

# Risk factors for non-communicable diseases in the workforce at a commercial power plant in South Africa

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## ABSTRACT

**Background:** Non-communicable diseases (NCDs) account for more than half of annual deaths globally and nearly 40% of deaths in South Africa. The workplace can be an important setting for the prevention of NCDs.

**Objectives:** The objectives of this study were to describe the prevalences of reported NCDs and previously identified risk factors for NCDs, as well as to assess risky behaviour for NCDs, and the 10-year risk for cardiovascular disease, amongst the workforce at a commercial power plant in the Western Cape province of South Africa.

**Methods:** A total of 156 employees was randomly selected from the workforce of 1 743. Questionnaires were administered to elicit self-reported information about NCDs, tobacco smoking, alcohol use, diet, physical activity and psychosocial stress. Biometric health screening included measurements and calculations of blood pressure, total cholesterol, random glucose, body mass index (BMI), waist circumference and waist-to-hip ratio (WHR). The 10-year risk for cardiovascular disease was calculated using a chart-based validated non-laboratory algorithm.

**Results:** The study participants had a mean age of 42.8 (25-64) years; 65.2% were male. A quarter (26.0%) smoked tobacco, 29.4% reported harmful or dependent alcohol use, 73.0% had inadequate fruit and vegetable intake, and 64.1% were physically inactive. Systolic and diastolic blood pressure was raised in 32.7% and 34.6% of the study participants, respectively, 62.2% had raised cholesterol, 76.9% were overweight or obese, and 27.1% had abdominal obesity. Overall, 17.4% were diagnosed with hypercholesterolaemia, 17.7% with hypertension, and 16.2% with depression. Around one third (34.1%) had a moderate-to-high 10-year cardiovascular disease risk.

**Conclusion:** The prevalences of both behavioural and physical risk factors for NCDs amongst the power station study participants were high. There is a need for effective workplace interventions to reduce risk for NCDs. The workplace is ideally suited for targeted interventions.

**Keywords:** risk behaviour, risk factors, non-communicable diseases, workplace, cardiovascular diseases

## INTRODUCTION

Approximately 45% of the global burden of disease is due to non-communicable diseases (NCDs).<sup>1</sup> Premature deaths in people of working age (36-64 years) are expected to increase by 41% from 2000 to 2030.<sup>2</sup> These deaths are attributed to a high prevalence of underlying risk factors.<sup>3</sup>

NCDs are attributable to four modifiable risky behaviours: tobacco smoking, unhealthy diet, physical inactivity and excessive alcohol use.<sup>1,3</sup> These behaviours contribute to several risk factors which include tobacco addiction, high cholesterol, diabetes, hypertension and obesity.<sup>4,5</sup> The risk factors are associated with NCDs such as ischaemic heart disease, cerebrovascular disease, cancers and chronic respiratory disorders.<sup>4</sup> This conceptual framework that links risky behaviours, risk factors and NCDs is derived from the South African Medical Research Council's (SAMRC) technical report on chronic diseases.<sup>4</sup> Psychosocial stress should also be considered as it increases susceptibility to mental

disorders, respiratory problems and cardiovascular disease (CVD).<sup>6</sup> Work-related stress, caused by heavy workloads and strained interpersonal relationships, may thus be a risk factor for cardiovascular diseases.<sup>6</sup>

NCDs account for 40% of deaths in South Africa, with cardiovascular disease being the biggest contributor, followed by cancers, diabetes and respiratory diseases.<sup>7</sup> According to the World Health Organization (WHO), these diseases have resulted in the loss of 65 000 lives per year in South Africa.<sup>8</sup> The Western Cape province has the highest NCD risk profile of all the provinces in South Africa,<sup>7</sup> accounting for 61% of deaths compared to the national average of 38%.<sup>8</sup> The Western Cape province also has the highest tobacco smoking rates (32% of females and 46% of males smoked in 2012),<sup>9</sup> and the highest rates of overweight (27%) and obesity (16%) amongst males.<sup>8</sup> Men in the Western Cape province also have higher mean waist circumference and waist-to-hip ratios (which measures abdominal obesity) than those in other provinces.<sup>8</sup>

Occupational health is linked to public health.<sup>10</sup> The increase in the prevalence of NCDs in workers is due to a complex interaction between unhealthy lifestyles, global economic crisis, increased productivity demands, and an ageing workforce.<sup>11</sup> Job strain, stress, shift work and unhealthy food provision in canteens all contribute to increased risk for metabolic disorders, obesity and coronary artery disease.<sup>12,13</sup> These diseases result in decreased productivity, and increased absenteeism, presenteeism, disability and staff turnover in the workplace, and reduce available resources within families.<sup>14,15</sup> The work environment directly shapes employee health and health behaviours, and acts as an accelerator or preventer of chronic disease.<sup>15</sup> Effective interventions in the workplace range from individual- to corporate-level activities, and include offering healthy cooking demonstrations, health risk assessments and feedback, provision of exercise facilities, access to healthy catered food, and monitored health programmes.<sup>16</sup>

Workplace-based health risk assessments can usefully assess risk factors for NCDs.<sup>17</sup> Results of a survey of South African workplaces in 2014 showed that the three most prevalent health issues were stress, hypertension and high cholesterol.<sup>18</sup> In South Africa, 32% of businesses provide health promotion programmes, and 82% perform health risk assessments and biometric screenings.<sup>19</sup> Health promotion programmes may lack clear objectives, and may not be organised as policies that involve employees as stakeholders.<sup>20</sup> Workplace health promotion should focus on transforming the work environment (business, psychosocial and physical).

The economic costs of NCDs, such as loss of workers and reduced productivity, are high.<sup>14,21</sup> Globally, economic growth is reduced by 0.5% for every 10% increase in NCDs.<sup>22</sup> The loss to South Africa's gross domestic product from 2006 to 2015, due to stroke, coronary heart disease and diabetes, was estimated at US\$1.88 billion.<sup>23</sup> Workplace health promotion has been shown to reduce absenteeism and medical aid costs, and improve productivity, morale and risk profiles.<sup>24</sup> More evidence-based guidelines to address NCDs are needed to harness innovation and scientific knowledge and guide health promotion and disease prevention programmes.<sup>18,25,9</sup>

Studies in South Africa have investigated prevention of NCDs primarily from a community-based perspective, and those that have been conducted in workplace settings have often lacked a robust design.<sup>26</sup> Studies have also focussed on physical activity in employees and the association of high healthcare costs with risk factors. Research on health risk assessments has focussed on self-selected employees who may have been healthier than the target population.<sup>23,27,14,9</sup>

The objectives of this study were to assess risky behaviour and risk factors for NCDs, to estimate the prevalence of reported NCDs, and to calculate the 10-year risk for cardiovascular disease, amongst the workforce at a commercial power plant in the Western Cape province, South Africa.

## METHODS

A cross-sectional survey was conducted, using a questionnaire and biometric testing, amongst a workforce in a commercial power plant in Cape Town in the Western Cape province of South Africa.

The industry had a large workforce of engineers, plant operators, physicists, technicians, artisans and support staff. The power plant operated a Health and Wellness Department that was mandated to provide occupational health services, medical surveillance, fitness for duty assessments and health promotion. All employees received subsidised meals. There were no indoor exercise facilities. Compulsory breathalyser alcohol testing was performed on all employees every time they entered the plant.

A sample size of 156 employees was calculated, based on the 1 743 permanently employed workers in 2015 with a 95% confidence interval, an error of 7.5% and a percentage of 50%, to give the sample size required to measure a variety of unknown proportions. The equation used was:  $\text{sample size} = z^2 \times p(1-p) / e^2 / 1 + (z^2 \times p(1-p) / e^2 N)$  where  $z$  is the  $z$ -score for the desired confidence interval,  $p$  is the proportion,  $e$  is the margin of error, and  $N$  is the size of the study population.

A list of employees was obtained from the Human Resources Department. Workers were randomly selected for inclusion in the study based on random numbers generated by computer. Workers were invited to participate via e-mail, and received follow-up phone calls if they did not respond. It was necessary to invite 395 people in total, using random sampling with replacement, as 220 did not respond to the e-mail or answer the telephone, and four declined to participate.

## Data collection

Three questionnaires and biometric health screening tools were used to collect data from the study participants. The first questionnaire elicited information on demographic characteristics (age, sex and job categories), self-reported medical history (diabetes, hypertension, hypercholesterolaemia, heart disease, lung disease, cancer and depression), and causes of psychosocial stress. All questions required a 'yes' or 'no' answer. Psychosocial stress was measured by asking respondents to indicate causes of stress from a list of 12 items. These items were previously identified by the company and incorporated in their annual health risk assessment. Respondents were also asked how well they coped with psychosocial stress.

Data on tobacco smoking and diet were elicited using the South African Demographic Health Survey Questionnaire.<sup>9</sup> Tobacco use included current and passive smoking. Questions on diet focussed on consumption of fruit and vegetables. Data on physical activity were collected using the validated Global Physical Activity Questionnaire (GPAQ).<sup>28</sup> Study participants were asked questions relating to usual levels of light, moderate and vigorous activity at work, during travel, and while performing recreational activities. Data on harmful alcohol use were collected using the validated Alcohol Use Disorders Identification Test (AUDIT) questionnaire;<sup>29</sup> questions were in a four-point Likert scale format, giving a possible total score of 41.<sup>29</sup>

Systolic and diastolic blood pressures were calculated from the average of three readings, with the participant seated for five minutes and the elbow slightly flexed, using a digital sphygmomanometer (Microlife AG, 9943, Switzerland).<sup>30</sup> Point-of-care testing of random glucose and total cholesterol were conducted with a finger prick capillary blood sample, using a Cardio Chek (Polymer Technology Systems, USA).<sup>31,32</sup> Standing height was measured to the closest 0.1 cm, with a stadiometer. Weight was measured to the closest 0.1 kg, using a portable calibrated scale (Seca 813, United Kingdom). Waist circumference was measured with a stretch-resistant tape that provided a constant 100 g tension, at the narrowest point of the waist, with the subject in mid-expiration. Hip circumference was recorded at the widest point over the greater trochanters and maximal protruding part of the buttocks.

Questionnaires were administered by trained health professionals from the Health and Wellness Department, at testing booths, in close proximity to employee's workstations, during both day and night shifts. All clinical measures were taken by trained health professionals. Data were collected from December 2015 to April 2016.

### Data management and analysis

Data were captured on an Excel spreadsheet and checked for errors or omissions before being analysed using IBM SPSS Statistics software Version 24.1.

Raw data from the GPAQ were analysed in terms of the metabolic equivalent of task (MET) minutes. The MET is a physiological measure that expresses the energy cost (or calories) of different levels of physical activities. One MET is the energy equivalent expended by an individual while seated at rest. MET minutes are a product of the intensity of physical activity and the duration. A minimum of 600 MET minutes per week is required for one to be considered physically active.<sup>28</sup> This translates to participating in a minimum of 150 minutes of moderate-intensity activity or 75 minutes of vigorous-intensity activity, per week. The raw data included the number of hours and minutes per week that individuals engaged with vigorous or moderate activity at work, and during travel or

recreation. The data were combined, according to the GPAQ manual, to give a total MET minutes per week.

Respondents with a score of seven or less on the AUDIT questionnaire were categorised as sensible drinkers; those with a score of 8-19 were considered to be potentially harmful drinkers, and those with a score of 20 or more, potentially dependent drinkers.

Body mass index (BMI)(kg/m<sup>2</sup>) was calculated, using height and weight (kg/m<sup>2</sup>). Participants were classified as normal (18.5-24.9 kg/m<sup>2</sup>), overweight (25-29.9 kg/m<sup>2</sup>) or obese ( $\geq 30$  kg/m<sup>2</sup>). Waist-to-hip ratio was calculated by dividing the waist circumference by the hip circumference; abdominal obesity was defined as  $> 0.95$  for males and  $> 0.86$  for females.<sup>33</sup> High (above threshold) random blood glucose was defined as  $> 11.1$  mmol/l, high total cholesterol as  $> 5.2$  mmol/l, high systolic blood pressure as  $> 140$  mmHg, and high diastolic blood pressure as  $> 90$  mmHg.<sup>34</sup>

The risk of suffering from CVD, such as a heart attack or stroke, over the next 10 years from the date of assessment was calculated for each employee, using a chart-based validated non-laboratory algorithm for South Africa, developed by Peer et al.<sup>35</sup> Factors included in the calculation of the CVD risk were sex, age ( $< 50$ , 50-60 and  $> 60$  years), systolic blood pressure, self-reported diabetes, BMI category, and reported current smoking status. The calculated risk was categorised as low ( $< 10\%$ ), moderate (10-20%) or high ( $> 20\%$ ).

Descriptive statistics were used to summarise findings. Normally distributed continuous data were reported as means ( $\pm$  standard deviation) or medians (range), and categorical data were reported as frequencies and percentages. Proportions for categorical data were compared between males and females, using the Pearson's Chi-Square Test, while medians were compared using the independent samples Mann-Whitney U Test.

Ethics approval was obtained from the Health and Research Ethics Committee (HREC) of Stellenbosch University (S15/08/165) and permission was obtained from the power plant to conduct the study.

**Table 1. Prevalence of risky behaviours amongst the workforce**

Risky behaviours	Males		Females		Total		p value
	n	%	n	%	n	%	
<b>Smoking</b>							
Current tobacco smoker	21	25.0	13	27.7	34	26.0	0.739
Passive tobacco smoker	14	34.1	15	60.0	29	43.9	0.004
<b>Alcohol consumption</b>							
Sensible	55	62.5	43	82.7	96	70.6	
Harmful	31	35.2	8	15.4	37	27.2	0.038*
Dependent	2	2.3	1	1.9	3	2.2	
<b>Nutrition</b>							
Inadequate fruit and vegetable intake	61	70.9	39	76.5	100	73.0	0.480
<b>Physical activity</b>							
Inactive	61	59.8	39	72.2	100	64.1	0.124

Note: denominators differ between variables as not all respondents answered all questions

\*p value denotes difference between males and females for all categories of alcohol drinking

**Table 2. Prevalence of cardiovascular risk factors amongst the power station employees**

Clinical measurement	Males n = 102		Females n = 54		Total n = 156		p value
	n	%	n	%	n	%	
Raised systolic blood pressure*	40	39.2	11	20.4	51	32.7	0.017
Raised diastolic blood pressure †	43	42.2	11	20.4	54	34.6	0.007
Hyper cholesterolaemia ‡	64	64.0	33	61.1	97	62.2	0.723
Suggested diabetes §	3	2.9	0	0.0	3	1.9	0.203
Overweight/obese¶	82	81.2	38	70.4	120	76.9	0.125
Large waist circumference, cm ¶	35	34.3	19	35.8	54	34.8	0.849
Waist-hip ratio**	35	33.7	13	13.7	42	27.1	0.009

\*≥ 140 mmHg; † ≥ 90 mmHg; ‡total cholesterol > 5.2 mmol/l; §random glucose > 11.1 mmol/l; ¶BMI ≥ 25 kg/m<sup>2</sup>; ¶ > 102 cm for men, > 88 cm for women; \*\*> 0.95 for men, > 0.86 for women

## RESULTS

### Demographic characteristics

A total of 156 employees participated in the survey; 102 (65.4%) males and 54 (34.6%) females. The mean age of the study participants was 42.8 (± 9.71) years. Most (58.6%) were supervisors or professionals, 24.8% were general employees, 13.3% were middle managers, and 4.2% were senior managers.

### Risky behaviours for NCDs

Table 1 presents key findings for tobacco smoking, alcohol use, fruit and vegetable intake and physical activity. Overall, 26.0% of the study participants smoked cigarettes; 44.6% of non-smokers reported passive smoking; and 29.4% were harmful or dependent drinkers. The majority (73.0%) had inadequate fruit and vegetable intake (< five portions per day), and 64.1% were physically inactive (< 600 MET min/week). The median for combined moderate and vigorous physical activity was 6.4 MET minutes per day (range: 0.0-473.6): 0.0 MET minutes per day at work (range: 0.0-252.9), 0.0 MET minutes per day during travel (range: 0.0-64.3), and 0.0 MET minutes per day during recreation (range: 0.0-195.0).

A higher proportion of men than women drank alcohol (p = 0.038), while more women than men were exposed to passive

smoking (60.0% vs. 34%, p = 0.004). There were no statistically significant differences between men and women with regard to other risky behaviour factors. However, the median MET minutes per day for total physical activity were 1.79 MET minutes per day (0.0-137.1) for women and 7.86 minutes per day (0.0-473.6) for men (p = 0.075), suggesting a tendency towards males being more physically active.

### Risk factors for cardiovascular disease

Table 2 presents objective CVD risk factors. Overall, a third exceeded the risk thresholds of 140 mmHg and 90 mmHg for systolic and diastolic blood pressure, respectively. More than 60.0% had raised total cholesterol (> 5.2 mmol/l), 77.4% were overweight or obese as defined by BMI, and 27.1% had abdominal obesity.

As shown in Table 2, significantly more men than women had elevated blood pressure but there were no differences, by sex, for total cholesterol, random glucose and body mass index. However, more men than women had abdominal obesity as measured by the waist-to-hip ratio, although not by waist circumference alone.

Table 3 presents the self-reported stress-related risk factors experienced by the study participants in their homes and workplace. The three most commonly reported risk factors were

**Table 3. Sources of psychosocial stressors among study participants**

Stress factor	Male N = 102		Female N = 54		Total N = 156		p value
	n	%	n	%	n	%	
Personal finances	26	26.8	16	30.2	42	28.0	0.659
Lack of resources to do work	28	28.6	14	26.4	42	27.8	0.778
Relationship with colleagues	21	21.4	11	20.4	32	21.1	0.878
Own health or health of family member	15	15.5	16	30.8	31	20.8	0.028
Lack of clarity concerning work outputs	20	20.4	11	20.0	31	20.3	0.952
Lack of recognition	18	18.4	9	16.7	27	17.8	0.793
Relationship with family/children	12	12.4	12	22.6	24	16.0	0.101
Lack of meaningful work	15	15.3	8	14.8	23	15.1	0.936
Relationship with partner/spouse	16	16.5	4	7.5	20	13.3	0.123
Relationship with supervisor	8	8.2	8	14.8	16	10.5	0.201
Emotional/mental health concerns	7	7.3	6	11.5	13	8.8	0.384
Challenges with addictions	4	4.9	1	1.9	5	3.3	0.466

personal finances, a lack of resources to do work, and relationships with colleagues. There were no significant differences between males and females apart from stress due to one's own health or members' health (males 15.5% vs. females 30.8%,  $p = 0.028$ ). Overall, 101 (66.0%) said they coped well with stress, 45 (29.4%) sometimes struggled to cope, and 7 (4.6%) did not cope well with stress.

### Non-communicable diseases

Table 4 presents self-reported and family NCDs, and use of medication for NCDs. The most common disorders were hypercholesterolaemia, hypertension and depression. The least common disorders reported were heart condition, lung condition, diabetes and cancer. Males and females did not significantly differ in the prevalence of disorders, apart from hypercholesterolaemia (males 23.1% vs females 7.5%,  $p = 0.018$ ).

Table 5 presents the estimated 10-year risk of developing a CVD for the study participants. Overall, 34.2% were at moderate-to-high risk. There was no significant difference between males and females ( $p = 0.289$ ), but the risk increased significantly with age ( $p < 0.001$ ).

## DISCUSSION

More than half of the study participants had an unhealthy diet and were physically inactive, while at least a quarter were current smokers and consumed alcohol at a harmful level. Participants reported moderate levels of stress, particularly from a lack of resources to do their work and personal finances. More than half of the employees exceeded the risk thresholds for overweight/obesity, blood pressure and total cholesterol. A substantial number were already taking medication for hypertension, hypercholesterolaemia, depression and diabetes. A third of the participants had a moderate -to-high risk of a cardiovascular event over the next 10 years. The findings demonstrate the huge opportunity for health promotion and disease prevention in the workplace setting.

A quarter of the participants smoked. The prevalence of smoking, in both men and women, was lower than in the Western Cape province general population (26.0% and 31.7%);<sup>7</sup> perhaps because our study only took into account cigarette smoking, whereas the national survey included all tobacco products. The power plant workforce had a high proportion of technicians and

“The workplace may be a missed opportunity to engage with health promotion and NCD prevention programmes.”

engineers from higher socio-economic classes, who are also known to have lower levels of tobacco smoking.<sup>36</sup> There was no difference in smoking between the sexes in our study, while men in the Western Cape province population smoked significantly more than women in 2012.<sup>7</sup> Nevertheless, significantly more women than men were exposed to passive smoking in our study.

Twenty-nine percent of the participants consumed alcohol at a harmful level. Nearly 4.5% of global NCDs are due to alcohol abuse.<sup>37</sup> South Africa has one of the highest risky drinking patterns in the world.<sup>38</sup> Risky behaviour with regard to dependant drinking in the male study participants was 2.0%; the same prevalence has been recorded for men in Africa.<sup>37</sup> In a study in the mining sector in South Africa 15.1% of employees were alcohol dependent.<sup>39,40</sup> The lower alcohol dependence prevalence of employees in the power plant can possibly be ascribed to the zero alcohol tolerance policy of the company, which has punitive consequences. Rates of harmful alcohol use amongst employees are high in the South African public, industrial and financial sectors.<sup>41</sup> According to the WHO, males in the African region, including South Africa, have higher levels of harmful drinking.<sup>38</sup> Harmful alcohol consumption amongst the employees in the study was 29.0%, compared to 25.0% in the South African mining industry in 2002<sup>40</sup> and 25.6% in Africa in 2010.<sup>37,42</sup> The prevalence of harmful drinking amongst the study participants was also higher than the rate found in the Western Cape province (16.0%).<sup>43</sup> This is of particular concern in a workplace environment that is potentially hazardous and has a zero-tolerance policy on alcohol use. Harmful alcohol consumption can be addressed in the workplace by offering behaviour-change counselling to employees.

As found elsewhere in South Africa<sup>44</sup> study participants had a diet low in fruits and vegetables, which may correlate with a higher

**Table 4. Self-reported NCDs and use of medication**

NCD	Males		Females		Total		p value	Family history		On medication	
	n	%	n	%	n	%		n	%	n	%
Hypercholesterolemia	21	23.1	4	7.5	26	17.4	0.018	29	20.0	20	14.6
Hypertension	18	19.6	7	12.7	25	17.0	0.256	64	45.1	21	16.0
Depression	15	16.1	9	16.4	24	16.2	0.970	20	13.9	17	11.8
Diabetes	4	4.4	6	10.7	10	6.8	0.140	52	37.4	11	8.0
Heart Condition*	6	6.4	3	5.4	9	6.0	0.798	33	22.8	7	4.9
Lung condition†	5	5.3	3	5.4	8	5.3	0.992	21	14.3	6	4.0
Cancer	3	3.2	0	0.0	3	2.0	0.177	38	26.0	2	1.3

\*heart attack, stroke, angina; †asthma, COPD

Note: denominators differ between variables as not all respondents answered all questions

risk for CVD, stroke, high blood pressure, cancer and obesity.<sup>7,12</sup> The finding is supported by the South African National Health and Nutrition Examination Survey,<sup>12</sup> which also found that unhealthy habits are promoted by an unhealthy eating environment and poor knowledge of the benefits of healthy food choices.<sup>45</sup>

Almost two thirds of the workforce was physically inactive, which supports data from other South African studies.<sup>12,24</sup> Meeting targets for physical activity can reduce the risk of coronary heart disease, type 2 diabetes, and certain cancers, by as much as 10%, and improve life expectancy.<sup>46</sup>

Blood pressure readings were similar to other community- and workplace-based reports in South Africa.<sup>7</sup> In this study, twice as many men than women exceeded the recommended thresholds for blood pressure. Medical restrictions are placed on workers with uncontrolled hypertension in the commercial power plant, as this poses a health and safety risk to the employee and the plant.

More than three quarters of the workforce was overweight or obese; this has been ascribed to high calorie intake, poor dietary composition, low levels of physical activity and changes in the gut microbiome.<sup>13</sup> In certain South African communities, people do not necessarily perceive themselves to be overweight, and may associate this with health and wellbeing.<sup>21</sup> In most South African studies, significantly more women than men have been reported to be obese (68.0% and 20.0%, respectively), when comparing BMI.<sup>8</sup> The opposite was seen in this workforce. Obesity in the workforce is also associated with difficulty performing work in confined spaces, decreased productivity, greater absenteeism, higher turnover and cost to company.<sup>9</sup>

More employees reported medication use for diabetes than reported having diabetes. Participants may have been unaware of their status, but complied with the prescribed medication.

Employees reported moderate levels of stress, particularly from a lack of resources to do their work and personal finances. A high proportion (16.2%) of the participants reported that they had a history of depression, and 11.8% were taking medication for it. The South African stress and health survey of 2004 indicated that, on average, 10% of South Africans suffer from major depression, with females having the highest rates.<sup>47</sup> These findings warrant further research to identify triggers of depression that might be particular to this workforce.

The study participants had a higher prevalence of self-reported NCDs than expected in the South African population. The higher prevalence may be due to the older mean age of the workforce when compared to the general population. In addition, stress and the impact of shift work on circadian rhythms could contribute to the higher prevalence.

## LIMITATIONS

More than 200 of the employees initially invited did not respond. This might be ascribed to a culture of prioritising job demands over 'other' activities, although there might have been some selection bias if response was associated with one's perceived health risk. Many of the findings were self-reported conditions which could lead to further bias; participants might have under-reported alcohol consumption, tobacco use and depression. The denominators varied for some of the questions, particularly those related to risky behaviour, where participants who were more at risk may have avoided answering, which could have led to an under-estimation of prevalence.

## RECOMMENDATIONS

A third of the workforce had a moderate-to-high risk of a cardiovascular event over the next 10 years and this demonstrates the opportunity for targeted health promotion and disease prevention in the workplace. The Health and Wellness Department at the company plans to use these findings as the basis for designing a series of interventions aimed to improve the organisational environment and to promote personal behaviour change. Potential under-reporting may bias the study; therefore future studies should use objective measures of NCDs. As there was a high non-response rate to the initial request to participate, the company needs to develop easily accessible health interventions that appeal to workers. Strengthening of routine annual health risk assessments is advocated in order to monitor changes in the worker's health status more effectively.

## CONCLUSION

A third of the workforce had a moderate-to-high risk of a cardiovascular event over the next 10 years. More than half of the employees exceeded the risk thresholds for overweight/obesity, raised blood pressure and total cholesterol. More than half had an unhealthy diet and were physically inactive. Employees reported moderate levels of stress, particularly from a lack of resources to do their work and personal finances.

**Table 5. Prevalence of estimated 10-year risk of developing a cardiovascular disease**

Category	Low risk		Moderate risk		High risk	
	n	%	n	%	n	%
All (N = 152)	100	65.8	30	19.7	22	14.5
Females (n = 54)	39	72.2	7	13.0	8	14.8
Males (n = 98)	61	62.2	23	23.5	14	14.3
< 50 years (n = 108)	99	91.7	3	2.8	6	5.6
50-60 years (n = 37)	1	2.7	27	73.0	9	26.3
> 60 years (n = 7)	0	0.0	0	0.0	7	100.0

## LESSONS LEARNED

- The high prevalence of NCDs and underlying risk factors in this workforce could result in long-term illness and absenteeism.
- The workplace may be a missed opportunity to engage with health promotion and NCD prevention programmes.
- The company could benefit in terms of productivity and staff engagement from a healthier workforce if psychosocial stress and unhealthy behaviours are addressed.

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## DECLARATION

The authors declare no conflicts of interest.

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