A risk-factor profile for chronic lifestyle diseases in three rural Free State towns

[a] **van Zyl S,** MBChB, MFamMed [a] **van der Merwe LJ,** MBChB, MSc(Surg), DA(SA) [b] **Walsh CM,** PhD
[c] **van Rooyen FC,** MComm [d] **van Wyk HJ,** MBChB, MMed(Clin Pathol) [d] **Groenewald AJ,** PhD
[a] Department of Basic Medical Sciences, Faculty of Health Sciences, University of the Free State, Bloemfontein, South Africa [b] Department of Nutrition and Dietetics, Faculty of Health Sciences, University of the Free State, Bloemfontein, South Africa [c] Department of Biostatistics, Faculty of Health Sciences, University of the Free State, Bloemfontein, South Africa
[d] Department of Chemical Pathology, Faculty of Health Sciences, University of the Free State, Bloemfontein, South Africa
Correspondence to: Dr Sanet van Zyl, e-mail address: gnfssvz.md@ufs.ac.za
Keywords: risk; lifestyle; chronic diseases

Abstract

SA Fam Pract 2010;52(1):72-76

Background: Chronic diseases of lifestyle account for millions of deaths each year globally. These diseases share similar modifiable risk factors, including hypertension, tobacco smoking, diabetes, obesity, hyperlipidaemia and physical inactivity. In South Africa the burden of noncommunicable disease risk factors is high. To reduce or control as many lifestyle risk factors as possible in a population, the distinct risk-factor profile for that specific community must be identified. Therefore, the aim of this study was to assess the health status in three rural Free State communities and to identify a distinct risk-factor profile for chronic lifestyle diseases in these communities.

Methods: This study forms part of the baseline phase of the Assuring Health for All in the Free State project, which is a prospective and longitudinal epidemiological study aimed at determining how living in a rural area can either protect or predispose one to developing chronic lifestyle diseases. The communities of three black and coloured, rural Free State areas, namely Trompsburg, Philippolis and Springfontein, were evaluated. The study population consisted of 499 households, and 658 individuals (including children) participated in the study. Only results of adult participants between 25 and 64 years will be reported in this article. The study group consisted of 29.4% male and 70.6% female participants, with a mean age of 49 years. During interviews with trained researchers, household socio-demographic questionnaires, as well as individual questionnaires evaluating diet, risk factors (history of hypertension and/or diabetes) and habits (tobacco smoking and physical activity levels), were completed. All participants underwent anthropometric evaluation, medical examination and blood sampling to determine fasting blood glucose levels.

Results: Multiple risk factors for noncommunicable diseases were identified in this study population, including high blood pressure, tobacco smoking, high body mass index (BMI), diabetes and physical inactivity. The reported risk-factor profile was ranked. Increased waist circumference was ranked highest, high blood pressure second, tobacco smoking third, physical inactivity fourth and diabetes fifth. The cumulative risk-factor profile revealed that 35.6 and 21% of this study population had two and three risk factors, respectively.

Conclusions: The study demonstrated a high prevalence of risk factors for noncommunicable diseases, e.g. large waist circumference, high BMI, raised blood pressure, tobacco smoking and raised blood glucose levels. Serious consideration should be given to this escalating burden of lifestyle diseases in the study population. The development and implementation of relevant health promotion and intervention programmes that will improve the general health and reduce the risk for noncommunicable diseases in this population are advised.

Ⓟ **Peer reviewed. (Submitted: 2009-03-05, Accepted: 2009-08-31).**

Introduction

Chronic diseases of lifestyle, also called noncommunicable diseases, are a group of diseases accounting for millions of deaths globally each year. National cause-of-death statistics released by Statistics South Africa in 2005 revealed that 20% of deaths in the 35- to 64-year age group were a result of chronic diseases of lifestyle.[1] Chronic lifestyle diseases share similar modifiable risk factors, which include hypertension, tobacco smoking, diabetes, obesity, hyperlipidaemia and physical inactivity. In South Africa the burden for noncommunicable disease risk factors is high. In a comparative risk-assessment study conducted in South Africa in which deaths due to selected risk factors were ranked by Norman et al,[2] high blood pressure was ranked second, tobacco smoking third, alcohol harm fourth, high body mass index (BMI) fifth, high cholesterol seventh, diabetes eighth and physical inactivity ninth.

Nearly one in three adults in the USA has hypertension.[3] High blood pressure (BP) remains the most important risk factor for stroke.[4] Stroke accounted for about one in every sixteen deaths in the USA in 2004.[5] In a South African study conducted by Connner et al in 2005,[6] the overall hypertension prevalence rate in a study population of 9 731 people in the age group 30 years and older was 55%. The overall hypertension prevalence rate in black African and coloured people was 59 and 55%, respectively. In this study,[6] hypertension was defined as a current BP ≥ 140/90 mmHg or having a history of hypertension.

A clear and well-documented association exists between obesity and hypertension. Obesity is not only associated with an increased risk of developing hypertension but also with an increased risk of developing other noncommunicable diseases, for example coronary heart disease, diabetes and stroke. The World Health Organization (WHO) estimates that

by 2015 the number of overweight people worldwide will increase to 2.3 billion, while more than 700 million will be obese.[7] The prevalence of overweight and obesity in South Africa is very high. Studies indicate that 56% of women and 29% of men have a BMI $\geq$ 25 kg/m^2.[8]

Information from the Centers for Disease Control (CDC) Health Effects of Cigarette Smoking Fact Sheet, published in 2004, indicated that cigarette smoking approximately doubles a person's risk for stroke. Smoking tobacco caused about 4.8 million of adult deaths worldwide in 2000.[9] A study conducted by Groenewald et al[10] showed that tobacco smoking in South Africa accounted for 12-15% of deaths in adults over the age of 35 years in 2000.

The WHO has projected the increase in people with diabetes to be 366 million by 2030.[11] The South African diabetes age standardised mortality rate of about 50 per 100 000 population is the twenty-fifth highest in the world.[12] A world health survey, conducted by the WHO in 2003, investigating the physical activity levels of adult South Africans, found that less than one-third of South Africans met the American College of Sport Medicine and Centers for Disease Control and Prevention recommendation for health-enhancing physical activity. Forty-six per cent of all South African adults were reported to be inactive (< 600 metabolic equivalent value minutes per week [MET min/wk]).[13]

In order to reduce or control as many lifestyle risk factors as possible in a population, it is important to identify the distinct risk-factor profile for that specific community. When a risk factor is identified, for example high blood pressure, the implementation of specific intervention programmes, such as adjustable dietary factors, can aid in achieving lower blood pressure.[14] By controlling high blood pressure the risk for cardiovascular disease can be reduced significantly. In 1979, CORIS, a community-based cardiovascular risk-factor intervention project, was launched in three districts in the south-western Cape. It successfully showed that community-based intervention reduces cardiovascular risk.[15]

The Assuring Health for All in the Free State (AHA FS) study is a research project aimed at determining how living in urban informal settlements and in rural Free State areas influences the lifestyles of populations that predispose them to both chronic diseases (such as obesity, diabetes and cardiovascular disease) and undernutrition. After identifying the relevant risk factors in the given populations, the aim of the study is to work with health care providers in the urban informal and rural areas to reduce and help control as many of the identified risk factors as possible, and thereby contributing to achieve an increase in the overall health of the study populations. The first leg of the study commenced in March 2007 in three rural Free State areas, namely Trompsburg, Philippolis and Springfontein.

Methods

This study forms part of the baseline phase of AHA FS, a prospective and longitudinal epidemiological study. Three rural areas, Trompsburg, Philippolis and Springfontein, were evaluated. Ten fieldworkers were appointed per town and trained in each community to visit all households in the black and coloured townships to explain the purpose of the study. The study group consisted of men and women between the ages of 25 and 64 years. The study protocol was approved by the Ethics Committee of the Faculty of Health Sciences, University of the Free State, and written informed consent was obtained from all participants.

Interviews with participants to complete household socio-demographic questionnaires as well as individual health questionnaires evaluating diet, risk factors (including a history of hypertension and diabetes) and habits, for example tobacco smoking and physical activity levels, were conducted by trained students from the Department of Nutrition and Dietetics at the University of the Free State, under the supervision of lecturers. Where necessary, Sotho, Tswana and Xhosa interpreters assisted. Ten per cent of all interviews were repeated to ensure reliability. Anthropometric evaluation was done on all the participants, whose weight and height were measured after an overnight fast, in an examination gown and without shoes. A Seca® (Germany) digital electronic foot scale was used for weight readings. The anthropometric indices computed were as follows: BMI as weight in kilograms divided by height in meters squared (kg/m^2), where underweight was defined as BMI < 18.5 kg/m^2, overweight as BMI 25–29.9 kg/m^2 and obesity as BMI $\geq$ 30 kg/m^2. The cut-off point for central obesity was a waist circumference of 102 cm for men and 88 cm for women.[16]

Participants underwent a medical examination as well as blood sampling. Blood specimens for the measurement of fasting venous plasma glucose (FVPG) were drawn into fluoride tubes. Samples were centrifuged within four hours and FVPG was measured immediately, using the glucose oxidase method, on a Beckman LX20® auto-analyser (Beckman Coulter, Fullerton, CA). Blood pressure was measured in the supine position with a DS-175, auto-inflate digital electronic blood pressure monitor. Hypertension was defined as a systolic blood pressure of 140 mmHg or higher and a diastolic pressure of 90 mmHg or higher. Fasting blood samples were measured for glucose. Urgent medical conditions were referred on the day of medical examination. All data forms and blood sample results were reviewed for referral. Referral letters were delivered to community workers for distribution. Patients were referred to local clinics, local health care providers and health care centres.

During the process of completion of the individual physical activity questionnaires in interviews with each of the participants, they were asked to recall all physical activities they had performed during the previous day. Using this information the researchers calculated the physical activity level (PAL) for each participant. These levels were classified as follows: sedentary 1–1.39 PAL; low activity 1.4–1.59 PAL; active 1.6–1.89 PAL and very active 1.9–2.5 PAL.[17]

Data were analysed descriptively, including frequencies, percentages and relative risk, by the Department of Biostatistics, Faculty of Health Sciences, University of the Free State.

Results

A total of 499 households were included in the study. The total study population consisted of 658 individuals, although only results of adult participants between 25 and 64 years are reported and discussed in this article. The mean age of this study group was 49 years.

Individual health questionnaires

Results obtained by means of the individual health questionnaires are shown in Table I. This questionnaire was used to determine the participants' history of smoking, hypertension, diabetes and PAL.

Table I: Results of reported risk factors determined by individual health questionnaires

Reported risk factors	Number of participants	Frequency	Percentage
Current tobacco smoking	546	214	39.2
Hypertension diagnosis	547	345	63.1
Diabetes diagnosis	546	59	10.8
Physical inactivity (PAL 1 [sedentary] and PAL 2 [low activity])	559	152	27.2

Anthropometric measurements

Findings on waist circumference measurements and BMI calculations are shown in Table II. In more than half of the participants measurements exceeding the healthy cut-off point values were found.

Table II: Anthropometric data (waist circumference and BMI) of participants

Variable	Number of participants	Frequency	Percentage	Gender percentage
Waist circumference	**545**			
Women (> 88 cm)	382	213	55.8	
Men (> 102 cm)	163	14	8.6	
Body mass index (BMI)	**553**			
25–29.9 kg/m² (overweight)		**112**	**37.6**	
Women		87		22.3
Men		25		15.3
≥ 30 kg/m² (obese)		**182**	**51.2**	
Women		169		43.3
Men		13		7.98

Blood pressure results

Medical examinations were carried out on 563 adult participants. The mean age was 49 years, and 29.4% of the participants were male. Forty-six (8.2%) participants were diagnosed with possible early hypertension. Three out of five women with clinical signs of pregnancy on abdominal examination were diagnosed with hypertension during pregnancy. Table III summarises the blood pressure profile of participants categorised according to gender, history of hypertension and antihypertensive treatment.

Table III: Blood pressure results of participants

	SBP ≥ 140 mmHg and DBP ≥ 90 mmHg or SBP < 140 mmHg and DBP ≥ 90 mmHg	SBP ≥ 140 mmHg and DBP < 90 mmHg	SBP < 140 mmHg and DBP < 90 mmHg
Gender			
Male (n = 166)	86 (51.8%)	26 (15.7%)	54 (32.5%)
Female (n = 397)	210 (52.9%)	60 (15.1%)	127 (32.0%)
Participants with a history of hypertension (n = 342)	226 (66.0%)	52 (15.2%)	64 (18.7%)
Participants on antihypertensive treatment (n = 290)	188 (64.8%)	44 (15.2%)	58 (20.0%)

Table IV: Blood glucose results of participants[18]

Gender	Blood glucose level			
	3.1–6.0 mmol/L n (%)	6.1–6.9 mmol/L n (%)	≥ 7.0–10.9 mmol/L n (%)	≥ 11.0 mmol/L n (%)
Male (n = 161)	14 (90.1)	8 (5.0)	6 (3.7)	2 (1.2)
Female (n = 385)	324 (84.2)	26 (6.7)	16 (4.2)	19 (4.9)

Table V: Ranked risk-factor profile for noncommunicable diseases in the study population

Rank	Risk factor	Number of participants	Frequency	Percentage
1	**Anthropometric data**			
	Increased waist circumference	545	351	64.4
	High BMI	553	294	53.2
2	**Hypertension**			
	self-reported	547	345	63.1
	Determined by medical examination	563	224	39.8
3	**Tobacco smoking**			
	Self-reported	546	214	39.2
4	**Physical inactivity**			
	Self-reported	559	152	27.2
5	**Diabetes**			
	Self-reported	546	59	10.8
	Determined by analysis of blood specimens	572	44	7.7

TableVI: Number of risk factors facing participants in this study population (n = 509)

Number of risk factors	Frequency	Percentage
0	21	4.1
1	173	34.0
2	182	35.8
3	107	21.0
4	25	4.9
5	1	0.2

Fasting blood glucose results

Table IV reflects the blood glucose levels determined for 546 participants who also completed an individual health questionnaire. A total of 7.8% of participants with an elevated glucose level of ≥ 7 mmol/L were referred to primary health care centres. Twenty-nine (47.5%) of the 61 participants that were using medication for diabetes mellitus at the time of the study and who had an elevated fasting blood glucose level of > 7mmol/L were also referred. Fifteen (2.9%) patients with no history of diabetes mellitus but an elevated fasting blood glucose level of > 7 mmol/L were referred for further investigation.

By obtaining data from individual health questionnaires, anthropometric measurements and results from medical examinations, multiple risk factors for noncommunicable diseases could be identified in this study population. Table V indicates the identified risk-factor profile for

the study population. Self-reported data (high blood pressure, tobacco smoking, physical inactivity, diabetes) and anthropometric data (high BMI, increased waist circumference measurements) were used to rank the risk factors identified in this study population.

In this study complete data sets for the following risk factors were available in 509 adult participants: anthropometric data, regarding high BMI, and self-reported information, regarding high blood pressure, tobacco smoking, physical inactivity and diabetes. Table VI illustrates the cumulative risk effects for these identified risk factors.

Discussion

The study presented here was undertaken to report on the health status of three rural Free State communities. Results of the study revealed previously untreated as well as poorly controlled lifestyle diseases.

Previous studies carried out in South Africa have shown that high blood pressure contributes to a considerable burden of cardiovascular disease.[19–21] In 2003, the South African Centre for Health Systems Research and Development reported in a study on confirmed noncommunicable chronic diseases that hypertension (41%) was the condition most commonly reported, followed by diabetes (14%).[22] Mollentze et al[23] reported that the prevelance of hypertension in an indigenous black population age 25 years and older in the rural community of QwaQwa in the Free State, was 29%. In our study the prevalence of self-reported hypertension was 63.1%, and poorly controlled hypertension was one of the main reasons for referral after medical examination. Studies in South Africa have indicated an escalating incidence of type 2 diabetes mellitus.[24] In our study, the prevalence of self-reported diabetes mellitus was 10.8%. It was also found that the control of diabetes in these communities was problematic. Despite some patients already having received treatment for diabetes mellitus, many presented with elevated blood glucose levels. The poor control of hypertension and diabetes clearly indicates the need for educational intervention programmes in this population.

Another risk factor for lifestyle diseases that seemed to be a major threat, especially in the female population, was obesity. In this study, 55.8% of women were found to have a waist circumference measurement of more than 88 cm. An earlier study by Walker[25] revealed the prevalence of obesity (BMI > 30 kg/m^2) to be in the order of 59% among urban black women.

The presence of major risk factors such as high waist circumference, high BMI, raised blood pressure, tobacco smoking and elevated blood glucose levels, which contribute to the development of noncommunicable diseases, was high in this particular population. The number of risk factors for participants (Table VI) revealed that 35.6 and 21% of this study population had two and three identified risk factors, respectively, associated with noncommunicable diseases. The INTERHEART Africa Study showed that only five risk factors account for 89.2% of the risk for an initial myocardial infarct, i.e. current or former tobacco smoking, self-reported hypertension and diabetes, abdominal obesity and raised ApoB/ApoA-1 ratio.[19,26] Three risk factors identified in our study, namely tobacco smoking, self-reported hypertension and diabetes, correspond with risk factors identified in the INTERHEART Africa Study (see Table V: risk factors 2, 3 and 5).

The escalating health care cost associated with the risk profile indicated in this study presents a specific challenge to health care providers, researchers, government officials and the general population. Serious recognition must be given to the increasing burden of lifestyle diseases in this study population.

The safest and best way to prevent and treat noncommunicable diseases once risk factors have been identified, is for people to make healthy changes in their personal habits. Lifestyle intervention programmes, for example dietary programmes that encourage better control of existing diseases like hypertension and diabetes, can form the cornerstones for a healthier community. Physical activity programmes can help to control weight and promote overall physical health in this population, and therefore aid in the prevention of most of the chronic lifestyle diseases. Patients with a specific risk profile, for example where a metabolic syndrome has been identified, will benefit significantly from intensive diet and exercise programmes as they will improve blood glucose levels, lipid profiles, hip-to-waist ratios, and lower blood pressure.

Implementing intervention programmes and promoting the importance of these programmes on a regular basis may considerably reduce the risk for noncommunicable diseases and improve the overall health profile of these communities. The development and implementation of relevant health promoting and intervention programmes that will improve the general health and reduce the risk for noncommunicable diseases in this population, is therefore urgently advised.

The authors acknowledge the limitations of the study. Not all modifiable risk factors, for example unhealthy diet and abnormal blood lipids, were assessed or reported on in this publication. We also acknowledge that there was a certain degree of bias regarding the age of the volunteers. Although all households in black and coloured communities were included in the sample, older and unemployed individuals were more likely to volunteer to participate due to the fact that a medical examination was performed free of charge. In these communities, the lack of health care coverage is a significant problem. More women than men participated in this study, possibly due to the fact that more men are employed labourers in the vicinity.

Conclusion

One of the primary aims of this study was to identify modifiable lifestyle risk factors in three rural communities in the Free State. The modifiable risk factors identified in this study as major threats to the health status of these communities are obesity, hypertension, tobacco smoking, physical inactivity and diabetes. These are all major risk factors for the development of different lifestyle diseases. The distinct risk-factor profile must be addressed in order to impact on the disease profile of these communities.

Based on the findings of this survey we recommend the following:

1. The introduction of education and awareness programmes that focus on the current noncommunicable disease profile in these communities.
2. The introduction of efficient and targeted lifestyle intervention programmes in these communities to reduce the lifestyle risk

factors identified by this investigation. A well-informed community will cooperate better, which will further promote the success of the suggested lifestyle intervention programmes.

3. Placing emphasis on the increased burden of noncommunicable diseases in South African communities during health professionals training programmes.
4. Carrying out a follow-up study in three years' time to investigate the impact of implemented lifestyle intervention programmes in these rural communities.

Acknowledgements

The AHA research group gratefully acknowledges the communities of Trompsburg, Philippolis and Springfontein. The authors would like to extend their sincere appreciation to the staff and students of the Department of Nutrition and Dietetics, and staff of the Department of Biostatistics and the Department of Chemical Pathology, University of the Free State, for their contributions to this study.

The National Research Foundation is thanked for their financial support of this project. Daleen Struwig, medical writer, Faculty of Health Sciences, University of the Free State, is acknowledged for the technical and editorial preparation of the manuscript for publication.

References

1. Statistics South Africa. Mortality and causes of death in South Africa, 1997–2003: Findings from death notification. Statistical release P0309.3. Pretoria: Statistics South Africa; 2005.
2. Norman R, Bradshaw D, Schneider M, et al. A comparative risk assessment for South Africa in 2000: Towards promoting health and preventing disease. S Afr Med J. 2007;97:637–41.
3. Fields L, Burt V, Cutler J, Hughes J, Roccella E, Sorlie P. The burden of adult hypertension in the United States 1999 to 2000. *Hypertension* 2004;44:398–404.
4. Whisnant JP. Modeling of risk factors for ischemic stroke: The Willis Lecture. Stroke 1997;28:1840–44.
5. Vital statistics of the US, NCHS. Available from http://www.cdc.gov/nchs/data/dvs/ MortFinal2003_WorkTable307.pdf (Accessed 27/03/2008).
6. Conner M, Rheeder P, Bryer A, et al. The South African stroke risk in general practice study. S Afr Med J 2005;95:334–9.
7. WHO. Obesity and overweight. Fact sheet No. 311. Available from www.who.int/medicentre/factsheets/fs311/en/print.html (Accessed 16/2/2009).
8. Department of Health (DOH). South African demographic and health survey 1998. Pretoria: Department of Health; 2000.
9. Ezzati M, Lopez AD, Rodgers A, Murray CJL (eds.). Comparative quantification of health risks: Global and regional burden of disease attributable to selected major risk factors. Vol. 1. Geneva: World Health Organization; 2004:497–596 (Chapter 11).
10. Groenewald P, Vos T, Norman R, et al. Estimating the burden of disease attributable to smoking in South Africa in 2000. S Afr Med J 2007;97:674–81.
11. Wild S, Roglic C, Green A, Sicree R, King H. Global prevalence of diabetes: Estimate for the year 2000 and projections for 2030. Diabetes Care 2004;27:1047–53.
12. World Health Organization. Death and DALY estimates for 2002 by cause for WHO member states. Geneva: World Health Organization; 2004. Available from http://www.who.int/healthinfo/statistics/bodgbddeathdalyestimates.xls (Accessed 26/10/2009)
13. World Health Organization. Preliminary results of the World Health Survey, 2002–2003; International physical activity data, South African results. Geneva: World Health Organization; 2005. Available from http://www.who.int/healthinfo/survey/whszaf-southafrica.pdf (Accessed 26/10/2009).
14. Appel L, Brands M, Daniels S, Karanja N, Elmer P, Sacks F. Dietary approaches to prevent and treat hypertension. Hypertension 2006;47:296–308.
15. Steyn K, Steyn M, Swanepoel ASP, et al. Twelve-year results of the coronary risk factor study (CORIS). Int J Epidemiol 1997;26:964–71.
16. Alberti KGM, Zimmet P, Shaw J. Metabolic syndrome – a new world-wide definition. A consensus statement from the International Diabetes Federation. Diabetic Medicine 2008;23:469–80.
17. Frary CD, Johnson RK. Energy. In: Mahan LK, Escott-Stump S, eds. Krause's food, nutrition and diet therapy. 11th edition. Philadelphia: Saunders; 2004:.21–36
18. Definition and diagnosis of diabetes mellitus and intermediate hyperglycemia: Report of a WHO/IDF consultation; 2006. Available from http://www.who.int/diabetes/publications/ Definition%20and%20diagnosis%20of%20diabetes_new.pdf (Accessed 29/07/2009).
19. Steyn K, Sliwa K, Hawken S, Commerford P, Onen C. Risk factors associated with myocardial infarction in Africa. The INTERHEART Africa Study. Circulation 2005;112:3554–61.
20. South African Demographic and Health Survey (SADHS); 1998. Available from http://www.measuredhs.com/aboutsurveys/search/metadata.cfm?surv_id=113&ctry_id=55& SrvyTp=custom (Accessed 29/07/2009).
21. South African Demographic and Health Survey (SADHS); 2003. Available from http://40.84.171.10/~etools/doh/sadhs/chapter12.pdf (Accessed 29/07/2009).
22. Centre of Health Systems Research and Development. The rapid assessment on compliant behaviour of people (18 years and older) with diagnosed noncommunicable chronic diseases. Pretoria: Department of Health; 2004.
23. Mollentze WF, Moore AJ, Joubert G, Steyn K, Oosthuizen GM, Weich DJ. Coronary heart disease risk factors in a rural and urban Orange Free State black population. S Afr Med J 1995;85:90–6.
24. Joffe BI, Seftel HC. Diabetes mellitus in black communities of Southern Africa. J Intern Med 1994; **235**:137–42.
25. Walker ARP. Epidemiology and health implications of obesity in Southern Africa. In: Fourie J, Steyn K, eds. Chronic diseases of lifestyle in South Africa. South African Medical Research Association technical report; 1995:73–85.
26. Norman R, Gaziano T, Laubscher R, Steyn K, Bradshaw and the SA CRA Collaborating Group. Estimating the burden of disease attributable to high blood pressure in South Africa in 2000. S Afr Med J 2007;97:692–98.