.8	7.8	10.5	19.8
Elemental carbon	Average (mg)	0.055	0.056	0.062	0.084
	Standard deviation	0.029	0.028	0.049	0.033
	Average RSD%	4.0	3.6	4.1	3.1
Total carbon	Average (mg)	0.101	0.116	0.145	0.175
	Standard deviation	0.043	0.045	0.082	0.074
	Average RSD%	3.5	4.9	7.4	10.4

the SKC method. The outcome of such a study could provide a conversion factor between these two methods that would take the different sampling flow rates into consideration.

LESSONS LEARNED

1. The EC values from the three-piece cassette DPM methods showed no significant differences when compared to the SKC method.
2. The EC values for the respirable, open face and stopper methods showed no significant differences under controlled surface and underground static conditions.
3. The OC and TC values for all the three-piece cassette DPM methods did not show a consistent significance pattern with the SKC method.
4. The respirable DPM method is recommended as an alternative method for use in the non-coal mining industry.

ACKNOWLEDGEMENT

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Material safety data sheets for man-made mineral fibres should include diameter distribution measurements

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ABSTRACT

A worker involved with the removal of insulation material from a large chamber presented with a persistent cough and chest discomfort. Examination of the insulation material identified it as rock wool with a mean fibre diameter of 3.47 µm. The distribution of the fibre diameters showed 53% to be less than 3 µm and therefore potentially respirable. Material safety data sheets for rock wool were studied and they did not include important information about fibre diameter. This case highlights the need for respiratory protection to be worn by workers exposed to man-made mineral fibres.

Key words: rock wool, man-made mineral fibres, exposure, scanning electron microscopy

INTRODUCTION

Man-made mineral fibres (MMMFs) are synthetically produced amorphous, inorganic fibres that are used mainly for structural strengthening, filtration, soundproofing and insulation. They are manufactured by melting rock, glass, slag or clay. They have a range of chemistries and several different names such as rock wool, glass wool, slag wool and mineral wool. MMMFs have been shown to be irritants and to cause contact dermatitis.[1] Although the subject is complicated by the various names given to MMMFs and by the fact that MMMFs can have surface coatings, it is widely accepted that rock wool is not a respiratory health hazard. The reasons for this are either that the fibres are too thick

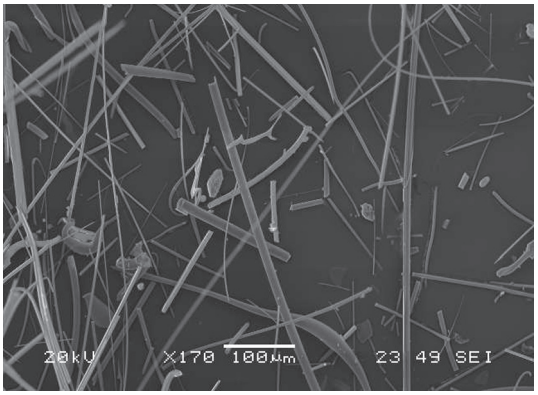

Figure 1. A representative field as seen using scanning electron microscopy. There is a marked variation in fibre diameter and length

Table 1. Information for rock wool included in MSDS available in the public domain[3-8]

Issue date	PEL or WEL	Mean fibre diameter	Diameter distribution	Acute health effects	Chronic health effects
2011[3]	2 f/cc TWA	Not given	Not given	Irritant: skin, eyes, throat.	Not classified as dangerous according to EU Directives 67/548/EEC and 1999/45/EC.
2011[4]	2 mg/m^3 TWA	Not given	Not given	Irritant: skin, eyes and upper respiratory tract.	No known long-term health effects.
2010[5]	1 f/cc TWA	Not given	Not given	Irritant: skin, eyes, nose, throat, upper respiratory tract.	Not described in man.
2005[6]	1 f/cc TWA	Not given	Not given	Irritant: skin, eyes, upper respiratory tract.	Not classifiable as to carcinogenicity in humans.
2003[7]	1 f/cc	Not given	Not given	Irritant: skin, eyes, nose, throat.	Not classifiable as to carcinogenicity.
2001[8]	1 f/cc TWA	Not given	Not given	Irritant: skin, eyes, upper respiratory tract.	None for humans.

WEL = Workplace exposure limit, PEL = Permitted exposure limit, TWA = Time weighted average.

to be respirable or that they are cleared rapidly from the lungs.[2] The diameter of a fibre determines whether it is respirable. Fibres with a diameter of less than 3 µm are respirable. Respirable fibres can reach the depths of the lungs. Thicker fibres may be inhaled but are trapped in the upper respiratory tract.

CASE DESCRIPTION

A 26-year-old-man, who did not smoke, supervised the removal of rock wool insulation from a chemical plant. He wore an FF1 type mask for part of the time while the rock wool was being removed from a chamber measuring 6 X 6 X 15 metres. Two weeks after exposure he consulted his doctor complaining of a persistent dry cough, and central chest discomfort. He was examined and reassured. His symptoms persisted and, as a result of his reading about the inhalation of fibres, he contacted the National Institute for Occupational Health (NIOH) enquiring about possible long-term effects. The NIOH offers a service to characterise material which may be respirable. He was requested to submit a sample of the insulation material for analysis. A sputum specimen was also requested but he was unable to produce this. The patient is being followed up by a pulmonologist – his symptoms have resolved, he is currently well and his lung function tests are within normal limits.

MATERIALS AND METHODS

A sample of the insulation material from the chamber was prepared for scanning electron microscopy (SEM) and chemical analysis using energy dispersive spectroscopy (EDS). Representative areas of the sample were photographed. The diameters of 100 randomly selected fibres were measured. Six material safety data sheets (MSDS) for rock wool were obtained from the Internet and their information was collated.[3-8]

RESULTS

By EDS, the fibres present in the material were composed of magnesium, aluminium, silicon, calcium and iron in ratios characteristic of rock wool. It was apparent that there was a mixture of large and narrow diameter fibres (see Figure 1). The distribution of the diameters is shown in Figure 2. The mean diameter was 3.47 µm. The six MSDS[3-8] studied did not give information on the fibre diameters. The acute health effects stated in the MSDS include irritation and discomfort of the skin, eyes, throat and upper respiratory tract. Rock wool is not classified as a carcinogen and there are no known long-term health effects described in the MSDS studied (see Table 1).

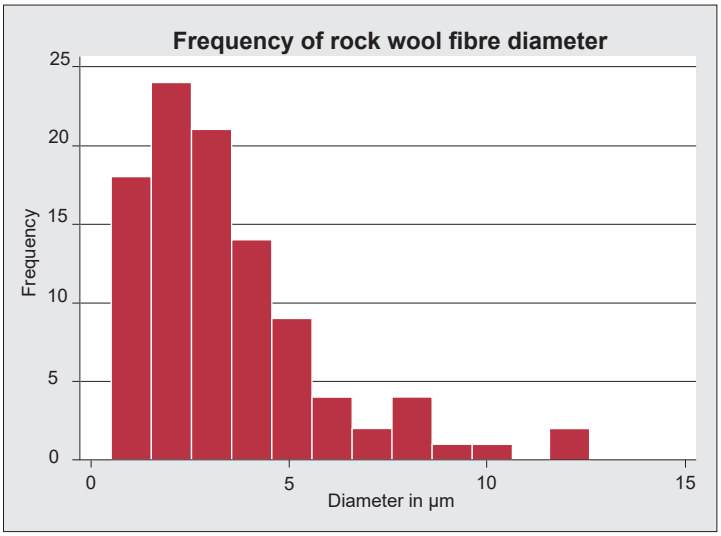

Figure 2. Distribution of fibre diameters of 100 randomly selected fibres measured using scanning electron microscopy

DISCUSSION

Of the fibres measured, 53% were less than 3 µm in diameter and therefore narrow enough to be respirable and capable of reaching the bronchioles and the alveoli.

Internationally, the recommended exposure limit for MMMF greater than 5 µm in length and less than 3 µm

in diameter is 1 fibre per millilitre (f/ml) TWA.[2] In the absence of clear evidence that the material does not contain fibres less than 3 µm diameter, respiratory protection should be worn at all times and an exposure limit of 1 f/ml should be adhered to.

> "The diameter of a fibre determines whether it is respirable."

MSDS should include critical information about the mean diameter and more importantly the diameter distribution of fibres. The distribution of diameters will show if some of the fibres are respirable, even though the mean diameter may be greater than 3 µm.

Animal studies in which rock wool is surgically implanted or injected into body cavities, bypassing the natural defence mechanisms have produced malignant tumours.[2] However, epidemiological studies in humans that have described an increase in cancers following exposure to rock wool have been criticised on methodological grounds.[9-10] The scientific literature suggests that rock wool is not likely to cause cancer in humans except through unlikely routes or levels of exposure.[2]

Fibrosis of the lung has been described in a man who was a rock wool insulator sprayer for 12 years. A needle biopsy of his lung showed the presence of rock wool fibres.[11]

CONCLUSIONS AND RECOMMENDATIONS

The symptoms which followed a short exposure, while not in themselves a serious threat to health, were sufficient to prompt an informed worker to seek expert advice. The SEM findings establish clearly that a mean diameter is an inadequate descriptor of MMMFs. More attention should be devoted to detailed examination of commercial MMMF products and the MSDS that accompany them should include diameter distribution measurements.

When working with MMMFs, masks and goggles should be worn to prevent irritation of eyes and upper respiratory tract and all exposed skin should be covered by protective clothing. In this case the worker wore an FF1 mask recommended in the MSDS but he did not wear it for all the time he was in the vicinity of the insulation removal work.

LESSONS LEARNED

1. **The diameters of MMMF fibres need to be included in MSDS.**
2. **The mean diameter of MMMFs is insufficient to determine respirability and the diameter distribution needs to be included in MSDS.**
3. **This case illustrates that a large proportion of fibres in a MMMF may be respirable and personal protective equipment should be worn at all times by workers exposed to MMMFs.**

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Do we know enough to prevent occupationally acquired tuberculosis in healthcare workers?

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ABSTRACT

Healthcare workers in South African healthcare facilities work in environments with a high density of tuberculosis patients due to the dual burden of tuberculosis and human immunodeficiency virus in the population, thus predisposing them to contracting tuberculosis. Despite the knowledge of the high tuberculosis incidence and the likelihood of tuberculosis transmission to both health care workers and patients, and the availability of basic infection control measures in our healthcare facilities, there is still inadequate implementation of infection control measures in healthcare facilities. This article seeks to review the knowledge base, instruments for tuberculosis control, the implementation of these tools and the knowledge gaps within the healthcare system in South Africa. A comprehensive review of scholarly literature was conducted based on Internet search engines. The review revealed the availability of adequate knowledge and tools for the control of tuberculosis in healthcare facilities, but inadequate implementation of infection control measures.

Figure 1. N95 mask

Keywords: Occupationally acquired tuberculosis, healthcare workers, infection control, healthcare settings

INTRODUCTION

Health Care Workers (HCWs) in South Africa work under extremely difficult conditions as a result of the challenges facing the healthcare system, including amongst others the shortage of HCWs across the board, increasing population, the high burden of disease especially human immunodeficiency virus (HIV) and tuberculosis (TB), and deteriorating healthcare infrastructure. The numerous challenges facing HCWs would then suggest that the country's healthcare authorities would be doing their utmost to create a conducive working environment for HCWs, especially prevention of occupationally acquired TB, as TB is a major public health problem in South Africa and requires vigilance[1] in the workplace. Within the healthcare system, the risk for occupationally acquired TB disease is even higher among HCWs co-infected with HIV in South Africa.[2]

Transmission of TB in healthcare settings to both patients and HCWs has been reported from virtually every country of the world, regardless of local TB incidence.[3] In resource rich countries TB has been recognised as an occupational hazard for HCWs since the 1950s,[3] and adequate infection control measures (ICMs) were then instituted to control the scourge caused by TB in HCWs. In South Africa pulmonary tuberculosis (PTB) caused by mycobacterium tuberculosis or mycobacterium other than tuberculosis (MOTTS) in the workplace including healthcare settings is recognised and accepted as an occupational hazard.[4]

Even though PTB in HCWs is known and accepted as an occupational disease, it still poses a serious threat to HCWs in South Africa.[2] This is due to the dual epidemic of HIV and TB, and the emergence and re-emergence of multidrug resistant TB (MDR-TB) and extremely drug resistant TB (XDR-TB) in our healthcare facilities and the complacency of healthcare authorities in the implementation of ICMs against occupational TB in healthcare settings in order to protect both patients and HCWs.

Occupational TB has the potential to disrupt, if it is not already disrupting, the provision of quality healthcare services by HCWs, as a result of absenteeism, decreased morale, and in extreme cases loss of HCWs. Joshi et al, found that the attributable risk of TB disease due to nosocomial exposure was high (25 – 5361 per 100 000 per year) among HCWs in low and middle income countries, especially in healthcare settings with more TB patients per HCW,[5] this finding alludes to the potential disruptions in healthcare service delivery as a result of TB in HCWs.

> "Occupational TB has the potential to disrupt . . . the provision of quality healthcare services . . ."

The World Economic Forum has identified tuberculosis in the workplace as an important disruption to the business and cause for concern, and in turn produced a toolkit for the integrated approach to TB and HIV in order assist business in the control of TB and HIV.[6] In a similar manner the Department of Public Service and Administration has also designed strategies to combat both TB and HIV in the public service including HCWs.[7] This article reviews the burden of occupational TB, the policy framework and the programmatic interventions in place for the protection of South African HWCs from occupationally acquired TB, as well as the availability of the required knowledge base and tools to institute ICMs against occupationally acquired TB in HCWs.

METHODOLOGY

A review of literature related to TB and HCWs was conducted using Internet searches on peer reviewed articles. We then used the electronic databases PubMed and HighWire Stanford University, for primary articles studies (on http://www.ncbi.nlm.nih.gov/pmc/, and http://highwire.stanford.edu/). The search terms used included TB in health settings, HCWs and TB, and TB in HCWs in South Africa; articles from 1990 to 2011 were selected. Finally, we reviewed the references in the articles selected from the Internet searches and the electronic databases.

DISCUSSION

Burden of occupational tuberculosis in healthcare workers

South Africa has the third highest TB incidence in the world after China and India with a TB incidence of 971 per 100 000 compared to the global average of 137 per 100 000 in 2009.[8] The high TB incidence in the South African population and thus the patients treated in the healthcare facilities, could be responsible for the high TB incidence among HCWs in South Africa as reported by a number of studies.[2,9-11] The risk of latent tuberculosis infection (LTBI) and active TB as an occupational disease is well established, and HCWs are recognised as a high-risk group for LTBI.[12] A study by University Research Co. LLC (URC) and the Desmond Tutu Tuberculosis Centre in five provinces in South Africa found that the average burden of TB in HCWs was 2% compared to 0.9% in the general population,[13] while O'Donnell et al. also found that HCWs had a 5 to 6-fold increased rate of hospital admission with MDR-TB or XDR-TB compared to non-HCWs.[11] The incidence of TB infection attributable to healthcare work is 5.8% (range 0-11%).[3,11]

Why is occupational TB of particular public health importance?

Occupational TB in healthcare settings is a preventable disease through adequate and relatively simple and affordable ICMs, and is a curable disease using standard TB treatment regimens, but with potentially fatal outcomes if inappropriately managed. It can lead to immense suffering and distress to the affected HCWs, co-workers and family members, while the healthcare system stands to lose valuable HCWs.

The number of patients in our healthcare facilities with TB and HIV co-infection has increased since the emergence of HIV and Acquired Immunodeficiency Syndrome (AIDS) in the 1990s. Patients with HIV progress to active TB, and are more likely to result in multidrug-resistance (MDR-TB) and produce nosocomial outbreaks of pulmonary TB, MDR-TB and XDR-TB in both patients and HCWs in healthcare facilities.[14] Several HCWs have died of TB and many others have developed active TB that is identical, by susceptibility profile or restriction-fragment-length polymorphism analysis, or both, to the outbreak from their hospital.[15,16,17] The healthcare system in South Africa, cannot afford to lose its highly skilled personnel to TB when it faces the challenges posed by the pandemic of HIV in midst of human resources for health shortages.

Risk associated with occupational TB

The risk of occupationally acquired TB is substantially higher in HCWs when the source of exposure is pre-chemotherapy patients, and declines drastically in patients on effective TB treatment,[18] as effective TB treatment reduces the infectious period of TB patients. The magnitude of the risk varies by setting, occupational group, prevalence of TB in the community, patient population, and effectiveness of TB ICMs.[19] The probability that a HCW who is exposed to TB will become infected depends primarily on the concentration of droplet nuclei in the air and the duration of exposure to infectious droplet nuclei. In addition the personal health status and environmental factors play a huge role in progression from TB infection to disease. Personal health status is affected by HIV status, previous TB disease in the last two years and other immuno-compromising conditions such as diabetes mellitus; while environmental factors include small enclosed

spaces, inadequate ventilation and improper performing of procedures and specimen handling.[19]

Policy framework for TB in HCWs in South Africa

The World Health Organization (WHO) in 2009 released an updated 'WHO policy on TB infection control in healthcare facilities, congregate settings and households' guideline, which is an evidence based policy for the implementation of sound TB control by all stakeholders,[20] including South Africa as a member of the WHO. The policy aims to provide guidance on how to reduce the risk of TB transmission in healthcare facilities.[20]

Within South Africa, the health and safety of all employees at work is covered by the Occupational Health and Safety Act, No. 85 of 1993 (OHSA).[21] The OHSA stipulates that an employer is obliged to provide, as far as is reasonably practicable, a safe workplace without risk to the health of its employees. Through the Hazardous Biological Agents (HBA) regulations the OHSA provides guidance on the management of TB in occupational settings, including the requirements for Health Risk Assessment every two years in a facility where HBA could be found. South Africa also has the draft national infection prevention and control policy for TB, MDR-TB and XDR-TB which guides management and HCWs to minimise the risk of TB transmission in healthcare facilities and other facilities where the risk of TB transmission is high due to high prevalence of both diagnosed and undiagnosed TB cases in healthcare facilities.[22]

> "... HCWs had a 5 to 6-fold increased rate of hospital admission with MDR-TB or XDR-TB compared to non-HCWs."

Programmatic interventions for the control of TB in HCWs

In general the interventions required for the control of occupational TB in healthcare facilities are known, as they are mostly statutory interventions. These are the regular risk assessment conducted every two years or as and

when HCWs with suspected occupational TB are identified, to determine the exposure and control measures for HBAs including TB in the workplace, as per the requirements of the HBAs regulations-promulgated in terms of the OHSA. The risk assessment findings should determine the type of control measures to be implemented.

In healthcare facilities the cornerstones of the control measures for TB are engineering controls, administrative controls and personal protective equipment (PPE). The engineering controls include negative-pressure local exhaust ventilation or dilution ventilation systems, with high-efficiency particulate air filtration and ultra violet treatment of ventilated air.[23] These are not always affordable and thus, natural ventilation and exposure to sunlight are still the best available control measure under resource constraints.[23]

Even though administrative controls are relatively simple and easy to implement, they are still not as effective as proper ventilation. They also have the limitation of dependence on the healthcare workers almost on daily basis as they include patient triaging, early diagnosis, treatment and management of TB patients as outpatient whenever possible.[23] Administrative control may be the first available control measure, where infrastructure does not permit adequate ventilation. And lastly the use of correct personal protective equipment (PPE), which should be a respirator with the capacity to filter a 1 micron particle,[23] such as the N95 mask shown Figure 1.

Beyond the three levels of control, HCWs should have access to a medical surveillance programme (MSP), which will cover pre-employment, periodic and exit medical examinations including TB screening for HCWs in high risk areas. It should incorporate the use of screening tools for TB such as the TB questionnaire and use of tuberculin skin testing (TST) or interferon assays in the immune diagnosis of TB, where warranted.

HCWs who are diagnosed with TB should be submitted to the office of Compensation Commissioner (CC) for compensation in terms of the Compensation for Occupational Injuries and Diseases Act, No. 55 of 1993,[24] according to Circular Instruction No. 178 on Compensation for pulmonary TB in HCWs.[24] And finally as the saying goes 'if you cannot measure, you cannot manage', there is a need to strengthen the surveillance system within healthcare facilities for the reporting of occupational TB. Occupational TB cases in healthcare facilities should be reported to the infection control programme through the statutory reporting system. The MSP should keep all records of HCWs diagnosed with TB even in instances where the CC adjudicates against the claim. Such record keeping will assist with the monitoring and evaluation of the MSP in the affected healthcare facility.

RECOMMENDATIONS

Occupational health services in South Africa boast some of the best services, provided by highly competent HCWs; unfortunately the situation is not the same for HCWs as the services provided in healthcare facilities for HCWs are rudimentary if any at all. The URC states that 40% of facilities have a TB screening programme or written occupational health policy, while only 30% of HCWs were trained in the use of PPE.[13] Even though the legislative framework for workers' health in South Africa is progressive; there is a substantial and critical need for the enforcement of the OHSA and its regulations by the Department of Labour, as well as implementation of adequate infection control measures by the facility managers and the Department of Health. In creating better conditions for HCWs, the employers will need to strengthen the aspects that follow.

1. Infection control measures in facilities:
    i. Develop and regularly update infection control protocols, based on the draft national infection prevention and control policy for TB, MDR-TB and XDR-TB;
    ii. Train HCWs in infection control measures; and
    iii. Monitor HCWs compliance in infection control measures.
2. Develop and implement basic occupational health services including MSP.
3. Work with the CC in strengthening the capacity of the office of the CC, and educate the HCWs on the role of the office of the CC.
4. Involve the labour unions in all workplace programmes, especially the control of TB.

The labour inspectors must enforce current legislation and penalise employers who fail to comply with labour laws, especially the OHSA.

CONCLUSION

We now have decades of evidence about the exposure of HCWs to TB in the workplace and their increased vulnerability to tuberculosis in South Africa in the absence of adequate control measures. South Africa is a signatory to a number of ILO and WHO conventions relating to the protection of workers in the workplace. South Africa also has labour laws including social protection laws, for HCWs in the event of occupational TB disease. Thus employers have a legal obligation to protect HCWs and workers in general. Unfortunately, for the thousands of HCWs, who put their lives at risk in healthcare facilities, the knowledge of and policies on TB control in healthcare facilities has not translated into programmatic interventions. Where programmatic interventions exist, it is not standardised across the healthcare system.

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LESSONS LEARNED

1. **HCWs bear the brunt of failed public health interventions against TB disease including MDR-TB and XDR-TB.**
2. **Simple, yet effective infection control measures such as administrative control measures and natural ventilation or sunlight have been shown to reduce the risk of infection in developed countries and are implementable in resource poor settings.**
3. **Early diagnosis and treatment with TB chemotherapy is as effective in HCWs, as in the general population.**
4. **Protection of HCWs from TB in healthcare settings is one form of health systems strengthening, in the fight against TB.**

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Managers' perspectives on accommodating deaf individuals within the automotive manufacturing industry: a qualitative study

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ABSTRACT

Deaf people seem to be perceived as having limited employment possibilities in industry. As the motor manufacturing working environment is perceived as having safety and productivity risks for the employment of deaf people, this study's objective was to investigate managers' perceptions in such an environment of employing deaf people.

A qualitative study was conducted. Data was obtained through individual semi-structured interviews with 15 managers of the manufacturing department of a motor manufacturing company.

The results indicated that deaf individuals could be accommodated in manufacturing. However, communication and safety issues posed the greatest challenges when employing deaf individuals. Employment depends on the implementation of certain changes to the manufacturing environment, creating a safer environment for deaf employees. Automotive manufacturing environments consist of various sections and positions in which deaf people could work safely and productively. The study also contributed to changing misconceptions about employing deaf people in a manufacturing environment.

Key words: deaf people, motor manufacturing environment, safety, productivity, perceptions

INTRODUCTION

Research has shown that deaf people form a minority of the world's population.[1] In terms of history, deaf people were not allowed to have an education, they were banned from religious services, not allowed to marry and were even on occasion sterilized.[2] The slogan 'Deaf people can' has been used by deaf people in the United States to protest against years of discrimination.[3] Dr I King Jordan, a president at Gallaudet University in Washington, DC, who is deaf, commented that deaf people can do anything but hear.[1] This comment indicated the fact that to be deaf does not mean to be incompetent. Culhan and Clarcq[4] mentioned that deafness should not be seen as a deficiency but rather as uniqueness that should not be limited with regards to social, intellectual, emotional, or academic development. Luckner and Stewart[5] indicated that an individual's disability is part of his or her identity and self-concept.

Deaf people live and experience life in much the same way as normal hearing individuals. These individuals do however face an ongoing battle, not only for physical survival, but also to steer their lives within different cultures.[6] As stated by Nikolaraizi and Makri,[7] there are many different cultures and languages in Africa, making communication for deaf individuals more challenging. Deaf individuals often feel trapped between the world of the deaf and the world of the hearing due to the fact that they do not consider themselves culturally deaf. Walker[2] mentions that deaf individuals who prefer to communicate through speaking do not see themselves as deaf, but rather as hard of hearing.

Another challenge facing deaf people is employment. MacLeod-Gallinger[8] stated that underemployment and unemployment are common among the deaf and that deaf women in particular seem to be underemployed and unemployed. A study done by Holte and Dinis[3] also indicated that deaf women in general seemed to earn less than normal hearing women.

The above discussion also suggests that, over the years, people have had certain perceptions of deaf people that led to such people being perceived as different from people of normal hearing capacity. The deaf culture thus has its own history, shared values, social norms, customs and technology, and these are passed down from generation to generation.[1]

Although it appears that negative perceptions about the employability of deaf people exist, possibly limiting their

employment opportunities, little research has been conducted in South Africa to investigate the actual perceptions about deaf employees in the workplace. Since managers play an important role in determining suitability for employment and as the automotive manufacturing environment has safety and productivity risks, this setting was selected for the research. Its purpose was to investigate what managers' perceptions were regarding deaf employees in a motor manufacturing environment and whether deaf people could be accommodated there.

METHODOLOGY

The research was conducted in natural settings where the social perspectives of the specific context (manufacturing department) were investigated. A qualitative research approach was used. In qualitative research, the researcher's role is to as accurately as possible describe the phenomenon as it appears, rather than focusing on a pre-given framework. This study is inductive in nature, as the study is not applying an existing theory or hypothesis, but rather begins in a natural setting, describing the events as they unfold.[9]

Research setting and sample

During 2010, 15 managers from the manufacturing department in one automotive industry were selected using convenience sampling. This type of sampling utilises subjects who are easy or convenient to reach. Quantitative studies using such sampling can be subject to bias.[10] It would then be difficult to make generalisations regarding the employment of deaf people in the motor manufacturing industry in South Africa, as the study only focused on one motor manufacturing company. However, this was a qualitative study that aimed to determine managers' perspectives on employing deaf people in this setting. The resulting conceptual framework can then be tested in a quantitative study with a larger sample.

Data collection procedure

The managers were interviewed individually and direct observations of the nature and functioning of the manufacturing environment done to enhance the quality of data. Semi-structured interactive interviews were used to collect data. A semi-structured, open-ended questionnaire was used as an interview guide. The interview guide consisted of four open-ended research questions, namely:

How do you perceive deaf people in general?
Can deaf people be productively employed in the motor manufacturing environment? (Explain answer.)
What are the safety implications for deaf people working in the manufacturing environment?
Which positions will be suitable for deaf people in this environment? (Motivate answer.)

> "... the accommodation of deaf employees would depend on the individual nature and extent of deafness ..."

Recording, managing and analysing the data

A grounded theory approach was used in the data analysis. The focus was on bringing order, structure and interpretation to the data. The interview data were recorded and transcribed, and observations of the manufacturing environment documented. Analysis of data followed, also adding new ideas and facts that emerged throughout the analysing process. For the purpose of the study, the researcher used coding to analyse the data. The initial mass of data was reduced through open coding thematic

Table 1. Summary of results

Research themes	Challenges to manage	Action strategies	Consequences
Communication	• Repetition • Pronunciation • Telephone • Lack of hearing • Meetings • Culture • Client communication • Concurrent talking • Noise • Missed information	• Write notes • Sign language • Lip reading • E-mail • Interpreter • Flickering lights	• Better communication • Productivity • Better work relationships • Improved safety
Safety/Accommodation	• Moving vehicles • Moving machinery • Falling equipment • Slower response times • Working individually	• Smoke machines • Signs • Buddy system • Additional training • Allocated walkways • Flickering lights	• Safer working conditions • Happier employees • Increased morale
Attitude	• Irritated • Frustrated • Respect • Ignorance • Culture • Mindset • Acceptance • Stereotypes • Uncomfortable • Resistance	• Mindset change • Awareness training • Policies	• Accommodate deaf people • Cohesion between employees
Positions	• No senior positions • Administrative • Least communication • Repetitive work • Computer work • Disciplining • Avoid management positions • Job rotation • Environment	• Mindset change • Awareness training • Policies • Write notes • Sign language • Lip reading • Interpreter • Flickering lights	• Trial employment of suitable deaf employees • Auditing of situation every 3 months • Conclusions and adjustments

content analysis.[11] Thereafter axial coding (procedures to put data together in new ways by making connections between categories) and selective coding (the selection of core categories, systematically relating them to other categories, validating relationships and identifying categories needing further refinement and development) were used.[11]

Data quality

Credibility (or internal validity) was ensured through consideration of the richness of the information collected, data saturation, and method and investigator triangulation.[11] Transferability was ensured by providing a detailed description of the context, whilst an audit trail ensured dependability and confirmability.[11]

Ethical aspects

Ethical approval was granted by the Research Ethics Committee of the Faculty of Economic and Management Sciences, University of Pretoria. Signed informed consent was also obtained from every manager prior to the recording of any data and confidentiality was maintained.

RESULTS

Table 1 provides a summary of the results obtained in terms of research themes, challenges to be managed, action strategies and consequences. The managers' experience of deaf individuals varied from limited to good.

DISCUSSION OF RESULTS

Communication

The managers perceived that the biggest problem with employing deaf people in the automotive manufacturing section would be communication. This included communication between employees, with managers, between different cultures, as well as with clients and suppliers.

Meetings would be a problem for deaf people. During meetings, various people may talk at the same time, making it difficult for deaf participants to follow the conversations. Deaf people would also be likely to miss information during meetings or important conversations.

They felt that due to the international inter-cultural communicative nature of the company, there would probably be

a considerable communication hindrance between a deaf employee and, for example, Japanese or French speaking clients and colleagues. The respondents mentioned that communication would be difficult between a deaf employee and someone who also finds it difficult to communicate effectively in English. Due to this language obstacle, their Japanese counterparts are often impatient in communication with employees from the South African company. Thus a sign language interpreter would be important in this situation to improve communication between deaf employees and their co-workers.

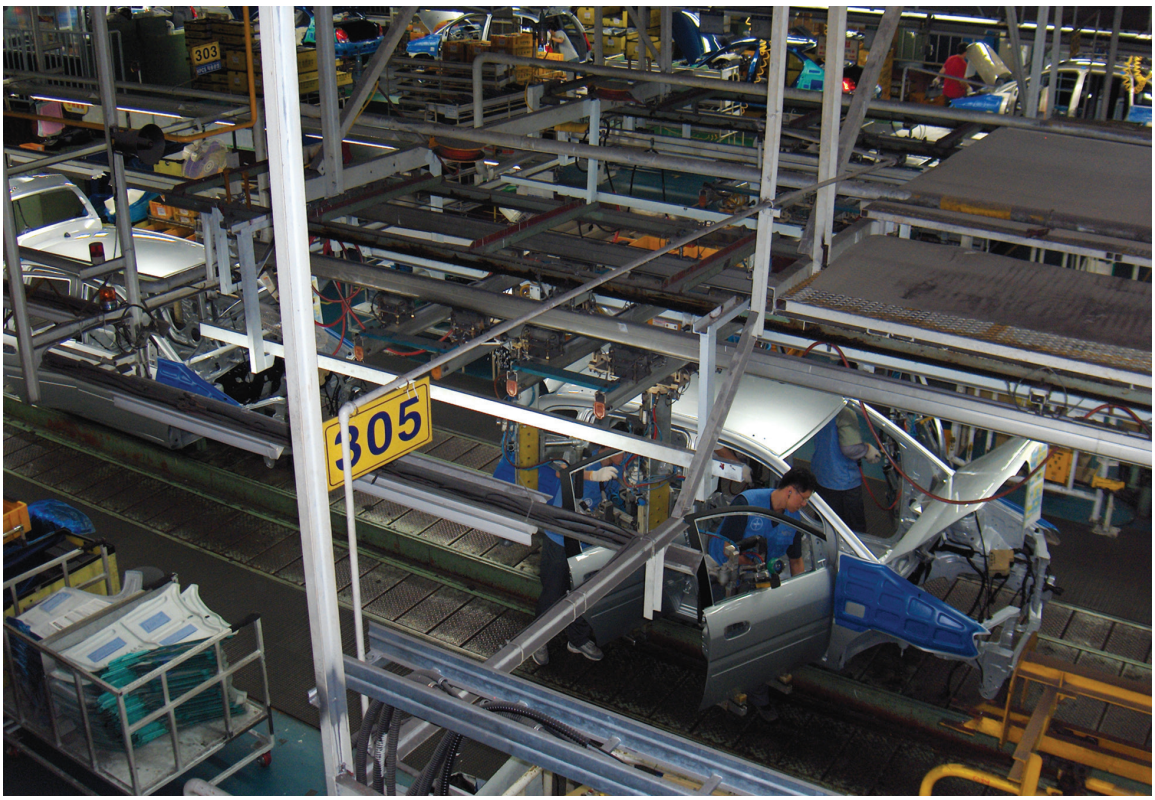
From the company's client service perspective, communication with deaf employees would be problematic when the clients were not able to communicate meaningfully with such employees. In most white collar positions in the company, a lot of internal and external client communication is required. The relationship between the company and its clients is very important, and a deaf individual in a managerial or supervisory position could jeopardise this. Thus, management in the company would probably recommend that deaf individuals be appointed in non-supervisory positions with limited communication requirements, for example as a shop floor worker in the body shop.

Telephonic communication was indicated as an important obstacle. Even if other employees could be utilised to assist deaf employees in this regard, it would not be feasible in terms of costs to employ people solely for this purpose. Therefore, positions as receptionists or personal assistants would be difficult, unless the necessary technology was available to assist with acceptable quality of communication in such positions.

> "... safety risks relating to deaf employees were emphasised as a major concern."

The managers acknowledged that the accommodation of deaf employees would depend on the individual nature and extent of deafness of such employees. This corresponds with the perception of Culhan and Clarcq[4] that the deaf individual's level of deafness, education, communication needs and type of work to be done will determine his/her employment possibilities.

Regarding the difficulties in communication, better communication with and positive attitudes toward deaf employees can be enhanced by a deaf awareness training programme for employees of the manufacturing section. Some of the difficulties could be addressed by informing employees of the



Source: http://en.wikipedia.org/wiki/File:Hyundai_car_assembly_line.jpg

communication challenge and providing them with strategies to help with more adequate communication by, for example, talking directly to the deaf individual in such a position that the deaf person can do lip reading. Recommendations made by Culhan and Clarcq[4] should be considered:

- Number of people in the room – Ensure that there are not too many people in the meeting. Should there be a large number of people, seat the deaf person in a position where he/she can clearly see all the attendees.
- Lighting – Ensure that the room has adequate lighting so that the deaf person can see all attendees clearly to be able to lip read.
- The deaf person may want to sit across from the speaker or presenter, and in the case of a meeting with many attendees, the person may want a sign language interpreter.

Devices such as phone amplifiers can be used, and Foster and MacLeod[12] recommend the use of e-mail communication for and with deaf employees. Communication with deaf employees can also be done by writing notes and messages on paper.

Attitudes and training

Some managers mentioned that employees and clients could get irritated and frustrated with deaf individuals due to communication difficulties. People do not have the time or patience to try and understand others if communication between them is unclear. Some managers had a certain perception regarding the characteristics of deaf people as employees. They seemed to perceive such people as "weaker" than non-impaired people. They did however acknowledge that this perception could be due to ignorance and a lack of understanding of the deaf culture.

Some managers believed that deaf people were similar to everyone else and should not be treated differently, but rather be accepted as they are. This view is more indicative of a lack of knowledge about deaf people rather than an attitude of discrimination against such people. While some managers perceived deaf people as intellectually normal but with a physical impairment, some also perceived them as people who should be treated with special consideration, where employees needed to know how to deal with deaf people and be more sensitive toward them. Some managers felt that deaf employees and their normal hearing co-workers would be uncomfortable working together.

Some indicated that various people in the company may show resistance to the employment of deaf people. Due to the diversity of employee cultures within the company, there may be resistance from different cultures or negative perceptions about deaf people. Non-impaired employees may also show resistance to awareness training (to enhance an understanding of deaf employees), and by law companies cannot force employees to attend such training.

Safety

During the interviews safety risks relating to deaf employees were emphasised as a major concern. For example in an emergency such as a fire in the manufacturing area, they would not be able to hear the alarm and respond adequately,

timely and safely. Where the deaf employee worked alone in certain areas under certain circumstances, responding suitably under dangerous conditions would depend on adequate hearing ability. Research also indicates that more injuries occur among disabled production workers than office workers.[13]

Moving vehicles in the manufacturing area constitute a major safety concern in the motor manufacturing industry. This would pose a significant safety risk for deaf employees, because moving vehicles, although equipped with sirens to indicate their presence and movement, would not be heard by these employees. Forklifts and electrical vehicles were perceived as being particularly dangerous due to the fact that they move without making a lot of noise.

Due to the high noise levels in most manufacturing areas, some managers had the perception that deaf employees would work harder than normal hearing employees, due to the fact that they are less distracted by the noise and consequently more focused on their task. Deaf employees would also be more detail-orientated and attentive, and their tactile and visual senses more developed than those of normal hearing individuals. They could therefore identify risks and weaknesses more adequately in manufacturing processes. Some managers, however, believed that deaf individuals would have slower response times when it comes to safety actions and productivity. For most managers the important issue was of safety rather than productivity. For example, when there is a parts shortage on the production line, this might be indicated by a light signal to the deaf employee, but the person's response time may be slow because he would not be able to hear someone shout to indicate which parts are involved.

Accommodation

Deaf employees could be accommodated more safely by installing warning lights or signal alarm systems so that they would be able to see an alarm go off. The company could also use the same mechanisms with telephones so that the deaf employee was able to see when the telephone rings and then inform a fellow colleague. However, the feasibility of implementing such systems would depend on the costs involved. The company would also have to create signs for deaf employees, in order to make equipment on the shop floor, moving vehicles, etc. more visible. Some managers mentioned that different manufacturing environments throughout the world use lights to increase visibility, which is called intelligence tracking. This could be implemented within the company. This corresponds with the research by Hansen,[14] who suggested that the use of strobe lights and three way mirrors on moving vehicles can help make the work area more accommodating in terms of safety for deaf employees and vehicle operators. It was also suggested that smoke producing machines linked to an alarm or warning system could also be utilised to make deaf employees aware of danger. A buddy system could also be implemented, where each deaf employee has a "buddy" or normal hearing person responsible for aiding him/her to adapt and respond adequately in the work situation.

The managers indicated that job restructuring could also be considered in order to accommodate deaf individuals more adequately.[15] This was also suggested by the research of Foster and Macleod.[12]

Positions

The main indication from the data collected was that administrative positions would be best suited for deaf employees, due to the fact that in these positions there is more consideration for communication barriers, without it having a serious impact on production. This links to a previously mentioned finding that positions requiring very little communication would be best suited for such employees. Deaf employees would be able to work in positions requiring repetitive work, such as data capturing, computer work and working at stations on the "trim-line" where employees know in detail what to do and what components to use. The packing of automotive parts into containers also does not require extensive human interaction and communication. Another position that would be a viable option is in engineering, where the employee stays situated in an office environment and plan, e.g. layout areas. Deaf employees could also work as mechanics, where it is required to work in a stationary position on the automobiles in the vehicle logistics department.

The reality that management's main abilities in the company relate to interpersonal communication, addressing meetings and accurate understanding and comprehension, led to most of the managers indicating that senior supervisory and management positions would not be suitable for a deaf individual. The managers also mentioned that, due to the controlling managerial nature of the manufacturing environment, a deaf person would not be able to express himself/herself adequately when having to effectively manage discipline when needed. In this environment the use of sign language would also not be effective.

CONCLUSIONS AND RECOMMENDATIONS

The results of the study indicated that communication in the workplace poses the greatest challenge when employing deaf individuals.

Managers seemed to differ in terms of how they perceived and understood deaf people. Some managers seemed to more readily accept the employment of deaf people in the manufacturing environment, while others had some pertinent doubts in this regard. All managers, however, seemed to acknowledge a lack of knowledge about deaf people and a willingness to improve their knowledge and understanding of such people. In this regard, the study appeared to contribute to changing misconceptions about employing deaf people in a manufacturing environment.

Training programmes could improve attitudes towards and perceptions of deaf people.

Safety risks relating to deaf employees in the manufacturing environment were emphasised by all managers. The necessity of creating a safe working environment for such employees was highlighted by all the managers. This would also provide normal hearing co-workers a safer work environment.

Managers seemed to agree that deaf people could be accommodated in the manufacturing sector, depending on certain adaptations and changes made to the working environment, in order to enhance safe and productive employment of such individuals. However, these actions would increase in costs for the company.

Managers indicated their perceptions of the type of positions that could be suitable for deaf employees. Administrative positions were preferred, as in these positions there is more consideration for communication barriers, without it having too serious an impact on productivity and safety.

Further research, with larger samples, to determine the generalisability of these findings is recommended.

Source: http://en.wikipedia.org/wiki/File:Final_assembly_3.jpg

LESSONS LEARNED

1. Deaf people will find it difficult to obtain employment in the motor manufacturing section of such companies, as some jobs are not suitable for such individuals.
2. The automotive manufacturing environment will be able to accommodate deaf individuals if management is willing to make technical adaptations and changes to the working environment, especially with the view of making this working environment less risky in terms of safety for such employees.
3. Employing deaf individuals in the automotive manufacturing area will incur monetary costs and expenditure.
4. Besides technical change and monetary cost implications, perceptions of managers and employees about the nature of being deaf and the abilities of deaf people as employees will have to receive attention.
5. Motor manufacturing companies should have a clear human resource management policy on the employment of disabled people, in order to facilitate the adequate provision of such employees to these working environments.

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Achievements in spirometry testing quality – where to from here?

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The author wishes to acknowledge and honour the memory of Professor Neil White and Dr Rob Harrison – stalwarts in the development of SANS 451, which they never saw come to fruition due to their untimely passing. Their passion and enthusiasm for the development of quality spirometry are missed.

ABSTRACT

The quality of spirometry testing in South Africa has been a concern for many years. The decision was made to develop and implement controls that would improve the quality of testing. At a meeting at the National Institute of Occupational Health in 2002, the reasons for and misconceptions contributing to this poor quality were identified. A planned approach to the improvement of spirometry testing was agreed by all present. This article describes the progress in achieving these steps and outlines what remains to be done.

Keywords: Spirometry, quality, SANS 451, National Standard

INTRODUCTION

The purpose of spirometry testing in the occupational setting is primarily to determine the respiratory function of an individual at employment and then to monitor the individual over time in an effort to prevent occupational disease or to identify deviations in health early enough that corrective action can be implemented to prevent further deterioration. A good quality spirogram is an important outcome when performing spirometry. The quality of spirometry testing in South Africa has been a concern for many years.[1,2] The concern first drove this author to action in early 2001 when a spirometry audit tool was implemented to measure the quality of testing in a group of spirometrists in the greater Durban area KZN. The results from this project demonstrated that practitioners were not producing quality spirograms. The author wondered if this was an isolated incident.

These results sparked communication with the late Professor Neil White in 2002. The communication proved that the author's concerns were valid as the quality of testing in many medical sectors was being questioned. Previous research conducted by Basson and Stewart[2] had shown that doctors who conducted spirometry testing were not following the basic requirements of spirometry as outlined in the then American Thoracic Society (ATS) Standards. Research conducted by Michell *et al*. demonstrated that ten years on nurses were making the same mistakes and that no real progress had been made in the quality of spirometry testing.[1] The decision was then made to put controls in place that would improve the quality of testing.

CONCERNS WITH SPIROMETRY TESTING

Interested stakeholders (academics, pulmonologists, technologists, practitioners, educators, suppliers and government representatives) were invited to a meeting at the National Institute of Occupational Health in late 2002. At this meeting the reasons for and misconceptions contributing to this poor quality were identified and discussed. The reasons were many and some are listed in Box 1. Striking concerns included, limited availability of training courses, no prescribed content for training, no control over persons who had completed the training, no control over persons performing the test and that anyone was implementing the test. It was agreed that action had to be taken to ensure that these concerns were addressed. A planned approach to the improvement of spirometry testing was agreed by all present. Four steps were identified (see Box 2) which would be interdependent and simultaneously developed.

A STARTING POINT

Here began a very slow process. A national guideline based on the ATS Standards for spirometry was published in the South Africa Medical Journal (SAMJ) in 2004 under the pen of the South African Thoracic Society.[3] This was a significant first step as there was now a South African guideline which could be used at practice level to guide the practitioner. The concern was that as a "guideline" it could not be enforced. In addition the guideline was published in a journal only available to subscribers so there would not be widespread knowledge of the document. What was needed was a document which practitioners could be forced to use as the minimum standards for compliance. Hence the need to ensure that a national standard was developed to which practitioners would have to subscribe. The author approached the South African Bureau of Standards (SABS) in 2005 and requested that a technical committee be established to develop such a national standard.

SANS 451 AND THE UNIT STANDARD 252125

Spirometry proved to be a very new area for SABS and after a number of meetings between the author and SABS there was an understanding of what was needed. SABS nominated Cecilia Woker to establish and head a technical committee to develop this standard. What was underestimated was the amount of time it would take to bring this project to fruition. It was to be a learning curve for all. Technical committee meetings were held at SABS offices in Pretoria but in addition to that a National Spirometry Committee, chaired by the author, was established under the guidance of the National Institute of Occupational Health. This committee was working parallel to the SABS Technical Committee with the intention of ensuring that the concerns with regard to training and registration were addressed concurrently. A unit standard for training was developed and submitted for recording with SAQA. It was recorded in February 2008.[5] The unit standard stipulates the minimum content and duration of training. In theory it would ensure that only registered training bodies were offering the training, the intention being that there was then a control on the training that would be offered to practitioners.

SABS, through the work of the Technical Committee, developed SANS 451: Spirometry – Generation of acceptable and repeatable spirograms.[6] It was based on the guideline published in the SAMJ[3] as well as the European Respiratory Society and ATS standards for spirometry testing. An extensive list of stakeholders had been put together and each step of the way the stakeholders were asked to comment on the developments in the standard. It was not until November 2008 that SANS 451 was ready to be launched. This was a significant achievement as there is now a recognised South African standard to which practitioners should subscribe and against which practitioners can now be measured in terms of performance.

WHAT DOES THE FUTURE HOLD?

Since the first discussions and stakeholders meeting in 2002, substantial developments have taken place. Three of the four steps shown in Box 2 have been achieved. A national guideline was published, SANS 451 has been launched as the national standard and a unit standard for the content of training of spirometry has been established. There is, however, still a significant amount of work that needs to be continued from this point forward to ensure quality testing.

1. The unit standard for spirometry is currently recorded in the basic nursing qualifications. This needs to be removed and placed as an elective within the advanced qualifications.
2. The ETQA for the unit standard (currently SANC) needs to ensure that accreditation of training providers is put in place.
3. A registration process is proposed to control those who are performing spirometry.
4. A continuing professional development point system needs to be developed and implemented to ensure that spirometrists remain competent in their practice.
5. Audits or reviews of practice should be implemented to measure compliance to SANS 451.
6. There is currently no process for the enforcement of the standard in the occupational setting, as is the case with audiometry. The Department of Labour and the Department of Minerals and Resources need to be engaged to amend legislation to make provision for this.

CONCLUSION

The launching of SANS 451 is the starting point. Practitioners need to ensure they receive the correct training based on the unit standard. After successful completion of the training the challenge is then passed to the practitioner to ensure that all spirometry testing complies with the standards prescribed in SANS 451. Once this is achieved the quality and value of the spirometry test will improve. Until then the value of the spirometry test produced will remain questionable.

BOX 1. REASONS FOR POOR QUALITY SPIROMETRY

- **No control of training.**
- **No training standards for minimum content.**
- **Anyone is allowed to do the test.**
- **Perceived as an easy procedure – just blow into the machine.**
- **Equipment is not being calibrated and verifications of calibration status are not being performed.**
- **Training is not mandated.**
- **No controls in place.**

BOX 2. STEPPED APPROACH TO IMPROVEMENT OF SPIROMETRY TESTING IN SOUTH AFRICA

1. **Publish a national guideline.**
2. **Development of standardised training.**
3. **Develop a SA national standard.**
4. **Registration process for spirometrists.**

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Upcoming events

HEALTH AWARENESS DAYS, WEEKS AND MONTHS

OCTOBER
Mental Health Awareness Month
Breast Cancer Awareness Month

DAY	TOPIC
8	World Hospice and Palliative Care Day
9	Partnership against AIDS Anniversary
9–13	National Nutrition Week
10	World Mental Health Day
10–14	National Obesity Week
12	World Arthritis Day
12–20	World Bone and Joint Week
13	World Sight Day
15	National Foetal Alcohol Syndrome Day
15	Global Handwashing Day
16	World Food Day
16	World Spine Day
17	World Trauma Day
17–23	Infection Control Week
20	World Osteoporosis Day
29	World Stroke Day

NOVEMBER
Red Ribbon Month
Quality Month

DAY	TOPIC
5	National Children's Day
7–13	SADC Malaria Week
9	World Quality Day
11	SADC Malaria Day
14	World Diabetes Day
25	International Day for the Elimination of Violence against Women
25 Nov–10 Dec	16 Days of Activism on No Violence Against Women & Children

LOCAL CONFERENCES

DATE	25 Nov 2011
TOPIC	Academic day and SASOM AGM
REGION	Western Cape
TARGET	All OH&S practitioners
COST	To be announced
CONTACT NAME	Jenny Acutt +27 (0)12 803 7418 E-mail: info@sasom.org

2011 SAIOH COUNCIL AND CERTIFICATION BOARD MEETINGS AND EXAMINATION DATES

7 October	07h00	OHPC/Oral
4 November	07h00	Council/Written
January 2012	07h00	OHPC/Oral

INTERNATIONAL CONFERENCES

DATE	PLACE	TOPIC	MORE INFORMATION
18–21 Oct 2011	Ghana College of Physicians & Surgeons, Ridge, Accra, Ghana	ICOH Intl. Conf. on Small and Medium-scale Enterprises – Learning from Good Practices in Small Workplaces	E-mail: ochealth@ghsmail.org
18–24 Mar 2012	Cancun, Mexico	30th ICOH Congress – Occupational Health For All: From research to practice	E-mail: admin@icohcongress2012.org www.icohcongress2012.org
2–4 April 2012	Nancy, France	INRS Occupational Health Research Conference 2012: Health risks associated with mixed exposures	E-mail: mixed-expo2012@inrs.fr
19–21 Sept 2012	Tarragona, Spain	5th Federation of Occupational Health Nurses within the EU (FOHNEU) Congress. Embracing the future – influencing change!	www.fohneutarragona2012.com
14–16 Nov 2012	Mahidol University, Bangkok, Thailand	ICOWHI 19th International Congress on 'Women's Health 2012: Partnering for a Brighter Global Future'	www.icowhi.org/

Women and work – an overview

C Blignaut, M Coombs and **V Schillack**

INTRODUCTION

"Give us labour and the training which fits us for labour! We demand this, not for ourselves alone, but for the human race!"

One cannot be blamed for thinking that the above-mentioned quote was uttered by someone like Germaine Greer or one of the other well-known feminists of the sixties. In fact it was the summation by Olive Schreiner of the demand by a large body of "modern" women to be given the opportunity to work. In her work "Woman and Labour" published in 1911 she stated that the relationship of women to work had been in constant change since the first existence of the human race.

SHORT HISTORY OF WOMEN AND WORK

During the hunter/gatherer era the savage man and the savage woman wandered freely together and worked together. She gathered berries and seeds while the man hunted. She dressed the kill with crude tools he had made.

When change came and humans settled in one place men hunted and fought off enemies who wanted to dispossess them of land. Women tended the fields and brought in the harvest, made earthen vessels and tended their young. They fetched the wood for the fire and carried the water from the stream. This era lasted for many centuries. Work related conditions such as what is now called the "low-back-pain syndrome" and "rotator cuff syndrome" made its appearance due to the manual transport of loads either on the back or on the head with arms raised.[2] In many developing countries, including in rural areas of South Africa these tasks are still performed on a daily basis by women.[3] (Joni Seager shows in "The Penguin Atlas of Women in the World" that in developing countries, women and girls spend a significant amount of time fetching water for the week, while men do not. For example, in Malawi women spend 6.3 hours per week fetching water, while men spend 43 minutes on this activity. Similarly, girls in Malawi spend 3.3 hours per week fetching water, and boys spend 1.1 hours.[4])

In time, fewer men were required to hunt or go to the fields of war resulting in work done by women being taken over by men. Women were now mainly involved in domestic tasks like washing, ironing, cooking, spinning and sewing. These activities resulted in carpal tunnel syndrome due to related movement and inappropriate postures of the wrist as well as cumulative trauma disorder.

As development progressed and industrialisation took place the demand for brute masculine force was replaced by steam. The demand for work by men increased and women were further consigned to domestic duties. These tasks were not appreciated as labour and appropriate remuneration and possible hazards to health were not considered. Women in dire straits to support themselves and family and slave women became part of the labour force by taking up work like wet-nursing, weaving in the textile industry or domestic work for the rich. Bernardini Ramazzini described the health risks associated with such work in the eighteenth century that included reference to changes in menstrual cycles as it related to particular work.[5]

The above-mentioned situation lasted until the outbreak of World War I although exceptions did occur. In the latter part of the nineteenth century women in America could train as teachers, nurses and the practice of medicine.[6] Dr Alice Hamilton, renowned occupational health physician, and her sister were forced, by a dwindling family fortune and a desire to live a more expansive life, to go into training.

The women employed in munitions factories, popularly known as munitionettes became the most visible face of the woman worker in WW I. Munitionettes produced 80% of the weapons and shells used by the British Army and daily risked their lives working with poisonous substances without adequate protective clothing or the required safety measures.[7]

The public recognition and sympathy that the 'canaries' (thus nicknamed for the yellow tinge that skin exposed to sulphur acquired) received could not make up for their work conditions. The government also invited women to join the ranks of the Women's Land Army (WLA), an organisation that offered cheap female labour to farmers not always keen to employ women. The 260 000 volunteers that made up the WLA were given little more than a uniform and orders to work hard as the fuel restrictions made a return to manual agricultural labour unavoidable.[8,9]

Between 1930 and 1950, women's labour-force participation in the United States increased primarily due to the rising demand for office workers, women's participation in the high school movement, and electrification which reduced the time spent on household chores. The 1940s were a turning point in married women's labour-force participation, leading many to credit World War II with spurring economic and social change. The war had several significant indirect impacts on women's employment, but its direct influence appears to have been more modest.[10]

In the 1950s to the 1970s, most women were secondary earners working mainly as secretaries, teachers, nurses, and librarians (pink-collar jobs). Claudia Goldin and others, specifically note that by the mid-1970s there was a period

of revolution of women in the labour force brought on by a number of different factors.

In 2009, women comprised 46.8% of the total US labour force and are projected to account for 46.9% of the labour force by 2018. This percentage had already been exceeded in 1975 in the then USSR and Czechoslovakia, the German Democratic Republic, Hungary and Poland.[11]

Informal labour is expanding globally, most significantly in developing countries.[12] In 2000, informal labour made up 78% of non-agricultural employment, 61% of urban employment and 93% of the new jobs in Africa.[13] Particularly after an economic crisis, labourers tend to shift from the formal sector to the informal sector. This trend was seen after the Asian economic crisis which began in 1997.[14] Women are employed more often informally than they are formally, and informal labour is an overall larger source of employment for females than it is for males. Women frequent the informal sector of the economy through occupations like home-based workers and street vendors.[16]

WOMEN'S HEALTH ISSUES AT WORK IN CURRENT TIMES

Women are now marrying later in life, staying in school longer, delaying childbirth, and having fewer children than in previous years.[17] More women are choosing to continue working while also balancing the traditional parenting role.[18]

The largest percentage of formally employed women (40%) in the USA worked in management, professional, and related occupations; 32% worked in sales and office occupations; 21% in service occupations; 5% in production, transportation, and material moving occupations; and 1% in natural resources, construction, and maintenance occupations.[19]

Women often face different workplace health challenges than men do, partly because men and women tend to have different kinds of jobs. Because of this, men and women experience different job-related problems. In terms of health, women generally have more work-related cases of carpal tunnel syndrome, tendonitis, respiratory diseases, infectious and parasitic diseases, and anxiety and stress disorders compared to men.[20] Other areas of concern for working women include heavy workload demands, family balance issues, and sexual harassment.

While both men and women working in construction face many of the same risks, there are some unique issues that are of greater concern to women. Tradeswomen are more likely than their male counterparts to die in job-related motor vehicle accidents or from job-related homicide and less likely to die from falls. Of women killed by motor vehicles, 30% worked as "flaggers".[21]

A study that examined PCB-exposed workers employed at capacitor manufacturing plants that used PCBs was done to determine whether death from certain neurological diseases was higher compared to the US population. It found women had a higher risk of death from certain neurodegenerative diseases (amyotrophic lateral sclerosis, Parkinson disease, and dementia) than their male counterparts.[22]

Most countries, including South Africa, now have legislation requiring equal access to employment and treatment. Regarding conditions of employment, the arguments in support of special protection for women are[23] :

- distinctive physiological and psychological characteristics;
- less developed muscular system of women due to physiological differences (at 20 years the muscular strength of a female is 65% of that of a male, dropping to 54% by the age of 55);
- the energy expenditure of women is 85% of that of a male counterpart (per kilogram body weight the vital capacity of women is 11% and the haemoglobin 20% less than in a man);
- women react to heat more quickly than men;
- the most important difference in the influence of working conditions relates to the specific sensitivities and susceptibilities of those functions of female organs connected with reproduction.

Through implementation of and adherence to the principles of risk assessment contained in both the Occupational Health and Safety Act[24] and the Mine Health and Safety Act[25] the specific abilities, limitations, susceptibilities and needs of female workers should be factored into determining risk control measures required to ensure the health and safety of all employees. This might result in an inability by management to meet the current political desire to have a gender distribution in all job categories that reflect the demographics of the country.

To make provision for the protection of the expectant mother, the foetus and the baby, the "Code of Good Practice on the Protection of Employees during Pregnancy and After the Birth of a Child" was added to the Basic Conditions of Employment Act.[26] The British Health and Safety Executive has issued guidelines to assist the new and expectant mother at work, the employer and the health care worker in ensuring that provisions are made to accommodate the specific sensitivities and susceptibilities of new and expectant mothers in the workplace. The European Council Directive 92/85/EEC [27] and European Commissions Guideline [28] can be consulted for additional information and guidance on determining risk and identifying controls to ensure the safety of new and expectant mothers.

SOME INTERESTING GENDER RELATED LABORATORY FINDINGS

Developmental and reproductive toxicology of metals has for years been a subject studied intensively. Nowhere is it more evident than among developmental toxicologists and teratologists that the teratogenicity of methylmercury and the developmental toxicity of lead in humans ranked among the

most tragic episodes, while recognition of these effects and subsequent efforts to prevent their recurrence rank among our greatest public health triumphs. The realisation of the effects of these metals in humans provided impetus to determine the toxicity of metals related to other health responses. Although metal intoxication is usually perceived as arising from unintentional intake of heavy metals of largely anthropogenic origin, such a view does not comprehensively describe the nature of this problem. Metals that cause responses of toxicity may be characterised physiologically as either essential or non essential, or chemically as either elemental, cationic, anionic or as organic metallic compounds. It is well known that toxic metals can impede the maternal-

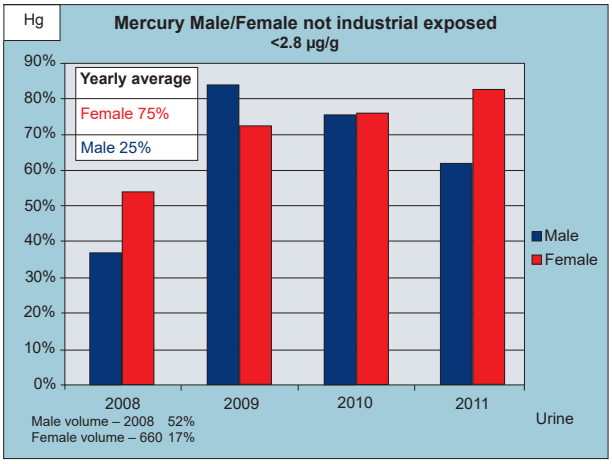

Figure 1

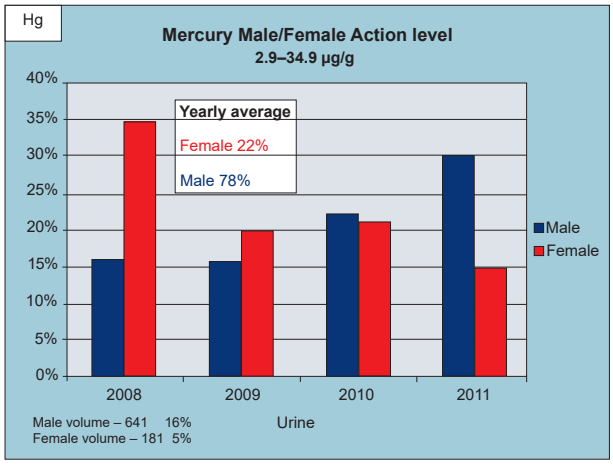

Figure 2

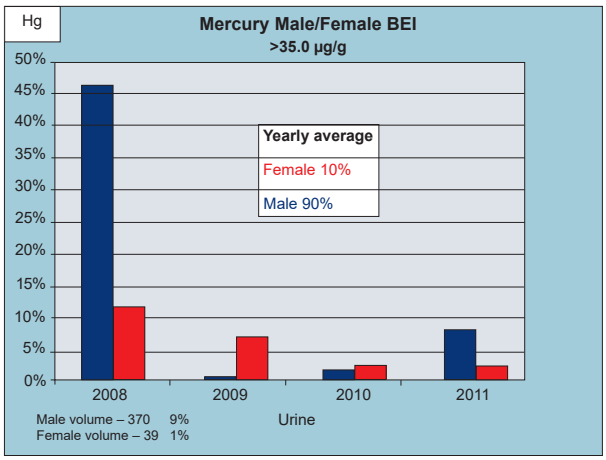

Figure 3

Figures 1 to 3. Illustrates male and female exposure to mercury within South African industry

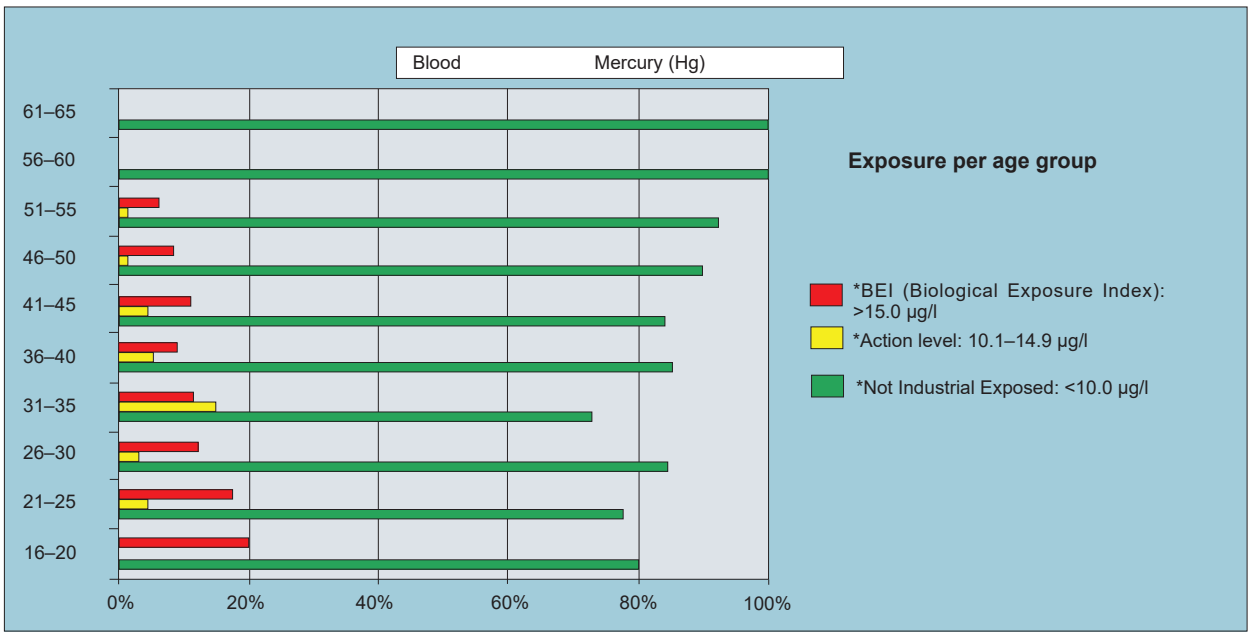

Figure 4. Illustrates the different age groups within South African industry exposed to mercury

foetal exchange processes, and such placental insufficiency can be the ultimate cause of developmental toxicity. Metals like mercury, cadmium, lead, selenium and arsenic have been known to accumulate within the placenta and to a certain extent be transported to the foetus.

Based on the data accumulated from industry over years it has become evident that women's exposure to heavy metal is still being underestimated and that women at child bearing age are employed in environments that might well be detrimental to their health and the health of their unborn child (see Figures 1 to 4).

A great deal of progress has been made towards the elucidation of the mechanisms through which certain heavy metals can induce developmental or reproductive toxicity. However, we tend to forget that women are part of all the sectors within industry and detecting and preventing their excess exposure to hazardous compounds should be a priority. In doing so we as health practitioners will to a certain extent prevent adverse development and reproductive effects on the world population, which continues to be an important, challenging and rewarding endeavour.

CONCLUSION

The world and with it women and work have been constantly changing since humans first made their appearance on earth. As humans, both male and female, change their world of work through mechanical, electrical, chemical, electronic or even metaphysical means or simply by the choices they make. Women will still carry the prime responsibility of producing the next generation of humans. The challenge for women lies in ensuring a resilience to cope in a constantly changing world and an awareness of the vast variation in life experiences that still exist between the different women of the world.

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The constitutional right to healthcare: National Health Insurance as a mechanism to increase access?

Elsabé Klinck

With debates on health systems reform being very topical, it is important to look at how, from a human rights perspective, any reform has to measure up against constitutional scrutiny. It is well-known that in a number of cases healthcare professionals and others, such as NGO's have called on the Constitution in relation to health sector reform, or the lack thereof.

1. THE RIGHT OF ACCESS TO HEALTHCARE

The South African Constitution awards every person the right of access to healthcare and simultaneously places a duty on government to realize these rights progressively[1]:

(1) Everyone has the right to have access to:
  (a) health care services, including reproductive health care;
  (b) sufficient food and water; and
  (c) social security, including, if they are unable to support themselves and their dependants, appropriate social assistance.
(2) The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of each of these rights.
(3) No one may be refused emergency medical treatment.

It should be noted that this right applies to "everyone" (and not only citizens) and that it includes access to social security. Social security could take the form of social insurance (e.g. medical scheme cover and/or national health insurance) or social assistance (e.g. care provided for free at public facilities to pregnant women and children under the age of 7). However, these interventions appear to not have been sufficient, and South Africa is, according to the World Health Statistics, as released by the World Health Organization in 2011,[2] still lagging behind in key health outcomes, whilst spending is comparable with that of the BRICS (Brazil Russia India China South Africa) countries, for example.

2. REALISATION OF THE RIGHT OF ACCESS TO HEALTHCARE

Section 27(2) provides more detail on the fulfilment of access to healthcare services. It obliges the state to:
- "take reasonable measures"
- "progressively realize" health rights
- undertake such realization "within available resources"

This means that these constitutional duties go beyond policy-making and the setting of guidelines. It also means that "resource constraints" should not be used as an "excuse" for non-delivery of services, but rather that the constitutional duty requires careful consideration of how the state will "progressively" realize health rights, within available resources. The Department of Health, in its most recent Strategic Plan acknowledges that there is, amongst others, lack of leadership, poor management, poor quality services and subsequent poor health outcomes, i.e. "inadequate outputs for the resources allocated … from the national fiscus".[3]

Given the contention that it is perhaps not only an issue of resources in the health sector (allocations from the fiscus may be sufficient), the how and where resources are spent may be of greater importance in the current debates. An investigation into "available resources" should therefore entail an analysis of the implications of resource-choices and access to healthcare from a wider perspective. As health budgets are often separated into "medicines", "human resources", "infrastructure", "primary care" and "hospital-care", the interrelated nature of the impact on resources is often understated or not considered at all.

According to Olivier *et al.* [4] the constitutional duty entails "devising, formulating, funding and implementing, as well as constant review of comprehensive, co-ordinated and well-targeted programmes. Issues such as staff shortages at top level in the National Department of Health may indeed play a role in whether programmes to address access to healthcare are "co-ordinated" and "well-targeted".

3. NHI AS A MEASURE TO REALIZE THE HUMAN RIGHT OF ACCESS TO HEALTHCARE

3.1 Health systems reforms

The NHI Green Paper [5] (i.e. draft policy) was released on 13 August 2011 for public comment. It proposes a whole range of transformational measures designed to take South Africa, over a 14 year period into a new health system. It includes a number of previously proposed health system interventions, mainly aimed at addressing public sector challenges. These include:
- *The establishment of an Office of Health Standards Compliance (OHSC):* An amendment bill to the National Health Act was proposed earlier in 2011, but still needs to be passed by Parliament. This body will accredit all health establishments (i.e. including occupational health facilities) for compliance with standards published by the OHSC,

will conduct inspections and will also house the office of a complaints ombud.

- *Re-emphasis on primary healthcare:* Each health district will be supported by a specialist team, comprising specialists such as anaesthetists, paediatricians and family physicians. Appointments are envisaged for as early as February 2012. The school nursing system will also be re-introduced, and ten primary healthcare agents (community health workers) will be deployed in each municipal ward to undertake preventative and health promotion work.
- *Categorisation of health facilities into various levels of hospital-based care:* In addition to the categorisation and possible specialities associated with each hospital level, the Department of Health has released draft regulations[6] that, amongst others, designate all hospitals in all provinces according to the categories of central (academic), tertiary (specialist), regional (general medical) and district hospitals.

A separate document[7] has also been released for comment on health facility management, as well as a new Human Resources Policy. Comments on all these documents (including the Green Paper) are due in October.

3.2 Financing and costs

The Green Paper states that NHI costing work will continue in 2012 and 2013. The costing model will be based on the "public sector costing framework" and funding sources will include the current fiscal allocations to health, contributions by employers and employees, and income tax. The quantum of these figures is not known, and will most likely have an impact on the decisions of employers as to the level and extent of occupational health- and primary-care services rendered, as well as whether continued medical scheme support would be affordable. It is also not known when payroll taxes will be introduced.

The NHI Fund will be separate from the Department(s) of Health (which will be a service provider paid by the NHI as well as a policy-maker), but the Fund will be accountable to Parliament and the Minister of Health.

3.3 Package of care

Apart from the specialist fields alluded to in the hospital categorisation and school nursing system, the exact nature of the package of care is not known. The Green Paper does, however, state that the system will be set on "evidence-based medicine", and that departures from treatment protocols and formularies will attract co-payments from NHI members.

3.4 Role of private providers

The document envisages contracting the services of private providers into the NHI, on a capitated basis (flat fee paid per patient per month). The capitation levels will be set taking into account international benchmarking, the risk profile of a population, and relevant indices.

Hospitals will get a so-called "global budget" from which they would have to fund NHI services, on the basis of so-called DRGs – Diagnosis-Related Groups, i.e. a flat fee for all treatments associated with a specific diagnosis. Each District Health Authority will be responsible to contract in providers, and to manage their performance.

3.5 Beneficiaries

All South African citizens and all permanent residents will be NHI members. It is expected that all other persons take out their own health insurance. The document does not mention refugees, but it has recently been reported[8] that refugees will no longer be able to access free public healthcare.

4. CONCLUSION

Many aspects in the NHI Green Paper, together with other health systems reforms, such as increasing the output of medical professionals from universities, will assist in addressing issues relating to access to quality care. A very positive aspect is the implementation of ten Pilot Sites for NHI over the next couple of years. This will provide South Africa with valuable lessons as to how implementation should proceed.

However, the Green Paper contains a number of gaps – most notably on the package of care and the funding model. Professionals in occupational health should also input into the role that occupational health and work-based primary care could play, and how these could slot into the various NHI elements.

The exact relationship of the NHI with other social security funds, such as the Compensation Commission and the Road Accident Fund is also not clear. Although the Departments of Health will continue to exist, the implications of a national system on provincial autonomy and administration resources is not clear yet.

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Elsabé Klinck owns EKC, a healthcare consulting enterprise. She specialises in health law, health policy and ethics. She was a senior lecturer in Constitutional and Human Rights Law before entering the health sector as a legal advisor in 2001. She has also worked for a private health-sector training institution, a pharmaceutical trade association and a healthcare consulting firm. For more on her business, visit: www.ekconsulting.co.za

SASOHN Port Natal

INTERNATIONAL NURSES' DAY

May 12th is International Nurses' Day – a day on which nurses throughout the world reflect on their profession and those who are no longer working at the bedside dedicate 100 minutes of service to those less fortunate. This year's theme of the International Council of Nurses (ICN) was "Closing the gap: Increasing access and equity" in order to strengthen nurses' understanding of access and equity and the effect of inequality on health. A strong link has been made between health and the living environment and in recognition of this SASOHN Port Natal decided to give their 100 minutes of service to the children and caregivers of the Palm Tree Centre in Amanzimtoti, KwaZulu-Natal. The adult caregivers had some respite while the children were taken on a picnic to the Amanzimtoti Bird Park. Picnic goodies, bird food and 15 excited children headed off to the park for an afternoon of fun and games. An interlude of laughter and happiness, in a natural environment was enjoyed by all and perhaps this service went a little way to improving the lives of all concerned, even if it was for just 100 minutes.

Occupational Health Nurse Practitioners have a vital role to play and are well positioned to improve both access to and equity of healthcare in their own organisations. Access to health systems is an important determinant in improving health outcomes[1] for those who depend on OHNP for a lot of their health care. Equity, in this context, does not mean equality of services but "implies an approach that gives more to those who have little, and thus less to those who have much. Rather than the allocation of equal shares, equity implies the allocation of fair shares" (McCoy 2003).[1] This is an important concept in the practice of OHNP and one that as nurses we have a duty to advocate for on behalf of those less fortunate who depend on us for a lot of their health care. It is this that inspired our outreach in honour of International Nurses' Day and one which I hope all those reading will, by some small act, incorporate into their own OH practice.

Thank you to the members of SASOHN Port Natal who generously gave of their time on Saturday, 14th May 2011, long may you advocate for the vulnerable in our society.

Penny Orton

Chairperson, SASOHN Port Natal

SASOHN Eastern Cape

DRUG AWARENESS IN THE WORKPLACE WORKSHOP

On 23 June 2011, SASOHN Eastern Cape held a workshop which coincided with SANCA's Drug Awareness Week (20–24 June 2011) and the International Day against Drug Abuse and Illicit Drug Trafficking on 26 June. Delegates were given insight into the recognition of addiction as well as the effects that addiction has on employees, friends and colleagues. This was followed by a discussion on the legal implications of drug testing in the workplace, with a focus on the difference between misconduct and incapacity when managing the employee. It was stressed that the employee has to be charged correctly from the outset, and depending on the charge (misconduct or incapacity) the appropriate action needs to be taken. Misconduct is clear cut and therefore employers often choose this charge above that of incapacity. Speakers also assisted the audience with an understanding of the chain of custody when taking samples for drug testing in the workplace. After a delightful tea, John Preller presented information on the community assistance available. He also stressed the importance of helping recovering addicts to enable themselves to rehabilitate and support themselves. Dr Bruce Woolard explained how narrative and horse therapy is used to effectively help addicts. The workshop was informative and gave new insight into the life of an addict, and how this could happen to any one of us. Thank you to all sponsors for making this day possible and for the lucky draw gifts.

L Jansen van Rensburg

Chairperson, SASOHN Eastern Cape

SAIOH news

SAIOH's annual conference took place on 17th and 18th August at Lesedi Cultural Village. Members were also entertained by tribal dancing and explaining of some of history of the tribe that lived in the area. We can report that this conference exceeded all our expectations in attendance figures and quality of papers presented.

At this point we must say a big thank you to all our sponsors, without your support a conference of this calibre would not be possible. All our presenters thank you for excellent papers and displays that all delegates enjoyed. Then our organisers, you did a great job, thank you and well done!

The theme of the conference was "Back to Basics" and papers presented were indeed food for thought. From all quarters, the feedback we received was very positive about the organisation and quality of papers delivered.

Johann Beukes

Occupational hygiene is a fairly young profession in Southern Africa by comparison to other professions, and the presenters gave delegates some insight into what the future holds in the field of occupational hygiene and the challenges facing this young profession. SAIOH would like to use this opportunity to encourage members who are not attending conferences and workshops to make every effort to attend. If you don't, you are missing out on valuable information and learning which is to your own detriment.

SAIOH has embarked on a marketing scheme to offer "Corporate Membership" to companies which will benefit in discounts for delegates attending conferences and exhibition space. Four companies have taken up corporate membership: 3M – Platinum; Wellcorp – Gold; SASOL Group Services – Platinum and North-West University – Gold.

One of the challenges we are facing is difficulty getting some members to submit their CPD points to maintain their status in the organisation. Members are encouraged to give this serious thought as they could lose their status resulting in their removal from the National Register and will not be allowed to practice any further. This is a route that SAIOH would prefer to avoid, but the assistance of our members is necessary.

The Department of Labour indicated in their presentation that legislation with regard to AIA is under review and it is likely that all AIA will have to be SANAS Accredited. A task team to look at this venture has been appointed and SAIOH is represented on this team:

The following persons serve on STC:-

Cas Badenhorst (SAIOH representative); Jakes Jacobs (SAIOH representative); Garth Hunter (SAIOH representative); Melinda Venter (SAIOH representative); Deon J v Vuuren; Pierre Wepener; Lindi Bouwer; Richard Mdlalose; Johan Schoeman; Petrus Laubscher; EC Julies; Jaco Pieterse; Bulelwa Huna (DoL); Milly Ruiters (DoL); Mpho (SANAS); Eben (SANAS); Azra (SANAS); Rob Randolf; Koos Roets; Dawie vd Heever; Fanie Kruger; Fanie Tau; Itumeleng Motlhamme; Ivan Niranjan; Rob Ferrie; Gaby Mizan; Elsabe Steyn.

The "Legal Knowledge Certificate" will also be re-introduced in the near future and all practicing personnel in an AIA from technologist level will be required to hold this certificate. Currently several AIAs are practicing under an exemption granted by the DoL which will soon be revoked. After the development of the criteria have been completed and approved by DoL and SAIOH, service providers will be requested to tender to provide this training. Assessments of candidates will be conducted by SAIOH's Professional Certification Board and certificates will be issued by the DoL.

Another difficulty to overcome is mentorship. From assessment results it has become obvious that candidates are either lacking workplace exposure or lacking guidance from their seniors. We all know that it is a problem that needs to be resolved but we would like to appeal to members to assist our young and up-coming colleagues so that we develop good quality occupational hygienists for the growing market in Southern Africa.

SAIOH President: Johann Beukes

SAIOH's new telephone number is +27 (0)12 661 5166 and fax number is 086 631 6117.

The Africa Regional Association of Occupational Health (ARAOH)/(SASOM) Congress

'Care for the occupational health needs of the worker: Biological, Physical and Psychological' 25–27 August 2011

Compliments received from the Congress attendees and the favourable comments on the evaluation forms for 22 Continuing Education Units indicate that the ARAOH/SASOM Congress was a huge success.

Delegates and presenters came from Botswana, Brazil, Cameroon, Canada, France, Ghana, Iraq, Italy, Ivory Coast, Kenya, Malawi, Netherlands, Nigeria, Senegal, South Africa, the United Kingdom, United States of America, Zambia and Zimbabwe. Excellent presentations addressed every aspect of 'Care for the occupational health needs of the worker: Biological, Physical and Psychological'.

The number of parallel sessions on travel medicine, hazardous chemical substances and hazardous biological agents, and the tracks on the International Commission on Occupational health, the SA Society of Occupational Health Nursing Practitioners, the SA Institute of Occupational Hygiene and Elixir Health, left the delegates spoilt for choice.

The presentation on 'Building occupational health and safety human capacity in Africa through sharing: a learning repository and journals' by Dr Linda Grainger was central to the theme of revitalising ARAOH. To underline the message SASOM distributed the latest issue of Occupational Health Southern Africa and we are aware of several presenters who wish to publish their research in the Journal.

The Neil White Memorial Seminar was incorporated into the programme and excellent presentations addressed occupational lung conditions, including asbestosis, mesothelioma, lung cancer and occupational asthma.

Much networking and several 'business' meetings took place during the three days. One such meeting arranged by Mrs Uche Ojomo, ICOH Board member, was that of the Pan African Business Coalition on HIV and Health. The Chief Executive Officer, Dr Valentine Engoudou Douala-Mouteng and the Chief Operating Officer, Mr Dinesh Appavoo met with interested persons from several countries to discuss the way forward.

The enthusiasm and camaraderie was tangible. The original ARAOH Board of eight persons swelled to 17 as officials from the different countries wished to contribute to ARAOH in future. See the accompanying photograph.

It was not all work as the running enthusiasts set off at 06:00 each morning for a fun run and guests were entertained at the Barnyard Theatre on the Friday evening. The Congress Dinner was well attended and included a drumming session which had everyone tapping in unison.

We have subsequently learned from Dr Musa Nyandusi that the Kenyan Government and Occupational Health organisations are working on a proposal to host the ARAOH Congress in Kenya in 2014.

SASOM wishes to express its gratitude to the presenters, delegates, chairpersons and organisers. Some of the presentations will be placed on the SASOM website in due course.

For more information contact the SASOM National Office at info@sasom.org

Jenny Acutt

Members of the ARAOH Board and others at the meeting held at the ARAOH/SASOM Congress on 27 August 2011.
At the back from the left: Dr Tim Ngozo (Zimbabwe), Dr Chiekh Cisse (Senegal), Dr Leon Seymore (South Africa), Dr Musa Nyandusi (Kenya), Dr Dingani Moyo (Zimbabwe), Dr Kader Toure (Senegal), Dr Charles Roos (ICOH National Secretary (South Africa), Dr Okon Akiba (SOEPHON, Nigeria), Dr Babacar Fall (ICOH National Secretary, Senegal), Dr Ferdie Smith (South Africa), Prof Daan Kocks (SASOM Chairman, South Africa), Prof Mary Ross (ICOH Board member, South Africa) and Dr Danie Ungerer (South Africa).
Front row from the left: Mrs Jenny Acutt (scribe, South Africa), Mrs Uche Ojomo (ICOH Board member, Nigeria), Ms Claudina Nogueira (South Africa), Dr Beatrice Sangare (Ivory Coast) and Dr Vusumuzi Nhlapho (South Africa)

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