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Economic burden of stroke in a rural South African setting

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ABSTRACT

Background: Stroke is the second leading cause of mortality and leading cause of disability in South Africa yet published data on the economic costs of stroke is lacking particularly in rural settings.
Methods: We estimate the total direct costs of stroke in 2012 from a health system perspective using a prevalence-based, bottom-up costing approach. Direct costs include diagnosis, inpatient and outpatient care. Analysis is based on the Agincourt health and socio-demographic surveillance system, which covers approximately 90,000 people. Published data from the SASPI study, Tintswalo Hospital Stroke register, and national cost databases were used. Sensitivity analysis was carried out to account for the variability in the data used.
Results: The total direct costs of stroke were estimated to be R2.5–R4.2 million (US$283,500–US$485,000) in 2012 or 1.6–3% of the sub-district health expenditure. Of this, 80% was attributed to inpatient costs. Total costs were most sensitive to the underlying incidence rates and to assumptions regarding service utilisation.
Conclusions: Our study provides a snapshot of costs incurred on stroke in rural South Africa. We show that stroke is a disease with high economic costs. Further studies that assess the lifetime costs of stroke are needed to better understand savings accrued from intervening at different stages of the disease.

1. Introduction

Stroke is the second most common cause of death in South Africa, after HIV/AIDS and the leading cause of disability [1]. Recent estimates suggest that at least 30,000 strokes occur yearly in rural South Africa [2]. Globally, approximately 3% of total health care system resources are devoted to stroke indicating that stroke imposes a significant economic burden on countries [3]. Studies looking at the economic consequences of stroke in South Africa are few and somewhat dated. According to one such study, cardiovascular disease (CVD) including stroke consumed 4.1 billion to 5.0 billion South African rands (R) in 1991, excluding costs of rehabilitation or community care [4]. Adjusting the costs to 2014 values using the consumer price index, the current cost of CVD would be R19–24 billion annually. Other stroke related studies focussed on cost of medication for stroke prevention [5], or cost of inpatient care at tertiary facilities but did not estimate total cost of stroke [6]. Further, none of the studies considered the cost of stroke within a rural setting.

Economic data can be used to advocate for new interventions or the increased uptake of existing ones. Policy makers in South Africa are becoming increasingly aware of the need to justify health decisions on the basis of both effectiveness and costs; this is echoed strongly in the Department of Health's National Strategic Plan on non-communicable diseases [7]. Previous analyses on the economic implications of high sodium intake in South Africa led to a draft policy on salt reduction [8,9]. As such, documenting the economic implications of stroke could promote evidence based decision making, assist in priority setting and influence adequate budgeting and planning for the prevention and treatment of stroke.

The present study is designed to meet the need for up-to-date information on the cost of stroke by (i) estimating the cost of stroke care in rural South Africa for prevalent cases in 2012 based on the standard of care (treatment protocols, coverage of interventions) and (ii) estimating the costs of stroke cases in the same population when coverage of all essential treatment or service utilisation is scaled up to 90%.

We utilize a variety of data sources namely: published data on stroke from the Agincourt Health and Demographic Surveillance Site, clinic-linked data for the Agincourt population on health care utilization patterns and the Tintswalo Hospital Stroke Register (THSR) — a rural hospital-based stroke register. The results of this study could help to understand the resource implications of stroke in South Africa and similar settings in sub-Saharan Africa, as well as make a case for intensifying efforts for stroke prevention initiatives in the rural settings of South Africa.

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2. Methods

2.1. Setting and population

This analysis is based on a population of approximately 90,000 people residing in the Agincourt sub-district of Mpumalanga province, north-east of South Africa [10]. The area is completely covered by a health and demographic surveillance system (HDSS). Comprehensive data on mortality and causes of death, births, and inward and outward migration have been collected through a yearly census update since 1992 via verbal autopsies [10]. Additional data on labour participation and educational status have been collected at different time intervals to complement demographic data and provide contextual information.

Social infrastructure and utilities are quite limited in the Agincourt sub-district. There is no formal sanitation, piped water to communal standpipes is erratic and electricity is affordable to a minority. High unemployment results in temporary labour migration of men and women which was estimated at 50–70% amongst males and 25–35% amongst females in the 20–59 year age group [11]. There are two public health centres, one private health centre and seven satellite clinics in the site. The Agincourt community is served by three district hospitals that are approximately 25–60 km away.

The health profile of the Agincourt population is characterized by the persistent burden of TB and HIV/AIDS, high maternal and child morbidity and mortality, and increasing non-communicable diseases. Using 1994–97 as the base year, the probability of dying from non-communicable diseases trebled by 2005 within the sub-district [12]. Though a slower decline was observed from 2006 to 2009, the mortality rates have plateaued at high levels [13]. Similarly, deaths due to HIV/AIDs initially decreased, then plateaued at high levels [12,13]. Stroke, rather than ischaemic heart disease is the dominant manifestation of CVD within this population [14]. Between 2007 and 2011, stroke incidence and mortality rates were 244 and 144 per 100,000 person years respectively [14,2].

2.2. Cost-of-illness analysis

This study is predominantly a cost of illness (COI) analysis that utilizes a prevalence-based approach. Prevalence-based COI studies estimate the costs of all disease cases (new as well as pre-existing) in a given year [15]. They include all medical care costs and morbidity costs for a disease within the study year and nothing has to be known or assumed about the survival rate or course of the illness [16]. Because new disease cases that occur in that given year of analysis must be known, incidence data is required. The name prevalence-based should therefore not be confused to mean the exclusion of epidemiological incidence data.

2.3. Perspective

The perspective of the analysis is the health system, with the government as the payer of public health services. This was the most appropriate perspective to choose as the intent was to inform evidence-based priority setting within the public health care sector. Because the government perspective was chosen, only direct costs related to provision of health care were assessed. These costs included hospital inpatient stay, diagnostic costs, outpatient costs and secondary prevention costs. Direct costs of patient transport were not included. Productivity losses as a result of time off work due to illness or due to caring for a stroke patient were also not included as these are indirect costs and not borne by the government. All costs were adjusted to 2012 using the consumer price index and reported in local currency, South African Rand (R) and United States dollar ($).We used an exchange rate of 1US$ = R8.70 for the year 2012 based on the South African reserve bank historical exchange rates [17].

2.4. Costing approach

There are 2 main approaches to resource costing: top-down and bottom-up) [18]. Top-down approach involves estimation of resource utilisation and costs by assigning a (national) average figure on non-patient specific bases such as using Diagnostic Related Groups (DRGs), or Healthcare Resource Groups (HRGs) [18]. DRGs are 'diagnosis-related' groups of patients that have similar resource consumption patterns [19]. It is not possible to use this method in South Africa where DRGs or similar classifications are not used in the public sector. The second approach, which is used in this study, is the bottom-up approach. This approach requires understanding the service delivery process for a patient (treatment pathway) and estimating relevant resource items and assigning costs to these items. Each of these processes requires detailed data and inventories. We use the Tintswalo hospital stroke register to understand the type of treatment a patient with stroke receives at a hospital in rural South Africa and the probability of receiving that treatment. The stroke register was established in 2001 to ascertain and assess rural stroke patients over 20 months [20]. We use the treatment pathway (Fig. 1) as a guide. We focus on the inpatient treatment pathway in the figure as the 'treatment' of stroke in the outpatient setting usually involves controlling risk factors, high blood pressure in particular and rehabilitation; the latter being largely unavailable in rural settings of South Africa. We do however calculate the outpatient costs. Clinic data linked to the Agincourt demographic surveillance system is used to determine health facility utilisation patterns by patients with stroke as well as the type of medication that stroke or hypertensive patients are on. We also use available data from published studies to estimate treatment coverage and adherence rates. Unit costs were abstracted from several national sources: (i) South African district health barometer for inpatient and outpatient care, (i) South African medicines price registry for cost of medicines, and (iii) NHLS for costs of laboratory investigations.

2.5. Estimating prevalence and incidence of stroke in rural Agincourt sub-district

The Southern African Stroke Prevention Initiative (SASPI) study conducted in 2001 within the Agincourt population determined stroke prevalence through verbal autopsy with subsequent assessment of suspected stroke victims by a neurologist [22]. That study is the only "community-based" prevalence study of stroke in rural South Africa with a well-defined denominator. Trained fieldworkers used a previously validated questionnaire to interview each household informant. The key questions were: "Has (person) ever had weakness down one side of the body?" and "Has (person) ever had a stroke?" Clinical assessment of possible stroke victims was lowest amongst migrant males 25–44 years. To account for this noncontact, the investigators adjusted the stroke rates in each 10-year age stratum and assumed the same proportion of stroke survivors in employed men as amongst predominantly unemployed men. Thus the local population denominator included men who temporarily reside outside the sub-district as they consider the sub-district home and return to seek health care when too ill to work [22]. Based on this study, 103 cases of stroke were identified amongst 724 individuals visited, giving an adjusted stroke prevalence rate, adjusted for non-response of 290 per 100,000 person years.

To the best of our knowledge there is currently no other information on incidence of stroke from community-based studies in South Africa. A hospital based study conducted in 1986 estimated a crude stroke incidence of 101 per 100,000 per year in a population ≥20 years in suburban areas of Pretoria [23]. However, in developing countries, most people who suffer a stroke do not reach hospitals and the data is out-of-date. These figures are therefore likely an underestimate.

In our study, estimates of stroke incidence were derived from a study that combined primary data from Agincourt HDSS with modelling techniques [2]. In the study by Maredza, Bertram and Tollman [2], the