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RESEARCH ARTICLE

Risk factor profile for non-communicable diseases: findings of a STEPS survey among the support staff at the University of Pretoria, South Africa

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Background: Non-communicable diseases (NCDs) are an important problem in South Africa; they account for 60% of all deaths. Early screening could help lower NCD incidences and long-term consequences.
Objective: The study aimed to profile NCD risk factors among insourced support staff at the University of Pretoria in 2018.
Design: A cross-sectional, descriptive study was conducted at the University of Pretoria, Hatfield Campus. The World Health Organization (WHO) STEPwise approach to chronic disease risk factor surveillance (STEPS) questionnaire was administered to collect data in three steps. The participants' behavioural risk profiles were gathered using the face-to-face interview technique (STEP I), followed by their physical risk profile using anthropometric and blood pressure measurements (STEP II). Last was the biochemical risk profile, including finger-prick blood glucose and cholesterol measurement (STEP III). Data were analysed using Epi-Info, version 3.54.
Subjects: A convenient sample of participants aged 18–64 years from the Departments of Industrial Hygiene and Building Services, Landscape Services, Sports Fields Management, and Security Services ($n = 146$, 60% were females) took part in the study.
Results: Most participants (97.8%) had low daily fruit and vegetable intake. Some 80% of the study population always or often added salt to their food when cooking. Daily alcohol consumption was reported by a quarter of the sample. More than two-thirds of all the participants were overweight or obese and 61% had central obesity.
Conclusion: The study identified a high prevalence of several NCD risk factors. Tailored nutrition education and monitoring are needed to lower the elevated risk.

Keywords: non-communicable diseases (NCDs), NCD risk factors, STEPS survey

Introduction

Non-communicable diseases (NCDs) cause an alarming 74% of deaths globally, and three-quarters of these deaths and 86% of premature deaths occur in middle- and low-income countries.[1] In 2019 NCDs caused 37% of deaths and are predicted to be the main cause of mortality in sub-Saharan Africa by 2030.[2] Four main kinds of NCDs account for over 80% of all premature NCD deaths, namely: cardiovascular diseases, cancers, diabetes mellitus, and respiratory diseases. People of all ages are vulnerable to several interacting modifiable behavioural and physiological NCD risk factors. Behavioural risk factors include unhealthy eating, physical inactivity, tobacco smoke exposure, or alcohol abuse.[3] The key physiological risk factors are raised blood pressure, overweight/obesity, hyperglycaemia, and hyperlipidaemia.[1]

There has been an epidemiological shift in the main causes of death and disease in South Africa, away from communicable diseases towards non-communicable diseases.[4,5] Correspondingly, according to the Statistics SA Mortality Report, between 2015 and 2017 cardiovascular disease deaths increased whilst infectious disease deaths decreased from 17.8% to 18.4% and from 19.5% to 17.6% respectively.[4] In the same period, NCDs were found to be responsible for a majority of the top 10 causes of mortality in South Africa, primarily from diabetes mellitus, cancer, and cerebrovascular, heart, hypertensive, and chronic respiratory diseases.[4] According to the NCD 2022 progress monitor, NCDs are responsible for 51% and 24% of deaths and premature deaths in South Africa respectively.[6]

South Africa aims to reduce the burden of NCDs by 2030 and has adopted the Sustainable Development Goal (SDG) Target 3.4: 'By 2030, reduce by one-third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being'.[7,8] The 90-60-50 cascade for diabetes and hypertension has been adopted as the first step to improving the early detection and treatment of NCDs.[7,8] Among others, various policies to reduce NCD risk factors in South Africa have been implemented and more health intervention programmes are being introduced in the workplace.[8–11] However, various NCD intervention strategies have been set back by the COVID-19 pandemic due to the disruption of economies and health systems.[6]

NCDs pose an economic burden to individuals and businesses due to increased absenteeism, lowered productivity, and early retirement due to morbidity.[12,13] It is important to note that these most vulnerable low socioeconomic populations are often at higher risk of being exposed to the NCD risk factors but with limited access to health services, thus increasing their morbidity and mortality.[14–17] Planning and implementation of relevant prevention, intervention, and control programmes necessitate the identification of the present NCDs and related risk factors in this population.[6,8,15,18] There are insufficient data available on the wellness of support staff such as the security, gardening, and cleaning personnel in South Africa. Therefore, this study aimed to assess the risk of NCDs among insourced staff at the University of Pretoria (2018).

Methods

Study design and site description

A cross-sectional, observational, descriptive study took place in October 2018 at the premises of the University of Pretoria, Hatfield campus. The methods were employed in line with the WHO stepwise approach for major NCD surveillance.[19] There were four data-collection stations, namely: questionnaire completion, anthropometry, blood pressure, and blood glucose and cholesterol measurement. There was also a fifth station where participant feedback forms and nutrition counselling were given. Interviews were conducted in open tents (with tables and chairs) whilst the other assessments including nutrition education were conducted in closed tents. Only one participant was addressed per unit of time to ensure confidentiality.

Study population and sampling

The study population was 1 550 contracted insourced staff members from the Department of Industrial Hygiene and Building Services (cleaning personnel), Landscape Services, Sports Fields Management (gardening personnel), and Security Services (security personnel) working at the campuses of the University of Pretoria in 2018. Both males and females aged 18–65 years were included in the study. Pilot study participants, pregnant women, absentees, and staff who were either too ill to participate or did not complete the consent form were excluded. The sample size was determined for the estimation of multinomial distributions. The study followed the method suggested by Thompson (1987) to estimate the sample size,[20] with a probability of 0.95 that all estimates were within 0.1% (10%) of the study population proportions. A total of least 127 participants was found to be sufficient. To have statistically robust estimates, the final sample size used in the study was 146.

Measurements

All three steps of the STEPs method were executed, and the WHO STEPS questionnaire was used, as shown in Figure 1. Each STEP of the instrument has a core (for determining basic variables) and expanded (for obtaining detailed data) section.[19] Due to time limitations, only the core sections were implemented, except on dietary intake, where the extended questions were also used.

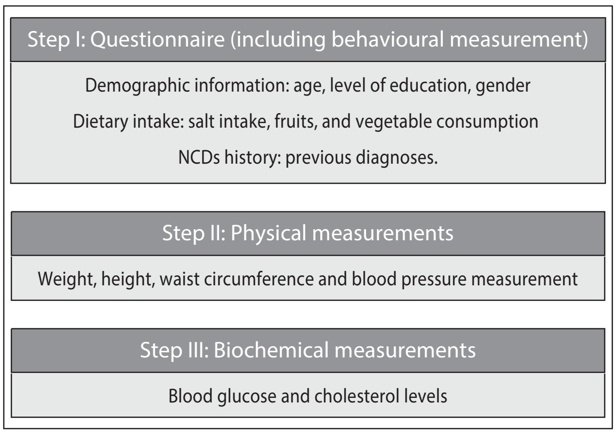

Figure 1: WHO 'STEPS'.

Questionnaire: step I

The researcher administered a questionnaire that recorded the participants' demographic information, NCDs history, and dietary intake (see Figure 1). Salt intake, and fruit and vegetable consumption in terms of frequency of consumption per week and average servings were recorded. Showcards with examples of different food items and serving sizes were used. A family history of NCDs, for example, hypertension and diabetes mellitus, with detailed enquiries regarding diagnoses and medications was also recorded.

Physical measurements: step II

Physical measurements shown in Figure 1 were determined in accordance with the recommended STEPwise protocols.[19] A digital Seca Sensa 804 Body-Check Analysis weighing scale (https://www.seca.com/en_nl/products/all-products/product-details/seca804sensa.html) was used for measuring the participants' weight to the nearest 0.1 kg. A Leicester stadiometer was used to take height measurements to the nearest 0.5 cm. Participants were weighed and measured standing upright with light clothing and no shoes. Then, participants' body mass index (BMI) was determined using their weight and height (weight [kg]/height [m^2]). A BMI < 18.5 kg/m^2 indicates underweight, BMI between 18.5 and 24.9 kg/m^2 comprises normal weight, BMI between 25 and 29.9 kg/m^2 depicts overweight, and BMI ≥ 30 kg/m^2 signifies obesity.[19] A constant-tension Myo Body plastic tape measure was used to measure WC to the nearest 0.1 cm. WC less than 88 cm in women and 102 cm in men is classified as normal, whereas WC > 88 cm in women and 102 cm in men indicates abdominal obesity and increased cardiometabolic disease risk.[19]

Blood pressure measurements were taken using digital sphygmomanometers (Omron HBP-1100-E; Omron Corp, Kyoto, Japan) on the bare left arm of seated participants. Two measurements were taken five minutes apart and the measurement procedure was repeated when there was a discrepancy of > 5 mm Hg.[19] Three different cuff sizes were used to ensure reading accuracy and patient comfort. These were small (17–22 cm), medium (22–32 cm), and large (32–42 cm) size cuffs. Systolic blood pressure (SBP) < 140 mmHg and diastolic blood pressure (DBP) < 90 mmHg was classified as normal. SBP between 140 and 159 mmHg and/or DBP between 90 and 99 mmHg was classified as elevated. Lastly, SBP ≥ 160 mmHg and/or DBP ≥ 100 mmHg was classified as raised blood pressure.[21] Participants with elevated blood pressure were referred to local clinics. All equipment was calibrated regularly before and during data collection.

Biochemical measurements: step III

Blood glucose and cholesterol levels of sitting participants were measured using a NESCO multi-check metre (https://nescomulticheck.com/). The second or third fingertip was kneaded, wiped using a sterile alcohol swab, lanced, and the first drop of blood wiped again to prevent contamination. Data collectors used new hand gloves and test strips for each participant. Cholesterol levels < 5 mmol/l were classified as normal, levels between 5 mmol and 6.1 mml/l were classified as elevated, and levels ≥ 6.2 mmol/l were classified as high.[19] The study participants worked from very early in the morning and others could only come for data collection in the afternoon. Thus, random blood samples were used to measure glucose in the participants who were not fasting, and fasting plasma glucose was measured from participants who reported to be fasting. Blood

Table 1: Interpretation of tests used for screening and diagnosis of diabetes (JEMSDA)[21]

Test	Interpretation		
Fasting plasma glucose (FPG) (mmol/L)	< 5.6 Diabetes normal	6.0–6.9 Impaired fasting glucose	≥ 7.0 Diabetes
Random plasma glucose (RPG) (mmol/L)	< 5.6 Diabetes normal	5.6–11.0 Inconclusive	≥ 11.1 Diabetes

glucose was interpreted according to the JEMSDA cut-offs presented in Table 1.[21]

Quality control

A pilot study was conducted among 72 participants to pre-test the questionnaire and adapt it according to need. Data collectors (BSc Dietetics final-year students) were trained in the WHO questionnaire administration and measurement techniques according to the WHO guidelines before data collection and supervised by the researcher during data collection. This helped to ensure uniformity in measurement, interpretation, question presentation, and adherence to interview timeframes.[19] After the completion of the interviews, the questionnaires were checked for completeness, and follow-up on incomplete ones was done by data collectors.

Data and statistical analysis

A biostatistician was consulted for statistical assistance and guidance. Data were double-entered in Excel 1997–2003 (Microsoft Corp, Redmond, WA, USA) by 2 individuals and transferred to EpiInfo 3.5.1 (https://www.cdc.gov/epiinfo/index.html) for cleaning and analysis. The coding of data was done in line with the WHO guidelines. A categorical variable comparison was performed using chi-square and a level < 0.05 was considered significant; 95% confidence intervals (95% CIs) on all proportions are reported. Categorical variables are presented as percentages, whilst continuous variables are expressed as mean ± standard deviation. The data were assessed for normality using the Shapiro–Wilk test. Variables were either normally or log-normally distributed.

Ethical consent

Ethical approval was obtained from the University of Pretoria, the Faculty of Health Sciences, and the Research Ethics Committee (Ethics number: 308/2018). The study was also registered by the Bureau for Institutional Research & Planning (BIRAP) office. Permission to undertake the study was obtained from the University of Pretoria's Office of the Registrar and the Management of the Departments of Industrial Hygiene and Building Services, Landscape Services, Sports Fields Management, and Security Services. Only individuals who consented after being enlightened as to what the study entails participated, and they could withdraw from the study without any consequences. Confidentiality was ensured during the interview and storage of the information. Participants' names were replaced with unique study identification numbers.

Results

Demographic information

There were 146 respondents, consisting of 60% of females. Their ages ranged from 19–61 years and 63% of the participants were in the 30–44 years age group. A majority (67.1%) of participants completed high school. Almost all the participants were of African ethnicity (99.3%). More than half of the participants were from the Industrial Hygiene department (see Table 2).

Distribution and prevalence of risk factors

Behavioural characteristics

Fruit and vegetable intake

Low consumption of fruits and vegetables (less than five servings of fruit and vegetables; at least 400 g of fruit and vegetables daily) was common in the study population. The prevalence of low fruit and vegetable intake was 97.9% for both males and females, as indicated in Table 3. The mean number of fruit and vegetable servings for all the participants was 3.2 ± 1.63 servings, whilst the mean number of days on

Table 2: Demographics of the study sample

Demographic characteristics	Gender		Total ($n = 146$) % (95% CI)	p-value
	Female, $n = 88$ (60%) % (95% CI)	Male, $n = 58$ (40%) % (95% CI)		
Age				
18–29	8.0 (3.3–15.7)	22.4 (12.5–35.3)	13.7 (8.1–19.3)	0.943
30–44	64.0 (53.9–74.7)	60.3 (46.6–73.0)	63.0 (55.2–70.9)	0.197
45–69	27.3 (18.3–37.8)	17.2 (7.3–27.4)	23.3 (16.4–30.2)	0.115
Department				
Cleaning	79.8 (69.6–87.4)	19.0 (9.9–31.4)	55.5 (47.4–63.6)	< 0.001***
Landscaping	6.5 (2.5–14.3)	15.5 (7.3–27.4)	10.3 (5.3–15.2)	< 0.001***
Security	11.4 (5.6–19.9)	63.8 (50.1–76)	32.2 (24.6–39.8)	< 0.001***
Other	2.2 (0.0–6.2)	1.7 (0.0–6.2)	2.1 (0.2–4.4)	< 0.001***
Education level				
Primary school or less	5.7 (82.9–96.0)	0.0 (0.0 – .2)	3.4 (0.5–6.4)	0.310
The secondary and high school completed	90.9 (82.9–96.0)	96.6 (88.1–99.6)	93.2 (89.0–97.3)	0.310
Tertiary	3.4 (0.7–9.6)	3.4 (0.4–11.9)	3.4 (0.5–6.4)	0.310

Note: Secondary school: attendance of grade 8 up to grade 10, matric/grade 12 not completed; high school completion: school attendance up to grade 12 including the achievement of matric certificate.

* Significant at $p < 0.05$, ** significant at $p < 0.005$, *** significant at $p < 0.001$

Table 3: Modifiable behavioural risk factors of NCDs classified according to gender

Risk factor	Gender		Total $n = 146$ % (95% CI)	p-value
	Female, $n = 88$ (60%) % (95% CI)	Male, $n = 58$ (40%) % (95% CI)		
Fruit and vegetable intake Less than 5 (fruits and veg) per day	97.7 (84.7–98.7)	98.3 (88.1–99.0)	97.8 (95.6–100)	0.745
Salt intake				
Add salt before eating (always/often)	19.3 (11.7–29.1)	29.3 (18.1–42.7)	23.3 (16.4–30.2)	0.393
Add salt when cooking (always/often)	80.7 (70.9–88.3)	81.0 (68.6–90.1)	80.8 (74.4–87.2)	0.373
Salt intake (too much/far too much)	19.3 (11.7–29.1)	15.5 (7.3–27.4)	17.8 (11.6–24.0)	0.102
Eat processed foods (always/often)	30.7 (21.3–41.4)	13.8 (6.1–25.4)	17.1 (11.0–23.2)	0.071
Alcohol intake				
Don't drink or drink occasionally	87.5 (78.7–93.6)	55.2 (41.5–68.3)	74.7 (67.6–81.7)	< 0.001***
1–4 drinks per day	10.2 (4.8–18.5)	29.3 (18.1–42.7)	17.8 (11.6–24.0)	< 0.001***
More than 4 drinks per day	2.3 (0.3–8.0)	15.5 (7.3–27.4)	7.5 (3.2–11.8)	< 0.001***
Cigarette smoking				
Never smoked	89.8 (81.5–95.2)	46.6 (33.3–60.1)	72.6 (65.4–79.8)	< 0.001***
Used to smoke less than 20	2.3 (0.3–8.0)	17.2 (8.6–29.4)	8.2 (3.8–12.7)	< 0.001***
Used to smoke ≥ 20	0 (0.0–4.1)	1.7 (0.0–9.2)	0.7 (0.7–2.0)	< 0.001***
Smoking on average < 20	8 (3.3–15.7)	29.3 (18.1–42.7)	16.4 (10.4–22.5)	< 0.001***
Smoking on average > 20	0 (0.0–4.1)	5.2 (1.1–14.4)	2.1 (0.2–4.4)	< 0.001***

* Significant at $p < 0.05$, ** significant at $p < 0.005$, *** significant at $p < 0.001$.

which fruit and vegetables were consumed per week was 3 ± 1.48 days for both males and females.

Salt intake

Even though more than half of the study population reported that they ate just the right amount of salt, one in five of them reported eating either too much or far too much salt. Around 80% of the respondents reported that they 'always' or 'often' add salt to their foods when cooking. On the other hand, 26.2% reported that they consume 'too little' salt or 'far too little' salt. The results showed that more males (55.9%) than females (51.2%) 'always' add salt to food during eating and cooking (see Table 3).

Smoking

The overall percentage of participants who were smoking was 18.4%, with significantly more males (34.5%) smoking compared with females (8%) ($p < 0.001$). Over a third of the male respondents reported either smoking up to 20 cigarettes or more per day and one in five of them had a history of smoking ±20 cigarettes. Only 8% of females reported to be smoking 20 or fewer cigarettes per day (see Table 3).

Alcohol

The prevalence of daily alcohol consumption for both males and females was 25.3%. The prevalence of alcohol intake was significantly higher in male (15.5%) compared with female (2.3%) participants ($p < 0.001$). Amongst the daily alcohol users, there were 7.5% binge drinkers (> 4 drinks daily) and about 40% took 1–4 drinks daily (see Table 3).

Physical measurements

Body mass index (BMI)

The mean weight and height of the participants were 78.5 ± 15.3 kg and 164.6 ± 7.5 cm respectively. The mean BMI was 29.2 ± 6.3 kg/m^2, and the mean BMI was significantly higher in females (32.0 ± 5.9) compared with males (24.9 ± 4.0) ($p <$ 0.001) (see Table 4). Obesity was more common in women (63.6%; CI 52.7–73.6) compared with men (12.1%; CI 5.0–23.3). However, overweight was higher in males (31%) compared with females (25%) (see Table 4).

Waist circumference (WC)

A substantial proportion of the study sample (60.1%) had central obesity (see Table 4). As indicated in Table 4, the mean WC for both males and females was 92.4 ± 13.1 cm. The prevalence of central obesity was significantly higher in females at 78.4% with a mean WC of 96.6 ± 12.6 cm compared with their male counterparts at 34.5% (86.0 ± 11.4) ($p < 0.001$). Only two-fifths of the study participants had normal WC (see Table 5).

Blood pressure

Over half (64.4%) of respondents had never had their blood pressure (BP) measured. The prevalence of previously diagnosed hypertension was 19.2%. Only 8.3% of the respondents had elevated or high diastolic blood pressure whilst 12% of the respondents had elevated or high systolic blood pressure. Among those who reported having hypertension, only half had controlled BP (see Table 5).

Biochemical measurements

Cholesterol

More than two-thirds of the participants reported that they had never had their blood cholesterol measured. Five percent reported that they had been previously diagnosed with elevated cholesterol and a quarter of these were on cholesterol medication. Among the study sample, 84% had normal blood cholesterol levels, while 15.7% had either elevated or high cholesterol levels (see Table 6).

Blood glucose

As indicated in Table 6, almost all the participants (94.3%) had normal blood glucose (CI 90.8–98.2), and only about 5% had either impaired glucose tolerance or diabetes at 4.1% (CI 0.9–7.3) and 0.7% (CI 0.7–2.0) respectively.

Table 4: Risk factors by gender

Risk factors	Gender: Female, *n* = 88 (60%) Mean (SD)	Gender: Male, *n* = 58 (40%) Mean (SD)	Total Mean (SD)	*p*-value
Age	39.4 ± 8.3	36.3 ± 9.6	38.2 ± 8.9	0.036*
Weight (kg)	82.4 ± 15.9	72.5 ± 12.2	78.5 ± 15.3	< 0.001***
Height (m)	160.5 ± 5.7	170.7 ± 5.5	164.6 ± 7.5	< 0.001***
BMI (kg/m^2)	32.0 ± 5.9	24.9 ± 4.0	29.2 ± 6.3	< 0.001***
WC (cm)	96.6 ± 12.6	86.0 ± 11.4	92.4 ± 13.1	< 0.001***
SBP (mmHg)	122.2 ± 14.5	126.3 ± 12.8	124.2 ± 13.9	0.142
DBP (mmHg)	74.8 ± 9.6	76.2 ± 9.3	75.4 ± 9.5	0.379
Glucose (mmol/l)	5.6 ± 1.3	5.6 ± 2.3	5.6 ± 1.7	0.920
Cholesterol (mmol/l)	4.2 ± 1.0	4.3 ± 0.9	4.2 ± 0.9	0.346
Fruit and veg serving	3.4 ± 1.7	2.9 ± 1.4	3.2 ± 1.6	0.054*
Fruit and veg consumption days per week.	1.4 ± 0.7	1.7 ± 0.8	1.5 ± 0.7	0.016*

Note: SD: standard deviation, BMI: body mass index, kg/m^2: kilograms per square metre (BMI unit), cm: centimetre (waist circumference/height unit).
* Significant at $p < 0.05$, ** significant at $p < 0.005$, *** significant at $p < 0.001$.

Discussion

The findings showed the presence of various NCD risk factors in the study population. According to local findings, majority of the South African population consume far less fruit and vegetables on average than is advised by international guidelines.[22,23] Similarly, this study's findings underline suboptimal intake of fruits and vegetables, which was reported by 97.8% of the study population. The low fruit and vegetable intake among the participants might be due to poor socioeconomic status.[24,25] Again, low fruit and vegetable intake may also be associated with a high frequency of fast food and sugary drinks purchases.[26,27] In 2012, the decline in fruit and vegetable intake was estimated to have caused 5.0% (95% UI 4.6–5.3%) of all deaths in South Africa, and 2.5% (95% UI 2.3–2.6%) of all DALYs, therefore fruit and vegetable promotion should be prioritised.[22] The participants' attitudes toward fruit and vegetable intake in this population also need to be explored.

Several studies have uncovered high salt intake (> 5 g per day) across different races in South Africa (black, Indian, and white population).[28–31] Similarly, in this study, 80% of the study population reported that they 'always' or 'often' add salt to their food when cooking, whilst 23% 'always'' or 'often' added salt when eating. Correspondingly, it was previously reported that 40% of South Africans' salt intake came from salt added during cooking and eating.[32] Again, one in five of the respondents reported that they always or often ate processed foods, which accounts for 55% of the salt consumed by South Africans.[32] More time spent at work may be the cause of an increase in processed food intake. Additionally, taste, attitudes, and cultural

Table 5: Summary of modifiable physical risk factors of NCDs classified according to gender

Risk factors	Gender: Female, *n* = 88 (60%) % (95% CI)	Gender: Male, *n* = 58 (40%) % (95% CI)	Total *n* = 146 % (95% CI)	*p*-value
BMI (kg/m^2)				
< 18.5 (underweight)	0 (0.0–4.1)	1.7 (0.0–9.2)	0.7 (0.7–2.0)	-
18.5–24.9 (normal)	11.4 (5.6–19.9)	55.2 (41.5–68.3)	28.8 (21.4–36.1)	0.696
25–29.9 (overweight)	25 (16.4–35.4)	31 (19.5–44.5)	27.4 (20.2–34.6)	0.008**
≥ 30 (obese)	63.6 (52.7–73.6)	12.1 (5.0–23.3)	43.2 (35.1–51.2)	0.137
WC (cm)				
< 88 (F) or < 102(M) (normal)	21.6 (13.0–30.2)	87.9 (79.5–96.3)	39 (31.1–47.0)	< 0.001***
≥ 88(F) or ≥ 102(M) (central obesity)	78.4 (69.8–97.0)	12.1 (3.7–20.5)	61.0 (53.0–68.9)	< 0.001***
Blood pressure (mmHg)				
Diastolic				
< 90	92 (84.1–96.7)	91.4 (81.0–97.1)	91.1 (86.5–95.7)	0.263
90–99	5.7 (1.9–12.9)	6.9 (1.9–16.7)	6.2 (2.3–10.1)	0.638
≥ 100	2.3 (0.3–8.1)	1.7 (1.9–16.7)	2.1 (0.2–4.4)	0.154
Systolic				
< 140	87.4 (78.5–93.5)	87.7 (76.3–94.9)	86.3 (80.7–91.9)	0.043*
140–159	11.5 (5.7–20.1)	12.3 (5.1–23.7)	11.6 (6.4–16.9)	0.286
≥ 160	1.1 (0–6.2)	0 (0–6.3)	0.7 (0.7–2.0)	-

Note: BMI: body mass index, kg/m^2: kilogram per square metre (BMI unit), cm: centimetre (waist circumference unit), mmHg: millimetres of mercury (blood pressure unit).
* Significant at $p < 0.05$, ** significant at $p < 0.005$, *** significant at $p < 0.001$.

beliefs may also have an impact.[33] Reduced sodium concentrations were observed among South Africans during the interim phase of the mandatory sodium legislation.[34] Therefore, a combination of sustained salt lowering in processed foods plus education will be instrumental in lowering salt intake in this population.[33,35.]

The overall prevalence of 'current' smoking was 18.4% in this study. This prevalence is higher than the values reported in local studies, including the South African National Health and Nutrition Examination Survey (SANHANES-2012), which reported a smoking rate of 17.6%.[23,36] High cigarette smoking in the study participants might be associated with lower education levels, working in an urban area, and poor socioeconomic status.[24,31,37,38] The daily smoking rate in males was four times higher than the smoking rate in females, at 34.8% and 8% respectively. This finding corresponds to the South African Demographic and Health Survey (SADHS) report of 37% and 8% daily/occasional smoking prevalence among males and females respectively.[24] The higher smoking rate in males compared with females has also been reported in other local studies.[23,39,40] This may be because women are less likely to take up risky health behaviours compared with men.[41]

South Africa is among the countries with the highest prevalence of alcohol consumption. According to the WHO (2018) report, around 29.9% of the South African population aged 15 and older consumed alcohol.[42,43] These findings show a lower prevalence of daily alcohol intake (25.3%). The difference in the values may be due to under-reporting of alcohol intake in this population. This is because the data were collected at the workplace, thus making participants more likely to under-report the use of socially undesirable goods and services.[44] On the other hand, the reported alcohol intake in this study is higher than the reported alcohol intake (16.3%) in another local study done in a rural area, which confirms the higher prevalence of alcohol intake in urban areas.[23,40,45] Similar to local SANHANES and SADHS reports, this study's findings also indicate higher risky alcohol intake among males compared with females.[24,40] This confirms the seriousness of the alcohol problem among low-socioeconomic African male populations in South Africa.[46] Risky drinking also negatively affects employees' productivity and health, therefore primary healthcare intervention and higher sales taxes on alcohol can be beneficial.[40,46]

According to the findings of this study, overweight/obesity was more common in women (88.6%) than in men (43.1%). This is higher than the estimated national prevalence of 68% in women and 31% in men.[24] This difference might be caused by the previously reported higher obesity risk in urban areas compared with rural areas due to reduced physical activity and the high availability of cheap energy-dense processed foods (costing 69% less than a typical South African healthier diet on average).[24,47–49] Obesity increases the risk of NCDs such as cardiovascular disease, hypertension, and type 2 diabetes mellitus.[50] Therefore, tailored obesity intervention strategies should be continually implemented and strengthened in order to counteract the projected increase in obesity of 47.7% and 23.3% in females and males respectively in South Africa by 2025.[50] The study results also indicate that underweight still exists, therefore undernutrition should not be neglected.

WC provides an estimate of abdominal or visceral obesity and independently predicts cardiovascular risk and morbidity.[51] A substantial proportion of the study sample (60.1%) had central obesity. Like recent local studies, the prevalence of central obesity was higher in females (78.4%) compared with their male counterparts.[47,52] Increased WC indicates high risks of metabolic syndrome. The traditional WC value tends to underestimate metabolic syndrome prevalence among men and overestimate it among women, therefore a specific South African black WC cut-off point is needed for accurate identification of the populations' metabolic state and appropriate interventions.[53]

In this study, the prevalence of previously diagnosed hypertension was 19.2%, and about half of the subjects had uncontrolled blood pressure. This confirms the elevated rate of uncontrolled blood pressure in South Africa even when on treatment, as reported by previous findings, with the prevalence ranging from 42% to 54%.[54] Almost 1 in 10 of the respondents had elevated or high diastolic blood pressure and elevated or high systolic blood pressure. This also corresponds to the increasing trend of hypertension over the past decades.[24,31] About two-thirds of the participants had never been tested for hypertension, indicating that some cases of hypertension remain undiagnosed or untreated. Hypertension screening, awareness, and management campaigns need to be strengthened in order to reduce cardiovascular risks, and the health and economic burden (estimated direct healthcare costs of ZAR 10.1 billion).[55]

Diabetes, mostly propelled by urbanisation and unhealthy lifestyle, is ranked as the second leading cause of death from natural causes in South Africa.[4,56] According to SADHS data analysis, the prevalence of pre-diabetes and diabetes was 67% and 22% respectively in 2016.[57] This study findings showed a

Table 6: Biochemical risk factors by gender

Risk factor	Gender		Total $n = 146$ % (95% CI)	*p*-value
	Female, $n = 88$ (60%) % (95% CI)	Male, $n = 58$ (40%) % (95% CI)		
Total cholesterol				
Normal (< 5 mmol/l)	87.5 (78.7–93.6)	79.3 (66.6–88.8)	84.2 (78.3–90.2)	0.277
Elevated (5–6.1 mmol/l)	9.1 (4.0–17.1)	19 (9.9–31.4)	13 (7.5–18.5)	0.254
High (≥ 6.2 mmol/l)	3.4 (0.7–9.6%)	1.7 (0–9.2)	2.7 (0.1–5.4)	0.334
Blood glucose				
Normal	94.3 (87.2–98.1)	96.5 (87.9–99.6)	94.5 (90.8–98.2)	0.077
Impaired glucose tolerance	5.7 (1.9–12.8)	1.8 (0.0–9.4)	4.1 (0.9–7.3)	0.982
Diabetes	0 (0.0–4.1)	1.8 (0.0–9.4)	0.7 (0.7–2.0)	0.050*

Note: mmol/l: millimoles per litre (blood cholesterol and glucose unit).
* Significant at $p < 0.05$, ** significant at $p < 0.005$, *** significant at $p < 0.001$.

lower (4.8%) prevalence. This is concerning, as it might be an indication of the unreliability of random blood glucose in screening for diabetes. Almost one in two adults with diabetes are undiagnosed globally and about 90% of these undiagnosed diabetes cases occur in low- and middle-income countries.[58] Therefore, for appropriate diagnoses of diabetes, an oral glucose test in conjunction with lab-based testing should be used in future studies.[59,60]

In the current study, only 15.7% of the study population had either elevated or high cholesterol, which is lower than the reported prevalence from other South African studies.[24,53] More than two-thirds of the participants reported that they had never had their blood cholesterol measured. This confirms the low rate of cholesterol screening, diagnosis, and treatment in the South African population, as another South African study reported that even though 67% of participants met the criteria for dyslipidaemia, only 1.05% of participants (with high cholesterol levels) were aware of their condition and only 0.7% were receiving treatment.[53] Late diagnosis and treatment increase the risk of complications, namely cardiovascular diseases, stroke, and even mortality. Interventions such as therapeutic lifestyle changes (e.g., maintenance of healthy bodyweight, being physically active, and lowering saturated fat intake) are important for lowering cholesterol levels.[61]

Conclusion and recommendations

The present study found a high prevalence of NCD risk factors: low fruit and vegetable intake, increased overweight/obesity and high WC, high salt intake, high smoking, and high alcohol consumption among men, among insourced staff at the University of Pretoria, Hatfield campus. This indicates the need to raise awareness regarding a healthy lifestyle, good nutrition, regular screening, and the importance of medication adherence (among the previously diagnosed) in this group. Appropriate tailored health and nutrition education should be conducted. Moreover, awareness of the already available services and resources aimed at NCDs from the Employee Wellness Programme should be continuously raised among all employees of the university. Household vegetable gardens should also be supported to improve intake among this group.

Study limitations and suggestions for future research

The limitations of the study include the small sample size; therefore the study findings may not be generalised to other similar settings. Some variables were self-reported, thus subjecting the findings to self-report and recall bias. This information subjectivity reduces the representativeness and transferability of the results across the population. Another limitation is that a cross-sectional study was conducted, which shows the risk factors only at a particular point in time. Poor adherence to fasting among the participants and difficulty in measuring adherence presented another limitation. Future research should qualitatively investigate the factors that contribute to the low fruit and vegetable consumption, and high cigarette smoking and salt intake among the insourced study group. It will be interesting to conduct follow-up research to quantify the salt intake in this population. The food environment must also be explored.

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