The direct and indirect costs of cardiovascular disease in South Africa in 1991

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Background. In South Africa, cardiovascular disease (CVD) is the leading cause of death among all population groups, other than blacks, among whom it ranks third. CVD therefore has a severe impact on the South African economy.

Objectives. To ascertain the availability and quality of South African data on the cost of CVD and to estimate the impact of CVD on the South African economy during 1991.

Methods. The direct health care costs and the indirect costs related to loss of productivity were estimated. Where no direct or complete detailed South African data were available, projections were made based on reasonable assumptions of data and models developed in other countries; these were applied to the limited available South African data. The major disease outcomes considered for this cost estimation were: expenditure on ischaemic heart disease, cerebrovascular disease (stroke), venous thrombosis and embolism, and peripheral vascular diseases and related conditions. These diseases are responsible for the majority of fatal cases of CVD reported in South Africa.

Results. The estimated total cost of CVD in South Africa in 1991 was between R4.135 billion and R5.035 billion. This does not include the cost of rehabilitation and follow-up of CVD patients since the necessary data were not available to estimate it. About three-quarters of the direct health care costs were carried by the private sector. The direct health care costs were estimated to be approximately 42% of the total cost. The rest reflects the indirect cost of earnings foregone as a result of premature morbidity and mortality.

Conclusion. To determine accurately the total economic burden of CVD on the South African economy, additional data will have to be collected. The estimated economic burden of CVD in South Africa clearly highlights the need for a broad-based population strategy, part of an overall national effort to prevent, diagnose and cost-effectively treat CVD.

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Cardiovascular disease (CVD) is the prime cause of death among the South African white, coloured and Indian populations, and the third most common cause of death among black South Africans aged 15 - 64 years.[1] Steyn *et al.*[2] reported that in 1988, ischaemic heart disease (IHD) and cerebrovascular disease accounted for 9.6% and 7.9% respectively of deaths of all South Africans aged 35 - 64 years. Such preventable premature losses in the most productive sector of the labour force clearly constitute a major cost to the economy. Increasing urbanisation, the adoption of a westernised lifestyle and concurrent emergence of associated diseases in black South Africans seem set to increase further the national cost of CVD.

Only the immediate implementation of effective preventive policies in the black community will ensure that the risk of developing these diseases does not occur to the same extent as in other South Africans.

Economic data are needed for health policy planners to develop a national CVD health policy. The purpose of this study was to ascertain the availability and quality of South African data on the cost of CVD, and then to estimate the economic impact of CVD on South Africa in 1991.

Methods

Direct health care costs and indirect costs related to loss of productivity were estimated. Where no direct or complete detailed South African data were available, projections were made based on reasonable assumptions of data and models developed in other countries.[3] Major disease outcomes considered for this cost estimation were expenditure on IHD, cerebrovascular disease (stroke), venous thrombosis and embolism, and peripheral vascular diseases and related conditions.[4] These are responsible for the majority of fatal cases of CVD reported in South Africa.

Direct cost of CVD

The prevalence-based approach to the direct cost of illness was used.[3] A scheme (Fig. 1) to calculate the costs incurred by CVD patients at all stages of illness was devised. Each health expenditure component was costed as a separate entity, and the final sum obtained by adding across cost categories. Where possible, high and low as well as private and public sector cost estimates were made for each category.

Transportation costs were based on assumptions described in detail elsewhere[3-5] and on the premise that patients travelled 6 km on average to see a doctor and 20 km for each trip to the hospital. The total number of visits of CVD patients to general practitioners (GPs) in 1991 was estimated from the data of Bourne *et al.*;[6] trips to physicians were set at one-quarter of this total.[7] Trips to hospitals were calculated from the 1987 Census of Hospitals and Clinics.[8] Ambulance costs were calculated by extrapolating the cost structure provided by the Cape Town Ambulance Services to the rest of the country. Only 2.3% of these costs is recouped from the private sector's use of the ambulance service. Private travel costs were based on the running of a medium-sized car in South Africa and on mini-bus taxi fares in 1991.[5]

Estimates of expenditure at GPs by CVD patients are based on a study of the morbidity profile seen by GPs in

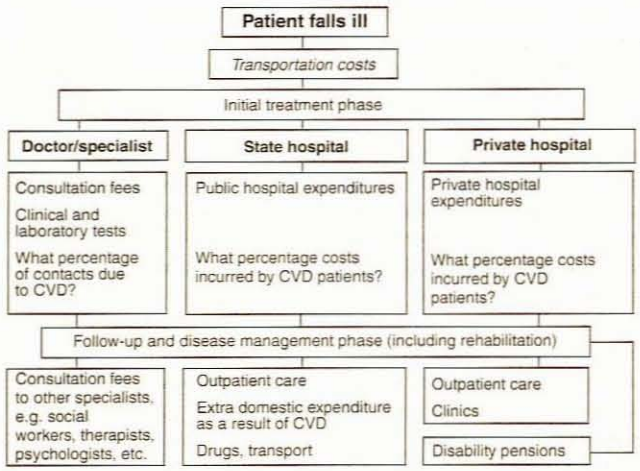

Fig. 1. The elements of the direct costs incurred by patients with cardiovascular disease (CVD).

South Africa.[6] CVD was responsible for 8.2% of the total number of GP contacts; of these, roughly 35.7% (2.9% of the total) had CVD caused by something other than hypertension.[6] Typical interventions and tests for CVD patients were determined from a survey of practising GPs, and costs taken as the rates recommended by the Medical Association of South Africa[9] and medical aid schemes.

The cost of visits to physicians was calculated as the number of private physicians practising cardiovascular medicine multiplied by the percentage time spent treating CVD multiplied by annual gross income. Only the first of these components is known with any degree of accuracy. There are roughly 2 375 physicians active in cardiovascular work (H. Strong, Medical Association of South Africa — personal communication). Bourne[7] estimated that 33.3% of their time was spent seeing patients with CVD. When this was corrected for the number of South African specialist cardiologists who catered only for CVD patients, it was estimated that South African specialist physicians, including cardiologists, spent an average of 40% of their total working time on CVD patients.

Annual expenditure by state hospitals on CVD patients could be calculated from: (*i*) the annual budget allocated to state hospitals in South Africa; (*ii*) the percentage CVD admissions to state hospitals; and (*iii*) the cost of treating CVD relative to the mean cost per patient. Information was only available on the first two. However, American data show that although the average length of stay of non-hypertensive CVD patients is 1.35 times as long as that of the average patient, they incur 3.9 times the per capita cost.[10] In this study, the ratio was conservatively placed at 1.5.

A distinction was made between hypertensive patients, who are as expensive to treat as the average patient in hospitals, and CVD patients needing more expensive treatment. Data from Groote Schuur Hospital showed that during 1991, 10.2% of all CVD inpatients were hypertensive. This rough figure was used to estimate the proportion of the cost for all state hospitals in South Africa. The costs of CVD attributable to state hospitals was estimated as: CVD costs = state hospitals' budget x % CVD inpatients x weighting factor (where weighting factor = prevalence x relative costs of hypertensives or non-hypertensives).

The estimated CVD costs at private hospitals were based on the various types of private hospital. Only the fee-for-service hospitals (11 117 beds in 1989) do extensive CVD work. This sector is oligopolistic, with 8 200 beds controlled by five private companies in 1993.[11] Work done by any one company was assumed to approximate that of the sector as a whole and was used for this estimation.

Cardiovascular drugs are typically costly. The private market accounts for the greater portion of sales. Decision Survey International, a pharmaceutical market research firm, assessed the rand value of sales at the manufacturing selling level for the year ending March 1992. Their weighted coverage of the total private market is estimated at 85%. The price structure of medicine entails a 21.2% mark-up from wholesalers to pharmacies, which in turn increase prices by 50%. Private sales of cardiovascular drugs could therefore be calculated. Details of drug expenditure at provincial hospitals were incomplete. However, these costs were already incorporated into state hospitals' budgets.

Minor direct CVD costs include expenditure on research, hospital buildings and patient costs. The estimation of research costs took into account allocations for CVD research in South Africa by the Medical Research Council, which comprised 50% of all research funding allocated in 1991. The percentage allocated by the tricameral parliament for maintenance and building towards CVD in 1991 was assumed to be the same as expenditures for CVD by state hospitals.[12-14] Assessment of the direct costs of long-term therapy and of patient follow-up, rehabilitation and disability pensions had to be abandoned because of a lack of reliable data.[4]

Indirect cost of CVD

The most common approach to the computation of indirect costs of illness is the human capital method that was chosen for this study. It is based on the discounted value of earnings foregone as a result of premature morbidity and mortality.[15] It is assumed that the worth to society of an individual's life is measured by future production potential, which in a competitive labour market is usually calculated as the present discounted value of expected labour earnings. Although critiques of the human capital theory abound,[4] it has the advantage that computations are easy to perform. Other approaches include willingness-to-pay methods.[16,17] Social valuation methods take into account awards made to individuals by courts and public commissions.[18,19] Recently a workable, non-monetary approach to the value of a human life was proposed.[20] However, it was observed that although people have an inherent value system for their health, they were not able to or would not translate these values into monetary terms.

The present value of future income lost because of premature mortality was computed using age-, sex- and population group-specific mortality data obtained from the Central Statistical Services.[21,22] Labour force participation rates and personal income figures were obtained from the Institutes for Futures Research.[23] The calculation was based on the number of people who died of CVD in 1989, labour force participation rates and average incomes; and the age for employment were taken as 65 to 15 years. The net present value of foregone future income was then calculated for a range of discount rates (0 - 10%) for each subgroup and totalled to derive a monetary value for each (Table I).

Productivity losses caused by disease (excluding mortality costs), whether long-term or short-term, are collectively known as morbidity costs and are best estimated by analysing morbidity patterns in a representative sample of the population. The dearth of these data for South Africa meant that a correlation between CVD mortality and morbidity costs had to be established. The closest equivalent data came from Canada.[24]

Age-specific mortality rates in Canada indicated that the bulk (80%) of CVD deaths occur after the age of 65 years, when most people have retired. The crucial statistic to compare is that of people below 65 years — the labour force participation rate-adjusted CVD mortality figures. Canada had a population of 27 million in 1991, while South Africa's population was 26.5 million in 1992 (excluding the TBVC states).[25] The Canadian annual income per capita of US$16 760 (1988) was 6.81 times that of South Africa's US$2 460. Canada's population is not as racially heterogeneous as South Africa's but differences among the income levels of the South African population groups were taken into account in the calculation of South African CVD mortality costs.

Canadian data for 1986 gave the present value of future income lost as a result of CVD-related premature mortality as Canadian $8 167 737 000.[26] This represents 31.9% of the total amount lost due to premature mortality. The annual value of CVD mortality was calculated as Canadian $3 468 383 000, i.e. approximately 42% of the mortality costs. This percentage was used to assess the morbidity cost to the South African population.

Table I. South African 1991 CVD mortality rates — net present value of foregone earnings in 1991 (R100 million)

	Discount rate (%)					
Population group	0	2	4	6	8	10
White men	10.475	8.935	7.798	6.930	6.249	5.702
White women	4.766	4.035	3.506	3.108	2.799	2.553
Coloured men	2.093	1.750	1.504	1.320	1.178	1.066
Coloured women	1.949	1.610	1.370	1.195	1.06	10.956
Asian men	1.466	1.235	1.065	0.937	0.838	0.758
Asian women	0.657	0.561	0.491	0.437	0.395	0.361
Black men	4.502	3.616	3.009	2.574	2.225	2.003
Black women	3.783	3.027	2.514	2.150	1.882	1.667
Totals	29.692	24.769	21.256	18.649	16.651	15.076

TBVC countries are excluded. Figures for blacks may be lower than actually reported because of under-registration and inadequate classification as to cause of death. Only people employed in the formal sector are included. The informal economy and non-remunerative activities for which shadow prices can be calculated, such as housework, are not taken into account.

Results

Table II summarises the range of expenditure estimated for direct and indirect costs. The overall costs of CVD in South Africa were estimated to lie between R4.135 billion and R5.035 billion, with the direct cost constituting between 40.7% and 43.1%, and indirect costs between 59.3% and 56.9% of the total. Between 72% and 78% of the total direct costs of CVD to the South African economy were private sector costs. It must be stressed that, because of inadequate data, these figures exclude follow-up and rehabilitation costs and expenditure at industry-based hospitals.

Elements of transport costs considered were: visits to GPs (between R4 272 510 and R4 299 130) and specialists (between R1 068 128 and R1 074 782), transport to hospitals and clinics (between R543 641 and R623 079) and ambulance costs (R12 082 819).

The cost of interventions by GPs (between R99 621 421 and R223 342 999) was added to their consultation fees (between R68 023 350 and R151 406 810) to estimate the overall CVD GP costs (Table II). Pre-tax income for GPs was taken to be between R200 000 and R400 000 after expenses, while specialist physicians including cardiologists earned double that and some far more. A conservative gross estimate of the earnings of specialist physicians before costs was put at R500 000 for these calculations, giving the following totals for CVD general physicians' costs:

2 375 x 0.4 x 500 000 = R475 000 000 (lower limit)

2 375 x 0.6 x 500 000 = R712 500 000 (upper limit).

The State spent approximately R5 037 billion on hospitals in 1991 (Table III). The last survey of the admission of patients to South African hospitals was conducted in 1987.[8] Of 496 449 inpatients discharged from state-funded hospitals, 30 949 suffered from some form of CVD (6.32%) during May and June 1987.[11] The CVD costs of all state hospitals were calculated according to this percentage, as data on outpatient attendances were unobtainable.

Table III. Allocation to state hospitals in South Africa in the 1991/1992 budget*

Province	Net expenditure (R)
Cape Province	1 778 518 855†
Cape Province-aided hospitals	50 397 641†
Natal	718 546 134
Orange Free State	374 712 942
Transvaal	2 018 666 418†
S.A. Development Trust hospitals	42 582 083
House of Assembly hospitals	54 272 000
Totals	~ 5 037 696 000

* The national health budget for 1991/2 was R8.175 billion (Budget Speech of the Minister of Finance, 20 March 1991, 10).
† Figures were not available for 1991/2 by the time the 1992 edition of the *SA Hospitals and Nurses Yearbook* went to press. They are 1990/1 figures inflated by the ratio that the 1991/2 health budget exceeded that of 1990/1, viz. 1.164.

Using the different weighting factors obtained at Groote Schuur Hospital for hypertensive and non-hypertensive patients, the following calculation was made:

Hypertensives = R5 037 696 000 x 6.32% x 10.2% x 1.0 = R32 475 002.

Non-hypertensives = R5 037 696 000 x 6.32% x 89.8% x 1.5 = R428 861 050.

Total expenditures on CVD at state hospitals were therefore approximately R461.3 million.

For the assessment of private hospital costs to CVD patients, those of Medi-Clinics were analysed. Between 10% and 15% of the total income of Medi-Clinic Corporation was generated from patients in CVD categories. Figures obtained from the Registrar of Medical Schemes and cross-checked with industry data put the costs of CVD incurred in the private hospital sector at between R84.3 million and R126.5 million. The pharmaceutical component of the fee-for-service hospital turnover is estimated at approximately 40%. These figures do not include pharmacy costs or physicians' fees to avoid double counting.

Table II. Estimated direct and indirect cost of CVD to the South African economy in 1991*

	Private sector costs in million rands		Public sector costs in million rands		Total costs in million rands		% of total costs	
Cost category	Low	High	Low	High	Low	High	Low	High
Direct costs								
Transportation costs	6.11	6.22	11.86	11.86	17.97	18.08	0.43	0.36
General practitioner costs	167.64	374.75			167.64	374.75	4.05	7.44
Physicians' costs	475.0	712.5			475.0	712.5	11.49	14.15
Public hospitals' costs			461.3	461.3	461.3	461.3	11.15	9.16
Private hospitals' costs†	84.3	126.5			84.3	126.5	2.04	2.51
Drug costs in private sector	470.2	470.2	†	‡	470.3	470.3	11.37	9.34
Minor costs	3.0	3.0	4.6	4.6	7.6	7.6	0.18	0.18
Total direct costs	1 206.35	1 693.7	477.76	477.76	1 684.11	2 170.93	40.71	43.14
Comparison of private and public sectors' costs	72%	78%	28%	22%				
Indirect costs								
Mortality costs (6% and 8% discount rates)					1 665.1	1 864.9	40.26	37.04
Morbidity costs					786.6	999.2	19.02	19.84
Total indirect costs					2 451.7	2 864.1	59.29	56.86
Total cost of CVD in 1991					4 135.71	5 035.03	100	100

* The public hospitals' costs include those of salaries and drug usage cost.
† Rehabilitation, follow-up costs and costs of CVD at industrial hospitals not included.
‡ Public sector drug costs are included in the cost of public hospitals.

The value of CVD drugs in 1992 at the manufacturing selling level was estimated at R328 million (Decision Survey International (Pty) Ltd: Referring S 8243 July 1993). This company estimated the size of the private CVD drug market to be R284 million, with R20 million in over-the-counter medication and R264 million in CVD prescriptions. The provincial hospital CVD drug market was R44 million including sales to provincial hospitals via Comed for the 12 months ending March 1992. The private sale of CVD drugs for the year until March 1992 could be calculated as follows: 100/85 (sample coverage) x 181.2/100 (overall mark-up) x 122.9/147.1 (1991/1992 CPI for health services) x R264 million = R470.2 million.

About R6 000 000 was spent on cardiovascular research in 1991, with half the funding being granted by the Medical Research Council.

The tricameral parliament allocated R25.9 million to the maintenance and building of state hospitals in 1991.[12-14] Of this, R1.6 million (6.17%) can be apportioned to CVD.

The total direct costs of CVD in South Africa in 1991 amounted to between R1 684 million and R2 171 million (Table II). Some of the cost categories are not neat. For example, the figure for state hospital costs is an amalgamation of costs of drugs, interventions, ward costs and salaries of medical personnel in the public health sector.

The indirect CVD cost calculation was based on the loss of productivity due to mortality and morbidity. Table II summarises the net present value of earnings foregone by people who died from CVD in 1991. Table I also shows the value of earnings lost at different discount rates. At a discount rate of 0%, the value of lost earnings is R29 692 million, whereas it is roughly half of this at a discount rate of 10%.

A high and low figure were selected from the range in Table I. The 6% discount factor was chosen as the high estimate and the 8% discount figure as the low estimate for mortality costs of CVD. A discount rate of 6% is in line with that currently used in the UK, whereas 8% is the rate recommended by South African economic advisors. CVD mortality costs amounted to between R1.665 billion and R1.864 billion in 1991.

For the morbidity costs a range of 5% on each side of 42% of the mortality costs was used. It can guardedly be assumed that South Africa's morbidity costs range between 37% and 47% of its mortality costs, or between R786.6 million and R999.2 million.

Discussion

The estimated impact of CVD on the South African economy as shown by these data is enormous. However, it would probably have been found to be much greater than the estimated range of costs if all the data required for this estimation were available.

The methodological difficulties experienced during this study were mostly related to the lack of data needed for evaluating aspects of the costs. This research highlighted the need for collecting good quality data to assess accurately the economic impact of any group of diseases in the country. There is a particular need to improve the access to data collected routinely from the private sector, as so few of these data are available. The most common problem encountered was that available data were aggregated in a manner not useful to the project's objective to assess the impact of CVD separately from the overall costs of all other diseases. Secondly, available data were not differentiated to a degree that would impart a satisfactory level of accuracy to figures. Thirdly, certain required data were not available for this study, but could be determined by suitable studies in the future. Fourthly, some data were unavailable and are likely to remain so, given the complexity of assessment in the face of the limited resources of the country (e.g. data on re-employment costs).

There is ongoing debate about assumptions made to assess indirect cost of disease, such as the appropriate rate to use when discounting foregone future earnings. In the UK, a standard rate of 5% in real terms was used for many years; it was recently revised to 6%.[27] The South African Department of Finance discounts public projects at a rate of 8%. Canadian researchers have recently discounted health benefits at a real rate of 6%, but allow for productivity gains of 2% and therefore use an effective discount rate of 4%.[25]

With regard to the direct costs of CVD, it was found that the private sector carries about three-quarters of the economic burden of CVD. The question arises as to whether the private sector indeed provides the bulk of CVD care for patients, or whether this funding merely reflects the high differential costs between the public and private sectors. These findings also reflect a relatively higher incidence of CVD among population groups who have higher levels of medical scheme coverage.

McIntyre and Owen suggested that real per capita spending on health in the public sector in 1992/93 had declined by 5% since 1980/81.[28] Yach reported that real per capita expenditure on health care in South Africa in 1992 was US$421 in the private sector and US$102 in the public sector.[29] According to the African National Congress Health Plan, half of the total South African budget in the early 1990s was spent by the private sector, which makes up the 20% of the population who belong to a medical scheme. The other half of the health budget provides for the public sector, which caters for the indigent.[30] This would suggest that the high differential between public and private sector spending on CVD found in this study shows inefficient and excessive use of resources in the private sector. A recent study on drug utilisation for hypertension in a small working class area of the Western Cape showed that primary care physicians tended to prescribe low-cost generic drugs for their patients without medical aid and high-cost ethical drugs for patients with medical aid.[31] This suggests a need for the development and evaluation of cost-effective therapeutic protocols for use in the private and the public sectors. The Medical Association of South Africa and the medical aid industry could play a major role in the development of such protocols, and studies should be conducted thereafter to evaluate their cost-effectiveness.

Currently 45% of black people who fall within the age group of the labour force are unemployed and therefore not considered in the indirect cost of CVD. With economic development, this unemployment rate should drop, and this should impact on the future indirect cost of CVD if necessary measures are not taken to protect the labour force against CVD and the associated loss of productivity.

Although no specific South African data exist on the impact of CVD on productivity, North American studies have shown that it is striking.[10,24,25] Table IV gives an indication of

the productivity and activity measures of the American population in 1980. Persons in the USA reporting hypertension alone (52.2% of all CVD patients) were less likely to be employed than persons in the general population. Persons in other subcategories of CVD were significantly more likely to be unable to work than those in the general population. They are about three times less active in terms of restricted-activity and mean bed-disability days than hypertensives or the general population.

Table IV. Annual productivity and activity measures for persons 17 years of age and over with CVDs in the USA in 1980[20]

	Productivity measures		
	Employed (%)	Unable to work (%)	Mean work-loss days
All persons	71.6	4.9	4.9
CVD patients			
Hypertension alone	52.2	7.9	6.5
CVD			
With hypertension	23.4	21.6	19.0
Alone	33.5	23.2	12.0
With complications	38.6	20.2	7.1

	Activity measures	
	Mean restricted-activity days	Mean bed-disability days
All persons	15.6	5.6
CVD patients		
Hypertension alone	20.1	6.0
CVD		
With hypertension	46.1	16.7
Alone	45.7	17.3
With complications	41.0	16.7

Although blacks still have the lowest CVD mortality rate in South Africa, recent surveys reveal a deteriorating pattern for CVD risk[32,33] as they are exposed to ongoing demographic transition and aggressive marketing of unhealthy products. This points to an increase in the future burden of CVD to the South African population. If, for example, all South Africans had a CVD risk profile identical to that of whites in 1991, an additional 3 000 people in the economically active age group of 15 - 64 years would have died — an increase of 20.4% on the figure actually reported. An extra 9 041 people would have died that year in the over-65-year age group, an increase of 47.7%

This study did not assess the cost of health education and health promotion activities to prevent CVD, but the enormous current economic impact, as well as the declining CVD risk profile in South Africans, highlights the need for preventive measures. Rose[34] effectively indicated that health promotion and prevention of disease is by far the most cost-effective way to reduce the burden of CVD in any society. Clearly, the need for a broad-based population strategy to prevent CVD as part of an overall national effort to prevent, diagnose and cost-effectively treat CVD has never been more crucial.

This study shows that CVD imposes an enormous economic burden in South Africa. The relative impact of these findings on CVD could only be evaluated once similar economic impact studies have been conducted for other diseases, such as TB or AIDS, that also contribute significantly to the overall burden of disease in South Africa.

Studies that highlight the economic burden of disease are becoming essential as a basis for rational health policy development and resource allocation. The World Bank's World Development Report of 1993 shows the growing popularity of such studies.[35] This study on CVD provides a template of the methodology required for the costing component of future studies of this nature in South Africa, provided that the essential data required are collected and reported in a format that allows for such studies.

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