



## The South African Stroke Risk in General Practice Study

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**Background.** Incidence of stroke is increasing in sub-Saharan Africa and stroke prevention is an essential component of successful stroke management. General practitioners (GPs) are well placed to manage stroke risk factors. To design appropriate strategies for risk factor reduction we need to know the risk factor prevalence in each of the population groups attending GPs. The aim of this study was to establish the prevalence of stroke risk factors in the South African general practice population.

**Method.** We conducted a multicentre, observational study of patients attending general practice in South Africa. Two hundred general practices were randomly selected from lists provided by pharmaceutical representatives. Each GP approached 50 consecutive patients aged 30 years and older. Patients completed an information sheet and the GP documented the patient's risk factors. The resulting sample is relevant if not necessarily representative in a statistical sense.

**Results.** A total of 9 731 questionnaires were returned out of a possible 10 000. The mean age of participants was 50.7 years. Seventy-six per cent had 1 or more risk factors and 40% had 2 or more risk factors. Hypertension was the commonest risk factor in all population groups (55%) but was highest in black patients (59%). Dyslipidaemia was commonest in whites (37%) and least common in blacks (5%). Diabetes was commonest in Asians (24%) but least common in whites (8%). Risk factors other than smoking increased with age.

**Conclusion.** This study provides unique data on the prevalence of stroke risk factors in a South African general practice population. Risk factors are common in all population groups, but differ in distribution among the groups. There is considerable opportunity to reduce the burden of stroke in South Africa through GP screening for and treatment of risk factors.

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Stroke is the third commonest cause of death worldwide and over two-thirds of those deaths occur in developing regions such as sub-Saharan Africa.<sup>1</sup> Local South African vital registration figures<sup>2</sup> and a verbal autopsy study from the Agincourt Health and Population Unit,<sup>3</sup> a rural demographic surveillance site in Limpopo province, confirm that stroke is an increasingly important cause of death in South Africa. But most people survive stroke and about half are disabled,<sup>4</sup> placing an enormous burden on the survivors, their families and the community.

The acute management of stroke has improved dramatically

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over the last decade with the introduction of stroke units, stroke management protocols and national guidelines,<sup>5</sup> and acute treatments such as thrombolysis.<sup>6,7</sup> However, the most cost-effective approach to management is to prevent the stroke in the first place.<sup>8</sup> To do this we need to reduce the individual patient's stroke risk factors (high-risk strategy), and reduce risk factors throughout the population (mass strategy).

Conventional stroke risk factors are divided into those we cannot influence such as increasing age, male gender, family history, socio-economic status and race; and those we can potentially influence such as hypertension, diabetes mellitus (DM), atrial fibrillation, smoking, hypercholesterolaemia, excessive alcohol intake, obesity, physical inactivity, and prothrombotic factors.<sup>7</sup> One of the most important risk factors for recurrent stroke is prior stroke or transient ischaemic attack (TIA). About 30% of people who have had a stroke or TIA will have another stroke during the following 5 years; and almost half of these will occur within 6 months to a year of the initial event.<sup>9,10</sup> Appropriate secondary prevention reduces this risk significantly.<sup>11</sup> General practitioners (GPs) play a major role in detecting and treating modifiable risk factors and implementing primary and secondary stroke prevention measures.

It is well established that the relative importance of risk factors for stroke and cardiovascular disease differs between populations.<sup>13-14</sup> If we are to design locally appropriate strategies to address risk factor reduction within the general practice population to facilitate both the high-risk and practice



population, then we need to know the prevalence of risk factors in each of the South African population groups. The aim of this study was to establish the prevalence of the most important stroke risk factors in the South African general practice population to facilitate both the high-risk and population approaches to stroke prevention.

## Methods

We conducted a multicentre, observational study of patients attending general practice in South Africa.

### Participant selection

Seventeen pharmaceutical company representatives countrywide were asked to submit a list of the names of 40 GPs in their respective areas (680 practices in total nationally). In order to include 200 general practices, we randomly selected 12 - 13 on each representative's list, with a further 1 or 2 as a backup to replace GPs who refused to participate. The GPs were therefore not selected on the basis of any specific characteristic that could have influenced the results.

Each consenting GP approached 50 consecutive patients aged 30 years or older to participate in the study. Patients were given an information sheet and written consent was obtained before including them in the study. Only demographic data were recorded for patients who refused consent. Management of patients with risk factors was left to the GPs' discretion.

### Risk-factor assessment and definitions

The GPs completed a 5-page questionnaire for each participating patient during the standard consultation for which the patient had attended the practice. The questionnaire included risk-factor and demographic information. The patient's most recent blood pressure (BP) measurement was documented. We defined hypertension as past history of hypertension or a current presentation with a systolic BP  $\geq 140$  mmHg, or a diastolic BP of  $\geq 90$  mmHg. The highest result in the past 12 months for fasting total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglycerides and blood glucose were recorded if available. We defined dyslipidaemia as a past history of hypercholesterolaemia or a current presentation with a fasting cholesterol level  $>$

5 mmol/l or LDL level  $>$  3 mmol/l. DM was defined as a past history of DM or a current presentation with a fasting blood glucose level of  $\geq 7$  mmol/l. Current smoking status, a history of ever having smoked, alcohol use and a history of previous stroke or TIA were noted. A current presentation or history of heart failure, ischaemic heart disease or venous thromboembolic event were also recorded. We defined atrial fibrillation as a past history of atrial fibrillation or a current presentation with atrial fibrillation or an irregular pulse rate. Current use of medication for cardiovascular risk factors was documented, as was a current

presentation or past history of motor, sensory, speech, or cerebellar abnormalities, double vision, amaurosis fugax or dizziness.

### Data analysis

Data were entered in EpiInfo and analysed using Stata 8. Descriptive statistics included the mean and standard deviations (SDs) as well as proportion with confidence intervals (CIs). We assessed the difference between population groups with regard to risk factors using chi-square tests. The distribution of the number of risk factors between the ethnic groups was compared using a Kruskal-Wallis test with adjustment after *post hoc* comparisons. We used logistical regression to determine the odds ratios (ORs) of the different population group categories for the various risk factors after adjusting for differences in age and gender.

### Ethics

The Medicines Control Council confirmed that no formal approval was required other than ethics committee approval, as no drug was to be used in the study. Ethics committee approval was obtained from the University of Pretoria (120/2001) and Pharma-Ethics (ICE-9490 012-ZAF)

## Results

### Demographics

Two hundred general practices were registered after 79 of the randomised GPs who refused to participate had been replaced by others in the same geographical area, as close as possible to the original randomised practice. A total of 9 731 questionnaires were returned. Data were available for 199 practices as 1 practice submitted questionnaires after the deadline date. The national distribution of participants was as follows (the percentage of the study sample and for comparison the percentage of the total South African population in the region are given in brackets for each region): Gauteng/Mpumalanga 2 689 participants (29%; 25%); Western Cape 1 744 participants (19%, 10%); KwaZulu-Natal 1 609 participants (18%, 21%); Limpopo Province 1 506 participants (17%, 12%); Central Provinces 855 participants (9%, 17%); and Eastern Cape 544 participants (6%, 16%).<sup>15</sup> Although participating patients were widely distributed across South Africa, the majority were seen in metropolitan cities and rural areas were underrepresented.

Six per cent of participants ( $N = 618$ ) were ineligible for analysis because of refusal ( $N = 303$ ), missing most data ( $N = 187$ ), or not meeting the inclusion criteria, e.g. under 30 years of age ( $N = 128$ ). A total of 9 133 participants were therefore included and 303 non-participants excluded because of either patient refusal or doctor refusal to enter a particular individual. The mean age of participants was 50.7 years (SD 13.9, range 30 -



100 years) and 73% of the participants were in the 30 - 59-year age range. The sex and population group distribution of participants and non-participants (because of refusal) was similar. Forty-five per cent of both the participants and non-participants were male, 23% of the participants were black, 7% coloured, 10% Asian, and 59% white; while 28% of the non-participants were black, 7% coloured, 8% Asian and 56% white.

Not all participants had all risk factors recorded. Only 31% had a total cholesterol reported and 40% had glucose values reported. In contrast, 96% of all participants had BP readings reported. Unfortunately, the proportion of tests done varied significantly among population groups. The proportion of each population group that had glucose values reported was as follows: black 30%, coloured 38%, Asian 55%, and white 41% ( $p < 0.001$ ). The proportions for total cholesterol were: black 8%, coloured 22%, Asian 22% and white 43% ( $p < 0.001$ ).

**Risk factors**

Seventy-six per cent of patients had 1 or more risk factors and 40% had 2 or more risk factors. There was a statistically significant difference ( $p < 0.001$ ) in the number of risk factors between population groups. *Post hoc* testing showed that this distribution was significantly different between all groups except between the coloureds and Asians ( $p = 0.15$ ,  $p < 0.004$  required for significance). Of the 24% with no reported risk factors, the majority (32%) were black patients. Three or more risk factors occurred almost as commonly in the Asian, white and coloured groups (11 - 14%), but far less commonly in the black group (4%).

Table I shows the prevalence of risk factors by population group. Figs 1 - 3 graphically compare the prevalence of hypertension, dyslipidaemia, and a history of ever having smoked cigarettes by age group and population group. Hypertension is clearly the commonest risk factor in all population groups but stands out as the major risk factor in black patients. Logistical regression revealed that whites were 44% less likely to have hypertension than blacks even having adjusted for age and gender (OR 0.66, 95% CI: 0.59 - 0.74). The proportion of people still hypertensive despite treatment was 47%.

Whites were 10 times more likely to have dyslipidaemia than those blacks for whom information was available (OR 10.2, 95% CI: 8.3 - 12.5). As expected, DM was most common in the Asian

population (26%) but surprisingly least common in the white population (8%). Most risk factors except cigarette smoking increased with age.

Atrial fibrillation was commonest in the white population (5%) followed by the coloured population (4%), and about equally common in the black and Asian population (2%). Current or past heart failure and venous thromboembolism were each present in 4% of participants. Ischaemic heart disease (past

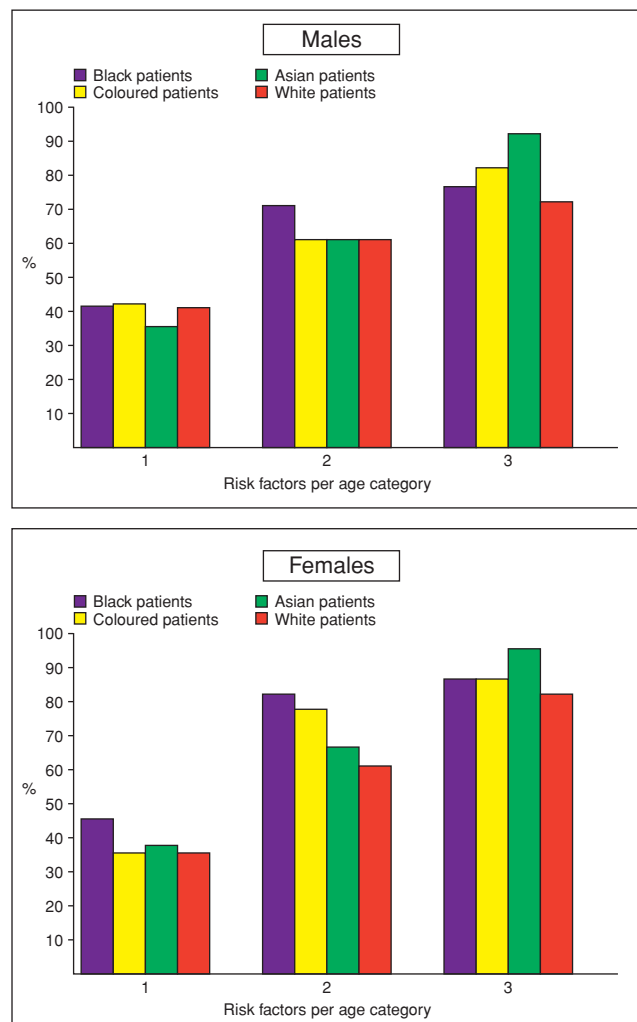


Fig. 1. Prevalence of hypertension by sex, age group and population group (age group 1 = 30 - 49, age group 2 = 50 - 69, age group 3 = 70+).

Table I. Risk-factor prevalence (percentage) by population group, adjusted for age and gender (95% confidence intervals)

Risk factor	Black	Coloured	Asian	White	Total
Hypertension	59 (57 - 61)	55 (52 - 59)	55 (52 - 58)	50 (49 - 52)	55
Diabetes mellitus	14 (12 - 15)	15 (12 - 18)	26 (23 - 29)	8 (7 - 8)	16
Dyslipidaemia	5 (4 - 6)	23 (20 - 27)	22 (19 - 25)	37 (35 - 38)	22
History of ever smoking cigarettes	21 (20 - 23)	44 (40 - 48)	26 (24 - 29)	42 (41 - 44)	33
Atrial fibrillation	2 (2 - 3)	4 (2 - 6)	2 (1 - 3)	5 (5 - 6)	3

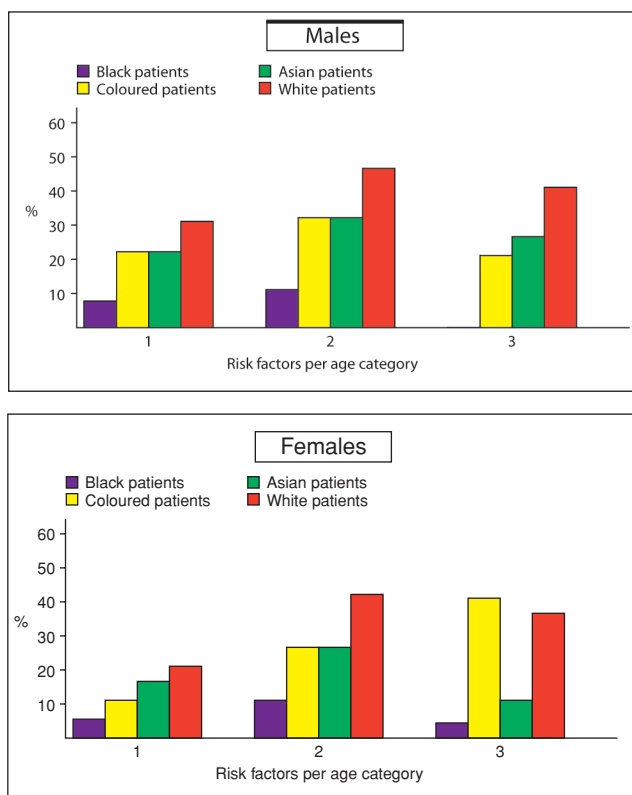


Fig. 2. Prevalence of dyslipidaemia by sex, age group and population group (age group 1 = 30 - 49, age group 2 = 50 - 69, age group 3 = 70+).

or present) was found in 8% of whites, 7% of Asians, 5% of coloureds and 1% of blacks. A history of previous strokes or TIA was present in 2% of blacks and coloureds, 4% of Asians, and 5% of whites.

**Discussion**

Our study provides unique data on the prevalence of stroke risk factors in a South African general practice population. We have found that these risk factors are common in all population groups, but that different distributions of risk factors exist in the various population groups. Hypertension is the single most important risk factor.

Our study has several limitations. Although we randomly selected general practices, the sampling was taken from lists of GPs provided by pharmaceutical company representatives. Representatives may have been more likely to include GPs who were interested in stroke or cardiovascular risk factors, or more easily accessible. The latter point explains in part why our sample underrepresents rural practices. Although we randomly selected practices, the proportion of various population groups in the study does not mirror South African demographics. This distortion probably reflects both the general practice population

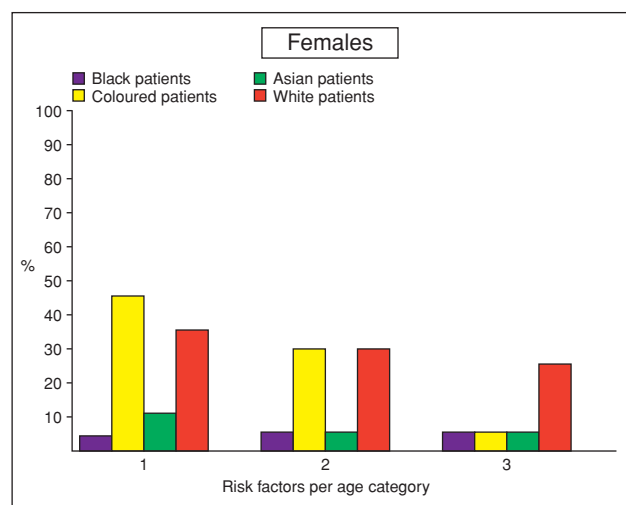
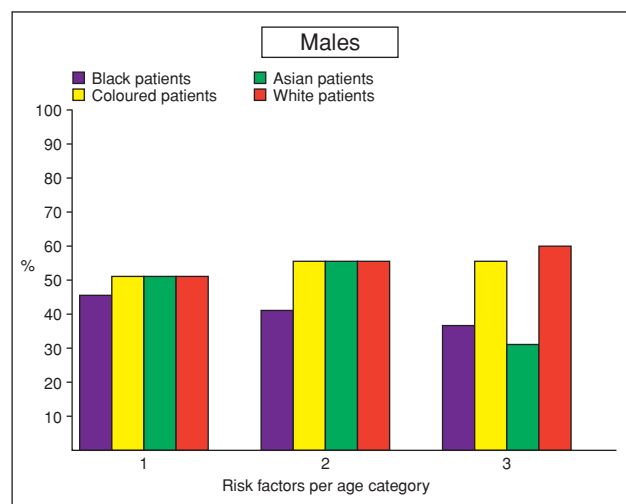


Fig. 3. Prevalence of cigarette smoking by sex, age group and population group (age group 1 = 30 - 49, age group 2 = 50 - 69, age group 3 = 70+).

in South African urban areas and our general practice selection bias. The subjects reported in this study therefore do not represent a true random sample of the South African population. In addition the study could not be analysed formally as a survey (using probability weighting for instance) because data on the exact number of patients and ethnic group proportions seen in each practice were not available. Furthermore, we did not take into account the fact that subjects in each practice could be regarded as belonging to a cluster in the analysis. These analysis limitations should not influence the point estimates much, but our CIs may appear more precise than they would have done with a survey analysis.

A major limitation of the study is that not all participants had all risk factors recorded, and the small numbers of glucose and total cholesterol values available, particularly for black and coloured participants. The percentages of reported risk factors were calculated on the total number of participants in each



population group. We are therefore likely to have underestimated hypercholesterolaemia and DM. Our definition of hypertension included patients with one BP reading  $\geq 140$  mmHg systolic or  $\geq 90$  mmHg diastolic. We may therefore have included patients who did not have persistent hypertension and as such have overestimated the prevalence of hypertension. Despite these limitations, this study provides useful information on the prevalence of stroke risk factors in a large sample of South Africans attending GPs.

Hypertension is a major risk factor for stroke, with stroke risk almost doubling with each 7.5 mmHg increase in diastolic BP.<sup>16</sup> There is an even stronger association with systolic hypertension.<sup>7</sup> We found an alarmingly high prevalence of hypertension in all population groups. Indeed, every second patient over the age of 30 years in our general practice sample had hypertension. This figure is much higher than the prevalence of hypertension — 21% for men and women over the age of 15 years when BP was defined as  $\geq 140$  mmHg systolic or  $\geq 90$  mmHg diastolic or on treatment — reported in the South African Demographic and Health Surveillance Survey (SADHS) in 1998.<sup>17</sup> The difference between the two studies is probably explained by the older age of patients in our study, and a different definition of hypertension used. While we used the same levels of systolic and diastolic BP to define hypertension, our definition included anyone with a history of hypertension. However, our population also has a much higher prevalence of hypertension than that found in Australians (44%, 95% CI: 43% - 45%)<sup>18</sup> in a study using very similar methodology to this study. The proportion of people still hypertensive despite being on antihypertensive agents was alarmingly high in our study (47%).

Despite the similarity in prevalence of hypertension between blacks and whites, when we adjusted for age and gender, whites were 44% less likely to have hypertension than blacks. This difference is also found in the USA, where African-Americans have a higher prevalence of hypertension and develop hypertension at a younger age than their white counterparts.<sup>19</sup>

The Asian population in South Africa is known to have a high prevalence of DM<sup>20</sup> and a self-reported prevalence of 8.5% was found in the Demographic and Health Survey.<sup>20</sup> Our very high prevalence of 24% probably reflects the bias of a general practice population rather than a true reflection of the population.

The overall prevalence of cigarette smoking in our study (21%) was similar to that found previously in South Africa (25%).<sup>21</sup> Among males there was little variation in the prevalence of smoking across population groups. Among females, who generally smoked less, the prevalence was low in Asian and black patients, but much higher in young coloureds and whites. The alarmingly high prevalence of smoking in the coloured population has also been noted before.<sup>21</sup> While the government has implemented strict controls on advertising and smoking in public places, and smoking in South Africa is thought to be decreasing, specific attention should be paid to decreasing this

risk factor in target groups.<sup>21</sup>

While the prevalence of dyslipidaemia among whites was similar to that found in caucasian populations elsewhere,<sup>18</sup> it was markedly lower in the black population, and intermediate in the Asian and coloured populations. This distribution of dyslipidaemia in the South African population is well documented,<sup>22,23</sup> but it is unlikely to remain constant for long. In the THUSA (Transition and Health during Urbanisation of South Africans) study, urban black professionals had significantly higher total serum cholesterol levels than their rural counterparts,<sup>24</sup> suggesting that increasing exposure to lifestyle risk factors will change this pattern.

Our study has several important implications. Stroke and vascular risk factors are common in the South African population attending GPs. The smaller burden in terms of number of risk factors in the black population group should not be of any comfort. If the anticipated health transition with its associated increase in cardiovascular risk factors, stroke and cardiovascular disease materialises, then this burden is likely to increase dramatically.<sup>25,26</sup> South Africa faces the enormous challenge of managing diseases of poverty, violence, and HIV/AIDS. Cardiovascular disease already adds to the load<sup>2</sup> and our findings highlight the considerable opportunity that exists to reduce that burden through GP screening and treatment.

The Southern African Stroke Foundation aims to increase health professional awareness of stroke and its risk factors in order to prevent stroke in high-risk individuals, and to raise awareness and lower risk in the general population. Our study provides baseline data against which progress in risk factor management can be measured.

More results and the full text version of this article are available on the Southern African Hypertension Society's webpage: <http://www.hypertension.org.za>

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