High Prevalence of Non-Communicable Diseases Risk Factors in 36,074 South African Financial Sector Employees: A Cross-Sectional Study

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Ethical Considerations: Research Ethics Committee of the Faculty of Health Sciences of the University of Pretoria (REC numbers 754/2018).

Clinical Significance: To date, there has been no large study to predict the 10-year risk for CVD in the SA workplace. This study presents evidence of the magnitude of NCDs, the risk factors and gender distribution in the financial sector. The data will be useful in formulating workplace health promotional programmes.

ABSTRACT
Objective: To determine the prevalence of non-communicable disease (NCD) risk factors, total NCD risk category and 10-year risk for cardiovascular diseases (CVD) in financial sector employees. **Methods:** This descriptive observational cross-sectional analysis, data from 36 074 employees was analysed. NCD risk factor data was obtained from health risk assessments that included a questionnaire and clinical measures. The 10-year risk for CVD was calculated using the Framingham non-laboratory based equation. **Results:** Inadequate fruit and vegetable intake (89.3%), insufficient physical activity (77.4%) and being overweight (66.8%) were the most prevalent risk factors. Females had significantly higher prevalence ratios for central obesity (2.28; $p<0.001$), insufficient physical activity (1.21; $p<0.001$), hypercholesterolaemia (1.15; $p<0.001$) and overweight (1.08; $p<0.001$) compared to males. **Conclusion:** A more concerted effort is required to provide employees with appropriate tools and education at the workplace to decrease and manage NCDs.

Key words: Non-Communicable Diseases, Risk factors, Health Risk Assessment, Employees, Framingham Risk Score

INTRODUCTION

The non-communicable disease (NCD) global epidemic accounts for approximately 40 million (>70%) of all deaths each year.[1] It is estimated that 67% of global NCD deaths occur in low- and middle-income countries (LMICs).[1] Approximately half of these preventable deaths affect people younger than 70 years and 45% of these deaths occur in economically active people between the ages 30 to 59.[2] In South Africa (SA), 55.5% of deaths are attributed to NCDs and account for more deaths per year than communicable diseases (33.4%) and injuries (11.1%) combined.[3]

Lifestyle-related risk factors are largely responsible for NCDs globally. The main lifestyle-related risk factors for NCDs are unhealthy diet, insufficient physical activity, alcohol abuse and smoking and these manifest as diabetes, hypertension, hyperlipidaemia and overweight/obesity.[4] The increasing prevalence of NCDs in LMIC is attributed to rapid urbanisation, globalisation, and access to international media and advertising that results in marked changes in patterns of consumption of food and alcohol, increased tobacco use, sedentary lifestyles, high levels of stress and insufficient physical activity. [5] Similarly, in SA, the highest number of NCDs related deaths occur in urban areas. [3] Nutritional surveys have shown that people living in cities frequently consume a diet, which is high in fat, refined carbohydrates and added sugar. [6]

NCDs are a major economic drain to both individuals and companies. A workforce with a high prevalence of NCDs is associated with increased absenteeism, reduced productivity or an increased risk of leaving employment early due to incapacity. [7] Lifestyle-related risk factors for NCD's can be identified and managed by implementing workplace health promotion programmes. Limited studies have been conducted to determine the prevalence of NCD lifestyle-related risk factors among employees in SA in different economic sectors, including the financial sector. In one study among 1 954 employees in 18 SA companies in various sectors, 86% of financial sector employees reported an inadequate fruit and vegetable intake (less than five servings of fruit and vegetables per day), 69% had insufficient physical activity (less than 150 minutes per week of moderate to vigorous physical activity) and 44.5% were classified as being either overweight or obese.[8] In another study, representing one financial institution in SA, 8 132 employees voluntary underwent a Health Risk Assessment (HRA) and

65.5% were overweight, 55.4% had insufficient physical activity and 62.8% had raised blood pressure. [9] Of concern is that 42.1% of employees had > 3 risk NCD factors, and this was particularly high in males and females older than 45 years (males = 48.4%; females = 47.8%).[9]However, to our knowledge none of these SA workplace health promotional studies have determined the 10 year risk of developing CVD disease event using risk estimation tools such as the Framingham risk equation.

Currently, many private health insurers, including SA's largest financial sector insurer, offer annual HRAs as part of their preventative screening benefits for their employers' groups at the worksite to characterise the health profile of its members. In many companies, the annual HRA is a starting point to introduce a comprehensive wellness program and is often the first step before implementing targeted health interventions. [10] While annual HRAs have become popular amongst employers and employees in SA and are commonly used to determine the prevelance of NCD risk factors, they often fail to capture all the data attributes that are required to predict that risk of developing CVD in a large population of subgroups.

Financial sector employees are potentially at high risk of developing NCDs as the nature of their work is sedentary, perceived to be stressful and characterised by long working hours. [11] The aim of this study was to determine the prevalence of NCD risk factors, total NCD risk category and 10-year risk for CVD (Framingham score) in financial sector employees of a privately funded health insurer, using data from an annual HRA. These findings will inform the development and implementation of NCD intervention programs for financial sector employees.

METHODS

Settings and Participants

Study design

A retrospective clinical audit with cross-sectional analysis of data.

Study Setting

This study was conducted in collaboration with a financial sector health insurer that offers and conducts annual Health Risk Assessments (HRA) at wellness days for its employee groups at their worksite settings throughout SA.

Study Participants

All 63 129 employees from the worksites were invited to voluntarily participate in annual HRA's, which were conducted by qualified, trained Registered Nurses or Biokineticists. The HRA's were advertised via email one month in advance, and again two and one week prior with an electronic booking link for a 30-minute appointment during working hours. A total of 36 074 financial sector employees from 73 worksites voluntarily participated in the HRA that was provided by a SA Private health insurer over a four-year period (2016 – 2019). This analysis comprises an evaluation of baseline HRA data of each employee which participated. All participants were between 18 years and 63 years at the time of undergoing the HRA. Consent to use the de-identified HRA data for academic research purposes was provided by each member when joining the health insurer. The health insurer forwarded anonymised data from the HRA to the researcher to conduct analysis. All information gathered remained confidential and was not made available to the employer of the various employee groups.

Measurements
The HRA consisted of the completion of 1) a Personal Health Assessment (PHA) questionnaire, and 2) anthropometrical and clinical measurements.

Personal Health Assessment (PHA) Questionnaire
Participants completed an online PHA questionnaire, which comprised of demographic, health and lifestyle risk factor questions. Demographic variables included age, sex, personal and family medical history and lifestyle variables included smoking habits, fruit and vegetable intake and levels of physical activity. Participants reported their current smoking status by indicating whether they are non-smokers or current smokers. Adequate fruit and vegetable intake was assessed by a single question related to the average daily fruit and vegetable intake (*How many servings of vegetables and fruit do you eat on average in a day?*). [12] Participants were categorised as those with "inadequate fruit and vegetable intake" if their daily fruit and vegetable intake was less than 5 servings of per day. Habitual physical activity was assessed using the Global Physical Activity Questionnaire, which is a validated self-administered questionnaire that includes questions on habitual levels of light, moderate and vigorous activity [13]. The physical activity domains include work-related activity, transport and leisure time activity, which were summed to calculate total minutes of physical activity per week. Participants were categorised as "insufficient physical activity" if they did not meet the American College of Sports Medicine guideline of > 150 minutes of physical activity per week.[14]

Anthropometrical and Clinical Measurements
The following anthropometric and clinical measurements were taken on each participant by qualified, trained Registered Nurses or Biokineticists.

Anthropometric measurements: Measurement of height, weight and waist circumference were obtained according to ACSM guidelines. [13] Height was measured to the nearest 0.1 cm, using a wall mounted ultrasound stadiometer (PUSH Stadiometer, InBody, USA). Body mass was measured using a digital scale (Microlife WS 80 N, MicrolifeAG, Widnau, Switzerland) and recorded to the nearest 0.1 kg. Participants were asked to remove shoes, jackets/jerseys and empty pockets for these measurements. Body Mass Index (BMI) was calculated as body weight in kilograms (kg) divided by height in meters (m) squared (kg/m^2).[14].Waist circumference was measured (in centimetres) using a non-stretch retractable tape measure at the narrowest part of the torso (above the umbilicus and below the xiphoid process).

Clinical measurements: Blood pressure was recorded (in mmHg) using an automated blood pressure machine (Microlife BP A2 Basic, Microlife AG, Widnau, Switzerland)) after a participant remained seated quietly for five minutes. Two readings were taken, approximately five minutes apart, and the lowest reading was recorded. Random blood glucose and total cholesterol concentrations were obtained using finger-prick capillary samples either on the right- or left-hand using standard guidelines for reliable finger-stick sample collection [15]. The Accutrend GCT Monitor (Roche Diagnostics, Mannheim, Germany) was used for measuring blood glucose and total cholesterol concentrations.

Outcome Measurements
The main outcome measurements were prevalence of eight NCD risk factors, total NCD risk category and the 10-year risk for cardiovascular disease (non-laboratory based Framingham cardiovascular risk score).[16]

Prevalence (% of participants) of NCD risk factors
The specific eight NCD risk factors and their definitions are:

(i) Insufficient physical activity: < 150 minutes of moderate- to high-intensity physical activity per week, [14]
(ii) Inadequate fruit and vegetable intake: < 5 servings of fruits and vegetables per day, [12]
(iii) Smoking: Current cigarette smoker, [14]
(iv) Overweight: BMI ≥ 25 kg/m^2, [17]
(v) Central obesity: Waist circumference >102 cm for men and >88 cm for women, [14]
(vi) Hypertension: A systolic blood pressure ≥ 140 and/or a diastolic blood pressure ≥ 90 mmHg), or use of anti-hypertensive medication [14],
(vii) Hypercholesterolaemia: A random total blood cholesterol concentration ≥ 5.2 mmol/L [14] and
(viii) Diabetes mellitus: A random blood glucose concentration ≥ 6.4 mmol/L [18] or self-reported diagnosis of diabetes mellitus.

NCD risk category (based on number of NCD risk factors)
An NCD risk category, based on the number of risk factors for NCDs (0-8), was also determined for each participant. All eight NCD risk factors were summed and the risk for each participant was categorised as follows: low risk (0-2 risk factors), moderate risk (3-4 risk factors) or high risk (≥5 risk factors).[19]

Framingham score (10-year cardiovascular disease risk score) (%)
A non-laboratory based CVD risk score (Framingham) was used to calculate the predicted 10-year risk of cardiovascular disease (CVD) (%) based on age, sex, systolic blood pressure, treatment of hypertension, body mass index (BMI), smoking and diabetes status. [19]

Framingham risk category (based on 10-year absolute CVD risk score as a %)
The Framingham score (10-year absolute CVD risk as a %) was also used to classify participants in the following Framingham risk categories: low risk (< 10%), intermediate risk (10-20%), and high risk (> 20%).[20] The prevalence (% participants) in each risk category was determined.

Statistical analysis
Statistical analysis was completed using StataSE15 (StataCorp, TX, USA). Data was categorised according to the definition in the "*Prevalence of NCD risk factors"* paragraph. Means, 95% confidence interval (CI) or standard deviation were included in the descriptive analysis. Prevalence of each NCD risk factor was presented as percentages with 95% CI by sex and age category. Prevalence ratios and risk ratios are also reported. Significance was assessed by a binary model for each risk factor, with sex, age group and their interaction as predictors in the model.

The 10-year Framingham risk score (FRS) was calculated for the study using the non-laboratory formula [16]. Smoking status was not captured in 2016. If an employee participated in two or more health assessments, their smoking status for 2016 was replaced with their smoking status in the later assessments. However, 4947 employees had only one assessment which was in 2016 and they were given a weight of 0.5 for smoking in the calculations of FRS. Significance for the FRS was assessed with a model approach with FRS as a continuous outcome and sex, age group and their interaction as predictors.

Ethical considerations
Research ethics approval for the study was obtained from the Research Ethics Committee of the Faculty of Health Sciences of the University of Pretoria (REC numbers 754/2018).

RESULTS

Demographics of the study participants

The demographics of the study population (n = 36 074) by sex and age group is shown in Table 1. Participants were more likely to be female (66.4%) compared with male (33.6%). The mean age (SD) of the participants was 38.1 (10) years, with similar mean age for males and females was 37.7 (9.8) years and 38.3 (10.1) years respectively.

Table 1: Demographics of the study participants (by sex and age groups)

			n (%)
All		Age (years)	36 074 (100)
Males	All males		12 134 (33.6)
	Age groups	18-29	2 515 (20.7)
		30-39	5 525 (45.5)
		40-49	2 417 (19.9)
		50-59	1 111 (9.2)
		>60	566 (4.7)
Females	All females		23 940 (66.4)
	Age groups	18-29	4 642 (19.4)
		30-39	10 652 (44.5)
		40-49	4 749 (19.8)
		50-59	2 667 (11.1)
		>60	1 230 (5.1)

Prevalence (%) of NCD risk factors

The prevalence (%) and prevalence ratio (female:male) of the eight NCD risk factors in the study population (all employees and by sex and age groups) is shown in Table 2.

The most prevalent NCD risk factors in this study population were inadequate fruit and vegetable intake (89.3%: 88.8 - 89.8), insufficient physical activity (77.4%: 76.7 - 78.0), being overweight (BMI $\geq$ 25 kg/m^2) (66.8%: 66.3 - 67.3).

Females compared to males were 2.28 times, 1.21 times, 1.15 times and 1.08 times more likely to have central obesity, insufficient physical activity, hypercholesterolemia and overweight respectively. Prevalence of insufficient physical activity (females = 82.2%, males = 68.0%;) and central obesity(females = 46.1%, males = 20.2%), being overweight (females = 68.4%, males= 63.6%,) and hypercholesterolaemia (females = 22.0%, males = 19.2%,) were significantly higher in females compared with males ($p<0.001$), while the prevalence of the following NCD risk factors was significantly higher in males compared with females: hypertension (males = 28.8%; females = 15.9%) and smoking (males = 27.1%; females =

16.0%) (p<0.001). The prevalence of being overweight (males = 38.4%; females = 30.4%) (p=0.717) and inadequate fruit and vegetable intake (males = 90.6%; females = 88.6%) (p=0.54) was similar in females and males (Table 2).

Table 2: The prevalence (%) and prevalence ratio (female:male) of NCD risk factors in the study population and by sex and age groups (all employees and by sex and age groups)

NCD risk factor	Age in years	All		Females		Males		F:M	p-value
		n	Prevalence (%) (95% CI)	N	Prevalence (%) (95% CI)	n	Prevalence (%) (95% CI)	Prevalence Ratio (95% CI)	
Insufficient physical activity	**All**	**9 848**	**77.4 (76.7-78.0)**	**6 433**	**82.2 (81.4-82.9)**	**3 415**	**68.0 (66.8-69.2)**	**1.21 (1.18-1.23)**	**<0.001***
	18-29	2 180	72.9 (71.4-74.4)	1 389	79.7 (77.9-81.3)	791	61.0 (58.3-63.7)	1.31 (1.24-1.37)	
	30-39	4 362	76.6 (75.6-77.5)	2 858	81.2 (80.1-82.3)	1 504	67.5 (65.7-69.3)	1.20 (1.17-1.24)	
	40-49	2 160	81.3 (80.0-82.5)	1 399	85.0 (83.5-86.4)	761	73.7 (71.2-76.1)	1.15 (1.11-1.20)	<0.001†
	50-59	984	81.6 (79.6-83.4)	682	85.0 (82.8-87.0)	302	73.6 (69.5-77.3)	1.16 (1.09-1.22)	
	>60	162	78.9 (74.1-83.0)	105	83.7 (78.0-88.1)	57	70.2 (61.2-77.9)	1.19 (1.04-1.36)	
Inadequate fruit and vegetable intake	**All**	**9 079**	**89.3 (88.8-89.8)**	**5 970**	**88.6 (88.0-89.2)**	**3 109**	**90.6 (89.8-91.4)**	**0.98 (0.97-0.99)**	**0.540***
	18-29	2 014	93.7 (92.8-94.5)	1 294	93.5 (92.3-94.4)	720	94.1 (92.6-95.3)	0.99 (0.98-1.01)	
	30-39	3 973	89.5 (88.8-90.2)	2 623	89.0 (88.1-89.8)	1 350	90.7 (89.4-91.8)	0.98 (0.97-1.00)	
	40-49 y	2 007	87.7 (86.6-88.8)	1 310	86.8 (85.3-88.1)	697	89.7 (87.8-91.4)	0.97 (0.94-0.99)	0.064†
	50-59	932	83.6 (81.7-85.4)	644	83.0 (80.6-85.1)	288	85.2 (81.7-88.1)	0.97 (0.93-1.02)	
	>60	153	83.0 (78.4-86.7)	99	81.0 (75.0-85.9)	54	86.5 (78.8-91.7)	0.94 (0.85-1.03)	
Smoking	**All**	**31 127**	**19.8 (19.3-20.2)**	**20 598**	**16.0 (15.5-16.5)**	**10 529**	**27.1 (26.3-28.0)**	**0.59 (0.57-0.62)**	<0.001*
	18-29	6 454	22.0 (21.0-23.0)	4 160	17.5 (16.4-18.7)	2 294	30.2 (28.3-32.1)	0.58 (0.53-0.64)	
	30-39	13 891	20.5 (19.8-21.2)	9 113	16.2 (15.5-17.0)	4 778	28.7 (27.4-30.0)	0.57 (0.53-0.60)	
	40-49	6 039	18.4 (17.4-19.4)	4 000	15.4 (14.3-16.6)	2 039	24.2 (22.4-26.1)	0.64 (0.57-0.71)	0.094†
	50-59	3 110	16.7 (15.4-18.1)	2 215	14.5 (13.1-16.1)	895	22.1 (19.5-25.0)	0.66 (0.56-0.77)	
	>60	1 633	16.0 (14.3-17.9)	1 110	14.4 (12.5-16.6)	523	19.5 (16.3-23.1)	0.74 (0.59-0.93)	
Overweight	**All**	**36 074**	**66.8 (66.3-67.3)**	**23 940**	**68.4 (67.8-69.0)**	**12 134**	**63.6 (62.8-64.5)**	**1.08 (1.06-1.09)**	<0.001*
	18-29	7 157	51.6 (50.5-52.8)	4 642	55.1 (53.7-56.5)	2 515	45.2 (43.3-47.2)	1.22 (1.16-1.28)	
	30-39	16 177	65.8 (65.0-66.5)	10 652	67.5 (66.6-68.4)	5 525	62.3 (61.0-63.6)	1.08 (1.06-1.11)	
	40-49	7 166	76.2 (75.2-77.2)	4 749	77.2 (75.9-78.3)	2 417	74.4 (72.6-76.1)	1.04 (1.01-1.07)	<0.001†
	50-59	3 778	78.3 (77.0-79.6)	2 667	77.7 (76.1-79.2)	1 111	79.8 (77.4-82.1)	0.97 (0.94-1.01)	
	>60	1 796	74.9 (72.9-76.9)	1 230	72.6 (70.0-75.0)	566	80.0 (76.5-83.1)	0.91 (0.86-0.96)	
Central Obesity	**All**	**36 074**	**37.4 (36.9-37.9)**	**23 940**	**46.1 (45.5-46.7)**	**12 134**	**20.2 (19.5-20.9)**	**2.28 (2.2-2.37)**	<0.001*
	18-29	7 157	22.0 (21.0-22.9)	4 642	29.3 (28.0-30.6)	2 515	8.3 (7.3-9.5)	3.51 (3.06-4.03)	
	30-39	16 177	34.0 (33.2-34.7)	10 652	43.3 (42.4-44.3)	5 525	16.0 (15.0-17.0)	2.71 (2.54-2.89)	
	40-49	7 166	46.3 (45.1-47.5)	4 749	56.1 (54.7-57.5)	2 417	27.0 (25.2-28.8)	2.08 (1.94-2.23)	<0.001†
	50-59	3 778	54.7 (53.1-56.2)	2 667	61.5 (59.6-63.3)	1 111	38.3 (35.4-41.1)	1.61 (1.48-1.74)	
	>60	1 796	57.8 (55.5-60.1)	1 230	61.5 (58.8-64.2)	566	49.6 (45.5-53.8)	1.24 (1.13-1.36)	

NCD risk factor	Age in years	All		Females		Males		F:M	p-value
		n	Prevalence (%) (95% CI)	N	Prevalence (%) (95% CI)	n	Prevalence (%) (95% CI)	Prevalence Ratio (95% CI)	
Hypertension	**All**	**36 074**	**20.3 (19.9-20.7)**	**23 940**	**15.9 (15.5-16.4)**	**12 134**	**28.8 (28.0-29.6)**	**0.55 (0.53-0.58)**	<0.001*
	18-29	7 157	13.3 (12.5-14.1)	4 642	8.4 (7.6-9.2)	2 515	22.2 (20.6-23.9)	0.38 (0.34-0.43)	
	30-39	16 177	17.9 (17.3-18.5)	10 652	13.0 (12.3-13.6)	5 525	27.4 (26.2-28.6)	0.47 (0.44-0.51)	
	40-49	7 166	26.4 (25.4-27.4)	4 749	22.0 (20.9-23.2)	2 417	35.0 (33.1-36.9)	0.63 (0.58-0.68)	<0.001†
	50-59	3 778	31.2 (29.8-32.7)	2 667	28.4 (26.7-30.1)	1 111	38.1 (35.3-41.0)	0.75 (0.68-0.82)	
	>60	1 796	22.2 (20.4-24.2)	1 230	19.7 (17.5-22.0)	566	27.7 (24.2-31.6)	0.71 (0.60-0.84)	
HCL	**All**	**36 074**	**21.1 (20.7-21.5)**	**23 940**	**22.0 (21.5-22.6)**	**12 134**	**19.2 (18.5-19.9)**	**1.15 (1.10-1.20)**	<0.001*
	18-29	7 157	10.9 (10.2-11.7)	4 642	11.7 (10.8-12.7)	2 515	9.5 (8.4-10.7)	1.24 (1.07-1.43)	
	30-39	16 177	17.3 (16.8-17.9)	10 652	17.5 (16.8-18.2)	5 525	17.0 (16.1-18.0)	1.03 (0.96-1.10)	
	40-49	7 166	27.9 (26.9-29.0)	4 749	27.7 (26.5-29.0)	2 417	28.3 (26.6-30.2)	0.98 (0.90-1.06)	0.002†
	50-59	3 778	37.0 (35.5-38.6)	2 667	40.1 (38.3-42.0)	1 111	29.5 (26.9-32.3)	1.36 (1.23-1.50)	
	>60	1 796	34.3 (32.1-36.5)	1 230	38.9 (36.3-41.7)	566	24.2 (20.9-27.9)	1.61 (1.37-1.89)	
Diabetes mellitus	**All**	**36 074**	**19.9 (19.5-20.3)**	**23 940**	**19.6 (19.1-20.1)**	**12 134**	**20.4 (19.7-21.1)**	**0.96 (0.92-1.00)**	0.088 *
	18-29	7 157	13.1 (12.3-13.9)	4 642	13.6 (12.6-14.6)	2 515	12.2 (10.9-13.5)	1.12 (0.98-1.27)	
	30-39	16 177	16.9 (16.3-17.5)	10 652	16.8 (16.1-17.5)	5 525	17.1 (16.1-18.1)	0.98 (0.91-1.05)	
	40-49	7 166	23.2 (22.3-24.2)	4 749	22.2 (21.0-23.4)	2 417	25.4 (23.7-27.2)	0.87 (0.80-0.95)	<0.001†
	50-59	3 778	31.0 (29.6-32.5)	2 667	30.1 (28.4-31.8)	1 111	33.3 (30.6-36.1)	0.90 (0.82-1.00)	
	>60	1 796	36.9 (34.7-39.2)	1 230	34.3 (31.7-37.0)	566	42.6 (38.6-46.7)	0.81 (0.71-0.91)	

HCL: Hypercholesterolaemia
*: p value for comparison between males and females
† p value for comparison between males and females of the age profiles

The prevalence of NCD risk factors differed between sexes in age groups. In males, the prevalence of insufficient physical activity increased from 61.0% in the youngest age group (18-29 years) to 73.6% in age group 50-59 years (p<0.001) but decreased to 70.2% in age group 60 years and above. For females, the prevalence of insufficient physical activity increased from 79.7% in age group 18-29 years to 85.0% in both 40-49 and 50-59-years age group and decreased to 83.7% above 60 years. Across all age groups, inadequate fruit and vegetable intake was similar in both males and females(p=0.064). The prevalence of central obesity and diabetes increased significantly from the youngest age group (18-29 years) to oldest age group (>60 years) in males and females (p<0.001). The prevalence of hypertension and hypercholesterolemia increased progressively from age group 18-29 years to 50-59 years (p<0.001) and declined in > 60 years category in both sexes. While overall the prevalence of being overweight progressively increased with age from 18-29 age group (51.6%) and peaked at 50-59 age group (78.3%).

NCD risk category (based on number of NCD risk factors)

The prevalence (%) of participants and prevalence ratio (female:male) by NCD risk factor categories (low, moderate and high risk) in the study population (all employees and by sex and age groups) is shown in Table 3.

Table 3: The prevalence (%) and prevalence ratio (female:male) of participants by NCD risk factor categories (low, moderate and high risk) in the study population (all employees and by sex and age groups)

Risk factor category	Age in years	All (n= 36 074)		Females (n=19 555)		Males (n=12 134)		F:M	p-value
		n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	Prevalence ratio (95% CI)	
Low risk (0-2 risk factors)	**All**	**11 220**	**31.1 (30.6-31.6)**	**7 034**	**29.4 (28.8-30.0)**	**4 186**	**34.5 (33.7-35.3)**	**0.85 (0.85-0.86)**	**<0.001***
	18-29	3 371	30.0 (29.2-30.9)	2 092	29.7 (28.7-30.8)	1 279	30.6 (29.2-32.0)	0.97 (0.96-0.98)	0.015†
	30-39	5 375	47.9 (47.0-48.8)	3 352	47.7 (46.5-48.8)	2 023	48.3 (46.8-49.8)	0.99 (0.98-0.99)	
	40-49	1 489	13.3 (12.7-13.9)	922	13.1 (12.3-13.9)	567	13.5 (12.5-14.6)	0.97 (0.95-0.98)	
	50-59	587	5.2 (4.8-5.7)	396	5.6 (5.1-6.2)	191	4.6 (4.0-5.2)	1.23 (1.18-1.29)	
	>60	398	3.5 (3.2-3.9)	272	3.9 (3.4-4.3)	126	3.0 (2.5-3.6)	1.28 (1.22-1.36)	
Moderate risk (3-4 risk factors)	**All**	**17 905**	**49.6 (49.1-50.2)**	**12 022**	**50.2 (49.6-50.9)**	**5 883**	**48.5 (47.6-49.4)**	**1.04 (1.03-1.04)**	**<0.001***
	18-29	3 120	17.4 (16.9-18.0)	2 083	17.3 (16.7-18.0)	1 037	17.6 (16.7-18.6)	0.98 (0.98-0.99)	0.150†
	30-39	8 269	46.2 (45.5-46.9)	5 532	46.0 (45.1-46.9)	2 737	46.5 (45.3-47.8)	0.99 (0.98-0.99)	
	40-49	3 701	20.7 (20.1-21.3)	2 465	20.5 (19.8-21.2)	1 236	21.0 (20.0-22.1)	0.98 (0.96-0.99)	
	50-59	1 884	10.5 (10.1-11.0)	1 314	10.9 (10.4-11.5)	570	9.7 (9.0-10.5)	1.13 (1.09-1.16)	
	>60	931	5.2 (4.9-5.5)	628	5.2 (4.8-5.6)	303	5.2 (4.6-5.7)	1.01 (0.98-1.05)	
High risk (5 or more risk factors)	**All**	**6 949**	**19.3 (18.9-19.7)**	**4 884**	**20.4 (19.9-20.9)**	**2 065**	**17.0 (16.4-17.7)**	**1.20 (1.18-1.22)**	**<0.001***
	18-29	666	9.6 (8.9-10.3)	467	9.6 (8.8-10.4)	199	9.6 (8.4-11.0)	0.99 (0.95-1.04)	0.113†
	30-39	2 533	36.5 (35.3-37.6)	1 768	36.2 (34.9-37.6)	765	37.0 (35.0-39.2)	0.98 (0.96-0.99)	
	40-49	1 976	28.4 (27.4-29.5)	1 362	27.9 (26.6-29.2)	614	29.7 (27.8-31.7)	0.94 (0.92-0.96)	
	50-59	1 307	18.8 (17.9-19.7)	957	19.6 (18.5-20.7)	350	16.9 (15.4-18.6)	1.16 (1.11-1.20)	
	>60	467	6.7 (6.2-7.3)	330	6.8 (6.1-7.5)	137	6.6 (5.6-7.8)	1.02 (0.96-1.08)	

*: p value for comparison between males and females

†: p value for comparison between males and females of the age profiles

Overall, 31.1% of participants were in the low risk category, 49.6% in the moderate risk and 19.3% in the high-risk category. Females were more likely to be in moderate (PR = 1.04; 1.03 – 1.04) and high risk (PR = 1.20; 1.18 – 1.22) categories respectively, and less likely to be in the low risk category compared to males (PR = 0.85; 0.85 - 0.86) ($p < 0.001$). There we no significant differences, across all age groups, between males and females in moderate and high-risk categories.

Framingham score (10-year cardiovascular disease risk score) (%)

The Framingham score and risk ratio (female:male) in the study population (all employees and by sex and age groups is shown in Table 4.

Table 4: The Framingham score (10-year cardiovascular disease risk score) and risk ratio (female:male) in the study population (all employees and by sex and age groups)

	All (n=36 074)	Females (n=23 940)	Males (n=12 134)	Risk Ratio (F:M)	p-value
Age in years	**Mean (95% CI)**	**Mean (95% CI)**	**Mean (95% CI)**	**Mean (95% CI)**	
All	**5.5 (5.5-5.6)**	**4.1 (4.1-4.2)**	**8.5 (8.4-8.6)**	**0.48 (0.48-0.49)**	**<0.001 ***
18-29	1.4 (1.3-1.6)	1.1 (0.9-1.2)	2.1 (2-2.3)	0.50 (0.48-0.52)	<0.001†
30-39	3.1 (3.1-3.2)	2.3 (2.2-2.3)	4.8 (4.7-4.9)	0.47 (0.46-0.48)	
40-49	7.3 (7.2-7.4)	5.4 (5.3-5.5)	11.0 (10.9-11.2)	0.49 (0.48-0.49)	
50-59	13.9 (13.7-14.0)	10.7 (10.5-10.8)	21.6 (21.3-21.8)	0.49 (0.49-0.50)	
>60	18.9 (18.7-19.2)	14.0 (13.7-14.2)	29.7 (29.3-30)	0.47 (0.46-0.47)	

*: p value for comparison between males and females
†: p value for comparison between males and females of the age profiles

Table 5: The prevalence (% participants) and prevalence ratio (female:male) in each Framingham risk category in the study population (all employees and by sex and age groups)

Framingham risk category	Age in years	All (n=36 074)	Females (n=23 940)	Males (n=12 134)	F:M	p-value
		Prevalence (%) (95% CI)	**Prevalence (%) (95% CI)**	**Prevalence (%) (95% CI)**	**Prevalence Ratio (95% CI)**	
Low risk (< 10%)	**All**	**85.0 (84.7-85.4)**	**90.1 (89.8-90.5)**	**74.9 (74.1-75.7)**	**1.20 (1.20-1.21)**	<0.001*
	18-29	23.3 (22.8-23.8)	21.5 (21.0-22.1)	27.6 (26.7-28.6)	0.78 (0.77-0.78)	<0.001†
	30-39	51.5 (51.0-52.1)	49.1 (48.4-49.7)	57.3 (56.3-58.4)	0.86 (0.85-0.86)	
	40-49	18.1 (17.7-18.6)	19.8 (19.3-20.3)	14.2 (13.5-14.9)	1.39 (1.36-1.43)	
	50-59	5.4 (5.2-5.7)	7.4 (7.0-7.7)	0.8 (0.7-1.0)	8.91 (7.46-10.66)	
	>60	1.6 (1.5-1.8)	2.3 (2.1-2.5)	0	-	
Intermediate risk (10-20%)	**All**	**10.2 (9.9-10.5)**	**7.5 (7.2-7.9)**	**15.5 (14.9-16.1)**	**0.48 (0.48-0.49)**	<0.001*
	18-29	0.2 (0.1-0.4)	0.1 (0.0-0.4)	0.2 (0.1-0.6)	0.52 (0.35-0.78)	<0.001†
	30-39	9.8 (8.9-10.8)	3.5 (2.8-4.5)	15.9 (14.3-17.6)	0.22 (0.20-0.26)	
	40-49	36.6 (35.1-38.2)	23.5 (21.6-25.5)	49.2 (47.0-51.5)	0.48 (0.45-0.50)	
	50-59	36.1 (34.6-37.7)	45.2 (42.9-47.5)	27.4 (25.4-29.4)	1.65 (1.62-1.69)	
	>60	17.3 (16.1-18.5)	27.6 (25.6-29.7)	7.3 (6.2-8.6)	3.76 (3.45-4.10)	
High risk (> 20%)	**All**	**4.8 (4.6-5.0)**	**2.3 (2.1-2.5)**	**9.6 (9.1-10.1)**	**0.24 (0.23-0.25)**	<0.001*
	18-29	0	0	0	-	<0.001†
	30-39	0.9 (0.5-1.4)	0.2 (0.0-1.3)	1.2 (0.7-2.0)	0.15 (0.04-0.63)	
	40-49	14.8 (13.2-16.5)	9.5 (7.4-12.3)	17.3 (15.2-19.5)	0.55 (0.49-0.63)	
	50-59	45.7 (43.4-48.1)	47.6 (43.4-51.7)	44.8 (42.0-47.7)	1.06 (1.04-1.09)	
	>60	38.7 (36.4-41.0)	42.7 (38.6-46.9)	36.7 (34.0-39.5)	1.16 (1.14-1.19)	

*: p value for comparison between males and females
†: p value for comparison between males and females of the age profiles

The mean Framingham score for all the employees was 5.5% and this was significantly lower in females compared with males (females = 4.2%; males = 8.2%) (Risk Ratio = 0.48 (95% CI

0.48-0.49) p < 0.001) (Table 4). The Framingham risk score also increased significantly with age in males compared to females (p < 0.001).

Framingham risk category (based on 10-year absolute CVD risk as a %)
The prevalence (% participants) and prevalence ratio (F:M) in each Framingham risk category in the study population (all employees and by sex and age groups) is shown in Table 5.

The main observation was that 85%, 10.2% and 4.8% of the employees were in the low risk (<10%), intermediate risk (10-20%) and high-risk CVD (>20%) Framingham risk categories, respectively. Female were less likely to be in the intermediate (PR = 0.48; 0.48- 0.49) and high risk category (PR = 0.24, 0.23-0.25) and more likely to be in the low risk category (1.20, 1.20-1.21) (p< 0.001). In all risk categories the PR (female:male) significantly increased from the youngest age group (18-29 years) to the oldest age group (>60 years) and was >1 (more females vs. males) in the older age categories > 50 years (p<0.001).

DISCUSSION

The first finding was that the most prevalent NCD risk factor in a large sample of financial sector employees was inadequate fruit and vegetable intake (89.3%), followed by insufficient physical activity (77.4%), being overweight (66.8%) and central obesity (37.4%). This is comparable with results from a cross-sectional study of 68 South African companies of a private health insurer, which observed high rates of insufficient physical activity (67%) and overweight or obesity (62%).[21] A pilot study of 1 954 employees in nine different corporate sectors (Engineering, Consulting, Transport, Finance, Logistics, Information Technology, Manufacturing and Academic) reported a similar prevalence of inadequate fruit and vegetable intake (86%), insufficient physical activity (69%) but a lower prevalence of being overweight (48.6%).[9] In one study conducted in a large financial sector company in South Africa, a comparable high prevalence of overweight or obesity (65.5%), but with lower insufficient physical activity (55.4%) was reported.[10] Our study is unique in that we recruited a large sample size from many financial sector companies in South Africa, this may explain differences in the prevalence of physical inactivity and overweight and obesity between these studies. Overall, these findings suggest that South African financial sector employees have a high prevalence of modifiable risk factors for NCDs. Based on results, two main risk factors (inadequate fruit and vegetable intake and insufficient physical activity) should specifically be targeted through intervention programmes.

A second finding is that females have a higher prevalence ratio of central obesity (2.3 times), insufficient physical activity (1.2 times), hypercholesterolemia (1.2 times) and overweight (1.1 times) compared to males. The prevalence of hypertension and smoking was significantly higher in males. This concurs with results from other studies in the SA financial and health insurance sectors, which reported that hypertension and smoking was more prevalent in males while being obese [10] and insufficient physical activity were more prevalent in females. [9,10] A study conducted in 51 mainly LMIC countries, including South Africa, showed a relatively similar higher female:male prevalence ratio of insufficient physical activity (1.3 times) but a significantly lower overall insufficient physical activity of 17.7% compared to 77.4% in our study[21]. The differences between private health insurance financial sector employees and general population adults in LMIC may be due to the occupational differences and socioeconomic status. These results highlight the need for sex-specific interventions when addressing NCD risk factors in the workplace.

The third finding is that the age group 50-59 years has the highest prevalence of NCD risk factors compared to the 18-29, 30-39 and 40-49 age groups. Hypertension, hypercholesterolaemia, diabetes mellitus, insufficient physical activity, overweight and central obesity progressively increased with age in both males and females. Long working hours are associated with decreased opportunity for physical activity and job stress is associated with unhealthy eating. These work-related factors contribute to the increase in NCD risk factors amongst older employees. [23] A South African financial study reported that older individuals were more overweight, and had a higher prevalence of hypercholesterolaemia and diabetes mellitus. [10] However, these results were based on data collected on males and females divided into two age categories (≤44 years and ≥ 45 years). Positive behavioural lifestyle changes, such as physical activity, can reduce the risk for disability among older adults despite having led sedentary lifestyle. [24] Any lifestyle intervention program should specifically target older employees.

Our fourth finding showed that 19.3% of employees had 5 or more risk factors (highest risk category), 49.6% had 3 to 4 risk factors (moderate risk category) and 31.1% had 0-2 risk factors (low risk category). This is higher than previously reported (7.3% of employees in the high-risk category) in 8132 financial sector employees in one financial institution in South Africa. [10] A study in India among financial sector of 340 employees, showed that 35.7% had 3 or more risk factors compared to the 68.9% of employees in our study. [25]. The results from our study confirm the high burden of NCD risk factors in South African financial sector employees compared with India. It is well established that employees with 2 or more risk factors have more doctor visits and accrue higher healthcare expenses than employees with less than 2 risk factors. [21] Therefore, interventions targeted at employees with multiple lifestyle risk factors could have a greater impact in preventing the burden of NCDs and decreasing absenteeism.

The fifth finding revealed that although the average 10-year risk for CVD (Framingham score) was low (5.53%) it significantly increased with age >50 years, particularly in males (overall RR = 0.48; 0.48 -0.49 in females compared to males). The average 10-year risk for CVD in the general SA population is reported at 8.8% but this was calculated for a relatively small sample (1 025 participants) between ages 25-74 years. [25] Furthermore the mean age of the sample was not reported making comparisons difficult however the relatively young sample (38.1 ±10.0 years) of the current study may explain the lower Framingham score reported but individuals older than 50 years are associated with a greater the risk for CVD, [27] reiterating the need for lifestyle intervention programs specifically designed for older employees.

Lastly, there were significantly more males in the intermediate and high Framingham risk categories compared with females. In all risk categories, the prevalence significantly increased with age and was highest in females in the older groups (> 50 years). A study of 340 financial sector employees in Western Maharashtra, India reported identically that females were less likely to be in the intermediate (0.48) and high-risk Framingham risk (0.24) category to this study with highest in employees 50 years or more [28]. A study in the SA general population reported similar sex differences but higher prevalence of high CVD risk (>20%) in males (17.4%) and females (8.4%) [26]. This confirms that a targeted health intervention needs to be sex-specific and focus on older adults within the workplace.

STRENGTH AND LIMITATIONS

A first strength of our study is the large sample size of SA financial sectors employees. Secondly, data were collected by health professionals using standardised and valid measurements. This study has some limitations. Firstly, the employees voluntarily participated

in the HRA conducted at the worksite therefore potential selection bias may have occurred whereby the employees living a healthy lifestyle may have decided to complete a HRA. Secondly, some of the smoking information was missing, which required imputation. Such biases are overcome using methods such as multiple imputation that allow individuals with incomplete data to be included in analyses. Multiple imputation is widely recognised as the standard method to deal with missing data to allow individuals with incomplete data to be included in analysis. [28] Thirdly, for this study we did not collect data about the employee's socioeconomic status (level of education, occupation, and income). Obtaining this data may have provide an opportunity to determine that association between the different socioeconomic statuses and risk factors for NCD. Fourthly, this is a descriptive cross-sectional study and causality cannot be inferred. A longitudinal study of the HRA would be beneficial as it would provide insights into trends and patterns of unhealthy behaviours over time.

CONCLUSION

This study shows that South African financial sector employees are a population at risk for developing NCDs. The most frequent NCD risk factors in this population are inadequate fruit and vegetable intake, insufficient physical activity, and being overweight, obese or centrally obese and the NCD risk factor profile varied by sex and age group. From these results we recommend the following: a) there is a need for workplace interventions to detect, prevent, and manage NCDs risk factors in financial sector employees to improve the health profile of these employees, b) interventions should be sex-specific, c) interventions should specifically target older age groups, and d) continued repeated risk screening using annual HRAs, in conjunction with additional educational and workplace interventions. Currently, such annual screening and intervention programs are implemented, but future research should be conducted to determine whether HRA participation over multiple years reduce the prevalence of NCDs among SA financial sector employees.

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