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Interpreting spirometry in the occupational setting

A comparison of the effect of two intervention regimes on coronary prone executives in the South African colliery industry

Physiotherapists' and occupational therapists' perceived barriers and enablers of return to work for survivors after stroke

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

We will be well into 2012 by the time you read this issue. Once again, we wish you a productive and satisfying year in which you are able to make significant contributions to building health and safety in the workplace.

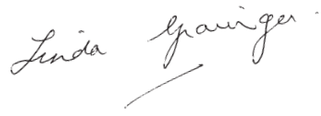
The first article in this issue is a Back to basics one that deals with the interpretation of spirometry in the occupational setting. It is based on a well-received presentation given by Van der Linden at a SASOHN Academic Day last year. She takes the reader through the logical and systematic process of checks and considerations, which are necessary to arrive at a correct and educated interpretation. Given the complexity of this process, the article does not purport to cover every aspect in detail. Readers are encouraged to consult the references provided in the article, especially the ACOEM Guidance Statement, the SANS 451 Standard, the SATS guideline, and the Mines Health and Safety Inspectorate's Guidance Note for Occupational Medical Practitioners: Lung Function Testing.

Grace, Wilders, Strydom and Ellis describe their comparison of the effect of two health promotion strategies on coronary prone colliery executives from six collieries in South Africa. Both had a physical fitness component, and one was enhanced with an educational component. The study is encouraging because it showed how a relatively short and simple intervention can make a substantial improvement in people with high-risk factors. This should motivate our practitioners in their health promotion programmes.

In the third article, Ntsiea, van Aswegen, Lord and Olorunju report their findings on the perceptions of therapists' perceived barriers and enablers of return to work (RTW) by survivors after stroke. This cross sectional study, conducted in stroke rehabilitation facilities in Gauteng, is part of an ongoing study to establish, amongst other objectives, the effect of a workplace intervention programme on the rate of RTW after stroke. Given the prevalence of hypertension and incidence of strokes in the working population, and the need for effective occupational rehabilitation, this study is likely to be most valuable.

On the news front, congratulations are due to Mohamed Jheebay of the Centre for Occupational and Environmental Health Research, School of Public Health and Family Medicine, University of Cape Town. He was recently elected to the Collegium Ramazzini. Leslie London, Head of the Department, writes that the "Collegium is an independent, international academy … to advance the study of occupational and environmental health issues and to be a bridge between the world of scientific discovery and the social and political centres which must act on the discoveries of science to protect public health. … The Collegium is comprised of about 180 fellows from around the world, elected in recognition of their expertise in the fields of occupational and environmental health." Leslie, Jonny Myers and Rodney Ehrlich are all fellows of the Collegium, and it is gratifying to have our colleagues recognised in this manner.

Please consider submitting papers in response to the call below. Although we have a healthy number of papers coming in, we are also very interested in featuring the listed topics. The Editorial Board has been working on the further development of the journal. One of the exciting initiatives is to have it listed on international databases so that the content is more visible and accessible. At this stage, the African Index Medicus has agreed to include our journal, which means that it will also be part of the Global Index Medicus. Finally, we would like to encourage more of our readers to send letters to the editor concerning articles which we have published. Your participation will be most welcome.



Call for papers for 2012

We are particularly keen to publish papers that present effective interventions relating to the disciplines of occupational hygiene, medicine and nursing. In addition to publishing papers on any relevant topic, we have planned subthemes for four issues as shown below. Please ensure that we receive your submissions no later than the dates indicated alongside the topic.

Issue	Theme	Submission date
May/June 2012	Infections and occupational health	29 March 2012
July/August 2012	Ethics and occupational health	27 May 2012
September/October 2012	Reproductive health and occupational health	14 July 2012
November/December 2012	Chronic diseases and occupational health	13 September 2012

We therefore invite you to submit original research, review, case study, or back to basics papers for consideration for publication in this issue. The authors' guidelines are available on the website, www.occhealth.co.za. All papers are peer-reviewed before publication. Should you be interested in submitting a paper, please indicate this by e-mailing the Editor at lindagsw@gmail.com Please provide some basic details about what you envisage would be included in the paper.

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As is our usual practice, we pay tribute to the generosity of the people who shared their expertise by reviewing papers for our journal during 2011. Their names and countries are listed in alphabetical order below.

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Upcoming events

HEALTH AWARENESS DAYS, WEEKS AND MONTHS

MARCH
TB Awareness Month

5–9	School Health Week
8	International Women's Day
8	World Kidney Day
20	World Head Injury Awareness Day
21	Human Rights Day
21	World Downs Syndrome Day
24	World TB Day

APRIL
Health Awareness Month

7	World Health Day
17	World Haemophilia Day
23–29	African Vaccination Week
25	World Malaria Day

LOCAL CONFERENCES

DATE	27–28 July 2012
TOPIC	SASOM Annual Congress
REGION	Gauteng
TARGET	All OH&S practitioners
COST	To be announced
CONTACT NAME	Jenny Acutt Tel/fax: +27 (0)12 803 7418 E-mail: info@sasom.org

2012 SAIOH COUNCIL AND CERTIFICATION BOARD MEETINGS AND EXAMINATION DATES (Proposed)

Date	Time	Meeting	Assessment
2 March 2012	07h00	Council	Written
20 April 2012	07h00	PCB	Oral

INTERNATIONAL CONFERENCES

DATE	PLACE	TOPIC	MORE INFORMATION
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
21–23 May 2012	Manchester, UK	2nd International Wellbeing at Work Conference	www.wellbeing2012@hsl.gov.uk
16–20 Sept 2012	Kuala Lumpur, Malaysia	9th IOHA Scientific Conference	www.ioha2012.net
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/

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Gloves In A Bottle – innovative, affordable skin care and protection that works.

Interpreting spirometry in the occupational setting

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ABSTRACT

Interpreting spirometry is not a case of simply picking up a spirogram and assessing the numerical values, nor is it reading a pre-programmed computerised feedback report which can be incorrectly pre-programmed and therefore gives at times an incorrect computerised interpretation. It is, rather, a logical and systematic process of checks and considerations, each of which is essential in order to ultimately report a correct and educated interpretation of the spirogram at hand. The purpose of this Back to basics article is to describe the sequence of events that must be adhered to in order to achieve a graphic and digital result that will be of sufficient technical adequacy to allow confident interpretation in the occupational health setting.

Key words: spirometry, interpretation, technical adequacy, abnormality classification

INTRODUCTION

Interpreting spirometry is not a case of simply picking up a spirogram and assessing the numerical values, nor is it reading a pre-programmed computerised feedback report which can be incorrectly pre-programmed and therefore gives at times an incorrect computerised interpretation. It is, rather, a logical and systematic process of checks and considerations, each of which is essential in order to ultimately report a correct and educated interpretation of the spirogram at hand. Equipment verification and calibration, the use of correct predicted values together with correction for ethnic origin and the reliability of the data all need to be taken into account when interpreting the final test result.

When utilising that spirometry result, it must also be remembered that whilst spirometry is useful in detecting disease and giving us an objective result on an individual's actual lung function as well as following the course of disease over time, it cannot on its own diagnose disease, measure the actual symptoms a patient feels, identify the symptomatic response to treatment or determine the actual disability.

The purpose of this article is to describe the sequence of events that must be adhered to in order to achieve a graphic and digital result that will be of sufficient technical adequacy to allow confident interpretation in the occupational health setting. It is understandable that not all subjects will give a spirometric result that matches the perfect idealised test that is usually achieved in the laboratory circumstance. However, there are certain minimum requirements even in the occupational health setting that must still be met for the test to be meaningful and useful for interpretation.

The use of appropriate reference values

Reference values are predicted values based on equations that take into account age, height, gender and ethnicity and are derived from extensive studies of normal, healthy population groups. The subject's blow is analysed against the predicted values and the result recorded as a percentage of predicted. Most people in the population will be close to this average or "predicted value", but some normal people will be above and others below the average due to various factors, some of which are unknown. The bottom of the normal range is described by the lower limit of normal (LLN). The LLN is the 5th percentile and the use of percentage of predicted for interpretation is an accepted alternative.[1] Further explanation is beyond the scope of this article.

The choice of reference values is challenging in our ethnically and culturally diverse population groups in South

Africa. The reference values for each individual subject should be chosen from a study done on individuals with the same ethnic and anthropometric characteristics as the subject being tested.[2,3] Typically, in South Africa the use of the European Community of Coal and Steel Workers (ECCS) values are used for subjects of white European descent (previously termed Caucasian).[1,4] Subjects who are not of white European descent usually show a lower forced vital capacity (FVC) and forced expiratory volume in the first second (FEV1) due to different limb length to chest ratio, and therefore a correction factor of 0.9 should be used for these subjects when referenced against ECCS predicteds.[4] The advice in the 2003 Mines Health and Safety Inspectorate Guidance Note for Occupational Medical Practitioners: Lung Function Testing given in this regard is currently under review to accommodate this correction factor.[5]

Data quality control

In order for a test to meet the minimum standard for quality control of data, all three blows need to meet all acceptability and repeatability criteria, as shown in Table 1.[4,6,7] If they do not, the subject should blow again until all criteria are met. If every effort has been made to get acceptable blows and this has not been achieved, usability criteria, as per Table 1, can be applied with caution and the final interpretation would then take these factors into account.

If a test is less than optimal it may still contain useful information and should therefore not be discarded but used with caution and understanding. For this the effects on interpretation of testing errors need to be fully understood.

Acceptability criteria

- Satisfactory unhesitating start.
- Smooth upward rise to peak.
- Peak that shows good effort.
- Smooth, continuous downward curve.
- No early termination.
- 6 second push out (3 secs for children), or cannot or should not continue.

Repeatability criteria

- Three acceptable blows.
- Min 3 and max 8 tests.
- 3 blows that are superimposed.
- Highest FVC within 150 mls of next highest FVC.
- Highest FEV1 within 150 mls of next highest FEV1.

Usability criteria

- No hesitation at the start of the test.
- No coughing during the first second of the blow.

Table 1. Criteria for acceptability, repeatability and usability[3,5,6]

Pre	Pred	Best	%Prd	2nd	3rd
FVC	4.11	2.93*	71%	2.88*	2.86*
FEV1	3.46	2.66	77%	2.67	2.58*
FEV1/FVC	0.80	0.91	113%	0.93	0.90
FEV6	–	–	–	–	–
FEV1/FEV6	–	–	–	–	–
PEFR	8.60	11.04	128%	11.34	11.29
FEF25-75	4.25	4.69	110%	4.77	4.14

Figure 1. Example of the numerical data for a spirometry test

Selecting the best test

Once the validity of the three measurements has been established the best test should be identified so that the correct values can be used for interpretation. ACOEM recommends that occupational spirometry test reports include values and curves from all acceptable curves and that the largest FVC and largest FEV1 be interpreted, even if they come from different curves.[8] The SANS 451 simplifies this concept, taking into account the situation where the spirometer software cannot create a new "best" test from a highest FVC and FEV1 should they come from two different blows by stating on page 29 that choosing the best test is done by selecting the blow with the largest sum of FVC and FEV1.[4] In Figure 1 the best test is indicated with the label "Best" above the column. You will see here that the highest FVC

is 2.93L in the first blow and the highest FEV1 is 2.67L from the second blow. Therefore the best test is the blow with the highest sum of FVC and FEV1 which is the test in the column labelled "Best".

Understanding flow volume and volume time curves

In order to interpret the spirogram, the flow volume and volume time curves should be fully understood. Both graphs in Figure 2 show the same three blows, but with different X and Y axial references giving you differing perspectives of characteristics of the blow. The flow volume curve on the left graphically depicts volume on the horizontal X axis and flow on the vertical Y axis. What is seen on this graph is mainly the part of the blow that occurs in the first second. This graph is not intuitively interpretable on its own but does readily reflect abnormalities in the exhalatory flow pattern as well as errors in technique. If a subject takes a deep breath in after the exhalation a line below the horizontal X axis will show and this is known as the inspiratory curve. This is what differentiates a graph or test as a simple flow volume curve (exhalation only) as opposed to a flow volume loop (exhalation followed by inhalation). This inspiratory portion of the test should only be carried out in the occupational health setting when adequate infection control measures are available, e.g. bacterial filters or disposable tubes.[9] The inspiratory portion of the test does not add enough valuable information to offset the infection control risk to interpretation for it to be carried out as a standard in the occupational health setting.[1,3]

"Interpreting spirometry is . . . a logical and systematic process of checks and considerations . . ."

The graph on the right, the volume time curve, depicts volume on the vertical Y axis and time on the horizontal X axis, showing the entire FVC and is most useful for assessing the end of the test. On this graph you can see the absolute cut off of the FVC which is not easy to see on the flow volume curve.

Measurements of spirometry

Spirometry can measure static and dynamic lung volumes. "Static" in spirometry simply means the measurement of volume only, whereas "dynamic" spirometry measures volume based on time.[10] For example a static lung volume could be the vital capacity (VC) which is the maximum amount of air that can be exhaled after the fullest inspiration possible and is not measured on time at all. An example of a dynamic lung volume would be the FVC which is the measurement of the maximum volume of air expired with maximal effort from a position of maximal inhalation.

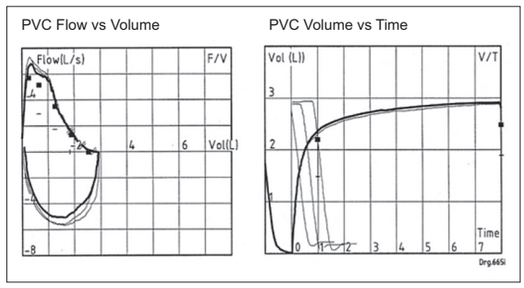


Figure 2. Graphs of the same three blows, depicting the flow volume curve on the left and the volume time curve on the right

Source: SANS 451, p. 35[4]

Pre	Pred	Best	%Prd	2nd	3rd
FVC	2.63	2.43	92%	2.37	2.22
FEV1	2.27	2.29	101%	2.26	2.11
FEV1/FVC	0.86	0.94	109%	0.95	0.95
FEV6	–	–	–	–	–
FEV1/FEV6	–	–	–	–	–
PEFR	6.19	6.67	108%	6.46	5.79
FEF25-75	3.71	4.12	111%	4.13	3.89

Figure 3. An example of a spirogram to show how the numerical data can be displayed

Interpretation cannot take place unless the following measurements used in spirometry are known and understood.[1]

- *FVC – forced vital capacity:* The maximum volume of air moved with maximum effort from maximum inspiration to maximum expiration.
- *FEV1 – forced expiratory volume in the first second:* The maximum volume of air moved with effort from maximum inspiration in the first second of the FVC.
- *FEV1/FVC – FEV1 as a ratio or percentage of the FVC:* The volume of air moved in the first second of the FVC expressed as a percentage of what was blown out in the total FVC.
- *PEF – peak expiratory flow rate:* The maximum rate of airflow in the FVC manouevre.
- *FEF25-75% – forced expiratory flow between 25 and 75% of the FVC:* The average rate of airflow in the middle portion of the FVC.

THE PROCESS OF INTERPRETATION

From the information gathered from the spirometry test certain deductions about what is happening throughout the lung can be made. Assessing the shape of the flow volume and volume time graphs together with an assessment of the numerical data will allow identification of a normal or abnormal test result.

Numerical data

For interpretation purposes, numerical data is read from the percentage (%) of predicted column. In the example in Figure 3, the FVC % of predicted is 92% and the FEV1 % of predicted is 101%. The FEV1/FVC, being how much

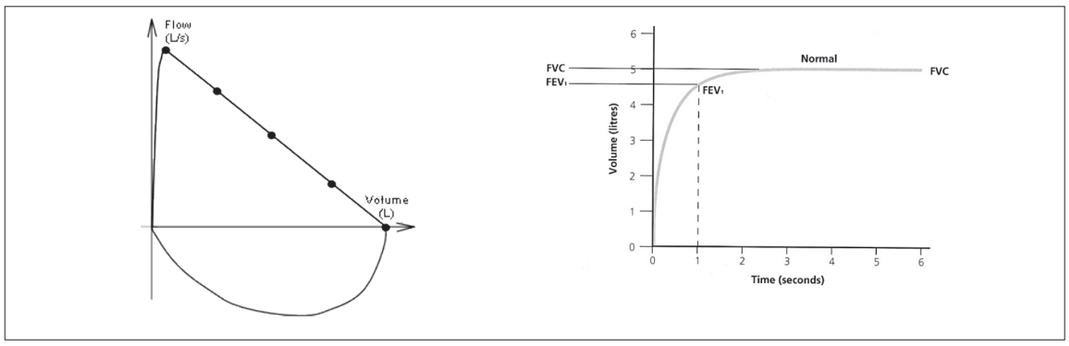


Figure 4. Examples of a normal flow volume loop on the left and a normal volume time graph on the right. (Diagrams taken with permission from Booker, Class Publishing Ltd and Education for Health UK[11])

air was blown out in the first second as a ratio of what was blown out in total, is read from the patient's actual blow. In this example, of the 2.43L of air blown out in total (FVC), 2.29L was blown out in the first second (FEV1). Therefore the FVC/FEV1 ratio of 2.29L to 2.43L in this example is 0.94 or 94%.

Classifying the abnormality

One of the aims of interpreting spirometry is to confirm a clinical diagnosis and classify the severity of the disease. The report should refer to the actual lung function and not the disease. In the occupational health clinic setting, the operator, who is normally the occupational health nurse or spirometrist, can identify basic abnormalities and when to refer. The referral doctor, who is usually the occupational medical practitioner or specialist, will use the information displayed on the spirogram to assist in making a final clinical diagnosis.[1] If the actual symptoms and the degree of spirometric impairment differ, more information will be required to evaluate fitness to perform an occupation or to support an application for compensation benefits.

After determining the technical adequacy of the test, the next step is to establish whether or not there is an abnormality. There are certain patterns of abnormal results that help categorise the clinical problem. Spirometry results are classified into one of four groups, based on their patterns. These are normal, obstructive impairments, restrictive impairments, and mixed obstructive/restrictive impairments. The results from a client can easily be assessed and classified by following the steps listed hereafter in the order shown:

- examine the flow volume and volume time curves;
- examine the FEV1/FVC;
- examine the FVC and FEV1; and
- examine other parameters.

The pattern of curves for each of the groups will be explained hereafter.

Normal spirometry

A flow/volume loop that has a typical shape is shown in Figure 4.[11] Going right, the exhalation tracing rises steeply from the baseline, does an inverted U turn at the apex, falls in a smooth downslope, and becomes almost horizontal at the end as it returns to the baseline. The down sloped curve from the apex of the curve to the end is usually smoothly concave, but there may be a smoothish convex hump near the top of the downslope.

A normal spirometry test, as in the case of Figure 5, would show:

- a volume time curve that is normal in appearance, ie rises smoothly, curves and plateaus;
- FEV1/FVC ≥ 70%;

Pre	Pred	Best	%Prd	2nd	3rd
FVC	2.55	3.41	134%	3.36	3.33
FEV1	2.19	2.82	129%	2.74	2.75
FEV1/FVC	0.86	0.83	96%	0.82	0.83
FEV6	–	–	–	–	–
FEV1/FEV6	–	–	–	–	–
PEFR	6.11	5.30	87%	5.29	5.35
FEF25-75	3.42	3.05	89%	2.90	2.97
Texp	–	5.78	–	5.82	5.87
Vext%	–	1.71	–	1.19	1.50
Cautions:					
Usability					
Acceptability		Time		Time	Time
Reproducibility					
SVC	2.92	–	–	–	–

* below lower limit of normal (LLN)

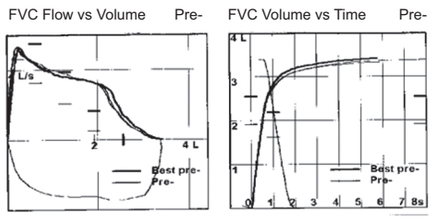


Figure 5. Example of a normal spirometry test

• FVC ≥ 80% of predicted, and above the 5th percentile;
• and FEV1 ≥ 80% of predicted and above the 5th percentile.

Lung function decreases with age and the normal average rate of decline in FVC and FEV1 is approximately 40 ml per annum.[5] Therefore, if an individual loses more than 200 ml[5] within a year or 15%[12] in either FVC or FEV1 within a year further investigation would be necessary to assess the cause. The assessment of average annual decline is particularly important in subjects who have a normal result as they can have a significant drop in results but still fall within the LLN's and therefore if the current result is not compared to previous results significant deterioration could be missed.

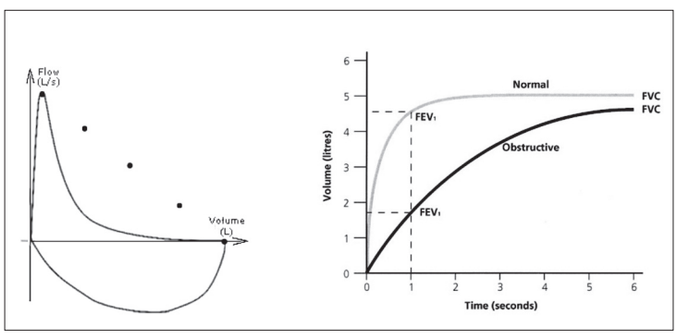


Figure 6. Examples of an obstructive flow volume loop on the left and an obstructive volume time graph on the right. (Diagrams taken with permission from Booker, Class Publishing Ltd and Education for Health UK[11])

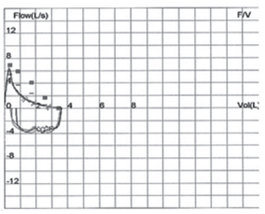
Obstructive impairments

Any disease that reduces the cross sectional area (diameter) of the airway will reduce airflow and produce an obstructive ventilatory disorder. These common diseases are asthma, COPD, chronic bronchitis, emphysema, bronchiectasis, cystic fibrosis, localised airway obstruction, and upper airway obstruction. An obstructive spirometry test, as shown in Figures 6 and 7, resulting from such reduced airflow is characterised by:

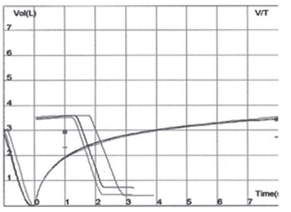
• lessening of the upslope of the volume time curve which makes the graph look flatter;
• increased concavity or scooping on the downslope of a flow volume curve; and
• FEV1/FVC ≤ than 70%.

If a test appears to be obstructive, it is necessary to carry out a bronchodilator reversibility test in order to clarify the obstruction further.[1,12] A reversibility test is simply spirometry carried out before and then after the administration of a bronchodilator drug and is the next logical step to provide additional or confirmatory information on the obstructive impairment already noted. A significant bronchodilator response is considered to be at least a 12% improvement in FEV1 in addition to at least a 200 ml increase in FEV1.[2,13,14] This test must be carried out by a person qualified to administer the medication and should not be done if the medication is contraindicated in the patient for any reason.

FVC Flow vs Volume



FVC Volume vs Time



Result	Pred	Best	%Prd	2nd	%Prd	3rd	%Prd
FVC (L)	3.43	3.61	105%	3.59	105%	3.52	102%
FEV1 (L)	2.95	▫1.95	66%	▫1.92	65%	▫1.89	64%
FEV1/FVC		▫0.54%		▫0.53%		▫0.54%	
PEFR (L/s)	6.87	5.98	87%	6.30	92%	6.38	93%
FEF25% (L/s)	5.89	▫2.23	38%	▫2.50	42%	▫2.55	43%
FEF50% (L/s)	4.12	▫1.02	25%	▫0.93	23%	▫0.97	24%
FEF75% (L/s)	1.67	▫0.28	17%	▫0.29	17%	▫0.40	24%
FEF25-75% (L/s)	3.38	▫0.77	23%	▫0.77	23%	▫0.76	22%

Figure 7. Example of a spirometry test showing an obstructive impairment

The FVC/FEV1 is inversely proportional to age and height. What this means is that the FEV1/FVC ratio decreases with age as a result of normal age-related decline in lung function. Therefore, even though using a fixed FEV1/FVC % to define obstruction is widely recommended, it can lead to the incorrect over-interpretation of an obstruction in the elderly or very tall subjects and missed interpretations of obstruction in young or very short subjects. For this reason, extra care

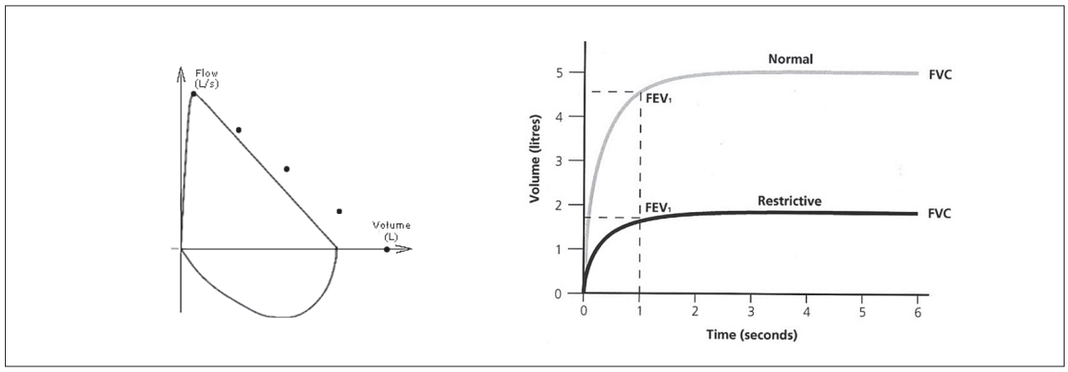


Figure 8. Examples of a restrictive flow volume loop on the left and a restrictive volume time graph on the right. (Diagrams taken with permission from Booker, Class Publishing Ltd and Education for Health UK[11])

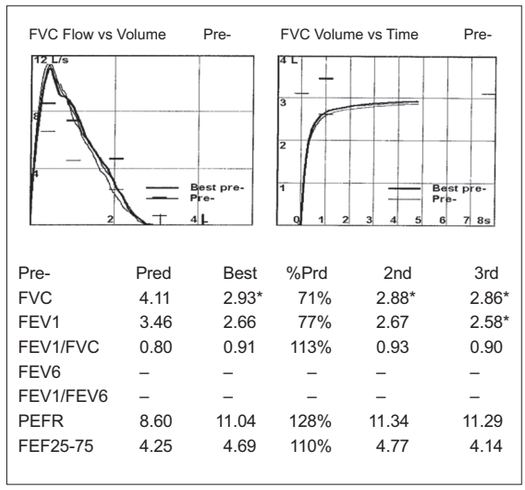
should be exercised in interpreting obstruction using the fixed ratio of FVC/FEV1.[9]

Restrictive impairments

The diseases that prevent the lungs from expanding or cause the lungs to become stiff produce restrictive ventilatory disorders.[1] This decreases the maximum volume of air that is able to be moved in and out of the lungs but the air still moves freely through the airways. A restrictive disorder, unlike an obstructive disorder, will not reduce the speed at which air can be exhaled from the lungs relative to a given volume, but will reduce the volume of air that is contained in the lungs on maximal exhalation. Restrictive disorders can be found in the following conditions: disorders of lung parenchyma, chest wall disorders, neuromuscular disorders, pleural diseases, and systemic diseases.

A spirogram test with restrictive impairments, as shown in Figures 8[11] and 9 will exhibit:

- normal shaped but small volume time trace;
- narrowing of the flow volume curve, may even appear convex;



Pre-	Pred	Best	%Prd	2nd	3rd
FVC	4.11	2.93*	71%	2.88*	2.86*
FEV1	3.46	2.66	77%	2.67	2.58*
FEV1/FVC	0.80	0.91	113%	0.93	0.90
FEV6	–	–	–	–	–
FEV1/FEV6	–	–	–	–	–
PEFR	8.60	11.04	128%	11.34	11.29
FEF25-75	4.25	4.69	110%	4.77	4.14

Figure 9. Example of a spirometry test showing a restrictive impairment

- FEV1/FVC normal ≥ 70% or high above ≥ 80–100%; and
- FVC and FEV1 both reduced to a similar extent (below 80% of predicted) such that the ratio FEV1/FVC is normal or in some cases elevated.

Restrictive impairments are often over diagnosed incorrectly due to poor patient effort, i.e. the patient does not blow out totally. To be certain of restrictive defects the patient should be referred for static lung volume measurements as well. Spirometry alone can only infer a restrictive impairment and is not the appropriate method to investigate or diagnose these conditions.

Mixed obstructive/restrictive impairments

Mixed obstructive/restrictive spirometry tests arise from disease processes that cause features of both an obstructive and restrictive defect. An example of this is cystic fibrosis, which can cause excess mucus production and damage to lung tissue.

A mixed impairment spirometry test (Figures 10[11] and 11) will show:

- the volume time curve is small and flat;

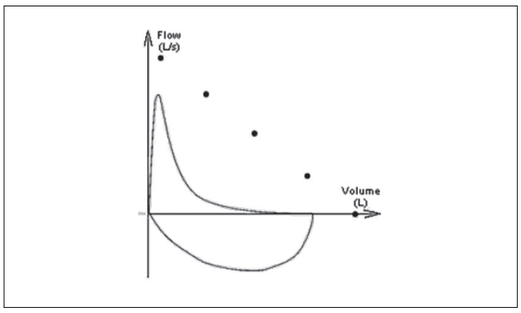


Figure 10. Example of what a mixed obstructive-restrictive impairment looks like on the flow volume loop. (Diagrams taken with permission from Booker, Class Publishing Ltd and Education for Health UK[11])

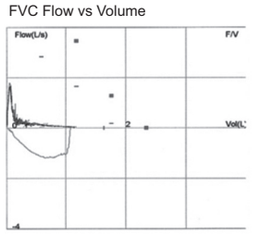
- on the flow volume curve there is concavity as well as reduced volume;
- FEV1/FVC below 70%;
- FVC below 80% of predicted; and
- FEV1 and FVC post bronchodilator administration are below 80% of predicted.

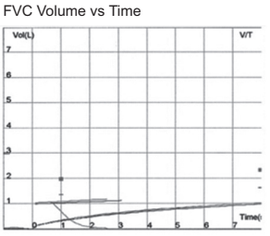
Grading the abnormality

The main reason for grading the severity of the impairment found on spirometry is to quantify the respiratory impairment and/or disability for medico-legal purposes and to optimise and standardise treatment practices.[1] The severity of impairment is linked to physical ability or impairment.

Spirometric abnormalities can be graded as mild, moderate or severe according to the SATS table shown in Figure 12.[1] Using the FVC and FEV1 percentages of predicted and the actual FEV1/FVC percentage, the index showing the lowest value is used for grading. In most instances:

- The severity of an obstructive impairment is graded on the best FEV1 as a percentage of predicted;
- The severity of a restrictive impairment is graded on the best FVC as a percentage of predicted;
- The severity of a mixed obstructive and restrictive abnormality is graded on the basis of either best FEV1 or best FVC as a percentage of predicted, with the worst of the two grades determining the grade. A good example of the grading of a possible mixed obstructive/restrictive





Result	Pred	Best	%Prd	2nd	%Prd	3rd	%Prd
FVC (L)	*2.34	▫1.17	50%	▫1.13	48%	▫1.07	46%
FEV1 (L)	*1.97	▫0.34	17%	▫0.32	16%	▫0.35	18%
FEV1/FVC		▫0.29%		▫0.28%		▫0.33%	
PEFR (L/s)	5.52	▫1.56	28%	▫1.67	30%	▫1.69	31%
FEF25% (L/s)	5.06	▫0.21	4%	▫0.21	4%	▫0.26	5%
FEF50% (L/s)	3.46	▫0.13	4%	▫0.12	3%	▫0.15	4%
FEF75% (L/s)	1.29	▫0.08	6%	▫0.07	6%	▫0.08	6%
FEF25-75% (L/s)	2.91	▫0.12	4%	▫0.11	4%	▫0.13	5%

Figure 11. Example of a spirometry test showing a possible mixed obstructive-restrictive impairment

Parameter	Normal	Mild (able to meet physical demands of most jobs)	Moderate (diminished ability to meet physical demands of many jobs)	Severe (unable to meet physical demands of most jobs)
% pred FVC	≥80	60–79	51–59	≤50
% pred FEV1	≥80	60–79	41–59	≤40
FEV1/FVC%	≥70	60–69	41–59	≤40

Impairment grade is allocated according to the worst affected parameter. Refer to pulmonologist if impairment grade and clinical assessment do not agree.

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Figure 12. South African Thoracic Society spirometric impairment grading table[1]

impairment can be seen in Figure 11. Here the best FVC is found in the "Best" column at 1.17L and 50% of predicted whilst the best FEV1 is found in the 3rd column at 0.35L and 18% of predicted. The FEV1 being the lowest of percentage of predicted between the FVC and FEV1 would then be used for grading. Using the grading table[1] in Figure 12 the FEV1 at 18% predicted would be a severe impairment.

CONCLUSION

Interpretation is a step by step process taking into account equipment verification and calibration, the use of correct predicted values together with correction for ethnic origin and the reliability of the data by applying acceptability and repeatability criteria. Assessing the shape of the flow volume and volume time traces is as important as assessing the numerical data. The severity of the abnormality is assessed using the South African Thoracic Society grading table.

RECOMMENDATIONS

1. If a test is less than optimal it may still contain useful information and should therefore not be discarded but used with caution and understanding of how the testing error affects the results.
2. Interpretation should be clear and concise and is useful to assist in the diagnosis of a subject but cannot be used alone to diagnose a subject with a respiratory disease.
3. In the event of an airway obstruction it is good practice to carry on with a bronchodilator reversibility study, especially in new subjects, which further assists in defining the obstructive abnormality as asthma or COPD.[9]
4. In cases where there is evidence of a restrictive impairment or a mixed impairment, referral for the measurement of Total Lung Capacity and gas transfer is recommended.[9]
5. If the actual symptoms and the degree of spirometric impairment differ, more information will be required to evaluate fitness to perform an occupation or to support an application for compensation benefits.
6. Do not depend on computer generated interpretations which can often be incorrect or misleading.

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A comparison of the effect of two intervention regimes on coronary prone executives in the South African colliery industry

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ABSTRACT

Corporate environment presently realises the importance of health promotion strategies to ensure health and productivity. In this pre-test-post-test quasi-experimental study, the effect of two intervention strategies (physical fitness and an enriched physical fitness programme) of 32 weeks on coronary prone colliery executives from six collieries in South Africa were studied. High risk executives volunteered to participate (availability sampling) resulting in a total of 143 participants (Group A: n = 77; Group B: n = 66). A reduction in six coronary risk factors was used to indicate the effectiveness of the intervention. The results of individuals presenting one or more coronary risk factors are reported.

Statistical analysis indicated that significant improvement was noted in many primary risk factors in the intra-group analysis. Regarding the inter-group changes no statistical differences occurred except for diastolic blood pressure in the pre-test. It was concluded that none of the two intervention regimes were superior to one another.

Keywords: coronary risk factors, physical fitness, health promotion, intervention programmes.

INTRODUCTION

The corporate environment presently realises that wellness programmes in the workplace have a great potential to impact on employees' long-term lifestyle choices because the average employee spends 50 hours a week at work and eats one third of his/her meals at work.[1] This has led to the designing of intervention programmes that address the health risks of the employees.[2,3] Approximately 90% of all companies in the USA with 50 or more employees and virtually all with more than 750 employees offer some form of health promotion programme at their workplace.[4]

In the South African context, information on the implementation and effectiveness of health promotion programmes is scant, however, some studies have revealed that various programmes are in place – especially amongst the bigger companies.[5-7] In this regard, research by Mchunu[8] showed that despite some of the companies offering some health promotion activities, non emerged as entirely health promoting workplaces. The focus of intervention regimes varies considerably – ranging from employee education and HIV/AIDS awareness as the major point of focus to back care receiving the least attention,[7] despite the fact that lower back pain has been shown to have the higher odds ratio (OR = 1.54) in mental/interpersonal functioning.[9]

This investment in lifestyle risk reduction and health promotion intervention stems from an emerging consensus that keeping employees healthy will result in corporate and employee benefits.[10] In this context, Edington[11] has stated that intervention regimes should not only be focused on the high-risk individual but also on the individual presenting with low risk. However, research has indicated that the more high-risk parameters an individual presents, the higher the health care costs and the greater the probability of morbidity and mortality.[10-12] Therefore, appropriate interventions to remedy this situation are imperative for the corporate environment.

Research on South African executives from the colliery industry has indicated that a large number fall into the undesired health zone of the following parameters: aerobic fitness (44.8%), obesity (35.7%), increased systolic and diastolic blood pressure (16.8%, 21.7%) and elevated total cholesterol concentration (53.2%).[13] This may, therefore, also increase their risk for coronary heart disease.[14-15]

In recent years, other wellness activities have been included in corporate health promotion programmes instead of only focusing on improving the physical fitness of the employees, as it has been suggested that an educational component may bridge the knowledge-behaviour "gap" which is encountered in some health promotion studies.[6] This may

encourage changes in attitude and behaviour, convincing participants to take more self-responsibility for their own health and wellness, thereby enhancing the effectiveness of the programme.[15] However, research comparing the effectiveness of various promotion programmes – especially those focusing on high risk employees is very limited in South Africa.[13] Therefore a study to compare the effect on coronary risk factors in executives of a physical activity programme with a programme including the same physical activity component as well as other educational activities was conducted in six collieries in South Africa. The outcome of this study may support the understanding of occupational health professionals regarding the effectiveness of various types of intervention programmes directed at high-risk executives.

METHODS

Study design

A quasi-experimental study design using a pre-test-post-test procedure to compare the effect of two types of intervention programmes on high risk executives, was used in this study. A reduction in coronary risk factors was used to indicate the effectiveness of the intervention.

Population and sampling strategy

A two stage sampling strategy was used. Firstly, six South African collieries situated in Mpumalanga and Gauteng Provinces were randomly allocated to Group A (3 mines) and Group B (3 mines). Secondly, high risk executives volunteered to participate (availability sampling) resulting in a total of 143 participants (Group A: n = 77; Group B: n = 66).

Participants

The purpose of the study was to compare the effect of the interventions in terms of a reduction in CHD risk factors. The factors that were selected, also referred to as the primary risk factors,[16] were hypertension (systolic ≥140 kg/m, diastolic ≥90 mmHg), obesity (BMI ≥30 kg/m^2), hypercholesterolaemia (≥5.2 mmol/L) and aerobic fitness (≥114 b/min). Smoking and physical inactivity were also noted. Executives with one or more risks for developing coronary heart disease were selected. Therefore the number of participants with respect to the individual risk factors differed as not all presented with a value that could be classified as a high risk. In the discussion of the results it is, however, indicated that some strategies and statistical procedures were used, correcting for these differences in order to reflect the most reliable picture.

All participants were screened by using the PAR-Q (Physical Activity Readiness Questionnaire) to ensure safety in the physical fitness intervention.[16] Individuals presenting with some contraindications for testing were not subjected to any physical fitness evaluation. Individuals using medication that could affect any of the parameters measured (blood pressure, heart rate, etc.) were excluded from the study. The age of the participants varied between 26 – 58 years (= 41.7 ± 7.98).

Measurements

Stature: Body height was determined by using a stadiometer with participants standing barefoot with the back pressed against the meter and keeping the head straight. Height was determined to the nearest 0.5 cm.

Body mass: Body mass was determined using an electronic scale and noted to the nearest 0.5 kg. Participants were barefoot only wearing a pair of shorts. The scale was calibrated regularly with a standardised weight.

Body mass index: Body mass index was calculated using the formula: weight (kg)/height (m^2).[16]

Blood pressure: An ALPK2 aneroid sphygmomanometer was used to determine arterial blood pressure according to the protocol as suggested by the American College of Sports Medicine (ACSM).[16] Participants were seated for five minutes prior to measurement and two readings were taken one minute apart. The participants with a systolic blood pressure of ≥140 mmHg and a diastolic blood pressure of ≥90 mmHg were categorised as high-risk.[16]

Total cholesterol: The Accutrend GC analyser was used in determining a non-fasting value of total cholesterol. An arterial blood specimen from a finger prick was collected for this procedure. The machine was calibrated by using the batch-related calibration strip before the assessments. A fasting period prior to the assessment of total cholesterol was not applied due to evidence-based research indicating that testing in the non-fasting state may not be clinically or significantly different from testing in the fasting state in identifying patients at risk for a future cardiovascular event.[17] The participants with a cholesterol concentration of ≥5.2 mmol/L were categorised as high-risk.[16]

Obesity: Participants with a BMI of ≥30 kg/m^2 were categorised as high-risk.[16]

Smoking: All participants who smoked were categorised as high-risk.[16]

Aerobic fitness: The protocol, suggested by ASCM, was used to determine the aerobic fitness by means of a 3-minute submaximal step test on a Reebok step-up bench.[16] The recovery heart rate in beats/minute indicated the aerobic fitness. Participants with a heart rate of ≥114 b/min were categorised as high risk.[18]

Physical activity: Participants with a leisure-time physical activity participation of ≤1-3 times per month were categorised as high-risk.[19]

"Research on South African executives from the colliery industry has indicated that a large number fall into the undesired health zone . . ."

Procedure

The assessment of the executives commenced immediately after an explanation of the tests and procedures. The assessments were done either in the executive's boardroom or in the gymnasium on site. The assessment sequence commenced with the demographic, PAR-Q questionnaires, informed consent, stature, body mass and blood pressure measurements followed by the determination of the total cholesterol with the physical fitness evaluation concluding the session.

Table 1. The effect of two intervention programmes on selected coronary heart disease risk factors in the high risk executives in the study (intra-group differences)

	Group	Pre-test			Post-test			
		n	$\bar{x}$	SD	n	$\bar{x}$	SD	p-value
Body mass index ≥30 kg/m^2	A	13	32.5	2.1	13	32.1	2.1	0.099
	B	23	32.8	3.2	23	32.4	3.0	0.049*
Systolic blood pressure ≥140 mmHg	A	5	142.0	4.0	5	128.0	12.0	0.084
	B	10	146.0	8.0	10	133.0	12.0	0.012*
Diastolic blood pressure ≥90 mmHg	A	7	93.0	5.0	7	83.0	12	0.038*
	B	15	95	3.0	15	87.0	9.0	0.002*
Total cholesterol ≥5.2 mmol/L	A	28	6.1	0.8	28	5.4	0.8	0.001*
	B	30	6.1	0.8	30	5.2	0.8	0.001*
Aerobic fitness ≥114 b/min	A	21	123	11.0	21	109	16.0	0.001*
	B	20	127	13.0	20	116	18.0	0.006*
Smoking	A	12	23.1	–	12	23.1	–	1.00
	B	12	23.1	–	12	23.1	–	1.00
Physical activity <1-3/month	A	17	32.7	–	16	32.1	–	1.00
	B	17	32.7	–	17	30.2	–	1.00

Pre-test – Before any intervention (baseline data); Post-test – Data after 32 weeks of intervention
*p ≤0.05 Statistically significant

Intervention programme

Group A underwent a 32-week physical fitness programme enriched with educational workshops regarding healthy lifestyle and wellness, while group B only followed the physical fitness programme. The regime was explained to both groups by means of a general programme orientation after which the 32-week intervention followed. The time frame of this period was based on the availability of the subjects and consent given by the collieries.

The ACSM's guidelines for improvement of fitness and general health, based on the FITT-principle, were used as the basis for the exercise prescription,[16,20] which was individualised to the executive's medical history, physical, physiological and bio-chemical results. Each programme was prescribed on a programme card to be followed at a fully equipped gymnasium on site or at the nearest available gymnasium in town. For the duration of the study (32 weeks) the exercise schedule was adjusted every 2-4 weeks to ensure progression, by increasing the exercise intensity as well as resistance. The exercise intensity was set at 65%-90% of their age adjusted maximal heart rate and training had to take place at least three times per week. The duration of the exercise schedule was approximately 40 minutes. The participants had the option to choose from five easily accessible types of cardiovascular exercises namely, cycling, walking, stepping, rowing and jogging. Resistance exercises were prescribed for conditioning and strengthening of the lower and upper body muscle groups using free or fixed weights. Each exercise session included a warm-up and cool-down phase where basic stretching exercises were performed (quadriceps, hamstring, calf, triceps and shoulder). The first training session and every time when their programmes were adjusted, were performed under the supervision of the researcher. For the duration of the 32 weeks they trained on their own without supervision. They could, however, contact the researcher if anything was unclear. Compliance of the sessions was noted on the exercise card. The exercises were performed outside their work schedule and no incentives for participation in the programme were offered.

The health promotion (educational) activities presented to Group A consisted of information sessions on exercise and nutrition, stress management and lower back pain. The aim of these health promotion activities was to promote the health and/or reduce illness-producing lifestyle habits of the executives. Another aim was to foster awareness, influence their attitudes and identify alternatives that would enable them to make informed choices and change their habits in order to achieve an optimum level of physical and mental health and improve the physical and social environment. The duration of these sessions was 30-45 minutes presented every eight weeks. Low back pain (not included in this study) was

Table 2. The effect of two intervention programmes on selected coronary heart disease risk factors in the high risk executives in the study (inter-group differences)

	Group	Pre-test				Post-test			
		n	$\bar{x}$	SD	p-value	n	$\bar{x}$	MSE ANCOVA	p-value
Body mass index ≥30 kg/m^2	A	23	32.7	2.2	0.531	13	32.2	0.78	0.909
	B	28	33.2	3.5		23	32.2		
Systolic blood pressure ≥140 mmHg	A	8	146	7.6	0.678	5	128	146	0.509
	B	14	144	7.1		10	133		
Diastolic blood pressure ≥90 mmHg	A	11	92	3.9	0.029*	7	85	75	0.915
	B	20	96	4.9*		15	85		
Total cholesterol ≥5.2 mmol/L	A	34	6.2	0.8	0.715	28	5.4	0.54	0.495
	B	36	6.1	0.8		30	5.2		
Aerobic fitness ≥114 b/min	A	40	126	10.5	0.397	21	110	214	0.358
	B	36	128	12.5		20	115		
Smoking	A	19	27%	–	0.673	12	23%	–	1.00
	B	17	26%	–		12	23%	–	
Physical activity <1-3/month	A	23	30%	–	1.00	31	60%	–	0.250
	B	20	30%	–		23	43%	–	

Pre-test = Before any intervention (baseline data; Post-test = Data after 32 weeks of intervention
*p ≤0.05: Statistically significant

presented to this group because it is a major issue in health care costs and productivity in the work environment.[9]

Statistical analysis

In the analysis of data for each risk category, only those individuals who were at risk in that category at the pre-test, were extracted from the database. Independent t-tests (or Chi-square tests for categorical data) were performed to determine if there was a difference between the means (or prevalence) of each risk factor for the two groups at the pre-test. Dependent t-tests (or Chi-square tests) were performed to determine the effect of the intervention programme in each group for that risk factor. An ANCOVA, adjusting measurements on the post-test for the measurements on the pre-test, (or Chi-square test) was performed to determine if there was a difference between the means (or prevalence) of each risk measurement for the two groups after intervention.

Ethics

Ethical clearance for the study was given by the Ethics Committee of the Faculty of Science and Agriculture, University of Zululand. Participants gave informed consent. All data were collected by a registered biokineticist and ethical guidelines for the profession as described by the Health Professions Council of South Africa were followed.

RESULTS

In Tables 1 and 2 the descriptive data relating to the effect of the two different intervention programmes on executives in South African collieries are presented. Table 1 refers to the intra-group changes (A vs A; B vs B) which occurred following the 32 weeks intervention (pre-test referring to the first evaluation and post-test referring to the evaluation after completing the intervention regime).

Table 2 refers to the inter-group differences (A vs B in the pre-intervention evaluation as well as in the post-intervention evaluation). In order to ensure the reliability of the comparison in Table 1 only the data of participants that completed the pre and post-test were used.

In Table 2, representing the inter-group changes, all high risk individuals were included in the two test periods. That implies that the numbers of the high risk individuals varied. Therefore, in the post-test the MSE-ANCOVA (mean square error) was used instead of the standard deviation which

Table 3. The effect of two intervention programmes on the frequency of coronary heart disease risk factors in the high risk executives in the study

	Group	GROUP A			GROUP B		
		Total sample (N)	High risk (n)	%	Total sample (N)	High risk (n)	%
Body mass index ≥30 kg/m^2	Pre	52	13	25.0	52	23	44.2
	Post	52	13	25.0	52	20	38.5
Systolic blood pressure ≥140 mmHg	Pre	52	5	9.6	52	10	19.2
	Post	52	3	5.8	52	6	11.5
Diastolic blood pressure ≥90 mmHg	Pre	52	7	13.5	52	15	28.8
	Post	52	6	11.5	52	10	19.2
Total cholesterol ≥5.2 mmol/L	Pre	51	28	54.9	52	30	57.7
	Post	51	23	44.2	52	26	50.0
Aerobic fitness ≥114 b/min	Pre	43	21	48.8	43	20	46.5
	Post	43	9	20.9	43	21	48.8
Smoking	Pre	52	12	23.1	52	12	23.1
	Post	52	12	23.1	52	12	23.1
Physical activity <1-3/month	Pre	52	17	32.7	53	17	32.1
	Post	52	17	32.7	53	16	30.2

Pre – Before any intervention (baseline data) (Pre-test)
Post – Data after 32 weeks of intervention (Post-test)
*p ≤0.05 Statistically significant

allows for correcting statistically for the difference in initial numbers in the pre and post-evaluations. The reason for this difference in numbers is due to the fact that a dropout figure of 20-25% was experienced between the pre and post-test. This figure may not solely be due to lack of interest but some of the participants were unavailable for the post-test due to other work-related responsibilities (overseas, meetings, site responsibilities, etc.).

"... both groups experienced a statistically significant increase in their physical fitness level."

Table 3 indicates the frequency of the coronary heart disease (CHD) risk factors in the executives. All the participants who participated in both evaluations (pre and post-test) were analysed. They are referred to as the total sample. From these groups those indicating a high risk value in the selected CHD risk factors (so-called primary risk factors) were studied.

From Table 1 it is clear that all parameters, except for smoking, showed improvement from the pre- to post-test. However, all changes were not statistically significant. In the case of smoking 23% reported smoking in both evaluations. Table 2 representing the inter-group differences during the two evaluations indicated a statistically significant difference in only the diastolic blood pressure in the pre-test.

From Table 3 it is clear that the percentage of participants in most of the parameters in both groups showing CHD risk factors declined from the pre to the post-test, except for BMI in Group A which stays the same (25%). In the case of aerobic fitness, the numbers in Group A declined from 48.8% to 20.9% but in Group B increased from 46.5% to 48.8%. There were no changes with respect to smoking in any of the groups.

Discussion

All parameters, except for smoking, improved after the intervention regime. However, not all the changes were statistically significant (Table 1). The small numbers in the various groups may be the main reason for this. However, some of these changes are clinically very important as the risk factor stratification of various parameters dropped from a high risk to a moderate/normal risk level. This is the case in systolic and diastolic blood pressure where both groups after intervention showed a lower risk stratification regarding the mean blood pressure value (Group A: systolic 142.0 → 128.0 mmHg; diastolic 93.0 → 83.0 mmHg; Group B: Systolic, 146 → 133 mmHg; diastolic 95 → 87 mmHg). Similarly, both groups experienced a statistically significant increase in their physical fitness level. Therefore, a salutogenic effect on the CHD risk factors resulted from both intervention programmes. This implies that not only may the risk of premature morbidity and mortality of these high level employees be decreased, but also the health care costs for the individual and company may be lowered.[9-11,21]

There were no statistically significant differences between the two groups at pre-test or post-test, excepting the diastolic blood pressure value in the pre-test which was significantly higher in Group B (96 mmHg vs 92 mmHg). Therefore, it

seems that both intervention programmes were successful but that no superiority was found in the effect of the "enriched" programme followed by Group A versus the traditional unsupervised physical fitness programme followed by Group B. This outcome is positive considering that these changes occurred over a relatively short time. Furthermore, it can be argued that Group B was made aware of health influences, with a change in other risks as a result.

The results in Table 3 indicated that in most parameters assessed, the percentage (%) of participants classified as "high risk" had decreased at the end of the intervention regimes. The BMI in Group A remained the same (25%) in the pre and post-test while smoking remains the same in the pre and post-test. This implies that both intervention regimes not only may lower the mean value of CHD risk factors (Table 1) – but in some cases may drop an individual from a high risk to moderate/normal risk stratification (systolic and diastolic blood pressure and aerobic fitness (Group A). According to the literature, an improvement in just one risk factor in individuals can improve presenteeism by 9% and reduce absenteeism by 2%.[22] Therefore, an intervention programme focusing on improving factors the high risk individuals in the company may not only increase productivity[23] but also reduce health care costs.[21]

CONCLUSION AND RECOMMENDATIONS

From this study it is clear that the two intervention programmes could improve most of the primary CHD risk factors in high risk employees. Neither of the two programmes, however, was superior. The small samples of high risk participants in some of the parameters could have influenced the outcome, and further studies with larger samples are recommended. It is imperative for companies to implement intervention regimes otherwise health care costs can be higher and the probability of morbidity and mortality greater.

LESSONS LEARNED

1. Companies can implement intervention programmes consisting of physical fitness, with or without an educational component, if the aim is to lower CHD risk factors in executives in South African collieries.
1. Intervention regimes can be effective without direct supervision, if well-structured and managed.
2. Companies are unaware that a large portion of their employees may be stratified as being in a high risk category and therefore employees need to be screened on a regular basis for CHD risk factors.

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Chromium (III & VI) toxicity

It works well in practice, but how does it work in theory?

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INTRODUCTION

The scientific literature contains a considerable number of studies on biological monitoring of urine chromium in occupationally exposed populations. The development in science and technology in the 21st century requires us to limit the exposure to this substance to the extent that it can be considered non-toxic to the environment and its organisms. Urine chromium concentrations have been widely used as an indicator of occupational exposure to these chemicals. However, the fact that chromium (III) is an essential micronutrient and acts as cofactor in insulin function, the maintaining of normal glucose tolerance complicates its use. Chromite ore processing and hexavalent chromium are listed as having carcinogenic potential, while lead and zinc chromates are suspected carcinogens. To identify these different species in urine or blood requires analysis techniques which can differentiate between the toxic chromium (VI) and non-toxic chromium (III) oxidation states.

With the growing recognition of the long-term hazards of heavy metals, notably cancer, that might be the result of these exposures, it has become more important to develop the analytical capabilities to analyse chromium levels to very low concentrations of exposure, accentuated by the fact that there is no safe exposure to carcinogens, and determine the trend level of chromium that can eventually be interpreted. Normal values, as it has been known for years may be erroneous, especially for trace elements / essential elements and are dramatically lower than those regarded as being correct, non-toxic or essential some years ago.

The question remains, are lower levels of total chromium considered safe or should we not determine the true the oxidation states of chromium and the impact it has on our health?

A. ABSORPTION, DISTRIBUTION AND EXCRETION

We know that trivalent chromium is poorly absorbed (<1%) from the GI-tract, whereas 50% of the hexavalent chromium can be absorbed from the gut and distributed to different organs cells and tissues. Chromium (VI) has a half life (t1/2) of 3–4 years and causes extensive damage if the levels of exposure are not limited to the lowest possible detection limit.

B. TARGET ORGAN OF CHROMIUM (VI)

Organ accumulation of chromium is extensive and includes the brain, liver, spleen, testes, bone marrow and reticuloendothelial system. Serum half life is 15–41 hours and approximately 80% of a chromium dose is excreted in the urine. The basis of chromium (VI) toxicity is its ability to penetrate the cell membrane where it produces mutagenic events which results in cell death. Organ toxicity is widespread and normally presents as respiratory tract disturbances, including acute pulmonary oedema within 72 hours of significant exposure.

Other symptoms are:

1) eczematous changes – “Blackjack disease”, painless ulcers on the hands, periumbilical region, axillae and forearms (“chrome holes”);
2) GI toxicity including severe haemorrhagic gastroenteritis;
3) hepatitis;
4) renal toxicity including tubular necrosis and glomerulonephritis.
5) haematologic disturbance – including methenoglobinaemia, thrombocytopaenia, anaemia and intervascular haemolysis;
6) cardiovascular disturbance including circulatory collapse and shock usually secondary to extensive GI corrosion/perforation; and
7) increased incidence of nasal cancer and bronchial carcinoma associated with occupational exposure to chromium (VI).

TREATMENT/MANAGEMENT MECHANISM

Chromium intoxication can be diagnosed through the analysis of blood or urine. Chromium (VI) exposure is more complex and can only be diagnosed through the determination of total chromium in red blood cells (see Figure 1).

Treatment of chromium (VI) ingestion includes:

1) management of hypotension or shock;
2) forced diuresis – integral part of management;
3) aggressive treatment of corrosive GI injury;
4) evaluation for intravascular haemolysis, methemoglobinaemia and renal failure.

MECHANISM

The mechanism of toxicity / carcinogenicity of chromium (VI) is explained by the uptake-reduction model (Figure 1). Chromium (VI) water solubility and ionisation properties gives the compound the ability to readily enter cells by diffusion through a nonspecific anion channel, whereas due to its

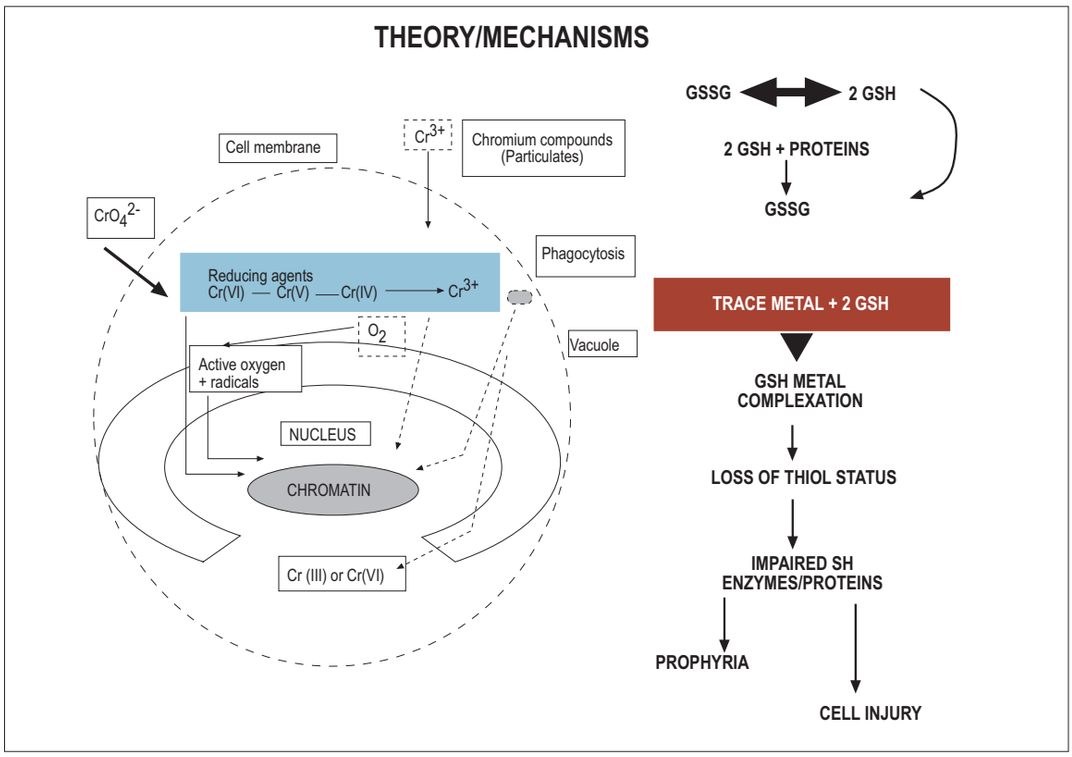

Figure 1. Illustration of the mechanism of carcinogenicity and detoxicification of chromium (VI)

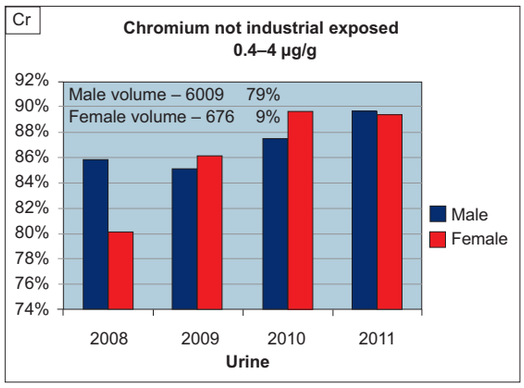

Figure 2. Total chromium urine: not industrial

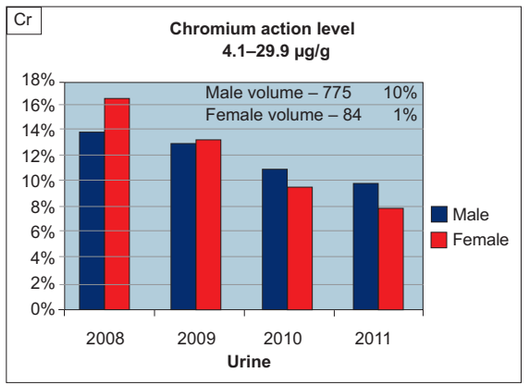

Figure 3. Total chromium urine: Action level – a very similar exposed (Normal level) pattern has been observed for both male and female workers

non-soluble nature chromium (III) does not seem to enter the cell through these anion channels.

Gluthathione appears to facilitate Cr(VI) uptake by reducing Cr(VI) to Cr(III) after it enters the cell. This process limits the concentration of Cr(VI) by reducing it to Cr(III). However, glutathione reduction action does allow the further uptake of Cr(VI) which can lead to excess chromium accumulation in the cell. There are other non-enzymatic processes like ascorbate and riboflavin, as well as enzymes like cytochrome P-450, DT-diaphorase and the mitochondrial electron chain transport. Chain complexes are all capable of reducing Cr(VI) in vitro.

Once chromium (VI) is reduced, it is capable of producing various forms of DNA damage including DNA strand breaks, DNA interstrand cross links, DNA-protein cross links as well as Cr DNA adducts. Thus, the different pathways of metabolism in tissue will influence the extent of DNA damage produced by Cr (VI). This DNA damage observed accounts for the functional changes in DNA replication and transcription which may be crucial and explains the carcinogenicity of chromium (VI) compounds.

CHROMIUM URINE AND RED BLOOD CELLS ANALYSIS DATA 2008–2011

The data reflect the extent of exposure to chromium in

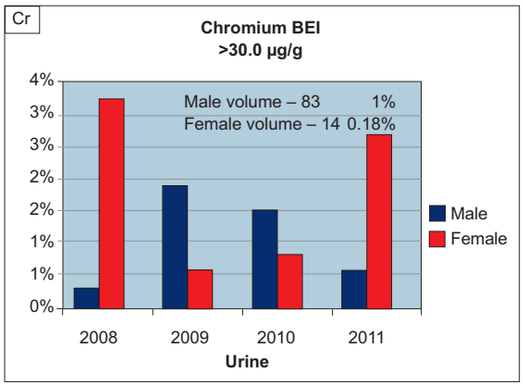

Figure 4. Total chromium urine: BEI – Significant increase in female chromium levels are noticeable

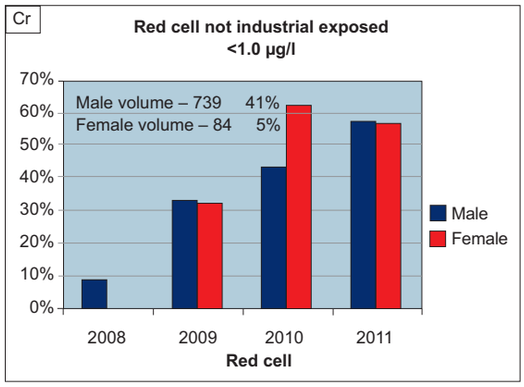

Figure 5. Red cell non-exposure (normal)

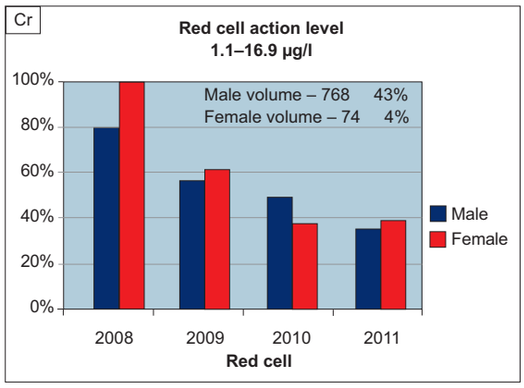

Figure 6. Red cell action level

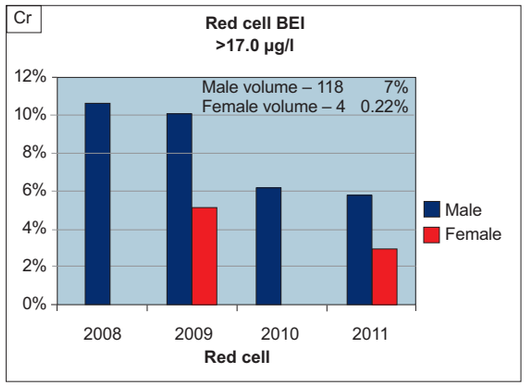

Figure 7. Red cell BEI

industry. Total chromium urine results were summarised and are graphically demonstrated in Figures 2 to 4. A gradual decline in exposures has been observed for the male workers. With respect to the female exposure, data followed a very similar pattern for normal and action levels.

The data for chromium (VI) in red blood cells (Figures 5 – 7) are alarming and illustrate that a significantly high percentage of workers were actually exposed.

CONCLUSION

Over the past few years an increased awareness among occupational physicians has led to the re-evaluation of chromium exposure and in particular the long-term exposure effect of Cr (VI) and the possibly symptomatic effects such exposure has on the workers health. Biological trend line evaluations of red blood cell chromium (VI) levels is a valid method to determine possible exposure or body burden resulting from long-term exposure to chromium (VI). From the results a noticeable drop in exposure was observed. However, chromium (VI) exposure in the workplace is a reality and still under-diagnosed.

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Physiotherapists' and occupational therapists' perceived barriers and enablers of return to work for survivors after stroke

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ABSTRACT

Stroke impacts on a survivors' ability to return to work. Successful return to work after stroke can enhance both recovery and life satisfaction by improving self esteem and social identity. This study was undertaken to establish therapists' perceived barriers and enablers of return to work of survivors after stroke. A cross sectional study in stroke rehabilitation facilities within Gauteng province in South Africa was conducted. The questionnaire was returned by 36 (68%) of these facilities.

The most commonly perceived barriers were the severity of the stroke survivors' physical impairments (n = 13) (36%) and their employment status (n = 11) (31%) at the time of having a stroke. The commonly perceived enablers were willingness of the employer to reasonably accommodate the stroke survivor at work (n = 12) (33%), family support (n = 8) (22%) and increased length of hospital stay to allow for intensive rehabilitation (n = 7) (19%). Stigma in the workplace was the only variable which had a statistically significant relationship with the type of clinical facility therapists worked at (p = 0.02).

Key words: **stroke, return to work, functional capacity assessment, physiotherapists, occupational therapists**

INTRODUCTION

Stroke impacts on a survivor's ability to participate in community activities such as returning to work[1] and affects people who are still within the working age.[2] Successful return to work (RTW) after stroke can enhance recovery and life satisfaction by improving self esteem and social identity.[3,4] Thus rehabilitation needs to promote RTW rather than focusing just on restoring bodily functions and return to activities of daily living (ADL).[5]

Stroke survivors are usually discharged from stroke rehabilitation when they have no significant aphasia, are independent in ADLs, and have functional ambulation or have reached their maximum functional potential given their impairments.[2] However, working age group stroke survivors need more complex and cognitively demanding activities after a stroke for them to be successfully returned to work.[6] Some people with severe brain lesions RTW after stroke while, some with mild brain lesions do not.[7,8] In a study by Busch et al. 53% of the patients who were considered to be functionally independent did not RTW after stroke. This indicates that severity of the brain lesion and functional independence are not the only barriers of RTW.

According to the Health Professions Council of South Africa the scope of physiotherapy practice rehabilitation includes: "getting the patient to maximum potential in both work and sport, including adaptation to permanent disabilities" and community care includes "offering services at day hospitals, rehabilitation centres, schools, industries and other organisations." This indicates that physiotherapists and occupational therapists need to think of actual and potential barriers which may prevent a person from returning to work. The plight of people with disabilities with regards to RTW is also acknowledged within the South African Employment Equity Act[9] in which a former Minister of Labour in the foreword stated that "employees who become disabled are often dismissed for poor performance or incapacity or they resign unnecessarily. They are often encouraged or forced to apply for disability benefits and they tend to retire earlier than other employees do, although if their needs are reasonably accommodated, they can continue as productive employees."

Recent research carried out internationally using

literature review and qualitative research methods established the following barriers of RTW for people with stroke: architectural barriers limiting access to the buildings; lack of appropriate transportation; poor local economy resulting in high levels of young unemployed people; stereotypes against people with disabilities[1]; older age at stroke onset; low education level[10]; lack of family support[6]; lack of intersectoral collaboration[11]; patients' lack of motivation to RTW; poor physical recovery; and lack of support from employer and colleagues.[12]

The role of the employer as an enabler of RTW is acknowledged by the South African government as indicated within the Employment Equity Act,[9] which states that an employer has to adhere to a "code of good practice on employment of people with disabilities" which ensures that an employee gets a proper objective assessment to establish: the extent to which they are able to perform work; the extent to which work conditions may be adapted; and the availability of a suitable alternative job.

Research concerning RTW has been conducted mostly in developed countries (e.g. Canada and the United Kingdom), which has limited application elsewhere. There is literature about stroke survivors' perceived barriers and enablers of RTW, however, not much has been done to establish the perceptions amongst therapists especially in developing countries. The context in which therapists work may influence their perceptions of factors that influence RTW and therapists' own beliefs and values can be an enabler or barrier of RTW.[13] Therapists' perceptions may also be influenced by their knowledge of the possible impairments and activity limitations that may result from the brain lesion and the difficulties that this may cause for work performance whereas stroke survivors' perceptions would be based on their experiences.[14] It is on this basis that this study was undertaken to establish therapists' perceived barriers and enablers of return to work of survivors after stroke. This paper is reporting the results of part of a larger and ongoing study to establish the following: the effect of a workplace intervention programme on the rate of RTW after stroke; current practice in RTW services for stroke survivors; factors which influence RTW after stroke and stroke survivors' perceived barriers and enablers of RTW.

METHODOLOGY

A cross sectional study was performed using a self administered questionnaire with open ended questions about perceived barriers and enablers of RTW after stroke, developed specifically for this study. Content validity of the questionnaire was established with the following group of therapists: two physiotherapists working in the field of neurological rehabilitation, two occupational therapists with vocational rehabilitation experience, three therapists with research experience, and one therapist working in the field of public health.

Each question on the questionnaire was validated against the aims and objectives of the study. Essential questions were added and invalid and redundant questions were removed. Some of the questions were rephrased to improve clarity and questions were rearranged to improve flow of information. After corrections were made the final questionnaire was sent to the project development team for final endorsement. The questionnaire had the following: basic information about the type of clinical facility and amount and type of patients seen at the rehabilitation facilities in this study; and open questions about perceived barriers of RTW, perceived enablers of RTW.

"The most commonly perceived enablers of RTW after stroke were willingness of the employer to reasonably accommodate the stroke survivor at work . . ."

The questionnaire was posted to all hospital-based stroke

The ability to climb stairs is required in order to access most of the buildings in which the stroke survivors work

rehabilitation facilities (22), primary health care facilities which offer stroke rehabilitation services (i.e. clinics and community health centres) (23) and stroke rehabilitation units not attached to a hospital (8) within the Gauteng province in South Africa (n = 53). Each facility received one questionnaire and was requested to send the responses within three weeks based on consensus among therapists working in that particular facility. A phone call was made to each clinical facility after two weeks to remind them of the research. Questionnaires were returned from 36 (68%) of these facilities (see Table 1). Frequencies and percentages for closed questions were recorded. Responses to open ended questions were categorised into themes and items within each theme were summarised using frequencies and percentages. A Fisher's exact test was used to establish the relationship between clinical facility and perceived barriers and enablers of RTW. Ethical clearance for this study was granted by the University of the Witwatersrand Committee for Research on Human Subjects (Clearance number M081132).

"... one of the barriers ... is lack of skills for less labour intensive work, and conversely that a higher education level is an enabler ..."

RESULTS

The highest number of responses was from hospital-based rehabilitation facilities 18 (50%) and the lowest was those from stroke rehabilitation units 5 (14%) (Table 1). Twenty-seven (75%) of these clinical facilities provided care for people with stroke who may require intervention to help them RTW if possible. The average number of people with stroke seen at each clinical setting on a monthly basis was 13 (±15) and of these, the average number of people who required RTW intervention on a monthly basis was 4 (±3).

Hand and arm function retraining can help a person cope with jobs that require bilateral arm use

Table 1. The clinical setting in which therapists in this study worked (n = 36)

Clinical setting	n (%)
Hospital based rehabilitation services	18 (50)
Primary Health Care	13 (36)
Stroke rehabilitation unit	5 (13)
Total	**36 (100)**

Table 2. Common perceived barriers of return to work after stroke (n = 36)

Barriers	Yes n (%)
Severity of the patient's physical impairments	13 (36)
Patient unemployed at the time of having stroke	11 (31)
Cognitive and visual problems	5 (14)
Inability to drive or access transport	5 (14)
Lack of skills for less labour intensive work	5 (14)
Want to receive a government disability grant	5 (14)
Therapists do not have equipment to assess patients for return to work potential	5 (14)
Stigma in the workplace	4 (11)
Rehabilitation staff shortage	4 (11)
HIV/AIDS complications of stroke	1 (3)

The most commonly perceived barriers of RTW after stroke from the therapists' perspective were the severity of the stroke survivors' physical impairments (n = 13) (36%) and their employment status (n = 11) (31%) at the time of having a stroke and the least perceived barrier of RTW was HIV/AIDS complications of stroke (n = 1) (3%) (Table 2). The most commonly perceived enablers of RTW after stroke were willingness of the employer to reasonably accommodate the stroke survivor at work (n = 12) (33%), family support (n = 8) (22%) and increased length of hospital stay to allow for intensive rehabilitation (n = 7) (19%) (Table 3).The least commonly perceived enablers of RTW were long duration of employment at the time of having stroke, being a bread-winner at the time of having stroke and ability to communicate (n = 1) (3% for each of these enablers (Table 3)). Stigma in the workplace was the only variable which had a statistically significant relationship with the type of clinical facility therapists worked at (p = 0.02). Therapists at primary health care facilities perceived stigma in the workplace to be a barrier to RTW after stroke and none of the therapists from the hospital based rehabilitation facilities and stroke units perceived stigma in the workplace as a barrier of RTW.

DISCUSSION

Severity of the stroke survivors' physical impairments was considered the most common barrier of RTW in this study. This is likely to be due to the fact that severe impairments result in functional limitations which may also reduce the

Table 3. Common perceived enablers of return to work after stroke (n = 36)

Enablers	Yes n (%)
Willingness of the employer to reasonably accommodate the patient at work	12 (33)
Family support	8 (22)
Long hospital stay to allow for intensive rehabilitation	7 (19)
Patient motivation to go back to work	5 (14)
Younger age at the time of having stroke	5 (14)
Multidisciplinary intervention between occupational therapy, physiotherapy and social work	5 (14)
Higher education level	3 (8)
Long duration of employment at the time of having stroke	1 (3)
Breadwinner at the time of having stroke	1 (3)
Ability to communicate	1 (3)

ability to RTW.[15] This perceived barrier is similar to that established by Stergiou-Kita et al. who indicated that a person should be fairly capable of managing most of their self care before they can RTW.[16] However, physical ability of the stroke survivor should be considered in relation to the physical demands of their job.[13] Therapists in this study did not specifically mention the link between severity of physical impairments and the physical job demands but did indicate that one of the barriers of RTW is lack of skills for less labour intensive work, and conversely that a higher education level is an enabler for RTW. This is similar to earlier research indicating that people with higher levels of education are more likely to do white collar jobs and are thus more likely to RTW after suffering a stroke.[4,11] However, it is worth noting that physical impairments cannot be considered in isolation when considering RTW. Willingness of the employer to reasonably accommodate the person back at work can also influence the process of RTW.[5,14,19] In South Africa the state has made available a code of good practice for employers which specifies the role of the employer as an enabler of RTW within the Employment Equity Act.[9] Physical impairments should not be a barrier if there is sufficient support in the form of increased access to vocational rehabilitation; increased financial resources to purchase assistive devices to facilitate reasonable accommodation; and decreased disincentives created by disability benefits and accessibility of the workplace.[20]

The second most commonly perceived barrier of RTW in this study was premorbid unemployment which meant that there was no work to which they could return. The unemployment rate in South Africa was 25% during the first quarter of 2011.[17] High unemployment rates may lead to a tendency to have more disability insurance benefits and routine security benefits.[1] This explains why therapists in this study also identified social grants as one of the barriers for RTW. Thus high unemployment rates may lead to a tendency to have more disability insurance benefits than job placements or RTW.

Cognitive problems were also considered to be barriers of RTW for survivors after stroke. Cognitive impairments are a significant barrier of RTW[18] and decreased cognitive ability is more of a barrier to RTW than physical impairments.[16] Only five of the 36 clinical facilities in this study considered cognitive ability to be a barrier to RTW. The reason why few clinical facilities identified cognitive ability as a possible barrier may be linked to a finding by Holmqvist et al. that most therapists do not use standardised cognitive assessment tools, to avoid subjecting the stroke survivor to too many tests in addition to doing physical tests.[6]

Willingness of the employer to reasonably accommodate the stroke survivor at work was considered as the main

"Physical impairments should not be a barrier if there is . . . increased access to vocational rehabilitation; increased financial resources to purchase assistive devices to facilitate reasonable accommodation; decreased disincentives created by disability benefits and accessibility of the workplace."

Endurance and strength is required in order to cope in labour intensive work environments

enabler of RTW in this study. This enabler was also identified in various studies which established that employer flexibility is one of the factors that enable successful RTW.[5,14,19] This enabler was also identified by stroke survivors in a study by Liv et al. in which stroke survivors indicated that willingness by the employer to reorganise the work and to believe in their capacity would enable them to RTW.[21] Work adaptation requires resources and may affect productivity, thus it becomes difficult to have a balance between being sensitive to employer's needs while accommodating the stroke survivor back at work.[16] Involving the employer by identifying their needs, expectations and potential accommodations in their workplace may help to overcome their lack of willingness to accommodate the stroke survivor back at work.[13] Therapists in this study mentioned a shortage of work ability assessment equipment and staff shortage as barriers of RTW. This finding is similar to that of Coetzee et al. whose study was done in the Western Cape province of South Africa. They also established that most clinical facilities in the Western Cape do not offer work ability assessments and those that offer these assessments have very long waiting lists as they are overwhelmed with requests from the South African social services agency to do disability grant eligibility assessments.[11]

"Willingness of the stroke survivor to RTW was also identified as an enabler of RTW . . ."

Inability to drive or use public transport was also identified as a barrier to RTW and this finding is similar to that of Treger et al. who also established that lack of transportation is one of the barriers of RTW.[1] This barrier was echoed by Coetzee et al. and they also made recommendations that the Department of Transport should assist the Department of Labour in order to remove this barrier which impeded participation of people with disabilities.[11]

Therapists in this study identified workplace stigma as a possible barrier to RTW. This indicates that even if the employer is willing to accommodate a person back to work, there is a need to have support from colleagues as well.[12] Family support was also identified as an enabler of RTW in this study. It was similar to the finding of Holmqvist et al. who reported that some families promote dependence by carrying out the ADLs for stroke survivors even though they could manage themselves and some made decisions for them without asking for their opinion.[6] Thus the family can in some circumstances make a decision for the person not to RTW even though they would have preferred to RTW.[6] Willingness of the stroke survivor to RTW was also identified as an enabler of RTW in this study and this is similar to a study by Stergiou-Kita et al. which also indicated patient willingness to be the most significant predictor of RTW.[16] They established that the goal of RTW must be initiated by the person with an acquired brain injury not the therapist. It is important to always find out why they are not willing to RTW in order to help them overcome self esteem barriers if they are found to be the reason for lack of willingness to RTW.[16]

Human immune deficiency virus (HIV) infections and acquired immunodeficiency syndrome (AIDS) were identified as a barrier to RTW. This perception may be based on the following: "Patients with HIV infection who do not have full blown AIDS or pulmonary infection have reduced work capacity, lower aerobic threshold, and poorer aerobic capacity than age matched controls".[22] None of the studies reviewed identified HIV as a barrier to RTW. This is not surprising as most of the RTW studies for stroke survivors were done in developed countries where HIV/AIDS is not a major problem. According to the Joint United Nations Programme on HIV/AIDS 2010 report, 5% of people in the sub-Saharan African have HIV/AIDS whereas in other countries the prevalence is less than 1%.[23] This explains why HIV/AIDS were not considered on the list of barriers to RTW in these studies done in developed countries. However, it should be noted that a person may not be discriminated against because of their HIV status as the South African Employment Equity Act[9] clearly states that everyone has a right to have a full assessment to establish possible RTW and consideration for possible reasonable accommodation at work.

Therapists working in primary health care facilities perceived stigma in the workplace as a barrier of RTW after stroke whereas those in the hospital based facilities and in the stroke rehabilitation units did not consider this to be a barrier. A possible explanation for this may be based on the fact that when stroke survivors are seen at a primary health care level it is usually long after discharge from the hospital or rehabilitation unit and some of them are back to work already and thus may give therapists feedback about challenges they face at work in terms of stigma as they may have experienced it. Stroke survivors who are still in the hospital or rehabilitation unit are not likely to have returned to work while at this stage of rehabilitation and thus their therapists may not have heard any of their patients complain about the workplace stigma. Hence they do not mention it anywhere in their list of possible barriers. None of the other perceived barriers and enablers had a significant relationship with clinical facility. This could be because the rest of the perceived barriers and enablers mentioned by therapists in this study may not be dependent on stroke survivors' feedback and thus the therapists' perceptions would be similar irrespective of whether a stroke survivor has returned to work or not.

CONCLUSION AND RECOMMENDATIONS

The most commonly perceived barrier of therapists regarding RTW of survivors after stroke is severe physical impairments.

Therapists' most commonly perceived enabler of RTW for stroke survivors is willingness of the employer to reasonably accommodate the person at work. It is thus recommended that: therapists who rehabilitate stroke survivors with less severe physical impairments should consider working with employers to help them understand how and why environmental modifications should be made in order to facilitate RTW; the length of hospital stay for stroke survivors be increased to enable them to attain their maximum functional potential; and that work ability assessments equipment and rehabilitation staff members should be increased in order to increase work readiness assessment services for stroke survivors. Our findings indicate that therapists in Gauteng have similar perceived barriers and enablers of RTW to those reported by investigators in developed countries.

LIMITATIONS

The information gathered about perceived barriers and enablers could have been more enriched if the data collection method was through interviews with appropriate follow-up questions instead of using a self administered questionnaire. The data did not have demographic information and feedback from individual therapists which would have been beneficial in results interpretation

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LESSONS LEARNED

- Stroke survivors need access to full rehabilitation in order to attain their maximum functional capacity.
- The willingness of the employer to reasonably accommodate the stroke survivor at work can be an important enabler of RTW.
- Involving the employer by identifying their needs, expectations and potential accommodations in their workplace may help to overcome their lack of willingness to accommodate the stroke survivor back at work.
- The occupational health team should ensure that physiotherapists or occupational therapists are involved in the rehabilitation of employees who have had a stroke, so that work ability assessments are conducted and work adaptations recommended.

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Department of Health releases Human Resource Strategy *Continued*

Elsabé Klinck

As explained in the previous issue (Volume 17, No. 6), the Department of Health's Human Resource for Health Strategy (HRHS) sets 8 strategic priorities, each of which are broken down into Objectives and Activities. These are described in detail below.

Priority 1: To provide proactive leadership and an enabling framework to achieve the objectives of the National Department of Health (NDOH) HRHS

Under this priority, the objectives are to create the leadership and governance structures for HR, such as a National Department of Health (NDOH) Workforce Secretariat, Task Teams on HR Planning, Performance, Management, Academia and on a Rural Strategy. It also envisages an annual national meeting of all Task Teams and stakeholders.

To ensure implementation, the HRHS recommends the appointment of:

- an HRHS Implementation Project Leader to manage the strategy, but to also interact with stakeholders and take charge of the communication around the HRHS;
- a National Recruitment and Retention Unit to develop a recruitment and retention strategy; and
- a Financing Committee to plan and monitor resources for the production of the healthcare workforce.

A further key objective relates to the establishment of an Institute for Leadership and Management in Health Care (see Figure 1 in previous issue). The Institute will, amongst others, make a competency assessment to establish the leadership and management competency gaps. It will also be responsible for training and development interventions. It is not clear how this Institute will relate to other initiatives, such as the South African Institute of Healthcare Managers (SAIHCM).

Priority 2: Establish a Centre for Health Workforce Intelligence which will provide health workforce information and ensure oversight on health workforce planning across the health care system.

This priority is about the gathering of data, the setting up of a reliable database, analysis, including so-called horizon scanning on budget trends, health technology trends, NHI, etc. and reporting to the Department of Health leadership (Director General and Minister of Health). A further objective is to enable linking of service plans with HR plans. The identification and opening of priority posts is also high on the agenda.

Co-operation with the Department of Health Education and Training is also envisaged as a key task of the Centre for Workforce, as well as the monitoring and tracking of graduates and their employment.

The Centre will be set within the organisational structure of the NDOH and will be supported by Provincial Health Workforce Committees.

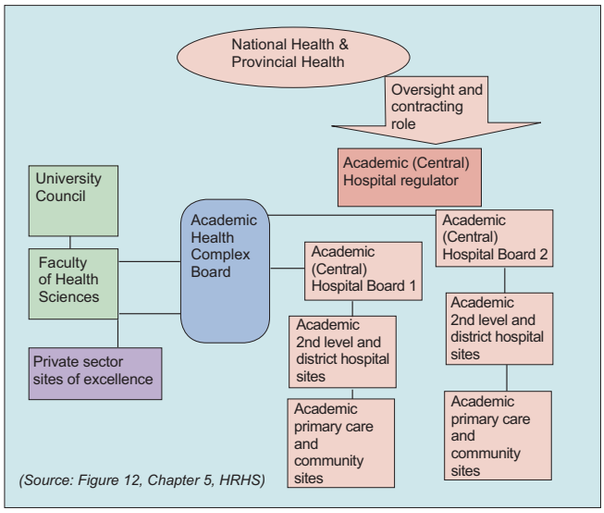

Figure 1. Academic health establishments

Priority 3: To meet workforce requirements of new and emerging service strategies and thereby ensure a health service which promotes health and provides value for money.

This priority relates to the announcements of the Minister of Health on the re-engineering of the Primary Care model and the proposals contained in the NHI Green Paper. The first three activities relate to (a) the job descriptions, advertisements of posts (which have taken place in September), appointments, scope of practice and training of the District Clinical Specialist Teams (to include, amongst others, anaesthetists, paediatricians, family physicians, etc.); (b) the job descriptions, skills, competencies and training of staff for the School Health Programme; and (c) the training of Community Health Workers, under the leadership of nurses.

Staffing norms are also to be developed for tertiary hospitals, regional and district hospitals.

Noteworthy is the activity that envisages the development of policies and interventions on the private sector on engaging with public health systems. This is planned to start with pilot projects for general practitioner, rehabilitative, mental and dental services.

This priority will also link with the NHI processes.

Priority 4: To ensure the revitalisation of the production of a health workforce with the skills mix and competencies, education and training, to meet health service demand.

This priority deals with planning for the future growth of the sector, bearing in mind the burden of disease, and service- and training requirements. In this, the NDOH will work with Higher Educational Institutions and the Department of Higher Education and Training. The clinical training grant would be investigated to include all relevant professional programmes. More academic clinicians should be grown.

The outcomes of the Nursing Summit 2011 will also be implemented under this priority.

The concept of mid-level workers will also be further investigated, including the service plan needs, the appropriate training platforms. Two categories, i.e. Clinical Associates and Pharmaceutical Assistants are given specific attention.

Clinical research is also envisaged for revitalisation, in particular through the implementation of nationally prioritised clinical research programmes. Funding for clinical research has to be "enabled".

Priority 5: To strengthen Academic Health Complexes and nursing colleges to strategically manage both health care and academic resources and provide an integrated platform for service, clinical, research and education functions.

A new model is proposed for academic medicine (Figure 1).

The objectives associated with this priority relate to the strengthening of Academic Health Complexes (AHCs) and a project team will manage this process. Information Technology, the highly specialized service needs and centres of excellence are envisaged. This priority will align with the announcement of the new five flagship central facilities.

Priority 6: To effectively manage human resources in a manner that attracts, retains and motivates the health workforce to both the public and private sectors in an appropriate balance.

As an employer of choice, the Department of Health will aim to:

- recruit the right people;
- ensure performance evaluation;
- ensure that performance is rewarded appropriately;
- analyse reasons for resignation and report its findings to line management;
- ensure fairness and equity; and
- ensure that training and development opportunities are matched with individual strengths and weaknesses.

Under this priority, integrated HR strategic plans are then to be developed, within the requirements set by the Department of Public Service and Administration. The HR management function will be strengthened. Moonlighting and so-called ARWOPS (Agreed Remunerated Work Outside of Public Service) will be stopped where abused. The Occupation Specific Dispensation (OSD) will also resort under this priority.

Priority 7: To develop a health workforce that delivers an evidence based quality service, with competence, care and compassion.

One of the new proposals in the HRHS is the licensing of all health professional practices. The document states that there are limited controls in relation to the right to open a practice and that "more licensing requirements" would have to be set. This would impact on occupational health facilities.

The National Coordinating Centre for Clinical Excellence in Health and Health Care (see Figure 1 in Vol. 17, No. 6) will be key in this regard. It is not clear how this Centre (or the licensing referred to above) will relate to the Office of Health Standards Compliance, for which an amendment Bill has already been published for comment. The Centre is envisaged to work closely with academia, professional societies and centres of excellence "to oversee quality of professional care". The Centre will also undertake work on excellence and cost-effectiveness in clinical care. The link between this Centre, and the cost-effectiveness analyses envisaged in both the Medicines Pricing Regulations and Medical Schemes Regulations are not immediately clear. In addition, Health Technology Assessment in the field of medical devices, envisaged by the National Health Technology Strategy, 2011 would also be impacted by the work of the Centre. The Centre will also provide "guidance on new and existing medicines, treatment and procedures" – and would therefore have to link with the development of the Essential Drug List, and Essential Equipment List within the National Department of Health (NDOH).

Priority 8: To promote access to health professionals in rural and remote areas.

This priority includes the appointment of a rural strategy task team to develop the details of the rural strategy and to support the NDOH in implementing it. It also includes defining 'rurality and remoteness' in view of the OSD and rural allowances. A key activity is to prevent rural posts from being frozen.

The education and training strategy includes ensuring an increase in the proportion of rural students in health professional courses and also to increase training that takes place in rural areas. Another activity relates to increased uptake of suitably qualified foreign health workers. The development and role of mid-level workers will also be a key activity within this priority.

CONCLUSION

The HRHS is a very comprehensive document. What is lacking from the strategy is more concrete timelines and the costs associated with the structures to be established in terms of the Strategy. Many stakeholders have also complained about the fact that the larger, general HR document was only released in September 2011, and whilst stakeholders were still preparing comments, the final document was released.

As far as licensing and clinical guidelines (through the proposed Co-ordinating Centre for Excellence) are concerned, there may be overlap between the envisaged Centre and the professional councils, Office of Health Standards Compliance and existing or envisaged programmes on the evaluation of medicines (e.g. the Essential Drug Lists and the evaluation of "cost-effectiveness" in the medicines pricing regulations) and medical devices (e.g. Health Technology Assessments as a mandate of the Ministerial Advisory Committee on Health Technology). These matters indicate that greater alignment is required between the various projects and programmes of the Department of Health.

It is not clear how the process of implementation of the HRHS will unfold over the next year. Aspects to be implemented as indicated in other documents, such as the NHI Green Paper, include the appointments and deployment of the Specialist Clinical Support Teams (comprising anaesthetists, family physicians, obstetricians, etc.) in all the health districts, the training of Community Health Workers and the increased intake of first year medical students by universities. It is also expected that the draft Primary Healthcare Policy would also be finalised (and/or released publicly), which would have further Human Resource implications for the organisation of clinics and health centres.

More HRHS information is likely to be included in the Department of Health Strategic Plan, normally released during the Minister of Health's Budget Speech (which will follow the adoption of the country's budget after Minister Pravin Gordan's Budget Speech on 22 February 2012).

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SASOM News

GOVERNMENT GAZETTE, 25 NOVEMBER 2011 NO. 34767 21 – NOTICE 817 OF 2011
NOTICE IN TERMS OF ITEM 4(C) OF PART A OF SCHEDULE 1 OF THE COMPETITION ACT 89 OF 1998 (AS AMENDED)
APPLICATION FOR AN EXEMPTION BY THE HEALTH PROFESSIONS COUNCIL OF SOUTH AFRICA IN TERMS OF PART A OF SCHEDULE 1 OF THE COMPETITION ACT
CASE NUMBER: (2008JAN3456) – REJECTION OF EXEMPTION APPLICATION

This is an assessment of the above ruling.

1. In 2008, the Health Professions Council of South Africa applied to the Competition Commission for an exemption from the provisions of Chapter 2 of the Competition Act in respect of a number of Ethical Rules of Conduct for Practitioners.
   a. These Ethical Rules have the potential effect of substantially preventing or lessening competition in the medical field and this anti-competitive effect may be a contravention of the Act.
   b. The Commission may exempt the rules if it considers these rules a requirement to maintain professional standards or the ordinary function of the medical profession.
2. The rules for which the HPCSA requests exemption are:
   a. Rule 3(2) - Restriction on canvassing and touting
   b. Rule 4 - Restriction on information to be printed on professional stationery by registered practitioners
   c. Rule 5 - Restrictive naming of practices
   d. Rule 7 - Restrictive fee sharing and acceptance and payment of commission
   e. Rule 8(4) - Restrictive formation of other forms of practice models
   f. Rule 8A - Restrictive sharing of consulting rooms
   g. Rule 10 - Restrictive supersession
   h. Rule 18 - Restrictive employment of practitioners
   i. Rule 23 - Restrictive participation in the manufacture for commercial purposes of medicines and medical devices
   j. Rule 23A Restrictive practice relating to shareholding in hospitals or other healthcare institutions
   k. Annexure 6, Rule 3(2) - Restrictive formation of partnership and other permissible juristic person by a certain category of practitioners.
3. Government Gazette 25 November 2011 No. 34767 21 - Notice 817 of 2011 gives notice that the exemption application by the HPCSA has been rejected and documents the Commissions' rulings in this matter.
4. Rules 5, 7, 8A and 10
   a. The Commission found that rules 5, 7, 8A and 10 did not qualify for an exemption due to the fact that there was no evidence found that these rules would lead to a substantial prevention or lessening of competition.
   b. It is therefore my understanding that the current ethical rules on (5) naming of practices, (7) fee sharing and acceptance and payment of commission, (8A) sharing of consulting rooms and (10) supersession remain unaffected and in force.
5. Rules 8(4), 18, 23, 23A and Annexure 6 rule 3(2)
   a. The Commission found that rules 8(4), 18, 23, 23A and 3(2) of Annexure 6 did not, in and of themselves, constitute a contravention of the Act.
   b. However, the Commission found that the rules could, depending on the manner in which they are applied in the context of a given set of facts lead to anti-competitive conduct in contravention of the Act.
   c. Should the manner in which these rules are applied result in anti-competitive effects, this would be assessed and addressed on a case by case basis.
   d. It is therefore my understanding that the current ethical rules on (8(4)) formation of other forms of practice models, (18) employment of practitioners, (23) participation in the manufacture for commercial purposes of medicines and medical devices, (23A) practices relating to shareholding in hospitals or other healthcare institutions and (Annexure 6 3(2)) formation of partnership and other permissible juristic person by a certain category of practitioners remain unaffected and in force, albeit that individual cases may be assessed for anti-competitive non-compliance with the Competition Act.
6. Rules 3(2) and 4
   a. The Commission found that rule 3(2) and rule 4 are not reasonably required in order to maintain professional standards or the ordinary functioning of the health profession and therefore rejects exemption.
   b. It is therefore my understanding that rule 3(2) restricting canvassing and touting and that rule (4) restricting the information to be printed on professional stationery by registered practitioners are deemed anti-competitive and that therefore their application in their current form is not permissible.
7. The notice further communicates that the Commission and the HPCSA will continue to engage with each other on issues related to the application of the above Ethical Rules. I have therefore enquired on this matter with Mr. Sipho Mtombeni, Analyst, Enforcement and Exemptions Division, who has kindly supplied the following explanatory note:

The analysis you sent me seems to be correct.

I do however want to bring something to your attention with regard to rules 3(2) and 4 (please note the difference between rule 3(2) and rule 3(2) of Annexure 6).

As you have correctly pointed out Rule 3(2) and 4, in their current form did not qualify for an exemption, thus the enforcement thereof by the HPCSA could lead to a contravention of the Competition Act.

The HPCSA has however embarked on a process of amending these rules, such that they would no longer amount to a contravention of the Competition Act.

It is important to note that in finding that these rules do not qualify for an exemption, the Commission is mindful of the purpose they are meant to achieve.

Thus with the proposed further engagement, the Commission will be working with the HPCSA to make sure its rules are able to achieve their primary objective, while not falling foul of the Competition Act.

Therefore we envisage a form of memorandum of understanding between the two agencies that will allow both agencies to continue in carrying out their respective mandates, without encroaching on the others.

We are however still to meet and discuss this with the HPCSA and this should take place early 2012.

At this stage I can't give you details of what this would mean for practitioners. I can however state that the interim arrangement with the HPCSA is that it will continue to enforce the rules as per its mandate.

Dr JNR Lapere, MD (Louv) DBG (Stell) LLM (UPE)
Updated 19-12-2011
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SASOHN Conference and AGM 2011

THE BIG 5 IN OCCUPATIONAL HEALTH

For only the second time in SASOHN history the Mpumalanga region hosted delegates and exhibitors in Malalane for the Annual Conference. The remote location was ideal for such an event and presented the hosts with unique challenges. The welcome cocktail, and a game drive through and braai in the Kruger National Park, set the pace and tempo for the three days. The theme for the conference was the Big 5 in occupational health (OH) which was linked to the Big 5 in wildlife. Presentations were selected to represent what is perceived to be areas of concern in OH.

The elephant represented the mind and Dr van Lill gave a presentation on burnout and stress. He highlighted the need to ensure that the psychological wellbeing of the health care worker (HCW) is given due consideration. It has been shown that a care giver who is stressed and approaching burnout will not be able to offer the required level of care. The buffalo appears calm and collected but when aggravated is quite the opposite. Laughter therapy for the relief of stress and aggression was presented by Keith Dyer. The audience were brought to their knees by this speaker who had them rolling with laughter. Thereafter, the rhino representing the concerns faced by heavy metals was covered by Dr Hannes Raath. The leopard, being fragile in numbers, was linked to fragility of disability management in the workplace as explained by Dr Jan Breytenbach. The lion – a predator – was likened to the impact of substance abuse by Ivan from Homemed who stood in at short notice for a cancelled speaker and the day ended with a motivational speaker, Mr André de Goede.

AWARDS

The annual SASOHN awards are made at the gala dinner. The following members were recognised for their achievements in 2011.

- OHNP of the year 2011 (individual category) – Elizabeth Doubell from Johnson Mattey.
- Journal article of the year 2011 – Karen Michell for her article "Evaluation of the quality of screening audiometry in a sample of occupational settings in East Rand, Gauteng".
- Region of the Year for 2011 – Mpumalanga.
- Ripple Effect award for outstanding contribution to education in OHN – Karen Michell.

MENTORSHIP AWARDS

Nursing in South Africa, with occupational health nursing no exception, is facing a problem in terms of mentorship. There is a scarcity of professionals who are willing to mentor students in the clinic setting. From 2011, SASOHN will be recognising members who are identified by their peers as being worthy mentors. All successful nominees this year were awarded with a certificate of recognition from SASOHN. Those nominated were Dineo Mmusi, Nomathemba Mabaso, Liza

ONHP of the year – L Doubell receiving her trophy for OHNP of the year in the individual category from I Jordaan, Gauteng

Doubell, Ina Denysschen, Trish van Rensberg, Petro de Wet, Carol Carpenter, Trudi Oates, Anne Queripel, Kim Arnold, Jeanette Mfelang, Alta Oosthuizen, Thandikile Ncubuka, Retha Botha and Gwendoline Nconco. SASOHN wishes to express its thanks to these members for contributing to the professional development of OHNPs and trusts that more members will join these ranks in the future.

Special mention must be made of the efforts made by the region to embrace the concept of "local is lekker". Gifts and entertainment were provided by local companies, organisations and small businesses. We trust this was again a worthwhile networking experience for all involved.

Beth de Kock, Chairlady Mpumalanga
Karen Michell, SASOHN President

Mentorship awards – Members receiving certificates for recognition of mentorship to OHNPs

SAIOH news

Dear colleagues and corporate members! The year 2011 has come and gone and it is time to bid farewell to it. Before we greet the year of 2012, I would like all of us to recall our achievements, many of which will contribute to the sustainable business growth of SAIOH. On this note SAIOH would like to wish all of you and your families a prosperous and safe 2012. All of our members who contributed to our success in 2011, a very big thank you!

The secret of our branches' success is our focus on members and their values. SAIOH depends on the support of its members to fulfil our vision in occupational hygiene and health in the workplace.

A new branch was established in North-West to serve members in that region and we wish you well in your endeavours for 2012.

The year 2011 was a successful year for SAIOH and it is our goal for 2012 to improve on those achievements.

Our planning for 2012 is set out below.

2012 SAIOH NATIONAL COUNCIL AND PROFESSIONAL CERTIFICATION BOARD MEETINGS

Date	Time	Meeting
3 February	07h00	PCB Meeting
2 March	07h00	Council Meeting
20 April	07h00	PCB Meeting
4 May	07h00	Council Meeting
20 July	07h00	PCB Meeting
3 August	07h00	Council Meeting
12 October	07h00	PCB Meeting
2 November	07h00	Council Meeting

WORKSHOPS AND CONFERENCE

Several workshops will be held in various regions and the dates of those will be published in due course to afford our members the opportunity to plan to attend and make contributions.

Our annual conference is already in the planning stage; check your mail for more details of this event.

GOALS FOR 2012

Some of our goals for 2012 which we would like to achieve are the following:

- to increase our membership as well as corporate membership;
- to finalise the registration as a Section 21 company;
- to get the OHTA modules implemented to assist our members;
- to implement the legal knowledge certificate; and
- to work towards the SANAS accreditation system for AIAs.

To enable SAIOH to achieve the above goals, the support of all SAIOH members is crucial!

SAIOH AND OHTA

A Memorandum of Understanding between the Occupational Hygiene Training Association Ltd (OHTA) and the Southern African Institute for Occupational Hygienists (SAIOH) has been finalised.

OHTA recognises the need to:

- improve protection of workers in southern Africa from occupational health and safety risks in the work environment;
- train people in occupational hygiene skills;
- have consistent standards of occupational hygiene training and qualifications worldwide to ensure effective health protection and transferability of skills;
- support the roles and growth of national occupational hygiene association(s) globally; and
- create a sustainable model for training delivery.

Goals with respect to the relationship between SAIOH and OHTA are listed below:

1. SAIOH will roll out the international training modules and qualifications as developed by the OHTA (www.OHlearning.com) and supported by the International Occupational Hygiene Association (IOHA) throughout southern Africa.
2. To raise the standard of training, and consequently the practice of occupational hygiene, to what is expected in the developed countries.
3. To raise the standard, and increase the spread, of occupational hygiene teaching and student assessments throughout this region.
4. To formalise an undergraduate educational programme in this region that will be internationally recognised and accepted and will allow a simpler, fairer and clearer procedure for those interested in occupational hygiene to follow this career path.
5. After successful completion, the six core training modules offered by OHTA will serve as an alternative to the current written assessment for occupational hygiene technologists at SAIOH Professional Certification Board. Successful candidates will then be issued with the intermediate certificate in occupational hygiene.

Approved Training Providers (ATPs) will be bound by the requirements and rules for ATPs as may be set from time to time by OHTA, including the requirement that all students on approved courses will sit the BOHS examinations arranged through SAIOH. In line with current procedures, all ATPs will be listed on www.OHlearning.com and are eligible to post approved courses on www.OHlearning.com

This approval process will not apply for multinational organisations that offer courses in these countries on a non-commercial basis.

All examinations will be provided and marked by the OHTA approved examination board – currently the BOHS Faculty of Occupational Hygiene – in accordance with its procedures.

SAIOH will make the bookings and pay for examinations through arrangement with BOHS and will arrange venues and supervise examinations.

SAIOH will co-ordinate all examinations in these countries for ATPs that they have approved.

Approval fees: SAIOH will "license" the ATPs locally and may charge training providers for costs associated with approving and auditing the ATPs as well as maintaining the system.

SAIOH would like to encourage its members to continue to strive in providing our employers with high quality service and support to achieve their legislative obligations in the workplace during 2012.

May you have a bright and prosperous 2012, a New Year filled with all good blessings! Happy New Year!

Johann Beukes, SAIOH: President