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Full Length Article

The relationship between cardiovascular risk factors and knowledge of cardiovascular disease in African men in the North-West Province

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ABSTRACT

Background: South Africa has an established high prevalence of cardiovascular disease (CVD), particularly amongst urban African communities. However, it was unknown whether African men's CVD knowledge was associated with their CV health profiles.

Objective: To investigate the possible relationships between CV risk factors and CVD knowledge in a group of African men.

Method: Questionnaires were completed by 118 African men from the North-West Province, South Africa, and health screening, including anthropometry, blood pressure, fasting blood sugar and cholesterol measurements, were done.

Results: The mean CVD knowledge score was 75%. Participants' mean BP was 146/92 mmHg, falling within hypertensive ranges. Their mean fasting blood glucose of 5.8 ± 2.0 mmol/L exceeded the normal cut-off value of 5.6 mmol/L. There was a lack of association between CV risk factors and CVD knowledge, except for a borderline significant association between triglycerides and CVD knowledge ($r = 0.167$; $p = 0.071$), implying that men with higher CVD knowledge had higher levels of triglycerides.

Conclusion: Despite African men's high CV risk and a relatively good understanding of CVD risk factors, there was no significant correlation between their CV risk factors and CVD knowledge.

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1. Introduction

Cardiovascular disease (CVD) is a major health problem and a leading cause of mortality, morbidity and economic burden (World Health Organization, 2009). Worldwide the primary risk factors (hypertension, obesity, physical inactivity, poor diet, alcohol and smoking) are increasing as a result of urbanization (Mendis, Puska, & Norving, 2011). The African Union has identified hypertension as one of the continent's biggest health challenges after HIV/AIDS (UNAIDS, 2011). As with HIV, South Africa also has one of the highest rates of hypertension in the world (Lloyd-Sherlock, 2014). A recent paper published on hypertension in adults from low- and middle-income countries found that 78% of South African adults older than 50 years, were suffering from hypertension (Lloyd-Sherlock, Beard, Minicuci, Ebrahim, & Chatterji, 2014).

1.1. *Background*

Although several studies addressed the high prevalence of cardiovascular (CV) risk factors in Sub-Saharan Africa (SSA) (Seedat, 2009; Sliwa et al., 2008; Tibazarwa et al., 2009; Twagirumukiza et al., 2011), studies investigating relationships between CV risk factors and knowledge of CVD are limited. CVD will continue to be a health threat unless the CV risk factors at population level are identified and actions implemented to reduce their impact (Bergman, Reeve, Moser, Scholl, & Klein, 2011). It is therefore important for individuals to be able to identify their own risks and susceptibility by having acquired knowledge (Deaton et al., 2011).

1.2. *Problem statement*

The prevalence of CVD is high among African men (Seedat, 2009). Early detection and prevention of risk factors can help to reduce the impact of CVD (DoH, 2013, pp. 1–79). People require knowledge to identify and address CVD risk factors. As it was unknown whether CVD knowledge enabled African men to prevent CV risk factors, this study endeavored to investigate a relationship between African men's CV risk factors and CVD knowledge.

1.3. *Purpose, objective and hypotheses of the study*

The overarching purpose of this study was to investigate the relationship between CV risk factors and knowledge of CVD in a group of African men. The first objective was to describe the CV risk profile of the group according to the risk score system developed by the European Society of Cardiology (ESC) and the European Society of Hypertension (ESH) (Mancia et al., 2013, p. 1288). The second objective was to describe the demographic information and the level of CVD knowledge of this selected target group by using a General Health Questionnaire (GHQ) and a validated Heart Disease Knowledge Questionnaire constructed by Bergman and colleagues at the National Institutes of Health (Bergman et al., 2011, p. 20). The third objective was to determine whether relationships exist between the CV risk profile and CVD knowledge.

In light of the above stated objectives, the following hypotheses were formulated as statements of the expected relationship between the variables in the study:

(H0). There is no statistically significant relationship between CV risk factors and CVD knowledge of African men in the North-West Province.

(H1). There is a statistically significant relationship between CV risk factors and CVD knowledge of African men in the North-West Province.

1.4. *Delimitation of the study*

Although there might be a correlation between CV risk factors and CVD knowledge, numerous other factors (including behavior) could also influence this correlation. Behavior fell beyond the scope of the current study. This study focused only on a specific group of African men working at Vaalharts Waterscheme. CV risk factors can be affected by treatment, but adherence to treatment fell beyond the scope of the current study.

1.5. *Definition of key concepts*

1.5.1. *Cardiovascular disease*

Cardiovascular disease can be defined as the development of pathology that occur in the vascular system. CVD is associated with one or more characteristics of an individual that increases the likelihood of developing a disease (Kramer, Newton, & Sivarnjan Froelicher, 2008).

1.5.2. *CV risk factors*

CV risk factors are associated with an increased risk of developing cardiovascular disease. In general, CV risk factors include demographic characteristics, family history of CVD, smoking, physical inactivity, abnormal lipids and lipoproteins, obesity, hypertension and diabetes (Kramer et al., 2008).

1.5.3. *CVD knowledge*

Knowledge describes a familiarity, awareness or understanding of facts, information, or skills, which is acquired through experience or education, by perceiving or theoretically acquired by a person (Cavell, 2002). In the context of the study the term CVD knowledge refers to the information that an individual has about CVD, and the possible risk factors contributing to the development of CVD. CV risk factor knowledge are very important for making decisions about health (Bergman et al., 2011).

2. Research design and method

2.1. *Design and context*

The study followed a descriptive, correlational, quantitative design. Correlational statistical analyses were used to identify relationships between the CV risk factors and CVD knowledge in a group of African men in the North-West Province, South Africa.

The study formed part of a wellness screening project at the Vaaharts Waterscheme, focusing on African men known to have an increased risk for CVD (Opie & Seedat, 2005).

2.2. Population

This population for this study comprised of 118 African men, aged 19–65 years, working at the Vaalharts Water Scheme who could read and understand English. Convenience sampling took place, as the entire sample group of 118 African men participated voluntarily in the research project. The following participants were excluded for the purpose of the study: women, participants of mixed race and caucasians.

2.3. Data collection

Two questionnaires, namely a General Health Questionnaire (GHQ) and a Heart Disease Knowledge Questionnaire were used, to obtain relevant data on the CVD knowledge and relevant health information. Participants were also screened to determine their individual CV risk profile. The data were collected by a multidisciplinary team that included the research nurse, and students from the NWU's departments of nursing, cardiovascular physiology and biokinetics. Four student nurses were trained to administer the questionnaires and to record the participants responses on laptops.

2.3.1. General health questionnaire (GHQ)

Participants completed a standardized GHQ to obtain information on their socio-demography, lifestyle and health status (including medical history, medication usage, smoking status, alcohol consumption, and exercise).

2.3.2. Heart disease knowledge questionnaire

The heart disease knowledge questionnaire was originally developed and validated by Bergman and colleagues at the National Institutes of Health in Canada (Bergman et al., 2011, p. 86). The 30-item questionnaire was designed to measure heart disease knowledge as conceptualized across five domains namely diet, epidemiology, risk factors, medical knowledge and symptoms of CVD. Items were statements that were responded to with either True or False. Permission was granted by the authors of this validated questionnaire to pilot it among a South African population. Minor adjustments were made to the original version's terminology to fit the specific population context. In order to avoid translation errors, the questionnaires were completed with the assistance of nursing students. In this study the questionnaire was tested among a selected group to ensure content-related validity, as well as to establish the level of understanding, appropriateness of language and to establish whether the data collected will be appropriate, meaningful and correct. The questionnaire was critically evaluated by four colleagues and experts in the field to establish face validity. Minor adjustments were made to the original questionnaire.

2.3.3. Health screening measurements

Individual health screening was performed after the completion of the questionnaires. Anthropometric measures, namely height and weight, were measured with a Seca 813 scale and Seca 213 portable stadiometer (Seca, Hamburg, Germany). The waist circumferences of each participant were taken in triplicate with a flexible metallic measuring tape with participants standing upright, with the face directed towards the observer. The waist circumference was measured at the widest point (below the last rib). Body mass index (BMI) was determined with the formula: weight/height^2. Anthropometric measurements were conducted by a level II registered biokineticist according to ISAK guidelines (Marfell-Jones, Olds, Stewart, & Carter, 2006).

Before blood pressure was measured the participants were seated for a rest period of five minutes. Blood pressure and heart rate were taken in a sitting position on both arms, repeated after a minimum five minute rest with the validated Omron M10 device (Healthcare, Tokyo, Japan). The appropriate cuff sizes were used according to the circumference of the upper arm. ESH and ESC Guidelines were followed for blood pressure measurements (Mancia et al., 2013).

Participants had to fast for 4–6 h before blood testing took place. A blood sample was obtained via a finger-prick according to standard operating procedures. Rapid blood glucose (BG) and the total cholesterol (TC) profiles were measured in mmol/L. BG was measured using One Touch Select glucometer (Lifescan, Johnson & Johnson, USA) and the TC profile was measured with the Cardiochek P.A. (Polymer Technology Systems, Japan). Both measurements were performed with all participants seated in the same position. Both the One Touch Select glucometer and Cardiochek P.A. devices have been validated for screening use. Apparatus were sufficiently calibrated. All health information and individual results were interpreted and explained to the participants at the end of the screening process, with the provision of educational materials. In case of a participant being identified with any abnormalities (such as hypertension or hyperglycemia), they were referred to the local clinic, hospital or doctor.

2.4. Data analysis

The data were analyzed with Statistica version 12 (Statsoft, Tulsa, OK, USA). The information of the GHQ, heart disease knowledge questionnaire and health screening measurements were analyzed using frequencies and means. The heart disease knowledge questionnaire was analyzed using the Cronbach's α coefficient to evaluate internal reliability. The questionnaire was reduced from 30 items to 20 items to ensure an acceptable Cronbach's α of 0.64 (CA = 0.64). The 10 items that were excluded were indicated as invalid to accurately test knowledge (the chance of correctly guessing the answer was high) (see Table 3).

Scatterplots (not shown) were used to explore data to identify outliners and determine homoscedasticity. Pearson correlation coefficients were used to determine associations between CV risk factors and CVD knowledge. Statistical significance was evaluated at a threshold of 0.05. This analysis was firstly conducted within the total group of participants. Thereafter, the participant group was divided into tertiles according to knowledge scores of low (10-13/20), medium (14-16/20) and high (17-20/20) scores. Means and proportions were

Table 1 – Characteristics of cardiovascular risk factors of the study group.

	African men (N = 118)
Cardiovascular risk factors	
Age (years)	46.0 ± 12.0
Body mass index (kg/m²)	25.9 ± 5.9
Waist circumference (cm)	90.3 ± 16.0
Hypertensive[1], N (%)	90 (76)
Systolic blood pressure (mmHg)	145.6 ± 22.8*
Diastolic blood pressure (mmHg)	92.0 ± 13.9*
Total cholesterol (mmol/L)	3.8 ± 1.3
Triglycerides (mmol/L)	2.5 ± 1.7*
LDL-C (mmol/L)	1.9 ± 0.9
HDL-C (mmol/L)	1.2 ± 0.6
Blood glucose (mmol/L)	5.8 ± 2.0*
Medication use	
Anti-Hypertensive treatment, N (%)	16 (13.6)
Glucose lowering drugs, N (%)	2 (1.7)
Lifestyle factors	
Alcohol (self-reported), N (%)	41 (34.7)
Smoking (self-reported), N (%)	40 (33.9)
Socio-economic status indicators	
Highest level of education	
None, N (%)	19 (16.1)
Primary school, N (%)	64 (54.2)
High school, N (%)	32 (27.1)
Tertiary education, N (%)	3 (2.5)
Total income per month	
<R1000, N (%)	2 (1.7)
R1000–R5000, N (%)	35 (29.7)
>R5000, N (%)	81 (68.6)

Values are number (N) of participants (%); arithmetic mean ± SD. Abbreviation: LDL-C, Low density lipoprotein cholesterol; HDL-C, High density lipoprotein cholesterol. Values indicated with * are above normal cut-off ranges according to ESH/ESC Guidelines. Participants were classified as hypertensive[1], according to ESH/ESC Guidelines (SBP ≥ 140 mmHg and/or DBP ≥90 mmHg).

compared between the low and high CVD knowledge scoring groups using independent t-tests and Chi-square tests, respectively.

3. Ethical considerations

The study was approved by the Health Research Ethics Committee of the North-West University (Potchefstroom Campus). This study complied with the guidelines stipulated in the Declaration of Helsinki: Ethical principles for medical research involving human participants (Williams, 2013). The participants were informed that participation was voluntary and that withdrawal from the study was possible at any time. Informed consent was signed after all procedures had been explained to them. Interpreters were available to relay the information in the participant's home language. The voluntary nature of participation was emphasized, as this study formed part of a wellness screening project instituted by the employer. The participants consented to having their results used for research purposes. All participants with identified risk factors received health education and were referred to their health clinics or medical practitioners when further management was required.

4. Findings

4.1. *Characteristics of study participants (including cardiovascular risk factors)*

Participants' ages ranged from 19 to 65 years, with a mean 46 years (Table 1). The findings of the study indicated that one third of the participant group is of a higher socio-economic class having completed high school and earning a monthly income of more than R5000 per month. One third of the participant group reported they are smokers and regularly consume alcohol. Only 16 participants indicated use of anti-hypertensive treatment and 2 participants were under treatment for diabetes.

The mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) of the group were respectively 145.6 ± 22.8 mmHg and 92.0 ± 13.9 mmHg. Both these values were within hypertensive ranges according to the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC) guidelines (SBP >140 mmHg and/or DBP > 90 mmHg) (Mancia et al., 2013, p. 1288). The men had a mean BMI of 25.9 ± 5.9 kg/m² (being the overweight value), and a normal mean waist circumference of 90.3 ± 16.0 cm according to the ESH/ESC guidelines for obesity (Mancia et al., 2013, p. 1288). Participants demonstrated an acceptable mean lipid profile (low LDL-C and high HDL-C), but their mean fasting blood glucose (BG) measurement of 5.8 ± 2.0 mmol/L was elevated above the normal value of 5.6 mmol/L (Mancia et al., 2013, p. 1288).

The group risk stratification indicated that one third of the participants fell within the moderate to high CV risk classification (Fig. 1). Only one out of four participants had a low CV risk profile. It should be kept in mind that the participant group consisted only of African men, which in itself is already considered a CV risk factor (Mancia et al., 2013).

4.2. *Cardiovascular disease knowledge*

The responses to the heart disease knowledge questionnaire are indicated in Table 2. The minimum score for the questionnaire was 10, maximum 19 with a mean of 15 and a standard deviation of 2.1. The total mean score for the heart disease knowledge questionnaire was 75.25%. This result indicated that African men had a relatively good knowledge of CVD (see Table 2).

4.3. *Relationship between cardiovascular risk factors and cardiovascular disease knowledge*

Overall, we observed weak/non-significant correlations between CV risk factors and CVD knowledge, as indicated in Table 4. The only correlation that indicated borderline significance was between CVD knowledge and triglyceride levels, but the r-value was weak ($r = 0.167$; $p = 0.071$). This was also evident when comparing participants triglyceride levels in the lowest tertile of CVD knowledge versus the highest tertile of CVD knowledge ($p = 0.13$) as indicated in Table 5.

Table 2 – Responses of the Heart Disease Knowledge Questionnaire used in this study.

Item	Question	Correct response	N = 118 (%)
I1	Polysaturated fats (olive oil) are healthier for the heart than saturated fats (fat on meat or chicken skin).	True	95 (80.5)
I4	Eating a lot of red meat increases heart disease risk.	True	103 (87.3)
I6	Trans-fats (food that is fried in oil) are healthier for the heart than most other kinds of fats.	False	74 (62.7)
I8	Walking and gardening are considered types of exercise that can lower heart disease risk.	True	113 (95.8)
I9	Most of the cholesterol (bad fat) in an egg is in the white part of the egg.	False	45 (38.1)
I11	Taking aspirin each day decreases the risk of getting heart disease.	True	41 (34.7)
I12	Dietary fiber e.g. whole grain bread lowers blood cholesterol.	True	116 (98.3)
I13	Heart disease (e.g. high blood, stroke) is a common cause of death in South Africa.	True	113 (95.8)
I14	The healthier exercise for the heart involves rapid breathing for a sustained period of time.	True	86 (72.9)
I15	Turning pale or gray is a symptom of having a heart attack.	True	85 (72.0)
I16	A healthy person's heart beat should return to normal within 15 min after exercise.	True	102 (86.4)
I19	HDL refers to "good" cholesterol (fats in the blood that is good for the body), and LDL refers to "bad" cholesterol (fats in the blood that is bad for the body).	True	82 (69.5)
I21	Feeling weak, lightheaded, or faint is a common symptom of having a heart attack.	True	103 (87.3)
I22	Taller people are more at risk for getting heart attack.	False	74 (62.7)
I23	High blood pressure is defined as 110/80 mmHg.	False	45 (38.1)
I25	Polyunsaturated fats come from plant sources such as corn, sunflower, and olive oil.	True	108 (91.5)
I26	People who have diabetes (high blood sugar) are at higher risk of getting heart disease.	True	109 (92.4)
I28	Eating a high fiber diet (e.g. brown bread, beans) increases the risk of getting heart disease.	False	94 (79.7)
I29	Heart disease is better defined as a short-term illness than a chronic, long term illness.	False	82 (69.5)
I30	Many vegetables are high in cholesterol (high in "bad" fat).	False	106 (89.8)
Total Score			**75.25%**

5. Discussion

The aim of the study was to investigate the relationship between CV factors and knowledge of CVD in a group of African men. Results indicated that despite these African men having an adverse CV risk profile and a relatively good knowledge of CVD risk factors, no relationship could be indicated. One third of the men in this study had two or more CV risk factors according the ESH guidelines. The findings indicated that these participants might know about CVD, nevertheless they may be unaware of their own susceptibility to CVD in relation to their risk factors.

The hypotheses were as follows: H0 – There is no significant relationship between CVD risk factors and CVD knowledge, H1 – There is a significant relationship between CVD risk factors and CVD knowledge. Thus, H1 is rejected. This finding is congruent with several studies (Crouch & Wilson,

Table 3 – Heart Disease Knowledge Questions not included in final analysis of this study.

Item	Question	Correct response	N = 118 (%)
I2	Women are less likely to get heart disease after menopause than before.	False	62 (52.5)
I3	Having had TB increases the risk of getting heart disease.	False	86 (72.9)
I5	Most people can tell whether or not they have high blood pressure.	False	71 (60.2)
I7	The most important cause of heart attacks is stress.	False	112 (94.9)
I10	Smokers are more likely to die of lung cancer than heart disease.	False	110 (93.2)
I17	Sudden trouble seeing in one eye is a common symptom of having a heart attack.	False	82 (69.5)
I18	Cardiopulmonary resuscitation (CPR) helps to clear clogged/blocked blood vessels.	False	102 (86.4)
I20	Arterial defibrillation (shock) is a procedure where hardened blood vessels are opened to increase blood flow.	False	102 (86.4)
I24	Most women are more likely to die from breast cancer than heart disease.	False	93 (78.8)
I27	Men and women experience many of the same symptoms of a heart attack.	True	74 (62.7)

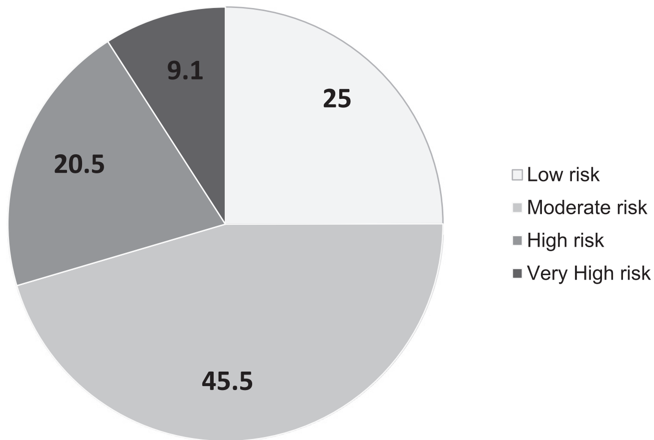

Fig. 1 – Cardiovascular risk stratification of participant group according to ESH/ESC Guidelines (Mancia et al., 2013, p. 1288).

2011; Homko et al., 2008; Metelska et al., 2011). There is limited evidence of studies that only investigated men's CV risk factors in relation to their knowledge of CVD. Findings from a similar study that investigated Australian rural women's knowledge of heart disease and the association with lifestyle behaviors, indicated that despite having a good knowledge of heart disease, over half of the participants reported having two or more lifestyle risk factors for heart disease (Crouch & Wilson, 2011). In a study conducted by Homko et al. (2008), amongst men and women with a low socio-economic status (rural and urban) in Pennsylvania (USA), it was clear that although women had a better CVD knowledge than men, both genders had high Framingham risk scores. No association was found between the perceived and actual CV risk, or between CVD knowledge and either perceived or actual CV risk factors (Homko et al., 2008).

Cardiovascular disease is largely caused by modifiable risk factors. Therefore, it can be referred to as a lifestyle disease, caused by changes in lifestyle, in particular dietary changes, increased in weight and obesity, tobacco and alcohol consumption (Alberts et al., 2005). The above mentioned modifiable risk factors are common in the African population with increased risk of CVD, especially hypertension (Alberts et al., 2005; Tibazarwa et al., 2009; van Rooyen et al., 2002). Unlike our findings, the CARDIA study conducted in an African–American population, indicated that knowledge of CVD risk factors was very low in young adults (Lynch, Liu, Kiefe, & Greenland, 2006). African–Americans had higher CV risk factors and lower CVD knowledge than their white counterparts (Lynch et al., 2006). Race and education were predictors of knowledge in this multi-ethnic study, but the levels of CVD knowledge across all groups were low. In the study it was found that lower education levels and men of African–American ethnicity were associated with a higher CVD risk burden (Lynch et al., 2006).

Table 4 – Pearson correlation coefficients for the relationship between cardiovascular disease knowledge and cardiovascular risk factors (N = 118).

Cardiovascular risk factors	r	p
Age (years)	−0.092	0.320
Body mass index (kg/m^2)	0.040	0.660
Waist circumference (cm)	0.037	0.626
Systolic blood pressure (mmHg)	0.075	0.421
Diastolic blood pressure (mmHg)	0.036	0.700
Total cholesterol (mmol/L)	0.080	0.388
Triglycerides (mmol/L)	0.167	0.071
LDL-C (mmol/L)	0.024	0.825
HDL-C (mmol/L)	0.070	0.453
Blood glucose (mmol/L)	−0.003	0.970

$P \leq 0.05$ regarded as statistical significant.
Abbreviation: LDL-C, Low density lipoprotein cholesterol; HDL-C, High density lipoprotein cholesterol.

Based on this study in the North-West Province, we could speculate on two possible explanations for the lack of association between CV risk factors and CVD knowledge. Only a small sample of African men were included, which may mask a general correlation existing in the greater population. Another explanation may also be that knowledge does not necessarily associate with positive health behaviors, as expected. This might indicate that these men have a good CVD knowledge, but they are unaware of their own susceptibility to CVD in relation to their lifestyle habits (Rosenstock, 1990, p. 42). It is evident that knowledge may not be enough to prevent CVD as this participant group showed relative good CVD knowledge, but had a high prevalence of CVD risk factors. Further research is required to investigate other contributing factors that may influence CV risk, other than knowledge. One example is health behavior. Many smokers do not realize the serious health implications of smoking. The lack of association between CV risk factors and overall CVD knowledge score may indicate that despite having an overall good knowledge of CVD, there may be a lack of health-promoting behaviors. Without awareness of personal susceptibility and self-efficacy, men might be less likely to modify their lifestyle and reduce the risk of CVD.

6. Strengths and limitations of the study

There are limitations to this study that should be recognized. Participants were limited to a relatively small sample of African men working at one institution, therefore generalizations to the wider population cannot be made. A larger population sample using random selection may rather be followed to allow generalization to the wider population. The participants self-reported on their smoking and alcohol intake that may have affected the reliability of the data. We used rapid tests to assess glucose and lipid levels, which may have resulted in either over- or underestimation of true levels. However, both the One Touch Select glucometer and Cardiochek P.A. devices have been validated for screening use. We tested only CVD knowledge, but additional components such as own perception and own susceptibility to CVD, and beliefs relating to prevention or self-care of disease, were not tested, which could have led to a better understanding of the findings. The strength of this study is the homogeneity of the sample group similar social-economic standing.

Table 5 – Comparison of CV risk factors between participants with high and low CVD knowledge scores.

	CVD knowledge low score (10–13/20) (n = 29)	CVD knowledge high score (17–20/20) (n = 26)	p-value
Cardiovascular risk factors			
Age (years)	48.7 ± 12.3	45.8 ± 13.8	0.42
Body mass index (kg/m^2)	26.8 ± 5.8	27.7 ± 6.4	0.58
Waist circumference (cm)	93.0 ± 16.4	94.9 ± 16.9	0.67
Systolic blood pressure (mmHg)	143.6 ± 22.8	147.8 ± 23.9	0.52
Diastolic blood pressure (mmHg)	90.4 ± 10.9	91.2 ± 14.72	0.82
Hypertensive[1], N (%)	16 (57.14)	16 (61.54)	0.91
Total cholesterol (mmol/L)	3.8 ± 1.2	4.0 ± 1.5	0.56
Triglycerides (mmol/L)	2.1 ± 1.4	2.7 ± 1.5	0.13
LDL-C (mmol/L)	2.1 ± 0.7	2.3 ± 1.2	0.60
HDL-C (mmol/L)	1.0 ± 0.4	1.1 ± 0.5	0.53
Blood glucose (mmol/L)	6.0 ± 2.3	6.1 ± 2.4	0.92
Medication use			
Anti-hypertensive treatment, N (%)	5 (17.2)	6 (19.2)	0.38
Lifestyle factors			
Alcohol (self-reported), N (%)	10 (34.5)	6 (23.1)	0.33
Smoking (self-reported), N (%)	13 (34.5)	7 (26.9)	0.33
Socio-economic status indicators			
Highest level of education			
None, N (%)	5 (17.2)	4 (15.4)	0.83
Primary school, N (%)	18 (62.1)	12 (46.2)	
High school, N (%)	5 (17.2)	9 (34.62)	
Tertiary education, N (%)	1 (3.5)	1 (3.9)	
Total income per month			
<R1000, N (%)	1 (3.5)	1 (3.9)	0.13
R1000–R5000, N (%)	6 (20.7)	5 (19.2)	
>R5000, N (%)	22 (75.9)	22 (76.9)	

Values are number (N) of participants (%); data are expressed as arithmetic mean ± SD; $P \leq 0.05$ regarded as statistically significant.
Abbreviation: LDL-C, Low density lipoprotein cholesterol; HDL-C, High density lipoprotein cholesterol.

7. Recommendations

Based on the findings of the study the following recommendations are made for nursing practice, education and research.

7.1. *Nursing practice*

The present study indicates that considerable work is required in the area of CVD primary prevention and control. We make several recommendations for primary health care (PHC) practice and future research. Health promotion programs should focus on providing health information and education that initiate primary prevention. Further research is needed to determine whether the results of the current study can be generalized to other population samples and to explore the impact of ethnicity, gender, educational levels on CVD knowledge. Lastly, a validated CVD knowledge questionnaire should be used to evaluate knowledge among a wider range of population groups, particularly in the South African context. The relationship between knowledge, risk perception, self-efficacy, and behavior change also needs further investigation.

7.2. *Nursing education*

Innovative educational strategies are needed to increase knowledge of CV risk factors to create risk awareness and self-efficacy among individuals. Providing health education may not be adequate to control and prevent CVD. Generally, nurses are responsible for the counseling of patients in primary healthcare clinics about behavior changes, namely smoking, harmful drinking, physical activity and an unhealthy diet. By giving patients the correct information on the prevention of CV risk factors and health behavior counseling, much can be done to prevent and control NCDs. Therefore, it is important that nurses get the relevant training to support health promotion and risky behaviors.

7.3. *Nursing research*

It is recommended that future research develops and validates a standardized CVD knowledge instrument better suited to the South African population. This information can assist in the design of effective health intervention programmes. It can also serve as education material to address individuals' specific gaps in CVD knowledge. The relationship between knowledge, risk perception, self-efficacy, and behavior change also needs further investigation.

8. Conclusion

Despite African men having an increased CV risk profile and a relatively good knowledge of CVD risk factors, there seems to be a disconnect between their CVD knowledge and CV risk.

Furthermore, in this group of African men this knowledge did not influence changes in their risk factor levels. The results suggest that a good CVD knowledge may not be sufficient to change their own CV risk factor levels. This impact can be controlled effectively if patients are aware of their conditions and take precautionary measures (DoH, 2013, pp. 1–79). Before prevention programs and policies can be developed, the gap between CV risk factors and CVD knowledge has to be determined (Bergman et al., 2011).

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